Rebecca Palaeochannel Borefield

H3 Level Hydrogeological Assessment
Groundwater Abstraction for Mine Water Supply

Prepared for:

Ramelius Resources

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1. INTRODUCTION

1.1 Project Overview

Ramelius Resources (Ramelius) are currently undertaking a Preliminary Feasibility Study (PFS) for the Rebecca Gold Project (the Project), located approximately 145 km northeast of Kalgoorlie, in the Eastern Goldfields Region of Western Australia (Figure 1.1).

The Project comprises four identified gold deposits (Rebecca, Duke, Duchess and Cleo), which lie within exploration tenement E28/1610. Ramelius plans to develop the Rebecca open pit in two stages (Stage 1 and Stage 2) and also the Duchess, Duke and Cleo open pits, over a total period of 8.5 years. Figure 1.2 shows the proposed life of mine (LOM) Rebecca, Duchess, Duke and Cleo pit shells in relation to the planned infrastructure. The proposed Project footprint is located to the southwest of Lake Rebecca, one of several large salt lakes in the region, with the closest point being approximately 400 m to the east of the northern end of Rebecca Pit.

To enable optimal resource recovery, the mining at Rebecca will occur below the groundwater level and hence, dewatering of the open-cut pits is required to provide dry mining conditions. AQ2's assessment of the dewatering required at the Project's various pits (covered in a separate H2 level hydrogeological assessment report, AQ2, 2024a), indicated that predicted total groundwater inflows to the pits, taking into account the sequence of mining and dewatering interference, will most likely be in the order of 4 to 20 L/s (averaging about 10 L/s), possibly as high as 22 to 25 L/s in Years 2 and 3 of mining. However, evaporation from the pit sumps and pit walls will remove some of this water and actual dewatering abstraction (from pit sumps) is likely to be less than predicted (in order of 3 to 15 L/s).

An H2 level hydrogeological assessment for groundwater abstraction (due to pit dewatering) at the Rebecca Project was undertaken by AQ2 to support Ramelius' 5C groundwater licence (GWL) application that was submitted to the Western Australian Department of Water and Environmental Regulation (DWER), together with a Groundwater Operating Strategy (GWOS), in September 2024 (AQ2, 2024a and 2024b). A 5C GWL211598(1) to abstract 900,000 kL/year (i.e. 28.5 L/s) of groundwater from the fractured rock aquifer system was approved by DWER on 17 March 2025.

The Project's current average make-up water demand, (i.e. after tailings storage facility (TSF) decant return is taken into account), is approximately 3 GL/year, equating to 95 L/s. The water demand is required for a mine life of 10 years, covering both the Rebecca Project and also the Roe Project, located approximately 45 km to the southeast of Rebecca.

The Project's water demand is planned to be mainly supplied by abstraction of groundwater within aquifer units in the regional Rebecca Palaeochannel system and its palaeo-tributary channels, with any dewatering input from Rebecca Project pits not being accounted for (i.e. a conservative approach). However, in practice any water input from pit dewatering and TSF recovery would reduce the water demand from the main water supply source during the dewatering period.

AQ2 has been engaged by Ramelius to undertake PFS water supply studies on the palaeochannel at the Rebecca Palaeochannel Borefield to develop the required process water supplies for the Rebecca Project. This phase of PFS hydrogeological studies was focused on initially confirming water resource availability at the Rebecca Palaeochannel Borefield and subsequently, its extent along the thalweg of the palaeochannel.

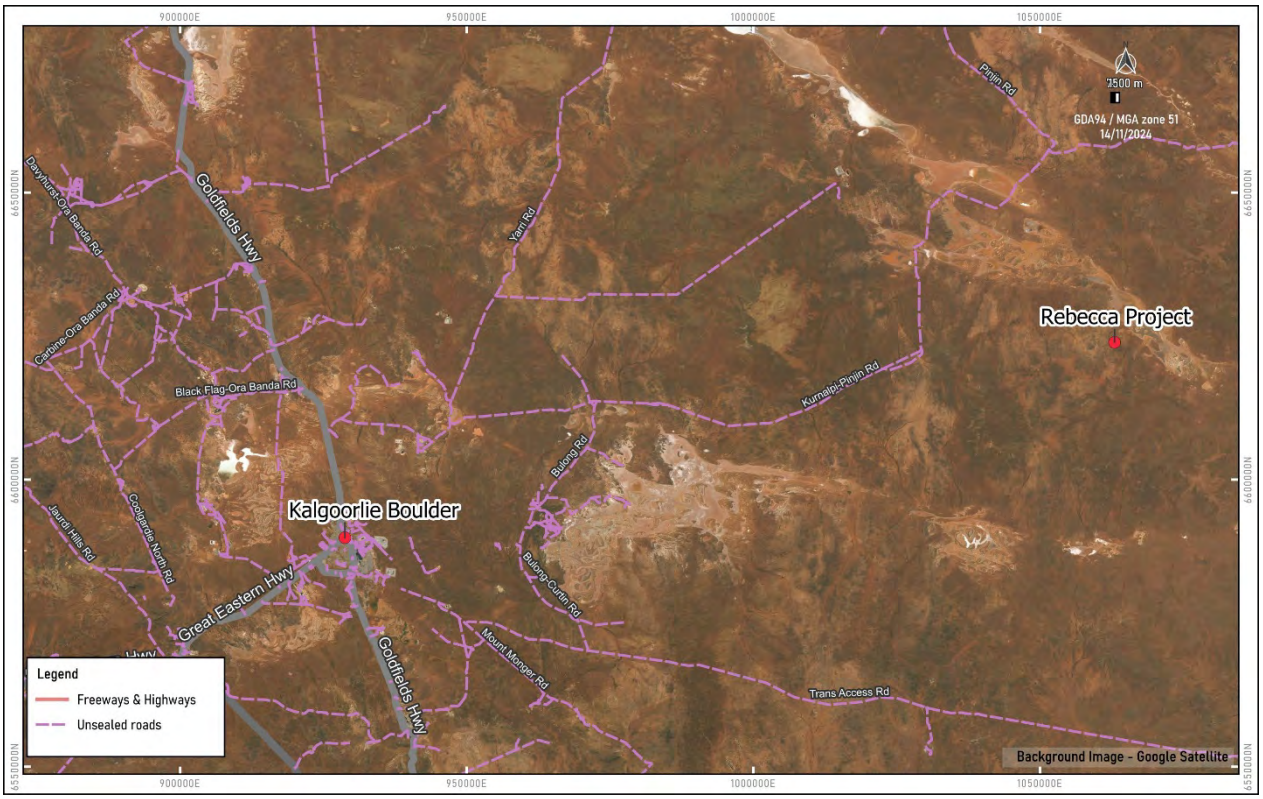


Figure 1.1 Rebecca Project Location

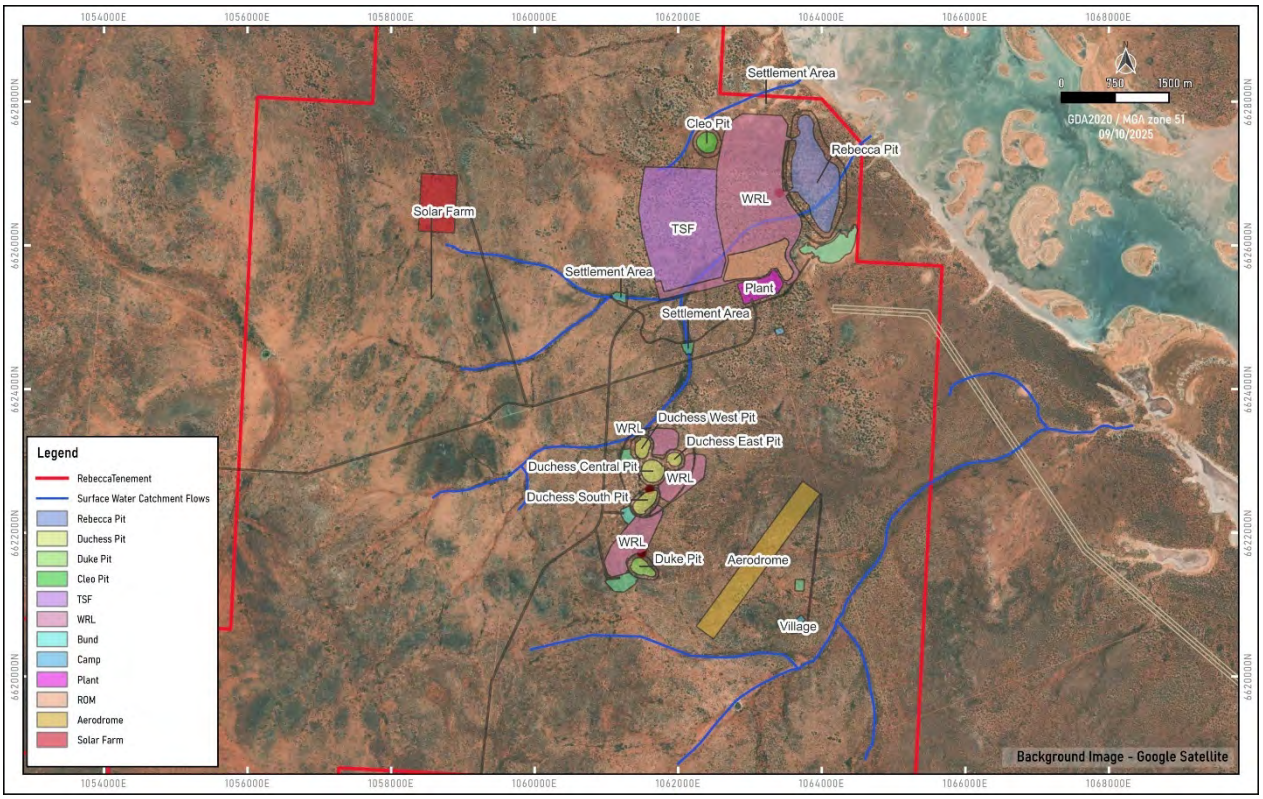


Figure 1.2 Rebecca, Duchess and Duke Pits and Nearby Mine Site Infrastructure

1.2 This Report

This report has been prepared in line with required submissions to DWER, relating to groundwater licensing approval (i.e. a 5C groundwater licence (GWL) application), based on the current Project's annual water demand of 95 L/s (3 GL/year).

This report has been prepared in accordance with DWER guidelines for an H3 Hydrogeological Report (*Operational Policy No 5.12 – Hydrogeological reporting associated with a groundwater well licenc*e, DWER 2009). An H3 level of hydrogeological assessment, (detailed hydrogeological assessment), requires an extensive investigation to determine the potential impacts associated with the proposed abstraction at the Rebecca Palaeochannel Borefield on the aquifer, environment and surrounding groundwater users. It includes the development of a numerical groundwater model to confirm that the palaeochannel aquifer is able to supply the required demand, without unacceptable impact on other users, due to changes in groundwater levels.

This report presents the results of the following tasks:

- A desktop study (including review and evaluation of available existing data and reports).
- Fieldwork programmes, including:
    - Delineation, via geophysical investigation, of the extent and depth of the main Rebecca Palaeochannel itself and two west to east flowing tributary branches.
    - Groundwater exploration drilling to confirm the sedimentary geology, the presence or absence of the palaeochannel basal sand unit and depth of the thalweg.
    - Drilling of new test production and monitoring bores.
    - Hydraulic testing of new production bores.
- The development of a numerical groundwater model to assess the ability of the Rebecca Palaeochannel Borefield to supply the required water demand of 3 GL/year, 95 L/s.
- Assessment of the extent of the cone of depression (i.e. drawdown), resulting from groundwater abstraction at the Rebecca Palaeochannel Borefield and the resultant impacts on any groundwater users and the groundwater environment.

2. PHYSICAL SETTING

2.1 Location

The Rebecca Palaeochannel system was targeted for groundwater supply investigations and the extent of this system in the local area is shown in Figure 2.1. This Figure also shows the location of Ramelius Resources' Rebecca Camp, which is approximately 1.3 km southwest of the proposed Rebecca Pit. Locally, the Rebecca Palaeochannel system runs in a northwest to southeast direction, with its base declining towards the southeast and joining the Raeside Palaeochannel system to the east. The Raeside Palaeochannel system is also fed by the Roe Palaeochannel system flowing from west to east (Figure 2.1).

In the vicinity of the Project, the main Rebecca Palaeochannel is locally fed by two tributary channels, with the base of both declining from west to east towards the main Rebecca Palaeochannel and these are also shown in Figure 2.1. The larger of these two is located approximately 22 km north and northwest of Rebecca Camp and the downstream, eastern section of this has been designated Area A as part of the hydrogeological investigations. The second smaller palaeochannel tributary system is located approximately 11 km south of Rebecca Camp and has been designated Area B. The Rebecca Palaeochannel Borefield is located in Area B.

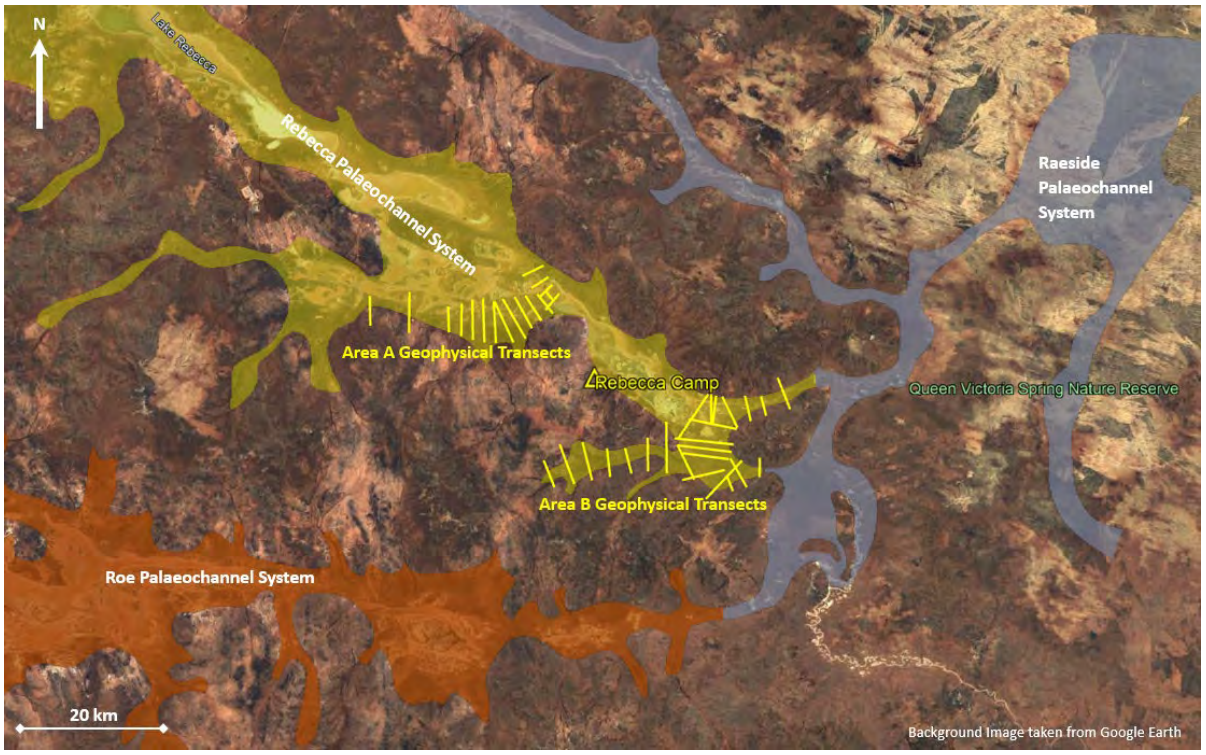


Figure 2.1 Palaeochannels and Passive Seismic Transect Locations

2.2 Heritage Value

The Rebecca Project and the proposed Rebecca Palaeochannel Borefield are located near to a number of heritage sites running down Lake Rebecca. These heritage sites are shown on Figure 2.2 as the Lake Rebecca Complex.

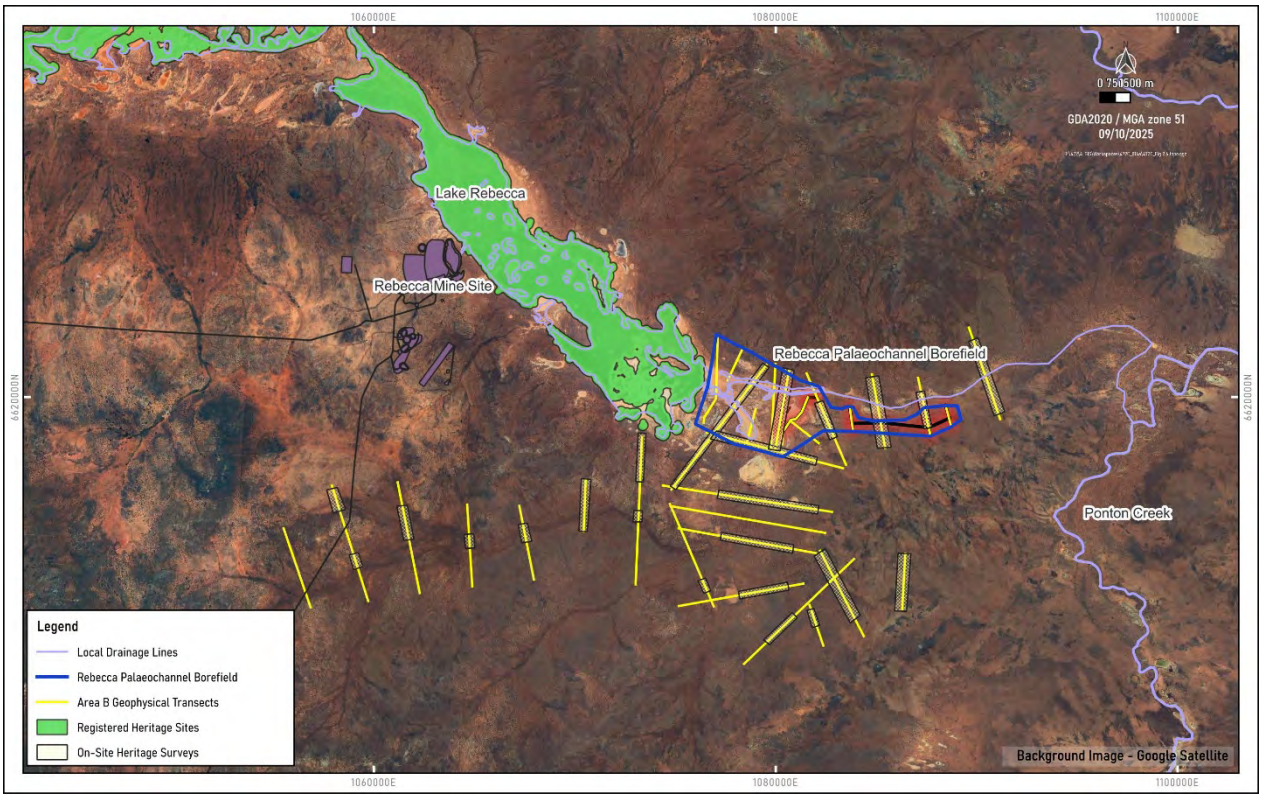


Figure 2.2 Heritage Sites in the Vicinity of Rebecca Project and Rebecca Palaeochannel Borefield

Ramelius recognises the Kakarra People as the traditional owners of the land that Lake Rebecca is located on, and the importance to the Kakarra People of leaving country as close as possible to the way that it was found. Ramelius acknowledges that within the vicinity of the Rebecca Project there are cultural places of great importance to the Kakarra People, as shown on Figure 2.2. Ramelius recognises the cultural significance of water to the Kakarra People.

In addition, heritage surveys of the proposed Rebecca Palaeochannel Borefield area were conducted in 2024, (prior to the commencement of any field work as shown on Figure 2.2) for Ramelius. The surveys included consultation with representatives of the Kakarra People. No sacred, ritual or ceremonial aboriginal sites, or artefact scatters were identified in the survey area covering the Rebecca Palaeochannel Borefield. Ramelius can supply a copy of the heritage survey report on request.

2.3 Climate and Rainfall

There are a number of regional weather stations which collect rainfall data. The nearest Bureau of Meteorology (BoM) weather station to the Project is at Edjudina (BoM Station Number 12027), located approximately 70 km to the northwest of the Rebecca Pit.

The project area has a semi-arid climate with dry, hot summers and cool to mild winters. January is the hottest month with mean daily minimum and maximum temperatures of 16.8°C and 33.7°C respectively. In winter, July is the coldest month with an average minimum temperature of 5.1°C and an average maximum temperature of 18.3°C.

The long-term average annual rainfall for the years 1900 to 2024 was 226 mm, but varied annually between 55.5 mm to 581 mm. The average annual rainfall for the more recent period 2012 to 2024 was 267 mm, slightly above the long-term average and indicating a general increase in rainfall in the Kalgoorlie region in the past decade. Rainfall is relatively evenly spread throughout the year.

Based on climatic records from the closest BoM weather station that records evaporation data, Kalgoorlie-Boulder (BoM Station number 12038, approximately 140 km west southwest of the Project), the long-term average potential evaporation of the area is approximately 2,640 mm/year. Evaporation greatly exceeds rainfall during every month of the year and is the highest in January (Table 2.1). The long-term average annual evaporation rate is about 12 times higher than the long term annual rainfall.

Long-term rainfall and pan evaporation data are summarised in Table 2.1 and are presented in Figure 2.3.

Table 2.1 Rainfall and Evaporation Statistics

Month	Long-term Average Rainfall (mm)[1]	Short-term Average Rainfall (mm)[2]	Long-Term Monthly Average Evaporation (mm)[3]
January	23.7	57.6	387.5
February	28.4	28.9	302.4
March	27.2	46.7	266.6
April	19.2	17.0	174.0
May	20.9	14.2	111.6
June	22.3	15.1	78.0
July	18.8	13.0	86.8
August	17.0	16.3	117.8
September	9.4	6.6	174
October	12.0	15.8	260.4
November	13.9	19.8	309.0
December	13.4	16.3	372.0
Total Annual Rainfall	226.1	267.1	2,640.1

1 Edjudina (BoM Station Number 12027) covers the period 1900-2024
2 Edjudina (BoM Station Number 12027) covers the period 2008-2024
3 Kalgoorlie-Boulder (Bom Station No. 12038) covers the period 1966 -2016

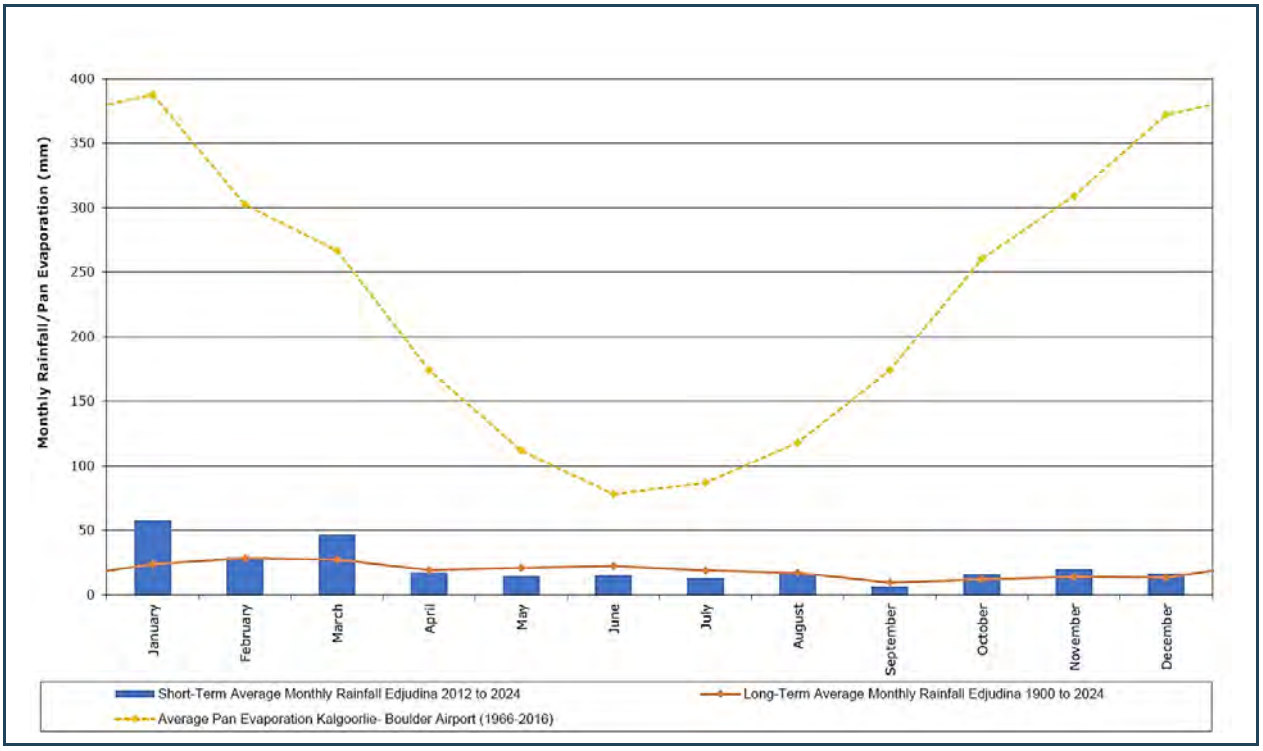


Figure 2.3 Rebecca Project, Long-Term Rainfall and Evaporation Data

The rainfall has also been monitored at an on-site weather station at Rebecca mine site since August 2023. The monthly rainfall recorded at Rebecca mine site station is comparable with the monthly rainfall from the Edjudina Station (Figure 2.4).

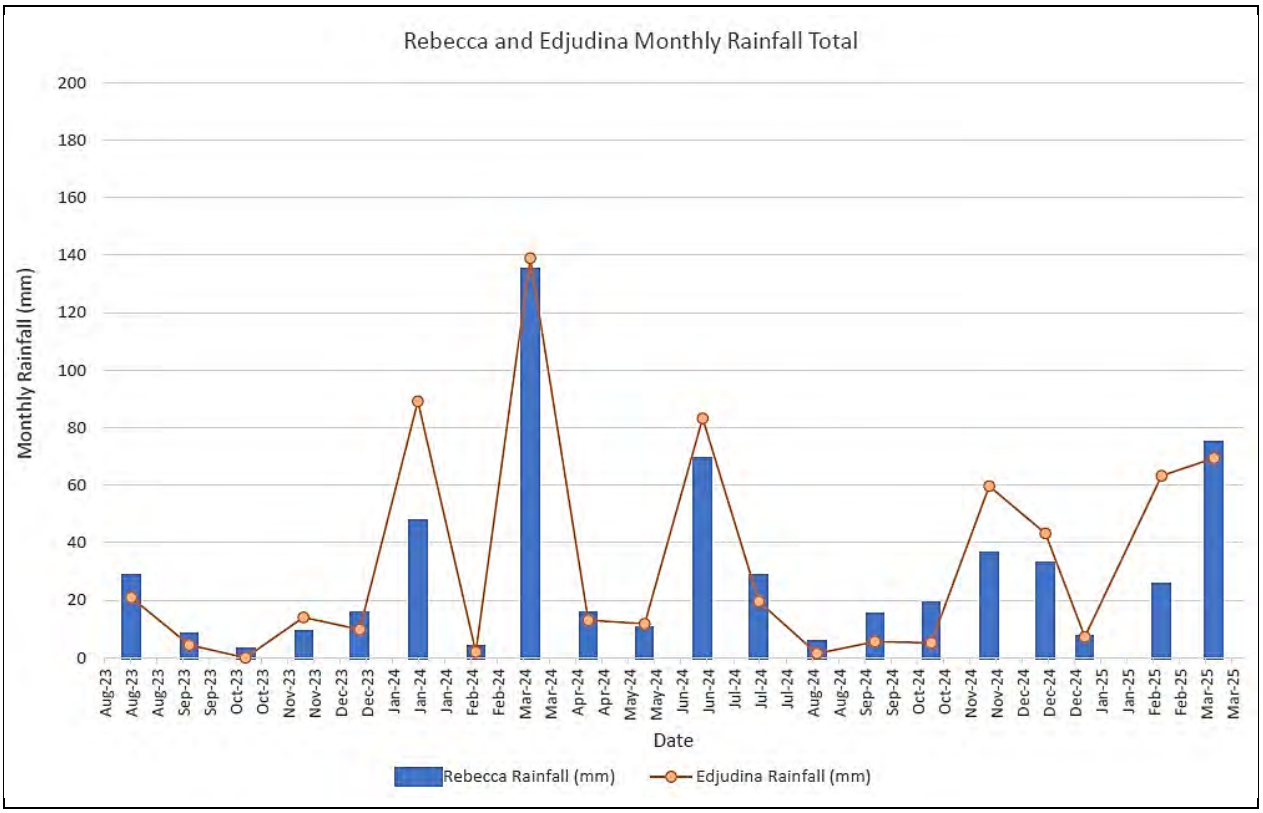


Figure 2.4 Rebecca On-Site Rainfall Station Data

2.4 Landforms and Drainage

The Project site and the Rebecca Palaeochannel Borefield are located southwest and within the catchment area of Lake Rebecca. Lake Rebecca is part of a paleo-drainage network which used to flow from the northwest to the southeast. What is colloquially termed Lake Rebecca is actually a complex of lakes that span approximately 120 km, separated by low dunes (refer to Figure 2.5). The dunes mean that the individual lakes within the Lake Rebecca complex are typically not hydraulically connected, but may become connected during large, rare runoff events. There are no natural permanent watercourses or wetlands within the project area. All drainage lines in the project area are small and intermittent, flowing only after major rainfall events. Drainage is internal, terminating in salt lakes and clay pans and surface drainage is only significant immediately following rainfall. Local flooding may occur, especially following cyclonic thunderstorms. It should be noted that the Rebecca Palaeochannel Borefield is located approximately 14 to 24 km to the west of the Ponton Creek system (Figure 2.5). Ponton Creek is recognised as a Wild River, which is defined as "those rivers which are undisturbed by the impacts of modern technological society. They remain undammed and exist in catchments where biological and hydrological processes continue without significant disturbance. They occur in a variety of landscapes, and may be permanent, seasonal or dry watercourses that flow or only flow occasionally, (Water and Rivers Commission, 1999). The proposed borefield area is partially located within the buffer of the Ponton Creek Wild River, but does not intersect with the watercourse (Figure 2.5). DWER is responsible for managing Wild Rivers in WA and the Ponton Creek Wild River is a Priority 1 system (DWER, 2009).

The Rebecca Palaeochannel Borefield is located on relatively flat ground, at an average elevation of approximately 330 mAHD (ranging from 327 to 334 mAHD). Land-surface elevations increase to approximately 370 mAHD along the ridges and decrease to about 335 mAHD at Lake Rebecca Area A and about 330 mAHD at Lake Rebecca Area B (Figure 2.6).

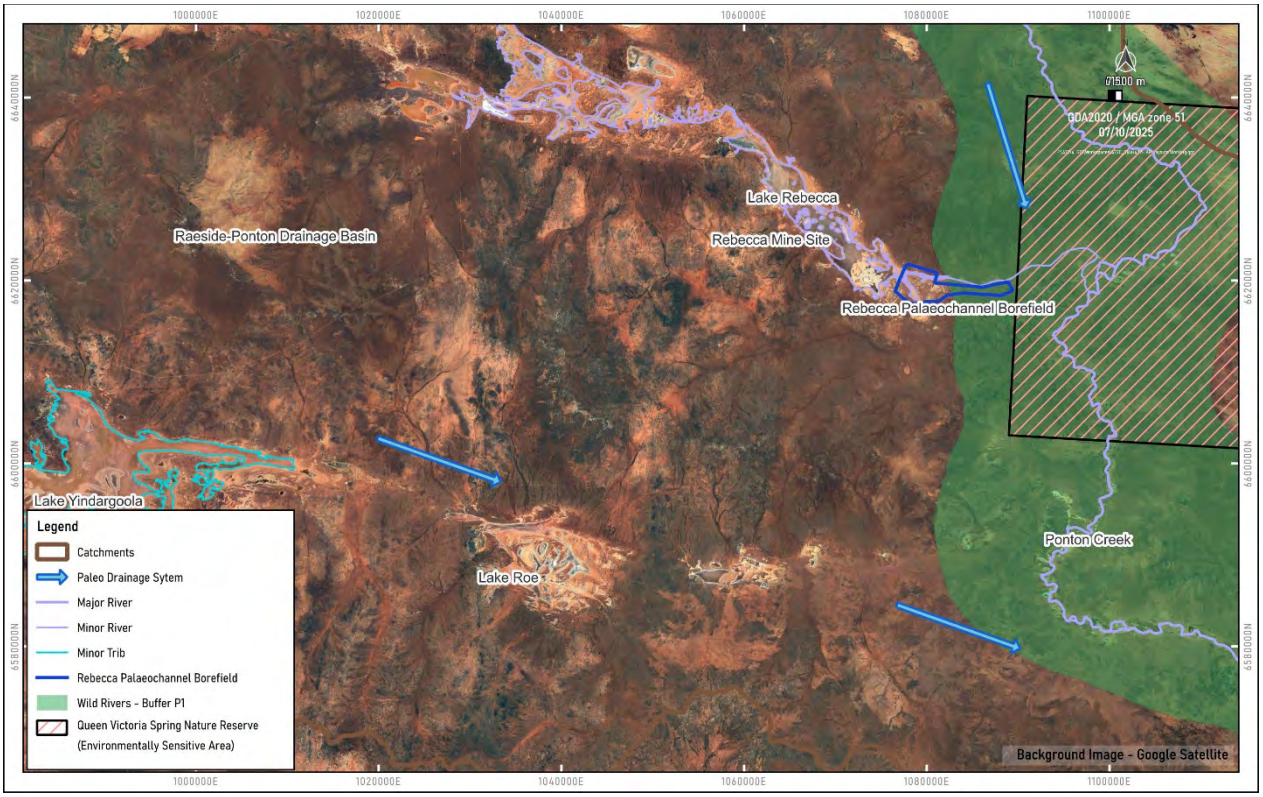


Figure 2.5 Regional Hydrology

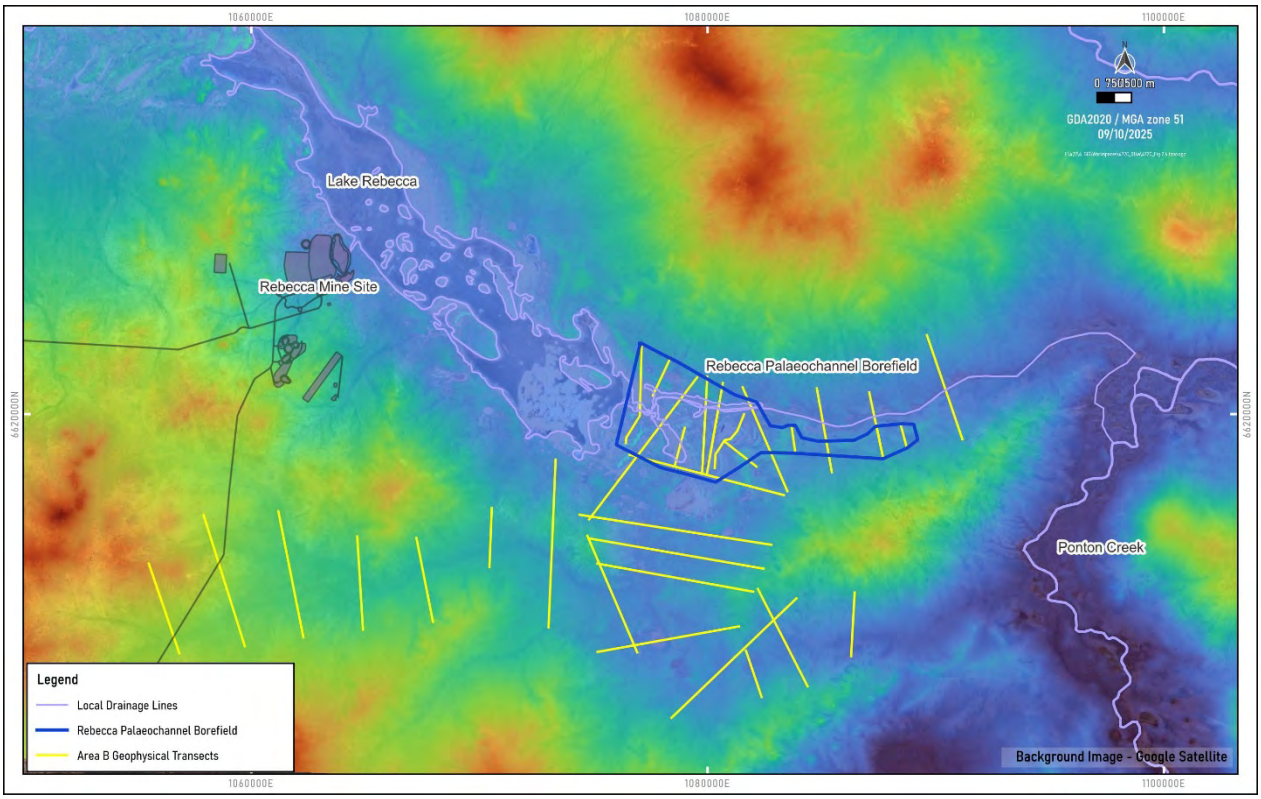


Figure 2.6 Regional Topography

3. HYDROGEOLOGY

3.1 Geology

3.1.1 Regional Geology

The Project lies within a greenstone area on the eastern margin of the Norseman-Wiluna Greenstone Belt. It is situated in the southern portion of the Laverton Tectonic Zone, a regional scale shear/fault system that is one of the more productive gold trends in the WA Goldfields. The Project comprises four identified deposits (Rebecca, Duke, Duchess and Cleo) where gold mineralisation is hosted by broad zones of disseminated sulphides in gneiss.

The basement rocks are deformed, resulting in significant north-trending faults and shear zones and minor east-west faults, as well as foliations, cleavage and lineation within the rock. Much of the bedrock in the area has been deeply weathered. Weathering generally persists to 40 to 50 metres below ground level (mbgl), although it is known to exceed 140 mbgl (e.g. at Rebecca Pit), particularly along the mineralised shear zones.

A cover of Cenozoic sediments is widespread in the Eastern Goldfields region. The thickest sections of cover occur in the form of a network of narrow paleovalleys (palaeochannels) that were incised into the weathered bedrock surface of the Yilgarn Craton during the Early Eocene, and then filled with continental to shallow marine sediments as a result of changes in climate and sea-level rise during the Middle Eocene to Miocene (de Broekert, 2002).

The Rebecca Palaeochannel Borefield (Area A) lies within the main Rebecca palaeodrainage system (Figure 2.1). Sediments in the Rebecca Paleodrainage are similar to that of the Roe Paleodrainage (Kern, 1995), and consist of the Wollubar Sandstone overlain by confining Perkolilli Shale. The Wollubar Sandstone comprises unconsolidated quartz sand, with minor conglomerate, silt, clay and lignite. The Perkolilli Shale is clay with minor sandy clay beds which become sandier in the upper reaches of the palaeochannels.

Overlying the palaeochannels and basement rock are a variety of Cainozoic superficial deposits (alluvium/colluvium, laterites, eolian and lake deposits). The colluvial and alluvial deposits occur in outwash fans and stream channels respectively and can reach thicknesses of up to 10 m.

3.1.2 Local Geology

The outcrop and bedrock geology in the Rebecca Palaeochannel Borefield area is shown in Figures 3.1 and 3.2.

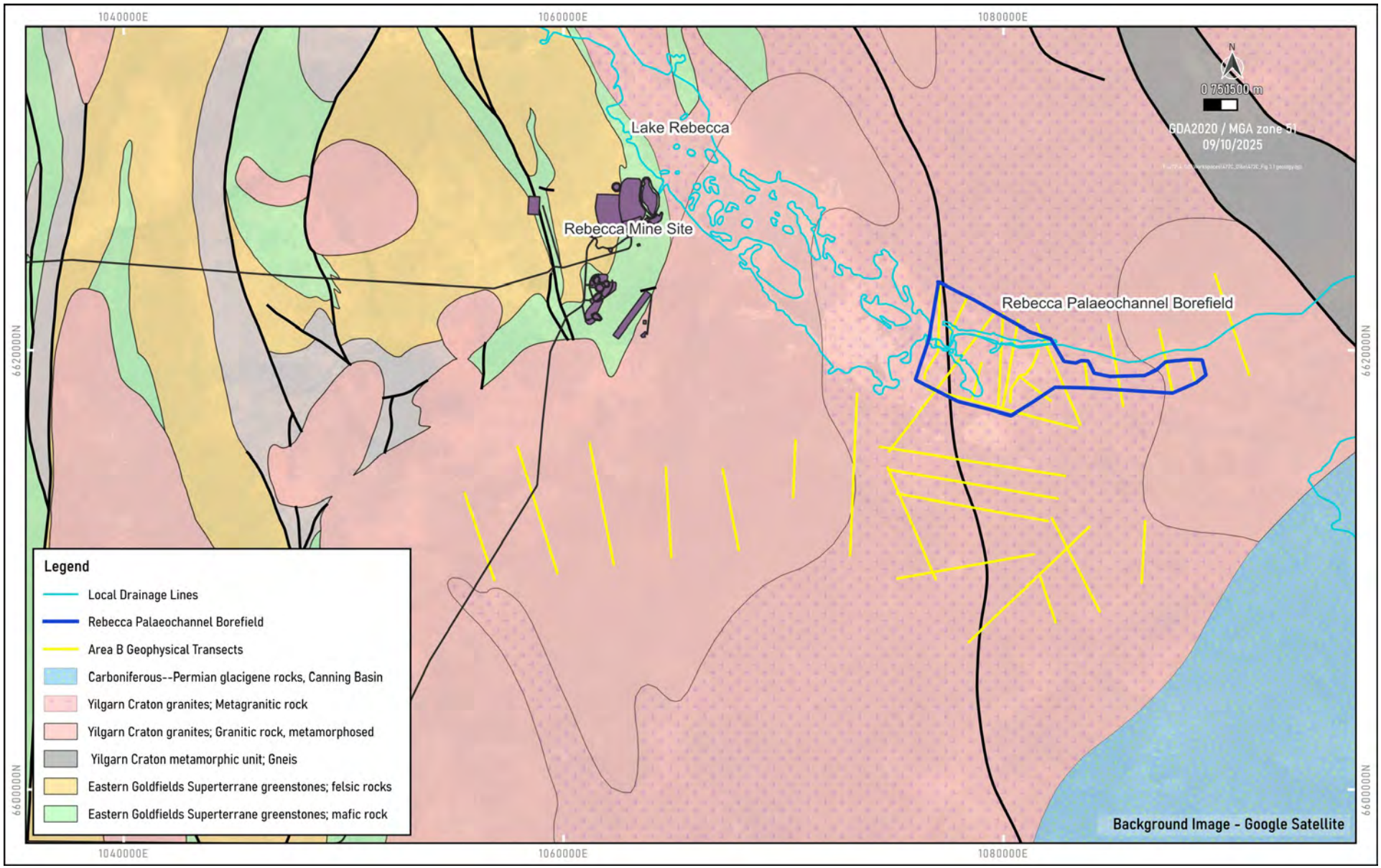


Figure 3.1 Rebecca Palaeochannel Borefield, Local Simplified Bedrock Geology

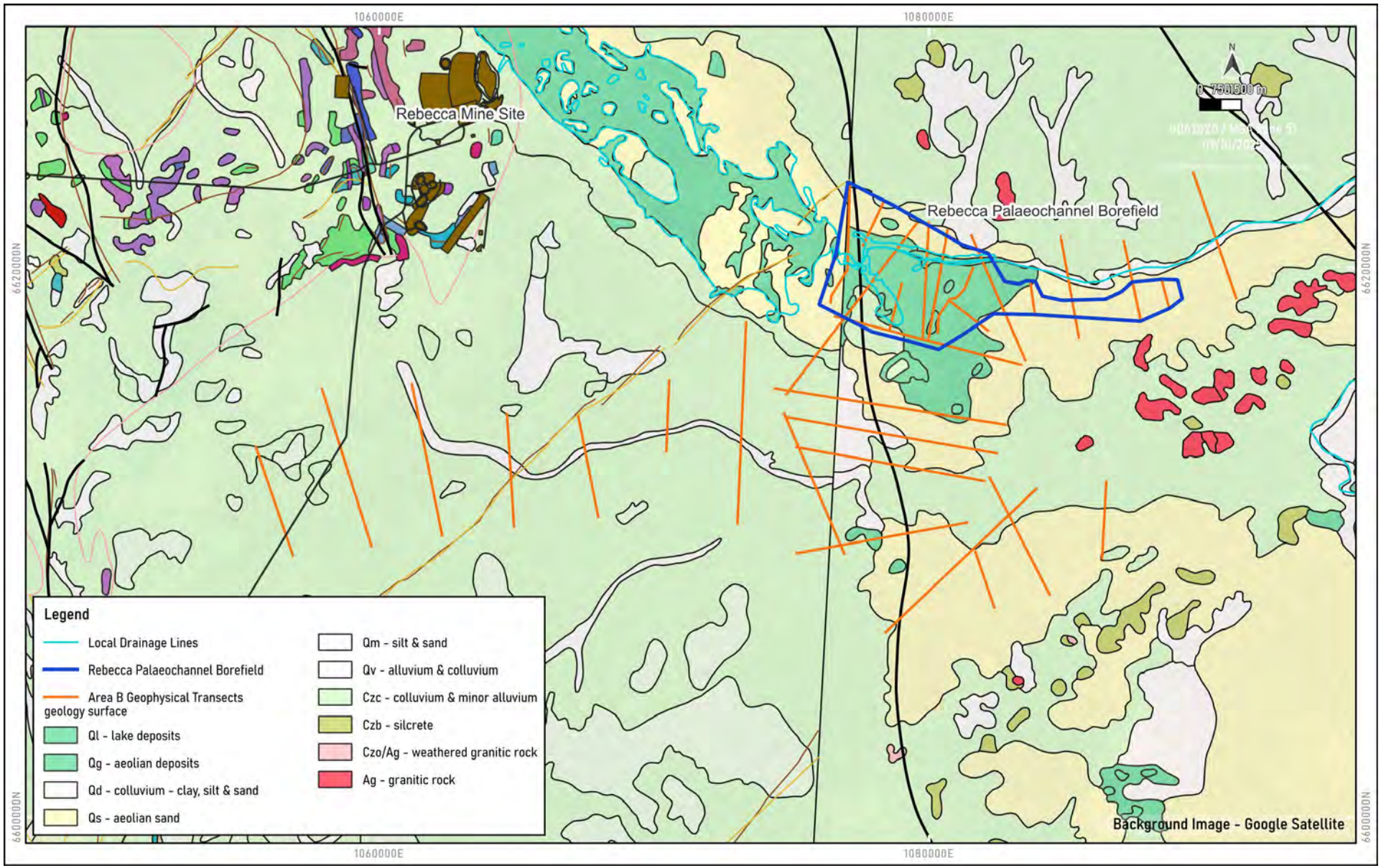


Figure 3.2 Rebecca Palaeochannel Borefield, Local Outcrop Geology

At the Rebecca Palaeochannel Borefield, the palaeochannel sand commonly deposited along the thalweg (lowest part) of the palaeochannel is the main target for groundwater supply. From the surface down, the palaeochannel geology generally comprises:

- Alluvium – generally comprising sand and silt.
- Palaeochannel Clay (Perkolilli Shale) - thick clay sequence with minor sand lenses. This unit is of variable thickness and acts as a leaky confining layer to the underlying sand aquifer.
- Palaeochannel Sand (Wollubar Sandstone) - basal palaeochannel (quartz) sand, fine to coarse grained. This aquifer underlies the clay aquitard and can be well over 10 m thick in the main palaeochannels.
- Weathered Bedrock – weathered greenstone belt strata (granitic rock) consisting of varicoloured saprolitic clay and saprock of varying thickness.

A schematic diagram of the Rebecca Palaeochannel system is shown in Figure 3.3, while a typical palaeochannel section in the Rebecca Palaeochannel is shown in Figure 3.4. A more comprehensive description of the local geology is presented in Section 5.5.

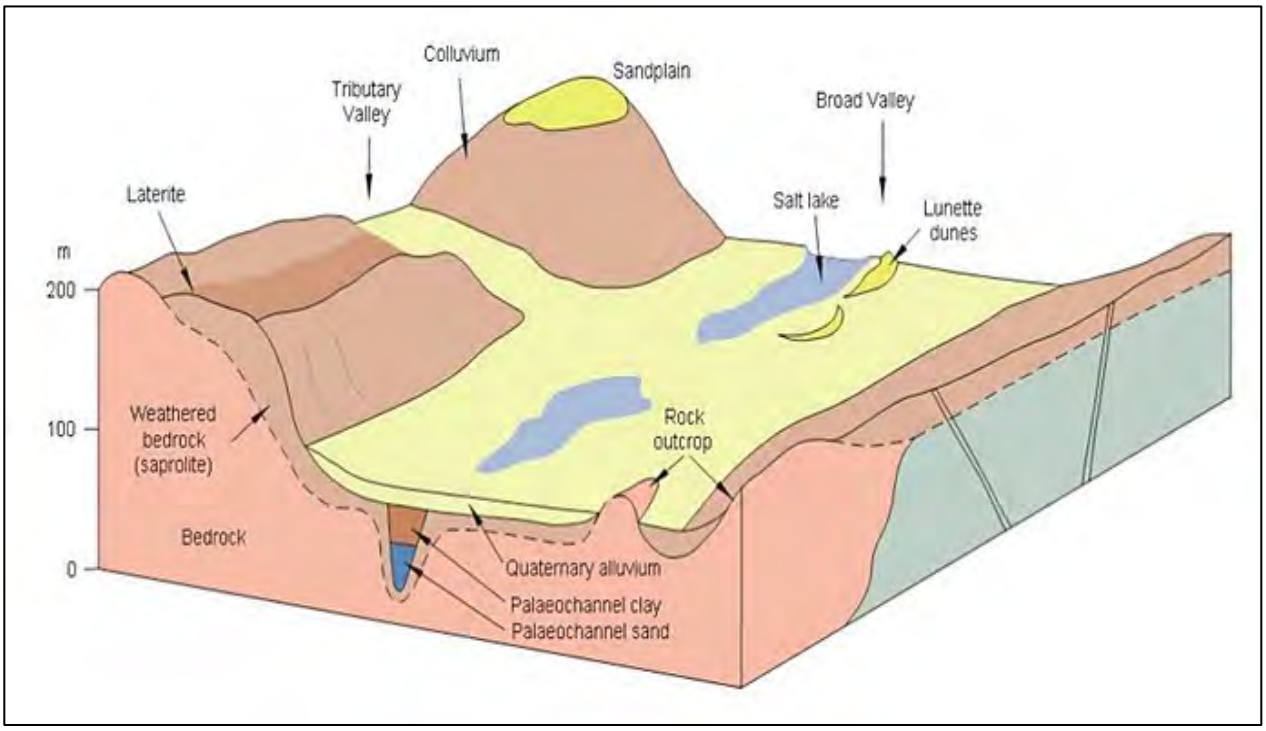


Figure 3.3 Schematic Diagram of the Rebecca Palaeochannel System

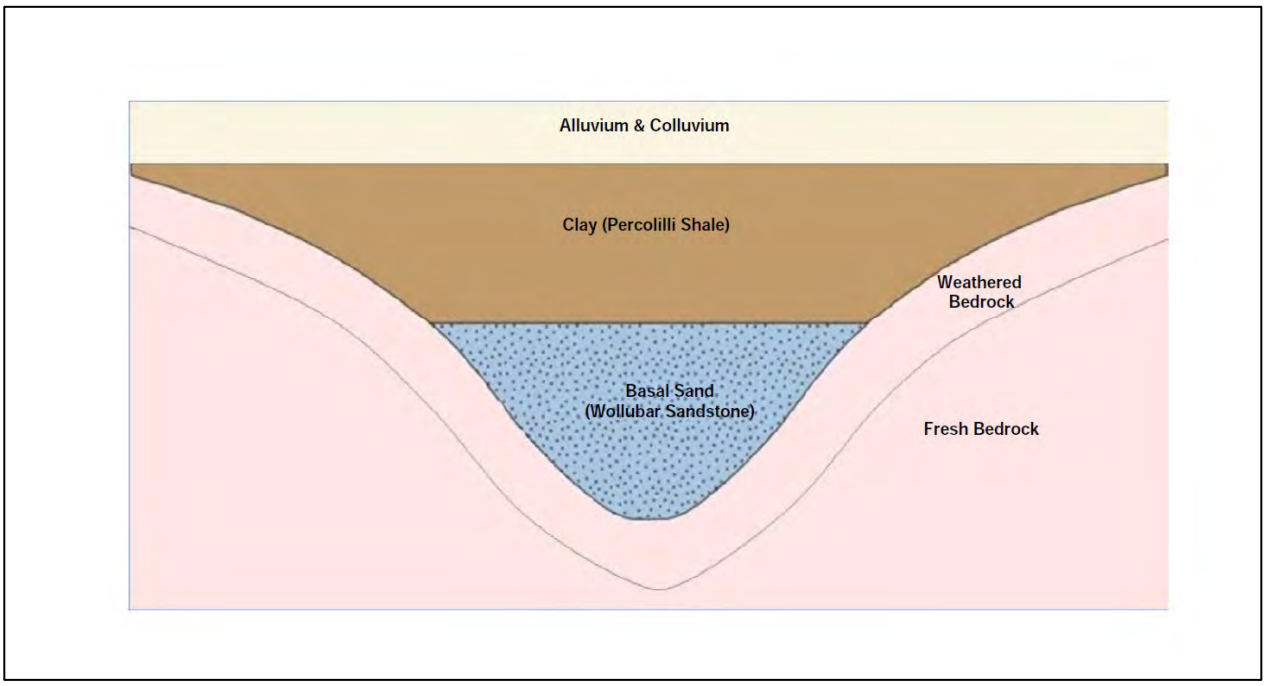


Figure 3.4 Schematic Geological Cross Section in the Rebecca Palaeochannel System

3.2 Hydrogeological Setting

3.2.1 Regional Hydrogeology

The regional hydrogeology has been well documented in numerous previous reports (Kern, 1995; Johnson, et. al., 1999 and RPS, 2013). A summary based on these reports, is presented below.

The occurrence of groundwater across the Goldfields region (the Project area) is mainly associated with the following main aquifer systems:

- Weathered/ fractured bedrock – low yielding, saline to hypersaline aquifer associated with partially weathered bedrock (i.e. saprock zone) at the base of weathering profiles (especially over coarse-grained felsic rocks), vuggy secondary minerals such as a calcrete and silcrete developed within weathered bedrock, and fresh fractured bedrock related to local and regional structures (i.e. fractures, faults, shear zones). This aquifer varies in extent and hydraulic properties, depending upon structural integrity, degree of weathering, bedrock depth and lithology. The weathered bedrock is generally in hydraulic connection with the underlying fractured bedrock.
- Tertiary-age sediments – high yielding, hypersaline aquifer associated with alluvial sands and gravels deposited within the base of the paleovalleys (palaeochannel aquifers). This aquifer can provide stable, long-term sustainable yields, due to 'high' permeability, large groundwater storage and significant leakage from the overlying clays and surrounding basement rocks.
- Quaternary-age sediments deposited along modern drainage lines - low yielding, shallow and intermittent brackish to saline aquifer associated with the alluvial and lacustrine deposits, which are sporadically saturated after heavy rainfall events, with the water table close to the surface in playa lake environments.

The regional water table ranges from less than 1 mbgl in playa-lake environments to more than 40 mbgl in elevated areas. The regional water table may be absent in high areas where the weathered and fractured zone is unsaturated or where fractures are poorly developed.

Regional groundwater flow is generally to the east towards the major palaeodrainage systems, the ephemeral lakes and salt pans. Directions of groundwater flow and variation in salinity are closely related to topography.

Recharge to the aquifers is via rainfall infiltration and is thought to be minimal due to high evaporation rates and low vertical infiltration rates. Groundwater discharge occurs mainly by evaporation from salt lakes, with a small amount by throughflow within the palaeochannel aquifers.

Most groundwater in the region is of saline or hypersaline quality. Lower salinity concentrations typically occur in low elevated areas of enhanced recharge and are typically located within unweathered fractured bedrocks (Kern, 1995) or in the uppermost reaches of palaeochannel systems. The higher salinity concentrations are typically found in groundwater of palaeochannels and in bedrock aquifers which are adjacent and below alluvial flats and playa lakes, where salinity values of up to 300,000 mg/L total dissolved solids (TDS) have been recorded.

3.2.2 Local Hydrogeology

The local hydrogeology is largely dominated/controlled by palaeochannel deposit aquifers, comprising the palaeochannel basal sand (Wollubar Sandstone) within the Rebecca Palaeochannel.

Aquifer properties suggest two hydraulic domains feeding the Rebecca Palaeochannel Borefield area:

- The main northwest-southeast channel with high permeability and storage.
- Two secondary tributary channel branches with lower permeability and storage.

The palaeochannel basal sand aquifer deposits are confined by an overlying thick, low permeability clay deposit (Perkolilli Shale) of up to 30-50 m thickness. This will severely limit direct recharge (via rainfall infiltration) to the palaeochannel basal sand aquifer, but will be important for long term leakage to the sand aquifer. It should be noted that in places there was an upper palaeochannel sand (mainly silty and clayey sand) encountered within the palaeochannel clay deposit (between 2 and 14 m thick).

Minor amounts of groundwater also occur within the weathered bedrock (i.e. saprolite/saprock), but these are low in importance compared to the palaeochannel basal sand deposits.

A more comprehensive description of the local hydrogeology and the conceptual hydrogeological model for the Rebecca Palaeochannel Borefield area are presented in Section 7.

4. EXISTING GROUNDWATER USE

4.1 Groundwater Dependent Ecosystems

4.1.1 Wetlands and Vegetation

Groundwater Dependent Ecosystems (GDE) includes biological assemblages of species such as wetlands or vegetation that use groundwater either opportunistically or as their primary water source.

The Bureau of Meteorology (BOM) has developed the Groundwater Dependent Ecosystems Atlas (GDE Atlas) as a national dataset of Australian GDEs to inform groundwater planning and management (BoM, 2023). The GDE Atlas contains information about three key types of ecosystems:

- 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.

The BOM GDE Atlas shows no aquatic GDEs (i.e. no wetlands of environmental significance) present in the vicinity (10 km radius) of the proposed Rebecca Palaeochannel Borefield. The nearest recognised aquatic GDE is Ponton Creek (~14 to 24 km to the east). The proposed borefield area is mapped with terrestrial GDEs of low, medium and high potential (Figure 4.1) which are as follows:

- Low potential terrestrial GDE described as extensive sandplain, with scattered granite outcrop supporting mainly spinifex hummock grasslands and mulga and mallee shrublands.
- Medium potential terrestrial GDE described as fresh or brackish ephemeral lakes and swamps with cane grass, lignum and paperbark shrublands.
- High potential terrestrial GDE described as salt lakes with extensively fringing saline plains, dunes and sandy banks, supporting low halophytic shrublands and scattered tall acacia shrublands.

Notwithstanding, the high, moderate and low potential GDE areas are also mapped as being respectively highly likely, moderately likely and likely to be inflow dependent ecosystems (IDE), reliant on water sources in addition to rainfall, such as water stored in the unsaturated zone, surface water or groundwater (BOM, 2024, Figure 4.2).

A reconnaissance and targeted flora and basic fauna survey of the Rebecca Palaeochannel Borefield area was undertaken by Botanica Consulting Pty Ltd (Botanica) in May 2024 (Botanica, 2024). The results of this assessment concluded the following:

- There are no wetlands of international importance (Ramsar Wetlands) or national importance (Australian Nature Conservation Agency Wetlands) within the survey area. The nearest gazetted reserve is the Queen Victoria Spring Nature Reserve (R 30491), approximately 2 km east of the survey area.
- No Environmentally Sensitive Areas were identified within the survey area.
- No critical habitat listed under the WA (Biodiversity Conservation Act 2016) BC Act was recorded within the survey area.
- No threatened ecological community (TEC) was located in the survey area.

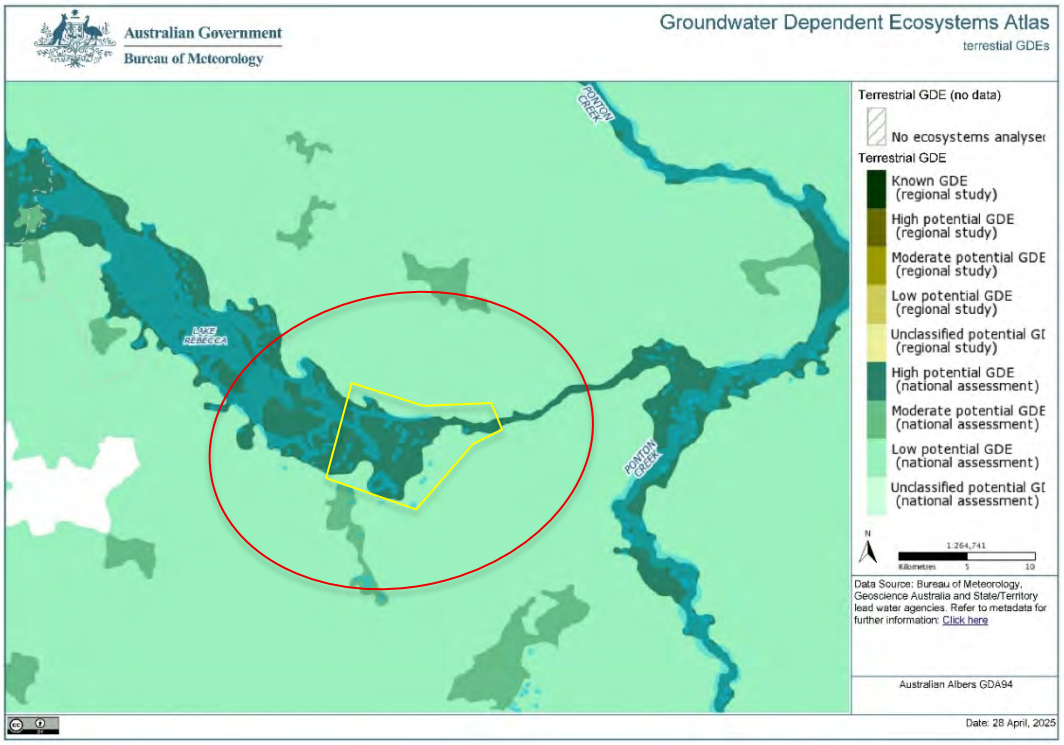


Figure 4.1 Desktop Search Results of Terrestrial GDEs Within 10 km Radius of the Proposed Rebecca Palaeochannel Borefield (BOM GDE Atlas Map)

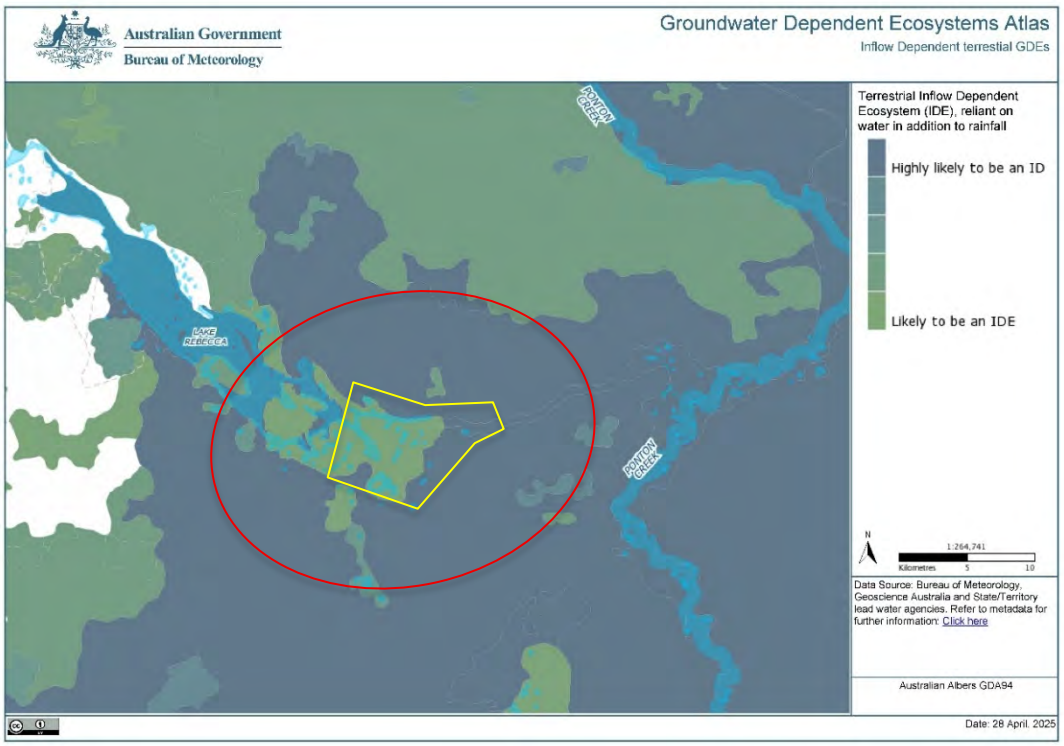


Figure 4.2 Desktop Search Results of Terrestrial Inflow Dependent (IDE) Within 10 km Radius of the Proposed Rebecca Palaeochannel Borefield (BOM GDE Atlas Map)

- Two priority ecological communities (PECs, as listed by DBCA) were identified within the survey area, that are protected by the WA BC Act and are the Ponton Land System PEC and the Emu Land System PEC (Figure 4.3). Both PECs are Priority 3 listed communities with several occurrences known in the Goldfields region.
- The field survey identified 148 vascular flora taxa within the survey area from 33 families and 73 Genera as occurring in the survey area.
- One species of Priority flora, *Eremophila perglandulosa* (P1), was identified as occurring in the survey area. *Eremophila perglandulosa* is a low, spreading, viscid shrub which grows to a height of approximately 0.25 m. The flowers are purple, and flowering has been recorded in January and Spring (WA Herbarium 1998).
- Fifteen vegetation communities were identified in the survey are - two Acacia open woodlands (MVG 13), one Eucalypt Woodland (MVG 5), one Casuarina forest and woodlands (MVG 8), five Mallee woodlands and shrublands (MVG 14), two Chenopod shrublands (MVG 22), one other shrubland (MVG 17), one Melaleuca woodland (MVG 9) and one Callitris forest and woodland (MVG 7). These vegetation communities occurred over five landform types with eight major vegetation groups. Vegetation identified within the survey area is not considered to be of high biological diversity and is well represented outside of the survey area.
- Mallee woodlands and shrublands (MVG 14) group (vegetation code SLP-RMW1) covers the majority of the proposed Rebecca Palaeochannel Borefield and is described as regrowth *Eucalyptus concinna* mid open mallee forest over *Eremophila scoparia, Senna artemisioides subsp. filifolia and Acacia hemiteles* mid shrubland over *Triodia scariosa* low open hummock grassland on sandy loam plain.
- Vegetation condition was mapped as Very Good (100% of the surveyed area). However, disturbances within the survey area were evident, including previous mining and exploration activities and pastoral land use. The eastern end of the survey area had been burnt in a wildfire in 2019 and was recovering from this, causing a modified vegetation structure in these areas. In some areas, some tree deaths were observed, but were not related to the wildfire and it was suspected that these trees had succumbed to drought.

The vegetation present in the vicinity (10 km radius) of the proposed Rebecca Palaeochannel Borefield is likely to source water from soil moisture in the unsaturated zone above the water table and is likely to rely on sporadic rainfall and overland water flow events, with no association with the groundwater (i.e. phreatophytic vegetation). It should be noted that the rooting zone of the vegetation found overlying the palaeochannels in the Kalgoorlie region is relatively shallow, only extending down to 1.5 m depth. The groundwater table at the proposed borefield is around 5 to 10 mbgl, well below most plants' rooting depths in this area. In addition, the groundwater is hypersaline (more than 170,000 mg/L Total TDS) and does not support any groundwater dependent ecosystems.

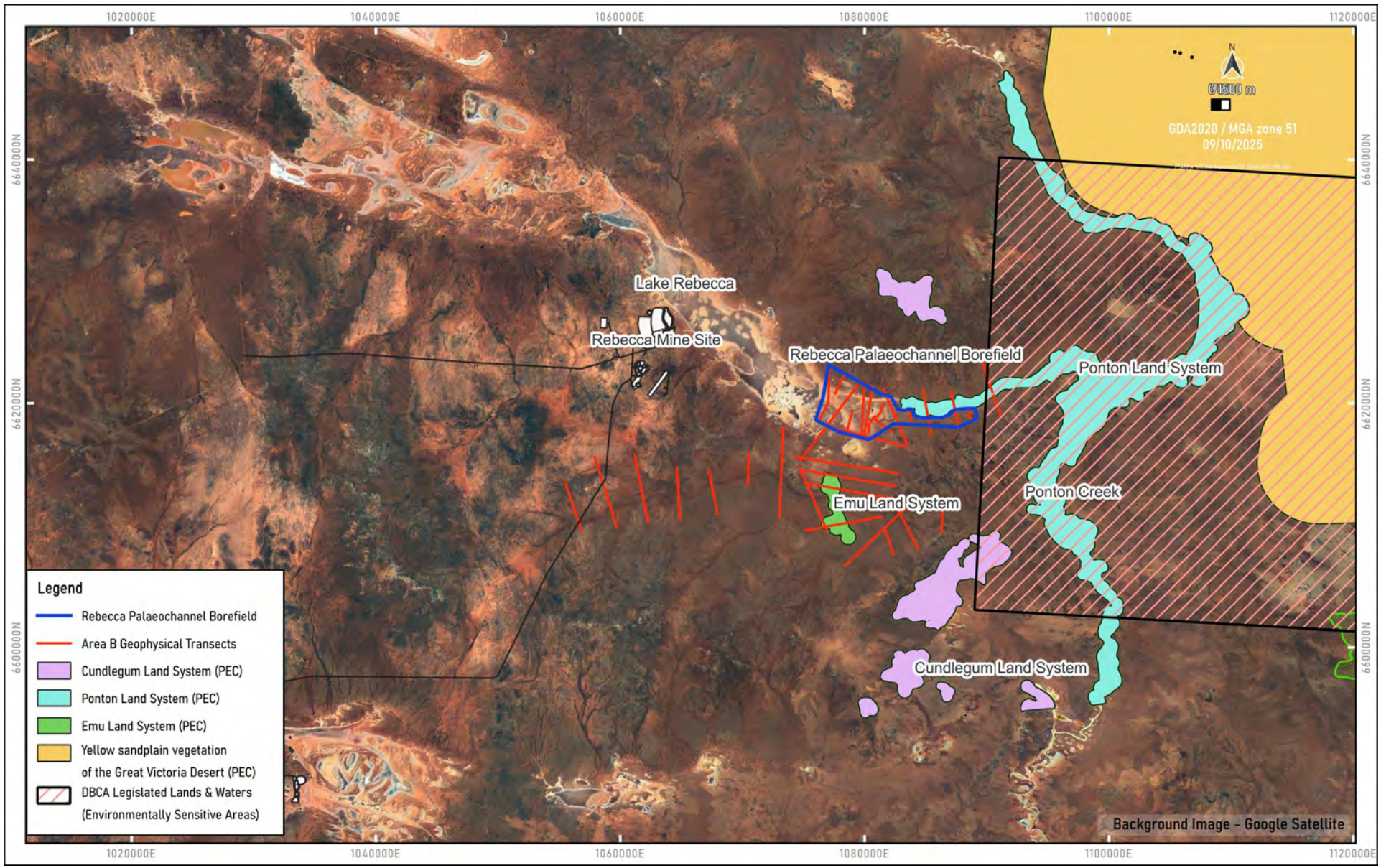


Figure 4.3 Locations of PECs in Rebecca Palaeochannel Borefield Area

4.1.2 Stygofauna

The issue of stygofauna has become increasingly prevalent for mining operations throughout WA. Stygofauna are known to exist in the Eastern Goldfields, are mostly prolific in "fresh" calcrete aquifers, but have been found in other types of aquifers with salinity levels in excess of 60,000 mg/L TDS. It is also known (EPA, 2013) that stygofauna are unlikely to occur in deep sands and clays (especially over solid rock) and do not exist in groundwater environments where salinity exceeds marine concentrations (sea water). Independent of all other factors, salinity appears to be the principal limiting factor for the occurrence of stygofauna in the palaeodrainage system of the project area. The majority of non-marine stygofauna are intolerant to salinity. Therefore, it is extremely unlikely that stygofauna are present in the Rebecca Palaeochannel Borefield area, which has a very high salinity (more than 170,000 mg/L TDS). Similarly, a number of previous assessments conducted for mining operations in the Goldfields, all concluded that stygofauna are unlikely to occur in the similar Roe and Lefroy Palaeodrainage Systems.

4.2 Surface Water

Due to the depth to water table (i.e. ~5 to 10 mbgl) and very high salinity (more than 170,000 mg/L TDS) at the Rebecca Palaeochannel Borefield, it is unlikely that the palaeochannel groundwater system and surface water system (Lake Rebecca and associated ephemeral surface water features) are in direct hydraulic connection (the water table is below the base of the local lake and creek beds). Ponding in the lake is attributed to infrequent surface water runoff or flooding events rather than surface expression of groundwater. It is noted that it might be possible for groundwater levels to rise close to the surface in low lying areas during and following extreme rainfall events (e.g. cyclones), due to higher than normal recharge. However, at such times, flow within the local lakes and creeks would be dominated by surface water runoff, with a minimal contribution from the groundwater (due to the low flow gradients and the low permeability of the lake beds).

4.3 Other Groundwater Users

Existing groundwater use has been assessed via the DWER Water Register Database of licensed registered users. According to this database there are currently no other groundwater users within a 10 km radius of the Rebecca Palaeochannel Borefield area. However, there are several licensed groundwater users that abstract water from the fractured rock aquifer system and two licensed groundwater users that abstract from the palaeochannel aquifer system further out from the Project area. Licensed drawpoints of the existing groundwater users and their annual allocations are shown in Figure 4.4. The nearest palaeochannel aquifer user is located approximately 55 km to the north-west (Northern Star, Carosue Dam Borefield; GWL103538, allocation of 2,500,000 kL/year) and the nearest fractured rock aquifer user is located approximately 60 km to the north-west (Nexus Pinnacles; GWL205570, allocation of 400,000 kL/year).

In addition to the DWER Water Register Database, the DWER Water Information Reporting (WIR) database provides information regarding water bores drilled (including licensed and unlicensed bores). This shows that there are no other groundwater users within a 10 km radius of the proposed Rebecca Palaeochannel Borefield.

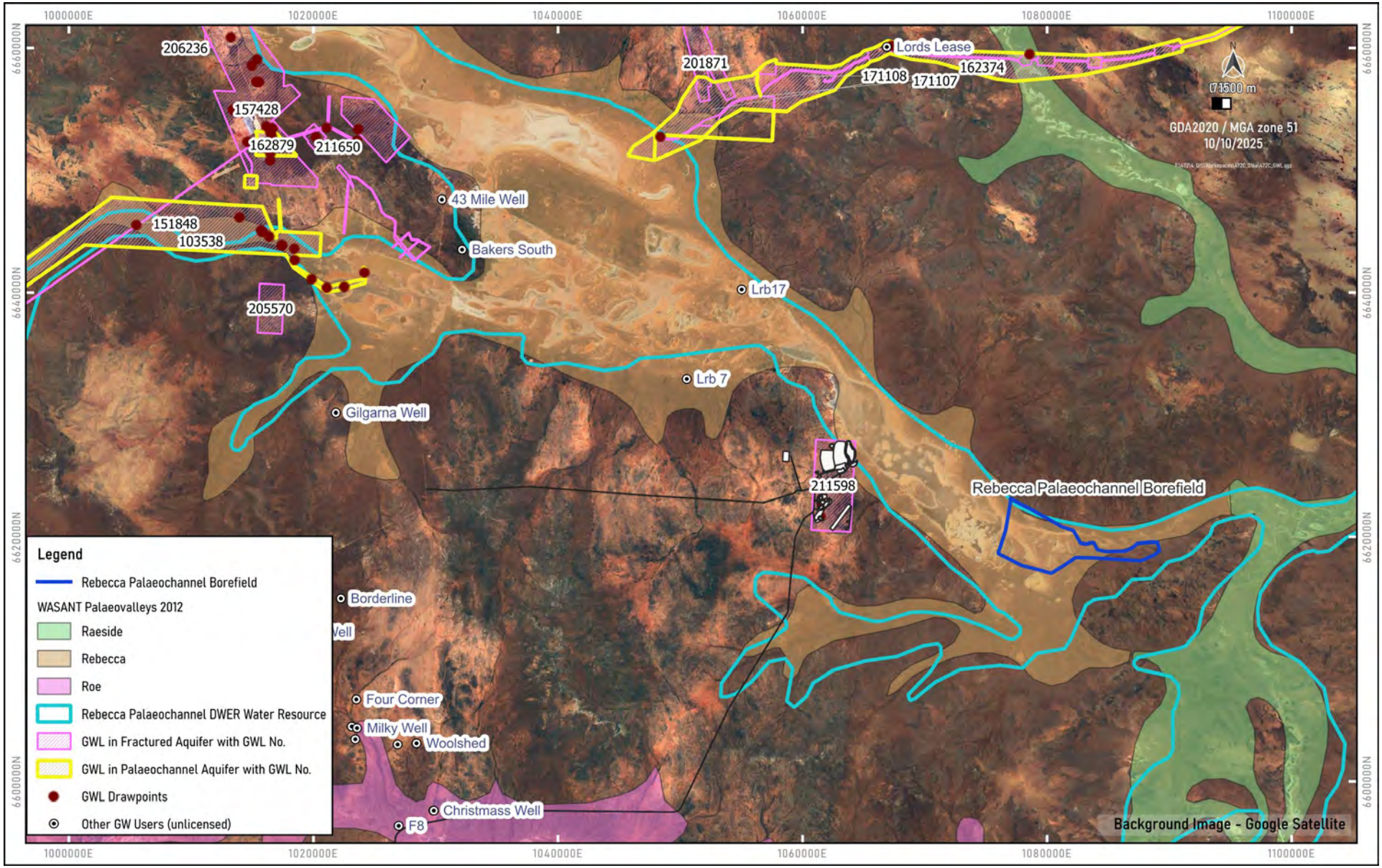


Figure 4.4 Closest Other Groundwater Users

5. INVESTIGATION PROGRAMMES

5.1 Objectives of the Fieldwork Programmes

A number of investigation programmes were carried out to determine the groundwater supply potential of the Rebecca Palaeochannel and its tributaries in the area around the Rebecca Minesite. The objectives of the field programmes undertaken during this hydrogeological study were to:

- Delineation of the main Rebecca Palaeochannel and its tributary channels (Areas A and B) using ground-based geophysical survey techniques (passive seismic geophysics).
- Determine the deepest parts of the palaeochannel system that the water could potentially be sourced from based on the geophysical survey. Please note that drilling targets were defined for Area B (the proposed Palaeochannel borefield) only.
- Determine the depth and the nature of the palaeochannel fill sediments (via exploration groundwater drilling) along selected points on each geophysical transect line in Area B such as:
    - Determine palaeochannel sedimentary lithologies.
    - Determine palaeochannel depth.
    - Identify the palaeochannel sand in the thalweg (the main trunk of palaeochannel).
    - Provide targets for subsequent water monitoring bores and test production bores drilling and installation.
- Drilling and installation of new test production bores and groundwater level monitoring bores in the palaeochannels encountered.
- Determine the hydraulic characteristics of the palaeochannel sand aquifer in the Rebecca Palaeochannel Borefield area (Area B) by aquifer testing.
- Determine the water quality of the palaeochannel.
- Determine the potential abstraction rates of the new bores for use as water supply bores.

Although both Area A and B were surveyed using passive seismic geophysics, groundwater exploration drilling targets were only defined for Area B from the geophysical data. The intention was that Area A would be investigated at a later date if the palaeochannel aquifer in Area B could not provide the required 3 GL/year water demand. This was not the case, with Area B giving good results, particularly within the main Rebecca Palaeochannel.

A detailed description of the fieldwork programme is provided below. The 2023-2024 fieldwork programme was managed by AQ2 (on behalf of Ramelius), which also provided technical expertise, with support from Ramelius.

5.2 Delineation of Rebecca Palaeochannel and Tributary Channels

Prior to any fieldwork undertaken a desktop study was completed, including review and evaluation of available hydrogeological data and reports focussed on the Rebecca palaeochannel system in the vicinity of the Project area.

The DWER Water Information Reporting (WIR) database provides information regarding bores drilled (including licensed and unlicensed bores) in the vicinity of the Project. According to DWER WIN Database, there are two drill holes (120416080 and 120416081), located approximately 16.5 km and 15 km to the north-northwest of the Project (mine site), which intersected palaeochannel sediments (Figure 5.1, Appendix A). The reported lithology in drill hole 120416080 appears to be more typical of the main channel of the palaeochannel (i.e. thalweg), with a 49 m thick clay and 13 m thick basal sand. However, drill hole 120416081 recorded approximately 4 m of coarse sand and gravel, with an additional 5 m of “not logged” section below

the logged sand that could be sand (with poor sample return – which would be typical for air drilling in a palaeochannel).

Additionally, two separate geophysical surveys (i.e. gravity/electromagnetic (EM) and aerial electromagnetic (AEM) have previously been conducted across the Lake Rebecca lake system to assist in delineation of the main palaeochannel and any paleo-tributary channel extents. Figure 5.1 shows the interpreted distribution of the palaeochannel and interpreted deepest part of each palaeochannel (the thalweg). Two major paleo-tributary channels were identified; one to the north-north east of the Project (Area A), with this tributary channel being downstream of the Carosue Dam borefield, and the other to the south-east (Area B).

5.3 Geophysical Surveys (Passive Seismic)

In 2023 and 2024, passive seismic geophysical surveys were carried out using the horizontal-to-vertical spectral ratio (HVSR) method, which was co-ordinated by Resource Potentials Pty Ltd. A number of geophysical transects were planned over interpreted palaeochannel locations as defined by AQ2 (based on the regional mapping of the Tertiary palaeochannel aquifers and previous geophysical surveys, refer to Section 5.2), mostly running perpendicular to each mapped palaeochannel along their lengths. Where the tributary palaeochannels met the main Rebecca Palaeochannel, more transects were added. It should be noted that the heritage areas (as shown in Figure 2.2) were not accessed and transect lines were terminated approximately 50 m short of the heritage areas.

Passive seismic geophysics was run along transects crossing Areas A and B and the transect locations are shown in Figure 5.2. Reports of passive seismic geophysical surveys for Areas A and B are presented in Appendix B. A total of 793 HVSR stations were acquired along 17 survey line transects totalling 77.3 line-kms at the northern survey area (Area A) over several weeks. A total of 1,533 HVSR survey stations were acquired along 24 survey line transects totalling 126.8 line-kms across the southern survey area (Area B) over several weeks in Phase 1 of the work, and 324 HVSR stations along 8 survey lines totalling 17.3 line-kms were acquired during phase 2.

The passive seismic geophysics highlighted an interpreted acoustic bedrock interface (i.e. potential depth to fresh bedrock) below overlying sedimentary cover deposits and identified the potential palaeochannel geometry. It should be noted that drilling data were not available during the initial survey phase for both the northern (Area A) and southern (area B) surveys and therefore constrained velocity analysis for depth conversion of the HVSR data could not be conducted. Instead, an average shear wave velocity (*VS*) of 400 m/s was used to depth convert all Phase 1 HVSR data for both areas A and B. This average Vs was later confirmed to be accurate during processing of the southern (i.e. Area B, proposed Rebecca Palaeochannel Borefield) survey area Phase 2 data, facilitated by the availability of new drilling information.

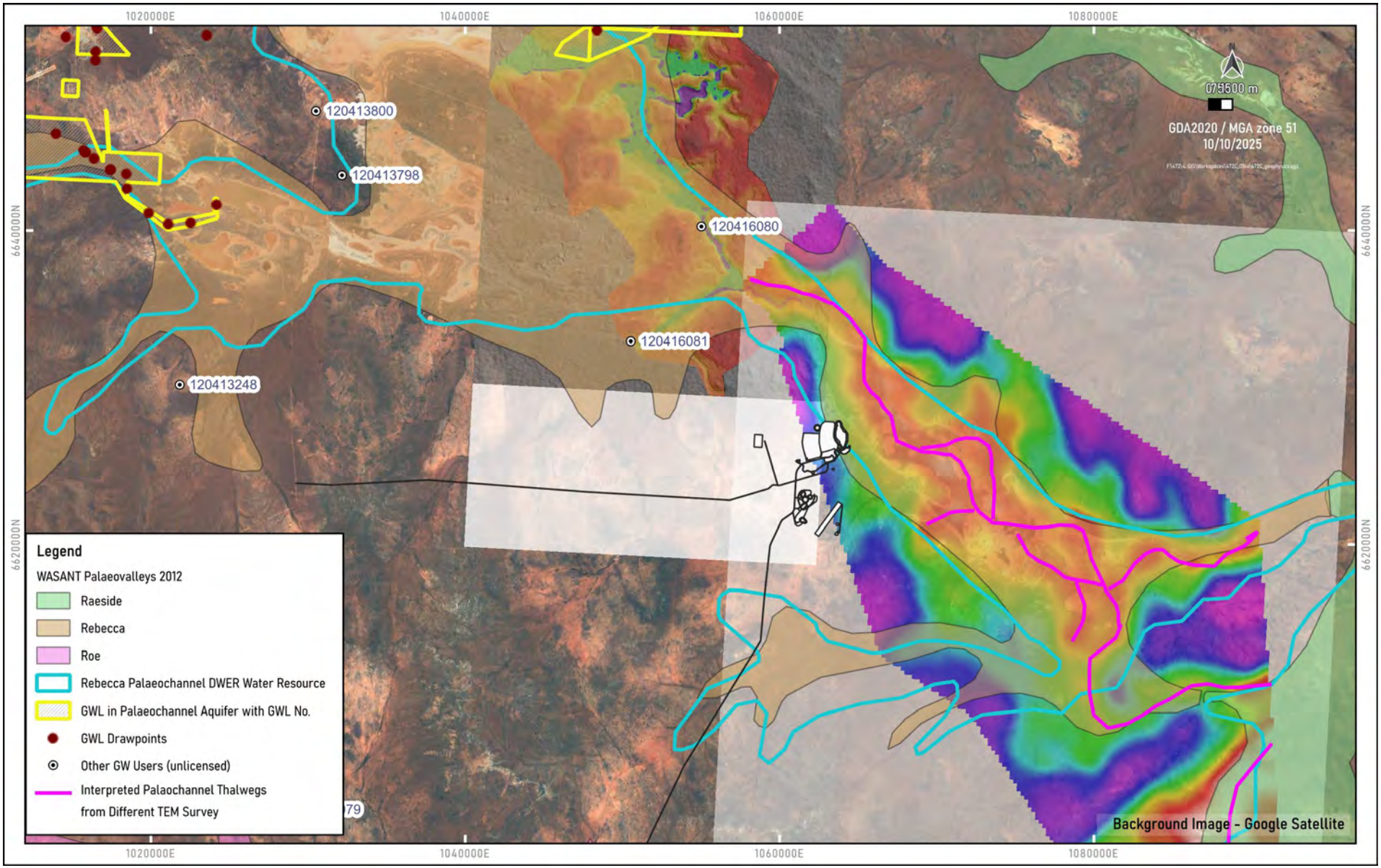


Figure 5.1 DWER WIN Database Bores and EM Geophysical Surveys

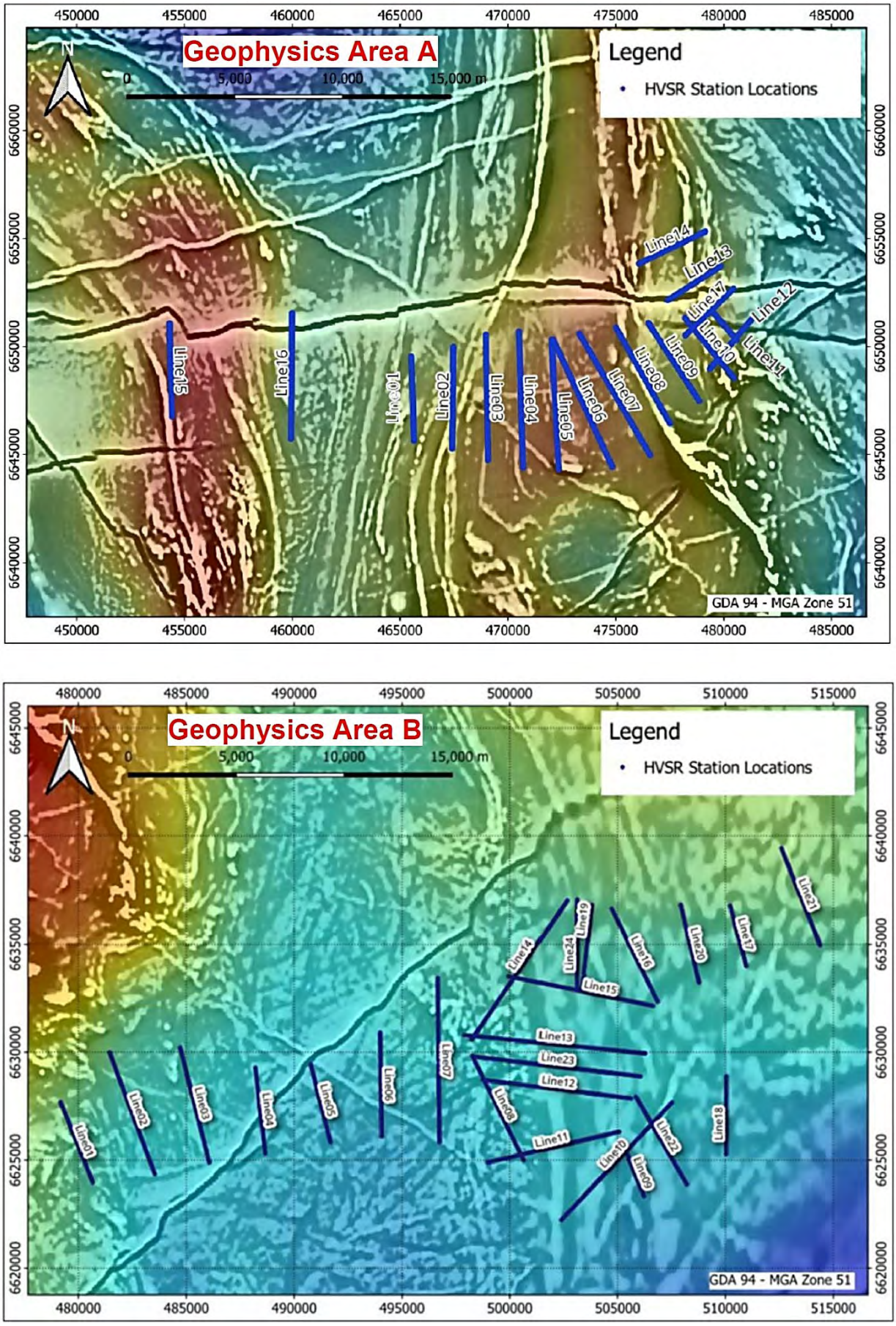


Figure 5.2 Northern (Area A) and Southern (Area B) Passive Seismic Survey Transect Locations, Overlain On Gravity Anomaly Pseudocolor Image and Magnetic Anomaly Greyscale Image

Overall, the passive seismic geophysics (HVSR) survey results show an undulating acoustic impedance contrast interface layer response or "acoustic bedrock" representing a layer that deepens to define palaeochannel structures on the majority of survey lines, likely sitting above weathered and fresh Archean granite-greenstone bedrock. Higher frequency (shallower) HVSR peak responses were also resolved above the bedrock HVSR peaks which could be related to shallower layers from within the sedimentary and regolith deposits, such as sand or gravel, calcrete, silcrete, cementation, silicification layers, etc.

Acoustic bedrock topography (both as depth to acoustic bedrock from the land survey (mbgl) and as bedrock elevation (mRL)) based on the modelled HVSR passive seismic results are shown for Area A in Figures 5.3 and 5.4 and for Area B in Figures 5.5 and 5.6. The survey results demonstrate the greatest depths to the fresh bedrock, which could be interpreted as the thickest sedimentary covers, potentially correlated to the palaeochannel thalweg. The results indicate the following:

- Modelled depths to the acoustic bedrock from passive seismic surveying from ground level ranged from 1.5 to 97 m within the Area A and from 1.5 to 100 m within the Area B.
- One main palaeochannel extending to the north-northwest of Area A, striking in a southeasterly direction toward Area B, then through the proposed Rebecca Palaeochannel Borefield, then striking in a northeasterly direction before joining the Raeside Palaeochannel system. This is consistent with the regional mapping of palaeochannel extents.
- There have been two potential palaeochannel thalwegs identified to the west of the main Rebecca palaeochannel in Area A and four potential palaeochannel thalwegs identified to the southwest, south and southeast of the main Rebecca palaeochannel in Area B, which could indicate additional tributaries of the main Rebecca palaeochannel.
- Besides mapping the broad geometry of palaeochannel topography and its tributary like features, by detecting the top of the hard and fresh bedrock sitting below soft regolith and sedimentary cover deposits, the passive seismic HVSR survey was also successful for mapping areas containing possible small and large vertical offsets of the acoustic bedrock which are interpreted to represent Cainozoic neotectonic faulting (evident on Survey Lines 13 and 14).

The geophysical survey results from Area B (only) were used to identify the most prospective hydrogeological drilling targets (i.e. the potential greatest thicknesses of the main palaeochannel and its tributary) and also to assist in defining the palaeochannel geometry (refer to Section 7.3), which is needed for subsequent numerical groundwater modelling (refer to Section 8).

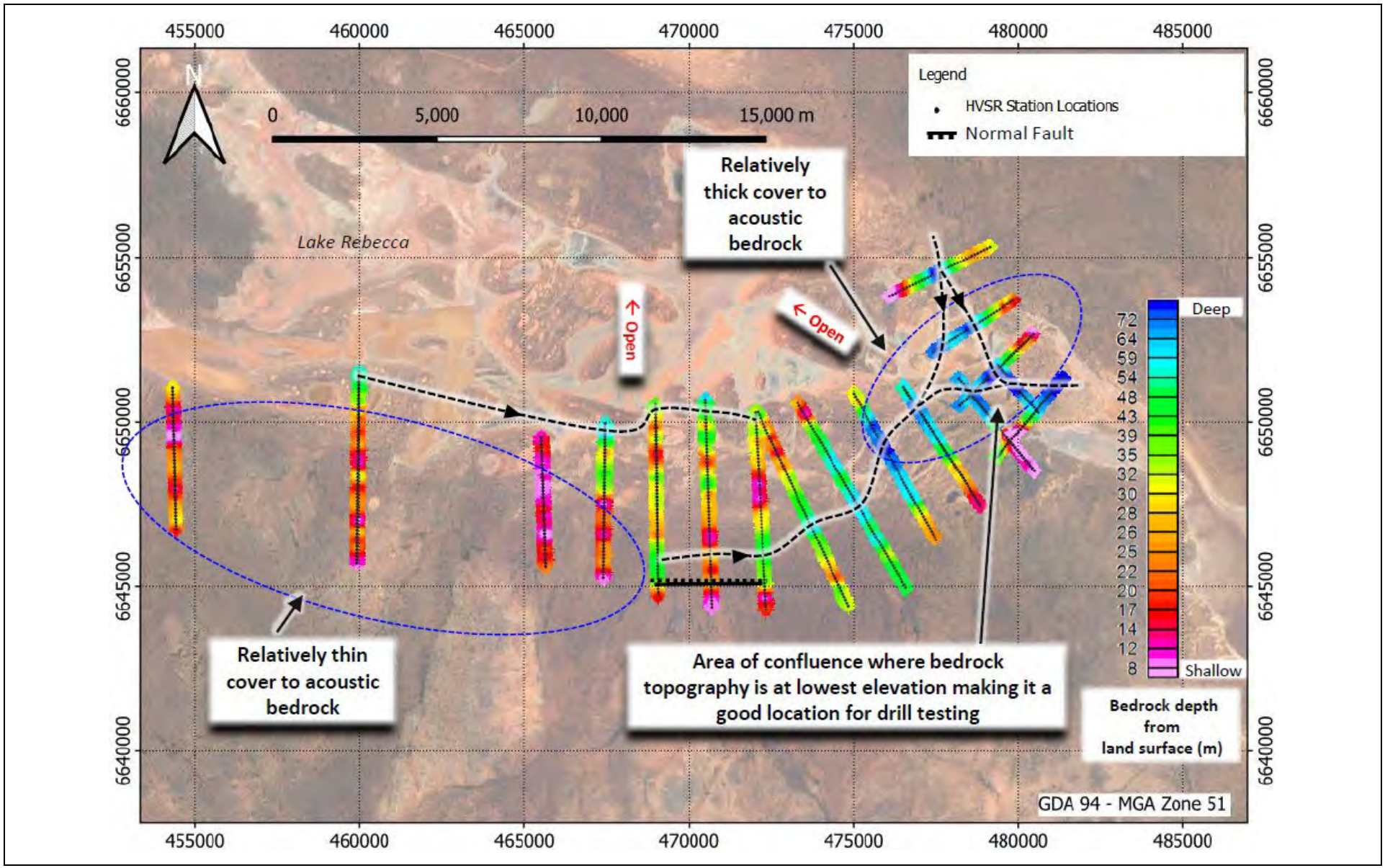


Figure 5.3 Rebecca Palaeochannel Area A – Modelled Acoustic Bedrock Topography (as Depth to Acoustic Bedrock from the Land Survey (mbgl))

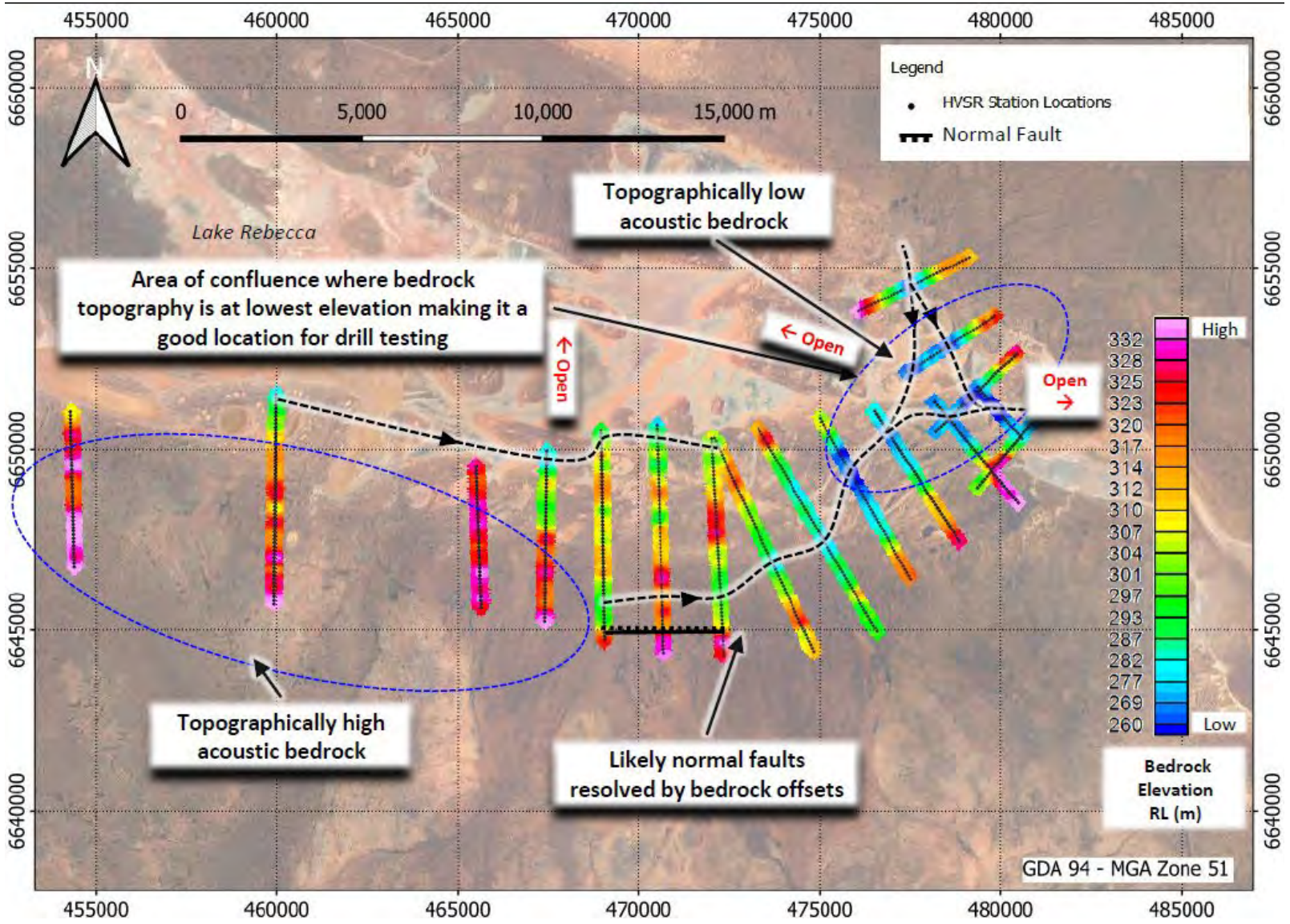


Figure 5.4 Rebecca Palaeochannel Area A – Modelled Acoustic Bedrock Topography (as Bedrock Elevation (mAHD))

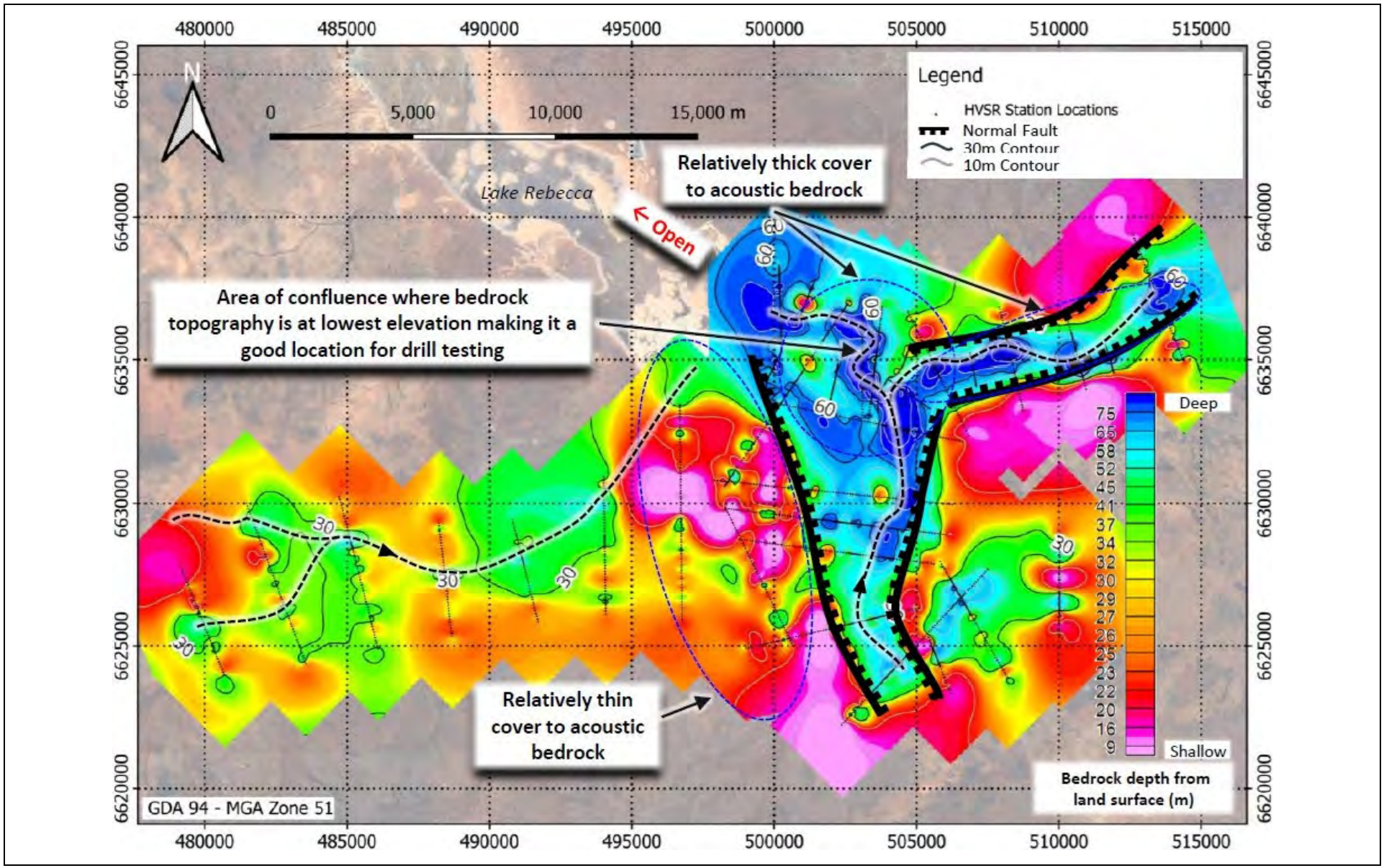


Figure 5.5 Rebecca Palaeochannel Area B – Modelled Acoustic Bedrock Topography (as Depth to Acoustic Bedrock from the Land Survey (mbgl))

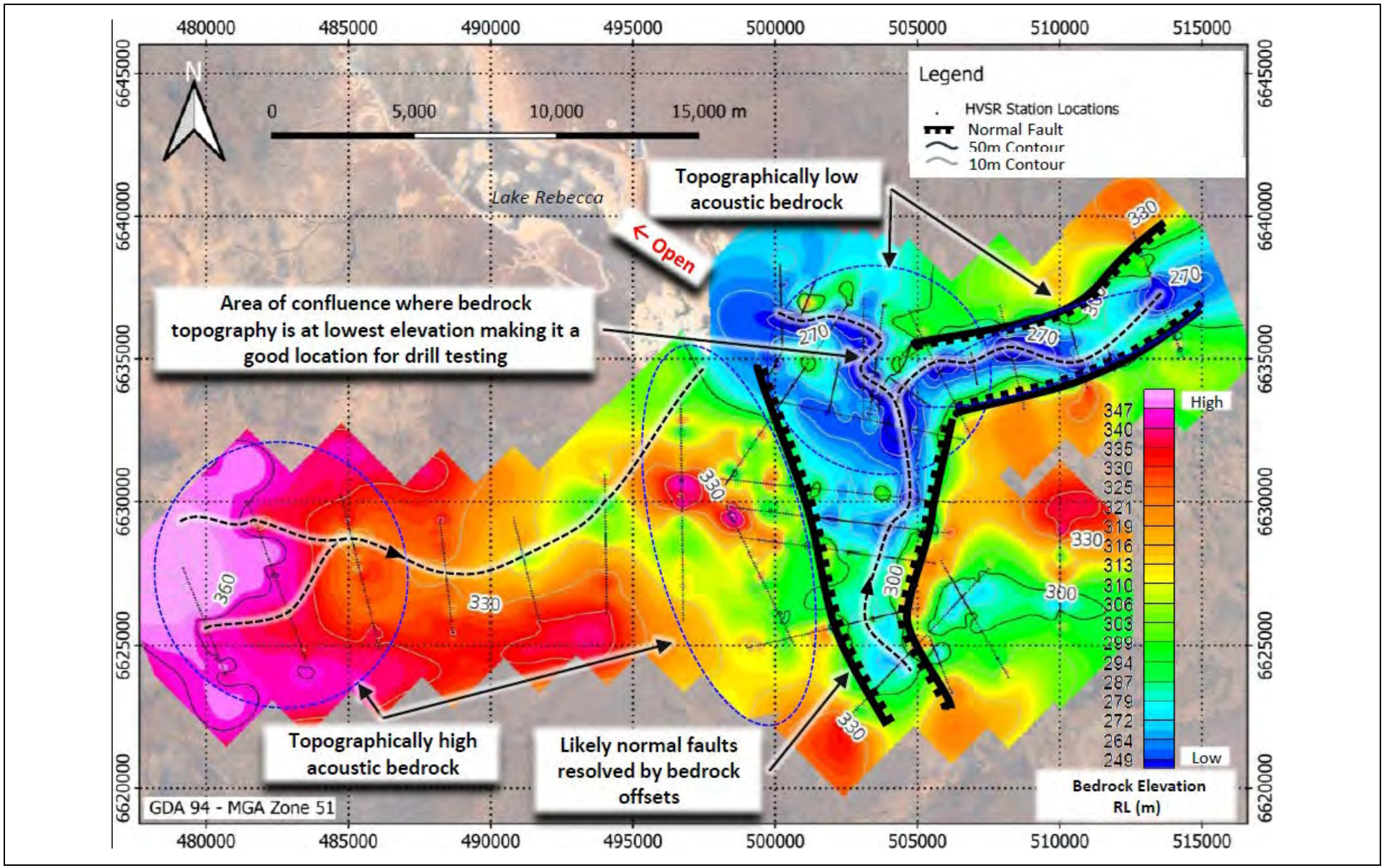


Figure 5.6 Rebecca Palaeochannel Area B – Modelled Acoustic Bedrock Topography (as Bedrock Elevation (mAHD))

5.4 Groundwater Exploration Drilling

An initial groundwater exploration drilling programme was carried out within the main Rebecca palaeochannel and its main tributaries in Area B. The main aims of this were to:

- Confirm the geology.
- Determine the depth to fresh unweathered bedrock (confirm the accuracy of the geophysical results).
- Confirm the presence, nature and thickness of the palaeochannel fill sediments (both palaeochannel clay and basal sand).
- Collect any hydrogeological information, if possible (i.e. first water strike, water yield during drilling).
- Identify the deepest part of the palaeochannel (thalweg).
- Select the best drilling targets to install test investigation bores and monitoring bores to allow hydraulic testing of the palaeochannel aquifer.

The groundwater exploration drilling programme was conducted by Kennedy Drilling, who are mineral exploration drilling contractors. Kennedy Drilling supplied an air core rig to perform the work. Air core drilling is designed to work in poorly consolidated lithologies and works using dual wall drilling rods and reverse circulation techniques. The exploration holes at Lake Rebecca were drilled using a 102 mm (4") blade bit. The drilling provided lithological samples, which were collected at 1 m intervals. Upon completion of each exploration drill hole, the holes were left open at that time to allow for subsequent reaming of particular holes (if required). However, all exploration holes that were not further investigated with water bore drilling were rehabilitated at a later stage.

The exploration hole locations were selected based on the results from the geophysical surveys interpretation of the deepest parts of the potential palaeochannel in Area B (i.e. proposed Rebecca Palaeochannel Borefield area) as shown in Appendix C. An initial phase of groundwater exploration drilling was undertaken between 11th November and 1st December 2023 with 46 exploration holes being drilled. The maximum drilling depth of the holes was 101 m, with an average drilling depth of 70 m. A second phase of groundwater exploration drilling took place between 1st and 8th February 2024 in the northeast of Area B, due to Ramelius acquiring an additional tenement, which allowed access for the drilling rig. This second phase comprised the drilling of a further 11 exploration holes to depths of between 18 to 113 m. The locations of all exploration holes drilled as part of the 2023-2024 groundwater investigation programme, together with the geophysical transects that they were drilled along are shown in Figure 5.7. Drilling details for all exploration holes are summarised in Table 5.1 and lithological logs are presented in Appendix D. It is noted that drill holes were numbered sequentially in the order of their drilling, from WBAC0001 to WBAC0057.

The original intention was for the drilling to penetrate the whole thickness of the palaeochannel sediments and continue through the saprolite and saprock and terminate in fresh bedrock. However, this was not always possible for a variety of reasons. In 5 holes, (WBAC0003, WBAC0004, WBAC0011, WBAC0034 and WBAC0051), the blade bit was unable to drill through coarse grained quartz sands near to the base of the palaeochannel. These sands were the target horizon for water supply and their thickness and composition needed to be ascertained. The blade bit could only penetrate between 1 to 6 m into these coarse sands before refusing to advance. In the first bores where this happened, switching over to a hammer bit was tried, but the overlying clay and silt formations were always too poorly consolidated and threatened to collapse, which could have caused the rod string to become stuck in the bore and lost. The 5 holes where the basal sand unit could not be penetrated were finished at a later date using a water bore rig and mud rotary techniques, which prevented hole collapse. This drilling showed similar results to the aircore rig and that the palaeochannel sands were not much thicker than had been shown with the aircore rig. In other holes, large thicknesses (up to 40 to 60 m) of saprolitic clay and saprock were encountered and it was not worth drilling through the entire sequence of these to reach fresh bedrock as the palaeochannel sediments were the main focus of the exploration programme.

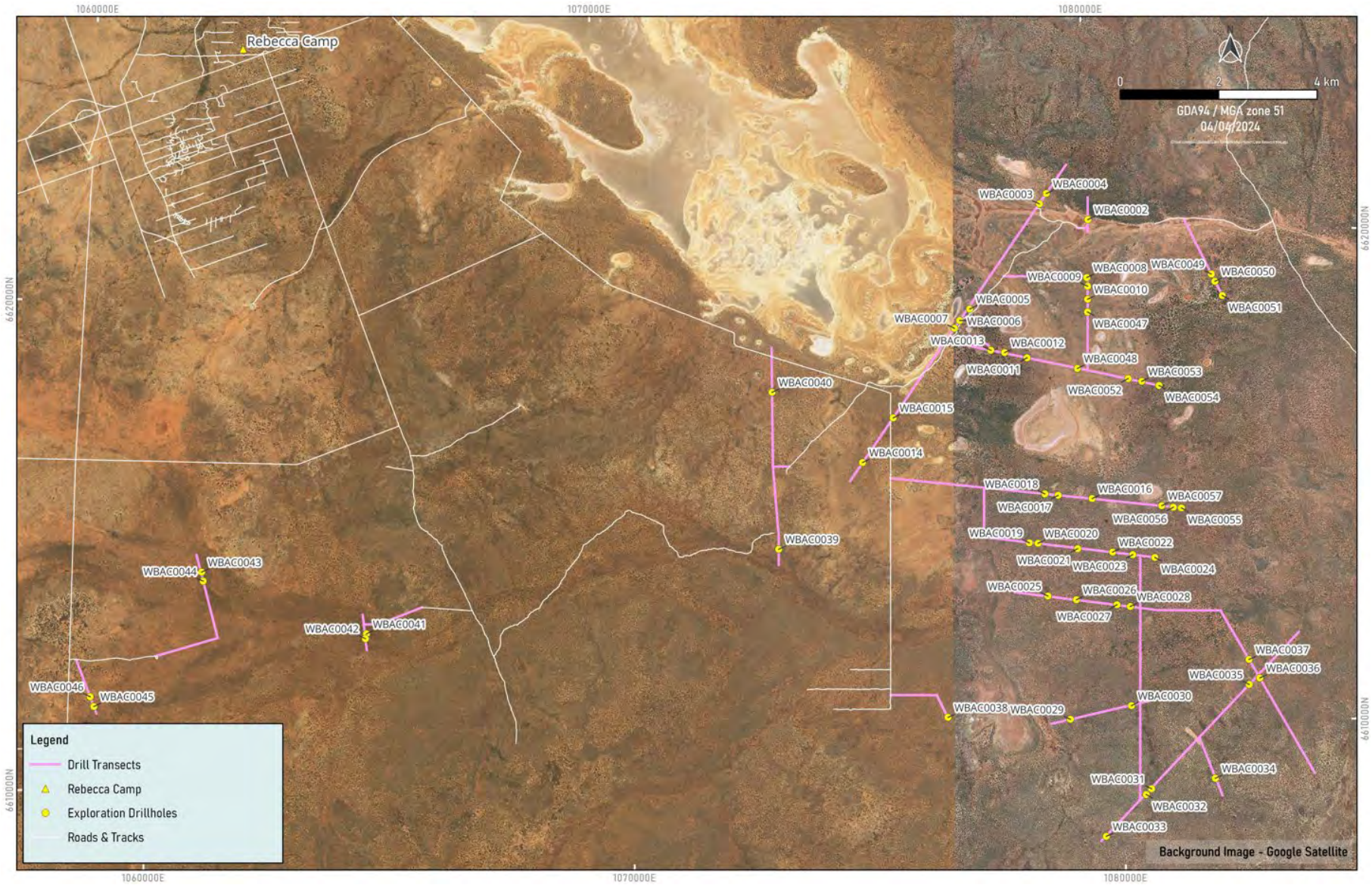


Figure 5.7 Water Exploration Drill Hole Locations

Table 5.1 Groundwater Exploration Holes Summary

Hole ID	Coordinates GDA2020 Zone 51J		Ground Level (mAHD)[1]	Drilled Depth (mbgl)	Main Palaeochannel Aquifer Unit[2]		
	Easting	Northing			Lithology	Depth (m)	Thickness (m)
WBAC0001	503101	6636118	334	2	-	-	-
WBAC0002	503107	6635950	321	86	Sand	62 - 83	21
WBAC0003	502122	6636270	337	78	Sandy Silt, silty Sand and Sand	14 - 30	16
WBAC0004	502122	6636270	337	92	Granulitic Sand	49 – 65 78 - 87	25
WBAC0005	500706	6634132	332	55	Gravel	30-40	10
WBAC0006	500504	6633900	326	57	Silty Sand	38 - 43	5
WBAC0007	496829	6629251	332	86	Silty Sand	38 - 40	2
WBAC0008	503084	6634773	331	74	Gravelly Sand	34 - 42	8
WBAC0009	503101	6634597	329	81	Gravelly Sand	33 - 39	6
WBAC0010	503101	6634332	329	92	-	None	-
WBAC0011	501871	6633140	330	62	Sand and silty Sand	56 -62+	6+
WBAC0012	501415	6633248	334	81	Granulitic Sand	78 - 81	3
WBAC0013	501135	6633294	333	86	-	None	-
WBAC0014	498531	6631013	339	92	-	None	-
WBAC0015	499152	6631919	334	68	-	None	-
WBAC0016	503192	6630280	329	72	-	None	-
WBAC0017	502503	6630346	328	76	Gravel and Sand	63-65 69 - 74	7
WBAC0018	502233	6630374	333	83	-	None	-
WBAC0019	501917	6629379	335	92	Gravelly Sand	62-66 70 - 76	10
WBAC0020	502094	6629370	334	85	-	None	-
WBAC0021	502899	6629260	335	80	Sand, but likely to be unsaturated	4 - 6	2
WBAC0022	503608	6629191	333	89	-	None	-
WBAC0023	504018	6629139	334	76	-	None	-
WBAC0024	504466	6629082	339	86	-	None	-
WBAC0025	502295	6628298	334	80	Gravelly Sand	14 - 18	4
WBAC0026	502874	6628223	338	68	Silty Sand & gravelly Sand	2 - 11	9
WBAC0027	503697	6628121	344	93	Silt, Sand, Gravel	5 – 17 19-23	16
WBAC0028	503968	6628085	346	101	Sand and Gravel	6 - 21	15
WBAC0029	502751	6625792	329	45	Silty Sand	29 - 37	8
WBAC0030	503992	6626069	335	76	Silty Sand	40 – 47 57-62	12
WBAC0031	504400	6624380	333	69	-	None	-
WBAC0032	504291	6624262	335	82	-	None	-

Hole ID	Coordinates GDA2020 Zone 51J		Ground Level (mAHD)[1]	Drilled Depth (mbgl)	Main Palaeochannel Aquifer Unit[2]		
	Easting	Northing			Lithology	Depth (m)	Thickness (m)
WBAC0033	503480	6623412	340	65	Silty Sand & Conglomerate	13 - 17	4
WBAC0034	505695	6624593	332	35	Silty Sand & Sand	26-28 34 - 35+	3+
WBAC0035	506383	6626500	339	80	Silty gravelly Sand	6 - 11	5
WBAC0036	506598	6626633	338	60	Gravelly Silt, but unsaturated	4 - 7	3
WBAC0037	506379	6627009	342	60	Silty gravelly Sand, but unsaturated	1 - 6	5
WBAC0038	500266	6625831	341	55	Silty Sand	12-24 29 - 36	17
WBAC0039	496828	6629249	343	53	-	None	-
WBAC0040	496692	6632439	338	53	-	None	-
WBAC0041	488456	6627529	357	58	-	None	-
WBAC0042	488434	6627431	357	60	Conglomerate	6 - 19	13
WBAC0043	485108	6628785	358	60	-	None	-
WBAC0044	485140	6628600	357	35	-	None	-
WBAC0045	482919	6626051	370	40	-	None	-
WBAC0046	482844	6626250	371	50	Sandy Silt	1 - 18	17
WBAC0047	503099	6634073	329	18	-	None	-
WBAC0048	502895	6632925	332	32	-	None	-
WBAC0049	505613	6634844	330	78	Sand	73 - 78	5
WBAC0050	505686	6634697	331	83	Sand	57 - 78	21
WBAC0051	505835	6634408	333	68	Sand	56 - 63	7
WBAC0052	503923	663218	331	102	-	None	-
WBAC0053	504200	6632663	331	113	Sand	105 - 111	6
WBAC0054	504550	6632579	335	99	-	None	-
WBAC0055	505007	6630089	336	112	-	None	-
WBAC0056	504842	6630104	334	97	-	None	-
WBAC0057	504607	6630134	335	71	-	None	-

Notes:
[1] elevation measured using handheld GPS unit or Google Earth estimate, bores were not surveyed for elevation
[2] If fully saturated.
NR – not recorded

The groundwater exploration drilling results indicated the following sedimentary sequence within the Rebecca Palaeochannel and its main tributaries:

- At surface, alluvium/colluvium (poorly sorted clay, silt and sand in various proportions), variable thickness between 2 and 6 m.
- An underlying upper palaeochannel clay (mainly silty clay, but becoming sandy in places), between 6 to 30 m thick.
- An upper palaeochannel sand (mainly silty and clayey sand) with variable thickness of 2 to 15 m. In some places there is no upper palaeochannel sand present.

- A lower palaeochannel clay (mainly silty clays, but becoming sandy silty clays in places), between 22 to 30 m thick.
- A basal palaeochannel sand, (mainly sand with gravels, with minor silt and clay bands present), with variable thickness between 6 and 21 m.
- Weathered basement (saprolite and saprock). It comprised a plastic clay with some basement chips, mostly up to 15 m thick, but in some places is more than 60 m thick.
- At base, fresh and hard felsic basement strata.

Figure 5.8 shows the interpreted distribution of the palaeochannel basal sand unit and interpreted deepest part of each palaeochannel based on the results from the groundwater exploration drilling. The main Rebecca palaeochannel distribution is mostly consistent with regional mapping of the Tertiary palaeochannel aquifers (DWER Water Resource and GSWA Palaeovalleys Map), previous gravity/EM and AEM) geophysical surveys (Figure 5.1) and recent passive seismic surveys (Figure 5.6).

The water exploration drilling showed the most prospective aquifer units lie within the main Rebecca Palaeochannel. Going from west to east down the main channel and within the thalweg of the palaeochannel, bore WBAC0003 had 16 m of sandy silt, silty sand and sand, WBAC0004 had a basal sand unit that consisted of a 16 m thick upper basal sand layer and a 9 m thick lower basal sand layer (a total of 25 m of a basal sand unit), which was divided by silty clay, sandy clayey silt layer, bore WBAC0002 had 21 m of basal sand, and bore WBAC0050 had a 21 m thickness of basal sand. The main palaeochannel has meandered across the confluence area (between bores WBAC0002 and WBAC0050), where two larger tributary channels meet the main Rebecca palaeochannel (in BMB008 area). In these confluence areas, it is possible that the original tributary watercourse meandered across a flatter floodplain, rather than strictly following a west to east orientated main flow channel.

There are also five palaeochannel tributary channels identified in Area B (Figure 5.8), which are as follows:

- The tributary channel that flows southeast of the main Rebecca palaeochannel (as evident in hole WBAC0005, which had 10 m of clayey sand), then joining the main palaeochannel somewhere in the WBAC008 area (in the palaeochannel confluence area).
- The tributary channel that flows from the south towards the main Rebecca palaeochannel (as evident from the south in holes WBAC038, WBAC0019, WBAC0017 and WBAC0011) was found to be shallower than the main palaeochannel (up to 50 to 68 m depth), but comprised between 6 and 10 m of silty sand. This tributary joins the main palaeochannel in the confluence area.
- The tributary channel that flows from the east-northeast towards another tributary channel that flows from south-north (as evident in the geophysical survey (Lines 9 and 11, Appendix C) and then confirmed in holes WBAC0030 and WBAC0034), was found to be shallow and thin (~4 m of silty sand).
- A second tributary channel that flows from the south towards the main Rebecca palaeochannel that appeared to be deep in the geophysical transect results (refer to Lines 12, 12, 15 and 23 in Appendix C). However, the groundwater exploration drilling results from holes WBAC0021 to WBAC0028 and WBAC0053 to WBAC0057 (Table 5.1 and Appendix D) found this palaeochannel tributary to be mostly clay filled, with minor shallow sand layers encountered only in two holes (WBAC0027 and WBAC0028) and is unsuitable for water supply.
- A tributary channel that flows from west to east into the main Rebecca palaeochannel, (which was regionally mapped, with the passive seismic results showing 'V' shape responses, suggesting the presence of a palaeochannel (refer to Lines 1 to 7 in Appendix C)). This was found to be shallow and largely clay filled, as shown in the exploration drilling results from holes WBAC0039 to WBAC0045 (Table 5.1 and Appendix D). The sand that was present within it was at a shallow depth and unsuitable for water supply.

It should therefore be noted that the sand and gravel palaeochannel units encountered at shallow depths, particularly in the secondary palaeochannel tributary channels further away from the main Rebecca palaeochannel (and not in the palaeochannel confluence area), are likely to be at least partially unsaturated, thin or silty / clayey and therefore not suitable for long term groundwater supply. The target horizons were deep semi-confined to confined sand and gravel sequences along the main Rebecca Palaeochannel and its adjacent tributaries that have the potential for sustaining the long-term groundwater volumes required (which could be maintained by groundwater leakage from the overlying clay and silt units).

5.5 Particle Size Distribution Analysis

Four samples of the palaeochannel basal sand were collected from four aircore drilled exploration holes:

- WBAC0003 (18-26 mbgl).
- WBAC0019 (62-74 mbgl).
- WBAC0029 (29-37 mbgl).
- WBAC0038 (29-35 mbgl).

WBAC0019, WBAC0029 and WBAC0038 were selected to provide information on the basal sand in the tributary channel that flows from the south towards the main Rebecca palaeochannel, whilst WBAC003 sample was collected from the upper part of the main palaeochannel sand unit.

The samples were sent to E-Precision Laboratory for Particle Size Distribution (PSD) analysis in order to determine the grain size distribution of the palaeochannel basal sand (i.e. the content of clay and silt (<0.075 mm), sand (<0.075-2 mm>) and gravel (>2 mm) fractions) in these locations. Laboratory cumulative particle size distribution curves for the four samples are shown in Figure 5.9 and the E-Precision Laboratory reports are presented in Appendix E. Additionally, the relative percentage of each grain size fraction, including the subdivision of the sand fraction for these specific samples is shown in Figure 5.10.

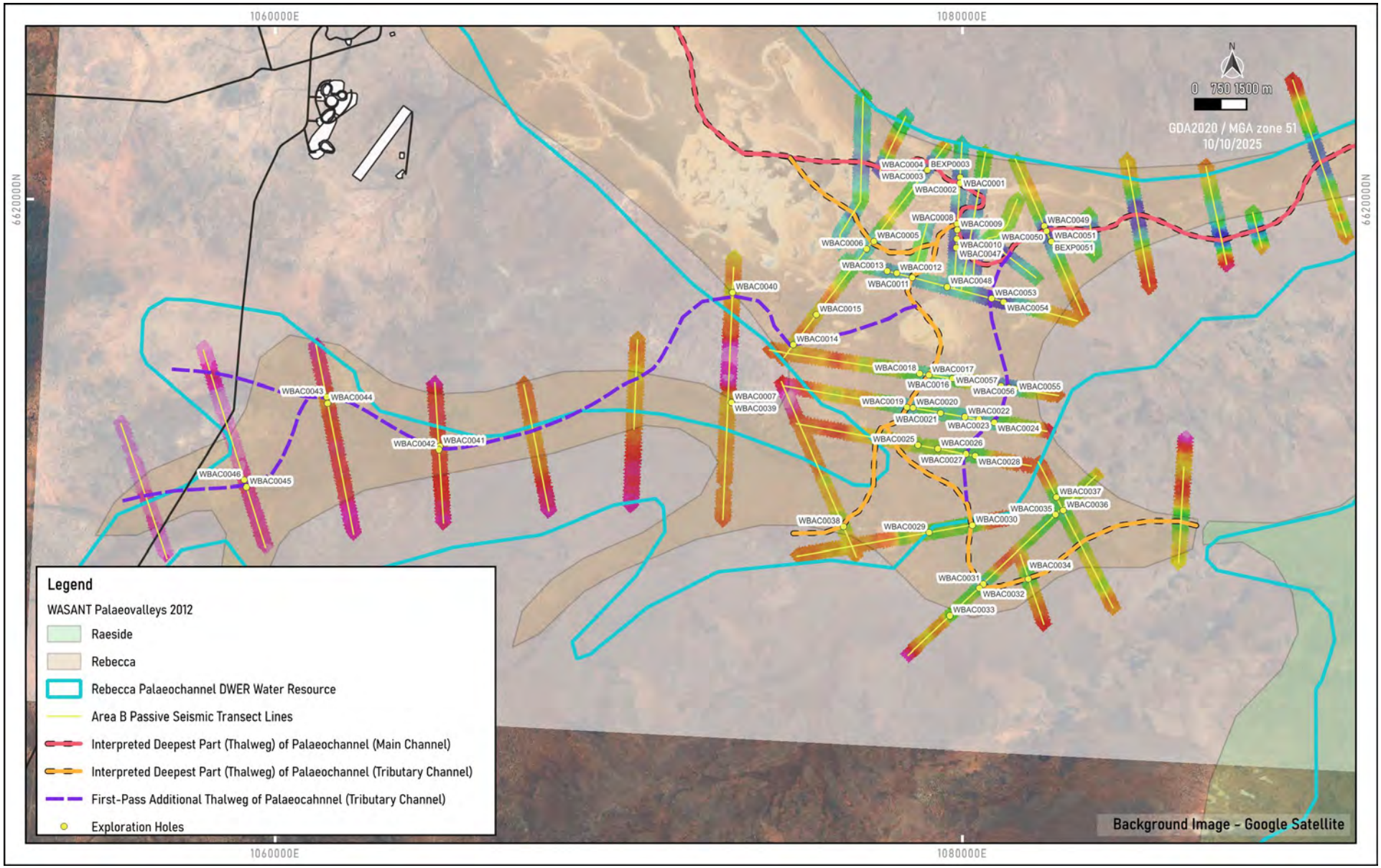


Figure 5.8 Inferred Extent of Rebecca Palaeochannel in Area B

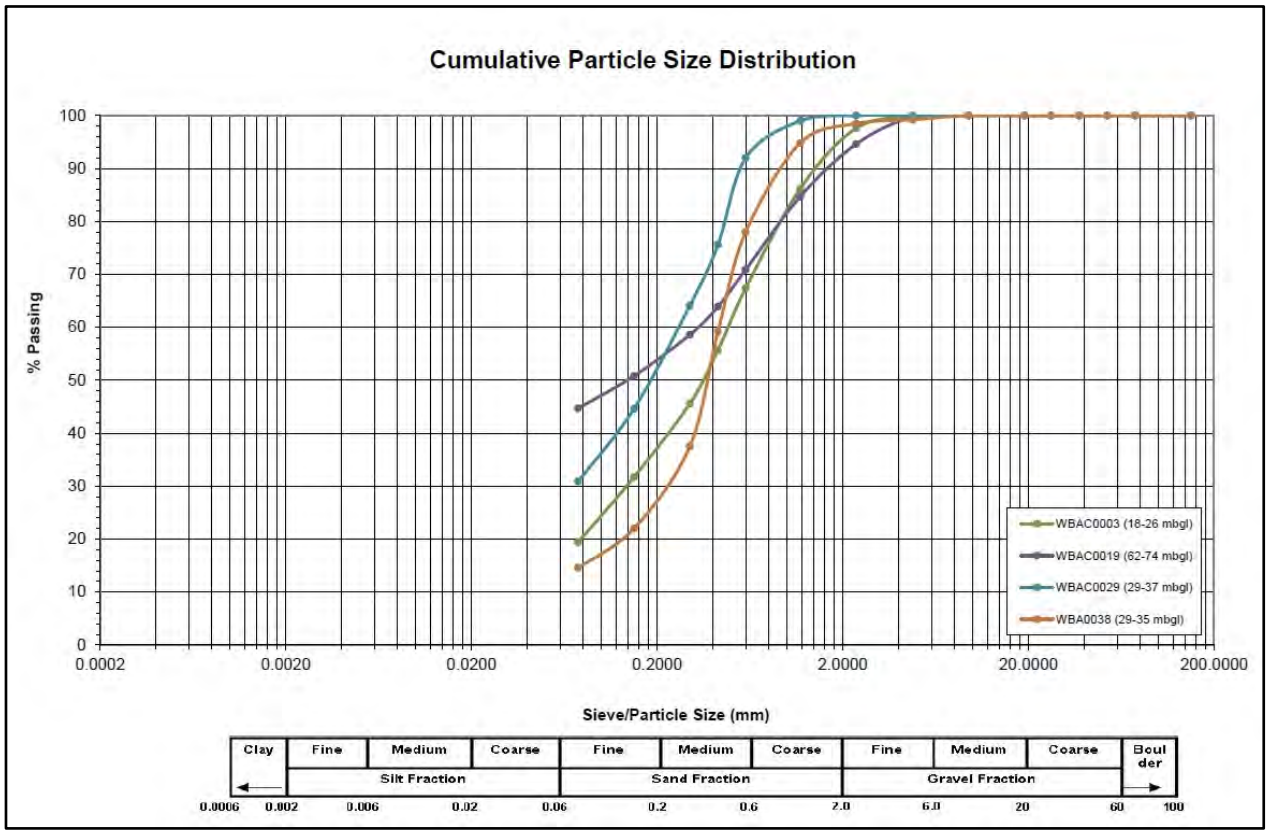


Figure 5.9 Particle Size Distribution Analysis

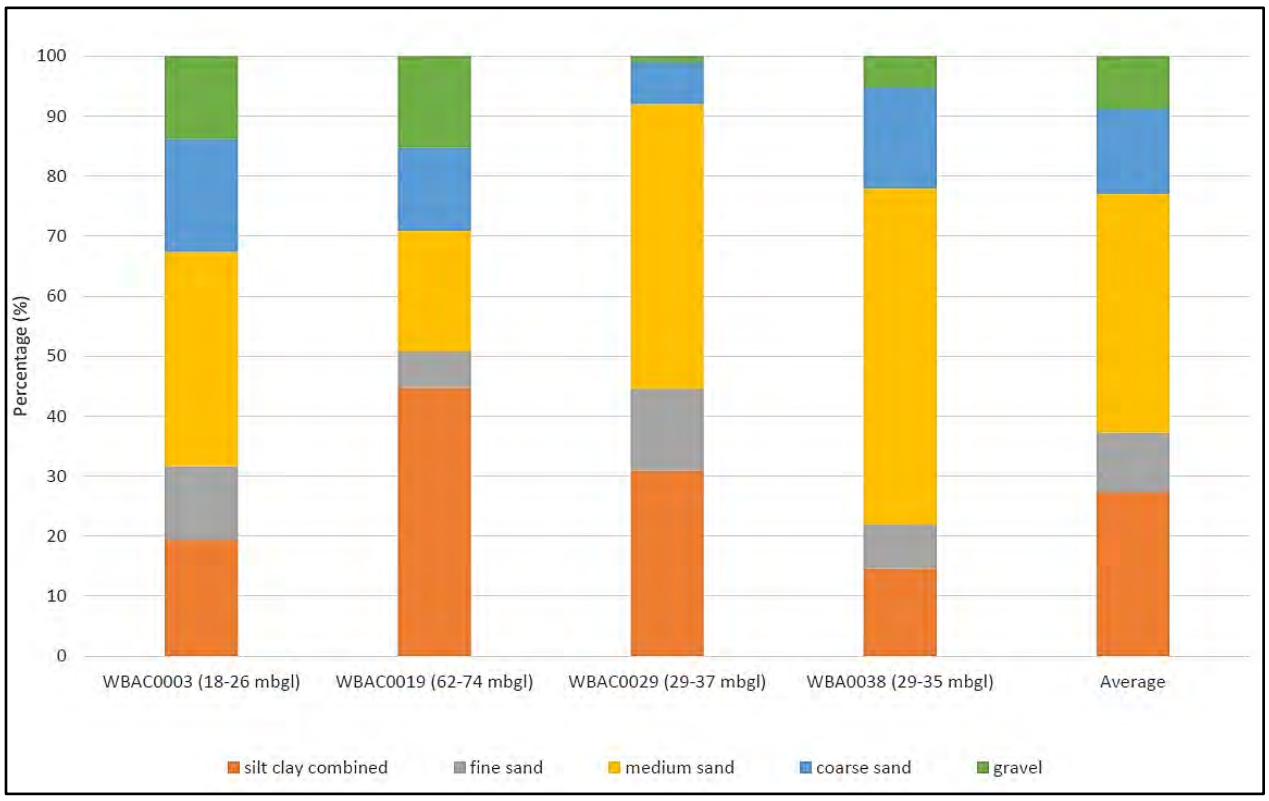


Figure 5.10 Distribution (%) of Each Fraction

Based on Figures 5.9and 5.10 the salient points of the PSD analysis are:

- Results for most of the samples (except for WBAC0019) are similar, with on average:
  - 78.4% of these samples being coarser than 0.075 mm diameter (i.e. sand and above), of which, 71.7% is within the sand fraction and 6.7% is within the gravel fraction.
  - 21.6% of samples were finer than 0.075 mm diameter (i.e. silt and clay).
  - the samples were dominated by medium grained sand (i.e. a total of approximately 57.5%)
- The tributary palaeochannel basal sand aquifer is generally silty/clayey fine to medium grained sand, with minor coarse grained sand and gravel and is relatively homogeneous across the samples.
- There are some differences in the distribution of each fraction from WBAC0019 sample with the remaining samples, with WBAC0019 having 44.7% of this sample being the silt and clay fraction, 40% being the sand fraction and 15.3% being the gravel fraction. The differences in distribution may be associated with the sampled depth and the basal sand becoming coarser (i.e. coarse sand and gravel) with depth, consistent with the palaeochannel origin of the fluvial deposition and a fining upwards sequence (as evident in the other shallow samples).

5.6 Water Bore Drilling and Construction

Based on the outcome of the groundwater exploration drilling programme (refer to Section 5.3), a water bore drilling programme was carried out between 14th February and 18th May 2024 with 4 test production bores and 9 monitoring bores drilled and constructed.

The water bore drilling was carried out by WA Water Bores, who are a specialist water bore drilling company based in Geraldton in Western Australia. WA Water Bores drilled both test production and monitoring bores using mud rotary drilling techniques, which were required to prevent the bore wall from collapsing due to the soft sediments of the palaeochannels. Mud cleaners were used and no mud pits were dug.

The locations of the test production and monitoring bores are shown in Figure 5.11. Construction details for the bores are summarised in Table 5.2, while bore completion data, including lithological and construction logs for the test investigation and monitoring bores, are presented in Appendix F. It should be noted that the production and monitoring bores were given the same number as the aircore exploration bore drilled at their respective sites, with the production bores having the prefix BPB and the monitoring bores BMB.

The 4 test production bores completed were numbered BPB004, BPB011, BPB017 and BPB050. Bores BPB004 and BPB050 are located in the main Rebecca Palaeochannel, whilst bores BPB011 and BPB017 are in tributary channels to it (Figure 5.11). At all test investigation bores, a 381 mm (15") diameter hole was drilled to approximately 3.5 mbgl to allow the installation of 200 mm ND (12") diameter steel surface casing. The bores were then drilled to target depths at 311 mm (12¼") diameter and cased with 200 mm ND (8") blank PVC Class 12 casing and 200 mm ND (8") Grade 316 stainless steel screens (1 mm aperture) installed against the targeted palaeochannel basal sand. The casing and screens were run to close to the base of the palaeochannel with installation depths ranging from 61 to 91 mbgl. The bore annulus was packed with gravel (1.6 to 3.2 mm graded) from the final depth to approximately 2 to 4 m above the slotted intervals, above which a 3 to 5 m bentonite seal was placed, followed by backfilling with gravel pack (above the seal) to close to the surface. The bore annulus was then completed with a 3 m cement plug to ground level.

Each production bore had a single monitoring bore installed close to it on the same drilling pad, with the exception of BPB004, which had 2 monitoring bores. Monitoring bore BMB004S was screened across a shallow upper palaeochannel sand horizon (between 10 and 23 mbgl) at BPB004, which was above the two palaeochannel basal sand horizons tapped by the production bore (48 to 64 mbgl and 80 to 89 mbgl). Monitoring bore BMB004D was screened across the deep palaeochannel basal sand aquifer at the same

point as BPB004. Monitoring bores BMB011, BMB017 and BMB050 were each installed with slotted sections installed across the same palaeochannel basal sand aquifer units as their corresponding production bore BPB011, BPB017 and BPB050. In addition, four monitoring bores were installed as standalone installations, comprising BMB005, BMB008, BMB019 and BMB030. These were constructed to monitor background groundwater levels in the palaeochannel sand aquifer at different points.

At all monitoring bores, a 203mm (8") diameter hole was drilled to approximately 3.5 mbgl to allow the installation of 165 mm ND (6.5") diameter steel surface casing. The bores were then drilled to target depths at 165 mm (6.5") diameter and cased with 50 mm ND blank and slotted PVC Class 12 casing, with 1 mm aperture slots installed against the same palaeochannel aquifer as their adjacent production bores. At each bore, the annulus was packed with gravel (1.6 to 3.2 mm graded) from the final depth to approximately 3 m above the slotted intervals, above which a 2 to 3 m bentonite seal was placed, followed by backfilling with gravel pack (above the seal) to close to the surface. The bore annulus was then completed with a 3 m cement plug to ground level.

At both test investigation and monitoring bores, after the bore casing installation, the bores were airlift-developed until the discharge water was free from sediment. Discharge rates during airlifting were measured. Bore headworks were installed comprising a heavy-duty steel standpipe with lockable cap and a small concrete surface plinth. On completion, the 2 main Rebecca Palaeochannel bores BPB004 and BPB050 had the highest airlift yields of 15 to 20 L/s and 52 L/s, respectively, while the tributary channel bore BPB011 airlifted at 14 L/s and bore BPB017 had a low airlift rate of 2.6 L/s. At the monitoring bores, airlift yields ranged from 0.7 L/s at BMB019 and BMB030 to 2.6 L/s at BMB017 (Table 5.2).

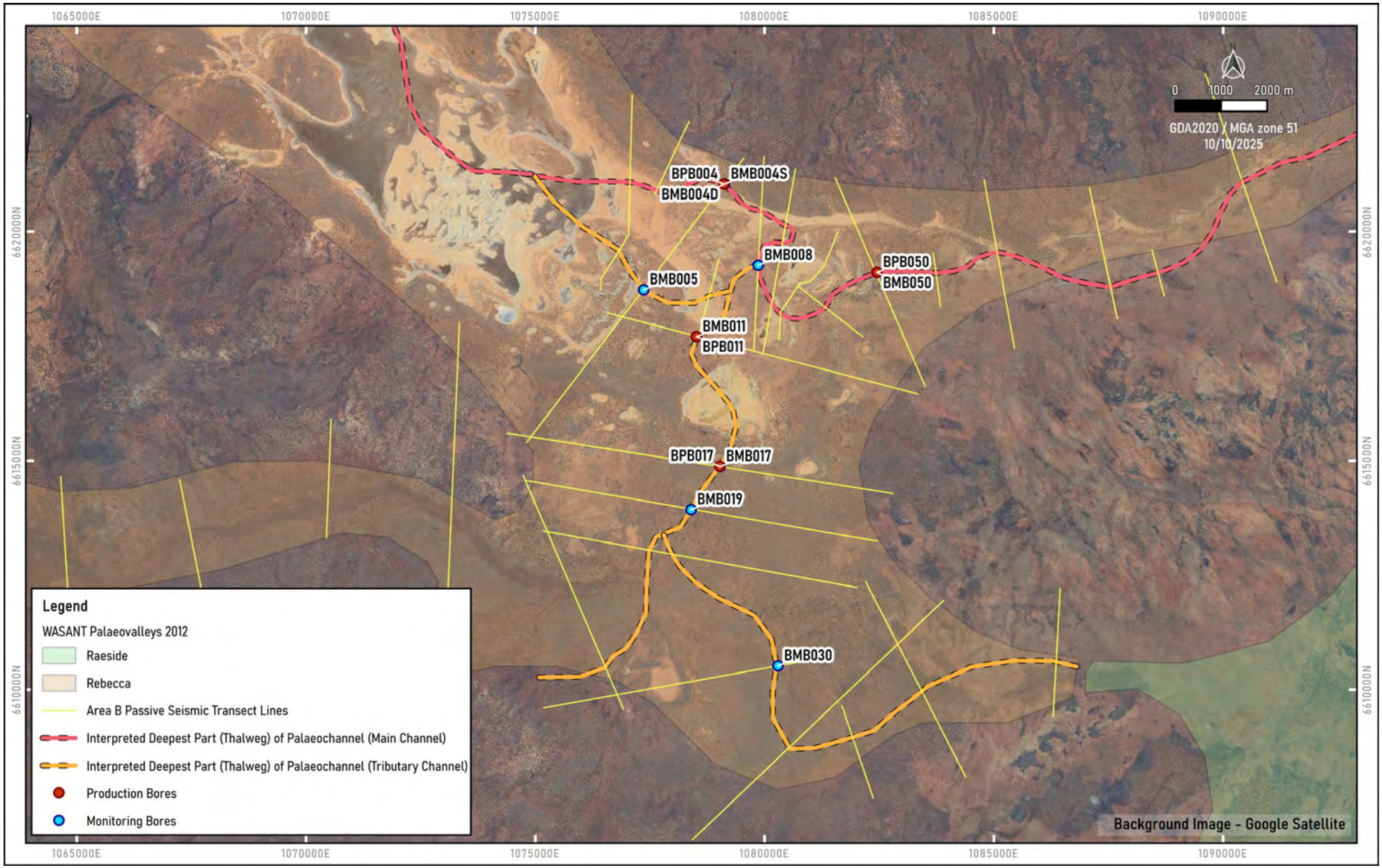


Figure 5.11 Rebecca Palaeochannel Borefield - Test Production and Monitoring Bore Locations

Table 5.2 Test Production and Monitoring Bores Summary

Bore Number	Coordinates GDA2020 Zone 51J		Ground Level (mAHD)	Top of Casing Elevation (mAHD)	Drilled Depth (mbgl)	Drilled Diameter (mm)	Casing Type	Cased Depth (mbgl)	Casing Internal Diameter (mm)	Screened Interval (mbgl)	Static Water Level (mbgl)	Date of Dip	Completion Final Airlift Rate (L/s)	Completion Final pH (pH units)	Completion Final Airlift EC (uS/cm)
	Eastings	Northings													
Test Production Bores															
BPB004	502263	6636480	326.77	327.29	94	311	Cl 12 PVC & Stainless Steel Screens	91	200	49 - 61 79 - 88	7.52	18/05/24	15 - 20	6.34	201,500
BPB011	501844	6633142	326.30	326.90	61	311	Cl 12 PVC & Stainless Steel Screens	61	200	52 - 61	7.97	17/05/24	14.3	6.20	193,200
BPB017	502496	6630351	326.50	327.35	77	311	Cl 12 PVC & Stainless Steel Screens	77	200	68 - 77	8.25	16/05/24	2.6	6.82	179,400
BPB050	505685	6634740	325.41	326.01	84	311	Cl 12 PVC & Stainless Steel Screens	77	200	59 - 77	7.89	17/05/24	52.2	6.63	187,000
Monitoring Bores															
BMB004S	502280	6636484	326.77	327.56	24	165	Class 12 PVC	18	50	12 - 18	5.98	19/05/24	1.5	5.26	167,800
BMB004D	502275	6636483	326.79	327.53	93	165	Class 12 PVC	89	50	53 - 89	7.54	18/05/24	2.0	6.77	194,900
BMB005	500645	6634096	325.56	326.34	54	165	Class 12 PVC	40	50	34 - 40	5.88	16/05/24	2.0	6.51	180,000
BMB008	503100	6634759	325.40	326.09	67	165	Class 12 PVC	62	50	20 - 62	5.05	17/05/24	1.7	6.99	170,300
BMB011	501845	6633135	326.33	327.02	61	165	Class 12 PVC	61	50	52 - 61	7.85	17/05/24	2.0	6.28	190,700
BMB017	502506	6630345	326.58	327.24	77	165	Class 12 PVC	74	50	62 - 74	7.91	16/05/24	2.6	5.75	175,800
BMB019	501928	6629375	326.95	327.64	83	165	Class 12 PVC	66	50	60 - 66	8.53	16/05/24	0.7	6.61	179,000
BMB030	503995	6626082	330.12	330.87	63	165	Class 12 PVC	44	50	38 - 44	17.08	16/05/24	0.7	4.47	139,200
BMB050	505685	6634740	325.42	326.01	82	165	Class 12 PVC	77	50	59 - 77	7.87	17/05/24	2.0	6.78	194,700

5.7 Hydraulic Testing

5.7.1 Test Pumping of New Test Investigation Bores

Following construction and development of the 4 test production bores (BPB004, BPB011, BPB017 and BPB050), an aquifer testing programme was conducted by the test pumping contractor Airwell during the period 4th to 30th August 2024, under supervision by an AQ2 hydrogeologist. This supervision was initially on site and later was conducted remotely from Perth.

Pumping tests were undertaken on each of the four bores to:

- Calculate the hydraulic conductivity, transmissivity and storage of the basal sand aquifer.
- Confirm the presence of hydraulic boundaries in the aquifer, which may comprise barrier or recharge boundaries (e.g. low permeability surrounding basement rocks and zones of increased storage via fault zones, respectively); and
- Assess groundwater flow conditions during pumping (i.e. sustainable yield).

At each bore, the aquifer testing comprised:

- A step-rate test (SRT; 4 x 100 minute steps of progressively increasing pumping rates per step).
- A constant-rate test (CRT) at BPB011 and BPB050 (for 72 hours), at BPB004 (for 60 hours) and BPB017 (for 24 hours).
- Recovery measurements following the cessation of pumping (until groundwater levels were within 90% of the initial water level or after 12 hours of the conclusion of CRT – whichever occurred first).

It should be noted that bore BPB017 only had a 24 hour constant rate test conducted on it due to its low yield, while bore BPB004 had a 60 hour constant rate test conducted due to the test pumping contractor's generator cutting out on the second attempt at doing the CRT. Examination of the drawdown data showed that the 60 hour time period was sufficient to determine the aquifer parameters for BPB004 and a third attempt at the CRT was not required. Pumping test durations and rates of each bore are listed in Table 5.3. After the cessation of pumping, water level recovery was monitored at each production bore and its adjacent monitoring bore(s).

During the tests, pumping rates were measured using an in-line flow meter. Water levels were measured in the test investigation and monitoring bores using a combination of pressure transducers (test bore and closest monitoring bore) and electrical water-level probe (for manual readings of distant monitoring bores).

The hypersaline discharge water was transferred via lay-flat pipe to a salt lake located near each of the tested bores to minimise potential impacts on the vegetated environment. It should be noted that Ramelius was allowed to discharge to the nearby lake (as per their agreement with DWER).

Table 5.3 Summary of Pumping Tests Conducted

Pumping Bore ID	Step Test				Constant Rate Test					
	Step Number	Duration (mins)	Pumping Rate (L/s)	Final Drawdown (m)	Duration (hours)	Pumping Rate (L/s)	Prod Bore Final Drawdown (m)	Monitoring Bore ID	Distance from Pumping Bore (m)	Mon Bore Final Drawdown (m)
BPB004	1	100	7.0	5.54	60.0	21.0	10.09	BMB004S	18	0.22
	2	100	14.0	7.71						
	3	100	21.0	9.75				BMB004D	12.5	4.40
	4	100	27.0	12.98						
BPB011	1	100	4.0	5.56	72.0	10.0	22.84	BMB011	7.5	16.78
	2	100	8.0	12.32						
	3	100	12.0	20.17						
	4	100	16.0	28.74						
BPB017	1	100	0.4	6.00	24.0	1.2	24.45	BMB017	12	8.23
	2	100	0.8	13.36						
	3	100	1.2	21.51						
	4	100	1.6	30.71						
BPB050	1	100	7.0	1.71	72.0	24.0	10.94	BMB050	10	6.85
	2	100	14.0	3.74						
	3	100	21.0	6.05						
	4	100	28.0	8.59						

SRT data were used to make a preliminary assessment of bore yield and confirm the target pumping rate for the CRTs. The test data were also graphically analysed using the Hantush-Bierschenk method to estimate bore efficiency. Graphical plots of drawdown versus log time for SRT are presented in Figure 5.12. SRT results are presented in Appendix G.

The results of analysis of the step-drawdown data indicate that three test investigation bores (BPB004, BPB011 and BPB050) are highly efficient, with a bore efficiency of between 78 and 82% at their maximum rates. These values represent the percentage of the total drawdown (at 100 minutes of pumping) that is caused by friction losses in the formation, rather than in the bore itself. The SRT data showed bores BPB004, BPB011 and BPB050 to be very productive and suggested that they should be able to cope with a CRT pumping rates of 21, 10 and 24 L/s, respectively. The SRT data showed that bore BPB017 is low yielding and suggested a pumping rate of 1.2 L/s during the 24-hour CRT.

Graphical plots of drawdown versus log time for CRT are presented in Figures 5.13 to 5.16, and also in Appendix G. The CRT and recovery test analysis results are also presented in Appendix G.

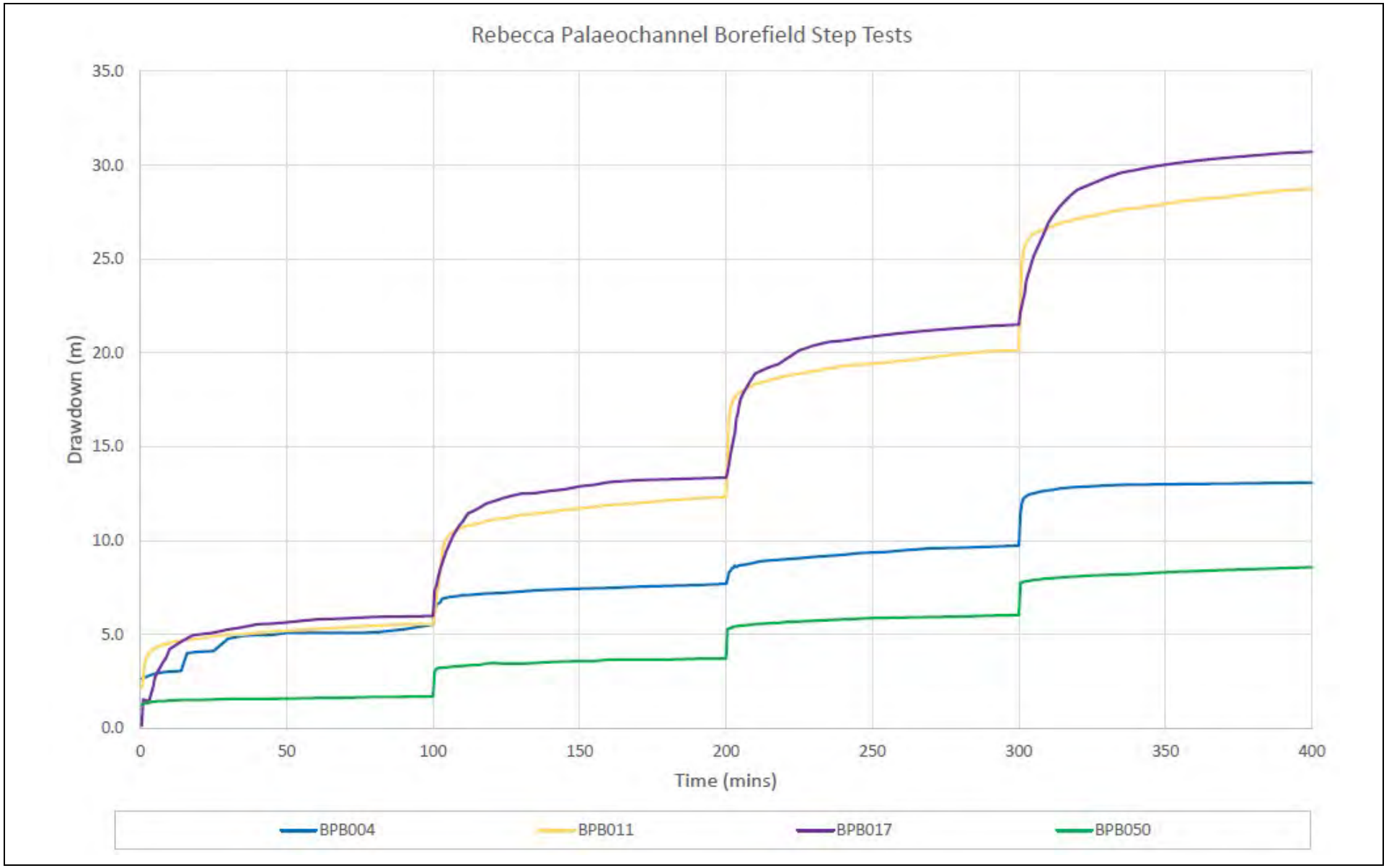


Figure 5.12 Rebecca Palaeochannel Borefield - Test Production Bores Step Rate Tests

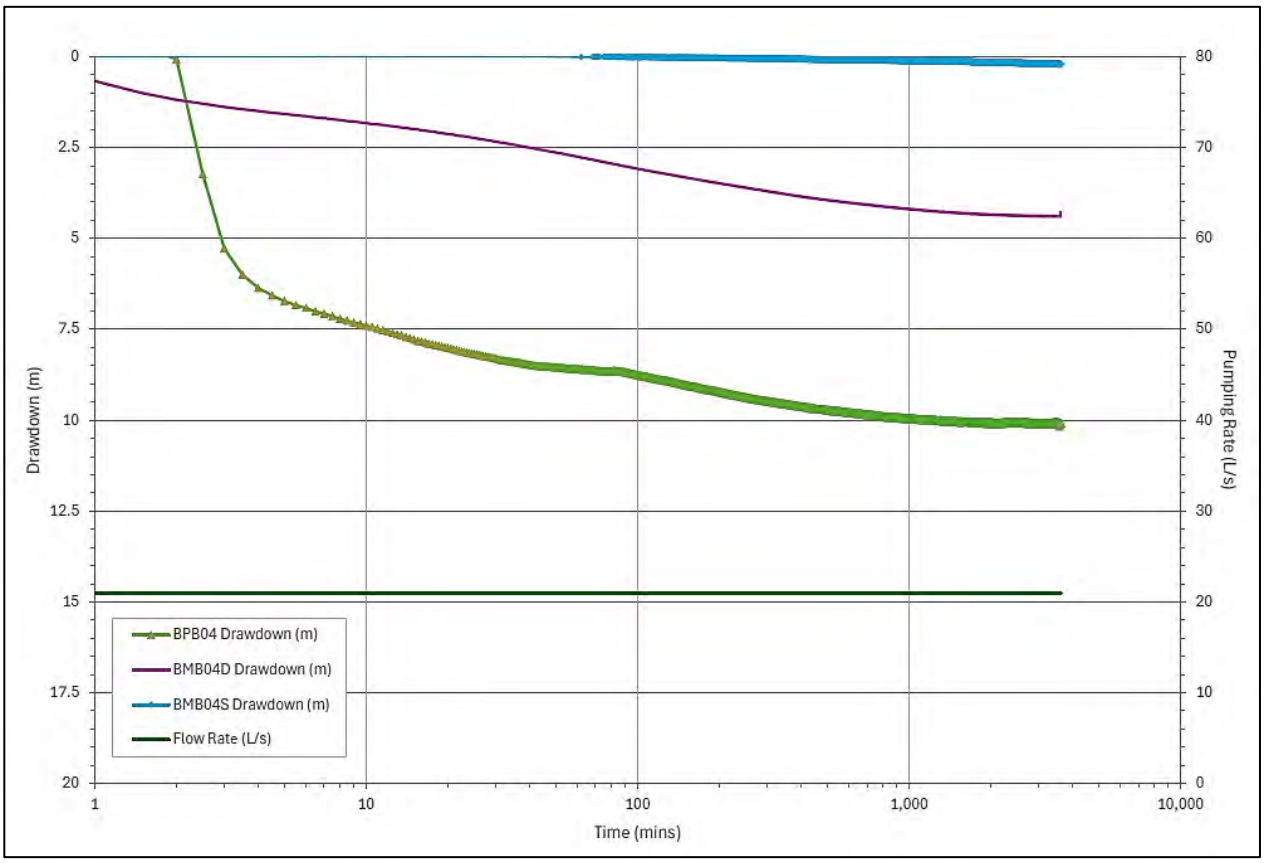


Figure 5.13 Rebecca Palaeochannel Borefield – Constant Rate Test at BPB004

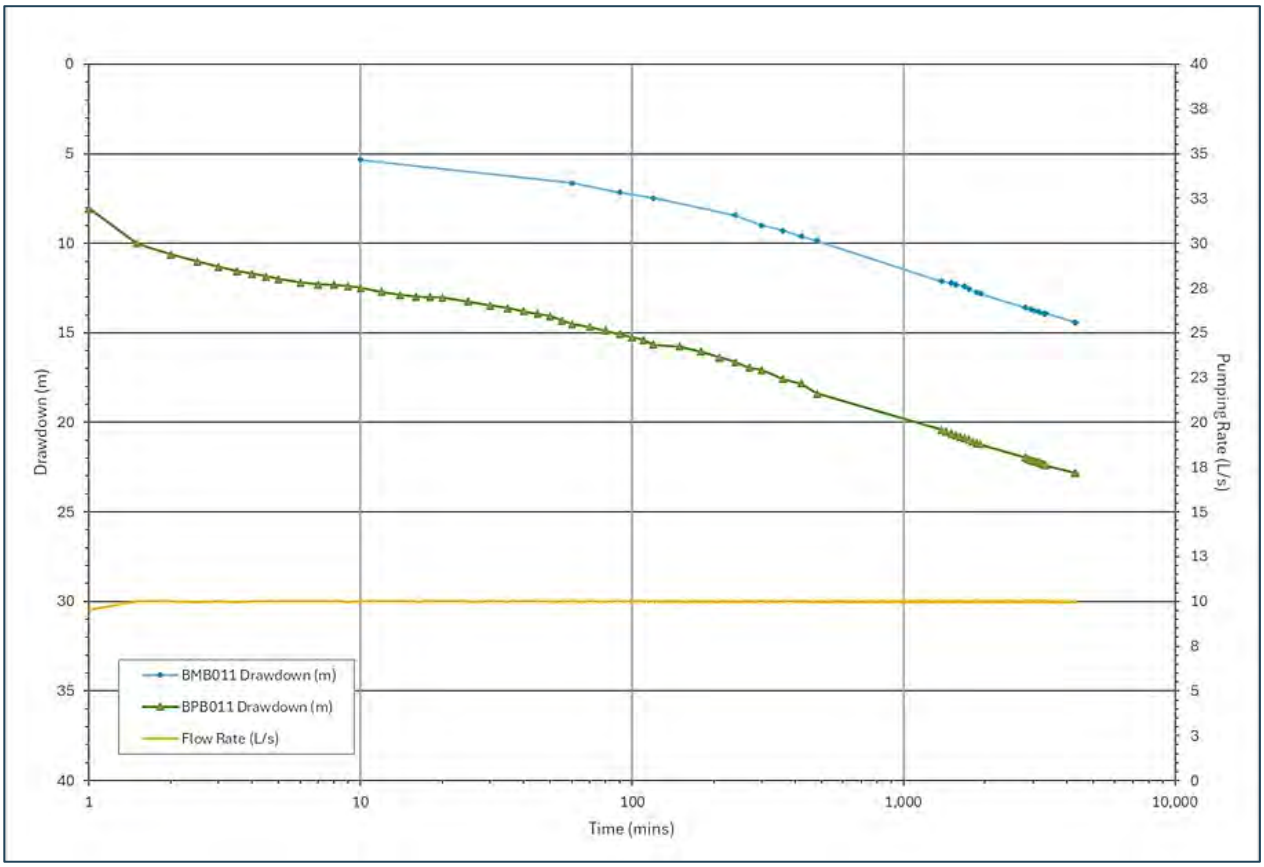


Figure 5.14 Rebecca Palaeochannel Borefield – Constant Rate Test at BPB011

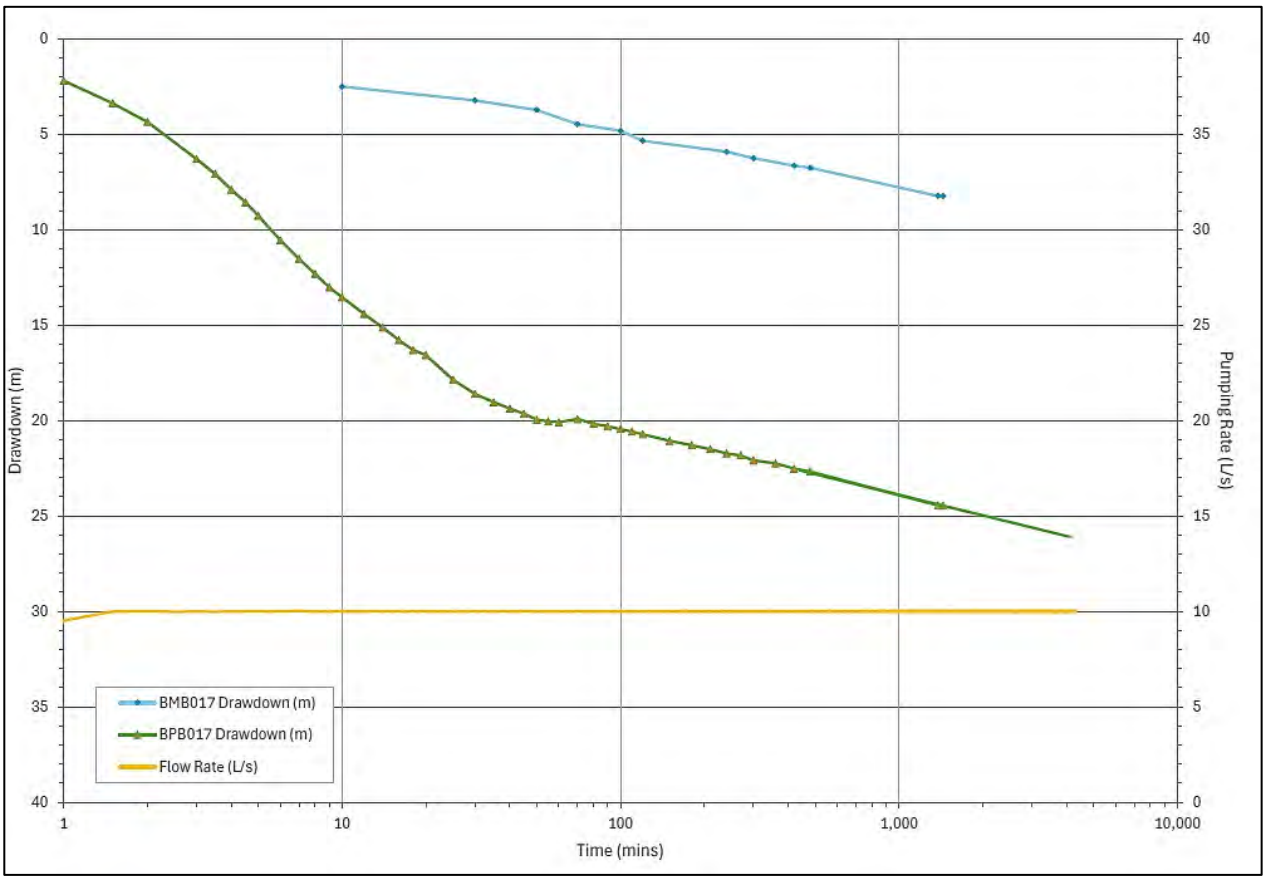


Figure 5.15 Rebecca Palaeochannel Borefield – Constant Rate Test at BPB017

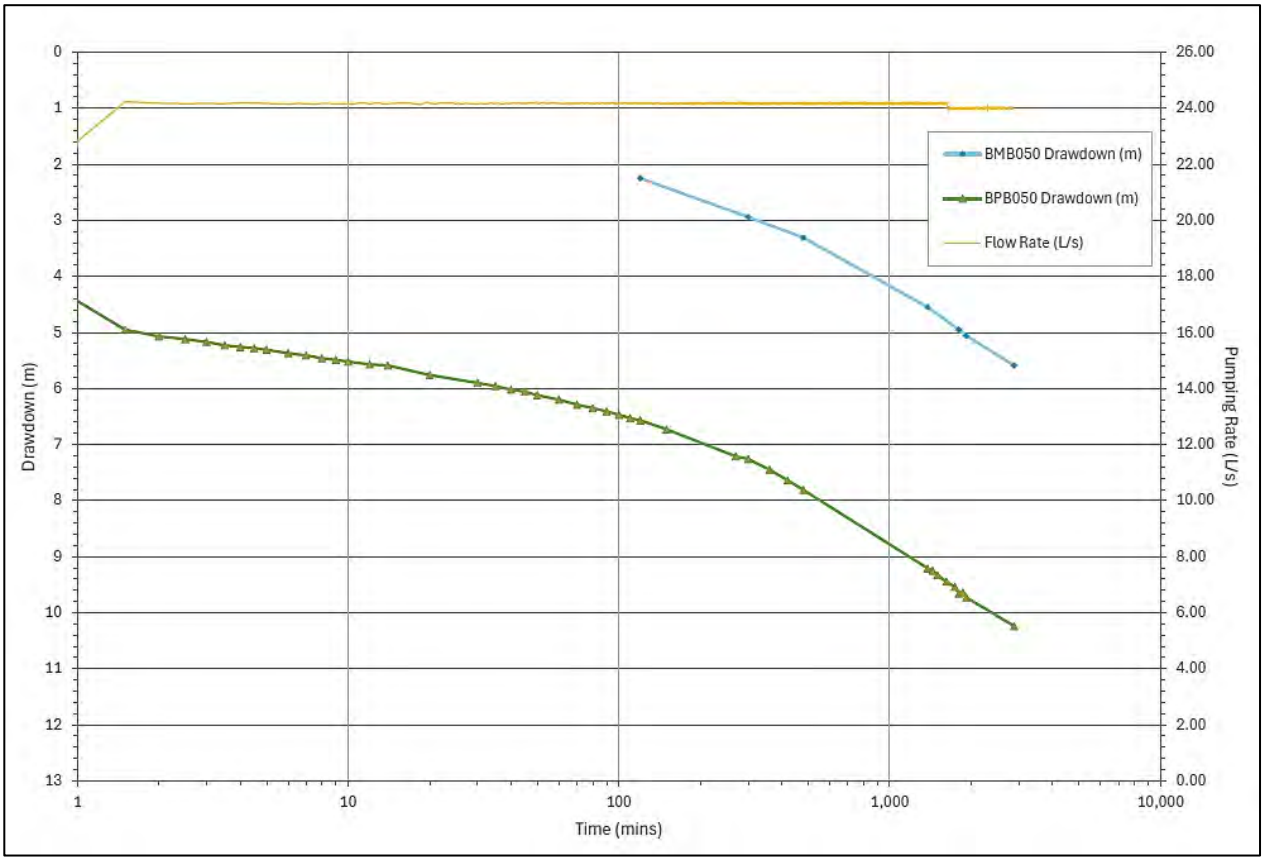


Figure 5.16 Rebecca Palaeochannel Borefield – Constant Rate Test at BPB050

The highest yielding production bores were the two in the main Rebecca Palaeochannel, BPB004 and BPB050, which had constant rate test pumping rates of 21.0 and 24.0 L/s and final drawdowns of 10.09 m and 10.94 m, respectively. Bore BPB011, located in the tributary channel, was pumped at a constant 10 L/s and had a final drawdown of 22.84 m. Bore BPB017 has a poor yield and could only be pumped at 1.2 L/s, with a final drawdown of 22.45 m after 24 hours of pumping. A proportion of the drawdown in most cases resulted from well loss caused by turbulent or non-linear laminar flow across the aquifer-bore interface. All neighbouring monitoring bores responded to pumping of their respective production bores, demonstrating good hydraulic connection.

Bore BPB004 sustained a pumping rate of 21 L/s over the 60 hours tested with the pumping bore drawdown stabilising and showing signs of leakage support from the overlying sediments. Bore BPB050 was pumped at the higher rate of 24 L/s and at the end of the 72 hour test, its drawdown was stabilising at just under 11 m. Bore BPB011 showed that it can sustain a pumping rate of 10 L/s, but bore BPB017 has a poor yield and this bore is only suitable for very low flow rate local water supply. Other than the leaky response in BPB004, the remaining bores showed evidence of an aquifer barrier boundary, being the transverse edge of the palaeochannel aquifer. The presence of the hydraulic barrier boundary is typical for palaeochannel aquifers due to the presence of low permeability bedrock either side of the palaeochannel, which limits the lateral extent of the palaeochannel.

Recovery data show that the water levels in all bores recovered by between 43% and 49% within the first 10 minutes after the cessation of pumping (bores BPB004, BPB011 and BPB050), demonstrating a highly transmissive aquifer. However, the remaining water level recovery generally took at least between 4 hours (BPB004) and 24 hours (BPB050).

Data collected during the aquifer testing was analysed using AQTESOLV software (HydroSOLVE Inc.) to infer representative hydraulic parameters of the tested aquifer (i.e. estimates of aquifer transmissivity and storativity), utilising different analysis methods to compare the results for both drawdown and recovery data. A summary of the data and analyses is presented in Table 5.4 and Appendix G.

It should be noted that most existing aquifer test analysis procedures assume that the:

- Aquifer has infinite areal extent.
- Aquifer is homogeneous, isotropic and of uniform thickness.
- Pumping well is fully or partially penetrating.
- Flow is unsteady.
- Water is released instantaneously from storage with decline of hydraulic head.

Under such assumptions of homogeneity, it is possible to devise graphical or analytical methods that can provide the estimations of aquifer parameters.

It should also be noted that aquifer test analyses have been undertaken using various type curve matching techniques based on the interpreted nature of the aquifer response. The most widely used methods are based on the semi-log /or log-log representation of the drawdown versus time (i.e. the Cooper-Jacob and Theis methods were used in our assessment). The analysis methods are detailed in Kruseman and de Ridder (1994).

Table 5.4 Summary of Estimated Aquifer Parameters -Test Investigation Bores

Pumping Bore	Monitoring Bore	Aquifer Thickness (m)	"Barrier" Boundary Evident (mins)	"Recharge/ Leaky" Boundary Evident (mins)	Average Effective Transmissivity (T m^2/d)	Average Hydraulic Conductivity (k m/d)	Storativity (S)
BPB004	BMB004D	25	-	800	275	11	0.0007
BPB011	BMB011	8	55	-	72	9	0.0004
BPB017	BMB017	7	-	-	5	0.8	-
BPB050	BMB050	21	60	-	400	19	0.0020

Palaeochannel aquifer transmissivity was calculated from the tests and the transmissivity was divided by the assumed aquifer thickness to provide an estimate of permeability (=hydraulic conductivity). The most relevant aquifer test data for calculating the transmissivity, are the 'early' time values, due to the 'late' time readings being influenced by an aquifer boundary (i.e. a presence of low permeability bedrock in the vicinity of the palaeochannel, which limits the lateral extent of the palaeochannel). This is evident in BPB011 and BPB050 (after approximately 55 and 60 minutes). Or, an aquifer recharge/leakage boundary (i.e. leakage to the pumped basal sand unit through the clayey layer from the overlying palaeochannel upper sand unit (unpumped unit), causing a pumped aquifer to attain a pseudo-steady state (stabilise)). It is noted that the estimated transmissivity and permeability values are bulk values for all of the aquifer material, none of the values apply to individual sand and gravel beds, which could have higher permeability.

The results from the 2 bores (BPB004 and BPB050) that target the main Rebecca Palaeochannel show an aquifer transmissivity in the range between 275 and 400 m^2/d, with increasing values from west to east, down the channel gradient. The secondary Rebecca tributary channels have lower aquifer transmissivities (5 to 70 m^2/d), owing to the palaeochannel sand being thinner and/or containing a greater content of the finer sediment fractions than the main Rebecca Palaeochannel. An average storativity value of $1.6x10^{-3}$ was estimated from the monitoring bores, reflecting the typically confined nature of groundwater within the palaeochannel.

5.7.2 Slug Tests

Hydraulic testing (slug tests) was undertaken at four standalone monitoring bores (BMB005, BMB008, BMB019 and BMB030), located the Rebecca tributary channels, and also at a shallow monitoring bore BMB004S, once all drilling and casing has been completed (Figure 5.11). The purpose of the hydraulic testing was to obtain local hydrogeological data to assess the near-bore aquifer permeability.).

Each slug test consisted of measuring the static water level in the bore, then introducing a near instantaneous change of water level by adding a solid (cylinder slug) into the bore and measuring the change in water level (i.e. rise and fall) over time, until the water level returned to its near original static water level. A pressure transducer was used to measure the water level changes over time, at 1-second intervals. The declining water levels were used for analysis of the permeability, utilising the Bower-Rice method.

The data plots are presented in Appendix G. The results of the slug tests show the fast recovery of water levels, which is indicative of a high permeability sediment (upper sand and basal sand) and the results from BMB008 are consistent with the results from the test pumping (i.e. main Rebecca palaeochannel). An estimate of transmissivity is provided in Table 5.5.

Table 5.5 Summary of Estimated Aquifer Parameters from Slug Tests - Monitoring Bores

Monitoring Bore	Aquifer Thickness (m)	Average Effective Transmissivity (T m^2/d)	Average Hydraulic Conductivity (k m/d)	Rebecca Palaeochannel / Tributary Channel	Tested Palaeochannel Unit	Comment
BMB004S	10	74	4.7	Main Palaeochannel	Upper Sand	Sand with minor silt
BMB005	10	93	9.3	Tributary Channel	Upper Sand	Clayey sand
BMB008	20	290	14.5	Main Palaeochannel	Basal Sand	Sand with minor silt
BMB019	6	8	1.3	Tributary Channel	Basal Sand	Clayey sand and gravel
BMB030	4	12	2.9	Tributary Channel	Basal sand	Silty sand

5.8 Groundwater Levels

Groundwater levels (mbgl) in the Rebecca Palaeochannel Borefield area have been recorded occasionally since the bore completion and are presented in Table 5.6.

Table 5.6 Summary of Groundwater Levels (mbgl and mAHD)

Bore/ Date	BMB004S	BMB004D	BPB004	BMB005	BMB008	BMB011	BPB011	BMB017	BPB017	BMB019	BMB030	BMB050	BPB050
Date	Groundwater Levels (mbgl)												
16-19/ 05/24	5.98	7.54	7.52	5.88	5.05	7.85	7.97	7.91	8.25	8.53	17.08	7.87	7.89
5-28/ 08/24	6.8	8.0	8.11	-	-	-	8.43	8.5	9.59	-	-	8.4	8.1
3/12/24	6.70	8.05	-	6.50	6.70	8.30	-	-	-	7.80	-	8.10	
11/03/25	6.70	8.11	8.03	6.53	5.74	8.55	-	-	-	9.35	17.70	7.89	8.26
Date	Groundwater Level Elevations (mAHD)												
16-19/ 05/24	320.79	319.25	319.25	319.68	320.35	318.48	318.33	318.67	318.25	318.42	313.04	317.55	317.52
5-28/ 08/24	319.97	318.79	318.66	-	-	-	317.87	318.08	316.91	-	-	317.02	317.31
3/12/24	320.07	318.74	-	319.06	318.70	318.03	-	-	-	319.15	-	317.32	-
11/03/25	320.07	318.68	318.74	319.03	319.66	317.78				317.60	312.42	317.53	317.15

The depth to groundwater is between 5 and 9.6 mbgl recorded across the Rebecca Palaeochannel Borefield area and its tributaries. It should be noted that there are some small potentiometric head differences (around 1.2 to 1.5 m) recorded between the upper palaeochannel sand layer (BMB004S) and the basal palaeochannel sand layer (BMB004D), indicating a downward head gradient and semi-confined separation between these sand layers (due to the clayey layer in between them). This limits the vertical flow between these sand units. In addition, water levels in bore BMB030 are much deeper (in order of 17 mbgl) than in the rest of the bores, which is likely to be related to the bore construction (screening lower basal sand and bentonite seal above the slotted section) as the exploration hole WBAC0030 recorded a water level strike around 3 mbgl. It should also be noted that the Cainozoic superficial deposits (alluvium / colluvium) are mostly unsaturated (i.e. above the groundwater level), with some water strikes encountered at the base of alluvium (during the groundwater exploration drilling programme).

Recent groundwater levels have been combined with surveyed project bore elevations to plot interpreted groundwater elevations and groundwater flow directions in and around the Rebecca Palaeochannel Borefield. These are shown in Figure 5.17 and presented in Table 5.6. The interpreted groundwater levels suggest that the water table elevation generally ranges between 320.8 and 317.5 mAHD from northwest to southeast along the main Rebecca Palaeochannel and from south to north in the tributaries. Overall, groundwater flow is under a very low gradient.

In December 2024 eight groundwater level monitoring dataloggers were installed in monitoring bores BMB004S, BMB004D, BMB005, BMB008, BMB011, BMB019, BMB030 and BMB050 in the Rebecca Palaeochannel Borefield. In addition, a barometric pressure datalogger was installed in the top of bore BMB011 to collect background atmospheric pressure levels in the area of the palaeochannel borefield. The monitoring network is to initially determine pre-development groundwater levels and water quality and then as environmental monitoring throughout the life of the water supply borefield, through to borefield closure and beyond.

In-Situ LevelTROLL 400 non-vented 60.1 m dataloggers were installed in each bore at varying depths, typically greater than 10 m below the static groundwater level. An In-Situ BaroTROLL was installed in bore BMB011 to record local atmospheric pressure variation and allow the non-vented dataloggers to be pressure compensated. All dataloggers were set to record at 6 hour intervals and were synchronised to record at the same time (06:00, 12:00, 18:00 and 24:00 each day). This allows the readings to be directly comparable with each other. All the dataloggers were installed using marine grade Spectra Braid attached to a marine grade steel O bolt, which was screwed into a 50 mm ID class 12 PVC end cap.

The groundwater level elevations (mAHD) for the period December 2024 until March 2025 are plotted in Figure 5.18. The data generally show very small variations in groundwater levels (less than 0.1 m), indicating limited direct rainfall recharge (owing to thick clayey layers that limit the vertical flow). There was a minor increase in groundwater levels (~0.05 m) evident, presumably as a response to local rainfall in December 2024, followed by a gradual recession for the next 2 months. The exception to this is BMB011 in the middle of the borefield, which shows isolated drops in groundwater levels from mid-February 2025. The explanation for this is that the adjacent production bore PBP011 has been used by the exploration drillers for their water supply (short-term pumping).

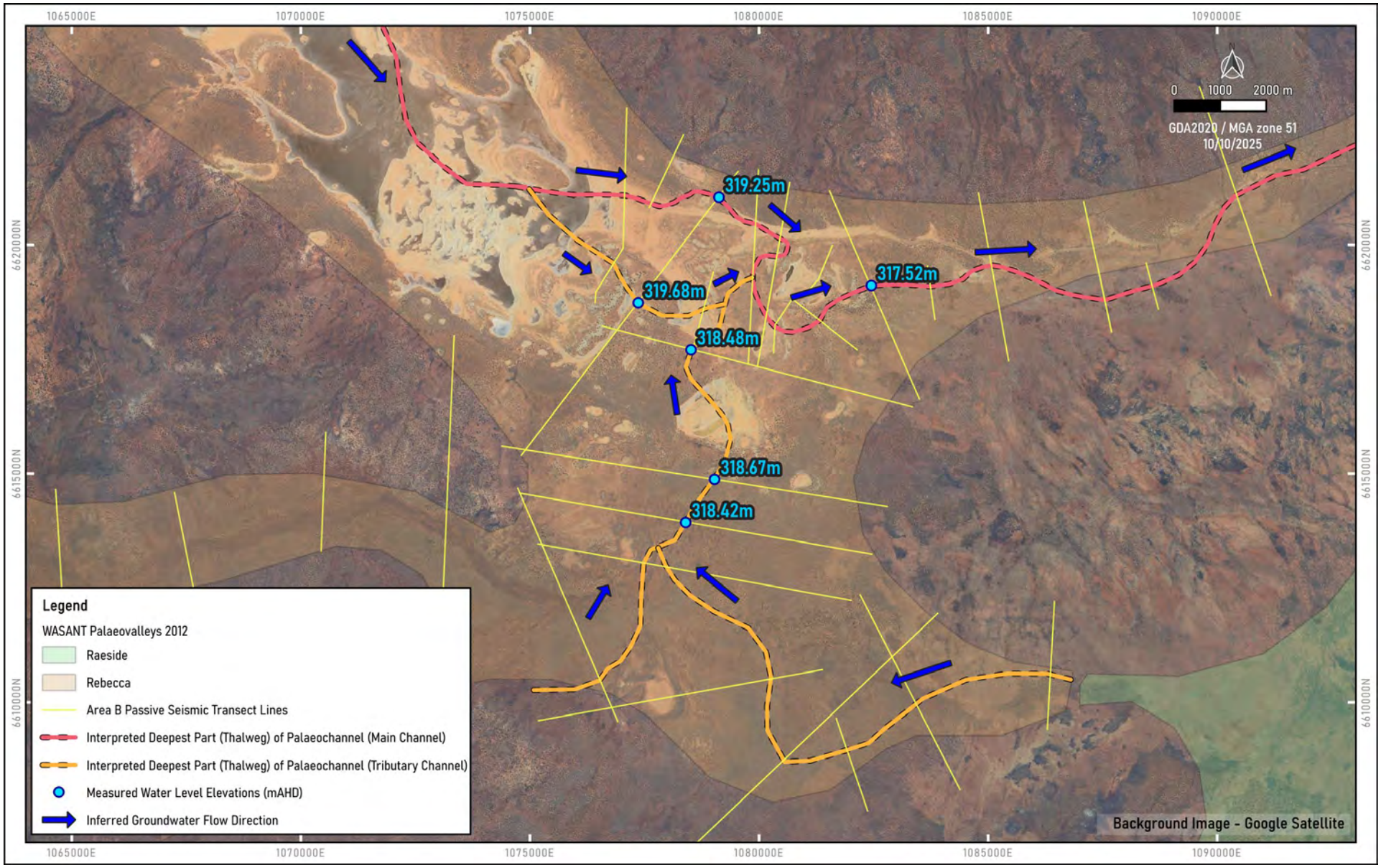


Figure 5.17 Rebecca Palaeochannel Borefield – Recent Groundwater Level Elevations and Flow Directions

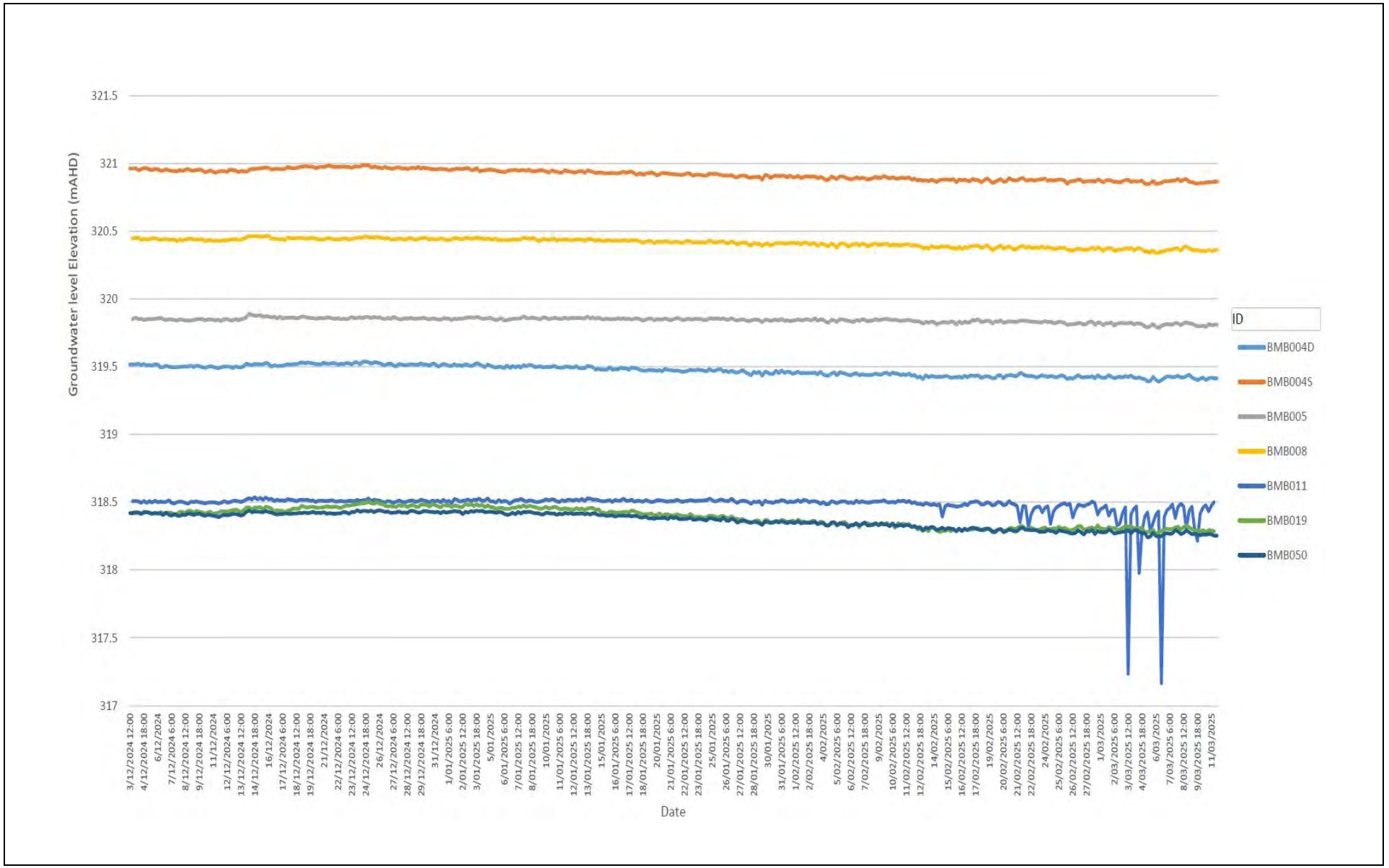


Figure 5.18 Rebecca Palaeochannel Borefield – Water Level Elevation (mAHD)

6. HYDROCHEMISTRY

Groundwater samples were collected from the following bores:

- Four production bores BPB004, BPB011, BPB017 and BPB050 at the end of their respective constant rate pumping tests in August 2024. These gave the most representative samples of groundwater from the Rebecca palaeochannel.
- Five monitoring bores BMB004S, BMB005, BMB008, BMB019 and BMB030 at the end of the bore development (airlift).

The samples were analysed by SGS laboratories in Perth and the hydrochemical results are listed in Table 6.1 and presented in Appendix H.

This data represents ambient groundwater quality and indicates the following:

- Groundwater is hypersaline with electrical conductivity (EC) values ranging from 130,000 µS/cm (BMB030) to 210,000 µS/cm (BPB011), equivalent to salinity values ranging between 90,000 and 120,000 TDS. This is consistent with the field EC values collected at the end of the bore development and ranging between 139,200 and 201,500 µS/cm (Table 5.2).
- Laboratory measurements of pH ranged from 4.4 to 6.9, indicating groundwater being acidic to neutral, but generally being slightly acidic to neutral in the main Rebecca palaeochannel (pH of 6.1 to 6.9). Laboratory pH values are consistent with the field pH values (Table 5.2).
- The groundwater is predominantly of a sodium chloride type, with high concentrations of magnesium and sulphate and relatively low calcium and bicarbonate concentrations.
- The production and monitoring bores' hydrochemical results are plotted on an expanded Durov plot (Figure 6.1) and show that the sampled waters have a very low variation in chemical composition based on the calculated percentage equivalents of the major ions. All samples plotted in the 9th quadrant, indicating 'end point' waters that are static and no longer interacting with their environment, with no evidence of recharge influence (as seen by the relatively low calcium and bicarbonate and high salinity). This is typical of groundwater found within a Goldfields palaeochannel.
- Concentrations of metals were mostly low (below the limit of reporting), with only iron and manganese concentrations being elevated in some samples.

It is noted that there is a small difference in electrical conductivity between the bores in the main Rebecca Palaeochannel and those in the tributary channels, with groundwater salinities being lower in the tributary channels than in the main palaeochannel channel, which is typical for palaeochannel aquifer systems. In addition, groundwater salinities are slightly lower in the upper palaeochannel sand unit (as seen in BMB004S) than in the lower palaeochannel basal sand unit (as seen in BMB004D), owing to limited rainfall recharge (due to thick clayey layer between both sand units that limit the vertical flow). Figure 6.2 shows the groundwater salinity distribution across the Rebecca Palaeochannel Borefield area.

To put this in perspective, seawater has an electrical conductivity of around 55,000 µS/cm, so the local palaeochannel groundwater is nearly 4 times more saline than seawater. However, it should be noted that high salinity concentrations are typically found in palaeochannel aquifers that are adjacent to and below alluvial flats and playa lakes, where salinities of up to 300,000 mg/L TDS have been recorded in the Kalgoorlie region. Overall, the groundwater in the Rebecca palaeochannel is of poor quality, but it is suitable for processing water supply where the industrial process used can cope with hypersaline water.

Table 4.2 Production Bores Hydrochemistry

Parameters	Unit	BMB004S	BMB030	BMB008	BMB005	BMB019	BPB004	BPB011	BPB017	BPB050
		15/5/24	17/4/24	21/4/24	30/3/24	10/4/24	13/08/24	26/08/24	30/08/24	20/08/24
pH**	pH	4.8	4.4	6.9	6.8	6.4	6.1	6.2	6.1	6.2
Conductivity @ 25 C	µS/cm	170,000	150,000	190,000	200,000	190,000	210,000	210,000	190,000	200,000
Total Dissolved Solids	mg/L	100,000	90,000	110,000	120,000	110,000	270,000*	250,000*	200,000*	240,000*
Total Alkalinity	mg/L	-	-	-	-	<1	59	61	32	43
Carbonate Alkalinity as CO3	mg/L	<1	<1	<1	<1	-	-	-	-	-
Bicarbonate Alkalinity as HCO3	mg/L	<5	<5	67	72	25	71	74	39	53
Sulphate, SO4	mg/L	12,000	11,000	15,000	15,000	15,000	18,000	17,000	15,000	17,000
Chloride, Cl	mg/L	91,000	80,000	110,000	120,000	110,000	150,000	130,000	110,000	130,000
Silica	mg/L						5.6	8.3	20	10
Calcium, Ca	mg/L	460	410	620	680	520	480	570	490	540
Potassium, K	mg/L	750	560	910	1,200	750	1,400	1,300	820	1,200
Magnesium, Mg	mg/L	5,400	4,400	6,500	6,800	5,500	9,600	8,500	6,900	8,300
Sodium, Na	mg/L	43,000	37,000	53,000	58,000	54,000	72,000	68,000	53,000	64,000
Iron	µg/L	<500	1500	<500	<500	<500	2,100	2,500	<500	700
Aluminium	µg/L	6400	8100	<500	1100	<500	-	-	-	-
Arsenic	µg/L	<100	<100	<100	<100	<100	-	-	-	-
Barium	µg/L	<100	<100	<100	<100	<100	-	-	-	-
Beryllium	µg/L	<100	<100	<100	<100	<100	-	-	-	-
Cadmium	µg/L	<10	<10	<10	<10	<10	-	-	-	-
Chromium	µg/L	<100	<100	<100	<100	<100	-	-	-	-
Cobalt	µg/L	<100	<100	<100	<100	<100	-	-	-	-
Copper	µg/L	<100	<100	<100	<100	<100	-	-	-	-

Parameters	Unit	BMB004S	BMB030	BMB008	BMB005	BMB019	BPB004	BPB011	BPB017	BPB050
		15/5/24	17/4/24	21/4/24	30/3/24	10/4/24	13/08/24	26/08/24	30/08/24	20/08/24
Lead	µg/L	<100	<100	<100	<100	<100	-	-	-	-
Nickel	µg/L	100	<100	<100	<100	<100	-	-	-	-
Selenium	µg/L	<100	<100	<100	<100	<100	-	-	-	-
Vanadium	µg/L	<100	<100	<100	<100	<100	-	-	-	-
Zinc	µg/L	<500	<500	<500	<500	<500	-	-	-	-
Manganese	µg/L						930	610	2,100	820
Nitrite Nitrogen, NO_2 as N	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.26	0.11
Nitrate Nitrogen, NO_3 as N	mg/L	1.9	<0.05	1.5	<0.05	<0.05	-	-	-	-

* TDS considered to be erroneous

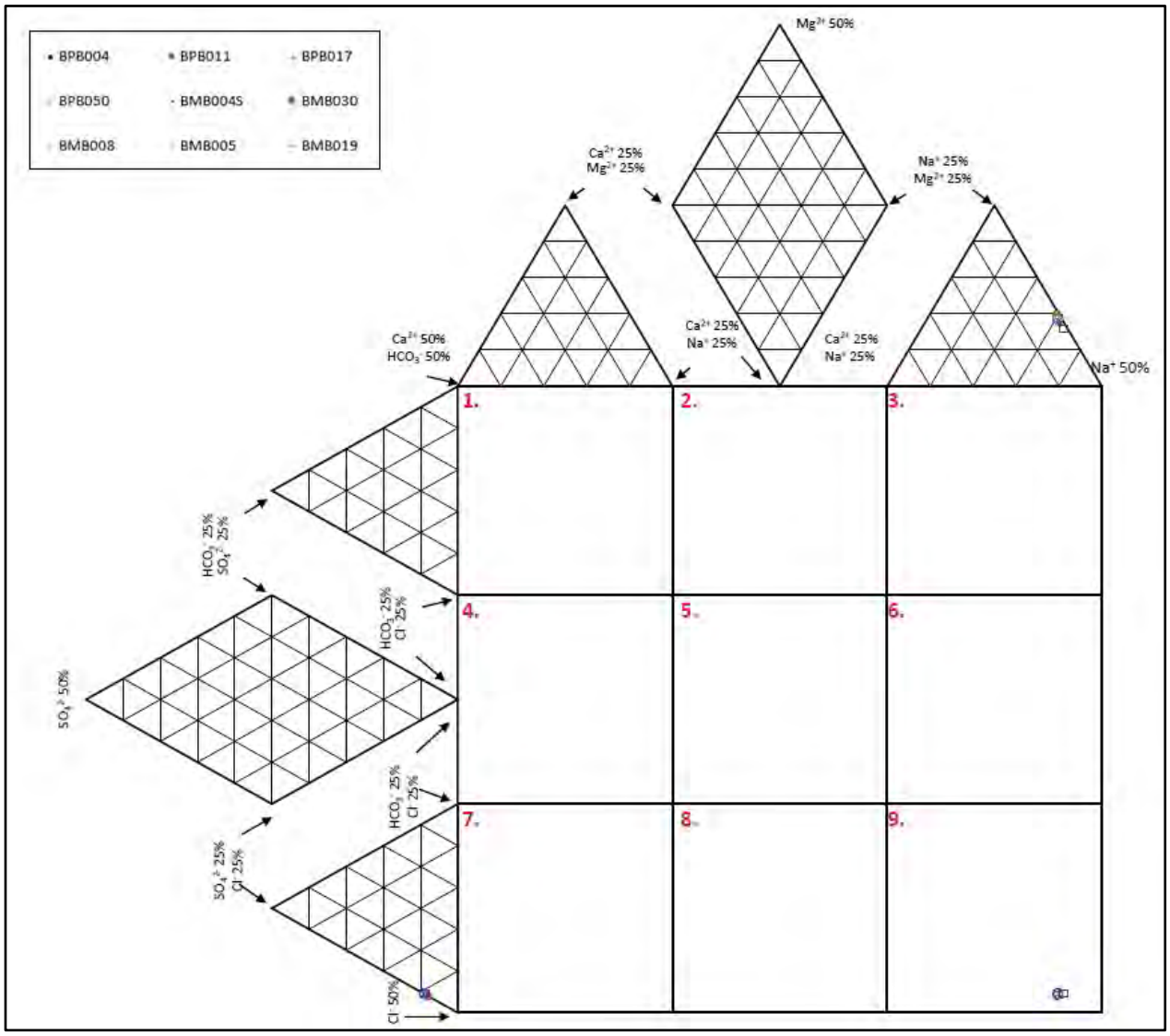


Figure 6.1 Rebecca Palaeochannel Borefield – Hydrochemistry on Expanded Durov Plot

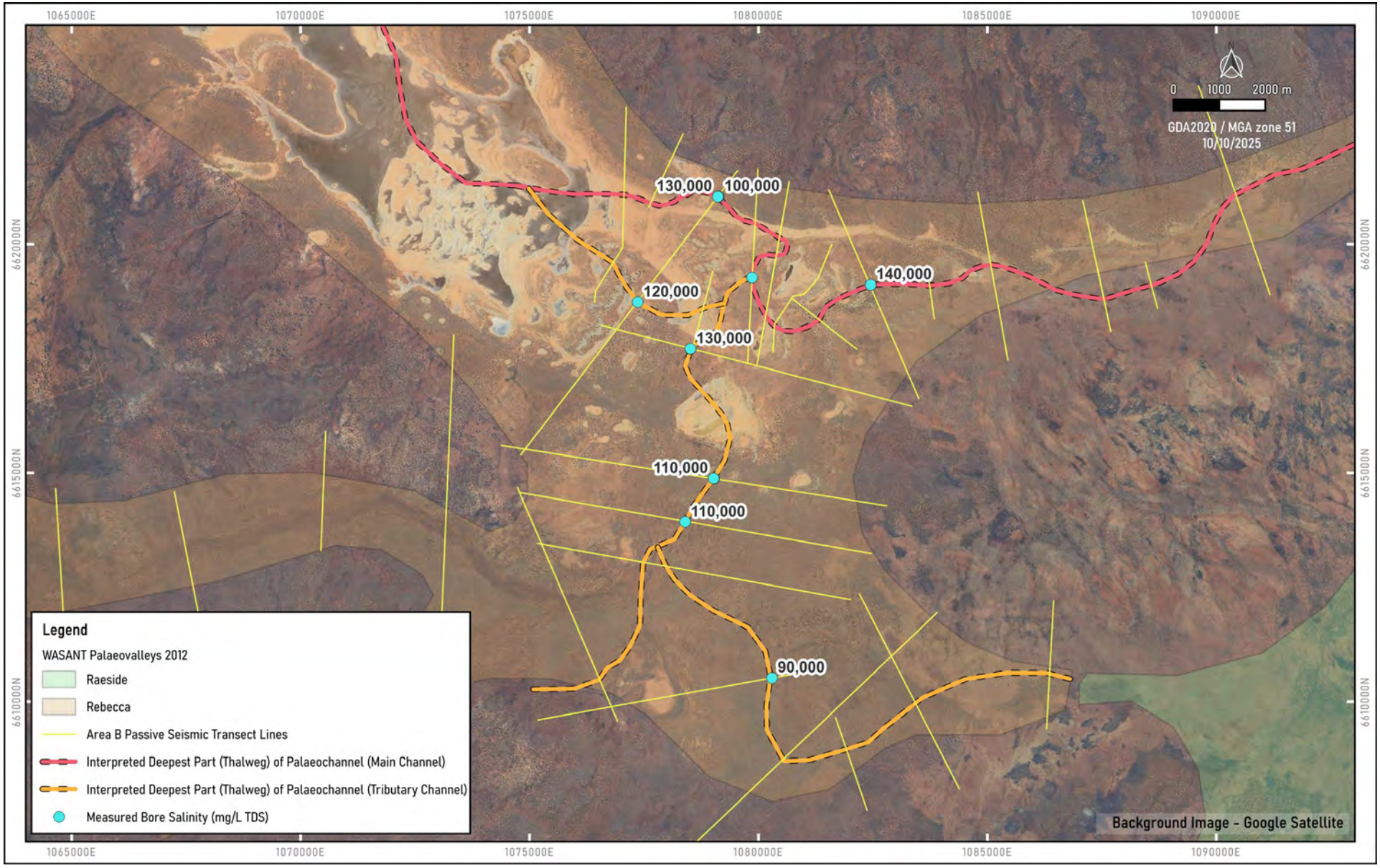


Figure 6.2 Rebecca Palaeochannel Borefield – Water Salinity Distribution

7. CONCEPTUAL HYDROGEOLOGY

A conceptual hydrogeological model for the Rebecca Palaeochannel Borefield area has been developed based on all available geological and hydrogeological data, including regional data and site-specific groundwater exploration drilling and hydrogeological investigation data.

7.1 Aquifers

The geology of the palaeochannel in the Rebecca Palaeochannel Borefield project area is illustrated in Figure 7.1, with the interpreted distribution of the palaeochannel basal sand unit and interpreted deepest part (thalweg) of each palaeochannel / tributary shown in Figure 5.8.

The palaeochannel varies from 65 m deep in the west to 89 m deep in the east of the main Rebecca channel (i.e. proposed borefield area) and between 36 and 66 m deep in the tributary channels. This is from approximately 260 mAHD in the west to 247 mAHD in the east of the main channel, representing a fall of about 13 m over a distance of approximately 7 km, at a gradient of about 0.0018. The palaeochannel is filled with thick clay (Perkolilli Shale), which is mainly silty clay, but becomes sandy silty clay in places, and is between 30 to 50 m thick and is thicker in the main palaeochannel than in its tributaries. This thick clayey unit confines (or semi-confines where more sandy clays are present) the underlying basal sand (Wollubar Sandstone), which is the main aquifer in the project area. The palaeochannel basal sand has a fairly consistent thickness of approximately 20 m in the main Rebecca palaeochannel (across the proposed Rebecca Palaeochannel borefield area). It is generally fine to coarse grained sand with moderate gravel and minor clay and silt, with finer grains occurring in the upper part of this aquifer and coarser grains intersected near or at the base. The palaeochannel basal sand unit was also encountered in the Rebecca palaeochannel tributaries, but at shallow depths and thin (up to between 4 to 10 m in thickness). The tributary palaeochannel basal sand aquifer is generally silty/clayey fine to medium grained sand, with minor coarse grained sand and gravel (as evident from the PSD results, refer to Section 5.5). Thinner and more clayey palaeochannel sands were encountered in the tributary channels further away from the main Rebecca palaeochannel and the palaeochannel confluence area.

Beneath these palaeochannel sediments (clay and sand) is weathered felsic basement mostly up to 15 m thick, but in some places is more than 60m thick, followed by fresh felsic basement. Minor groundwater is encountered in the weathered basement.

Overlying the palaeochannels and basement rock are a variety of Cainozoic superficial deposits (alluvium and colluvium) with a variable thickness of between 2 and 6 m across the project area. These deposits are mostly unsaturated, with minor water encountered at the base of this unit (as seen in some of the exploration holes).

7.2 Aquifer Parameters

The pumping test results from the 3 bores (BPB004, BPB008 and BPB050) that target the main Rebecca Palaeochannel show an aquifer transmissivity of the basal sand unit in the range between 275 and 400 m2/d, which are similar to transmissivity values reported in the same Rebecca Palaeochannel well upstream of the Project area and in other palaeochannels in the Kalgoorlie region. Estimates of basal sand permeability range between 11 and 20 m/d, increasing downstream towards the east. The secondary Rebecca tributary channels have lower aquifer transmissivities (in the range of between 5 to 90 m2/d), owing to the palaeochannel sand being thinner and/or containing a greater content of the finer sediment fractions than the main Rebecca Palaeochannel. An average storativity value of 1.6x10-3 was estimated from the monitoring bores, reflecting the typically confined nature of groundwater within the palaeochannel (refer to Section 5.7).

Specific yield values for the palaeochannel sand could not be determined during the aquifer testing (as the aquifer was confined). An estimate of specific yield was based on other palaeochannels and observed response to long-term pumping and is expected to be approximately 15% to 20%.

No testing has been conducted on the palaeochannel clay (which acts as aquitard), although based on AQ2's experience in the Kalgoorlie region and a literature review, the permeability will be low, such that the direct abstraction of groundwater is not possible. Groundwater movement through the clay aquitard is possible, but will be at low rates. Long term leakage from the clay into the underlying basal sand aquifer is likely to be very important for borefield operation and aquifer sustainability.

No site-specific hydrogeological data are available for the thin alluvium unit (clay with minor sand and gravel) due to this unit being mostly unsaturated (i.e. above the water table, refer to Section 8.4 for more details). The weathered basement (saprolite and saprock) and fresh felsic basement were not hydraulically tested, but based on AQ2's experience in the Kalgoorlie region and a literature review, bores drilled into the weathered and fresh unfractured basement have airlift yields of either negligible or less than 0.5 L/s, suggesting very low permeability.

A summary of aquifer parameters is presented in Table 7.1. Further refinement of aquifer parameters, within measured ranges was completed as part of the model calibration (refer to Section 9).

Table 7.1 Summary of Aquifer Parameters

Aquifer Unit	Horizontal Hydraulic Conductivity / Kh (m/d)	Vertical Hydraulic Conductivity / Kv (m/d)	Specific Yield (%)	Specific Storage
Alluvium	0.01	0.001	5	NA
Upper Palaeochannel Clay	0.01 to 0.1	0.005 to 0.01	5	1.00e-6
Upper Palaeochannel Sand*	0.5 to 9	0.05 to 0.9	15	8.60e-6
Lower Palaeochannel Clay	0.01 to 0.5	0.005 to 0.05	5	1.00e-6
Palaeochannel Basal Sand	1 to 20	0.1 to 2	20	8.60e-6
Basement Saprolite/Saprock	0.005	0.0005	0.5	1.00e-7
Basement	0.001	0.0001	0.1	1.00e-7

Key: *Not always present or clayey

Given the sedimentary nature of the geological units present in the study area which have been deposited in a fluvial environment, vertical permeabilities of the palaeochannel sediments (clay and sand) are estimated to be lower than horizontal permeabilities by a factor of 10 (i.e. kv/kh=0.1). This will restrict vertical flow, but will allow leakage of groundwater into the underlying basal sand unit.

7.3 Palaeochannel Geometry

Based on available data, the results from the geophysical surveys and the groundwater exploration drilling (refer to Section 5), the main Rebecca palaeochannel (in Area B) has been defined as extending from the northwest to the southeast before turning east through the Rebecca Palaeochannel Borefield. In this area, the main channel meanders within a confluence zone with tributary channels. It then then heads in an east-northeasterly direction, before joining the Raeside Palaeochannel system. Five potential palaeochannel tributary channels of differing sizes have been identified to the southwest, south, southeast and east-northeast of the main Rebecca palaeochannel in Area B. Only three of these tributary channels (southeast, south and north-northeast) have been confirmed to contain sandy units, with the remaining two channels being filled with fine sediments, comprising clays and silts.

The width of the palaeochannel basal sand deposits have been estimated based on the results of the geophysical surveys, geological exploration drilling and the test pumping. The presence of an aquifer barrier boundary was seen in the pumping test results of bores BPB011 and BPB050. In these, the presence of low permeability bedrock limits the lateral extent of the palaeochannel aquifer, causing greater drawdown after 55-60 minutes of the constant rate test as the cone of depression encounters the margins of the basal sand aquifer. AQTESOLV software was used to estimate the potential width of the palaeochannel sand in each pumped bore by simulating the 'no-flow' boundaries and by matching the drawdown curves from production and monitoring bores with Theis solution curves. Figure 7.1 shows examples of Theis curve matching with the assigned boundary conditions. The no-flow boundary method represents the bounded aquifer by placing a pumping "image" bore on the opposite side of the boundary from the "real" bore. The results show the width of the main Rebecca palaeochannel to be approximately 400 m at bore BPB050 and the width of the southern tributary channel to be approximately 650 m in the confluence area at bore BPB011. These results are consistent with the passive seismic geophysical results interpretation of the lateral extents to fresh bedrock (Figures 7.2 and 7.3). This shows a narrower tributary channel at the headwaters (upgradient) of approximately 150 m width and widening toward the north to an approximately 650 m wide tributary channel (at the confluence area). Due to a lack of drilling data further west and east of the Rebecca Palaeochannel Borefield, it is assumed that the main palaeochannel has a similar width as in the Rebecca Palaeochannel Borefield area.

7.4 Groundwater Levels and Flow Direction

The monitoring bore records (refer to Section 5.8) indicate the following:

- The depth to groundwater is generally between 5 and 10 mbgl across the Rebecca Palaeochannel Borefield area and its tributaries.
- The water table elevation is estimated to generally range between 320.8 and 317.5 mAHD west to south across the main Rebecca palaeochannel and south to north in the tributaries. Overall groundwater flow is under a very low gradient.
- There are some small potentiometric head differences between the upper palaeochannel sand layer and the basal palaeochannel sand layer, indicating a downward head gradient. There is a semi-confined separation between these sand layers (due to the clayey layer in between them), which limits the vertical flow between these sand units. However, vertical leakage from the clay unit into the underlying sand unit will be very important in supporting long term groundwater abstraction from the basal sands.
- There are very small variations in the groundwater levels (less than 0.1 m) recorded (using data loggers recording at 6-hourly intervals) for the November 2024 to March 2025 4-month monitoring period. This suggests limited direct rainfall recharge, owing to thick clayey layers that limit vertical flow.
- The Cainozoic superficial deposits (alluvium / colluvium) are mostly unsaturated (i.e. above the groundwater level), with some water strikes encountered at the base of alluvium.

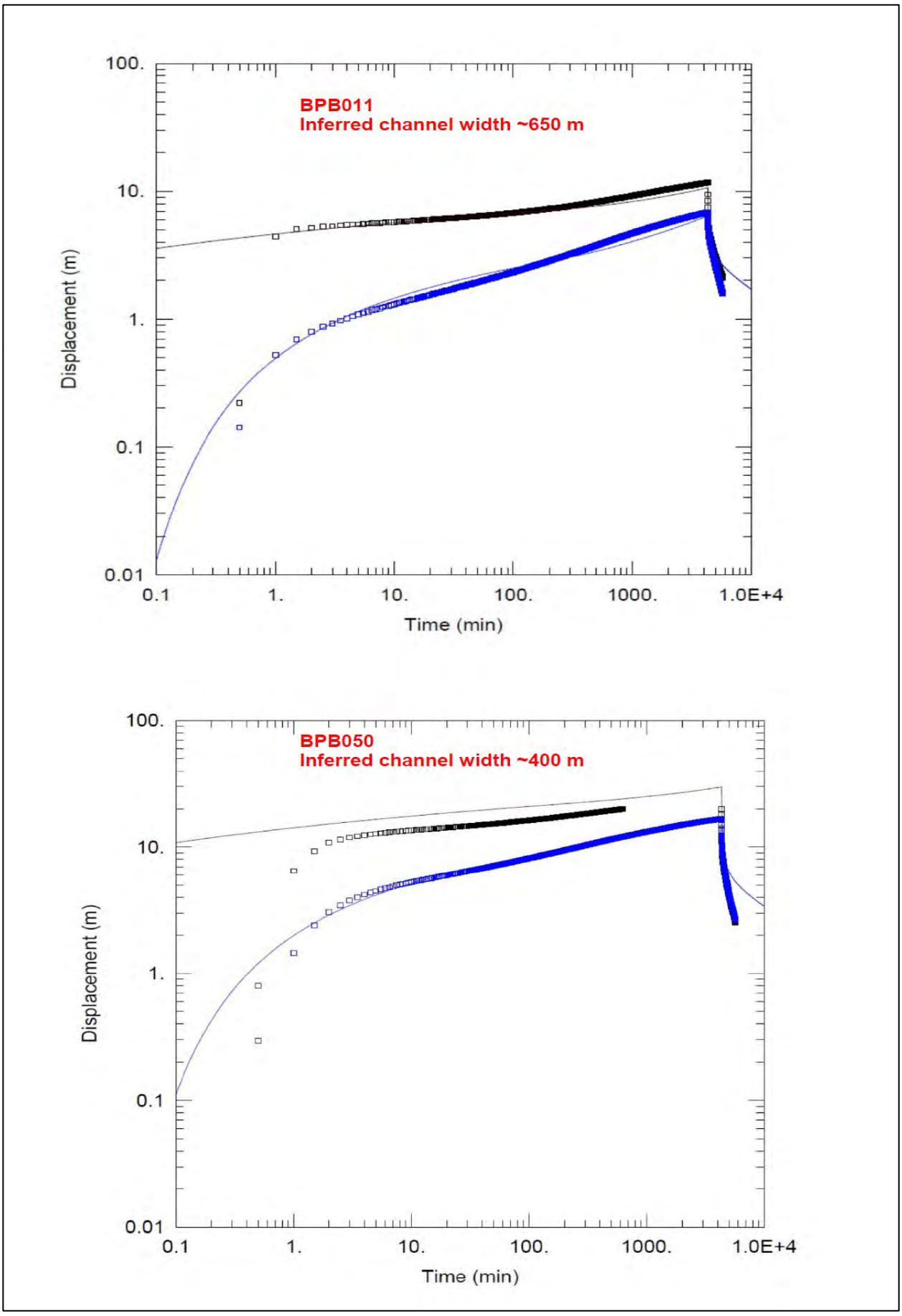


Figure 7.1 Examples of Theis Curve Matching with Assigned "Barrier" Boundary Conditions

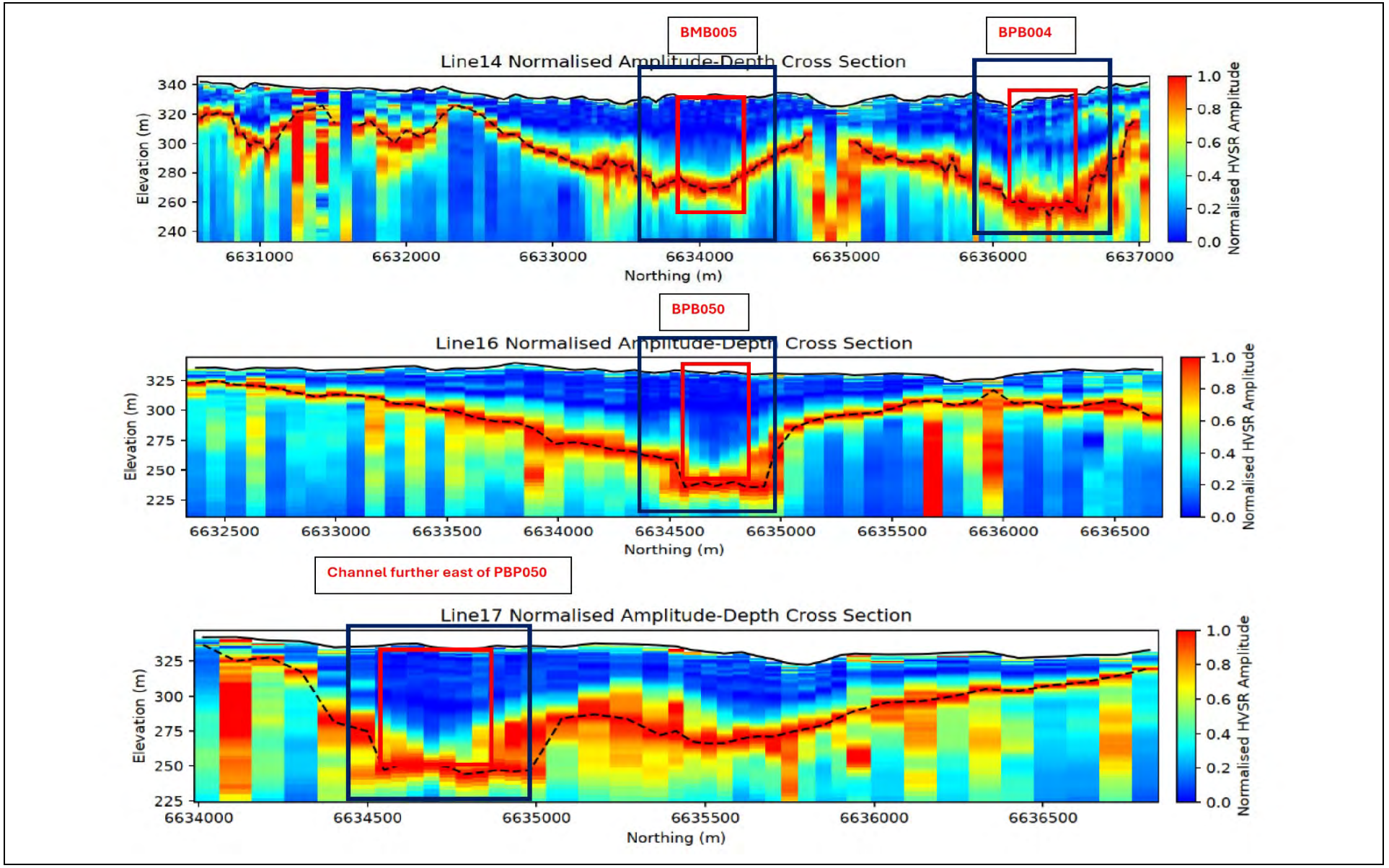


Figure 7.2 Examples of Estimated Widths of Basal Sand and Clay in Main Rebecca Palaeochannel Based on Geophysical Surveys

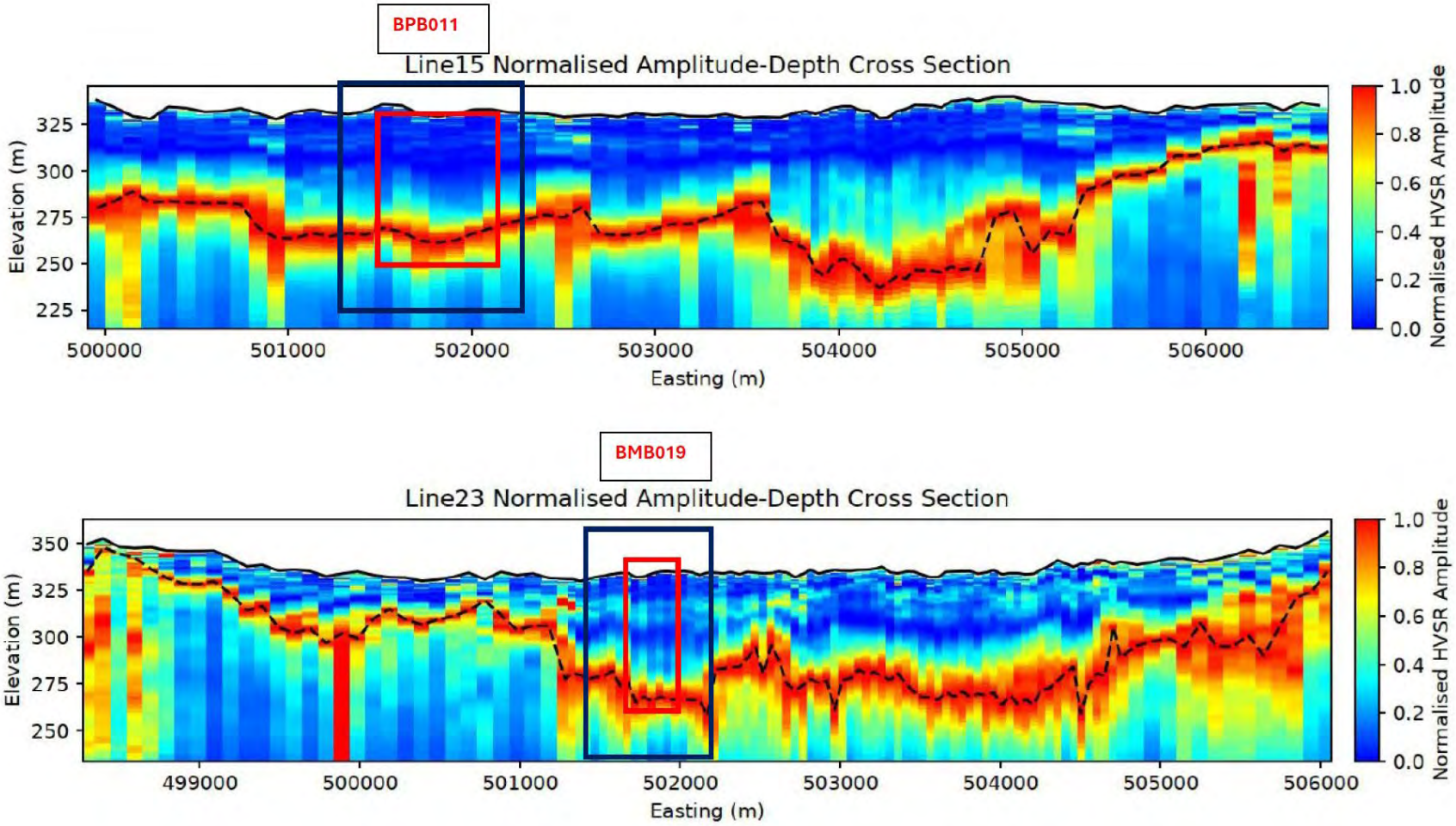


Figure 7.3 Examples of Estimated Widths of Basal Sand and Clay in Rebecca Tributary Palaeochannel Based on Geophysical Surveys

7.5 Groundwater Recharge and Discharge

Figure 7.4 presents a schematic conceptual hydrogeological model of the Rebecca Palaeochannel, showing key points related to groundwater recharge and discharge, which are as follows:

- Rainfall from storm events produces runoff from basement outcrops, the palaeochannel surface sediments and reduced runoff from sandy areas.
- The runoff flows as sheet flow across the low gradient terrain, ponding in some areas and flowing into creek channels in others.
- Evaporation takes place from surface water ponds, wetted soil areas and via plant evapotranspiration from soil water and shallow groundwater.
- Runoff is likely to infiltrate within the area of the palaeochannel through the thin Quaternary sediments (alluvium and colluvium).
- Further downward infiltration of groundwater takes place into the palaeochannel clay (aquitard) with minor leakage into the confined palaeochannel basal sand aquifer.
- Minor inflows of groundwater will occur into the palaeochannel sediments from the surrounding basement strata.
- Groundwater throughflow occurs along the main Rebecca palaeochannel to the northeast where it joins the Raeside Palaeochannel system.

Natural rates of recharge to the whole palaeochannel system are very low and have been estimated to be less than 0.01% of annual rainfall in the Kalgoorlie region (Commander, 1992). Additionally, the 'end-point water' type (i.e. low concentrations of calcium and bicarbonate and high salinity) confirms the limited direct rainfall recharge to the palaeochannel aquifer at the Rebecca Palaeochannel Borefield (refer to Section 6).

In hydrogeological terms Lake Rebecca represents a natural groundwater discharge area with a shallow, near ground level water table. Groundwater inflows into the lake are volumetrically small (due to the low flow gradients and low permeability of the lake beds) and are removed by evaporation, as is typical for playa environments, resulting in virtually no permanent water ponding in the lake footprint. Ponding in the lake is attributed to infrequent surface water runoff or flooding events rather than surface expression of groundwater.

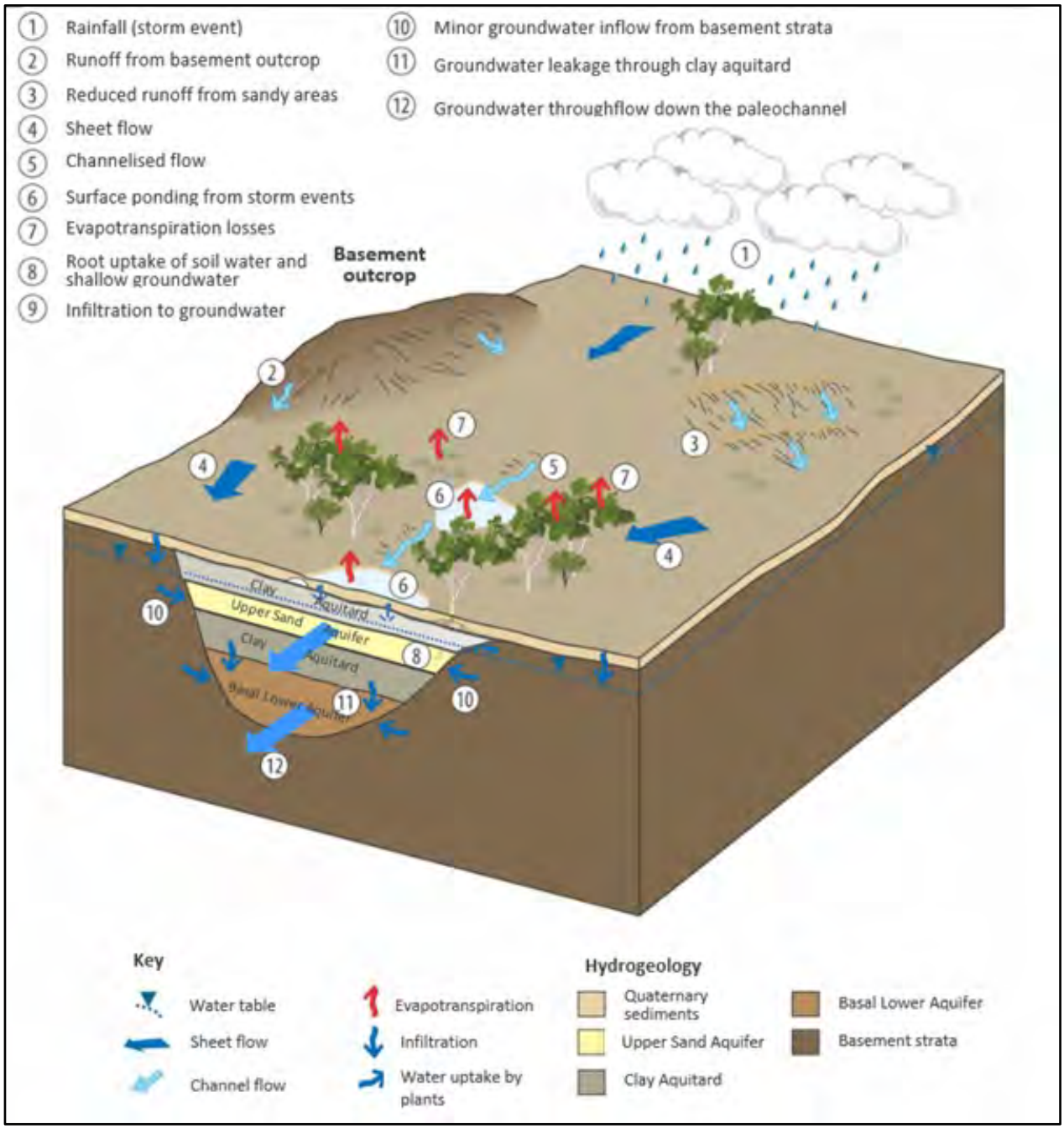


Figure 7.4 Schematic Conceptual Hydrogeological Model, showing Key Points Related to Groundwater Recharge and Discharge

8. PROJECT WATER DEMAND AND PROPOSED GROUNDWATER ABSTRACTION

8.1 Project Water Demand

The Project's current average make-up water demand after TSF decant return is taken into account, for ore processing and other mining operations is estimated at approximately 3 GL/year (95 L/s). This water demand is required for a mine life of 10 years, covering both the Rebecca and Roe Projects. Water demand is expected to vary over the life of mine, however for the purpose of this assessment, a conservative approach has been adopted with an assumption of a constant water demand of 3 GL/year. It is also noted that there are no water quality (salinity) requirements specified for mine water demand.

For the purpose of this assessment, the Project's water demand is planned to be mainly supplied from the regional Rebecca Palaeochannel system and its tributary channels, with any dewatering input from the Rebecca Project pits not being accounted for (i.e. a conservative approach). However, in practice any water input from pit dewatering and TSF recovery would reduce the water demand from the main water supply source during the dewatering period.

8.2 Proposed Water Supply Abstraction System

8.2.1 Individual Bore Sustainable Yields

Extrapolation of the test pumping late-time drawdown data at BPB004, BPB011 and BPB050 are shown in Figures 8.1 to 8.3 and indicate that pumping rates of 21, 10 and 24 L/s respectively, are sustainable in the long-term. Over the 10-year mine life groundwater levels will drop to approximately 23 mbgl (i.e. 15 m drawdown) at BPB004, approximately 46 mbgl (i.e. 38 m drawdown) at BPB0011 and approximately 29 mbgl (i.e. 21 m drawdown) at BPB050, which are well above their pump depths. However, the actual drawdown trend of the aquifer, will depend upon the palaeochannel aquifer's response to longer term pumping.

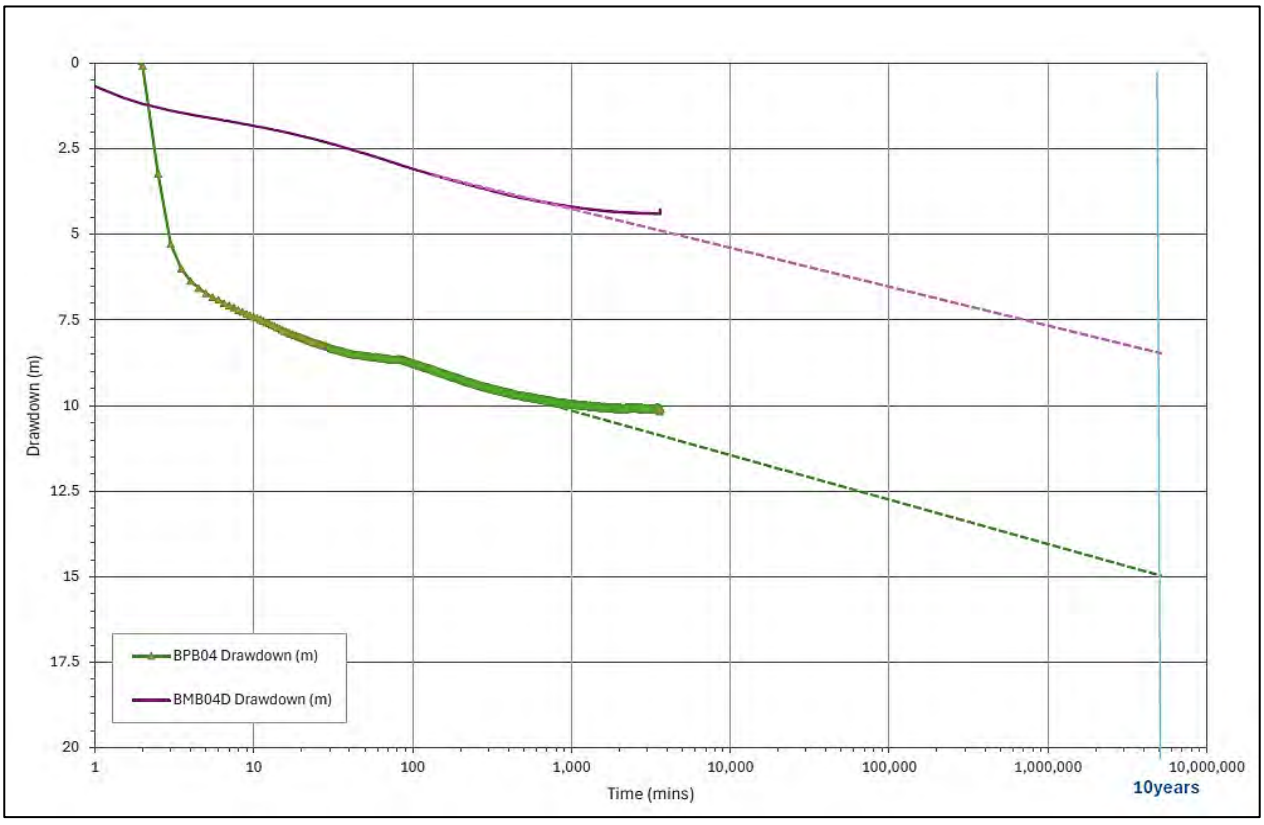


Figure 8.1 Extrapolated Long-Term Drawdown at BPB004

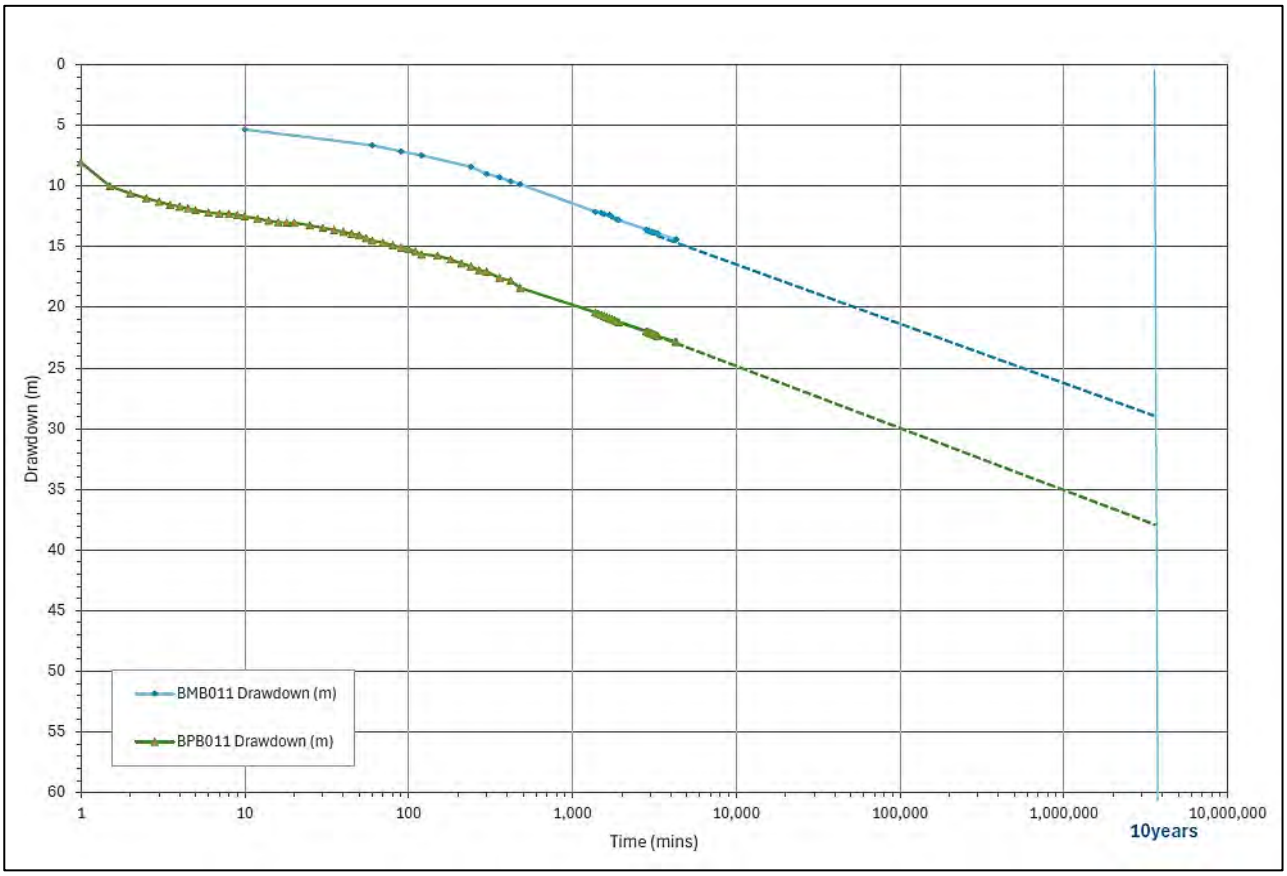


Figure 8.2 Extrapolated Long-Term Drawdown at BPB011

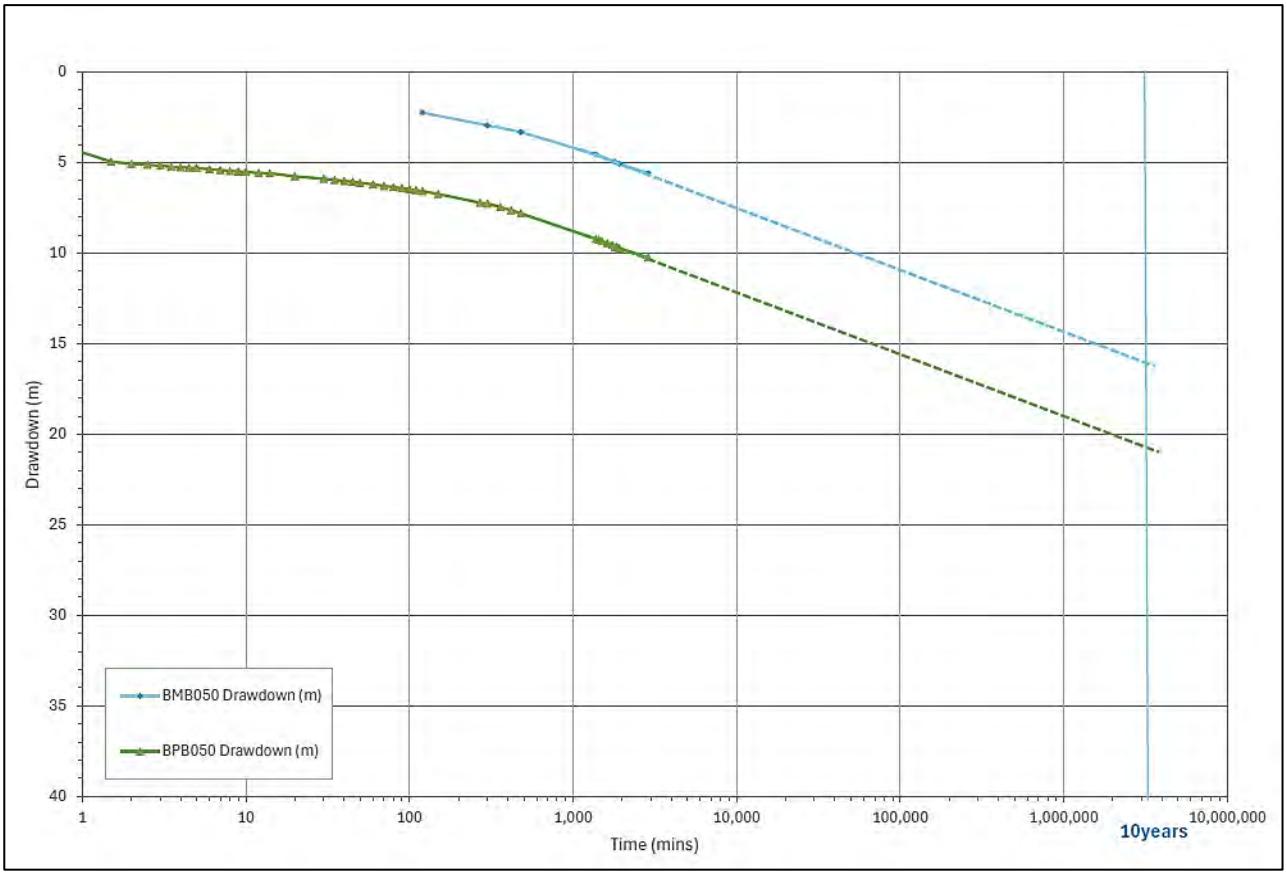


Figure 8.3 Extrapolated Long-Term Drawdown at BPB050

The sustainable yield for an individual bore is a recommended maximum average abstraction rate, that does not exceed an acceptable water level drawdown in the bore. Production bores BPB004, BPB011 and BPB050 were analysed using the Source Reliable Output (SRO) methodology to calculate sustainable yield and the outputs for these are shown in Appendix I. The SRO methodology is an analytical method that uses the results from the step drawdown test combined with transmissivity and storage values from the constant rate test. The late time data incorporated the aquifer barrier boundary effects, meaning that the transmissivity values used are valid for a bounded palaeochannel aquifer configuration. To be conservative, the SRO analysis was carried out assuming that there was no groundwater recharge over a 10 year (3,650 day) period.

SRO analysis of each bore pumping on its own and in isolation, with no other abstractions from the same palaeochannel system, suggests the following sustainable pumping rates for each bore:

- BPB004: 20 L/s.
- BPB011: 10 L/s.
- BPB050: 20 L/s.

The SRO estimates are conservative, particularly for the main Rebecca Palaeochannel bores BPB004 and BPB050, which are very productive.

It should be noted that bore BPB017 was not analysed as its yield is too low, and it is only suitable for small scale local water supply (~1 L/s).

8.2.2 Water Supply Potential Targets

The groundwater supply investigation (refer to Section 6) has shown that the most prospective area for water supply is from the main Rebecca Palaeochannel, comprising the palaeochannel basal sand up to 21 m thick, which extends along the length of the main palaeochannel. SRO analysis of the two production bores within the main palaeochannel (BPB004 and BPB050) has given estimates of sustainable yield of 20 L/s each when used in isolation (without interference effects from surrounding production bores).

The tributary palaeochannels adjacent or close to the main Rebecca Palaeochannel (i.e. in the confluence area) are also prospective, with a sustainable yield of 10 L/s being estimated from SRO analysis of one production bore, BPB011. The tributary palaeochannels further away from the main Rebecca Palaeochannel are not prospective and have little potential of sustaining significant long-term yields of groundwater, owing to their high clay content.

8.2.3 Proposed Water Supply Rebecca Palaeochannel Borefield

The exploration drilling programme showed the main Rebecca Palaeochannel to have basal sandy aquifer units of up to 21 m thickness, either as a single layer (BPB050) or as two layers combined (BPB004). Due to the main Rebecca Palaeochannel being relatively homogenous across the Project area, the expectation is that the aquifer thickness will extend along the length of the main palaeochannel in the proposed Rebecca Palaeochannel Borefield area. For example, a basal sand thickness of 21 m was seen in exploration hole WBAC0002, which is between BPB004 and BPB050 (Figure 5.7 and Table 5.1). It is reasonable to assume that the palaeochannel sand aquifer will have similar properties both upstream (northwest) from BPB004 and downstream (east) of BPB050 along the Rebecca Palaeochannel.

Production bores constructed within the main Rebecca Palaeochannel will cause preferential drawdown propagation along the palaeochannel due to it being a linear feature (bounded by the bedrock). These have the potential to interfere with each other, causing larger levels of drawdown. Therefore, palaeochannel bores are usually widely spaced to try to minimise interference drawdown and are often spaced at minimum 1 km intervals along the palaeochannel. Although the SRO analysis indicates a sustainable yield

of 20 L/s per production bore in the main Rebecca Palaeochannel (refer to Section 8.2.1), the possibility of interference drawdown needs to be considered. Reducing individual bore abstraction rates to 12 L/s each and spacing the bores at least 1 km apart, should allow the required 95 L/s (3 GL/year) to be supplied from 8 production bores. As each bore will require maintenance at some time, an allowance of 2 standby production bores is recommended to allow uninterrupted production of the full 95 L/s flow. Therefore, a borefield of 10 production bores is recommended, with 8 of these bores being used at any one time and 2 of the bores being on standby. Spacing the bores at least 1 km apart along the main Rebecca Palaeochannel will mean a borefield of a minimum 9 km long from end to end. However, due to access restrictions to some of the deepest parts (thalweg) of the main Rebecca Palaeochannel caused by the presence of a Class A priority ecological communities (PEC) east of bore BPB050, the potential palaeochannel borefield will probably be up to 15 km long from end to end.

A conceptual Rebecca Palaeochannel Borefield configuration is shown in Figure 8.4 together with the interpreted deepest part (thalweg) of the main Rebecca Palaeochannel and its tributaries and the location of nearby PECs. It is proposed to utilise two existing production bores BPB004 and BPB050 and drill and construct 8 new production bores (nominally named WB01, WB02, WB03, WB04, WB05, WB06, WB07 and WB08), all these bores being located in the main Rebecca Palaeochannel. Please note that the proposed additional production bore locations are provisional only (subject to further, more detailed investigation). This borefield configuration has been used in numerical groundwater flow modelling to simulate the groundwater system and assess the Rebecca palaeochannel system's ability to provide the Project's 3 GL/year water demand over the mine life, without detrimental impact to the environment and other users (refer to Section 9 for more details).

It should be noted that in addition to the proposed Rebecca Palaeochannel Borefield configuration, use of the tributary palaeochannel systems in the confluence area such as that tapped by bore BPB011 and also seen at monitoring bores BPB005 and BPB008, might allow the abstraction to be spread laterally in these areas, reducing the required water take from the main Rebecca Palaeochannel.

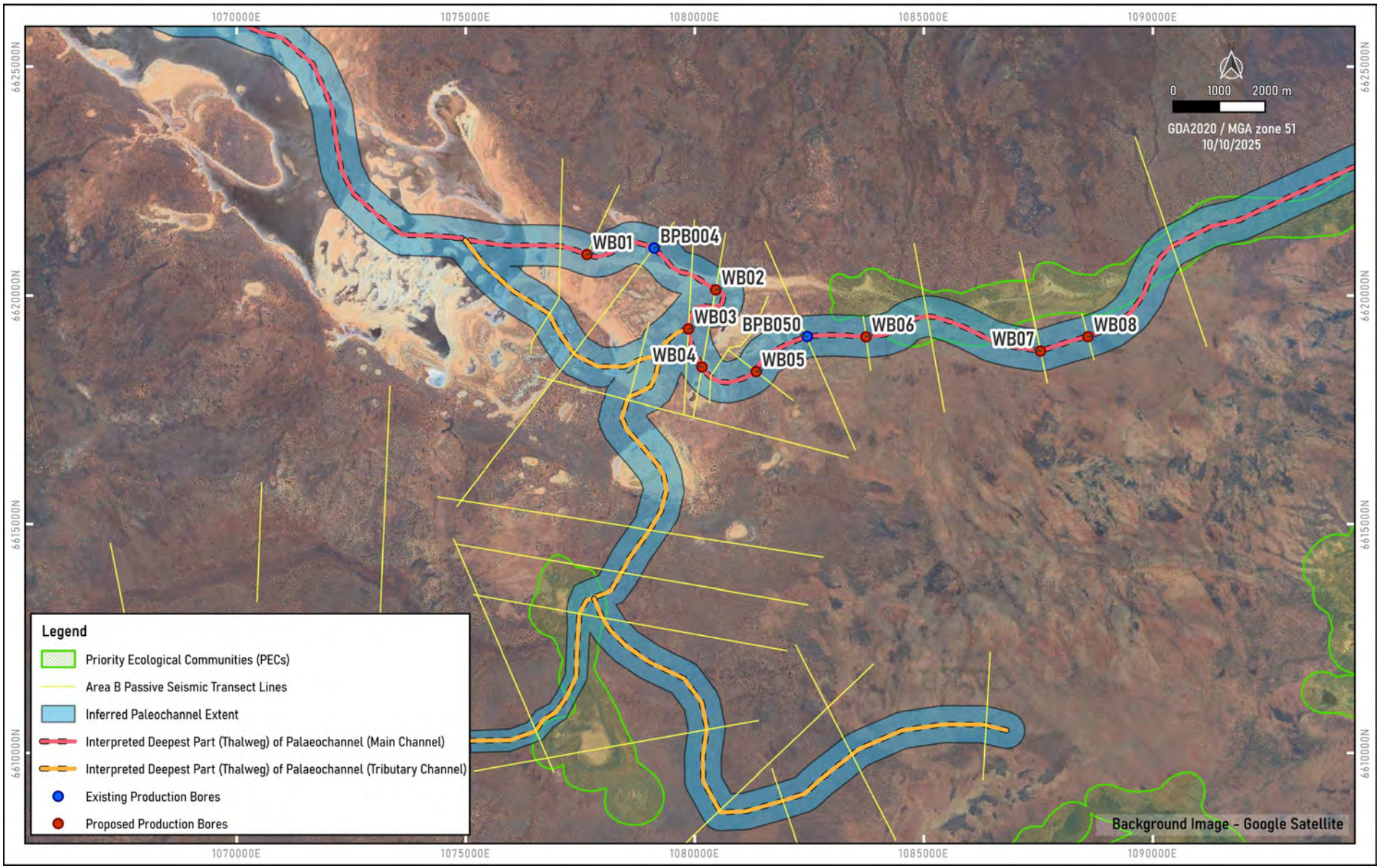
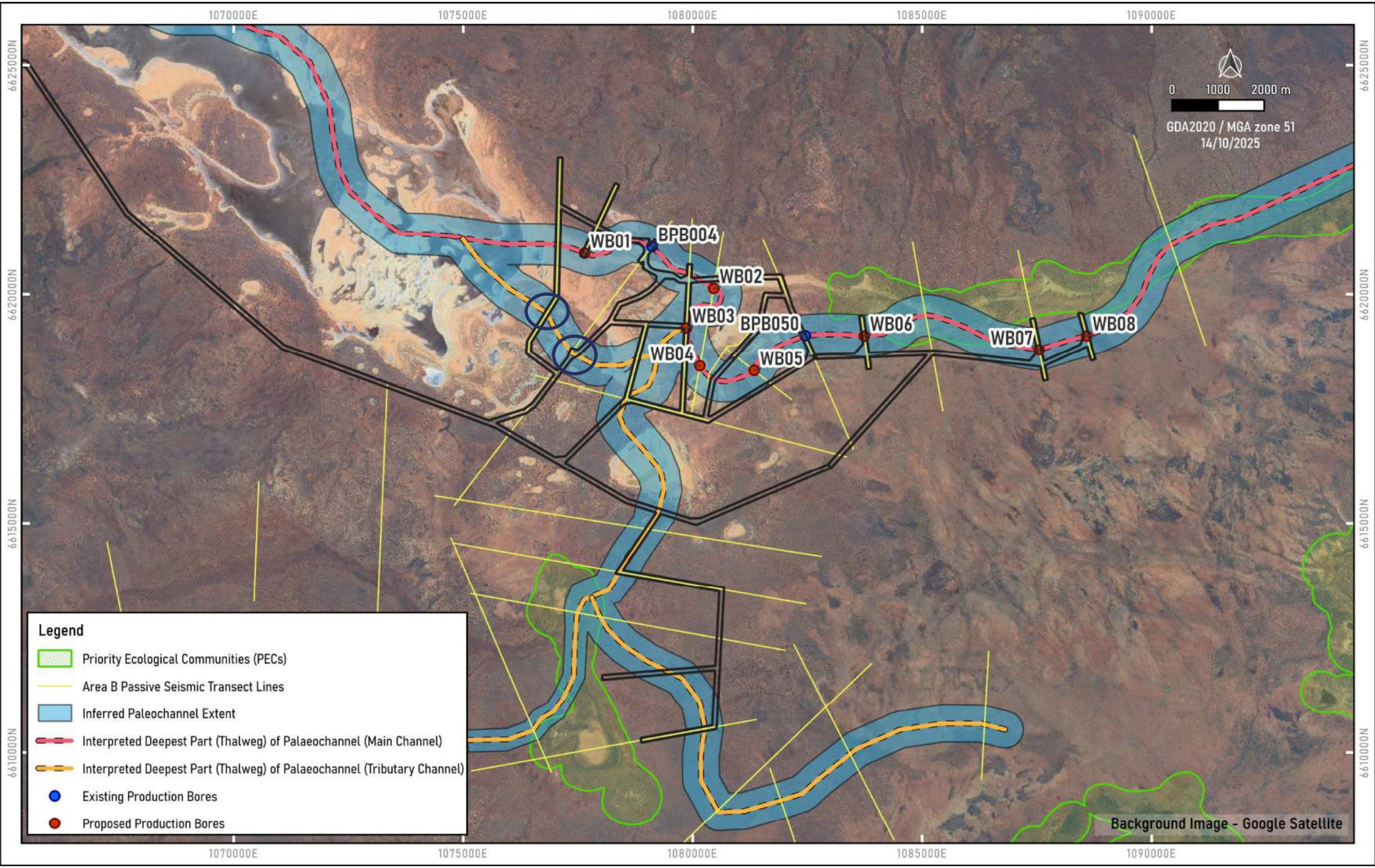


Figure 8.4 Conceptual Rebecca Borefield Configuration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GDA2020 / MGA zone 51
14/10/2025
WB01
BPB004
WB02
WB03
BPB050
WB06
WB07
WB08
WB04
WB05
Legend
Priority Ecological Communities (PECs)
Area B Passive Seismic Transect Lines
Inferred Paleochannel Extent
Interpreted Deepest Part (Thalweg) of Palaeochannel (Main Channel)
Interpreted Deepest Part (Thalweg) of Palaeochannel (Tributary Channel)
Existing Production Bores
Proposed Production Bores
Background Image - Google Satellite

9. WATER SUPPLY ASSESSMENT (NUMERICAL GROUNDWATER MODELLING)

9.1 Objectives

A regional groundwater flow model was developed to simulate the groundwater system and assess the Rebecca palaeochannel system's ability to provide the Project's 3 GL/year (i.e. 96 L/s or 8,300 kL/d) water demand over the 10-year mine life, without detrimental impact to the environment and other users.

Key features of the groundwater model are listed below and described in detail in the following sections:

- Seven model layers were used to represent the alluvium, the upper palaeochannel clay and sand, the lower palaeochannel clay, palaeochannel basal sand, saprolite and the surrounding basement.
- The model extent includes the Rebecca Palaeochannel borefield area and the surrounding groundwater catchment.
- Recharge to the aquifer system from rainfall has been simulated.
- Evapotranspiration from the shallow water table areas across the modelled catchment.
- Groundwater inflow from upstream (north west and south east) and outflow to downstream (north east).
- Groundwater abstraction from existing and proposed water supply bores.

9.2 Model Set up

9.2.1 Model Extent

The regional groundwater flow model was developed using the MODFLOW-USG code (Version 1.4.00, Hydrogeologic Inc., 2017), using the Groundwater Vistas graphical user interface (Version 9.07, Build 41 Environmental Simulations Inc, 1996 to 2024). The extent of the groundwater model domain is summarised in Table 9.1 and shown in Figure 9.1. The model and all associated data are specified using the MGA Zone 51 (GDA 2020) coordinate reference system. The model covers an area of 43.3 km (north to south) and 54.8 km (east to west).

Table 9.1 Coordinates of Model Boundaries MGA Zone 51 GDA 2020

Model Point	Easting	Northing
Western Corner	468681	6647246
Northern Corner	484191	6663786
Eastern Corner	523400	6644623
Southern Corner	505985	6620732

The distribution of model cell sizes is shown in Figure 9.2. This cell size distribution is the same across all seven layers of the model. The model uses a minimum cell size of 25 m in the palaeochannel and adjacent areas, increasing to cell sizes of 200 m and 800 m further away from the palaeochannel. Over the seven model layers, this results in a total of 2,266,677 model cells and 2,088,478 active model cells.

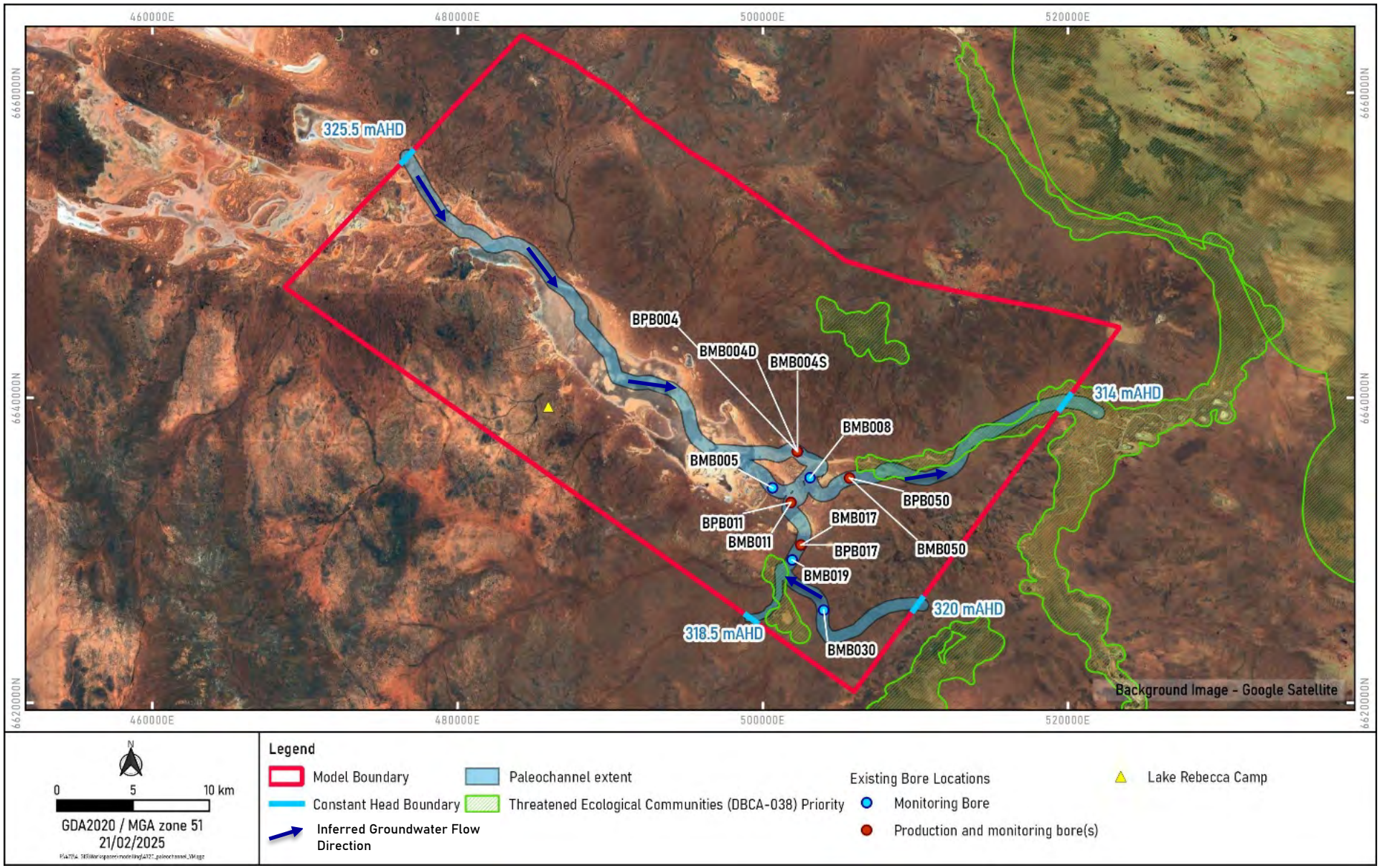

Figure 9.1 Model Extent and Boundary Conditions

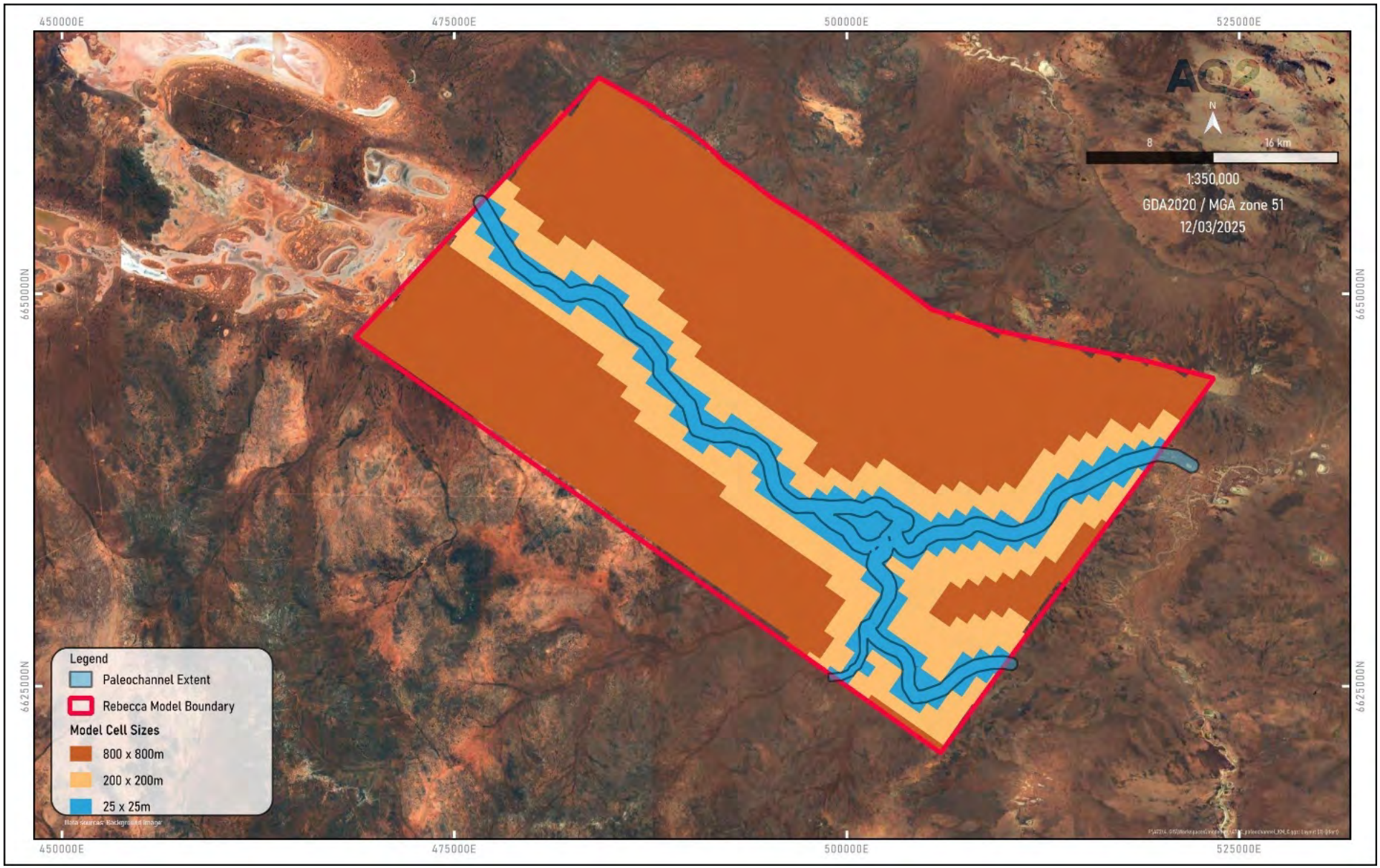

Figure 9.2 Model Cell Size Distribution

9.2.2 Geological Model

A Leapfrog geological model was constructed for the palaeochannel, in the proposed water supply area (Rebecca Palaeochannel Borefield area) and the areas upstream and downstream, to allow the definition of key hydrogeological units and the thickness and extent of the aquifer and aquitard units in the palaeochannel. Leapfrog is an industry standard geological modelling package. The development of the Leapfrog model is described below.

The top elevation of layer 1 (ground surface) was developed using the NASA Shuttle Radar Topography Mission (SRTM) 1 arc-second elevation data (NASA, 2013). Lithological logs for exploration and water bore drilling were used to determine layer thickness within the palaeochannel. Outside of the palaeochannel the bedrock elevation was determined using geophysical data from transects in Area B (south-eastern corner of the model); this data formed a 3D surface of limited extent. Geophysical cross sections along transects in Area A (north-western corner) allowed the depth to fresh basement to be interpolated as points. The two elevation data sets were then joined in Leapfrog with the basement elevation inferred in between. The locations of bores, from which lithological data was used to define the thickness and extent of aquifer units and the location of the geophysical transects, are shown in Figure 9.3.

The model uses seven layers to simulate the hydrogeological units summarised in Table 9.2. Aquifer geometry and extents were derived from borehole lithology, geophysical interpretations and test pumping results (refer to Sections 7 and 8).

Table 9.2 Model Layer Summary

Layer	Hydrogeological Units	Description
1	Alluvium	Sand and silt covering entire model extent. Top of Layer is ground level (topography). Variable thickness between 2 and 6m.
2	Upper Palaeochannel Clay & Saprolite	Clay and silt with minor sand horizons within the palaeochannel extent (6-28m thick) with weathered basement (saprolite) flanking.
3	Upper Palaeochannel Sand, Clay and Saprolite	Local sand in zones or otherwise clay and silt within palaeochannel (2-14m thick) with weathered basement (saprolite) flanking.
4	Lower Palaeochannel Clay, Saprolite and Basement	Clay within the palaeochannel extent (22-52m thick) with weathered basement (saprolite) along the edges of the channel, fresh igneous basement rock outside of the channel.
5	Palaeochannel Basal Sand, Saprolite and Basement	Sand and gravel within the base of the palaeochannel (6-41m thick) with weathered basement (saprolite) along the edges of the channel, fresh igneous basement rock outside of the channel.
6	Saprolite and Basement	Saprolite underlying the palaeochannel (2-15m thick) with fresh igneous basement rock outside of the channel
7	Basement	Fresh igneous basement rock

The limited spatial extent of the palaeochannel sediments was simulated by including the geometry of the Leapfrog model (described above) and by assigning representative zones for hydraulic conductivity and storage. The palaeochannel sediments were constricted to within the palaeochannel morphology for each layer. Outside of the palaeochannel in layers 2 and 3, the surrounding lithology was simulated as saprolite, whereas layers 4 and 5 featured a transitional zone of saprolite between the basement and the palaeochannel. The geometry of model layers is summarised in Table 9.2 with aquifer property zones, by layer, shown in Appendix J. Aquifer property zones vary in layers 2 to 6, with a single zone used in layers 1 and 7 to represent the alluvium and basement. A schematic model section is shown in Figure 9.4.

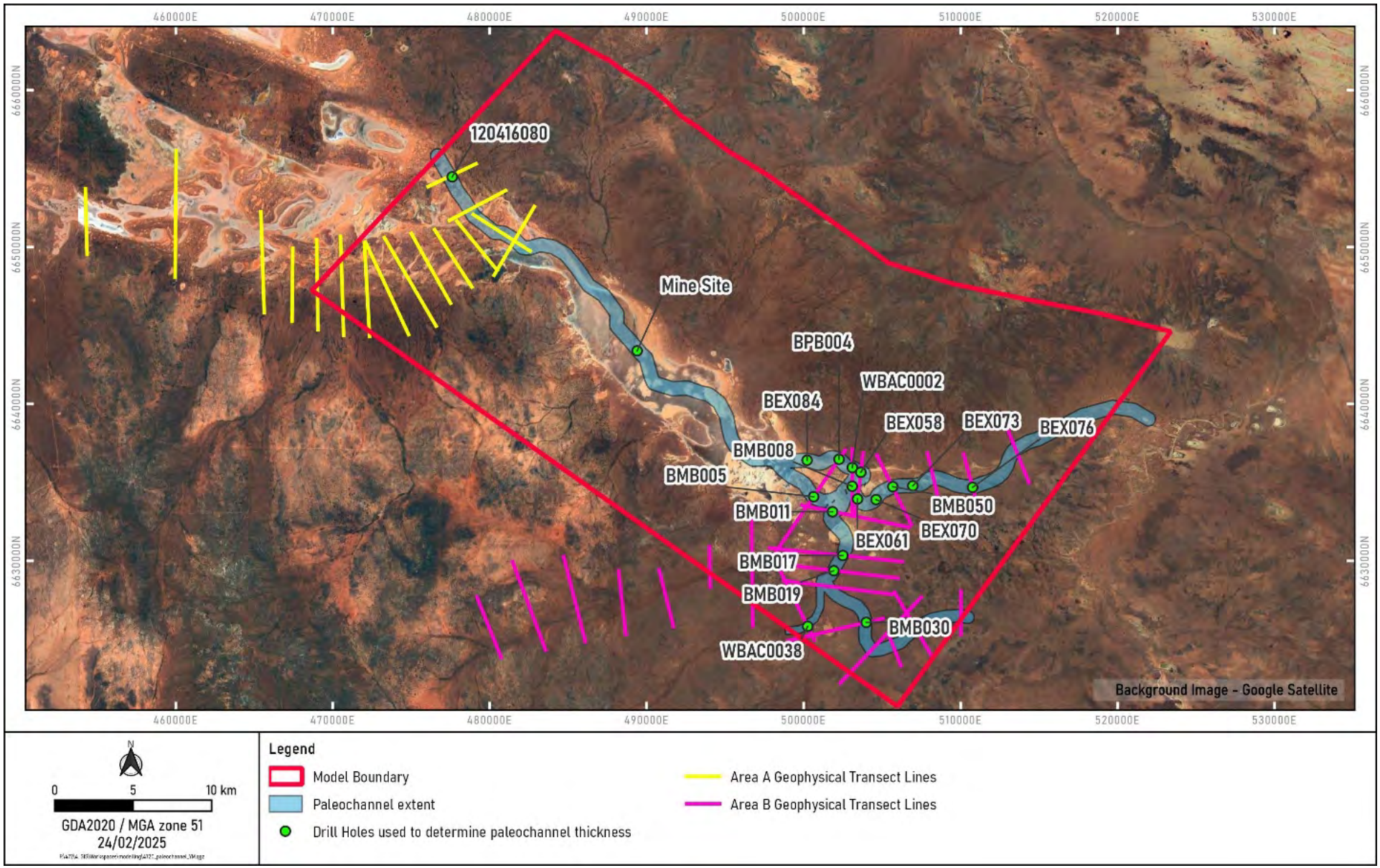

Figure 9.3 Drill Hole Locations and Geophysical Transects Used To Develop the Leapfrog Model

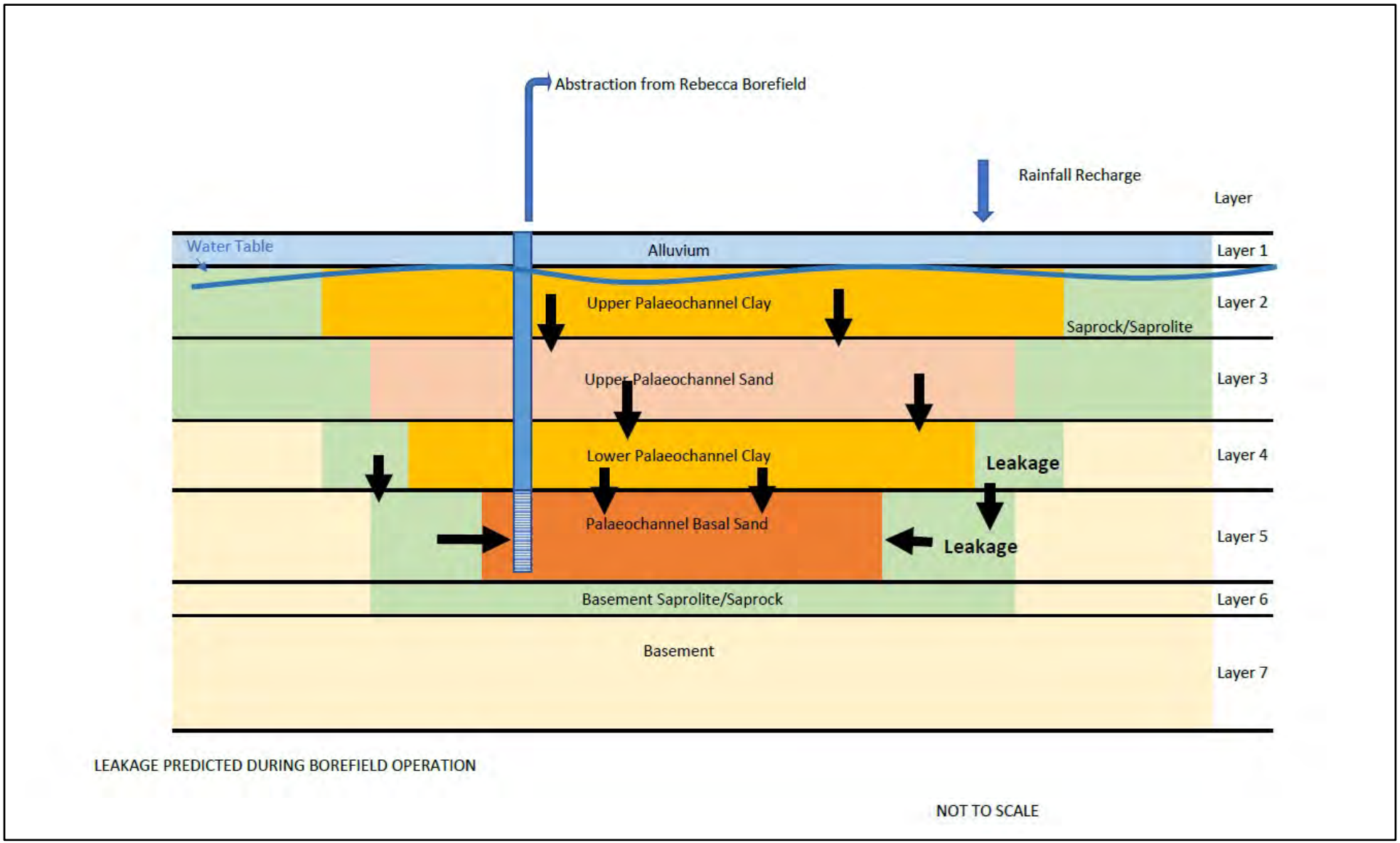

Figure 9.4 Rebecca Palaeochannel Borefield - Schematic Model Section

9.3 Groundwater Inflow and Outflow

9.3.1 Groundwater Throughflow

The direction of groundwater flow in the modelled catchment is generally west to north-east along the palaeochannel, with inflows also from the south and south-east. Groundwater gradients along the palaeochannel are very low; there is very little difference in groundwater levels measured within the existing monitoring bores, with groundwater levels measured in the palaeochannel aquifer (palaeochannel basal sand) between 317.5 and 320 mAHD.

Groundwater inflow and outflow from the catchment are simulated using constant head boundaries (CHBs). These boundaries are assigned over the width of the main palaeochannel and its tributary channels in all layers. Elevations for the constant head boundaries are shown in Figure 9.1 and summarised in Table 9.3.

Table 9.3 Summary Table of Constant Head Boundaries

Boundary Location	Constant Head Value (mAHD)
North-Western (Inflow)	325.5
Southern (Inflow)	318.5
South-Eastern (Inflow)	320.0
North-Eastern (Outflow)	314.0

All other model boundaries are assigned as the no flow type.

9.3.2 Recharge

In addition to groundwater inflow from upstream, the groundwater system is recharged from rainfall recharge, simulated using the Recharge (RCH) package in Modflow USG. The modelled recharge distribution is shown in Figure 9.5. The rate of recharge was adjusted during model calibration and also used for model predictions. The recharge rates applied to the calibrated model are summarised below:

- In the palaeochannel, recharge was assigned at a rate of 1.0 x 10^{-8} m/day.
- Outside the palaeochannel, recharge was assigned at a rate of 5.0 x 10^{-10} m/day.

9.3.3 Evapotranspiration

Evapotranspiration (ET) across the modelled catchment was simulated using the Evapotranspiration (EVT) package in Modflow USG. The EVT package uses a depth dependent relationship such that if the predicted aquifer water levels are at or above a specified elevation (the ET surface), ET occurs at the maximum specified rate. If predicted water levels decrease to below the specified ET surface, the ET rate decreases linearly to zero as the predicted water level approaches an elevation equal to the ET surface, minus a specified extinction depth. This relationship is shown schematically in Figure 9.6. Details of the ET package included in the calibrated model are summarised below:

- ET losses are included over the model domain at a maximum rate of 2.74 x 10^{-8} m/day.
- The extinction depth was set at 1.0 m.
- The ET surface was set consistent with the simulated ground level (top of layer 1).

Figure 9.5 Simulated Recharge Zones

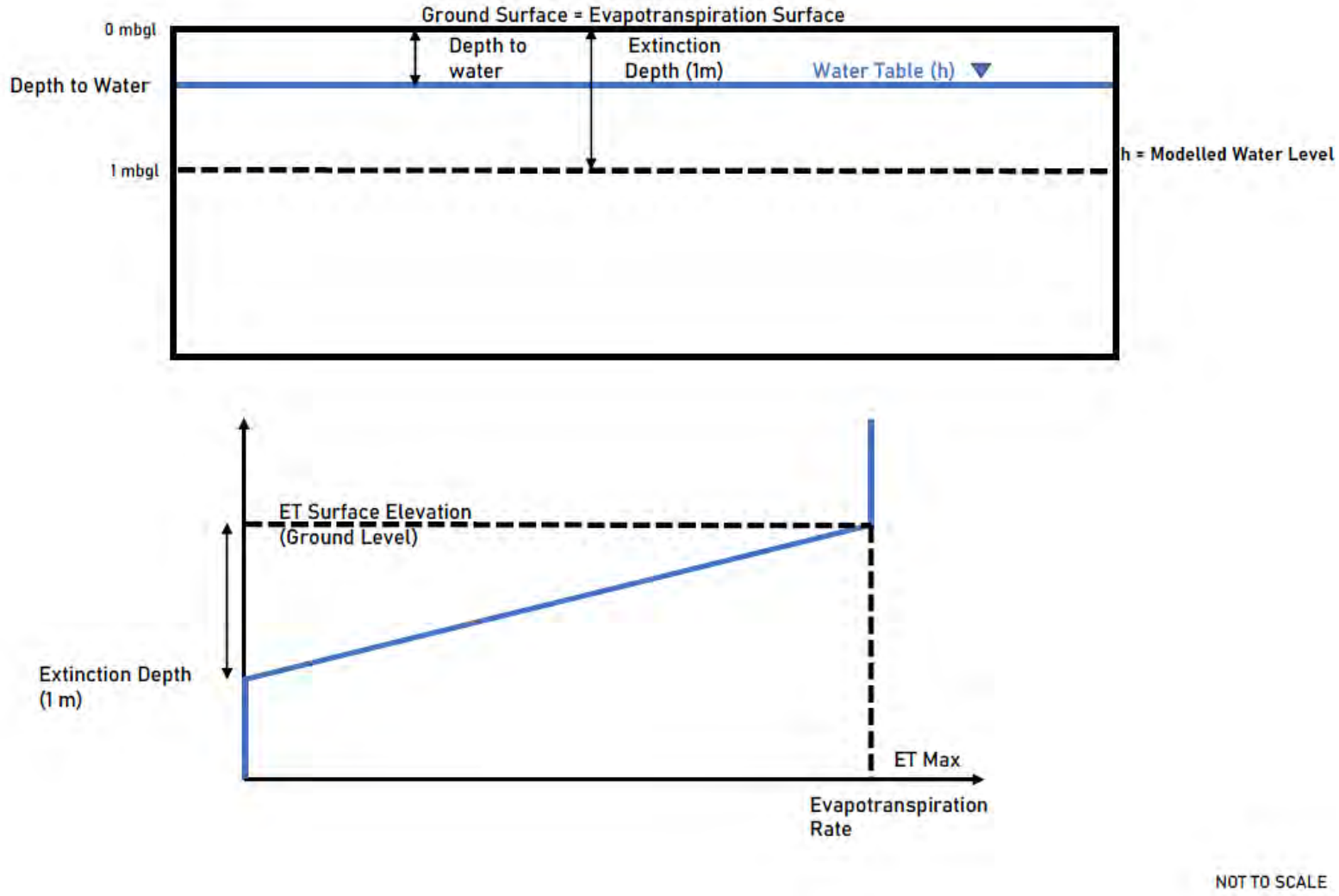

Figure 9.6 Evapotranspiration Conceptual Diagram

9.3.4 Groundwater Pumping

The Modflow USG (WEL) package was used to simulate test pumping that was undertaken in August 2024 as part of model calibration. The locations of existing monitoring and pumping bores used in model calibration are shown in Figure 9.1. For model predictions, to assess the potential for the Rebecca Palaeochannel borefield to supply the Project water demand, the same Modflow USG (WEL) package was used. The locations of existing and proposed water supply bores within the Rebecca Palaeochannel Borefield are shown in Figure 9.7.

9.4 Model Calibration

9.4.1 Approach

Model calibration is the process by which the parameters of a numerical model are adjusted, with realistic limits to provide the best match to measured data. The process involves testing and refining the aquifer properties and boundary conditions of the model to improve the match between observed and simulated values. The groundwater model was calibrated to steady state (pre-development) conditions and transient (time varying) conditions using a manual or trial and error approach.

Data available for model calibration includes:

- Pre-development or steady state groundwater levels measured at 6 monitoring bores, installed in 2024 (BMB004D, BMB005, BMB011, BMB017, BMB019 and BMB050).
- The change in water level (drawdown) measured in monitoring bores during the test pumping of production bores BPB004, BPB011 and BPB050, conducted in August 2024.

The steady state calibration reflects the current groundwater level conditions (measured during recent investigations) and provides a set of pre-development groundwater levels for the transient model calibration (test pumping). The model was also calibrated to transient or time varying conditions by simulating the water level response from the test pumping.

Combinations of aquifer properties were investigated as part of the replication of the response to test pumping. The aquifer properties that provided the best match to the observed response to pumping were used to divide some of the hydrogeological units of the palaeochannel into zones (as shown in Appendix J). These zones extend mid-way between each pumping bore. Any changes required to achieve the match to the pumping tests were fed back into the steady state model calibrations.

9.4.2 Steady State Calibration

Recently measured water levels and contours of predicted steady state water level are shown in Figure 9.8. The contours of predicted groundwater level simulate the general direction of groundwater flow from the south-east along the main Rebecca palaeochannel, then bending to the north-east in the confluence area, where the main channel intersects the tributaries to the south. The groundwater flow direction in the palaeochannel tributaries from the south south-west to the north towards the confluence area was also replicated. The contours also show a relatively flat hydraulic gradient along the paleochannel aquifer.

Measured and modelled water levels are also shown in Figure 9.9. Measured and modelled water levels are generally replicated by the model, with observed water levels under and / or over predicted by less than 1 m. The largest difference between measured and modelled water levels is at BMB005, where the observed water level was under predicted by 1 m. At BMB019 the measured water level was over predicted, with a difference between the measured and modelled water level of 0.15 m (above the observed). For four out of the six observation locations, the observed data was matched within 0.5 m.

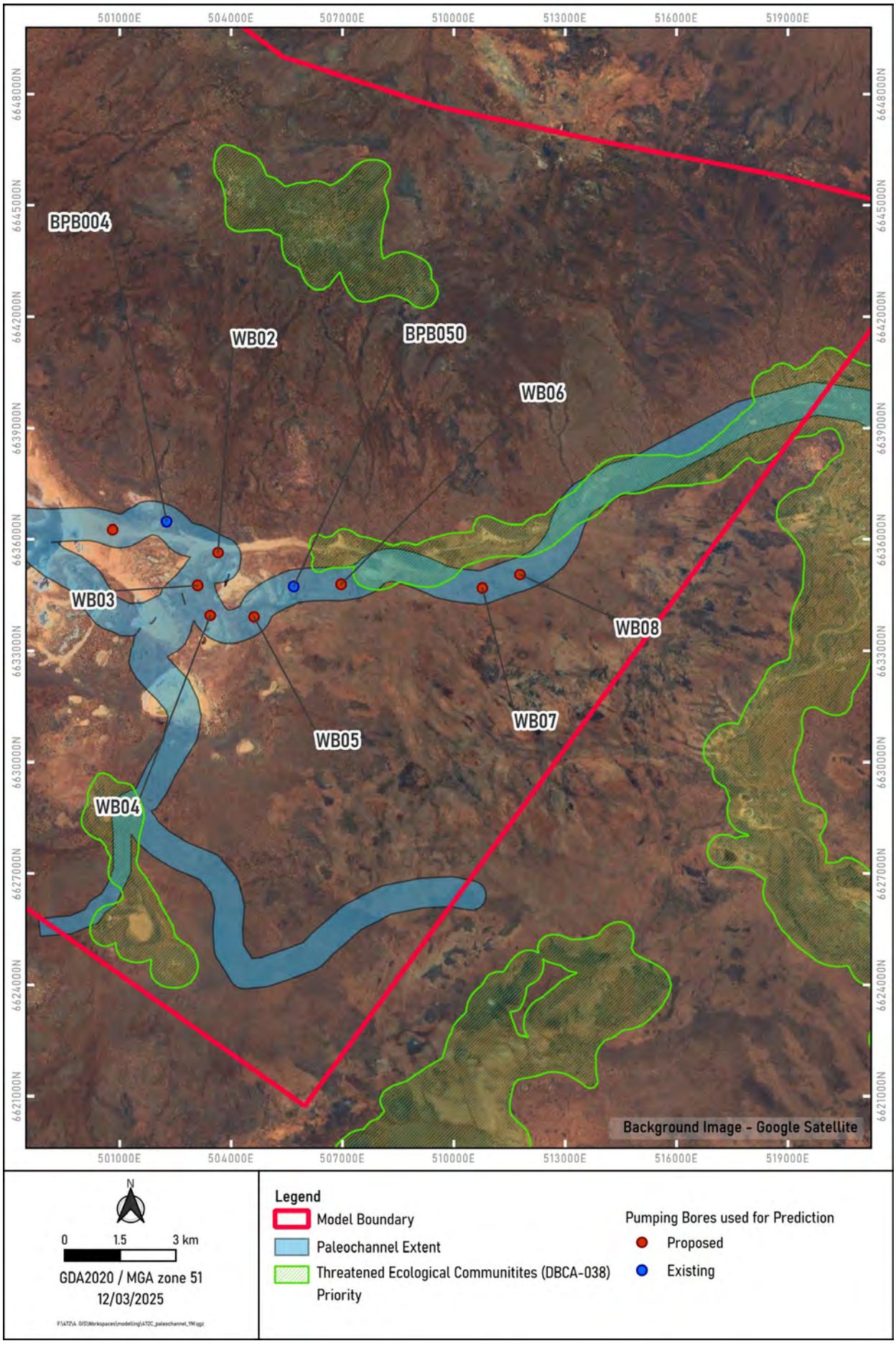

Figure 9.7 Existing and Proposed Water Supply Bores

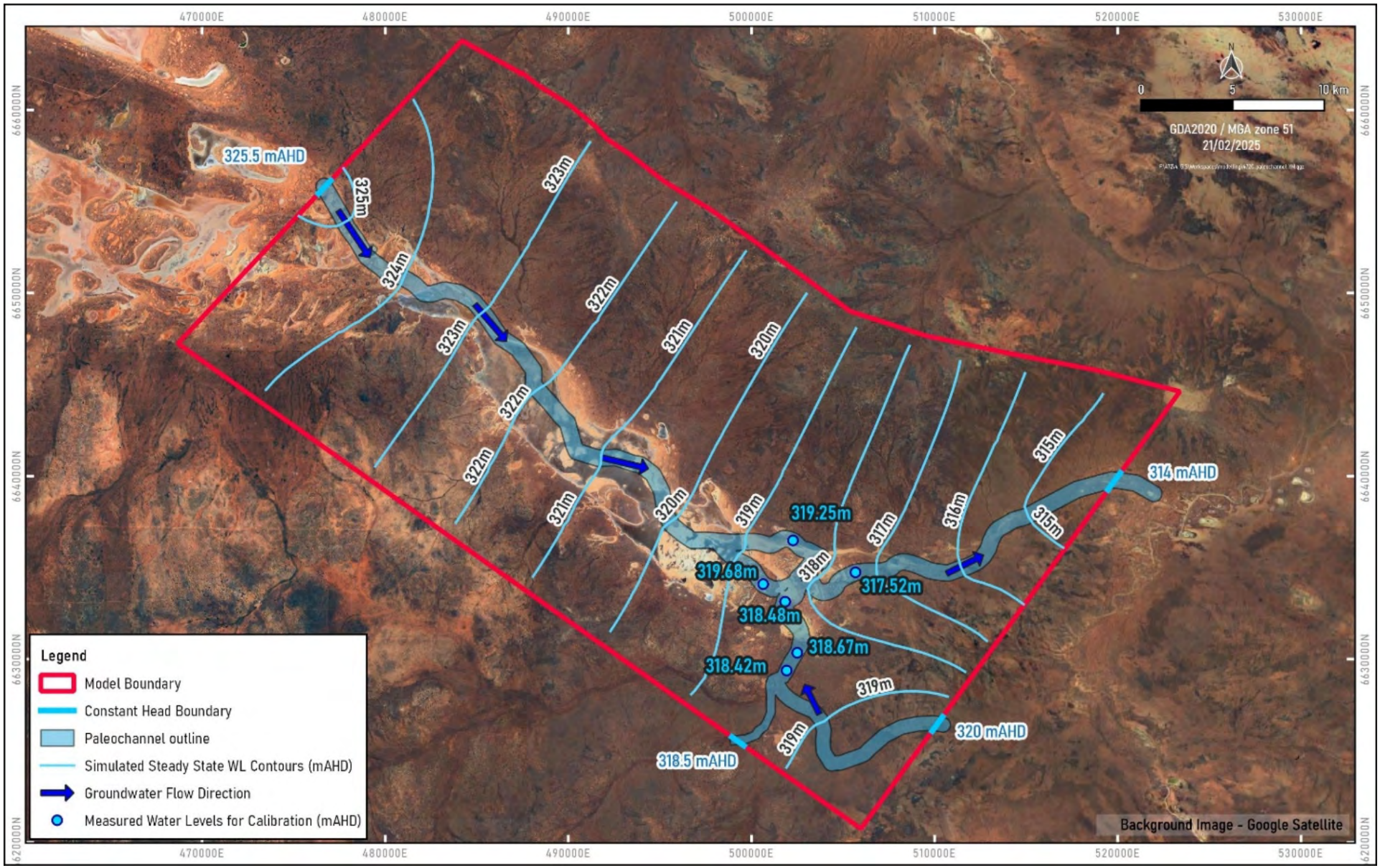

Figure 9.8 Measured Water Levels and Contours of Predicted Steady State Water Level

The steady state model predicted water balance for the entire modelled catchment is summarised in Table 9.4. Predicted groundwater inflows and rainfall recharge are very low consistent with the very low measured and inferred hydraulic gradient. Despite the inclusion of ET, no ET losses are simulated in the steady state model water balance.

Table 9.4 Model Predicted Steady State Water Balance

Component	Inflow (kL/day)	Outflow (kL/day)
North-Eastern Outflow (Constant Head Boundary at 314 mAHD)	-	38
South-Eastern Inflow (Constant Head Boundary 320 mAHD)	1	-
Southern Inflow (Constant Head Boundary 318.5 mAHD)	-	-
North-Western Inflow (Constant Head Boundary 325.5 mAHD)	36	-
Recharge	1	-
Evapotranspiration	-	0
Storage	-	-
Borefield Abstraction	-	-
Total	38	38

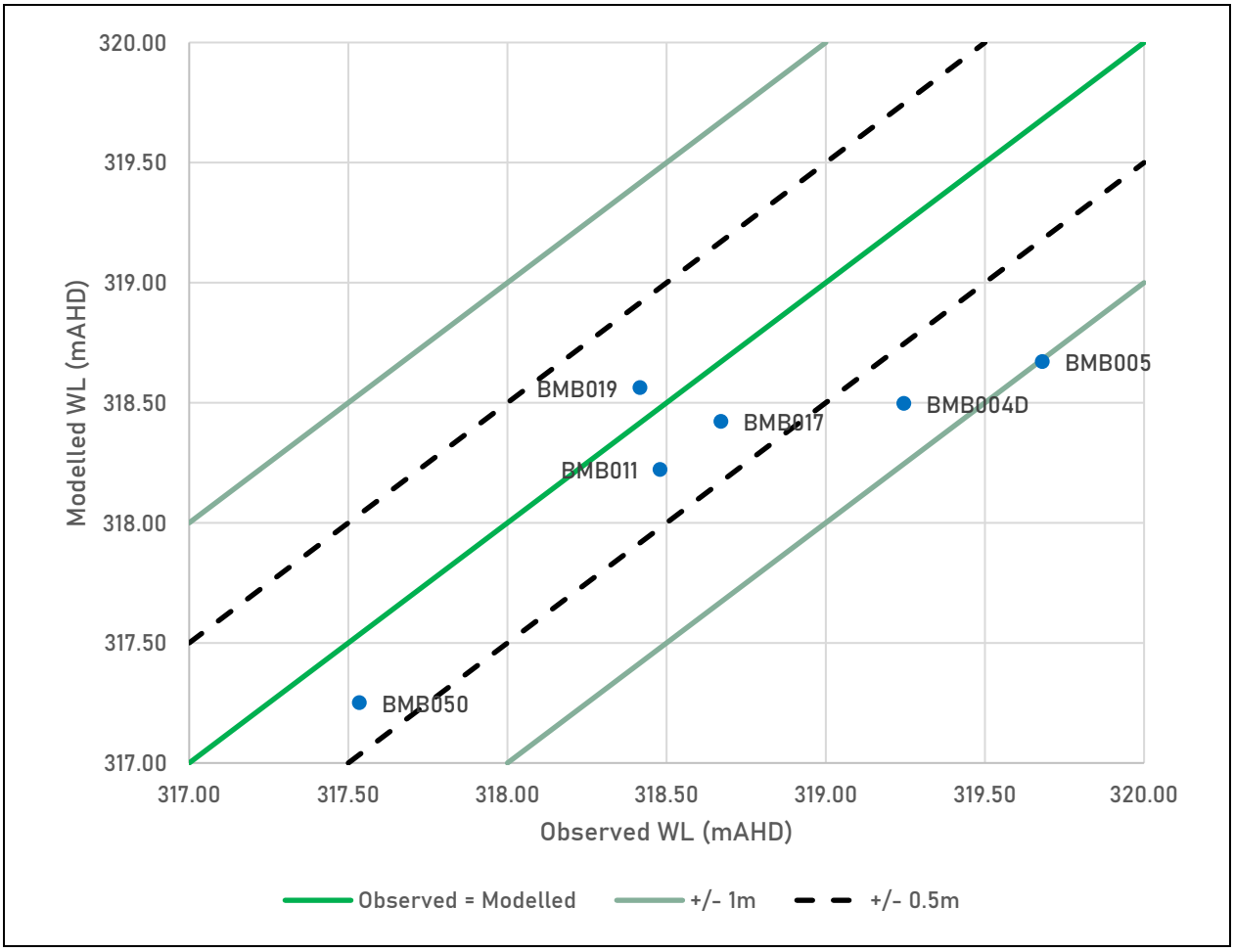

Figure 9.9 Steady State Observed and Measured Water Levels

9.4.3 Test Pumping Calibration

It should be noted that regional groundwater models are generally not suitable to simulate the data collected during aquifer tests because:

- Drawdowns at pumping bores are influenced by bore losses that results from near bore characteristics (pumping losses and formation losses) that are not simulated by regional groundwater models.
- Observation bores are often located close to pumping bores, or in the case of regional groundwater models, in the same model cell, or one to two model cells away from pumping bores. This limits the capacity of a regional groundwater model to simulate the steep water level gradients that may develop around a pumping bore.
- Larger cells sizes, required for the development of a regional scale groundwater flow model, often contain significantly greater storage volume than the entire volume of water removed during lower flow pumping tests.

Nevertheless, in the absence of any long term monitoring data, the regional model was used to simulate the measured water level response (drawdown) at the monitoring bores monitored during the constant rate pumping tests. Models were run for test pumping at these bores and durations:

- Pumping bore BPB004, including 2.5 days pumping and 2 days of recovery, using drawdown and recovery measured at monitoring bores BMB004S and BMB004D.
- BPB011, including 3 days pumping and 2 days of recovery using drawdown and recovery measured at monitoring bore BMB011.
- BPB050, including 3 days pumping and 2 days of recovery using drawdown and recovery measured at monitoring bore BMB050.

The locations of the production bores and associated monitoring bores are shown in Figure 9.1.

To replicate the measured drawdown response to pumping, the following aquifer parameters were adjusted:

- The hydraulic conductivity of the overlying palaeochannel clay units (aquitards), both vertical and horizontal.
- The storage values assigned to the palaeochannel basal sand.
- The hydraulic conductivity of the saprolite (weathered basement).

The replication of the drawdown response for each test is discussed in detail in the following sections.

9.4.4 Results

The measured and modelled drawdown response at BMB011 to pumping from BPB011 is shown in Figure 9.10.; the best match between the observed and modelled drawdown response was achieved by reducing the vertical hydraulic conductivity of the lower palaeochannel clay (zone 26) to 5.0 x 10^{-4} m/day.

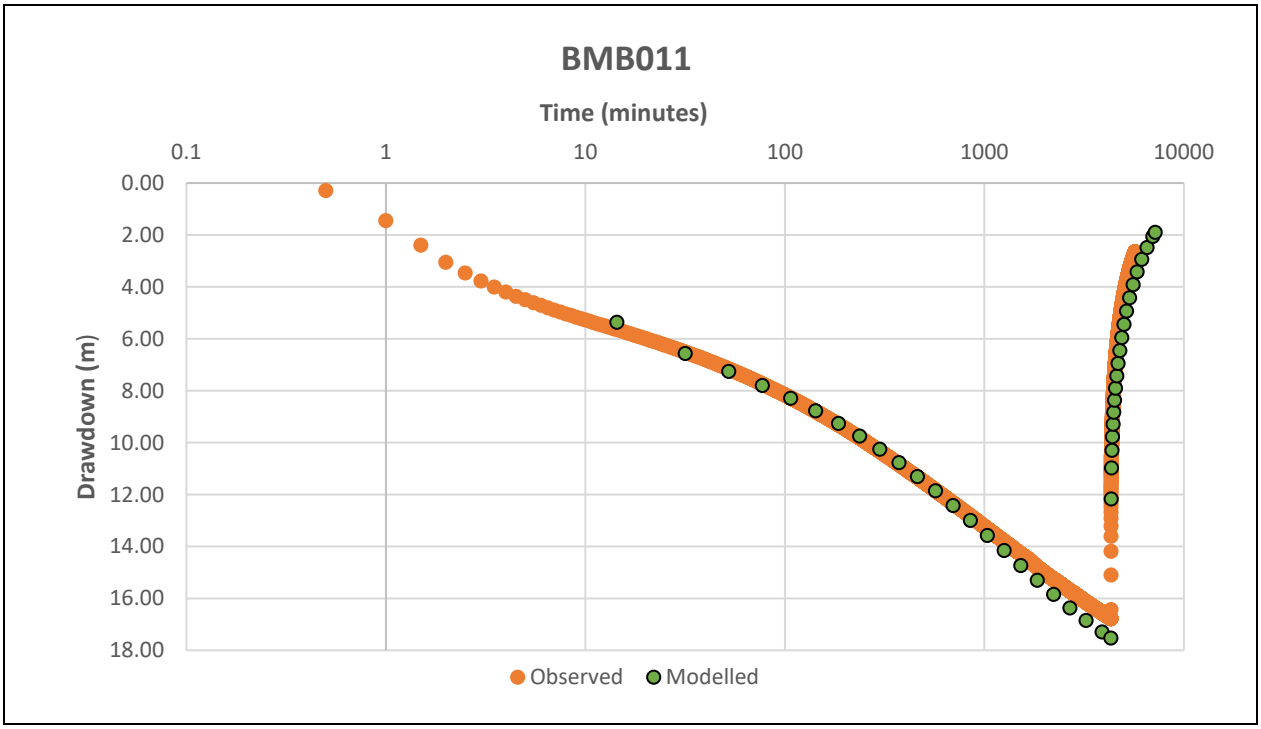

Figure 9.10 Observed and Modelled Drawdown BMB011, BPB011 Constant Rate Test

The measured and modelled drawdown response to pumping at BPB050 at monitoring bore BMB050 is shown in Figure 9.11. The best fit to the observed drawdown was obtained when:

- The specific storage of the palaeochannel basal sand was set to 7.5 x 10^{-5} m^{-1}
- The lower palaeochannel clay horizontal and vertical hydraulic conductivities were increased to 0.022 m/day and 0.0022 m/day respectively.

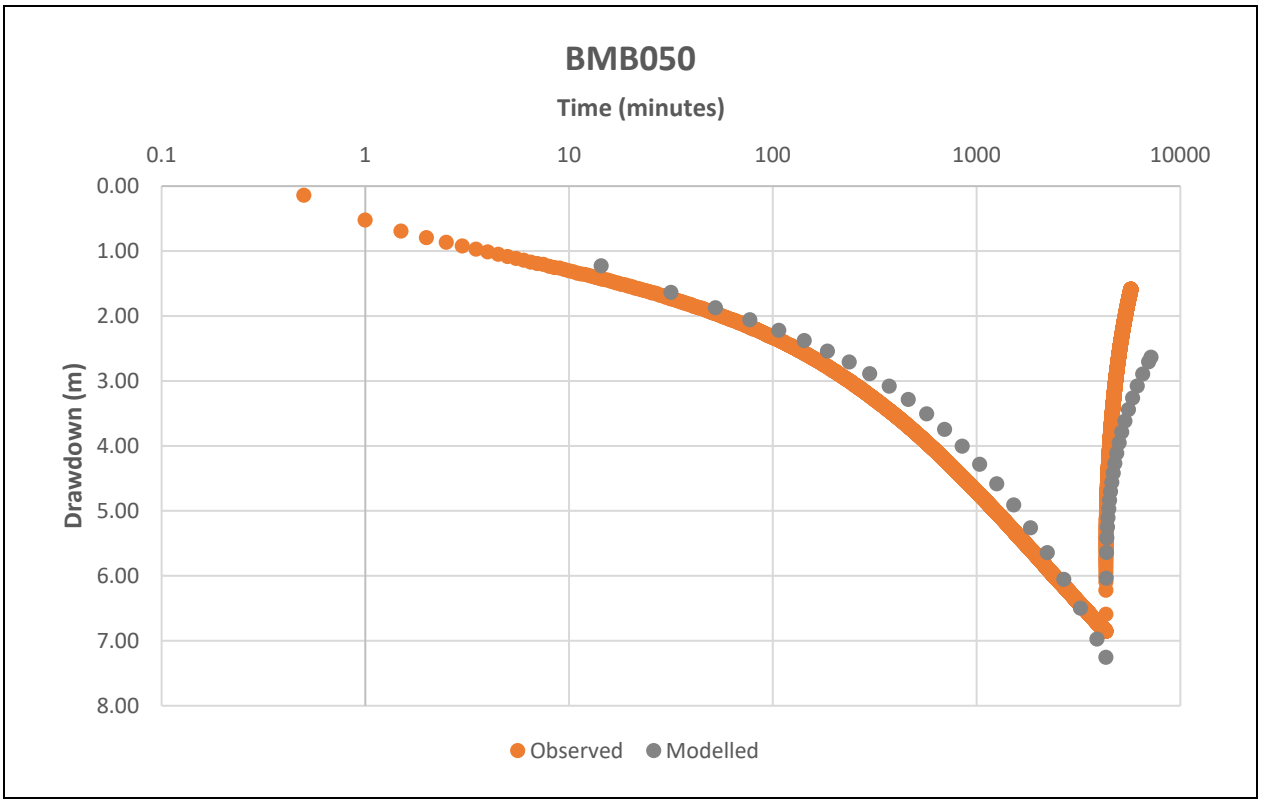

Figure 9.11 Observed and Modelled Drawdown BMB050, BPB050 Constant Rate Test

The measured and modelled drawdown response to pumping at BPB04 measured at the shallow monitoring bore BMB004S is shown in Figure 9.12. The drawdown response at the deep monitoring bore BMB004D is shown in Figure 9.13. The test pumping calibration was focused on achieving a match to the observed drawdown and recovery at the deep monitoring bore BMB004D (screened in the same palaeochannel basal sand unit). The best match to the observed response at BMB004D was obtained when:

- The specific storage of the palaeochannel basal sand was set to 4.3 x 10^{-6} m^{-1}.
- The horizontal and vertical hydraulic conductivity of the overlying lower palaeochannel clay unit was reduced to 0.25 m/d and 0.025 m/d respectively.

No single set of values provided the best fit to drawdown in the shallow and deep monitoring bores (BMB004S and BMB004D) and the parameters that produced the best match to the response at BMB004D pumping were adopted for the model calibration.

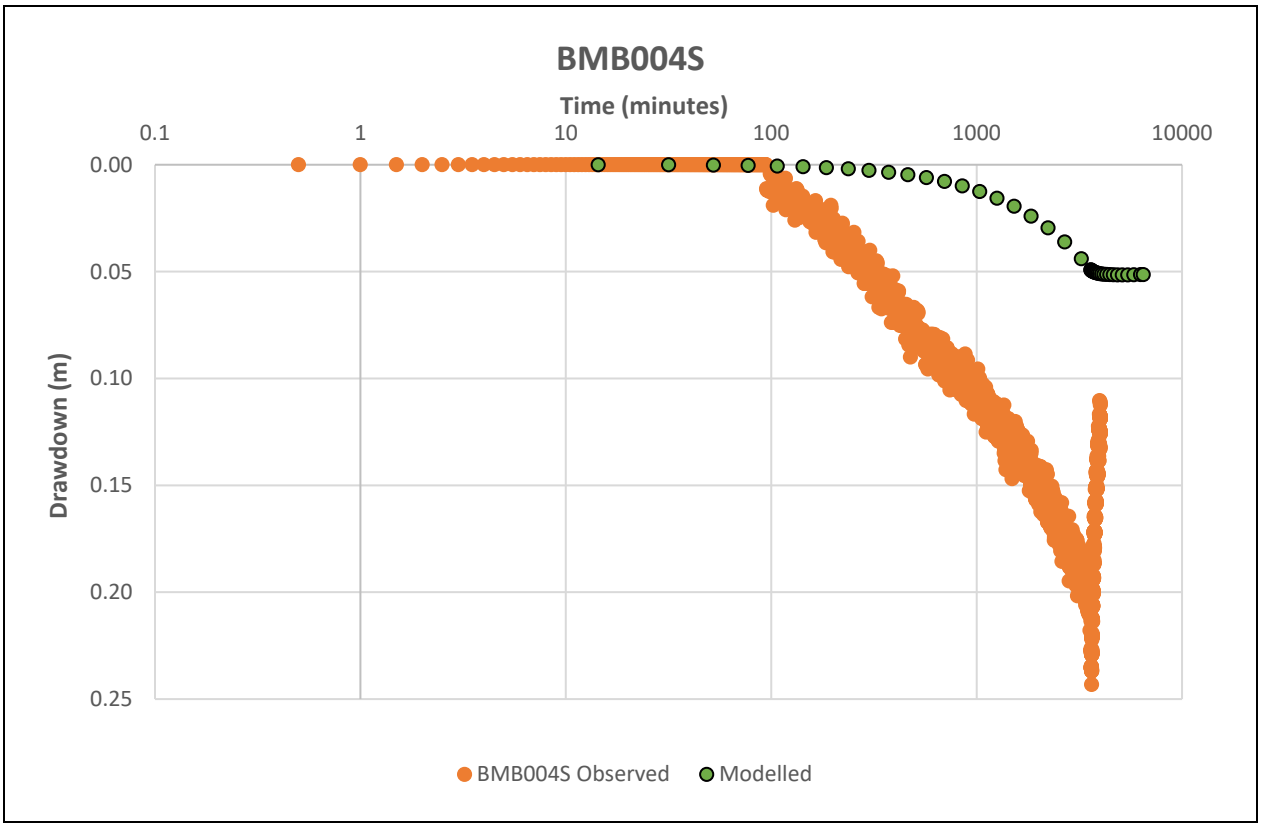

Figure 9.12 Observed and Modelled Drawdown BMB004S, BPB040 Constant Rate Test

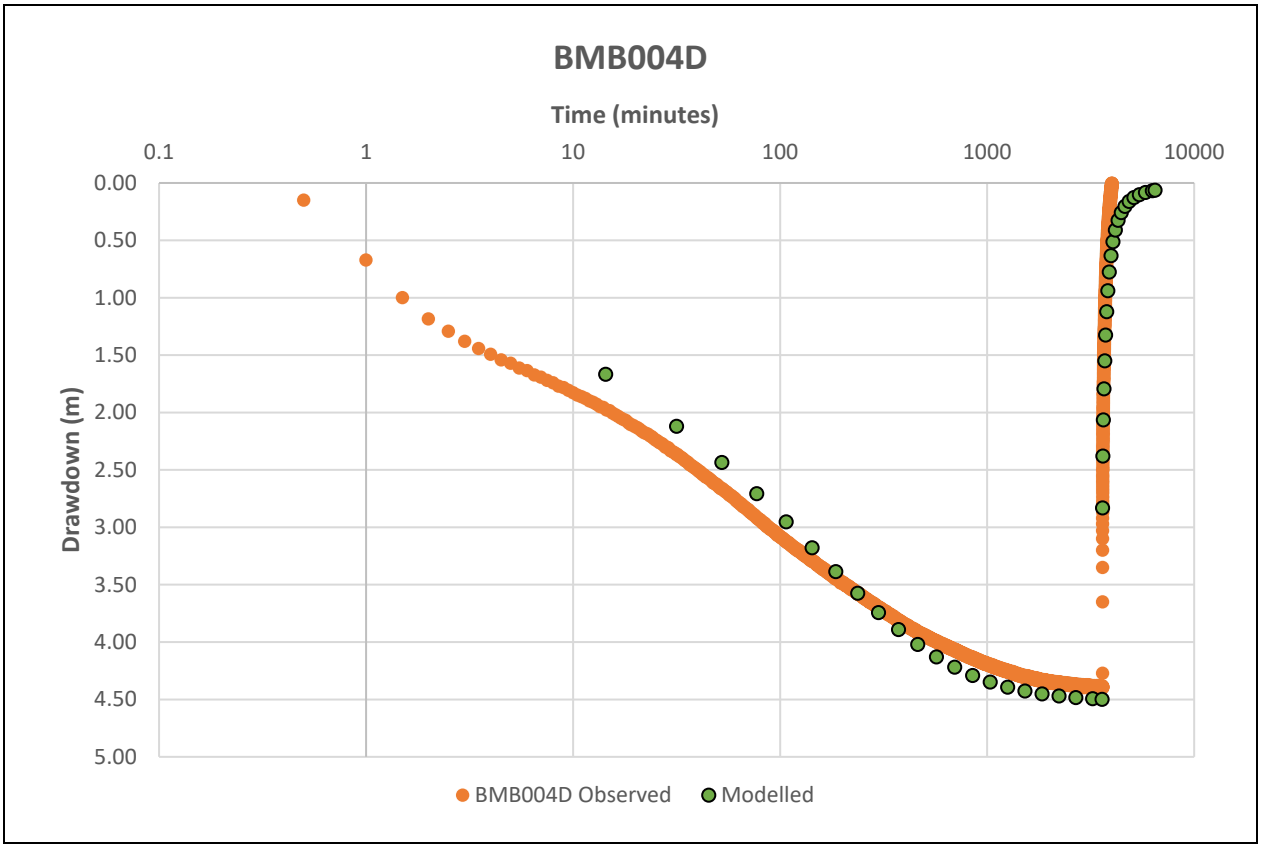

Figure 9.13 Observed and Modelled Drawdown BMB004D, BPB004 Constant Rate Test

9.5 Aquifer Parameters

Aquifer parameters assigned to the calibrated steady state and transient (test pumping) models are summarised in Table 9.5 and Table 9.6. The spatial distribution of these zones and their values is shown in Appendix J. Unconfined aquifer storage values have been assigned consistent with similar hydrogeological environments and have not been calibrated.

Recharge was assigned to the calibrated model assuming the zonation shown in Figure 9.4. Recharge was assigned along the length of the paleochannel at a rate of 1.0 x 10^{-8} m/d and to the areas outside of the paleochannel at a rate of 5.0 x 10^{-10} m/d. These rates of recharge represent 0.1 and 0.01% of the long term average rainfall for the region (270 mm per year). These recharge estimates are consistent with those estimated by Commander et al (1992) and the low recharge rates expected in the region.

Table 9.5 Calibrated Aquifer Parameters - Hydraulic Conductivity

Zone	Layer	Kh (m/day)	Kv (m/day)	Hydrostratigraphic unit	Description
1	1	0.01	0.001	Alluvium	
2	Multiple	0.001	0.0001	Basement	
3	Multiple	0.005	0.0005	Saprolite	
4	2	0.1	0.01	Upper Palaeochannel Clay	
5	2	0.05	0.005	Upper Palaeochannel Clay	
6	2	0.01	0.0005	Upper Palaeochannel Clay	
7	3	0.5	0.05	Upper Palaeochannel Sand	

Zone	Layer	Kh (m/day)	Kv (m/day)	Hydrostratigraphic unit	Description
8	3	1.0	0.1	Upper Palaeochannel Sand	
9	3	1.0	0.1	Upper Palaeochannel Sand	
10	3	1.0	0.1	Upper Palaeochannel Sand	
11	3	9.0	0.9	Upper Palaeochannel Sand	
12	4	0.2	0.02	Lower Palaeochannel Clay	
13	4	0.05	0.005	Lower Palaeochannel Clay	
14	4	0.01	0.001	Lower Palaeochannel Clay	
15	4	0.25	0.025	Lower Palaeochannel Clay	
16	5	1.0	0.1	Palaeochannel Basal Sand	
17	5	3.0	0.3	Palaeochannel Basal Sand	
18	5	7.0	0.7	Palaeochannel Basal Sand	
19	5	9.0	0.9	Palaeochannel Basal Sand	
20	5	13.0	1.3	Palaeochannel Basal Sand	
21	5	15.0	1.5	Palaeochannel Basal Sand	
22	5	18.0	1.8	Palaeochannel Basal Sand	
23	5	20.0	0.2	Palaeochannel Basal Sand	
24	3	8.0	0.8	Upper Palaeochannel Sand	
25	3	5.0	0.5	Upper Palaeochannel Sand	
26	4	0.022	0.0022	Lower Palaeochannel Clay	Added zone at BPB050
27	2	0.01	0.001	Upper Palaeochannel Clay	Added zone at BPB050
28	4	0.1	0.01	Lower Palaeochannel Clay	Added zone at BPB004
29	2	0.01	0.001	Upper Palaeochannel Clay	Added zone at BPB004
30	4	0.01	0.0005	Lower Palaeochannel Clay	Added zone at BPB011

Table 9.6 Calibrated Aquifer Storage Parameters

Zone	Layer	Ss (m^{-1})	Sy(%)	Hydrostratigraphic unit	Description
1	1	1.0×10^{-6}	5	Alluvium	
2	Multiple	1.0×10^{-7}	0.1	Basement	
3	Multiple	1.0×10^{-7}	0.5	Saprolite	
4	2	1.0×10^{-6}	5	Upper Palaeochannel Clay	
5	3	8.6×10^{-6}	15	Upper Palaeochannel Sand	
6	4	1.0×10^{-6}	5	Lower Palaeochannel Clay	
7	5	4.3×10^{-6}	20	Upper Palaeochannel Sand	Aquifer at BPB004
8	5	7.5×10^{-5}	20	Upper Palaeochannel Sand	Aquifer at BPB050
9	5	8.6×10^{-6}	20	Upper Palaeochannel Sand	Aquifer at BPB011

9.6 Other Model Details

Other details of the model setup are outlined below:

- For the transient model calibration, stress periods were set at a 2 to 2.5 day time increment and utilised the Automatic Time Stepping (ATO) package in Modflow USG, with the following parameters:
  - An initial time step of 1 x 10^{-2} days.
  - A minimum time step of 1 x 10^{-3} days.
  - A multiplier of 1.2 and a reduction factor of 2.0.
- Over both the prediction period, stress periods were set at a monthly time increment and utilised the Automatic Time Stepping (ATO) package in Modflow USG, with the following parameters:
  - An initial time step of ~ 10 days.
  - A minimum time step of 1 x 10^{-1} days.
  - A multiplier of 1.2 and a reduction factor of 2.0.

The parameters included in the Modflow USG solvers are summarised in Table 9.7.

Table 9.7 Solver Parameters

Solver	Parameter	Value
SMS	Number of Outer and Inner Iterations	50 / 20
	Head Change Criterion for Outer Iterations	0.01
	Head Change Criterion for Inner Iterations	0.0001
	Print Flag for Convergence Information	1
	Nonlinear Method	Cooley / Newton Raphson
	Linear Solution Method	XMD Solver
	Truncated Newton Option	True
	Learning Rate Reduction Factor	0.7
	Learning Rate Increment	0.07
	Memory Term Factor	0.1
	Momentum Term	0
	Maximum Backtracking Iterations	200
	Residual Change Tolerance	1.2
	Backtracking Factor	0.9
	Residual Reduction Limit	100
xMD	Acceleration Method	CGSTAB
	Ordering Scheme	Original Ordering
	Level of Fill	7
	Number of Orthoganalisations	10
	Create Reduced System	No
	Residual Convergence Tolerance	0
	Perform Drop Tolerance	Yes
	Drop Tolerance Value	0.001

9.7 Model Predictions

9.7.1 Prediction Setup

The calibrated groundwater model has been used to simulate:

- The potential for the palaeochannel aquifer to support the water demand of approximately 8,300 kL/d (96 L/s) for a period of 10 years (i.e. over the life of the Project).
- The regional drawdown impacts of abstraction.

The modelled Rebecca Paleochannel borefield layout is shown in Figure 9.7 and includes:

- Two existing production bores BPB004 and BPB050, located in the main Rebecca palaeochannel.
- Additional eight proposed bores (WB01, WB02, WB03, WB04, WB05, WB06, WB07 and WB08) located in the main Rebecca palaeochannel.

This modelled borefield configuration is consistent with the conceptual design (refer to Section 8). A borefield of 10 production bores is recommended, with 8 of these bores being used at any one time. It should be noted that four bores (WB02, WB03, WB04 and WB05), located in the middle of the borefield where the greatest drawdowns are expected (due to the interference between bores), have been modelled that only 2 of these bores being pumped at the same time (i.e. either a pair of WB02 and WB04 or WB03 and WB05), with other 2 bores being on standby.

Other details of model predictions are outlined below:

- Initial water level conditions across the model domain, were taken from the steady state model to represent pre-development groundwater conditions.
- Model predictions were undertaken using monthly time intervals and were completed for a period of 10 years using 120 monthly stress periods (periods over which all model stresses were held constant).
- Model fixed boundaries and assigned rainfall recharge to the catchment and ET were unchanged from the steady state calibrated models.
- Assigned monthly abstraction rates, per bore, are shown in Table 9.8. All 10 production bores were assigned to be pumped at an average default pumping rate of 1,037 kL/d (12 L/s) and were simulated using the WEL package in Modflow USG. Pumping was simulated from the palaeochannel sand aquifer only. Eight bores were assumed to be operational at any one time as per the scheduling shown in Table 9.7. This annual schedule was repeated for the 10 years of the model prediction.

Table 9.8 Schedule of Monthly Pumping Rates Used for Model Predictions

Month	Pumping Rate (m^3/day)										
	WB01	BPB004	WB02	WB03	WB04	WB05	BPB050	WB06	WB07	WB08	Total
1	1036.8	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	8294.4
2	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	1036.8	8294.4
3	1036.8	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	8294.4
4	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	1036.8	8294.4
5	1036.8	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	8294.4
6	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	1036.8	8294.4
7	1036.8	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	8294.4
8	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	1036.8	8294.4

Month	Pumping Rate (m^3/day)										
	WB01	BPB004	WB02	WB03	WB04	WB05	BPB050	WB06	WB07	WB08	Total
9	1036.8	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	8294.4
10	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	1036.8	8294.4
11	1036.8	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	8294.4
12	1036.8	1036.8	0	1036.8	0	1036.8	1036.8	1036.8	1036.8	1036.8	8294.4

9.7.2 Results

Total water demand and predicted borefield pumping for the Base Case is shown in Figure 9.14. Model results suggest that the palaeochannel aquifer will deliver the water supply requirements of 95 L/s (~8,300 kL/d) over the 10-year demand period.

Predicted water levels at pumping location BPBP050, located in the centre of the proposed Rebecca Palaeochannel Borefield are shown in Figure 9.15. Water levels are shown in all palaeochannel aquifer units (i.e. the upper palaeochannel clay, upper palaeochannel sand, lower palaeochannel clay and palaeochannel basal sand). As would be expected, the maximum reduction in water level is predicted in the palaeochannel basal sand (pumped unit) with a smaller water level reduction predicted in the overlying palaeochannel aquifer units. Predicted water levels in the palaeochannel basal sand also show the impact from the cycling of operational bores throughout the model prediction.

Predicted water levels in the palaeochannel basal sand and the overlying aquifer units are predicted to remain above the simulated elevation of the top of the palaeochannel basal sand aquifer over the prediction period. After ten years of borefield operation (i.e. Year 10 of the model simulation), the upper aquifer units (upper palaeochannel clay and upper palaeochannel sand) are predicted to be dewatered, as shown by the single water level trace shown for the upper palaeochannel units during Year 10. Over the duration of the prediction the elevation of the water table is predicted to be above the water level predicted in the basal palaeochannel sand aquifer.

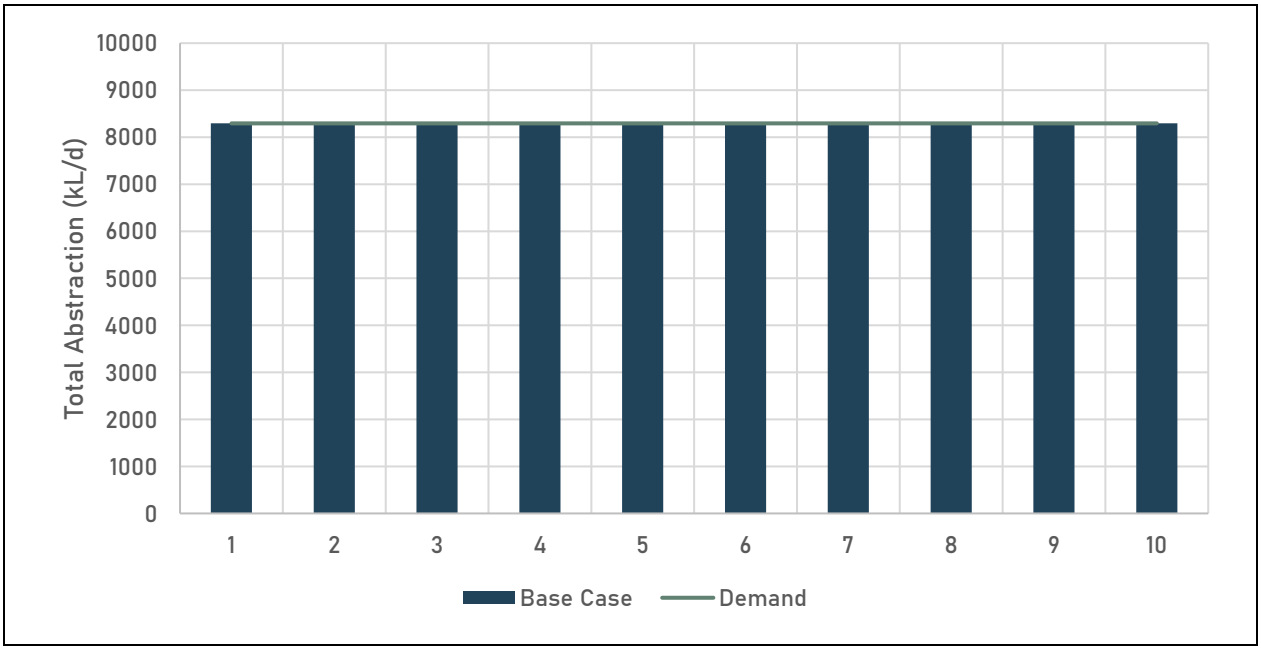

Figure 9.14 Predicted Water Supply Pumping Base Case

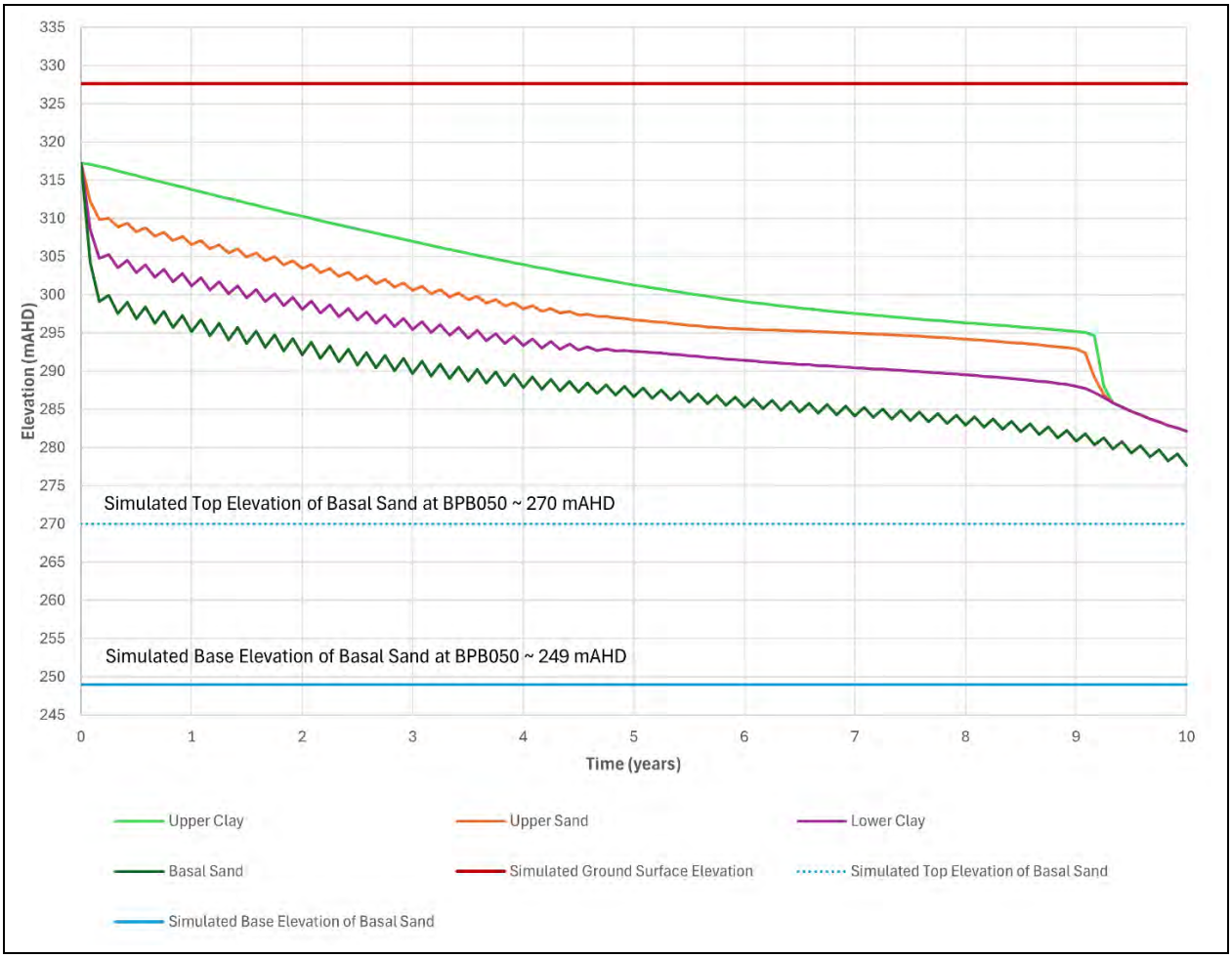

Figure 9.15 Predicted Water Levels BPB050 Base Case (All Palaeochannel Aquifer Units)

Contours of predicted water table drawdown and the predicted water level reduction (drawdown) in the palaeochannel basal sand at the end of the 10 year model prediction are shown in Figure 9.16 and Figure 9.17. Contours of these predicted drawdowns are calculated by subtracting the predicted groundwater levels that result from ten years of operational pumping from the pre-development or steady-state groundwater levels. The maximum water table and palaeochannel basal sand drawdowns are predicted in the centre of the modelled borefield area. At pumping location BPB050, located in the centre of the borefield, the maximum predicted water table drawdown is 36m, while the maximum predicted water level drawdown in the palaeochannel basal sand at BPB050 is 40 m.

Drawdowns (both water table and water level in the paleochannel basal sand) are also predicted to extend along the palaeochannel upstream and downstream of the borefield and also along the palaeochannel tributaries (in the confluence area). Water table drawdown of 1 m is predicted to extend a maximum distance of 6.7 km upstream and 8.5 km downstream of the borefield (i.e. upstream of bore WB01 and downstream of bore WB08). Water level reduction in the palaeochannel basal sand of 1 m is predicted to extent a maximum distance of 6.8 km upstream and 8.9 km downstream of the borefield. Drawdown is also predicted to extend into the adjacent saprolite / basement, however the magnitude of this drawdown is much less than that drawdown predicted along the paleochannel (around 10 m of drawdown is predicted in the basement adjacent to the paleochannel after ten years of operational pumping).

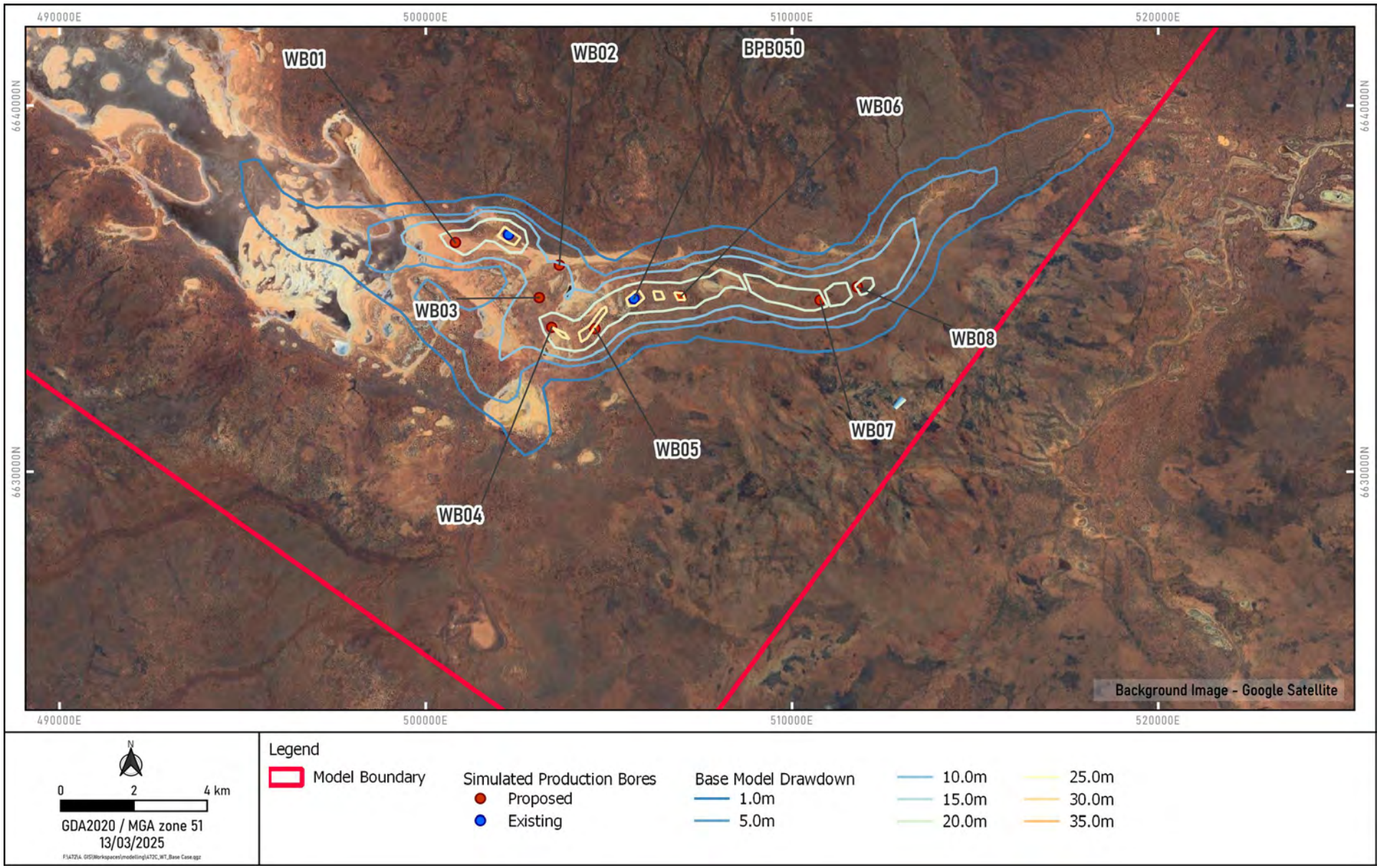

Figure 9.16 Contours of Predicted Water Table Drawdown Base Case After Ten Years

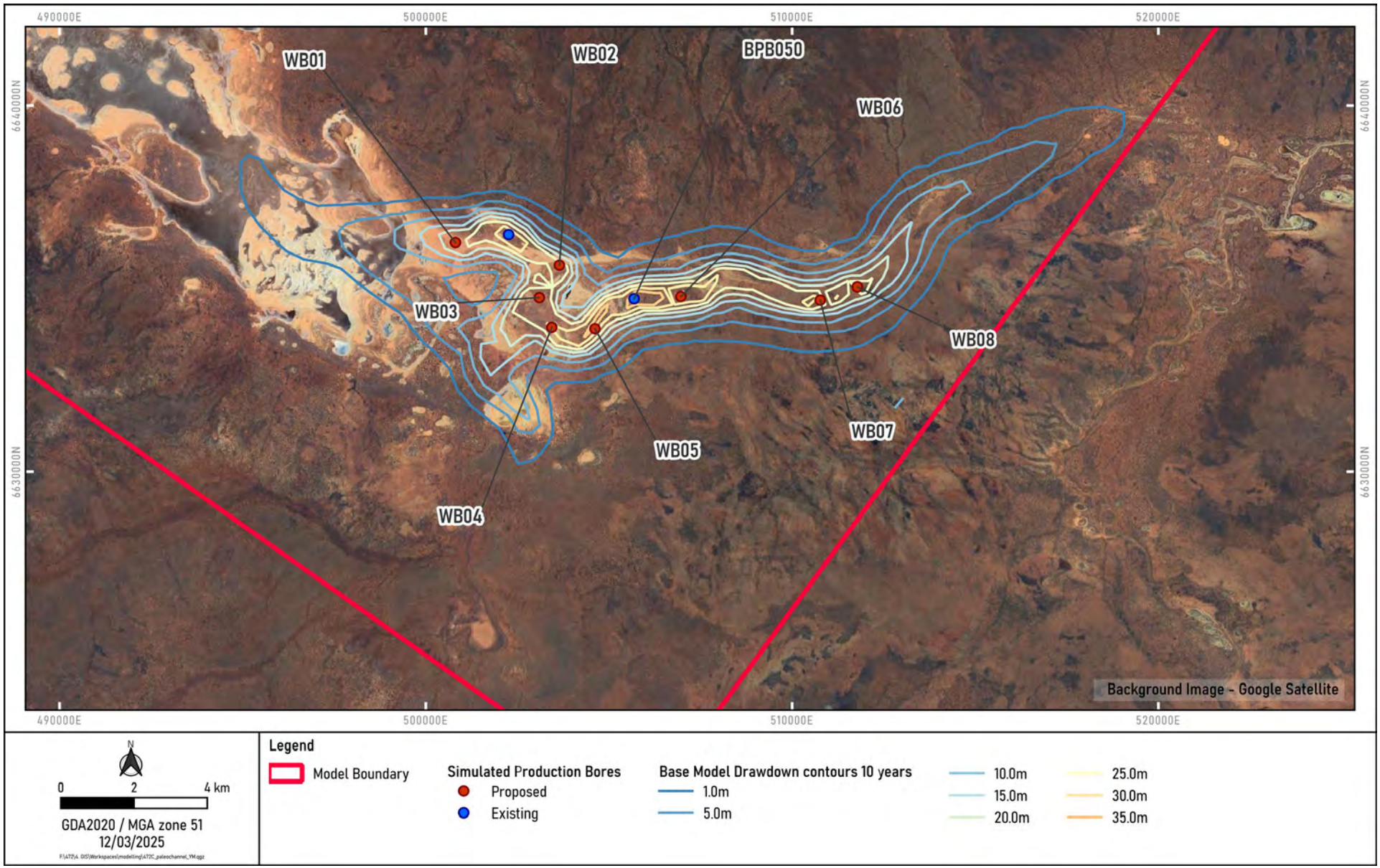

Figure 9.17 Contours of Predicted Palaeochannel Basal Sand Drawdown Base Case After Ten Years

The model predicted water balance at the end of the ten year prediction period is shown in Table 9.9. Also shown in Table 9.9 are the corresponding steady state water balance components, shown in brackets and italics for comparison. The modelled water balance suggests that similar to the steady-state model, the abstracted water is drawn from storage, with only a minimum contribution from recharge and groundwater inflows. Therefore, the source of groundwater abstraction is storage (depletion). Groundwater inflow from the north -western and south eastern boundaries is predicted to be the same as the steady state predicted water balance. Groundwater outflow from the north-eastern boundary is reduced, with groundwater inflow predicted at this boundary after ten years of abstraction. This inflow is however less than 5% of the total predicted abstraction.

Table 9.9 Base Case Water Balance at End of Year Ten

Component	Inflow (m^3/day)	Outflow (m^3/day)
North-Eastern Boundary (314 mAHD)	228(*0*)	0 (*38.*)
South-Eastern Boundary (320 mAHD)	1 (*1*)	- *(-)*
Southern Boundary (318.5 mAHD)	-	- *(-)*
North-Western Boundary (325.5 mAHD)	36 (*36*)	- *(-)*
Recharge	1 (*1*)	- *(-)*
Evapotranspiration	- *(-)*	0 *(0)*
Storage	8035 *(-)*	6 *(-)*
Borefield Abstraction	- *(-)*	8295 *(-)*
Total	8,301 *(38)*	8,301 *(38)*

(-) denotes no water balance component

9.8 Model Uncertainty

The groundwater flow model has been developed using the information available and has been used to replicate the observed water level response from long term pumping. As with any groundwater system, there are still uncertainties regarding the behaviour of the groundwater system over the life of the borefield. These can only be reduced once the project is developed further, and more data is collected on long term performance. This information will only be available when extended and large volume abstraction commences. An assessment of the impact of these uncertainties on long term performance of the aquifer system has been completed and is described below.

9.8.1 Approach

To assess the impact of these uncertainties on long term performance of the aquifer system, model uncertainty has been completed using a trial and error approach. Aquifer parameters were varied within realistic ranges to achieve the best match to measured water level response to pumping. As part of the calibration process, the model was observed to be sensitive to the following parameters:

- The vertical hydraulic conductivity assigned to the overlying palaeochannel clay units (Layers 2 and 4).
- The specific storage of the palaeochannel basal sand aquifer unit.
- The specific yield of the palaeochannel clay.
- The hydraulic conductivity assigned to the saprolite.

Three alternate model calibrations were developed and used for model predictions to assess the potential for the palaeochannel aquifer system to supply the project water demand. Details of the Uncertainty Runs are outlined in Table 9.10 below. For Cases 2 and 3 the model was recalibrated, with a new set of initial or pre-development water levels predicted.

Table 9.10 Summary of Uncertainty Cases

Uncertainty Run	Description
Case 1	Specific yield of palaeochannel clay (layer 2 and 4) reduced from 5% to 2.5%
Case 2	All palaeochannel clay zones (layer 2 and 4) reduced to 0.005 m/day and 0.0005 m/day for horizontal and vertical conductivity, respectively. Horizontal and vertical hydraulic conductivity of saprolite increased to 0.01 m/day and 0.001 m/day, respectively.
Case 3	Horizontal and vertical hydraulic conductivity of saprolite to values assigned to the basement (0.001 and 0.0001 m/day respectively).

9.8.2 Results

Predicted abstraction over the 10 year demand period for the Base Case and all Uncertainty Cases are shown in Figure 9.18. For all Uncertainty Cases the water demand of 95 L/s is predicted to be fully met.

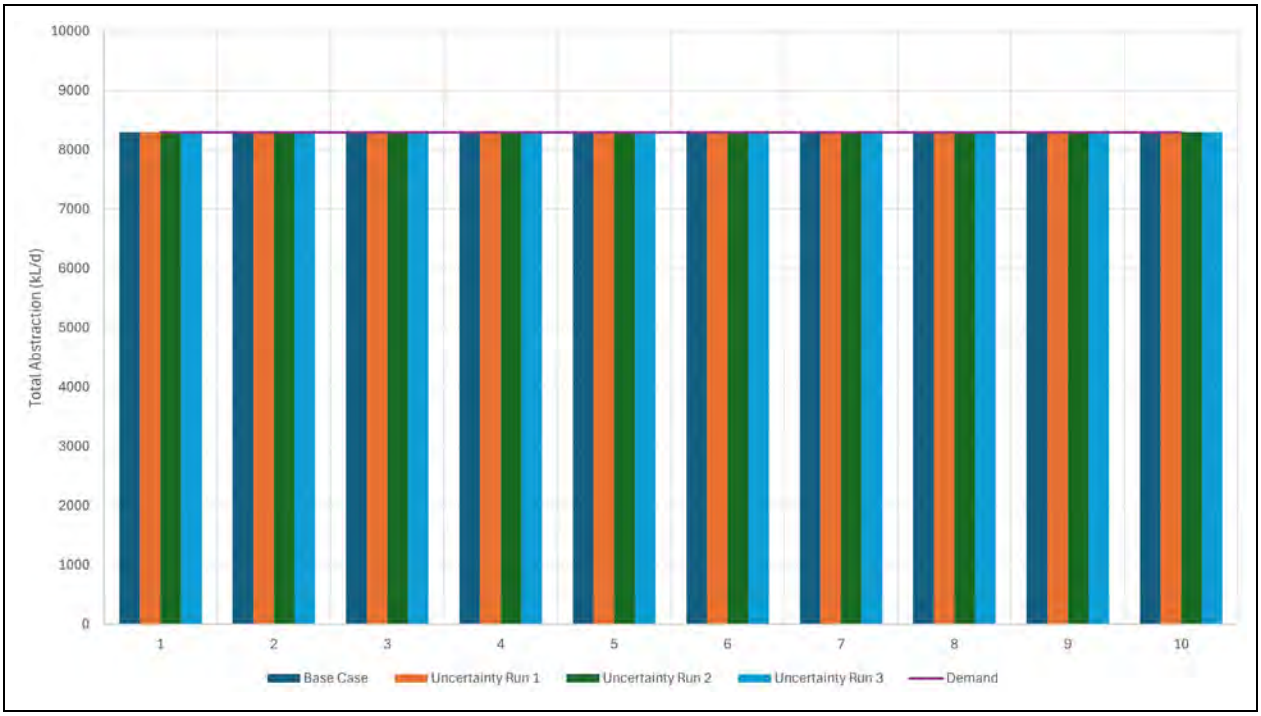

Figure 9.18 Predicted Total Abstraction Base and Uncertainty Cases

Predicted water levels at pumping location BPBP050 located in the centre of the proposed borefield for the Base Case and the Uncertainty Cases are shown in Figure 9.19. For Uncertainty Runs 1 and 2, water levels are predicted to decrease to below the simulated top elevation of the palaeochannel basal sand unit. For Uncertainty Run 3, predicted water levels are similar to those predicted for the Base Case, and water levels in the palaeochannel basal sand unit are predicted to remain above the elevation of the top of the palaeochannel basal sand unit over the ten year prediction period. These results suggest that:

- A lower specific yield or unconfined storage in the sediments that overlie the palaeochannel basal aquifer may result in additional drawdown over the life of mine (Uncertainty Run 1) in the borefield area and have the potential to impact long term borefield yields.
- Lower horizontal and vertical hydraulic conductivity in the sediments that overlie the palaeochannel basal aquifer may results in additional drawdown over the life of mine in the borefield area (Uncertainty Run 2) and have the potential to impact long term borefield yields.

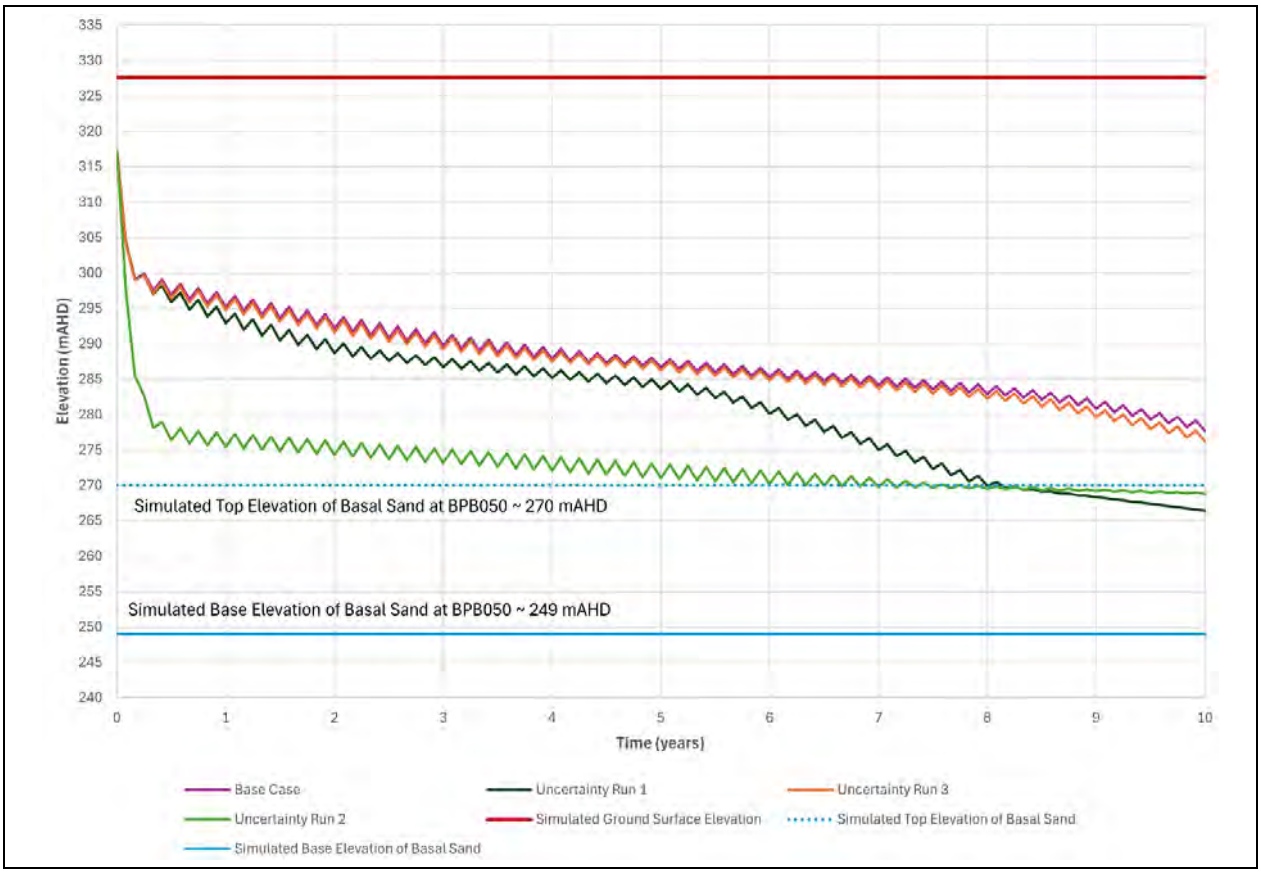

Figure 9.19 Predicted Palaeochannel Basal Sand Unit Water Levels All Cases BPB050

Contours of predicted water table drawdown and predicted water level reduction in the palaeochannel basal sand at the end of the 10 year prediction are shown as outlined below:

- Contours of Predicted Water Table Drawdown, Uncertainty Case 1 (Figure 9.20).
- Contours of Predicted Palaeochannel Basal Sand Drawdown, Uncertainty Case 1 (Figure 9.21).
- Contours of Predicted Water Table Drawdown, Uncertainty Case 2 (Figure 9.22).
- Contours of Predicted Palaeochannel Basal Sand Drawdown, Uncertainty Case 2 (Figure 9.23).
- Contours of Predicted Water Table Drawdown, Uncertainty Case 3 (Figure 9.24).
- Contours of Predicted Palaeochannel Basal Sand Drawdown, Uncertainty Case 3 (Figure 9.25).

These drawdowns are the difference between the pre-development or steady state water level and the water levels predicted at the end of each 10 year prediction. Predicted drawdown for the Uncertainty Runs is summarised below:

- Similar to the Base Case, the maximum water table drawdown is predicted in the borefield area. The maximum water table and palaeochannel basal sand drawdown, of 50 m is predicted at BPB050 for Uncertainty Run 1. This drawdown reflects the reduction of the water table or dewatering of the material overlying the palaeochannel basal sand unit.
- For Uncertainty Run 2, a smaller reduction in water levels is predicted. The maximum predicted water table reduction, at bore BMB050 is around 20 m, with a predicted reduction in water levels in the palaeochannel basal sand of around 48 m.
- For Uncertainty Run 3, the maximum predicted water table reduction, at bore BMB050 is around 35 m, with a predicted reduction in water levels in the palaeochannel basal sand of around 40 m.
- Water table drawdown of 1 m is predicted to extend a maximum distance of 10.7 km upstream of the borefield (upstream of Bore WB01, Uncertainty Run 2) and a maximum distance of 8.9 km downstream of the borefield (downstream of WB08, Uncertainty Run 1).
- Water level drawdown of 1 m in the palaeochannel basal sand is predicted to extend a maximum distance of 13.4 km upstream of the borefield (upstream of Bore WB01, Uncertainty Run 2) and a maximum distance of 9.2 km downstream of the borefield (downstream of WB08, Uncertainty Run 2).

9.8.3 Water Balance

Model predicted water balances after ten years of operational pumping for Uncertainty Cases 1, 2 and 3 are shown in Table 9.11 to Table 9.13. Also shown in Tables 9.11 to 9.13 are the corresponding steady state water balance components, shown in brackets and italics for comparison.

Similar to the Base Case predicted water balance, the water balances for Uncertainty Case also show that the source of groundwater abstraction is storage depletion (~95%). Groundwater inflow from the north west and south east for the Uncertainty Cases are unchanged from the steady state predicted water balance. Outflow to the north eastern outflow boundary is reduced, similar to the Base Case, with inflow of up to 395 kL/d predicted at the boundary (less than 5% of the total groundwater abstraction).

Table 9.11 Uncertainty Case 1 Water Balance End of Year Ten

Component	Inflow (kL/day)	Outflow (kL/day)
North-Eastern Boundary (314 mAHD)	385 *(-)*	0 *(38)*
South-Eastern Boundary (320 mAHD)	1 *(1)*	- *(-)*
Southern Boundary (318.5 mAHD)	- (0)	- (-)
North-Western Boundary (325.5 mAHD)	36 *(36)*	- *(-)*
Recharge	1 *(1)*	- (-)
Evapotranspiration	- *(-)*	0 *(0)*
Storage	7,898 *(-)*	25 *(-)*
Borefield Abstraction	- *(-)*	8,295 *(-)*
Total	8,319 *(38)*	8,319 *(38)*

(-) denotes no water balance component

Table 9.12 Uncertainty Case 2 Water Balance End of Year Ten

Component	Inflow (kL/day)	Outflow (kL/day)
North-Eastern Boundary (314 mAHD)	395 (-)	0 *(38)*
South-Eastern Boundary (320 mAHD)	1 *(1)*	- (-)
Southern Boundary (318.5 mAHD)	- (-)	0 *(0)*
North-Western Boundary (325.5 mAHD)	36 *(36)*	- (-)
Recharge	1 *(1)*	- (-)
Evapotranspiration	- *(-)*	0 *(0)*
Storage	7,963 (-)	101 (-)
Borefield Abstraction	- (-)	8,295 (-)
Total	8,396 *(38)*	8,396 *(38)*

(-) denotes no water balance component

Table 9.13 Uncertainty Case 3 Water Balance End of Year Ten

Component	Inflow (kL/day)	Outflow (kL/day)
North-Eastern Boundary (314 mAHD)	243 *(-)*	0 *(38.)*
South-Eastern Boundary (320 mAHD)	1 *(1)*	- *(-)*
Southern Boundary (318.5 mAHD)	-	0 *(0.)*
North-Western Boundary (325.5 mAHD)	36 *(36)*	-*(-)*
Recharge	1 *(1)*	- (-)
Evapotranspiration	- *(-)*	0 *(0)*
Storage	8,021 *(-)*	4 *(-)*
Borefield Abstraction	- *(-)*	8,295 *(-)*
Total	8,301 *(38)*	8,301 *(38)*

(-) denotes no water balance component

9.8.4 Water Supply Assessment Results

The numerical modelling indicates that the Rebecca paleochannel aquifer is capable of supplying the required demand for the Project (95 L/s or 3,800 kL/d), under Base Case and all three Uncertainty Cases scenarios, without detrimental impact to the environment.

The modelling indicates that a proposed Rebecca Palaeochannel Borefield configuration, would enable sufficient capacity for the Project's process water requirements. Additional bores may be required if higher than expected demands are required from the borefield.

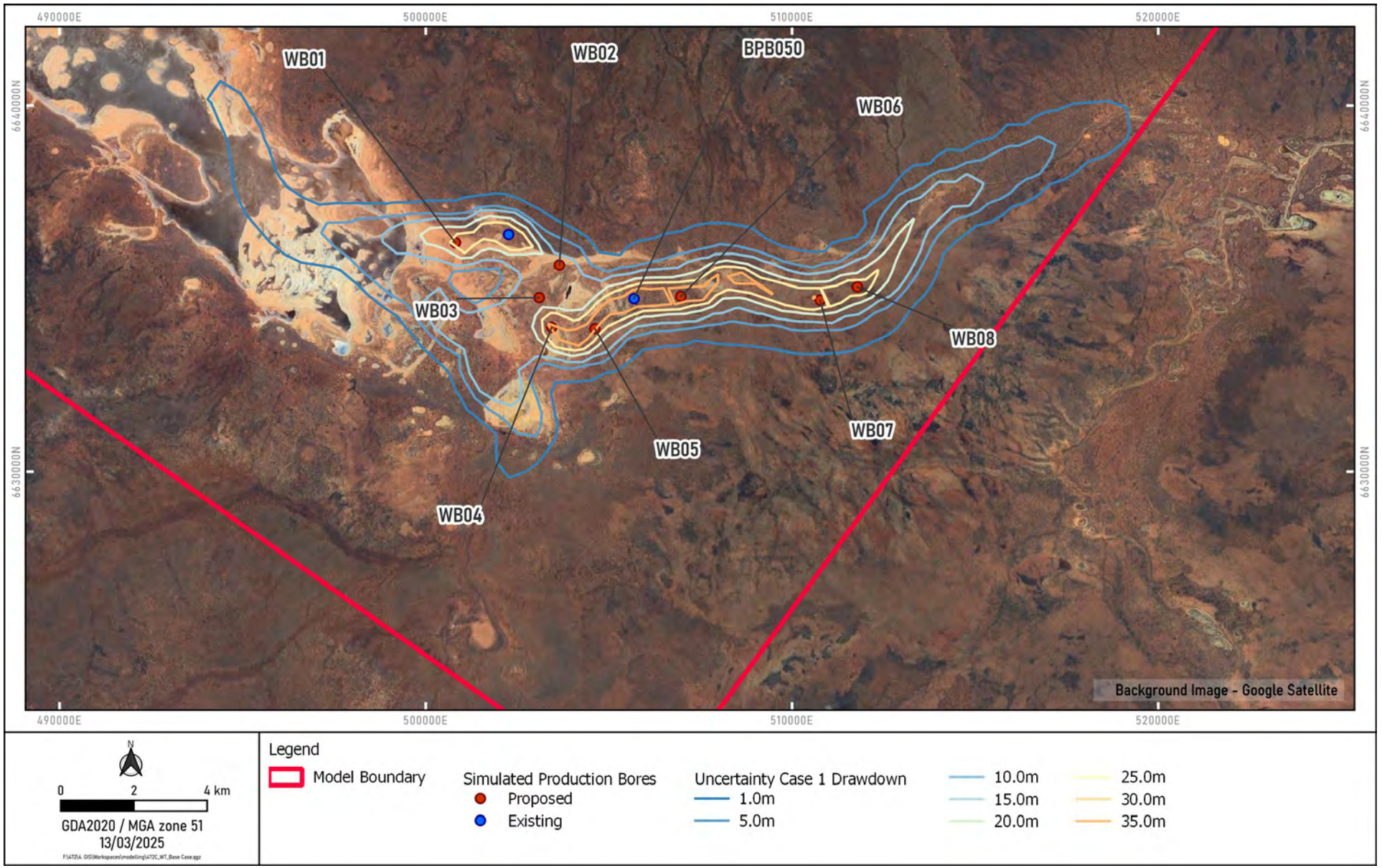

Figure 9.20 Uncertainty Case 1 Contours of Predicted Water Table Drawdown After Ten Years

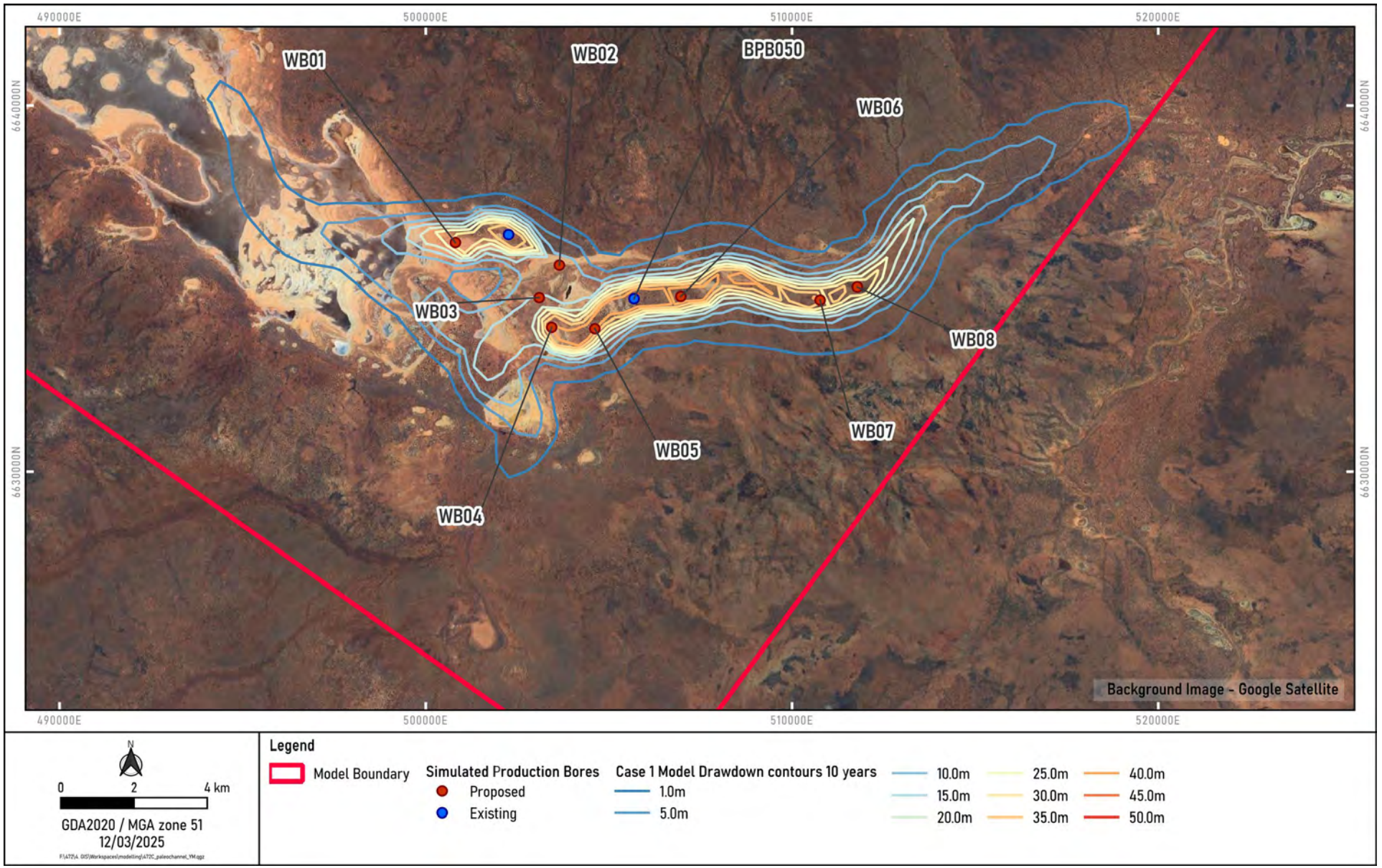

Figure 9.21 Uncertainty Case 1 Contours of Predicted Drawdown Basal Sand After Ten Years

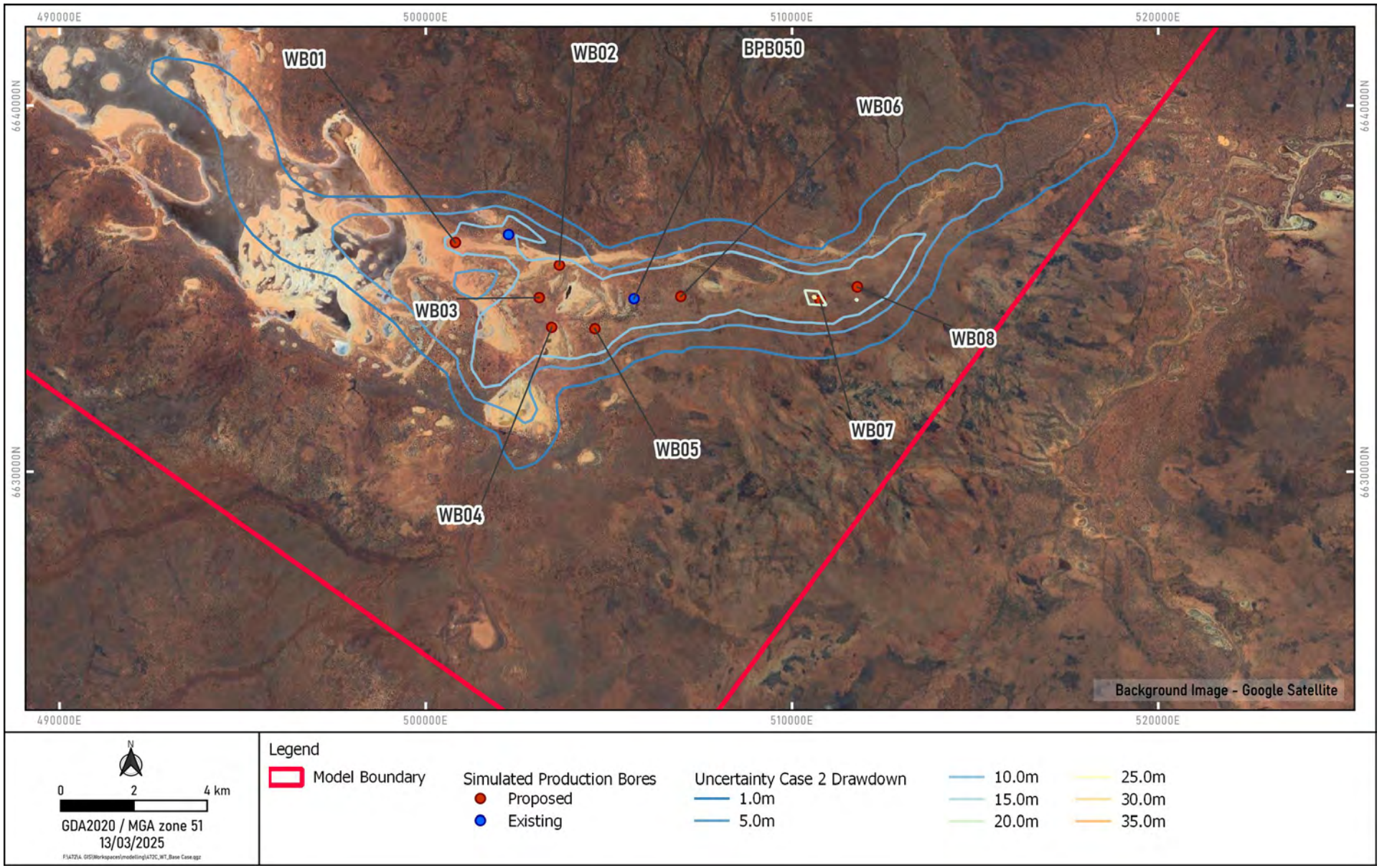

Figure 9.22 Uncertainty Case 2 Contours of Predicted Water Table Drawdown After Ten Years

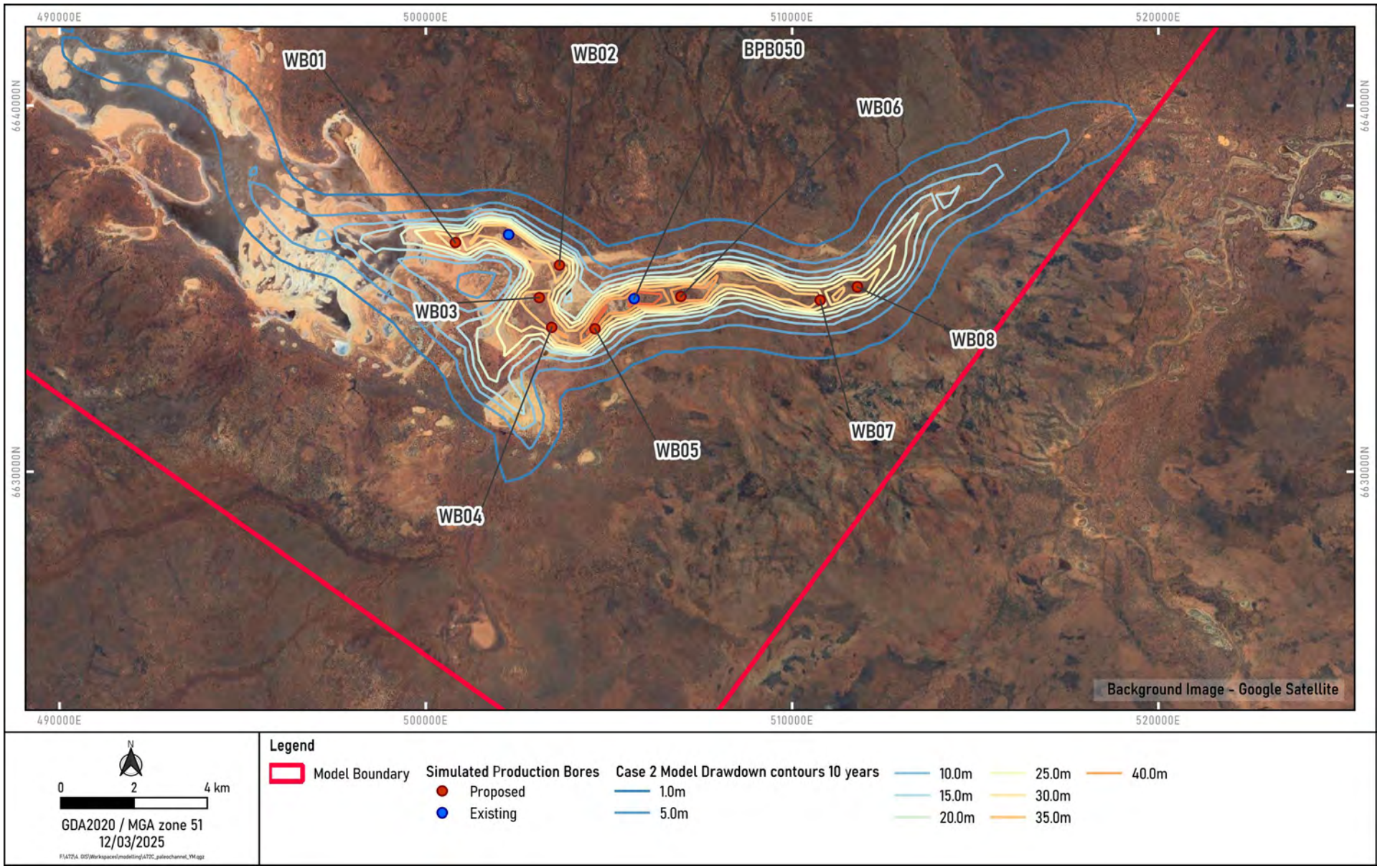

Figure 9.23 Uncertainty Case 2 Contours of Predicted Drawdown Basal Sand After Ten Years

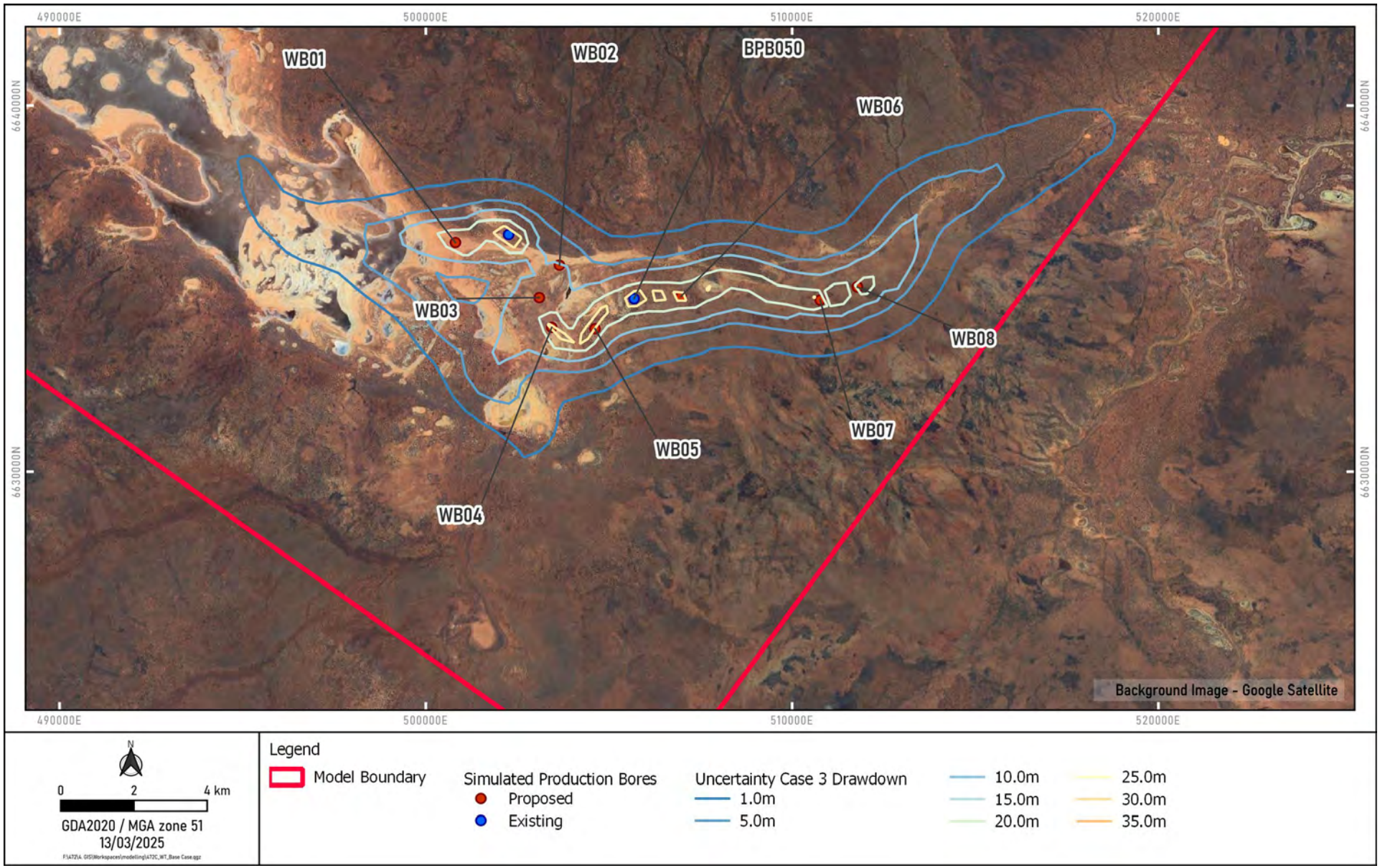

Figure 9.24 Uncertainty Case 3 Contours of Predicted Water Table Drawdown After Ten Years

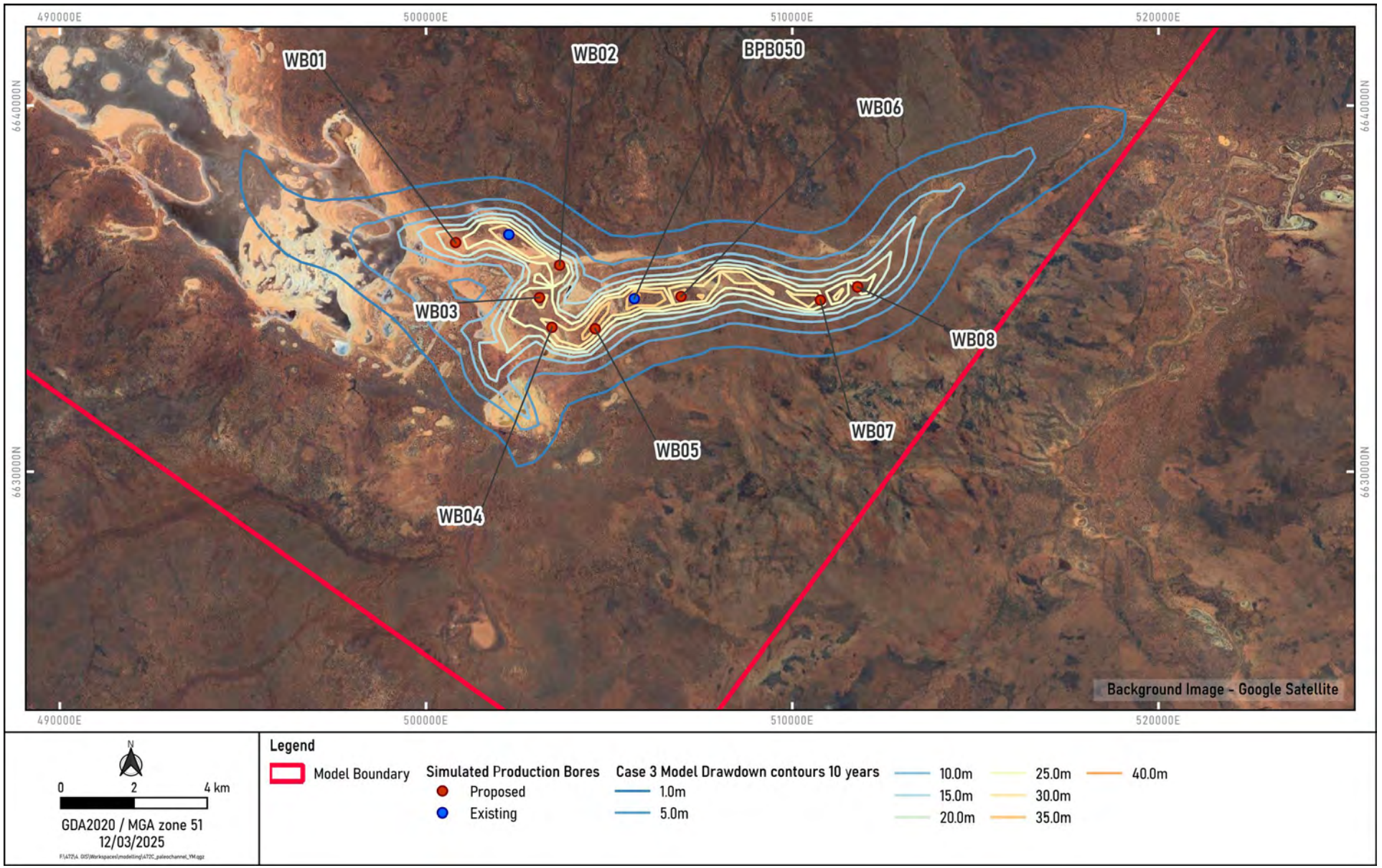

Figure 9.25 Uncertainty Case 3 Contours of Predicted Drawdown Basal Sand After Ten Years

9.9 Model Limitations, Assumptions and Class

The groundwater model was developed and calibrated using the available data to provide a representation of the Rebecca palaeochannel aquifer system. There is however inherent uncertainty in all long term hydrogeological modelling. To address this in the absence of long term operational scale pumping and associated monitoring data, a range of aquifer parameters have been investigated to replicate the measured response to testing pumping (water level drawdown and recovery). Additionally, prediction models have been run to predict the impact on long term water supply of the assignment of more conservative (i.e. less productive) aquifer parameters.

More confidence in model predictions will only be achieved with operational data that reflects large scale and longer term stresses on the aquifer system and provides more information on the palaeochannel aquifer system response to long term pumping.

9.9.1 Model Limitations

As with all models there are limitations associated with the data availability, conceptualisation and representation of dynamic flow processes. The following list identifies areas where limitations in the model features and / or data availability have been identified and maybe improved during future work programmes (if required):

- The model was set up to simulate the regional aquifer systems and predict the potential for water supply abstraction and associated water level drawdown impacts. The model simulates the hydrostratigraphic units identified and divides them into several zones based on the replication of the drawdown responses observed during pumping tests. The model does not provide a good representation of localised features. These features are not required for the simulation of long term abstraction from the aquifer system on a regional scale.
- The model is calibrated to a set of pre-development water levels or steady state conditions and was also used to simulate the measured drawdown and water level recovery responses to three pumping tests with a duration of 2.5 to 3 days and an associated recovery period.
- Confined aquifer storage values were investigated as part of replicating the measured response to test pumping. Unconfined aquifer storage values have been assigned consistent with similar hydrogeological environments and have not been calibrated.
- The model has not been calibrated to transient or time varying conditions that reflect potential seasonal changes in water levels over periods of several months to years. As a result, the model has not been used to simulate any seasonal variations in water level across the modelled catchment and only long term average rainfall was simulated as part of model predictions.
- The simulated model water balances suggest that the through flow in the catchment is small and that the source of abstraction is aquifer storage. The collection of water level data across the catchment may provide more confidence in the assignment of aquifer storage parameters (unconfined storage or specific yield) in shallow aquifers.
- Measured drawdown responses pumping tests (of several days duration) have been simulated by the model as a way of calibrating model parameters. Model predictions were completed for a longer period than the calibration (10 years) using the resulting aquifer parameter distributions. Long term behaviour of the aquifer systems, which will involve greater stresses than those observed during testing, may differ from that identified and simulated by the pumping tests. More confidence in model predictions can only be obtained if model performance is compared to longer term and larger scale operational stresses.

9.9.2 Model Assumptions

The following assumptions are included in model predictions:

- No density dependence is included in model predictions as it is assumed that there is no significant difference in groundwater salinity across the catchment.
- Long term predictions do not account for potential climate change and the subsequent impact on evaporation and rainfall conditions in the catchment in the future.

9.9.3 Model Class

Based on the Australian Groundwater modelling guidelines (2012), specifically Table 2-1 (Model confidence level classification – characteristics and indicators), the model satisfies the requirements of a Class 2 confidence level (the intermediate level) for the paleochannel aquifer in the water supply borefield area as measured drawdown responses pumping tests (of several days duration) have been simulated by the model as a way of calibrating model parameters. Model predictions were completed for a longer period than the calibration (10 years) using the resulting aquifer parameter distributions. Long term behaviour of the aquifer systems, which will involve greater stresses than those observed during testing, may differ from that identified and simulated by the pumping tests. More confidence in model predictions can only be obtained if model performance is compared to longer term and larger scale operational stresses.

Based on Table 2-1 of the guidelines, the model is suitable for the purpose of predicting the water supply potential of the paleochannel aquifer and associated drawdown impacts. It is also suitable for the prediction of flow paths (using particle tracking).

10. ASSESSMENT OF POTENTIAL IMPACTS

10.1 Aquifer Impacts

Groundwater level drawdown contours in the palaeochannel aquifer due to abstraction have been predicted by the numerical groundwater model and the results are discussed in Section 9.

To sum up, in the Rebecca Palaeochannel Borefield area, predicted palaeochannel water level changes (decline) are at their maximum in the vicinity of the Rebecca Palaeochannel Borefield production bores, but are elongated along the palaeochannel aquifer. The extent of predicted drawdown is limited beyond the palaeochannel aquifer due to the low permeability nature of the surrounding basement strata.

After 10 years of pumping of the Rebecca Palaeochannel Borefield, the maximum predicted drawdown in the palaeochannel aquifer is 40 m, the predicted depth to the water table (water levels in the clay and / or palaeochannel aquifer) is between 44 and 48 mbgl.

Drawdowns (both water table and water level in the paleochannel basal sand) are also predicted to extend along the palaeochannel upstream and downstream of the borefield and also along the palaeochannel tributaries (in the confluence area). Water table drawdown of 1 m is predicted to extend a maximum distance of 6.7 km upstream and 8.5 km downstream of the borefield (i.e. upstream of bore WB01 and downstream of bore WB08). Water level reduction in the palaeochannel basal sand of 1 m is predicted to extent a maximum distance of 6.8 km upstream and 8.9 km downstream of the borefield.

Drawdown is also predicted to extend into the adjacent saprolite / basement, however the magnitude of this drawdown is much less than that drawdown predicted along the paleochannel (around 10 m of drawdown is predicted in the basement adjacent to the paleochannel after 10 years of operational pumping).

The predicted dewatering abstraction from the Rebecca palaeochannel aquifer is highly unlikely to have any adverse impacts on the water supply potential of the overall aquifer system outside of the immediate Rebecca Palaeochannel Borefield area. At the end of 10 years of pumping from the Rebecca Palaeochannel Borefield, groundwater abstraction from the borefield will cease and aquifer water levels will be allowed to recover.

10.1.1 Groundwater Quality

Groundwater at the Rebecca Palaeochannel Borefield is hypersaline (between 90,000 to 120,000 mg/L TDS). As the beneficial use of the groundwater is ore processing and mine water usage, any decrease in water quality (if evident) in unlikely to have any environmental impact.

10.2 Other Existing Groundwater Users

Based on the data available through the DWER databases (Section 4.3), the nearest other palaeochannel aquifer groundwater user is located approximately 55 km to the north-west from the Rebecca Palaeochannel Borefield (Figure 4.4), therefore no groundwater users are likely to be impacted by the proposed water supply abstraction.

10.3 Groundwater Dependent Ecosystems and Stygofauna

There are no known GDEs (including stygofauna) within the predicted cone of depression, thus the proposed water supply abstraction from the Rebecca Palaeochannel Borefield is highly unlikely to have any adverse impacts on any GDEs. In addition, the palaeochannel aquifer at the Rebecca Palaeochannel

Borefield is confined by the thick overlying clay and the groundwater is naturally hypersaline. Therefore, abstraction from the Rebecca Palaeochannel Borefield is unlikely to affect any GDEs.

The vegetation present in the vicinity (10 km radius) of the proposed Rebecca Palaeochannel Borefield is likely to source water from soil moisture in the unsaturated zone above the water table and is likely to rely on sporadic rainfall and overland water flow events, with no association with the groundwater (i.e. phreatophytic vegetation). It should be noted that the rooting zone of the vegetation found overlying the palaeochannels in the Kalgoorlie region is relatively shallow, only extending down to 1.5 m depth. The groundwater table at the proposed borefield is around 5 to 10 mbgl, well below most plants' rooting depths in this area. In addition, the groundwater is hypersaline (more than 90,000 mg/L Total TDS) and does not support any groundwater dependent ecosystems.

11. GROUNDWATER MONITORING

A detailed proposed management framework for the Rebecca Palaeochannel Borefield will be outlined in the Groundwater Operating Strategy (GWOS), which will be prepared and submitted to DWER to support a 5C licence application (i.e. together with this H3 Level Assessment report). The GWOS includes a groundwater monitoring programme that is designed to assess aquifer performance, the potential impacts of proposed groundwater abstraction and specify operational requirements. GWOS data will be compiled in regular monitoring reports and the monitoring programme will be amended as necessary.

The following two monitoring schedules at the Rebecca Palaeochannel Borefield are proposed as part of the GWOS (Table 11.1), which cover periods of active and inactive water supply borefield operation:

- Active water supply borefield abstraction – when groundwater is abstracted from the water source for water supply purposes, an extensive monitoring programme is undertaken.
- Inactive water supply borefield abstraction (standby mode)- when there is no water supply pumping, due to temporary shutdown of mining operations or the mine is placed in Care of Maintenance status, limited monitoring only is required.

Table 11.1 Proposed Groundwater Monitoring Programme at the Rebecca Palaeochannel Borefield

Bore Type	Data Requirement	Monitoring Frequency
Active water Supply Borefield		
Production Bores (active)	Groundwater Abstraction Volume (cumulative flow readings)	Monthly
	Water Levels	Monthly
	Field Water Quality– pH, EC and temperature	Quarterly
	Laboratory Analysis*	Biannually
Monitoring Bores	Water Levels	Monthly
Inactive Water Supply Borefield (Standby)		
Production Bores (when inactive)	Water Levels	Annually
Monitoring Bores	Water Levels	Annually

* pH, Conductivity (EC), Total Dissolved Solids (TDS), Total Hardness (as $CaCO_3$), Total Alkalinity (as $CaCO_3$), carbonate (CO_3), bicarbonate (HCO_3), calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), ammonia (NH_3), phosphate (PO_4), chloride (Cl), sulphate (SO_4), nitrate (NO_3), silica (SiO_2), aluminium (Al), iron (Fe), manganese (Mn), arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), selenium (Se) and zinc (Zn).

A totalising flow meter should be installed at each production bore and be read monthly and inspected regularly for faults and maintenance undertaken as required, with calibration as per the manufacturer's specifications. Details of any significant meter maintenance and replacement will be collated throughout the water year and incorporated into the annual monitoring summary.

Manual water level measurements from the production and monitoring bores should be taken monthly. The water level meters should be inspected regularly for faults and maintenance undertaken as required, with calibration as per the manufacturer's specifications.

Water samples will be collected quarterly from all active production bores, for field measurement of pH, electrical conductivity (EC) and temperature and biannually for full major component chemical analysis (as per list in Table 18) by a reputable laboratory.

12. SUMMARY

AQ2 has been engaged by Ramelius to undertake DFS water supply studies on the palaeochannel at the Rebecca Palaeochannel Borefield to develop the required process water supplies for the Rebecca Project (i.e. the current Project's annual water demand of 95 L/s (i.e. 3 GL/year)). This phase of DFS hydrogeological studies was focused on initially confirming water resource availability at the Rebecca Palaeochannel Borefield.

This report has been prepared in line with required submissions to DWER, relating to GWL approval (i.e. 5C licence application). This H3 level of hydrogeological assessment requires an extensive investigation to determine the potential impacts associated with the proposed abstraction at the Rebecca Palaeochannel Borefield on the aquifer, environment and surrounding groundwater users and includes the development of a numerical groundwater model to confirm that the palaeochannel aquifer is able to supply the required demand, without unacceptable impact.

Key results from this H3 Level Hydrogeological Assessment are summarised below:

- The Project lies within a greenstone area on the eastern margin of the Norseman-Wiluna Greenstone Belt. The basement rocks comprise mafic-ultramafic volcanic and felsic volcano-sedimentary rocks (i.e. gneiss, amphibolite, diorite and granite).
- are deformed, resulting in significant north-trending faults and shear zones and minor east-west faults, as well as foliations, cleavage and lineation within the rock. Palaeochannels have been cut into this and infilled with Tertiary sediments that locally comprise:
  - Thin alluvial deposits at surface, that are unsaturated.
  - An underlying thick, low permeability clay deposit (Perkolilli Shale).
  - A basal sand aquifer (Wollubar Sandstone).
- There are no groundwater dependent ecosystems within a 10 km radius from the edges of the Rebecca Palaeochannel Borefield and it is very unlikely that stygofauna are present at the Rebecca Palaeochannel Borefield, which has hypersaline groundwater.
- There are no other licensed palaeochannel aquifer system users in the proximity of the Rebecca Palaeochannel Borefield (i.e. the closest one is located 55 km north-west of the proposed borefield).
- Two geophysical surveys were carried out in 2023 and 2024 to investigate the depth and shape of the main palaeochannel and provide target locations for groundwater exploration drilling. Passive seismic (HVSR) and gravity surveys were run across up to 32 transect lines crossing the palaeochannel in Area B. The passive seismic results were good, delineating the palaeochannel base and its depth.
- Drilling targets were selected from the geophysical results and an initial phase of groundwater exploration drilling was undertaken late 2023 with 46 exploration holes being drilled. The maximum drilling depth of the holes was 101 m, with an average drilling depth of 70 m. A second phase of groundwater exploration drilling took place in February 2024 in the northeast of Area B and comprised the drilling of a further 11 exploration holes to depths of between 18 to 113 m. These were drilled using the Reverse Circulation drilling method.
- The exploration drilling in Area B was successful and confirmed the palaeochannel's geology:
  - The palaeochannel varies from 65 m deep in the west to 89 m deep in the east of the main Rebecca channel (i.e. proposed borefield area) and between 36 and 66 m deep in the tributary channels. This is from approximately 260 mAHD in the west to 247 mAHD in the east of the main channel, representing a fall of about 13 m over a distance of approximately 7 km, at a gradient of about 0.0018.

- The palaeochannel is filled with thick clay (Perkolilli Shale), which is mainly silty clay, but becomes sandy silty clay in places, and is between 30 to 50 m thick and is thicker in the main palaeochannel than in its tributaries. This thick clayey unit confines (or semi-confines where more sandy clays are present) the underlying basal sand (Wollubar Sandstone), which is the main aquifer in the project area. The palaeochannel basal sand has a fairly consistent thickness of approximately 20 m in the main Rebecca palaeochannel (across the proposed Rebecca Palaeochannel borefield area). It is generally fine to coarse grained sand with moderate gravel and minor clay and silt, with finer grains occurring in the upper part of this aquifer and coarser grains intersected near or at the base.
- The palaeochannel basal sand unit was also encountered in the Rebecca palaeochannel tributaries, but at shallow depths and thin (up to between 4 to 10 m in thickness). The tributary palaeochannel basal sand aquifer is generally silty/clayey fine to medium grained sand, with minor coarse grained sand and gravel. Thinner and more clayey palaeochannel sands were encountered in the tributary channels further away from the main Rebecca palaeochannel and the palaeochannel confluence area.
- Beneath these palaeochannel sediments (clay and sand) is weathered felsic basement mostly up to 15 m thick, but in some places is more than 60m thick, followed by fresh felsic basement. Minor groundwater is encountered in the weathered basement.
- Overlying the palaeochannels and basement rock are a variety of Cainozoic superficial deposits (alluvium and colluvium) with a variable thickness of between 2 and 6 m across the project area. These deposits are mostly unsaturated, with minor water encountered at the base of this unit (as seen in some of the exploration holes).

- Based on the outcome of the groundwater exploration drilling programme, a water bore drilling programme was carried out between February and May 2024 with 4 test production bores and 9 monitoring bores drilled and constructed. The bores were drilled through the palaeochannel sediments and terminated in the basement bedrock or saprolite. Each test production bore was cased with 200 mm ND (8") blank PVC Class 12 casing with 200 mm ND (8") Grade 316 stainless steel screens (1 mm aperture) installed against the targeted palaeochannel basal sand (up to 61 to 91 mbgl).
- Each production bore had a single monitoring bore installed close to it on the same drilling pad, with the exception of BPB004, which had 2 monitoring bores. Monitoring bore BMB004S was screened across a shallow upper palaeochannel sand horizon (between 10 and 23 mbgl) at BPB004, which was above the two palaeochannel basal sand horizons tapped by the production bore (48 to 64 mbgl and 80 to 89 mbgl). Monitoring bore BMB004D was screened across the deep palaeochannel basal sand aquifer at the same point as BPB004. Monitoring bores BMB011, BMB017 and BMB050 were each installed with slotted sections installed across the same palaeochannel basal sand aquifer units as their corresponding production bore BPB011, BPB017 and BPB050. In addition, four monitoring bores were installed as standalone installations, comprising BMB005, BMB008, BMB019 and BMB030. These were constructed with a 50mm PVC slotted casing to monitor background groundwater levels in the palaeochannel sand aquifer at different points.
- Pumping tests were conducted on all 4 test investigation bores in August 2024. These comprised step tests (4 steps of 100-minute duration at various rates), constant rate tests of between 24 to 72 hours duration and recovery tests. Groundwater levels were monitored in both the test investigation bores and adjacent monitoring bores. The highest yielding production bores were the two in the main Rebecca Palaeochannel, BPB004 and BPB050, which had constant rate test pumping rates of 21.0 and 24.0 L/s and final drawdowns of 10.09 m and 10.94 m, respectively. Bore BPB011, located in the tributary channel, was pumped at a constant 10 L/s and had a final drawdown of 22.84 m. Bore BPB017 has a poor yield and could only be pumped at 1.2 L/s, with a final drawdown of 22.45 m after 24 hours of pumping.
- The results from the 2 bores (BPB004 and BPB050) that target the main Rebecca Palaeochannel show an aquifer transmissivity in the range between 275 and 400 m^2/d, with increasing values from west

to east, down the channel gradient. The secondary Rebecca tributary channels have lower aquifer transmissivities (5 to 70 m^2/d), owing to the palaeochannel sand being thinner and/or containing a greater content of the finer sediment fractions than the main Rebecca Palaeochannel. An average storativity value of $1.6x10^{-3}$ was estimated from the monitoring bores, reflecting the typically confined nature of groundwater within the palaeochannel.

- Groundwater samples were taken from each of the new production bores and monitoring bors. The groundwater is hypersaline, with salinity ranging from 90,000 to 190,000 mg/L total dissolved solids (TDS). The salinity increases significantly from the west of the palaeochannel to the east. The groundwater is of sodium chloride type, with high concentrations of sulphate and magnesium and low calcium and bicarbonate and is an "end-point water" type water, indicating little to no recent rainfall recharge.
- The palaeochannel geometry was defined, with the width of the main Rebecca palaeochannel being approximately 400 m at bore BPB050 and the width of the southern tributary channel to be approximately 650 m in the confluence area at bore BPB011. These results are consistent with the passive seismic geophysical results interpretation of the lateral extents to fresh bedrock. This shows a narrower tributary channel at the headwaters (upgradient) of approximately 150 m width and widening toward the north to an approximately 650 m wide tributary channel (at the confluence area).
- The water table elevation is estimated to generally range between 320.8 and 317.5 mAHD west to south across the main Rebecca palaeochannel and south to north in the tributaries. Overall groundwater flow is under a very low gradient. The depth to groundwater is generally between 5 and 10 mbgl across the Rebecca Palaeochannel Borefield area and its tributaries. There are very small variations in the groundwater levels (less than 0.1 m) recorded for the November 2024 to March 2025 4-month monitoring period. This suggests limited direct rainfall recharge, owing to thick clayey layers that limit vertical flow. The Cainozoic superficial deposits (alluvium / colluvium) are mostly unsaturated (i.e. above the groundwater level), with some water strikes encountered at the base of alluvium.
- A Modflow numerical groundwater flow model was produced of the local area to simulate the groundwater system and groundwater abstraction from the basal sand aquifer to meet the water demand. The model consisted of seven model layers representing alluvium, upper palaeochannel clay, upper palaeochannel sand, lower palaeochannel clay, basal palaeochannel sand, saprock/saprolite basement and the surrounding basement. The model extent includes the original Rebecca Palaeochannel Borefield, its north and south extensions and the surrounding groundwater catchment. The model was calibrated to both steady state conditions and transient conditions, using test pumping data from the Rebecca Palaeochannel bores.
- A base case was run in the model consisting of aquifer parameters derived from the pumping tests and literature values for the palaeochannel clay, saprolite and basement layers. The model was run simulating abstraction from two existing bores (BPB004 and BPB050) and eight proposed bores (WB01, WB02, WB03, WB04, WB05, WB06, WB07 and WB08). The model run predicted that the aquifer will deliver the water supply requirements over the demand period (10 years of operational pumping) with a maximum drawdown of 40 m in the centre of the borefield (i.e. around BPB050). Water table drawdown of 1 m is predicted to extend a maximum distance of 6.7 km upstream and 8.5 km downstream of the borefield (i.e. upstream of bore WB01 and downstream of bore WB08). Water level reduction in the palaeochannel basal sand of 1 m is predicted to extent a maximum distance of 6.8 km upstream and 8.9 km downstream of the borefield. Drawdown is also predicted to extend into the adjacent saprolite / basement, however the magnitude of this drawdown is much less than that drawdown predicted along the paleochannel (around 10 m of drawdown is predicted in the basement adjacent to the paleochannel after 10 years of operational pumping).
- Three model uncertainty runs were performed. For Uncertainty Case 1, the specific yield of the palaeochannel clay was reduced from 5% to 2.5%.In Uncertainty Case 2, reducing the horizontal and vertical hydraulic conductivity of the palaeochannel clay and increasing the hydraulic conductivity

(horizontal and vertical) assigned to the saprolite. For Uncertainty Case 3, Horizontal and vertical hydraulic conductivity of saprolite to values assigned to the basement For all uncertainty Cases, the water demand is met throughout the 10 years of operational pumping.

- The numerical modelling indicates that the palaeochannel aquifer is capable of supplying the required demand for the Project under both base case and Uncertainty Case 1, Case 2 and Case 3 scenarios, without detrimental impact to the environment.
- A groundwater operating strategy will be required to support a 5C groundwater abstraction licence.

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APPENDIX A
DWER WIN DATABASE (BORE LOGS)

Site Ref	From (mbGL)	To (mbGL)	Lithological Description
120416080	0	2	Clayey sand, orange
	2	15	Gritty clays, red gy-gn 4-8m red-bn 8-15m
	15	21.5	Clayey sands and gravels gravel is granule size well rounded ironstone and laterite pisolites. Matrix is red gy clay w sandy grit throughout. Gravels occur in multiple thin layers and are partially indurated
	21.5	23	Ironstone sands, yellow in clayey matrix
	23	26	Clays indurated it. Gy-gn w/some ironstone grit. Ironstone. Granule layer
	26	31.5	Clays it gy-gn with some grit
	31.5	36.5	Ironstone gravel in limonitic clay matrix 34.35m almost pure gravel, no clay
	36.5	49	Clays it gy-gn, silty w/occassional grit very sticky
	49	62	Sands 49-51 silty vfg yellow 51-52 f.G. Yellow 52-53 mg yellow 53-61 c-vcg yellow, white at base. Clean, no clay fraction below 52m. Ail oxydized. 61-62 vcg w/qtz pebbles to 3cm
	62	65	Basement limonitized f.G. Metased.
120416081	0	1	Clayey sands, orange
	1	4	Gritty clays, brick red
	4	13	Clay, typical puggy sticky salt lake clays with grit
	13	19	Very sandy clay, includes well rounded grit and granules of white quartz and angular fragments vein quartz some indurated haematizoid zones.
	19	38	Not logged
	38	39	Limonitic sandy zone. Below 40m clays predominately med grey w/acc red yellow varigated
	39	45	Not logged
	45	47	Limonitic sandy zone
	47	49	Ironstone gravel (sub angular) inc angular vein quartz
	49	57.5	Not logged
	57.5	60	Sands white - very light grey running sands in saline groundwater
	60	61	Gravel band sub angular to well rounded quartz. Pebble to 4cm diam
	61	66	Not logged
	66	67	Silty clay dark olive bn, micaceous
	67	70	Not logged
	70	71	Silty clay gy, micaceous
	71	74.5	Not logged
	74.5	76	Clay gy, micaceous w/f - v.F.G. Sand and silt. Sands, c-vcg in a dark bn clay matrix. This zone includes occ 2-3cm sub-rounded quartz pebbles and some pyrite cemented zone
	76	86	Hard contact basement fresh it grey-gn vfg meta sediment.

APPENDIX B
GEOPHYSICAL SURVEY REPORTS

Passive Seismic HVSR Surveying, Data QA/QC, Editing, Processing, Preliminary Velocity Analysis and Results, Northern Survey Area, Rebecca Gold Project, Western Australia

Summary Report
for

RAMELIUS RESOURCES

by

Ismail Yavuz

Resource Potentials
www.respot.com.au

November 2023

Disclaimer: *This report and opinions contained herein are based on the processing and review of data supplied on behalf of **Ramelius Resources Limited**. The authors base their conclusions and recommendations on these data in the format it was provided. The authors do not take any responsibility or liability for any commercial decisions or work carried out by **Ramelius Resources Limited**, any related party, or subsequent parties, or actions resulting from them. This report or its contents cannot be referred to or quoted, whole or in part, in any statement, study, report, prospectus, loan, thesis, or other agreement or document without the expressed written approval of the client and Resource Potentials Pty Ltd.*

Introduction

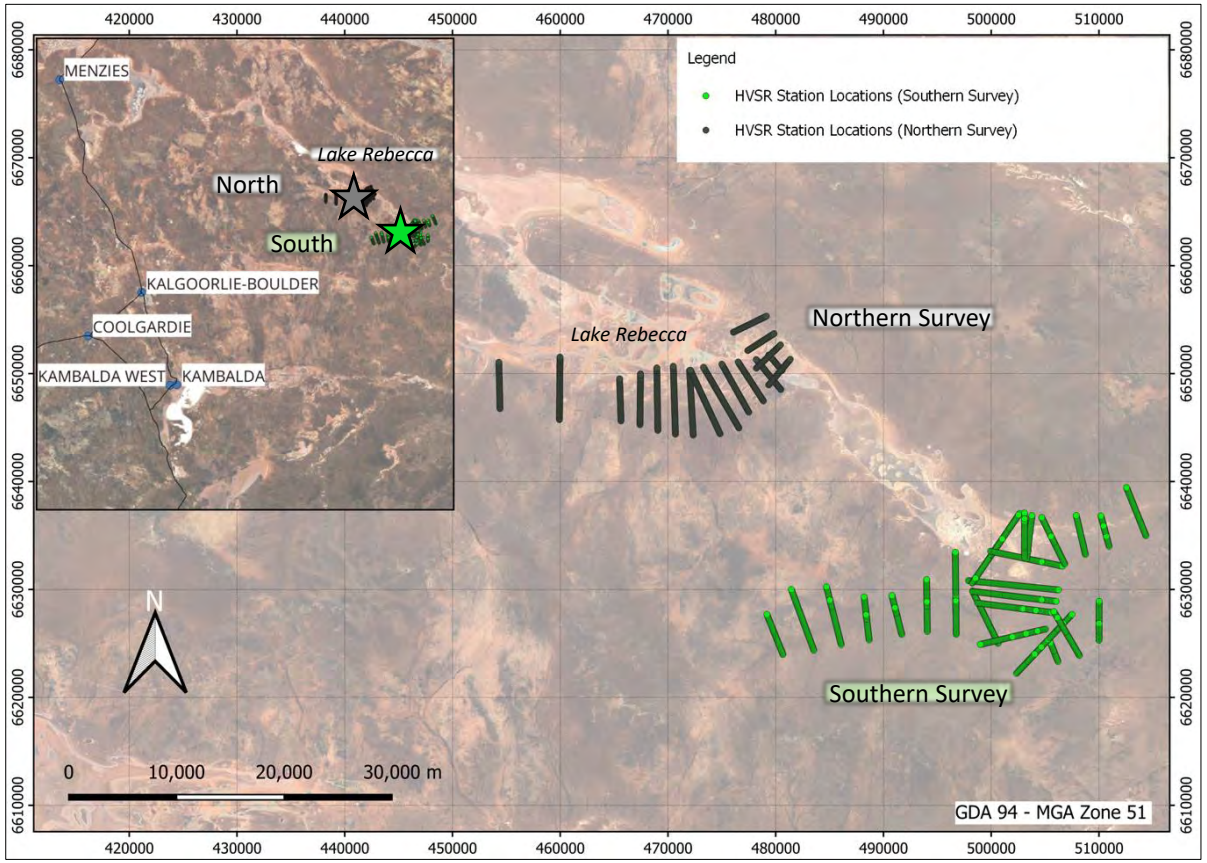
Ramelius Resources Limited (ASX: RMS) conducted passive seismic surveying using the horizontal to vertical spectral ratio (HVSR) method at their Rebecca Gold Project, which is located approximately 115 km NE of Kalgoorlie in Western Australia (see location map to the right).

HVSR surveys were carried out over northern and southern survey areas at the lake Rebecca project and were designed for delineating the locations, meander, geometry and calculated depths of paleochannels and their thalwegs for ground water exploration. As requested by RMS, this report focuses on the northern survey area only, and the southern survey area is summarised in a separate report (Yavuz, 2024).

Tromino® seismometers hired from Resource Potentials (ResPot) were used to collect HVSR data along survey lines at both northern and southern survey areas (see location map right and zoomed-in map on Slide 2). Passive seismic HVSR station recording data were acquired and downloaded by XM Logistics (XML) survey staff between late April to early July 2023. The field data were provided to ResPot to assess the recordings, provide data QA/QC, propose recording repeat stations, and carry out preliminary data processing and cross-section generation, and provide regular client updates showing preliminary results throughout the acquisition periods.

On completion of each HVSR survey area, ResPot carried out final data processing and depth conversion on all passive seismic HVSR data bedrock peak frequency responses, with final HVSR amplitude-depth cross-sections generated for each passive seismic survey transect. Drilling data were not available during the time of data processing. Therefore constrained velocity analysis for more accurate depth conversion of the data could not be carried out, and an assumed average shear wave velocity (V_S) of 400 m/s was used to depth convert all HVSR peak frequency data into acoustic bedrock depths. This average V_S should be updated later for more reliable bedrock depth when bedrock depth from drilling is measured at an HVSR station for V_S calibration.

The HVSR survey results highlight an undulating acoustic impedance contrast bedrock layer response or "acoustic bedrock" representing a layer that deepens to define paleochannel structures on the majority of survey lines, likely representing the top of fresh Archean greenstone and granite-gneiss bedrock. Higher frequency (shallower) HVSR peak responses were also resolved above the bedrock peaks which could be related to shallower layers from within the sedimentary and regolith deposits, such as sand or gravel, calcrete, silcrete, cementation, silicification layers etc., and velocity inversion layers likely cause by a mud layer. These HVSR survey results have located a paleochannel drainage system having variable width, geometry and depth, and have resolved deeper areas of the paleochannel valley which may form potential targets for RMS to test for groundwater and estimate water volume, salinity and flow rates for future mine site water requirements.



Map showing passive seismic survey line locations where the Northern survey stations for this report are shown in black and the southern survey stations forming a separate report are shown in green, overlain a Google Earth satellite image highlighting modern Lake Rebecca salt lake playa.

Final data products from this study include:

- Raw and processed passive seismic HVSR data in ASCII format for archive and government reporting requirements, along with an excel spreadsheet of all HVSR station coordinates.
- CSV file of the main acoustic impedance contrast layer ("acoustic bedrock") as estimated depth from land surface and in RL elevation based on the SRTM height datum (geoidal height above avg. sea level).
- Raw and normalised amplitude 3D georeferenced geotiff images of HVSR cross-sections based on RL elevation.
- Raw and normalised HVSR amplitude cross-section image plots with map layout for all survey lines (see also Appendix 1).
- Data grid of acoustic bedrock elevation.

Survey coordinates in this report use the GDA94 datum and MGA 51 projection. Cross-sections are plotted in RL elevation above sea-level using SRTM 1 arc-second (30m cell size resolution) digital elevation data as the surface topography reference (geoidal height datum above sea-level).

Survey Specifications and Equipment

Both northern and southern Lake Rebecca HVSR surveys were designed by AQ2 Hydrogeologists working with RMS. The HVSR survey line transects at the Lake Rebecca southern HVSR passive seismic survey area have variable orientations. Existing geophysical survey data and digital elevation coverage over the area is limited to ground gravity with 2.5 km average station spacing (considered low) and airborne magnetics with line spacing which ranges between 50 m and 100 m over the northern survey area. Therefore, the surface extents of the Lake Rebecca salt lake playa, coupled with the state wide datasets provided some indications of the possible locations of paleochannel systems (see map image to the right).

All passive seismic HVSR survey data were acquired using a sampling frequency of 128 Hz and an acquisition recording time of 20 minutes per station. Self contained Tromino® ENGY TEB seismometers were used to collect passive seismic HVSR data at fixed recording stations with 100 m station spacing, where each Tromino® was firmly coupled to the ground and covered with a heavy duty bucket weighed down by sand bags in order to shield the Trominos® from wind motion and wayward animals, effectively reducing unwanted noise.

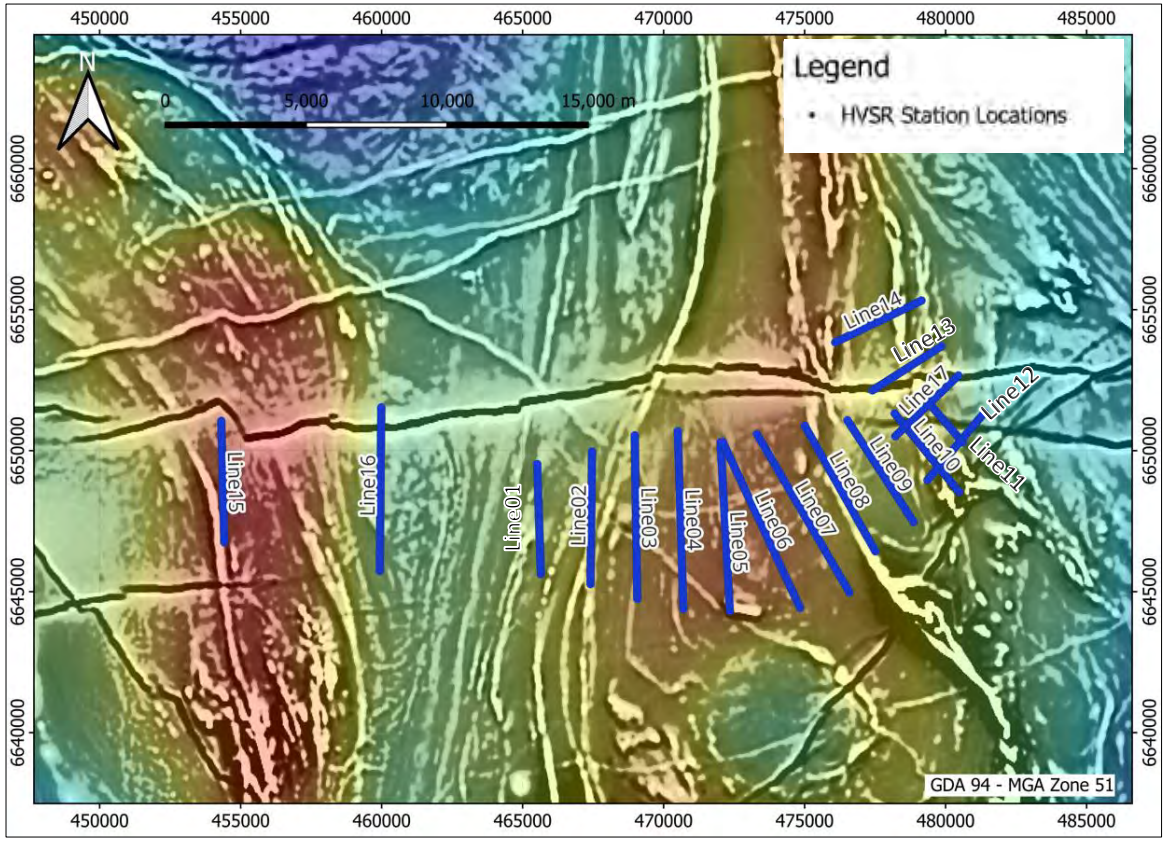
ResPot daily communications between AQ2 Hydrogeologists, RMS and XML, and the quick turnaround of preliminary cross-sections provided daily by ResPot, enabled adjustments to the acquisition plan to help optimise XML field crew efforts as surveying progressed. As a result, areas of interest requiring higher than 100 m spatial resolution were quickly identified, allowing stations to be infilled to 50 m spacing before the field crew demobilised. Additional survey line transects were also added where needed, and some survey line transects were extended where possible if and when they fell short of closing off paleochannels identified during surveying.

Location information was recorded by the Tromino® units in-build GPS system. Field logs and handheld GPS recordings were also manually recorded for station identity and associated field conditions for each survey station as a failsafe to match recording stations to their respective digitally recorded location and to assist with data processing and generating HVSR peak amplitude cross-sections.

A total of 793 HVSR stations were acquired along 17 survey line transects totaling 77.3 line-kms at the southern survey area over several weeks. The XML field crew completed the survey in a relatively short time frame considering the area covered.

Passive seismic survey specifications.

Survey Line Number	Number of Stations	Approx. Line Length (km)	Survey Line Number	Number of Stations	Approx. Line Length (km)
01	40	3.9	**10**	37	3.6
02	53	4.7	**11**	19	1.9
03	59	5.8	**12**	32	3.1
04	64	6.3	**13**	12	1.1
05	61	6	**13A**	18	1.7
06	66	6.5	**14**	35	3.4
07	66	6.5	**15**	44	4.3
08	52	5.1	**16**	59	6
09	44	4.3	**17**	32	3.1
Total				**793**	**77.3 km**



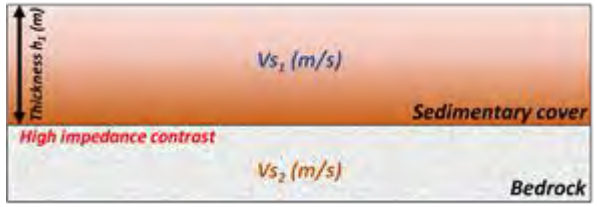
Map showing northern survey area passive seismic station locations (blue dots), overlain on a filtered state wide gravity (low resolution) anomaly pseudocolor image semi-transparent on top of a filtered high resolution state wide magnetic anomaly greyscale image.

Tromino® ENGY TEB seismometer specifications:

- Manufacturer: MoHo s.r.l.
- Dimensions: 10 x 14 x 8 cm
- Weight: 1.1 kg
- Vibration sensors: 3 orthogonal velocimeters
- Sampling rate: 64 kHz per chn.
- Output sample rate: 128 Hz
- Sensor frequency range: 0.1 - 1024 Hz

Passive Seismic HVSR Survey Method

The passive seismic HVSR technique is based on measuring the local resonant frequency of horizontal and vertically travelling ambient shear waves trapped and amplified within soft slow velocity sedimentary deposits or weathered bedrock (saprolite) over hard well lithified fresh bedrock forming an interface with a strong acoustic impedance contrast. The vibration data are analysed for peak resonant frequencies f_0 (Hz) of the soft overburden layer that are then converted into depth domain to represent the soft sedimentary and regolith cover thickness *h,* through Equation 1 below.



$$f_0 = V_S / 4h \quad \textbf{(Equation 1)}$$

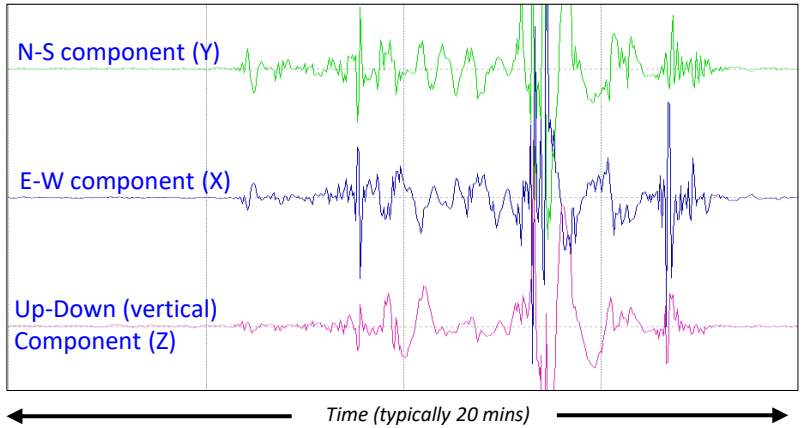
Passive seismic HVSR surveying involves using a seismometer with three axial sensors to record ambient or naturally occurring seismic vibrations from natural sources (wind, ocean waves, micro-seismicity, earth tides, etc.) and far field manmade signals over a range of frequencies (0.1-100 Hz) and a specific recording time period (generally 10-30 mins). The Tromino® seismometer records three orthogonal components of vibration: two horizontal components (north-south and east-west or X and Y) and one vertical (up-down or Z) component (top panel to the right).

The recorded time-series vibration data for each sensor component (top panel to the right) are then transformed into frequency spectra by using a Fast Fourier Transform (FFT) and are then presented as a frequency-power spectrum plot for all three receiver components (middle panel to the right). Shear wave resonance developed within a low velocity and low density layer sitting over a higher velocity and higher density layer (e.g., regolith or sedimentary cover over hard and fresh bedrock) produces a local minimum in the vertical component frequency-power spectrum relative to the horizontal frequency-power spectrum, thereby creating an 'eyelet' shaped separation between the horizontal and vertical vibration component profiles (middle panel to the right).

The horizontal (H) to vertical (V) spectral ratio (HVSR) is then calculated by dividing the geometric average of the horizontal components (N-S and E-W) by the vertical component (Up-Down) to generate an HVSR plot (bottom panel to the right). The HVSR response forms a peak in amplitude at the resonant frequency of the main acoustic bedrock interface (bottom panel to the right). It is not uncommon to resolve multiple HVSR peaks which can arise from multiple layer interfaces above the acoustic bedrock. Peak resonant frequencies from HVSR recordings are then depth converted using velocity analysis, assumptions or 1D modelling, and then displayed alongside each other in pixel plots (cross-section). Depth conversion of the HVSR peak frequency responses are further discussed in detail on Slide 7.

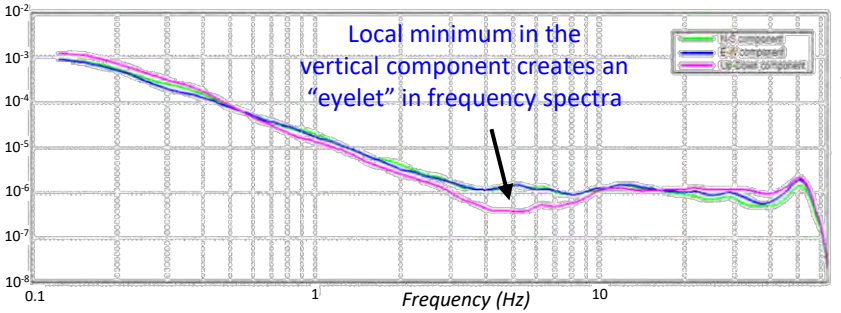
It is important to note that the effects of external noise can alter the measured peak frequency from the true geological peak frequency. Furthermore, the accuracy and precision achieved when depth converting HVSR peak frequency data is more reliable at higher frequencies (shallow depths). The following condensed example helps to illustrate this: assuming a constant V_s of 500 m/s and a standard deviation of ± 0.2 Hz when measuring a 2 Hz HVSR peak representing an acoustic bedrock interface at 62.5 m, an average depth difference of ±6.31 m or approximately 10% is calculated. However, for an 8 Hz peak representing a shallower acoustic bedrock interface at 15.6 m, under the same assumed standard deviation of ± 0.2 Hz, the depth calculation yields an average depth difference of only ± 0.39 m or approximately 2.5%.

Measurement of ground vibrations at a recording station in time series



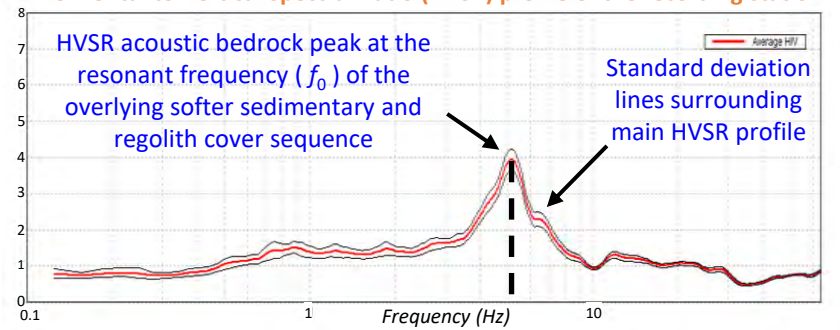
FFT

Frequency power spectrum of the recording station vibration data in three directions



HVSR

Horizontal to Vertical Spectral Ratio (HVSR) profile of the recording station



HVSR Data QA/QC and Editing 1/2

Passive seismic HVSR time series vibration data files, recording station GPS locations and field notes were provided by XML to ResPot via Dropbox as surveying progressed. These data were sorted into individual passive seismic HVSR station recordings, which were then manually assessed for station location, data quality, noise levels and stuck vibration receiver components.

Noise in passive seismic can arise due to strong wind, poor coupling of the instrument with the ground, anthropogenic activity, operators standing close to the recoding instrument, stuck geophone sensors, or readings taken over poor ground conditions, such as sub-crop/out-crop, soft mud, cavernous ground, or positioned above large buried boulders. Therefore, identifying poor quality HVSR data recordings and manually removing noisy segments of data during processing, before the HVSR resonant peak frequency response is calculated, is a key processing step carried out on a station by station basis during the survey acquisition period and final processing.

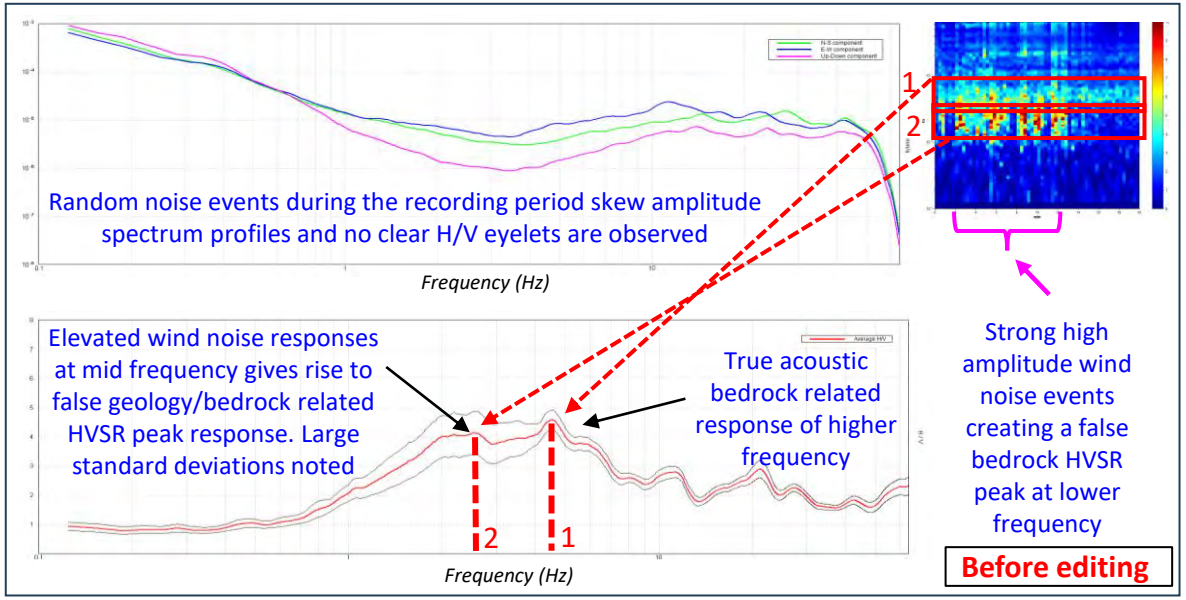
HVSR resonant peak frequency responses were observed to vary across the project area, but overall, moderate-to-high amplitude and low-to-high frequency HVSR resonant responses from deep and shallow acoustic bedrock were detected and later interpreted to mostly correspond to the top of hard acoustic bedrock sitting below softer paleochannel fill or transported sediments. The majority of the HVSR data recordings were of high quality, however some data were observed to be of poor quality and required extensive data editing and cleaning efforts to enhance HVSR bedrock peak frequency responses. A small number of these poor quality HVSR station recordings could not be sufficiently edited due to high amplitude background noise observed across the full 20 minute recording, mainly resulting from strong wind noise during acquisition. These noise trains showed up on HVSR profiles as high amplitude and low frequency HVSR peak responses that masked HVSR response related to local geology/bedrock. Therefore, these stations recordings were recommended for repeating where recording stations were considered critical for interpretations.

For passive seismic HVSR data editing and cleaning, each 20 minute station recording was divided into 20 second recording segments and displayed as H/V stability plots, as shown as the colour images to the far right, where each column of colour pixels represents the H/V frequency response in the vertical axis over the total 20 min recording time in the horizontal axis. Noisy 20 second recording segments were identified and manually removed to reduce the noise in the combined recording, which effectively removed false HVSR peaks and improved interpretability of HVSR peak responses related to geology.

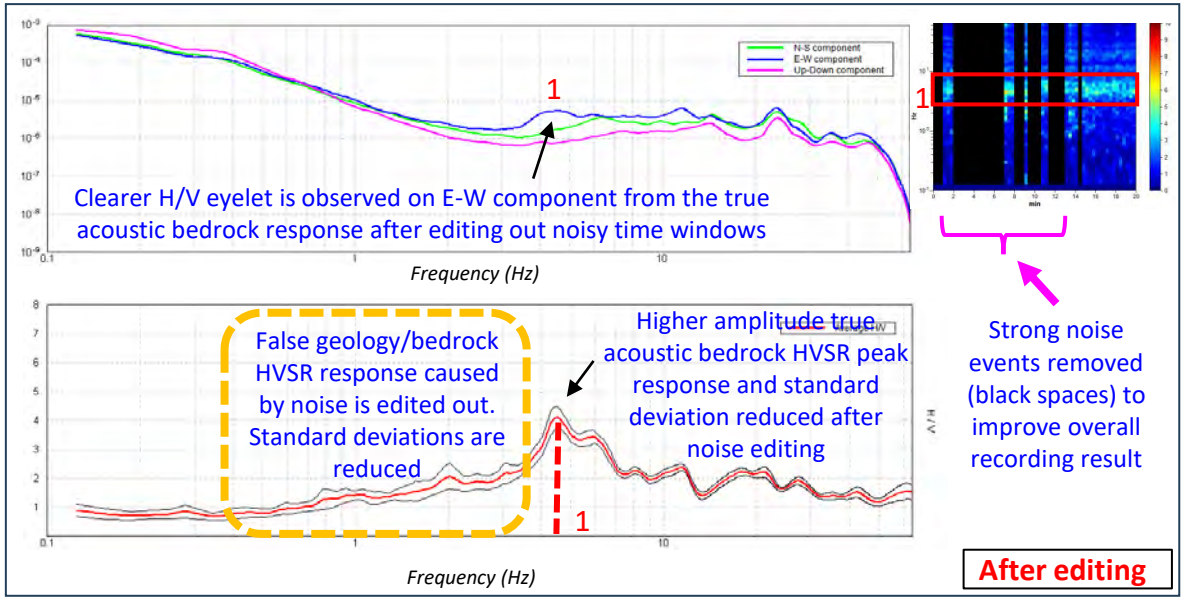
The images to the right show an example of an unedited (top) and edited (bottom) HVSR recording from station 4046 along survey Line 04. This example displays time periods mainly at the front end of the station recording period which appears to contain spurious noise, likely from wind, which creates a false a low frequency peak to the H/V response at approximately 2.6 Hz which could be interpreted as deeper acoustic bedrock interface. This false HVSR peak was edited out by removing the noise affected segments of the recording. Also note the reduction of the standard deviation profiles after editing (shown as the black profiles either side of the averaged H/V response profile displayed in red), particularly at low frequency values. Also note the highly improved character of the HVSR peak frequency response and corresponding H/V eyelet, which is clearly identified after editing.

Where the station recordings were too noisy for edits, the stations were recommended for repeating (acquired again), as discussed on Slide 5. Examples of typical cleaned HVSR responses observed in the study area are provided on slide 6.

Frequency spectra profiles and HVSR profile for Line04 - Station 4046 (before editing)



Frequency spectra profiles and HVSR profile for Line04 - Station 4046 (after editing)



HVSR Data QA/QC and Editing 2/2

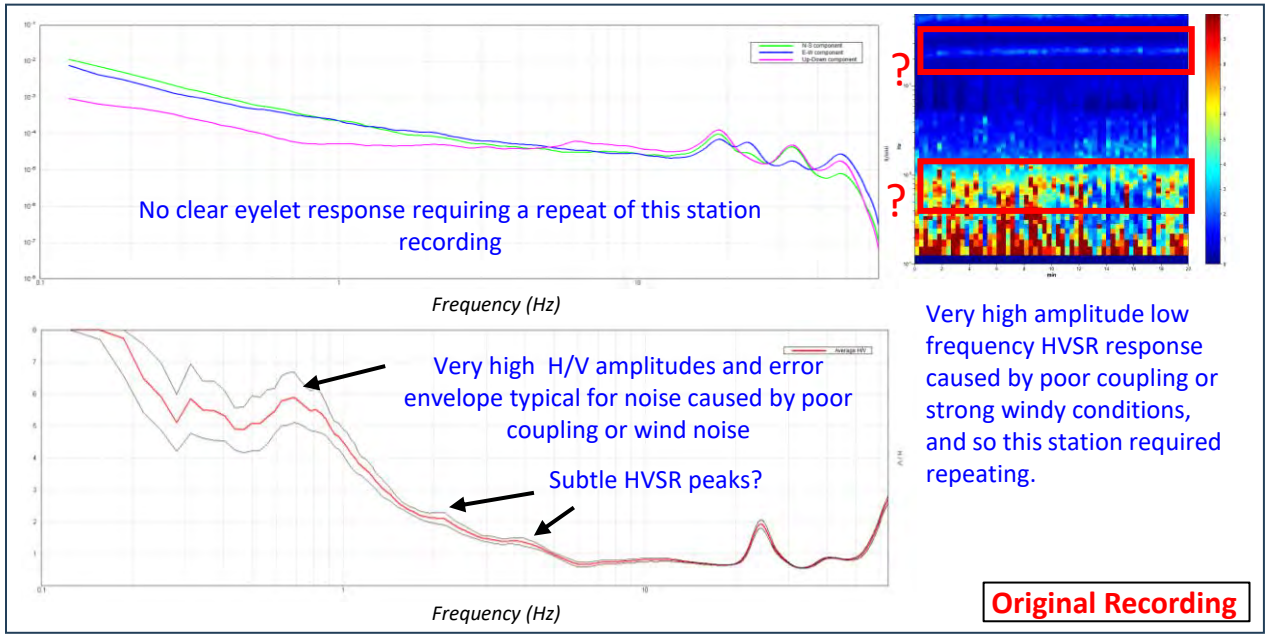
A very small handful of passive seismic HVSR recordings acquired during this survey contained HVSR responses that were vastly different from neighboring passive seismic HVSR recordings, and which possibly represented stronger periods of wind noise during acquisition, poor coupling of the seismometer with the ground, or areas of sub-crop where no reliable HVSR peak interface existed. These HVSR station recordings may also have been affected by strong anthropogenic noise.

Due to the continuous nature of these noisy responses across the full 20 minute recording time, data editing and cleaning could not be carried out to enhance geological responses, and therefore these survey stations were recommended for repeating. Where time permitted, many of them were repeated by the XML field crew.

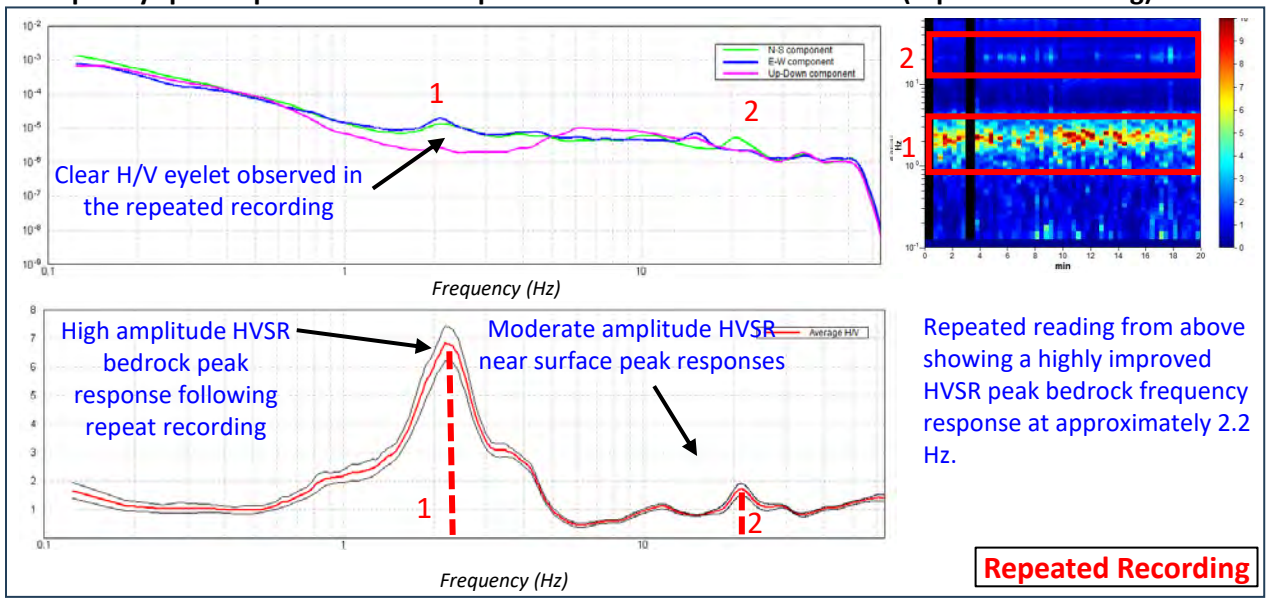
An example of a single HVSR station recording considered to be of poor data quality is displayed to the top-right. This HVSR data recording is characterised by high amplitude HVSR responses at low frequencies, with subtle hints of a deep local geological response at low frequency, which was observed to be very dissimilar to neigbouring station recordings. These characteristics are present throughout the entire recording time and provide little confidence in the station recording data. Therefore, in order to confirm the HVSR resonant peak frequency response at such locations, very noisy station recordings were recommended for repeating, like the repeated HVSR station recording example displayed bottom-right below the original bad HVSR recording above. The repeated recording displays a clearer or more distinct HVSR response at low frequency, as predicted by neighboring recording stations. Many of the requested repeat station recordings where considered critically located for interpretation of the main paleo-channel axis and were completed by XML to provide improved interpretability when compared to the original recordings, justifying the need for repeating of such noisy HVSR stations.

Following manual editing of the passive seismic HVSR data, the recorded HVSR peak frequency data were converted from frequency to depth. The depth conversion process is explained in detail on Slide 7.

Frequency spectra profiles and HVSR profile for Line10 - Station 10018 (original recording)



Frequency spectra profiles and HVSR profile for Line10 - Station 10018R (repeated recording)



HVSR Station Data Observations

HVSR station data profile responses from the Lake Rebecca northern survey area are relatively non-uniform in terms of frequency range, HVSR peak amplitude and character, which is most likely related to the variable bedrock depths and lateral variability of acoustic impedance contrasts between different geological layers and the weathering profile across the survey area. For example, high amplitude HVSR bedrock peak frequency responses can often be attributed to a sharp acoustic impedance contrast between low-density, slower-velocity sedimentary deposits and higher-density, higher-velocity acoustic bedrock, fresh Archean greenstone and granite-gneiss. Broad and low amplitude HVSR responses may indicate a gradual change in acoustic impedance contrast between geological layers or a gradational weathering profile caused by saprolite formed above the fresh bedrock. Higher levels of wind noise may also mask and subdue the HVSR bedrock peak frequency response.

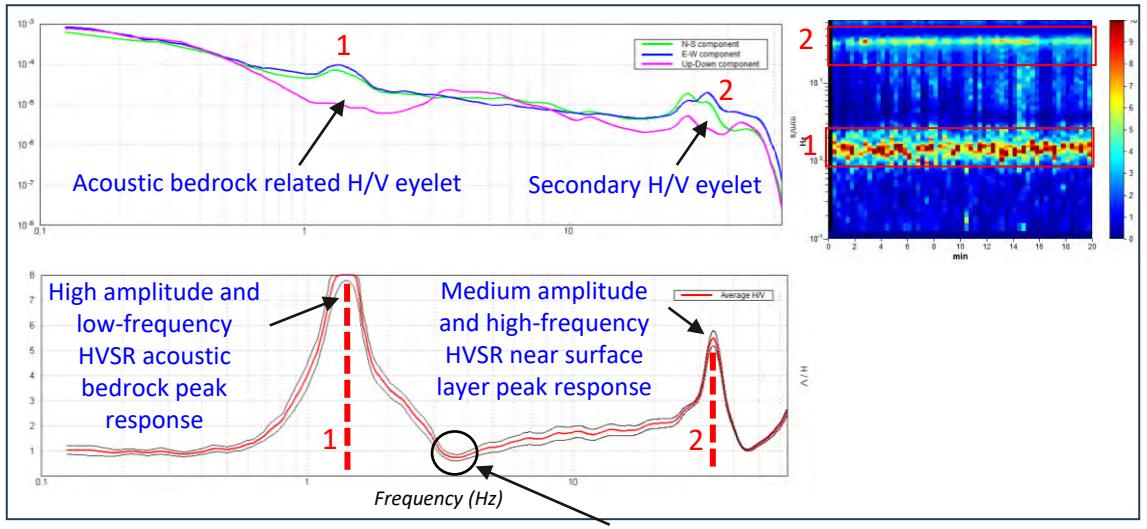
In some geological environments, multiple HVSR peak responses may be observed, with the lowest frequency HVSR response related to acoustic bedrock forming deeper layers, and sometimes higher frequency and high amplitude HVSR peak responses above the bedrock peak are detected and are usually related to shallow layering within the channel fill/sedimentary deposits, which in this study area could be calcrete, silcrete, cementation, silicification layers, gravel-sand layers, conglomerate, etc. It is also possible that these higher frequency HVSR peak responses could represent modal responses (multiples of the main HVSR resonant peak frequency), and care is required when interpreting these higher frequency HVSR peak responses. Some velocity inversion were observed where the HVSR is less than 1.0, and this could represent mud layers.

The recorded vibration frequency spectra profiles and HVSR profiles below display examples of typical cleaned HVSR station recording responses observed with in the northern survey area.

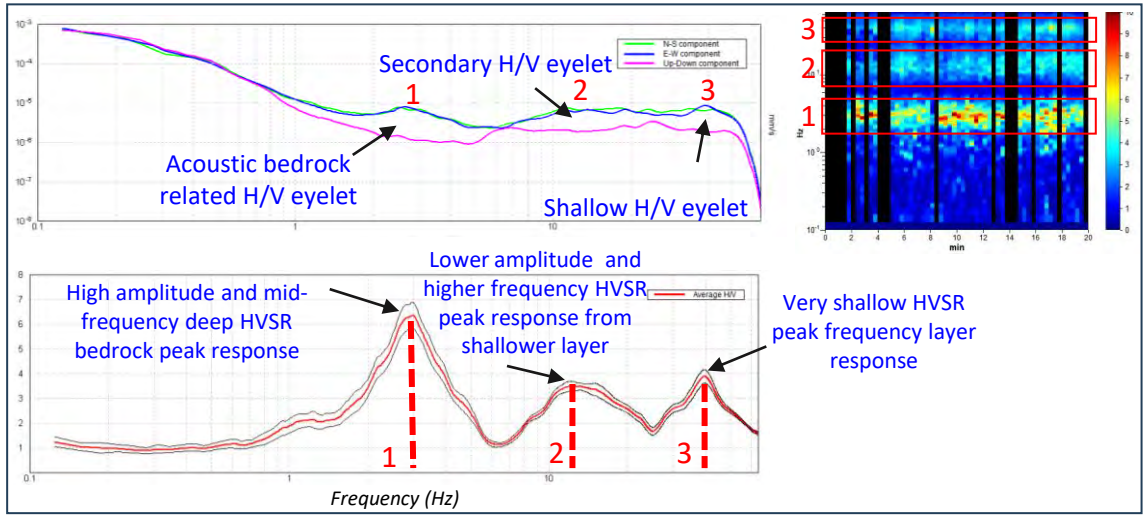
Example 1: *Station 12023 from Line12* – Low frequency and high amplitude HVSR bedrock peak frequency response observed at 1.4 Hz related to deeper acoustic bedrock (fresh granite-gneiss) with overlying paleovalley fill gravels, sand etc. There is also a very high frequency response at 33.7 Hz which may be related to a hard interface close to surface, like a clay hardpan or ferricrete, and a velocity inversion at about 4 Hz.

Example 2: *Station 6005 from survey Line06* – Multiple HVSR peak frequency responses are observed, including an HVSR bedrock peak frequency response at 3.0 Hz related to deep acoustic bedrock, a mid-frequency broad HVSR peak response at 12.3 Hz, possibly representing a shallow layer interface within the paleochannel fill, and a very high amplitude HVSR peak frequency at 39.5 Hz, most likely related to a shallower interface at or close to surface, such as hardpan or laterite.

Example 1: Station 12023 from survey Line12



Example 2: Station 6005 from survey Line06



HVSR Vs Analysis, Depth Calibration, Depth Conversion and 1D Modelling

The conversion of passive seismic HVSR bedrock peak frequency data into depth from surface can be carried out by calibrating measured HVSR bedrock peak frequency responses from recordings taken next to drillholes with well-lithified fresh or hard acoustic bedrock logged at a known depth, or against depth to hard bedrock from shallow drilling or mining. The depth to fresh bedrock is best determined from drillholes that have intersected fresh bedrock coincident to passive seismic survey stations, if available. Air core (AC) or rotary air blast (RAB) blade refusal depth can also be considered to represent approximate depth to hard saprock or fresh bedrock. Where no bedrock depth information is available, then assumptions can be made from local geology to input an assumed average shear wave velocity (V_s) for preliminary depth calibration, which can be updated later when bedrock drill data become available.

There are three primary methods of depth calibration that may be used to convert HVSR peak frequency data from frequency domain to depth. The first two methods involve estimating a constant average V_s for the soft cover sequence layer using geological assumptions or by applying 1D modelling by using bedrock depth drilling information where a calibration HVSR reading is taken next to a drillhole intersecting hard and fresh bedrock at a known depth directly below the recording station. These three methods are referred to as V_s analysis. A fourth method extracts a trendline from HVSR peak frequency measurements taken at a number of drillholes having a range of known depths to fresh/hard bedrock, and then the data are cross-plotted for regression analysis, more commonly referred to as "trendline analysis". For trendline analysis to work, the f_0 and bedrock depths must cover a range of values, meaning it will not work in perfectly flat bedrock settings and there must be a reasonable correlation forming a trend line between bedrock depths and HVSR peak frequencies.

1) ***Drillhole calibrated average Vs analysis***

   Bedrock depth from one or more drill logs and corresponding nearby HVSR peak frequency measurements from a survey area are input into Equation 1 (see below) to calculate an average V_s of the soft upper layer, which can then be used in areas away from drilling in a survey area to convert recorded HVSR peak frequencies to depth. $f_0 = V_S / 4h$ ***(Equation 1)***

2) ***Assumed average Vs***

   In a survey area where the geology and regolith are known but there is no drilling data, one or two assumed average V_s values can be applied to generate preliminary depth estimates, which can be revised when drilling data to fresh bedrock become available.

3) ***Modelling based V_s analysis***

   Velocity and density assumptions based on local geology or measurements of logged lithology are input into Equation 1 or used to 1D forward model the subsurface acoustic impedance layering such that the 1D modelled HVSR profiles match the observed HVSR profile data, thereby obtaining a geologically reliable V_s profile which can then be used in areas away from the modelled station to convert recorded HVSR peak frequencies to depth using Equation 1. This method can be updated when drilled bedrock depth information coincident to HVSR recording stations become available. 1D modelling is also more reliable when carried out at a recording station taken at a drillhole into fresh bedrock for better modelling constraint.

4) ***Trendline analysis***

   Depth to fresh/hard bedrock from a number of drillholes in a survey area intersect bedrock at a range of depths are HVSR surveyed at each drillhole to plot peak frequency against bedrock depth to obtain a trendline showing a good correlation, and then generate an equation to be used to directly convert measured HVSR peak frequencies into fresh bedrock depth for an entire survey area. This equation based method will typically provide better depth conversion than using an average V_s for the cover layer, because it accounts for vertical gradients in V_s arising from inhomogeneous cover sequences laterally and greater sediment compaction or decreasing weathering with increasing cover thickness, resulting in increasing V_s with depth.

Drillholes intercepting fresh bedrock were not available during this study, and therefore accurate and calibrated velocity analysis could not be carried out. An assumed constant shear wave velocity (Vs) of 400 m/s was applied, which is typical for this type of Yilgarn Craton paleochannel geological setting. This average Vs was used to convert all measured HVSR bedrock peak frequencies to fresh bedrock/saprock depth for the entire northern survey area. As a result, there will most likely be some minor depth discrepancies between calculated acoustic bedrock interface depths and actual interface depths when fresh bedrock/saprock is intersected by future drilling. It is recommended to revisit the HVSR depth conversion process for the northern survey area once local drilling information intercepting fresh bedrock proximal to good quality HVSR survey stations becomes available. Despite the lack of drilling data for Vs analysis and layer depth calibration, the relative calculated depth measurements between measured station data are still very useful for mapping the location and geometry of underlaying incised paleochannels and geologically recent normal fault structures.

Raw and Normalised Amplitude HVSR Cross Sections

The depth-converted HVSR response data along survey lines are displayed as coloured cross-section images (as pixel plots), with the HVSR amplitude responses displayed as raw amplitude and as normalised amplitude to enhance lateral continuity of HVSR peak responses and to show possible layering within the cover sequence (see example HVSR cross-section plot to the right).

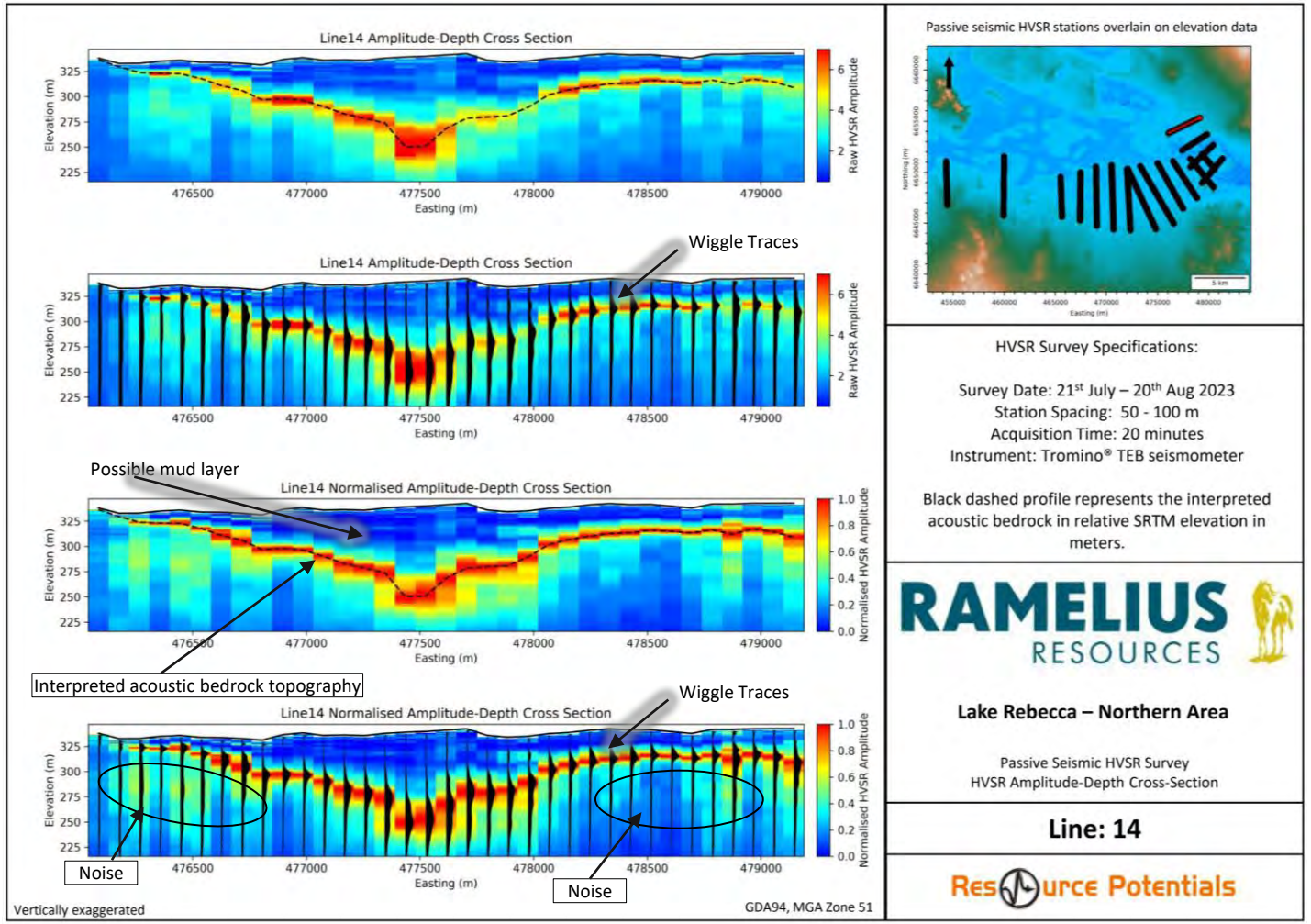
Passive seismic HVSR data were amplitude normalised by applying a filter process that equalises variations in the HVSR peak amplitudes observed at individual recording stations. This amplitude normalisation allows for subtle HVSR resonant peak frequency responses to be amplified and stronger amplitudes to become subdued, enhancing lateral layer continuity along survey transects across the project area. However, in a similar fashion, amplitude normalisation can also enhance noise, where persistent noise oscillating at constant frequency may appear on the amplitude normalised cross-sections as a coherent looking HVSR response between stations that could be misinterpreted as a geological layering to the untrained eye.

HVSR bedrock peak frequency responses for this study were manually interpreted for each HVSR station recording, converted to depth using an assumed constant average V_S of 400 m/s (as discussed on Slide 7) and then displayed on final cross-sections as black dashed lines. These dashed lines are interpreted to represent the main 'acoustic bedrock' interface, but they could also be shifted up or down after velocity calibration using drilling data to get bedrock depths at a passive seismic station.

An example multi-plot of HVSR amplitude-depth cross-sections from survey Line 16 is shown to the right as raw (top two sections) and normalised (bottom two sections) HVSR amplitude responses, where hot colours represent zones of higher amplitude and cool colours represent zones of lower amplitude. Very dark blue layers could represent velocity inversion caused by mud layers. Similar multi-plots were generated for each survey line and accompany this report in PDF format (see also Appendix 1 of this report). 3D georeferenced raw and normalised amplitude cross-section images for all survey lines are also provided in Geotiff format for 3D integration with other project geospatial datasets (for example see Slide 14).

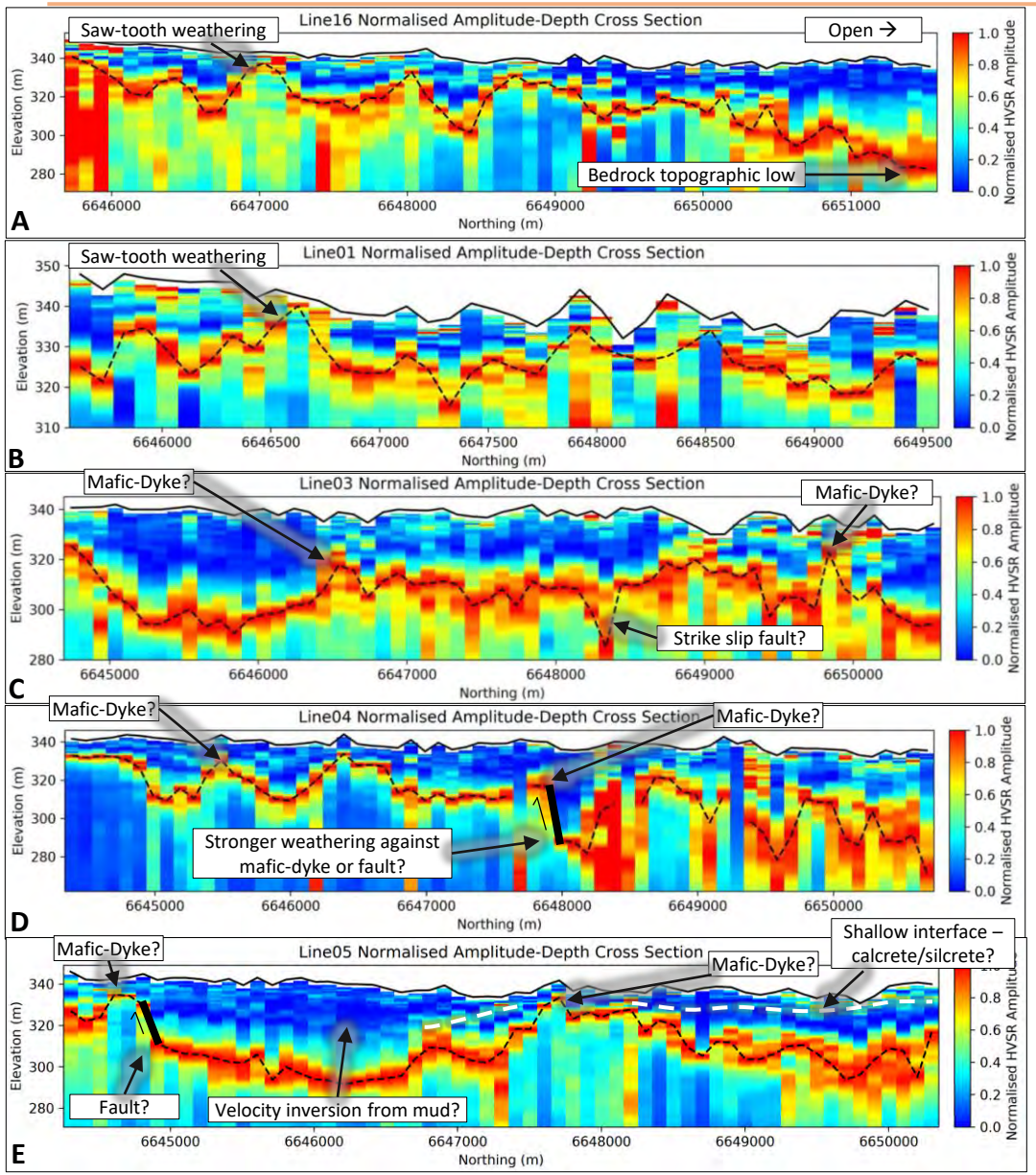
Final calculated depth from surface and RL elevation of the calculated acoustic bedrock were then gridded and imaged in order to assist with interpretation and visualisation of the HVSR survey results as acoustic bedrock topography to identify fresh bedrock elevation low zones and possible fault structures (see example on Slides 11 and 12).

A CSV database of the interpreted main acoustic bedrock as depth from land surface and as RL elevation were generated, along with various products listed on Slide 1. Elevations are referenced to sea level and were obtained from SRTM 1 arc-second (30 m cell size resolution) digital elevation data.



Example map layout image for a passive seismic survey Line14 HVSR cross-sections provided as multi-plot images of raw and normalised HVSR amplitude cross sections with and without HVSR wiggle traces. Note that the elevation is relative to SRTM 1 arc-second (30 m cell size resolution) digital elevation data. A similar multi-plot image is provided for each passive seismic survey line in Appendix 1 and as PNG images accompanying this report.

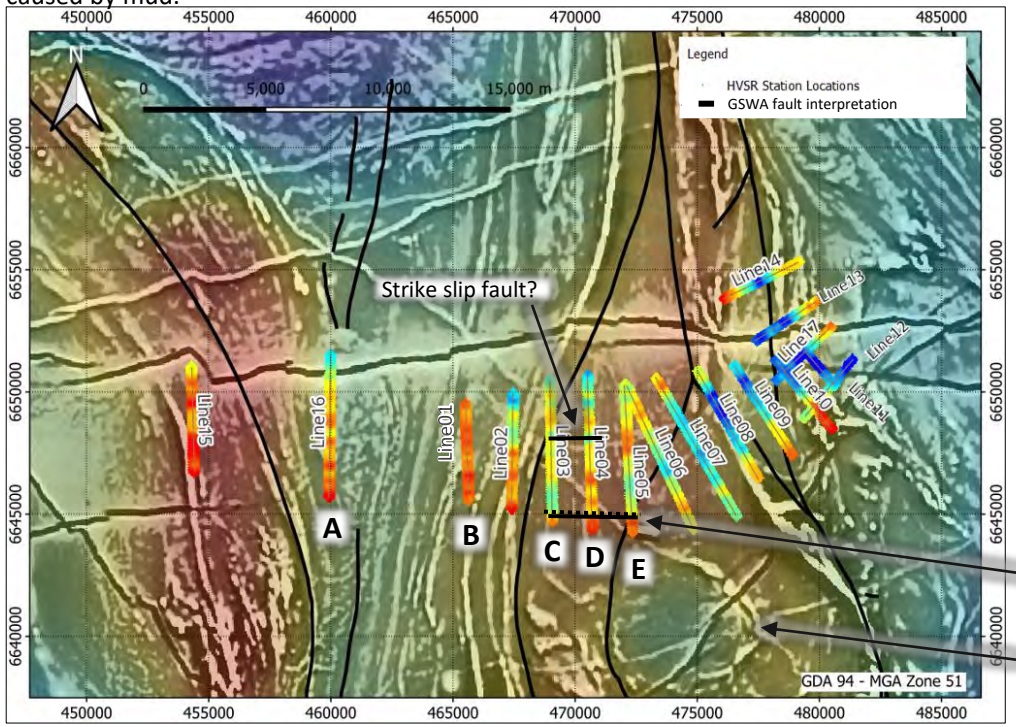
HVSR Survey Results 1/5



Example HVSR normalised amplitude cross-sections at central survey area with high level interpretation features. Elevations are referenced to SRTM data (30m cell size resolution). Survey line locations are shown on the map to the right.

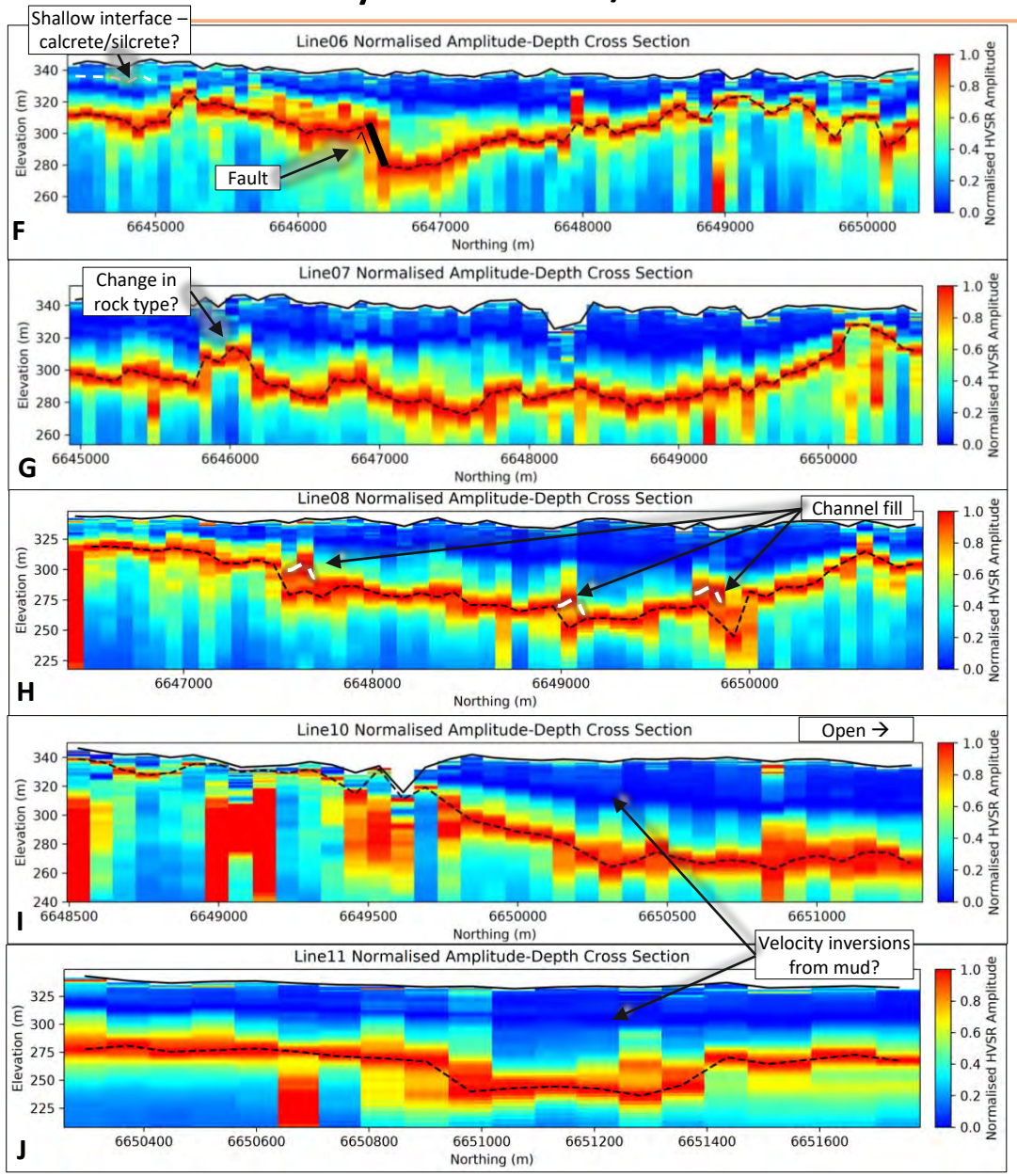
The Lake Rebecca passive seismic HVSR survey results from the northern survey area have successfully resolved an undulating acoustic bedrock impedance contrast interface response on all survey lines, and this layer has been plotted relative to the depth from land surface or as RL elevation for the interpreted acoustic bedrock sitting below softer sedimentary and regolith cover deposits. Calculated depths to acoustic bedrock range from approximately 1.5 m (outcrop/subcrop) to 97 m. When surface topography is taken into consideration, the highest elevations and thinnest cover are resolved on survey Line 14, and the lowest elevations and thickest cover are resolved on survey Line 11. In general, the shape and character of the resolved acoustic bedrock on all survey lines indicates a complex paleochannel system, and possibly U-shaped valleys formed by Permian glacial processes in deeper parts of the paleochannels.

Example normalised HVSR amplitude cross-sections of select survey lines from within the central part of the survey area are shown to the left and eastern part on the following slide. The main branches of an interpreted paleochannel axis are recognised by the large undulations in acoustic bedrock topography, which can vary between survey lines in both depth and width (see annotations on cross-sections to the left). Smaller scale undulations in the acoustic bedrock to the sides of the main paleochannel axes are also resolved and could represent channel terraces and tributaries, areas of confluence between converging paleochannel axis, and differential weathering depth caused by changes in bedrock lithology. The paleotopographic surface has a variable nature which could be a reflection of the flow regime or potentially reflect a saw-tooth weathering pattern of the bedrock interface associated with bedrock lithologies, faulting, zones of altered bedrock, or weathering along geological structures (see examples Line16 and Line01, A and B to the left). Dark blue layers could be caused by mud.



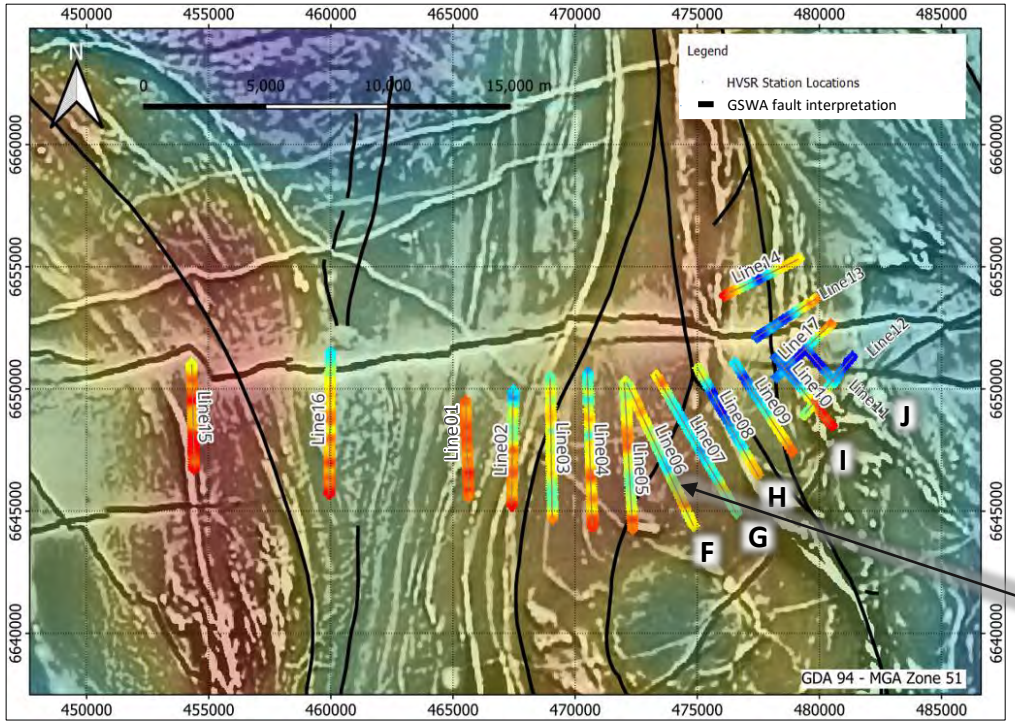
Map showing northern survey area passive seismic station locations (fine black dots) and GSWA fault interpretation line work, overlain on a filtered state wide gravity (low resolution) anomaly pseudocolor image semi-transparent on top of a filtered low resolution state wide magnetic anomaly greyscale image, which is overlain by a passive seismic bedrock elevation RL (m) image along survey lines. A good correlation is observed between trends of magnetic features and structures in the bedrock topography resolved by the HVSR survey.

HVSR Survey Results 2/5



Shallower acoustic contrast interfaces are also observed on many of the HVSR corss-sections (semi continuous white dashed lines on cross-sections to the left and previous slide), and these shallow layers likely represent localised acoustic impedance contrasts in the sedimentary and regolith cover sequence caused by calcrete, silcrete and hard pan for shallow features, and conglomerates or gravel channel fill for the deeper acoustic impedance contrasts immediately above the main HVSR response (see survey Lines 08 and 11, H and J, for example to the left). Some possible velocity inversions (deep blue layers) could be caused by soft mud in the cover sequence.

Large offsets in the interpreted acoustic bedrock topography between neighbouring stations along the traverse likely indicate the presence of normal faulting formed by Permian to recent neotectonics, likely Miocene.



Map showing northern survey area passive seismic station locations (fine black dots) and GSWA fault interpretation line work, overlain on a filtered state wide gravity (low resolution) anomaly pseudocolor image semi-transparent on top of a filtered low resolution state wide magnetic anomaly greyscale image, which is overlain by a passive seismic bedrock elevation RL (m) image along survey lines. A good correlation is observed between trends of magnetic features and structures in the bedrock topography resolved by the HVSR survey.

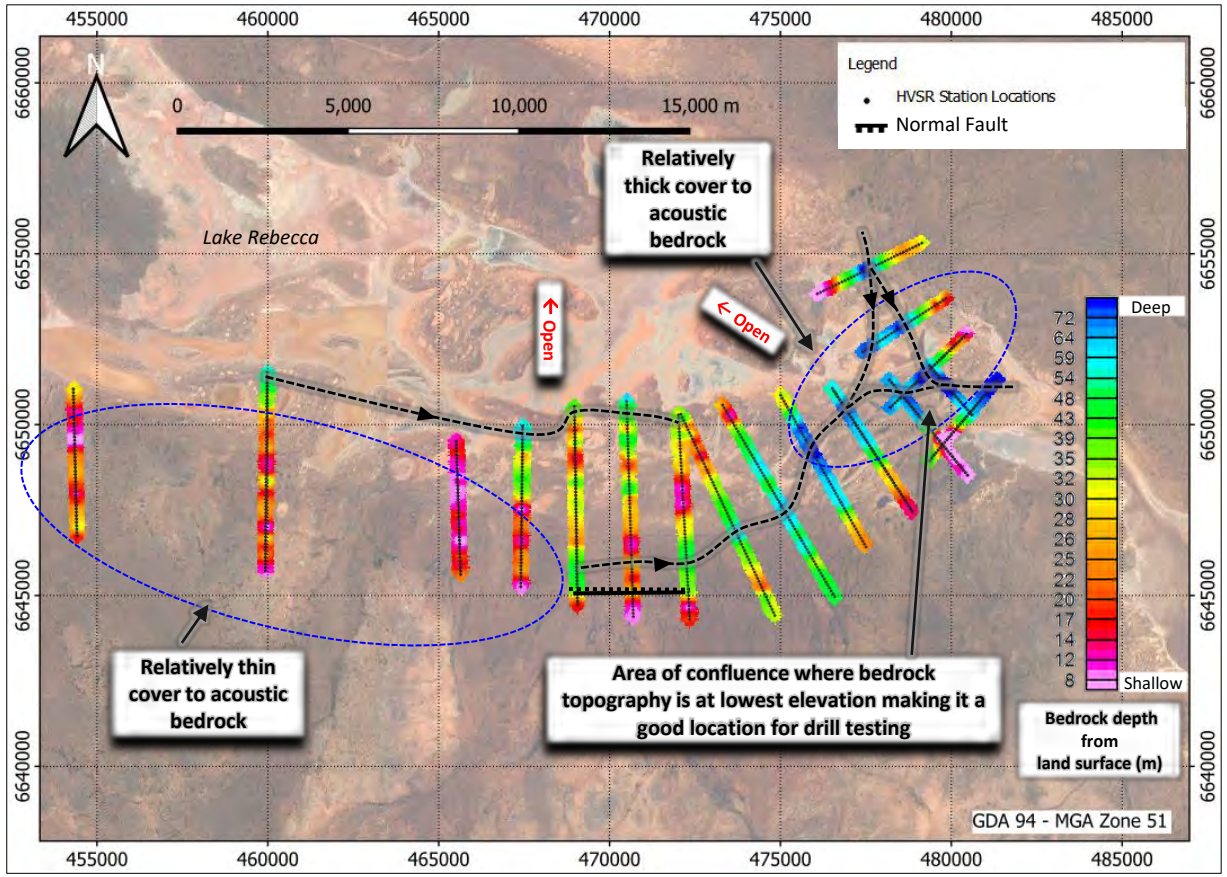
Fault observerd in example cross-section of survey Line06 corresponds with state wide fault interpretations

Example HVSR normalised amplitude cross-sections of eastern survey area with high level interpretation features.
Elevations are referenced to SRTM data (30m cell size resolution). Survey line locations are shown on the map to the right.

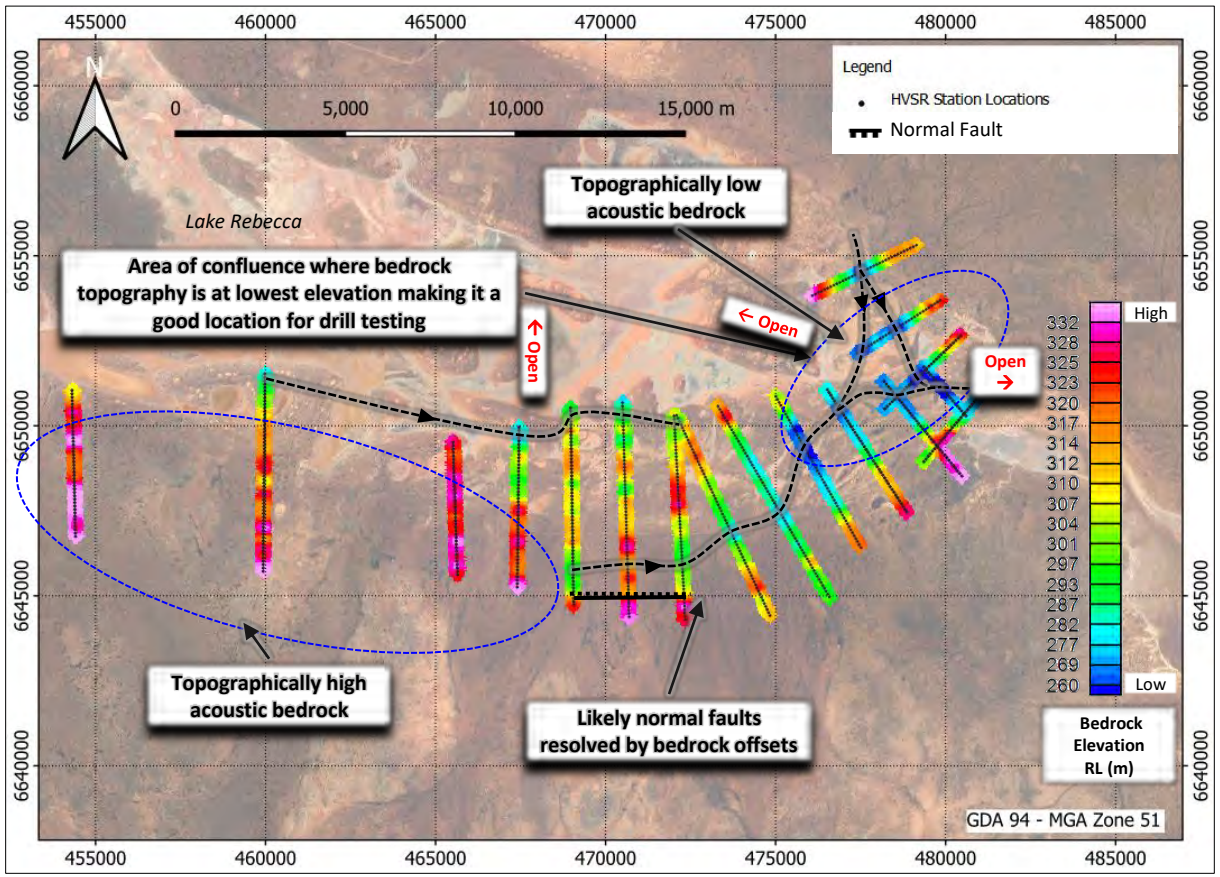
HVSR Survey Results 3/5

The map view images below show colour images of HVSR derived acoustic bedrock results as depth below ground surface (below left) and as bedrock topography (below right), with interpretation line work on top. The colour stretch for the depth from land surface is reversed such that hotter colors indicate thinner cover and cooler colors indicate thicker cover. For the bedrock topography map, the hotter colours indicate higher RL values and cooler colours reflect lower RL values. Both images are overlain on a Google satellite image for reference.

These maps have helped to highlight a paleochannel system deepening in the east, but a deep paleochannel could also sit under Lake Rebecca to the north of survey lines in the west and centrally which shown deep bedrock at the northern end of the survey lines. The passive seismic survey results provides RMS and AQ2 with an indication of the size, shape, meander and location of the paleochannel system and paleo water flow direction within the survey area, which can subsequently be used for ground water exploration by helping to generate drill targets and help to generate water volume estimations when used in conjunction with other hydrogeological datasets. Whilst these results are very encouraging, the results presented here should be considered as broad-spaced due to the wide survey line spacings, and further HVSR surveying with updated drilling information to constrain velocity analysis should be considered. Additional HVSR surveying around the deepest paleochannel sections (lowest elevation and thickest cover) as infilling between existing survey lines may be considered to help map out the areas of interest in greater detail if required, and extension survey lines could be considered to close off open zones of paleochannel axes.



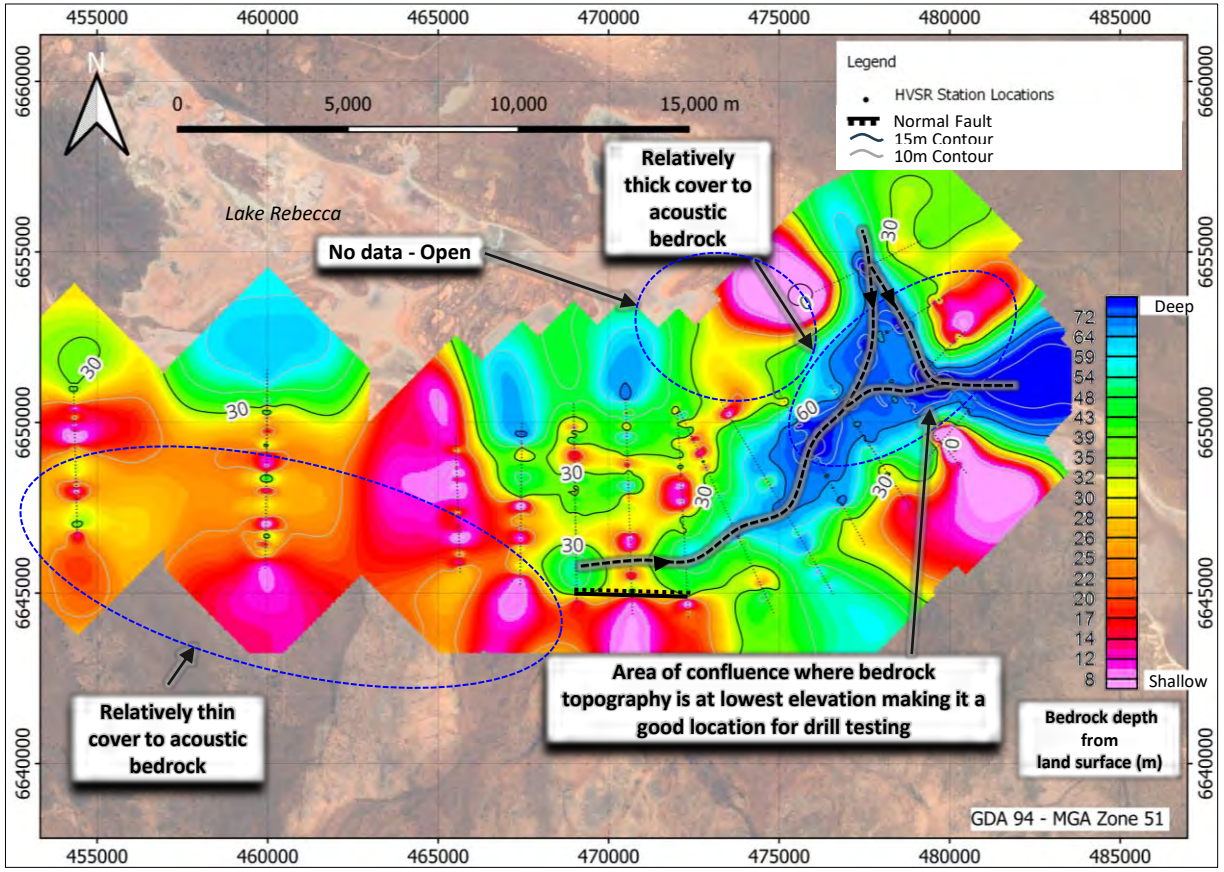
Map showing passive seismic station locations (black dots), image of calculated depth to acoustic bedrock from land surface surrounding survey lines with reversed colour stretch so that deeper bedrock is cooler colours, overlain on a Google Earth satellite image.



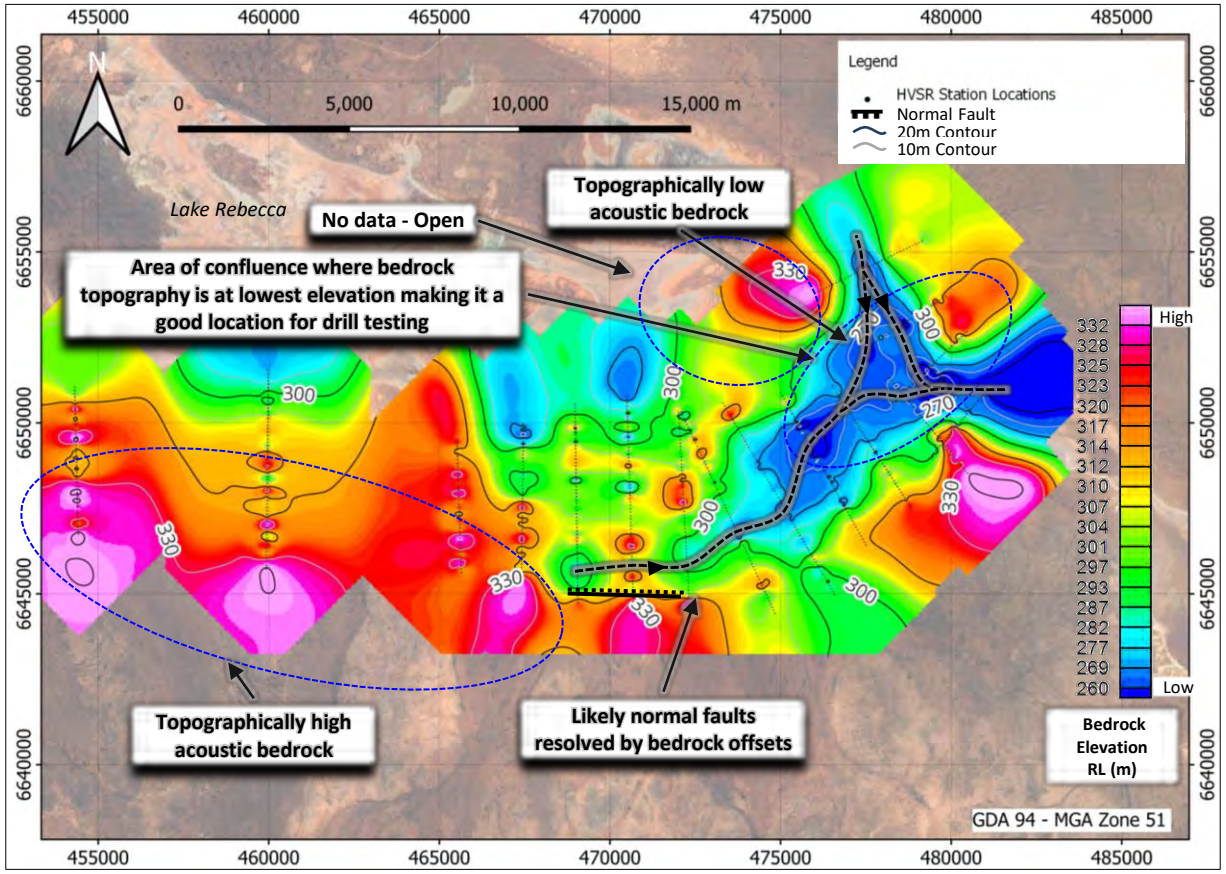
Map showing passive seismic station locations (black dots), image of calculated bedrock elevation RL (m) surrounding survey lines, overlain on a Google Earth satellite image.

HVSR Survey Results 4/5

Similar to the previous slide, the map view images below show the HVSR derived acoustic bedrock results as images of depth from ground surface (below left) and as bedrock topography (below right) with interpretation line work. However, the gridding parameters for these images has been broadened to allow a larger interpolation/extrapolation envelope of 3,000 m around the HVSR survey lines. As a result, the large gaps arising from wide spaced survey lines have been filled with gridded data. However, it is important to note that as a result of the large interpolation/extrapolation distances, the reliability of the interpolated/extrapolated data is dramatically diminished and these images are therefore intended for visual purposes only. For example, the circled area below indicates shallower bedrock in an area where there is no HVSR data, and actual bedrock could be quite deep in this area.



Map showing passive seismic station locations (fine black dots), image of gridded calculated depth to acoustic bedrock from land surface with reversed colour stretch, overlain on a Google Earth satellite image.



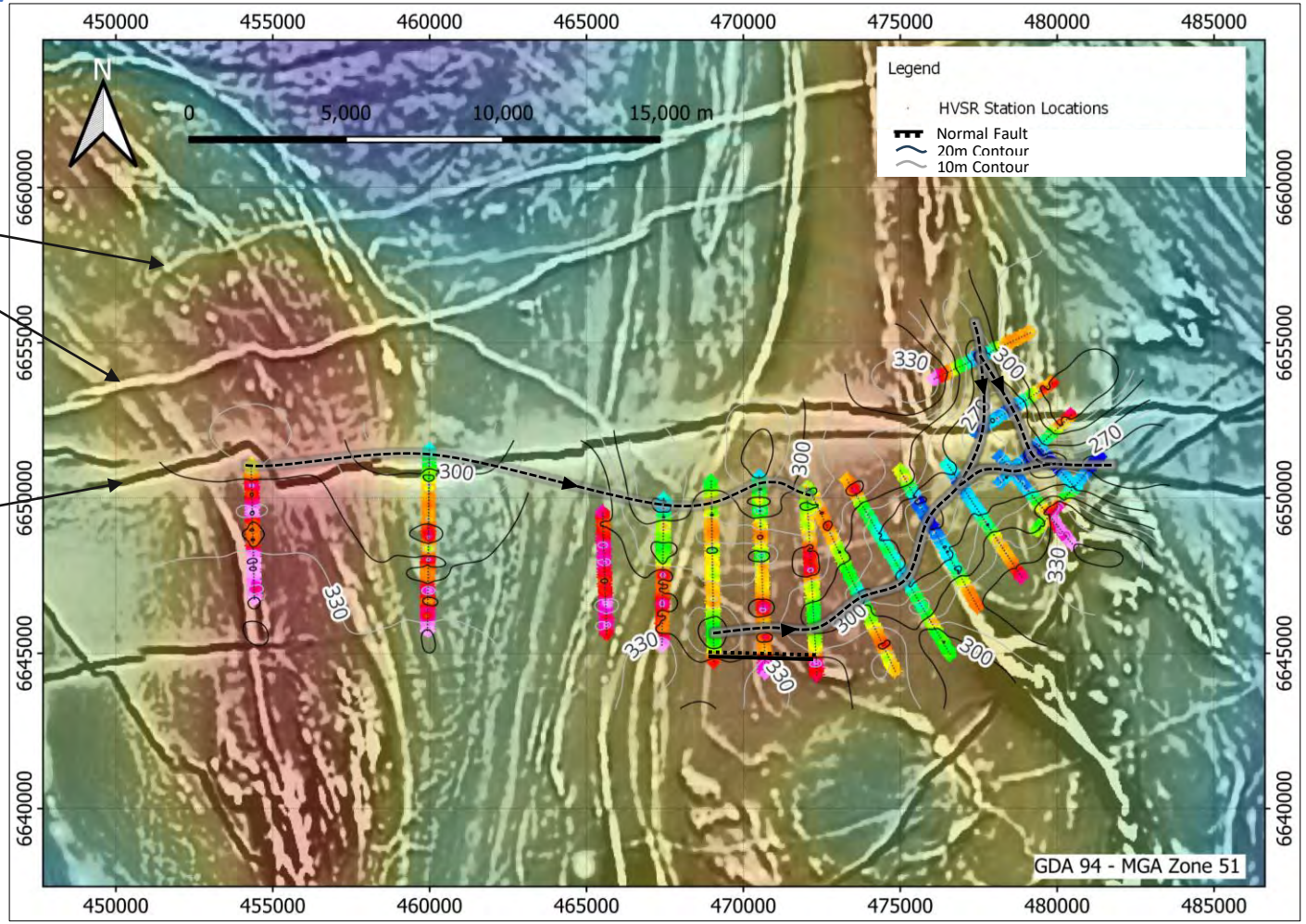
Map showing passive seismic station locations (fine black dots), image of gridded calculated bedrock elevation RL (m), overlain on a Google Earth satellite image.

HVSR Survey Results 5/5

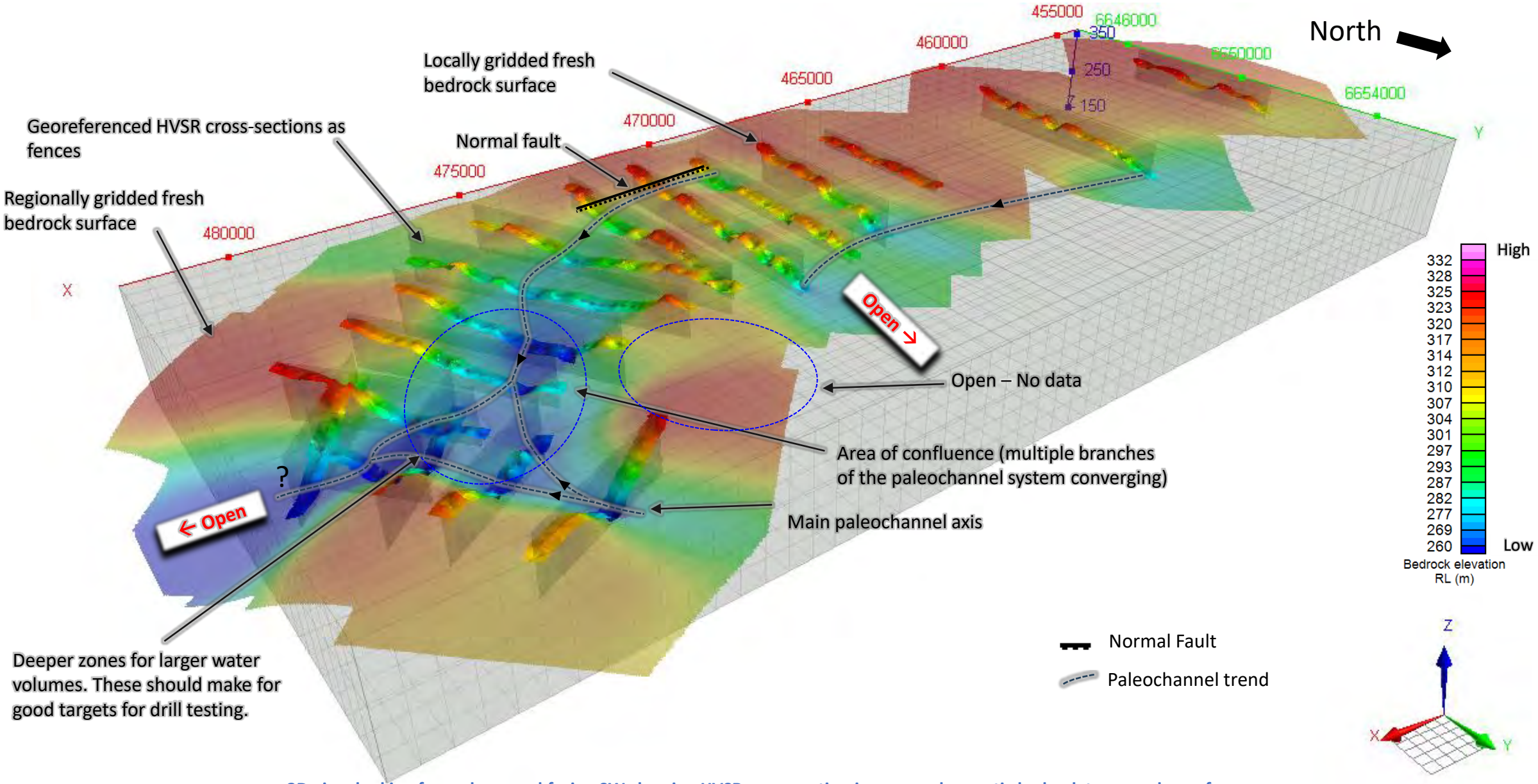
Map showing northern survey area passive seismic station locations (fine black dots) and interpretation line work, overlain on a filtered state wide gravity (low resolution) anomaly pseudocolor image semi-transparent on top of a filtered low resolution state wide magnetic anomaly greyscale image, which is overlain by a passive seismic bedrock elevation RL (m) image, with broad scale bedrock elevation contours generated using regional gridding. A good correlation is observed between trends of magnetic features and structures in the Archean greenstone and granite-gneiss bedrock and the HVSR surveyed deep paleochannel zones.

Proterozoic mafic dykes

Proterozoic dyke cross-cutting everything and reversely magnetised



3D Visualisation of Passive Seismic HVSR Survey Results



3D view looking from above and facing SW showing HVSR cross-section images and acoustic bedrock topography surfaces surrounding survey lines and interpolated between survey lines in RL elevation, with interpretation line work.

Conclusions and Recommendations

Passive seismic HVSR surveying at the northern survey area of the RMS Lake Rebecca Gold Project area has delivered excellent results showing how this geophysical method was successful for resolving and mapping the subsurface location, geometry and preliminary calculated depths of an underlaying paleochannel drainage system. These survey results confirm the Tromino® HVSR passive seismic method as a quick, easy and affordable method for detecting acoustic bedrock, allowing for mapping of subsurface paleodrainage and geologically young normal faults in this geological setting.

Besides mapping the broad geometry of paleochannel topography and its tributary like features, by detecting the top of the hard and fresh bedrock sitting below soft regolith and sedimentary cover deposits, the passive seismic HVSR survey was also successful for mapping areas containing possible small and large vertical offsets of the acoustic bedrock which are interpreted to represent Cainozoic neotectonic faulting. Some U-shaped paleochannels in the deeper channel systems were observed and these may have been initially carved out by Permian glacial processes. Higher frequency/shallower HVSR layer responses, and potential velocity inversion layers (mud?), were also detected on multiple survey lines possibly caused by stratigraphic layering within the paleochannel fill deposits (as noted in Survey Line 08 and 11 on Slide 10) to possibly represent deeper conglomerate and shallower interfaces possibly caused by calcrete, silcrete, sands-gravels and other hard layers within the regolith, including possible mud layers (see also Survey Line05 on Slide 9).

The passive seismic HVSR survey data were planned by AQ2 and RMS, and then acquired by XM Logistics field staff from late April to early July 2023 initially using 8x Tromino® TEB seismometers, for a total of 793 HVSR station recordings acquired along 17 widely spaced survey lines. The majority of the final HVSR data were considered to be of excellent quality, with generally mid-to-high amplitude and low-to-moderate frequency HVSR bedrock peak frequency responses observed. Minimal data editing was required to reduce noise and standard deviation, and to improve coherent HVSR peaks and layer responses, with only a handful of HVSR stations requiring repeating due to high levels of noise which could not be fixed by data editing. Final HVSR survey data were organised into a database, edited, processed and depth converted using an assumed constant average V_S of 400 m/s to produce normalised and raw HVSR amplitude cross-sections for all survey transects.

Depth discrepancies between future drilling and the results generated during this study are likely to exist, because fresh bedrock drilling information for depth calibration was not available. ResPot recommends revisiting the depth calibration and conversion once drilling intercepting fresh bedrock proximal to good quality HVSR station recordings becomes available.

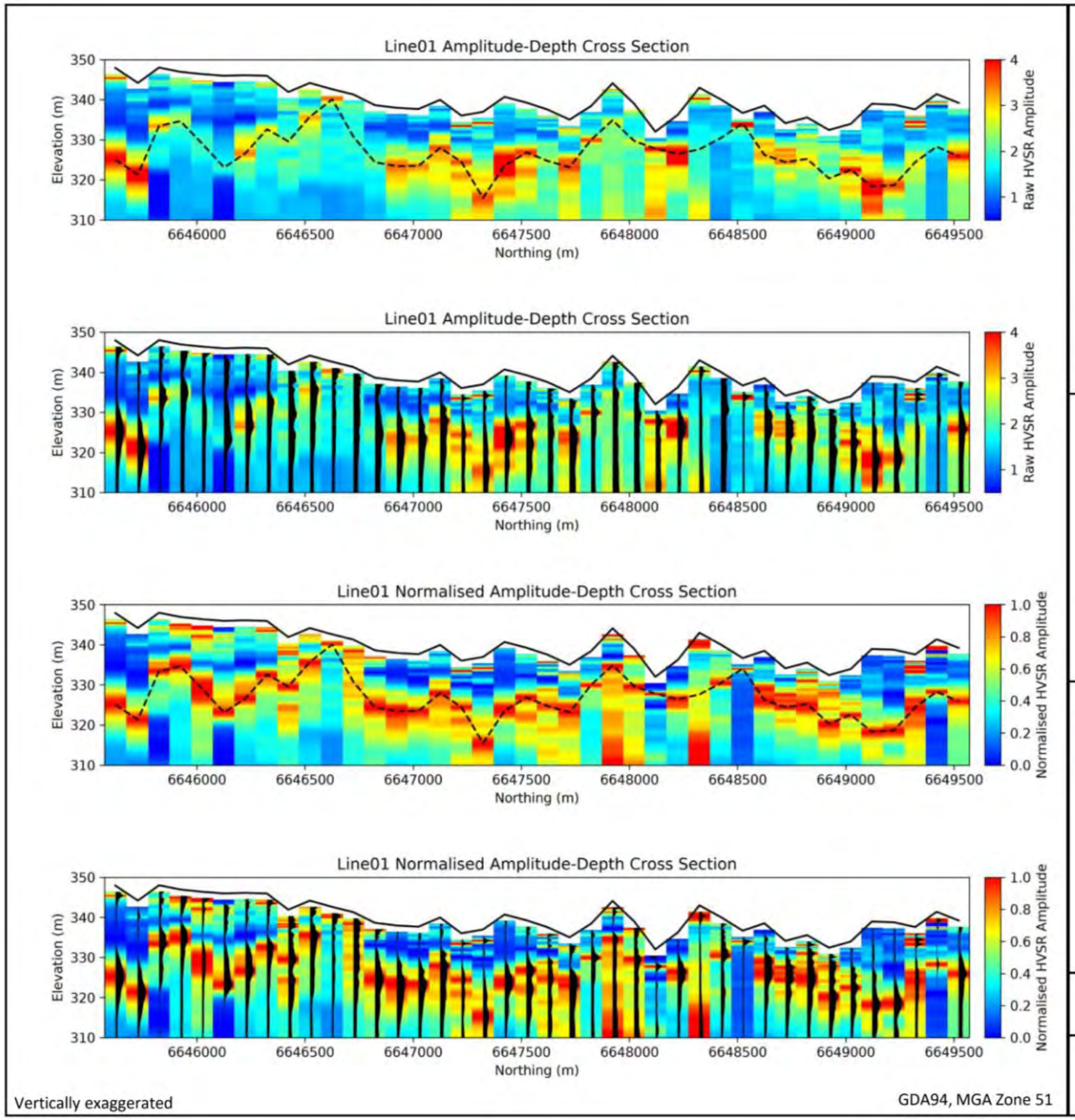
The calculated depths to the acoustic bedrock range from 1.5 m to 97 m, with the deepest resolved acoustic bedrock (when surface topography is considered) located at Station 11014 on Survey Line 11. This should be a good target location for RMS and AQ2 to consider drillhole testing of a deep paleochannel axis. Final bedrock depths from this test drillhole may also be fed back into depth calibration to update calculated HVSR bedrock depths. Calibrating the depth-conversion to shallower HVSR responses, such as calcrete or mud interfaces (etc.), may also allow RMS and AQ2 to estimate volumes of possible shallow aquifer layers between the interpreted HVSR layer interfaces.

Further value from these passive seismic results may be attained by integrating them with other geospatial datasets, like high resolution airborne magnetics, detailed gravity and airborne electromagnetics, to aid subsurface interpretations of the project area regolith and geology. ResPot recommends additional HVSR surveying to close off the interpreted open paleochannels on ends of survey lines and to infill between existing survey lines in areas of interest to provide more subsurface detail and improve spatial resolution surrounding drilling which may allow for better groundwater targeting and aquifer management.

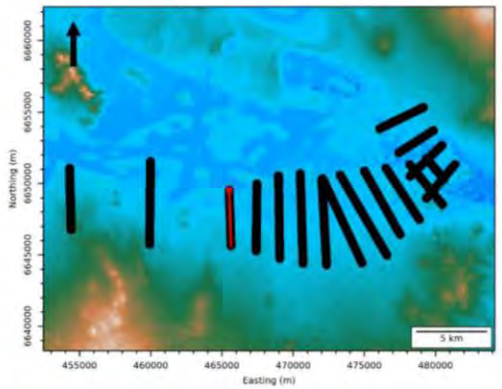
References

Yavuz, I. 2024, Passive Seismic HVSR Surveying, Data QA/QC, Editing, Processing, Preliminary Velocity Analysis and Results, Southern Survey Area, Rebecca Gold Project, Western Australia. Unpublished report for REM, 40pp.

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

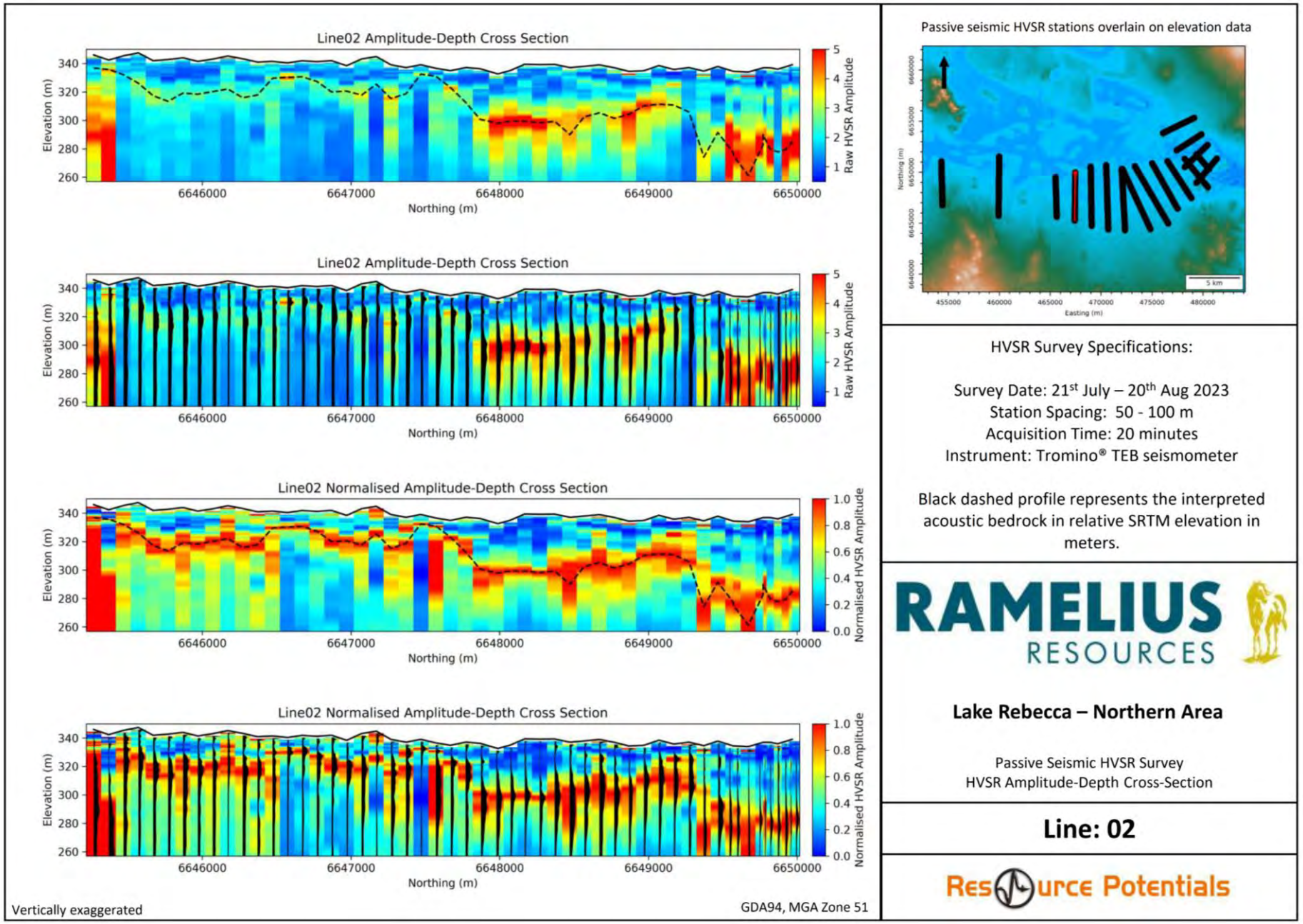
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 01

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data

HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

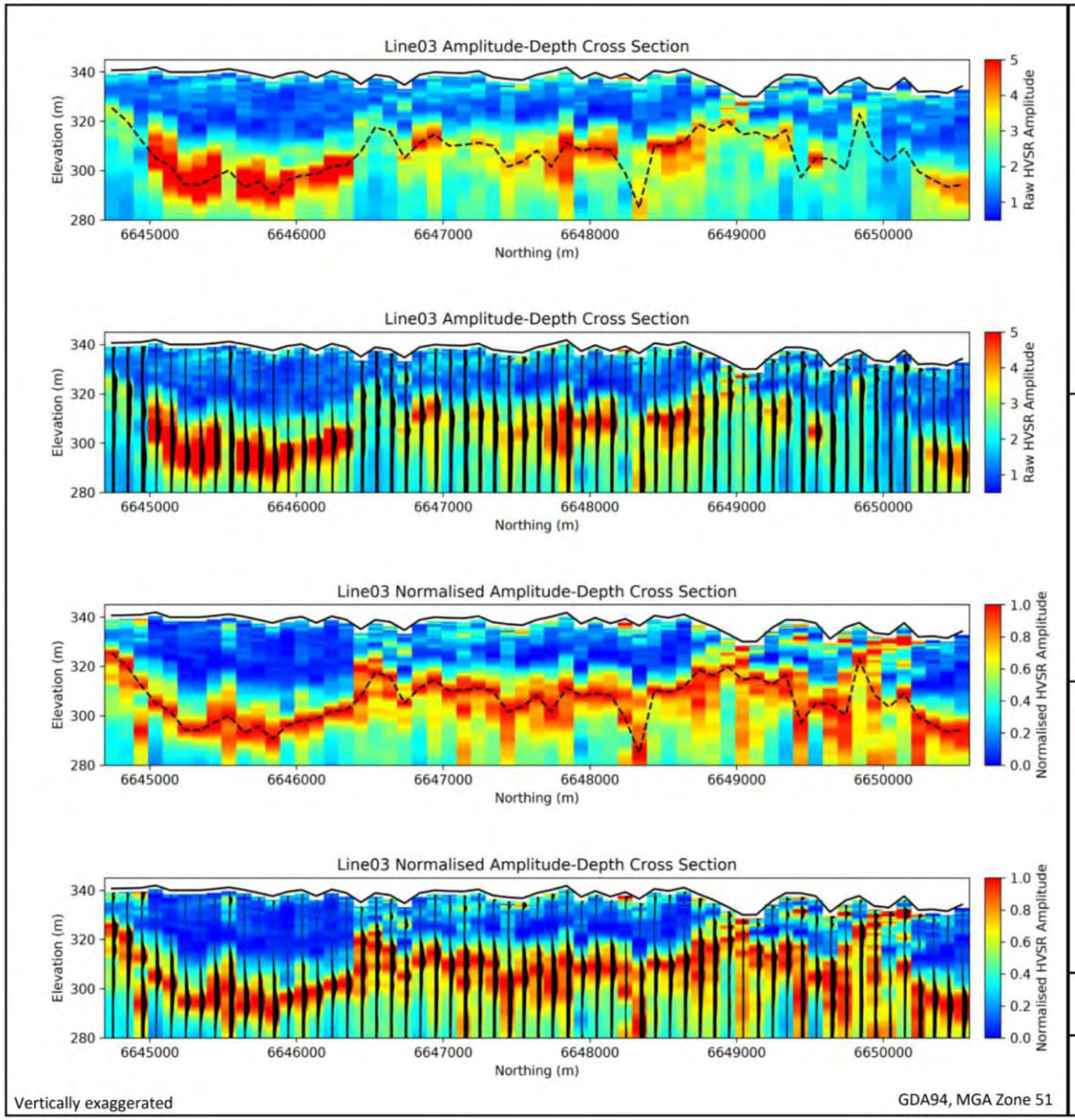
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

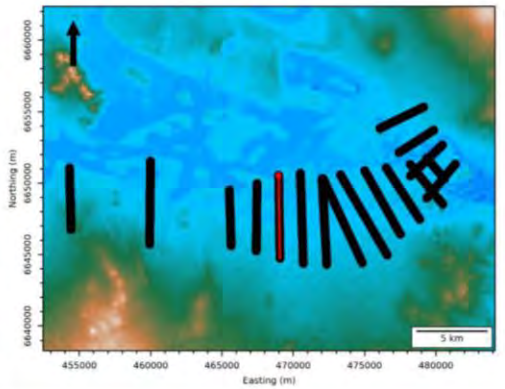
Line: 02

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

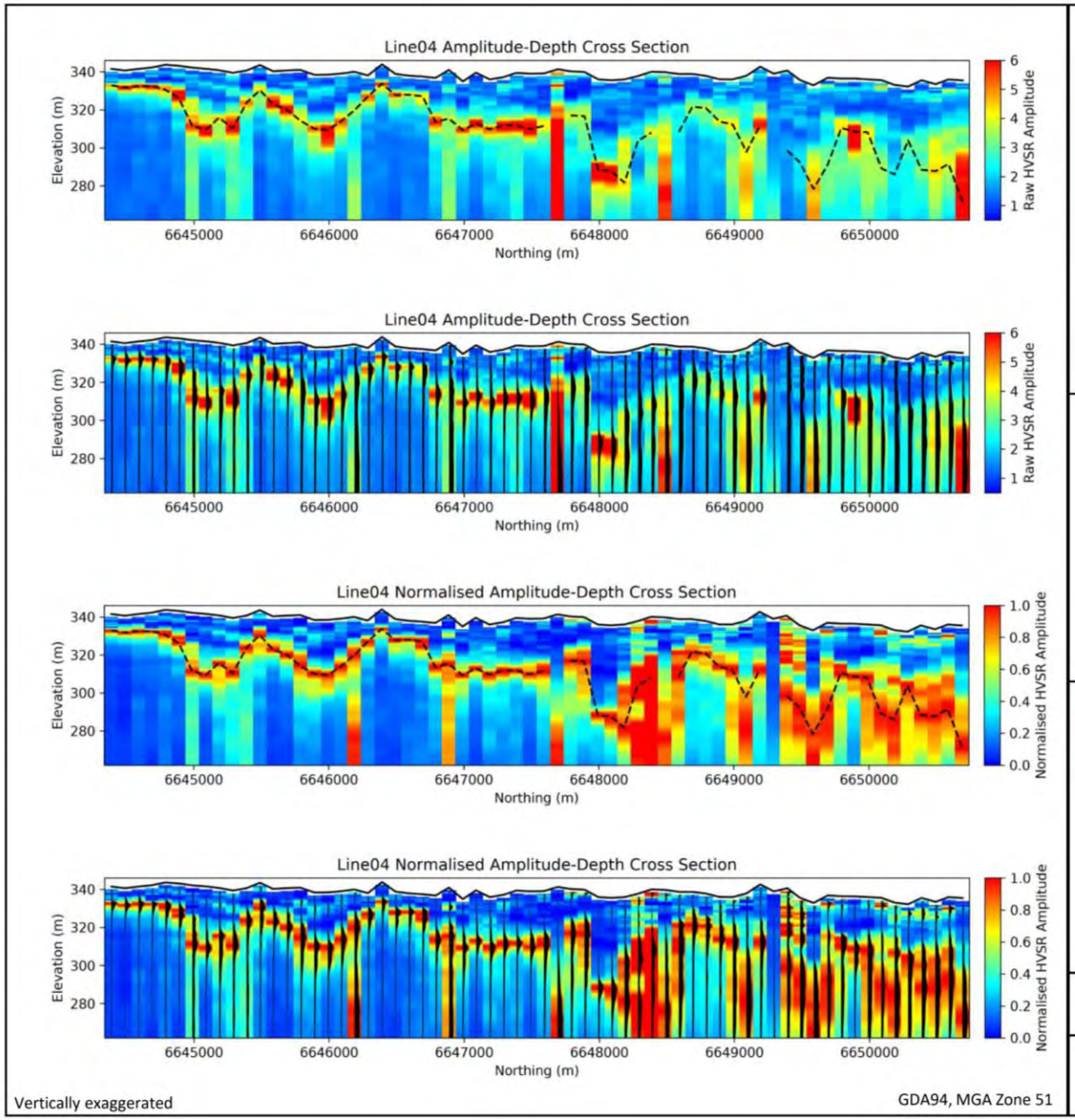
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

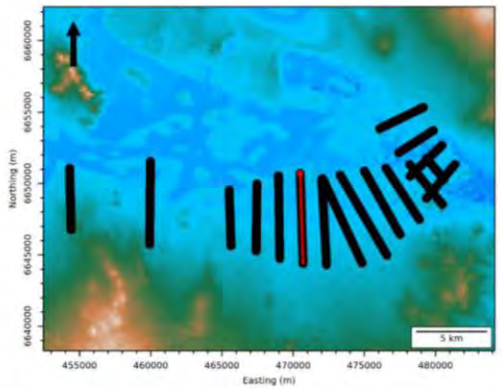
Line: 03

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

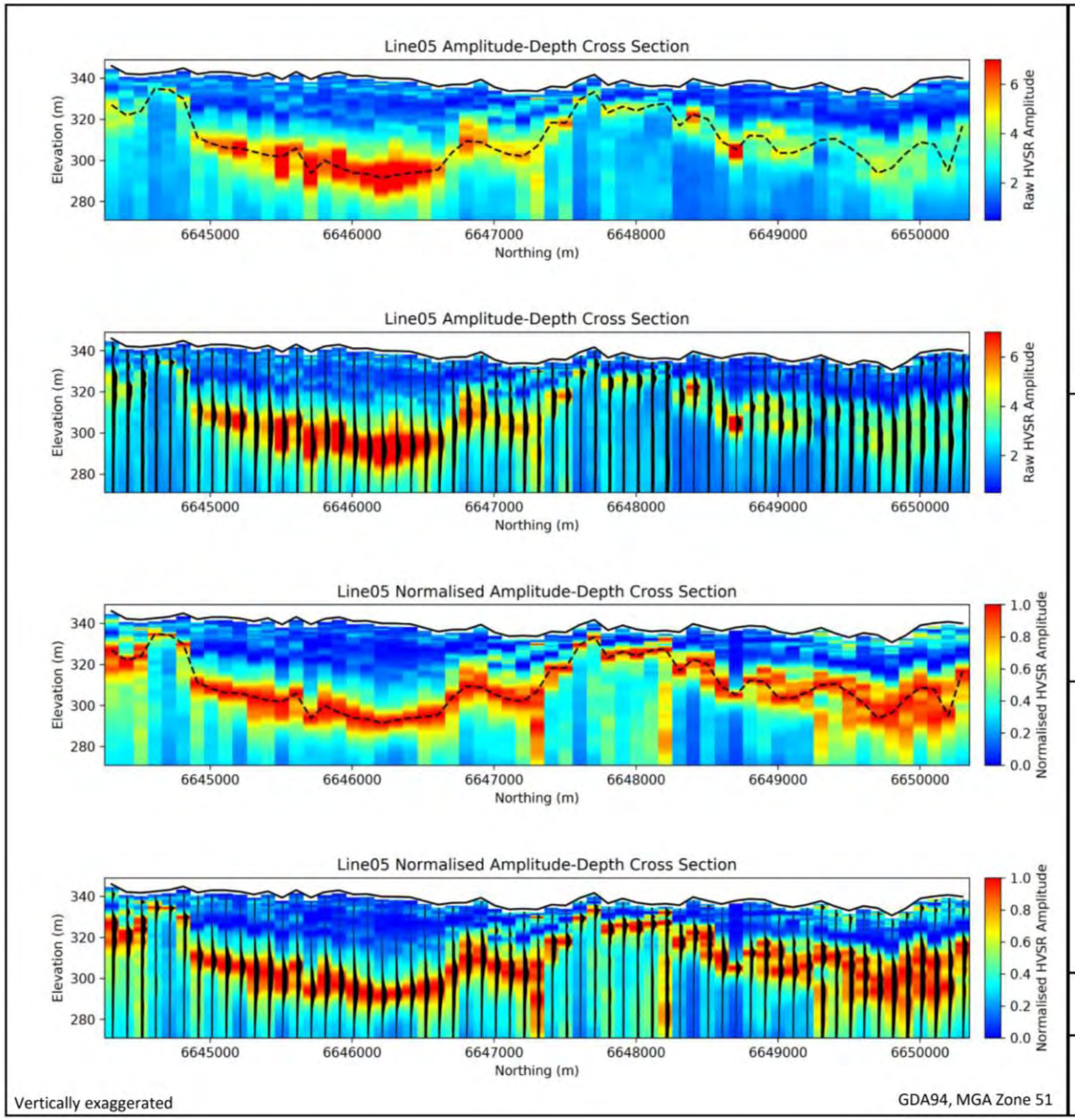
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

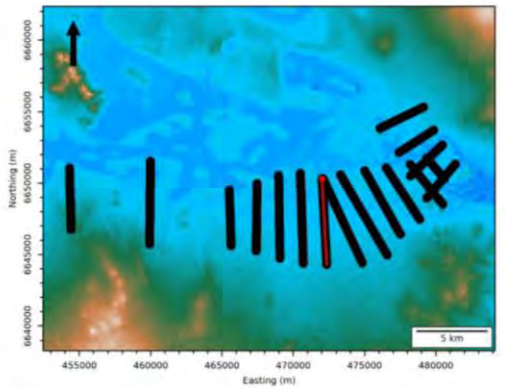
Line: 04

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

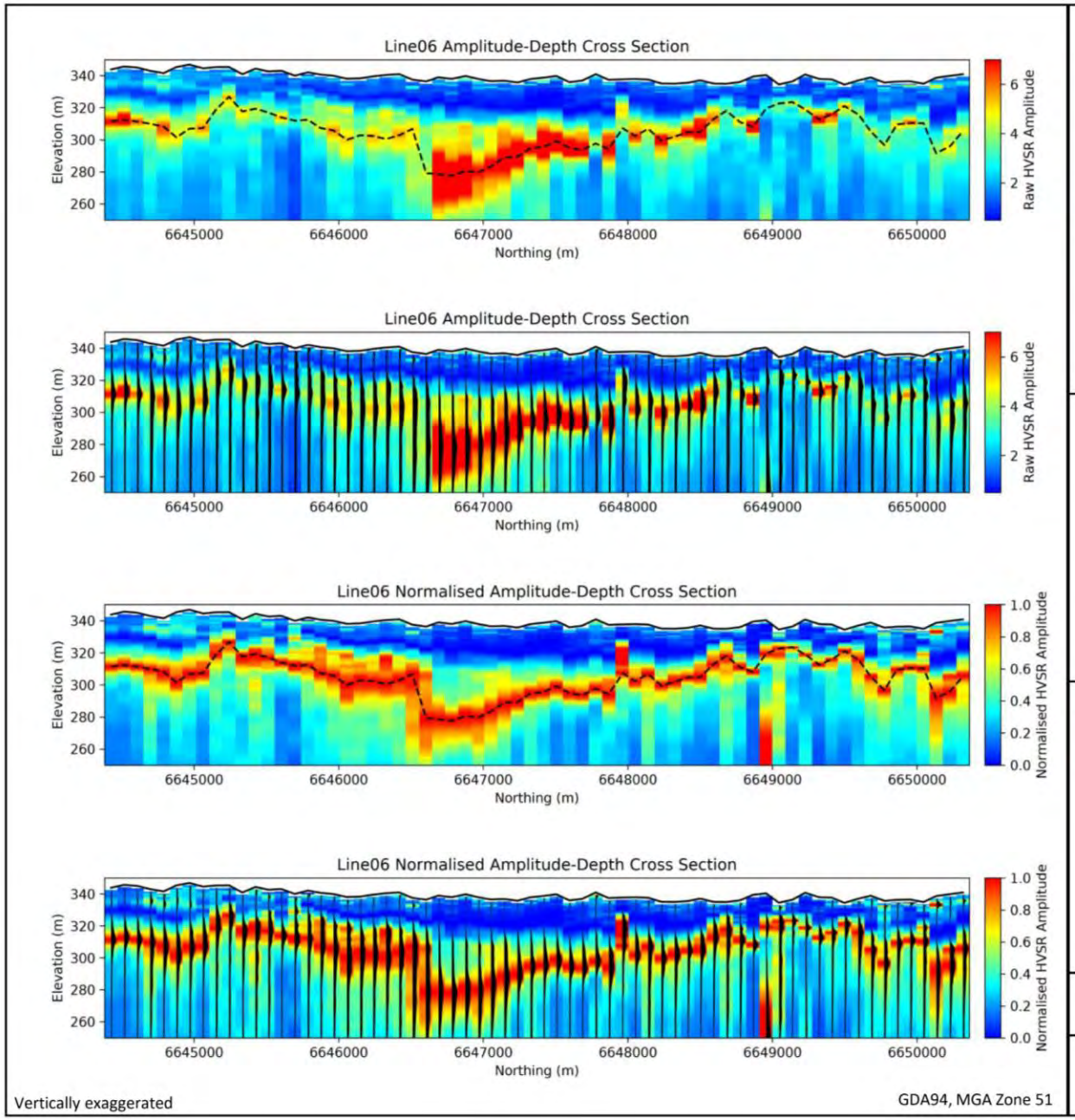
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

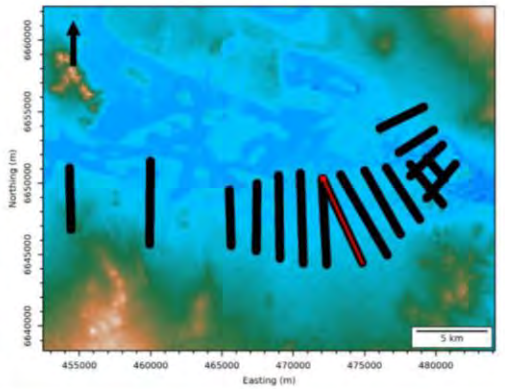
Line: 05

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

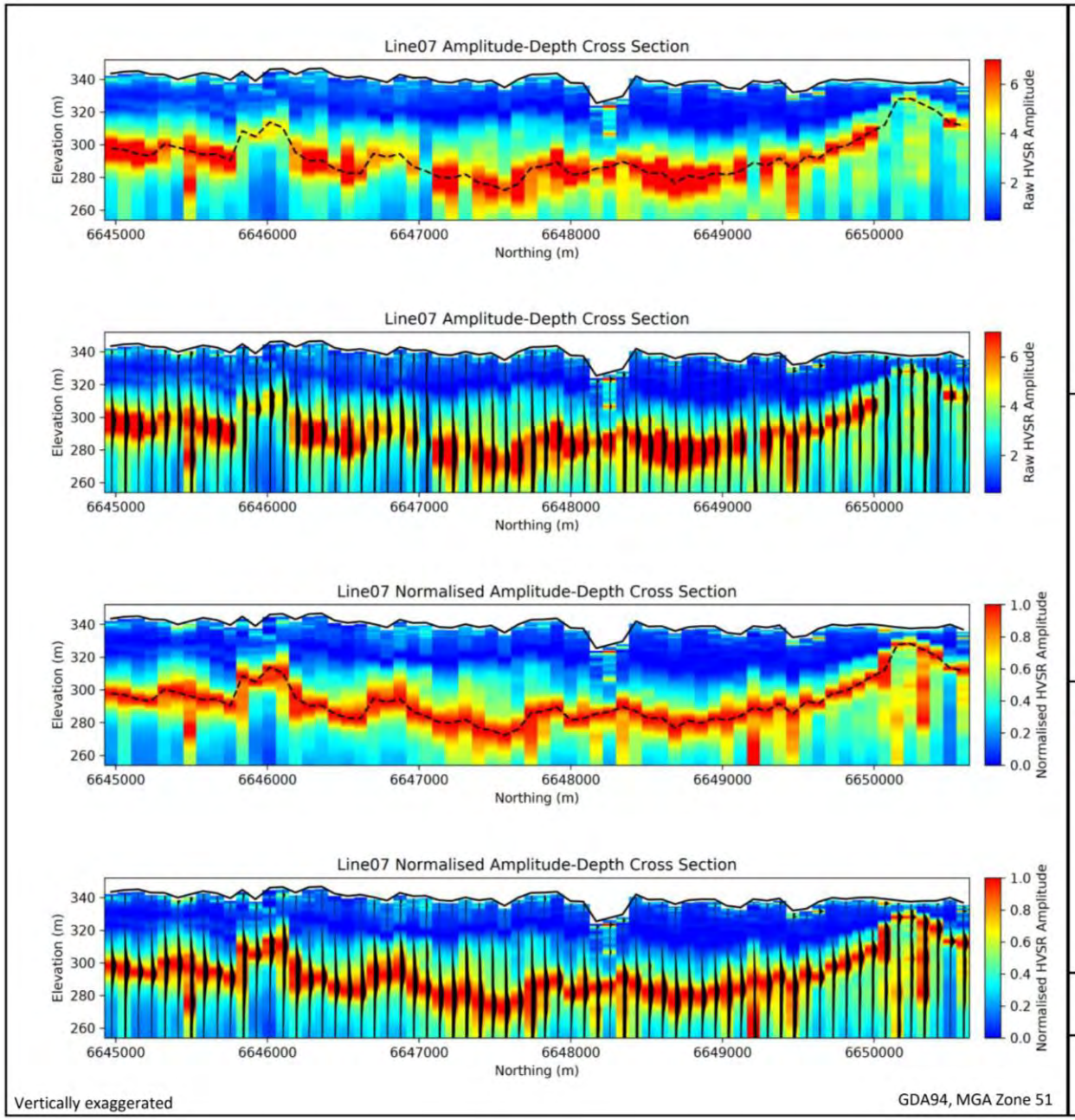
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

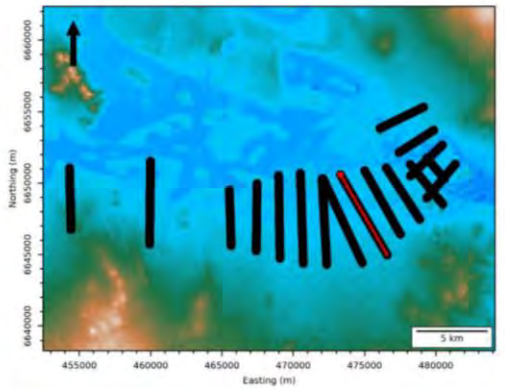
Line: 06

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

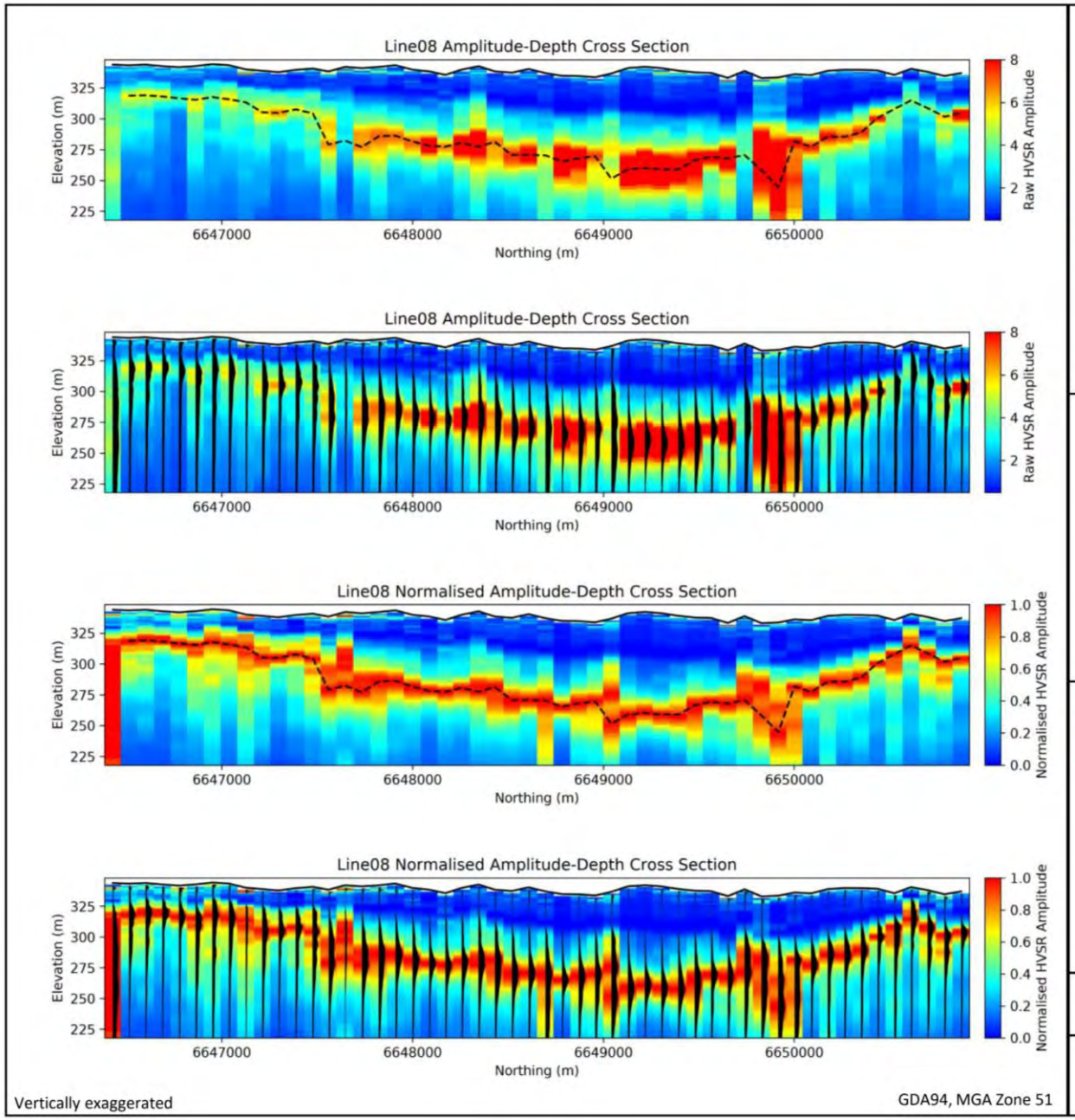
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

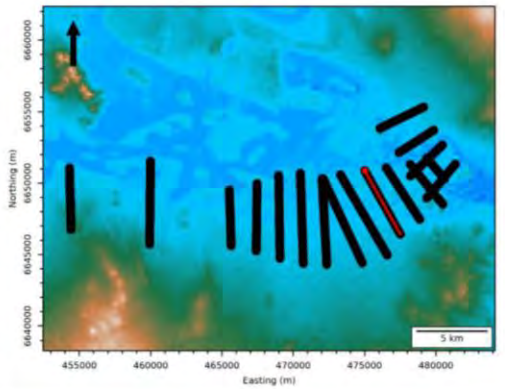
Line: 07

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

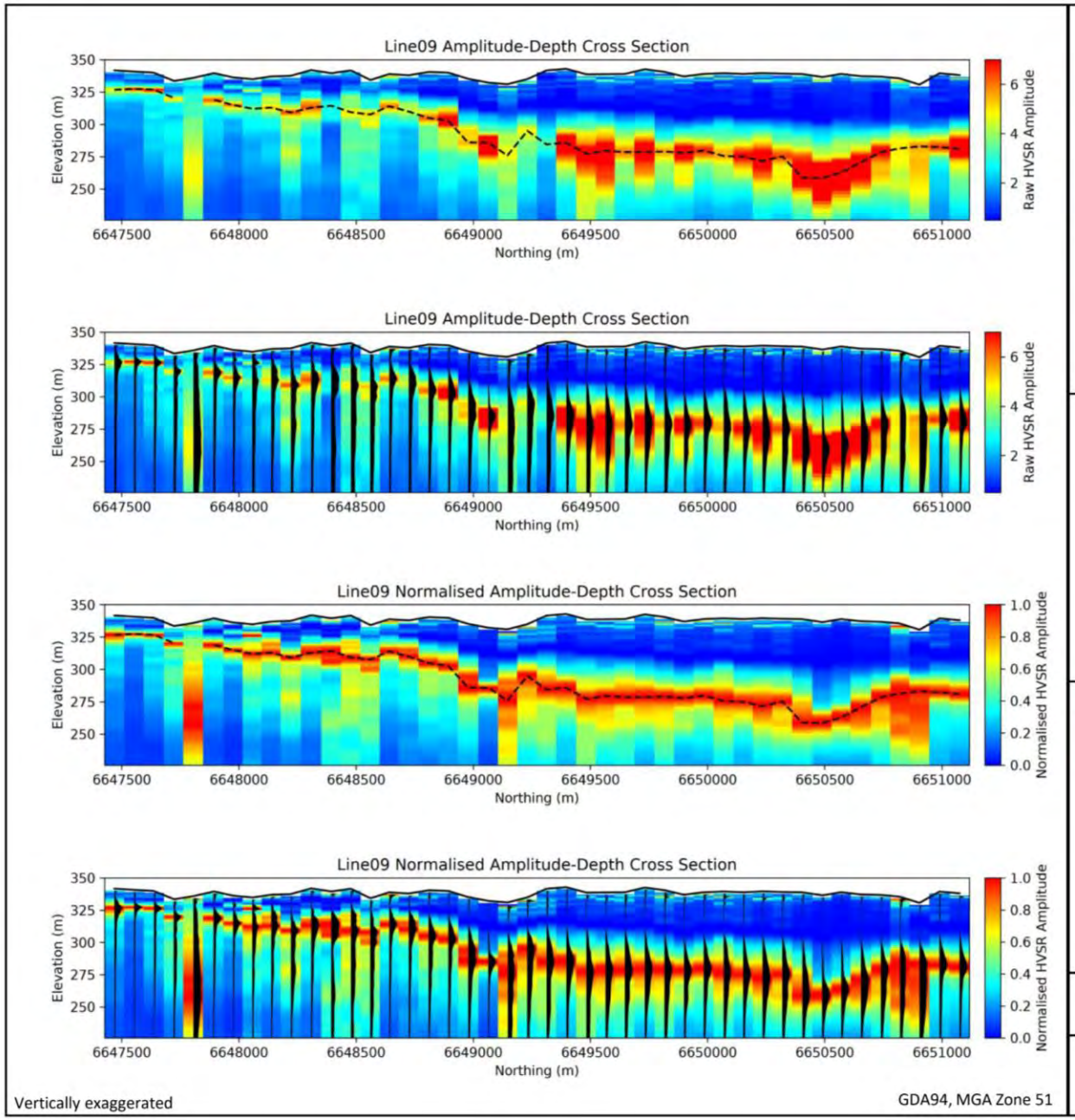
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

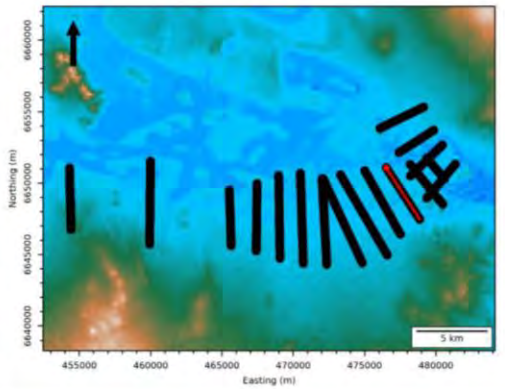
Line: 08

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

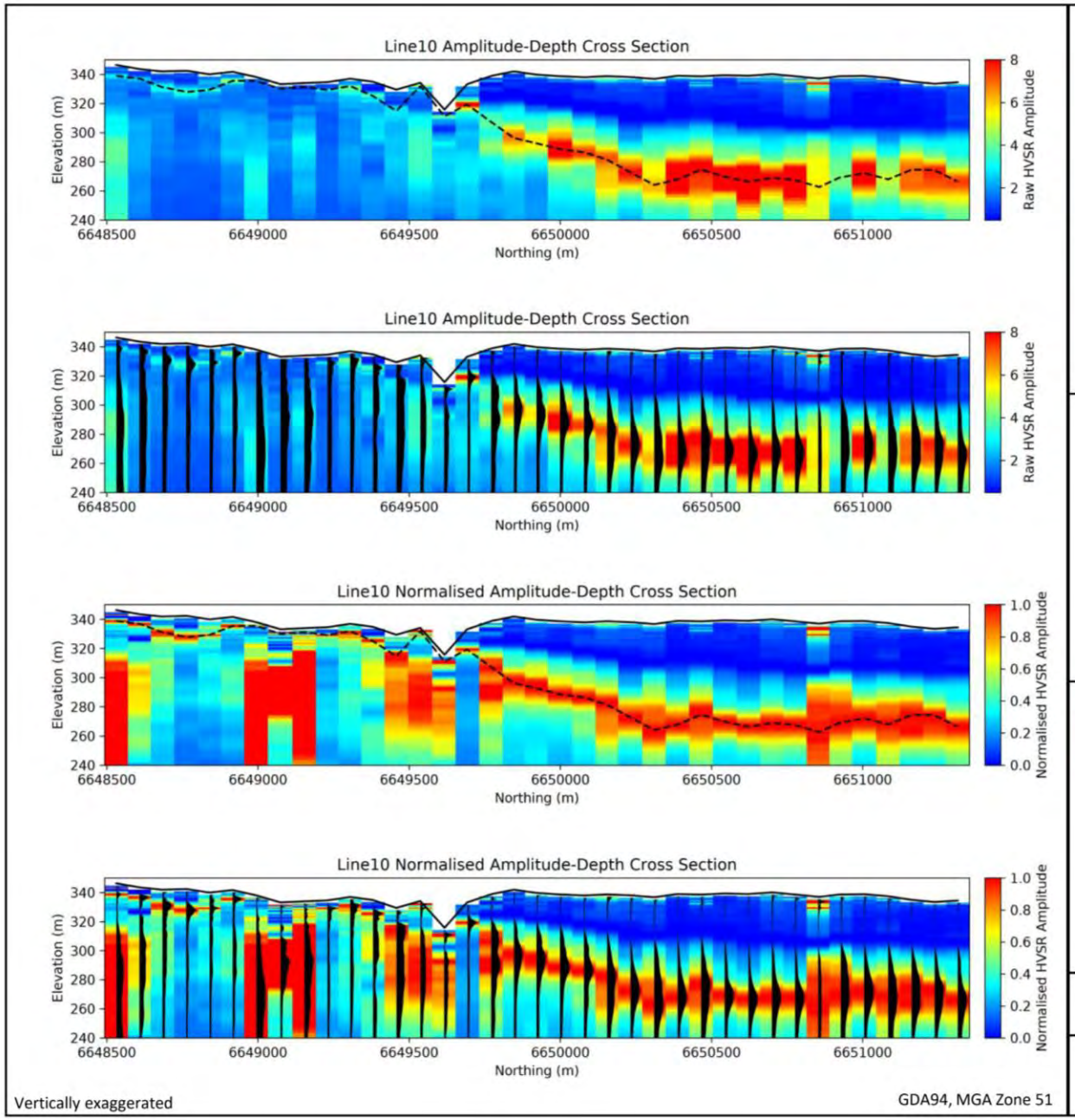
RAMELIUS RESOURCES

Lake Rebecca – Northern Area

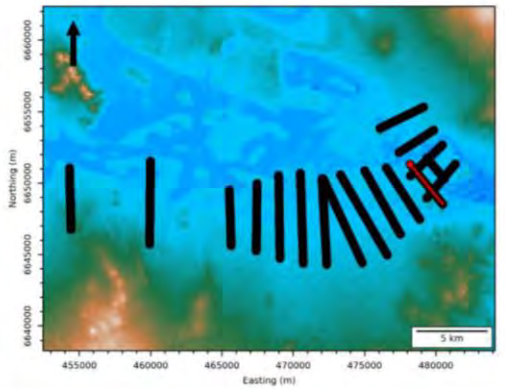
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 09

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

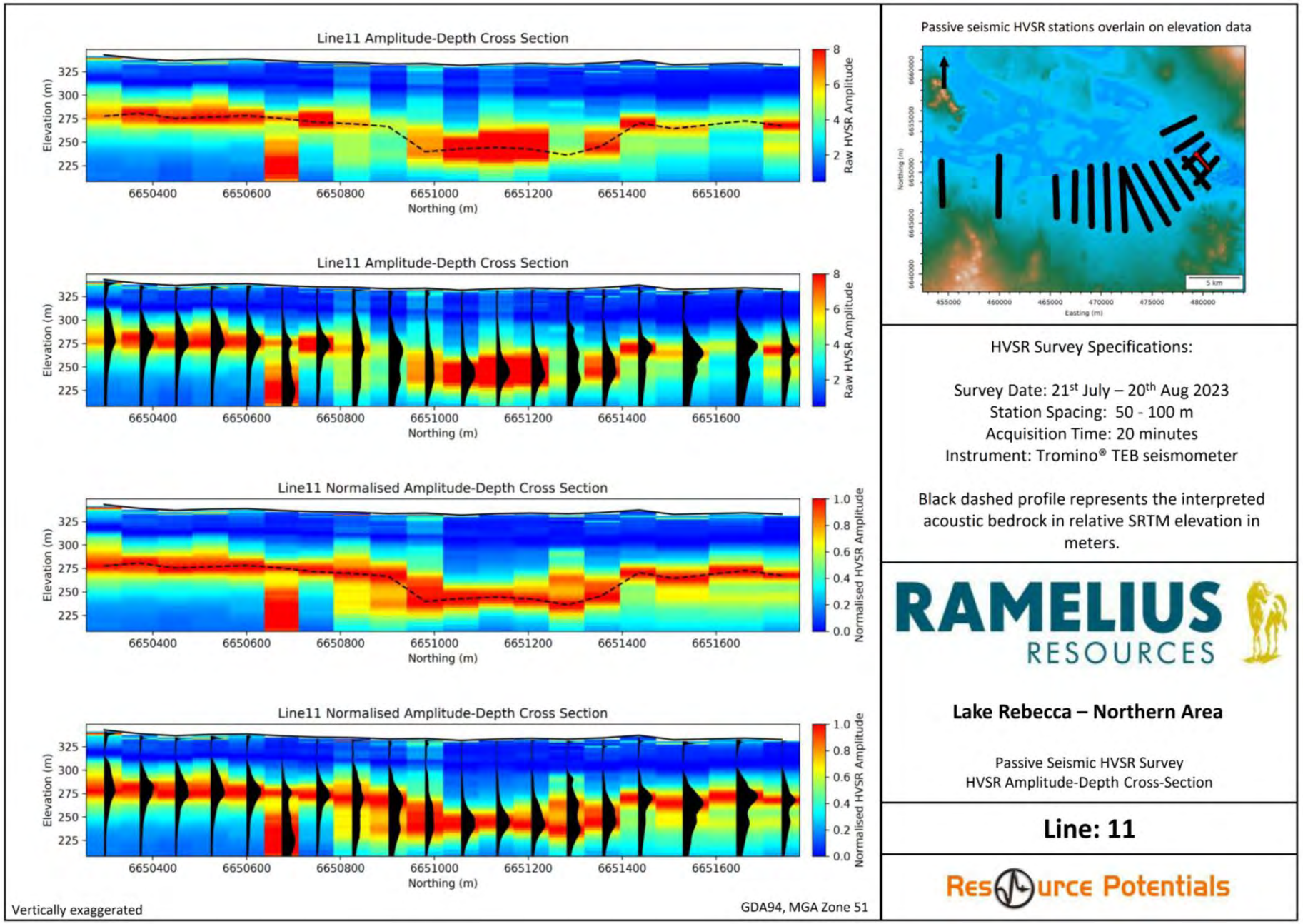
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 10

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data

HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

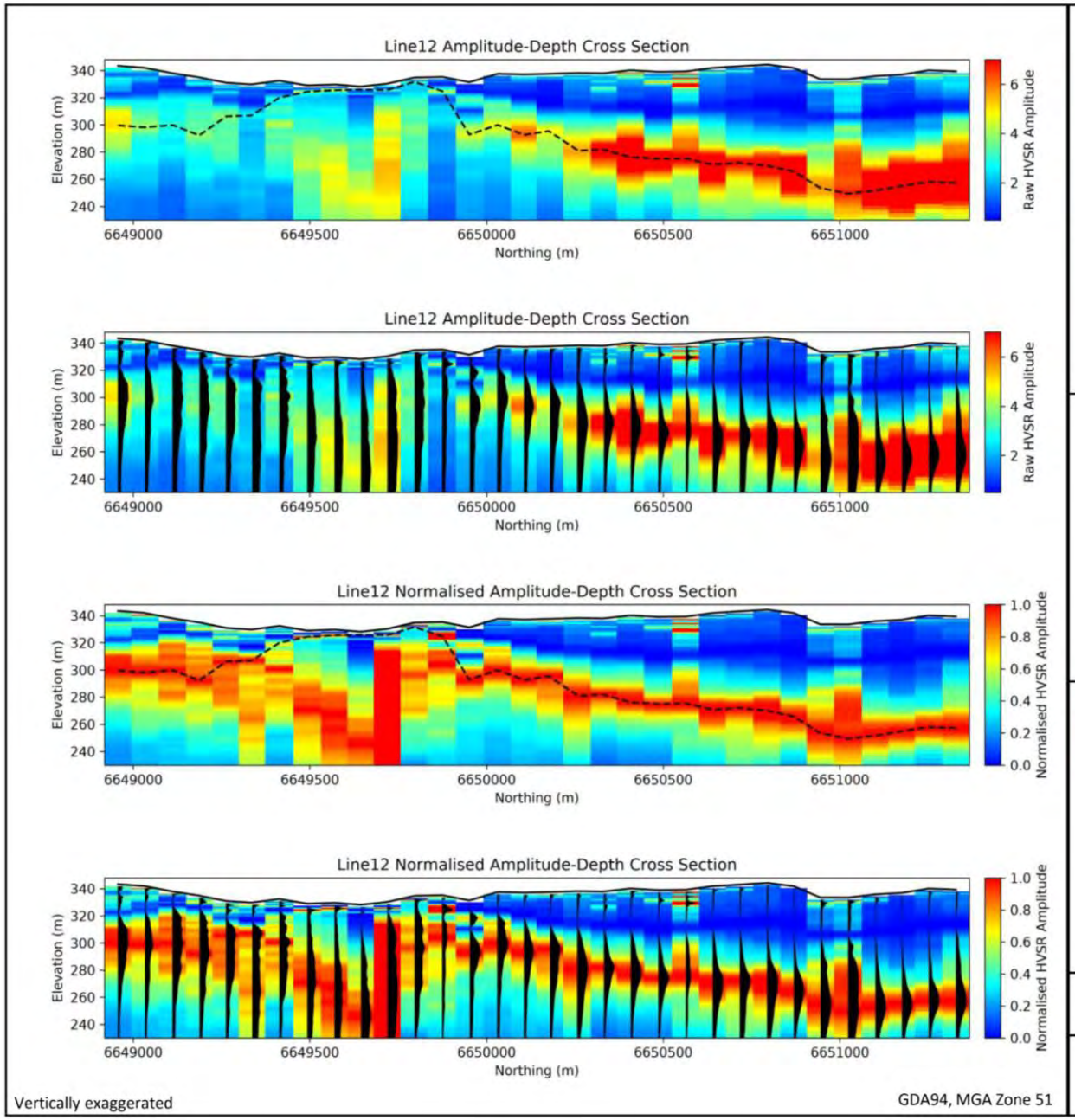
RAMELIUS RESOURCES

Lake Rebecca – Northern Area

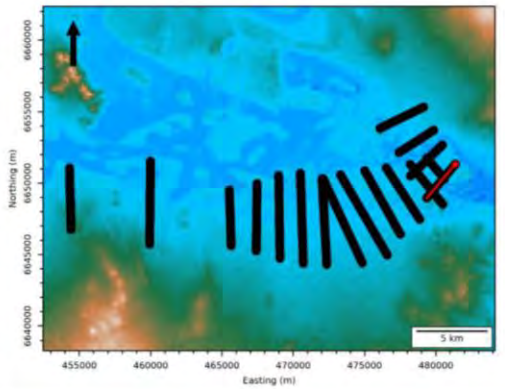
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 11

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

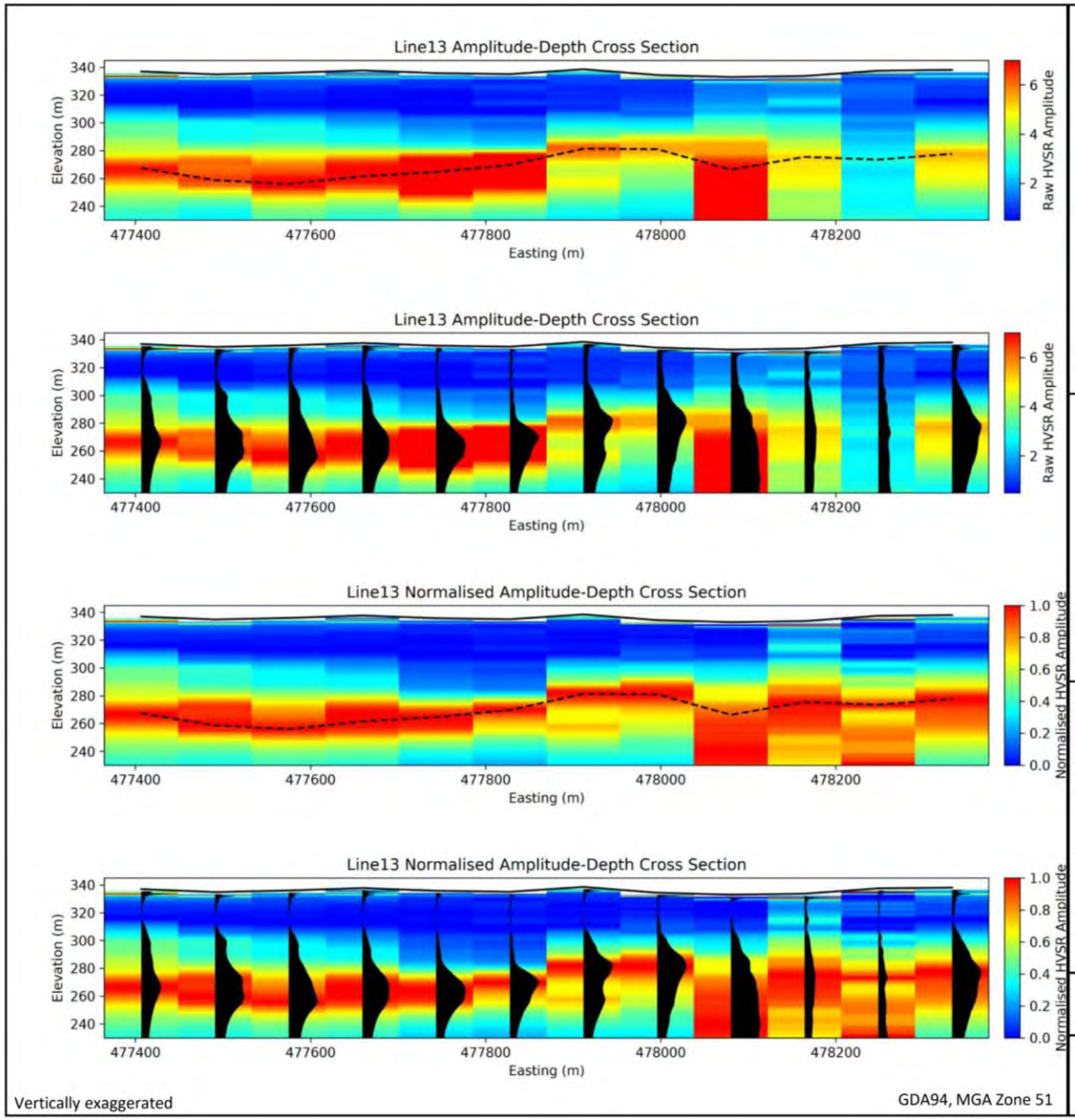
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

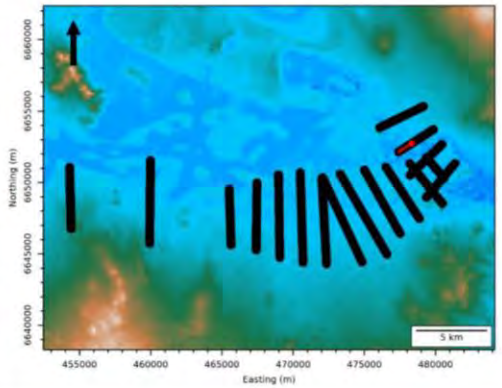
Line: 12

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

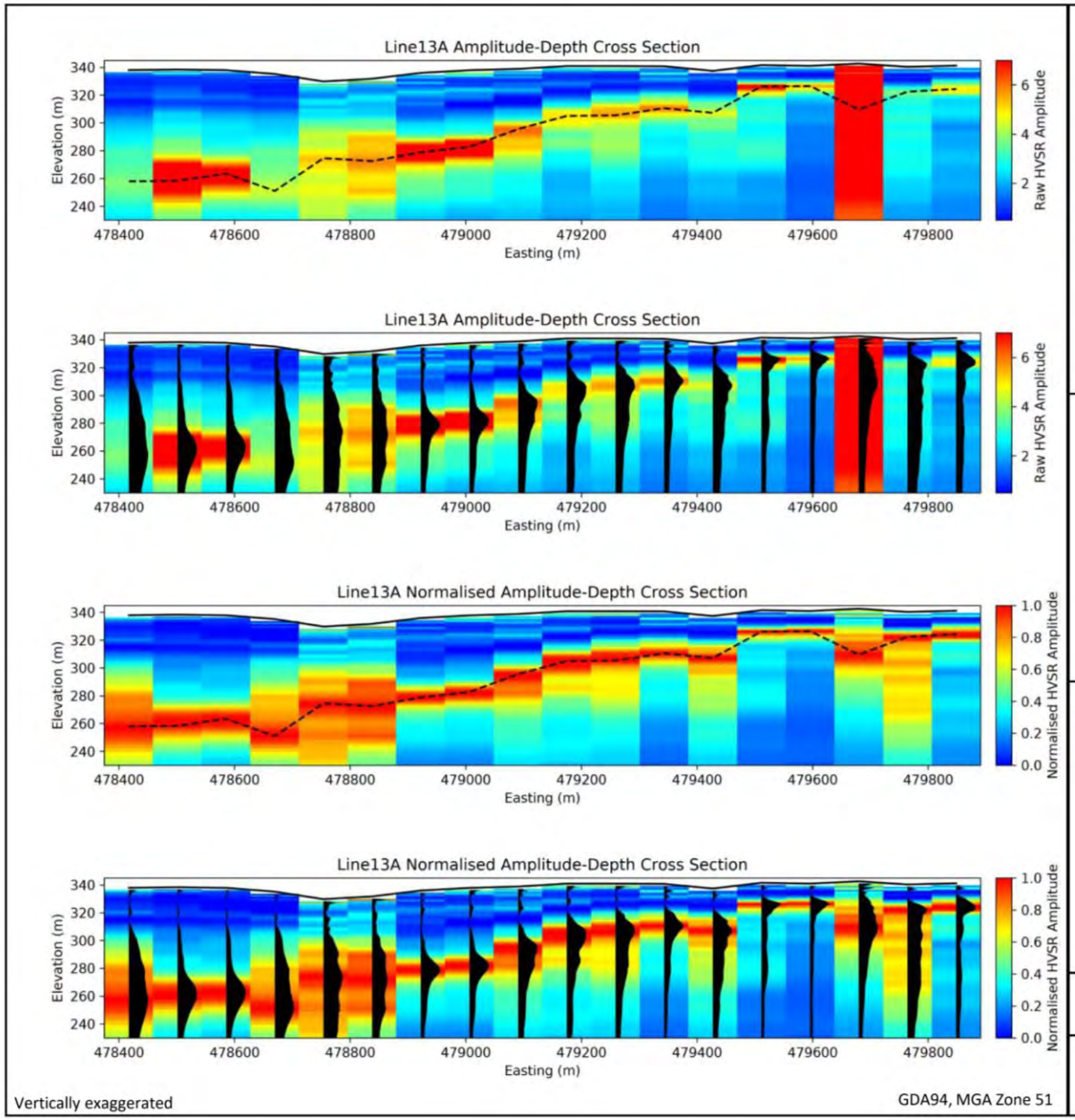
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

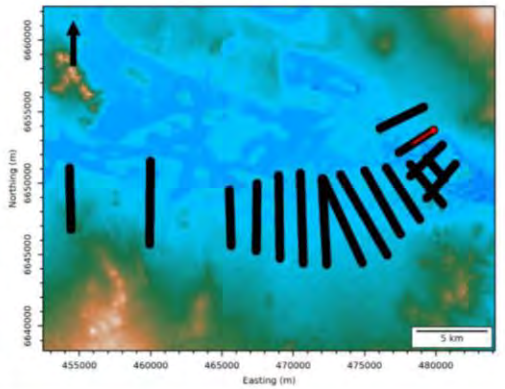
Line: 13

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

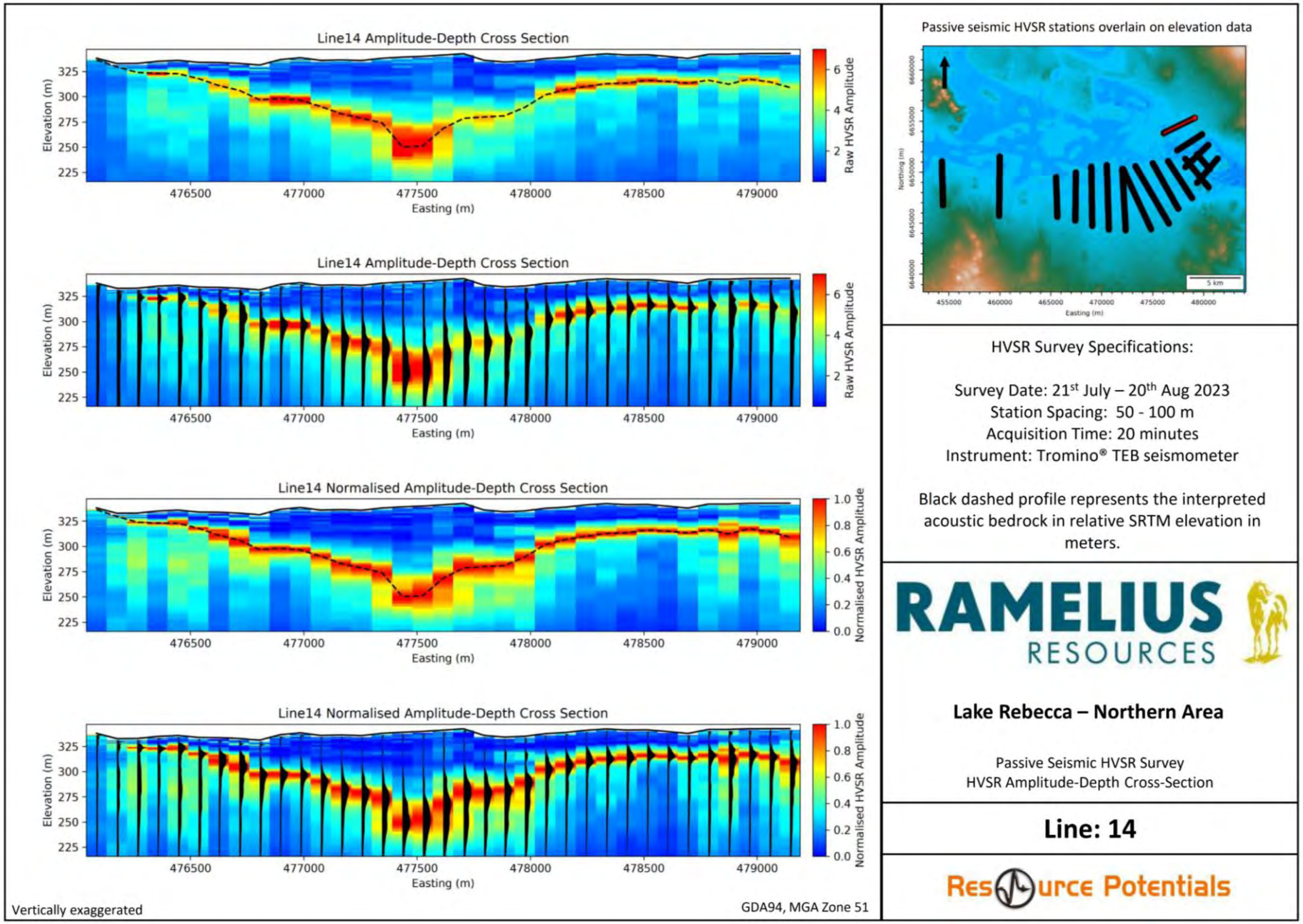
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 13A

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data

HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

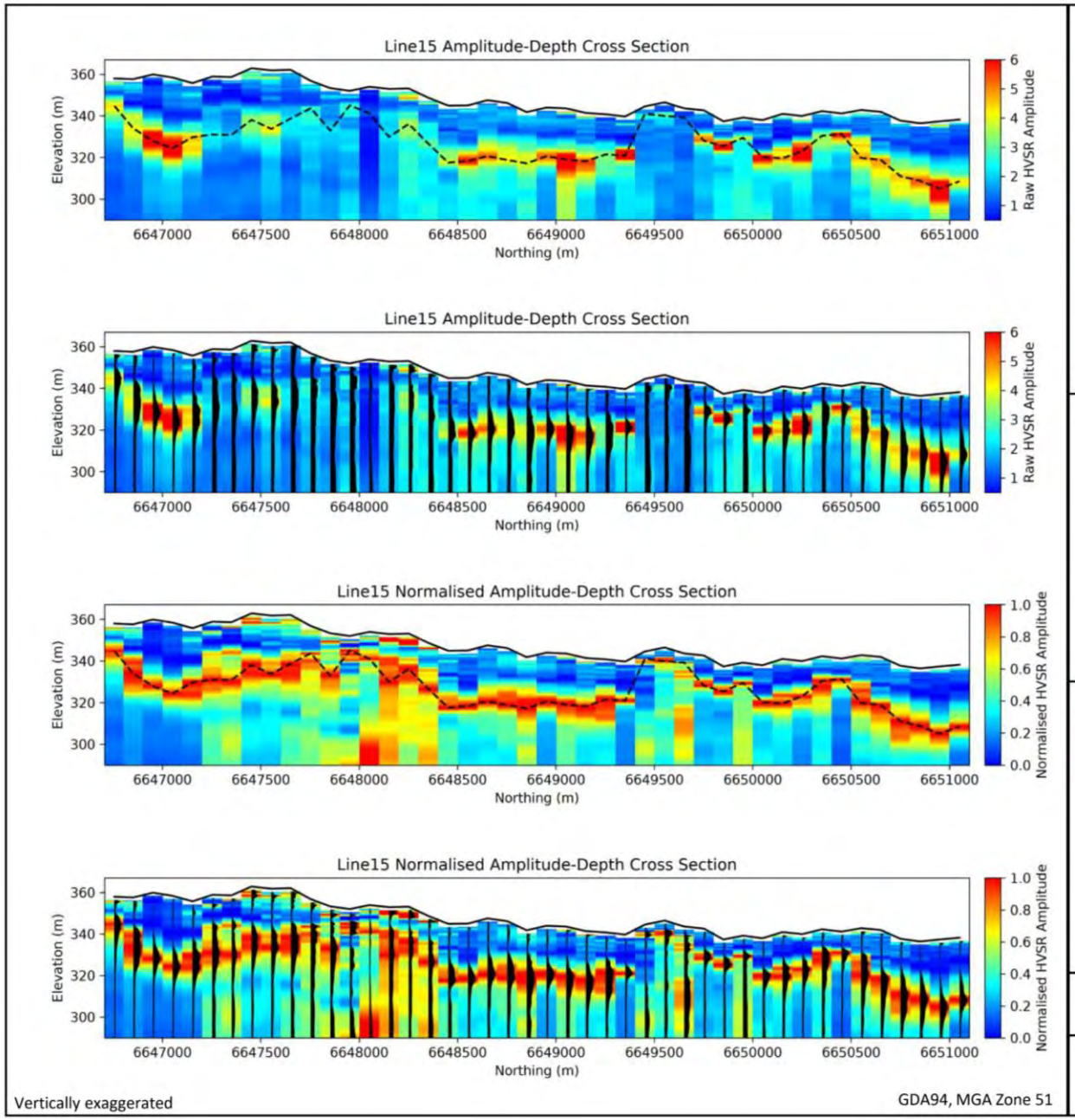
Lake Rebecca – Northern Area

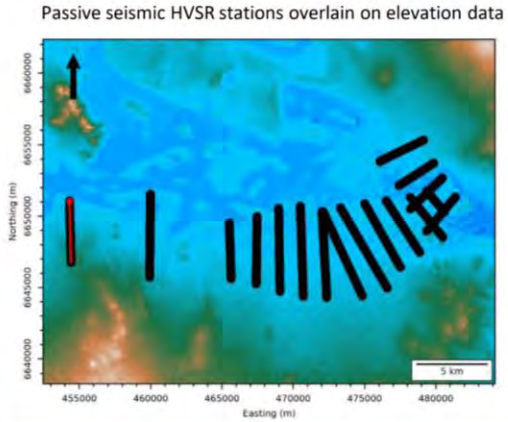
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 14

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line





HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

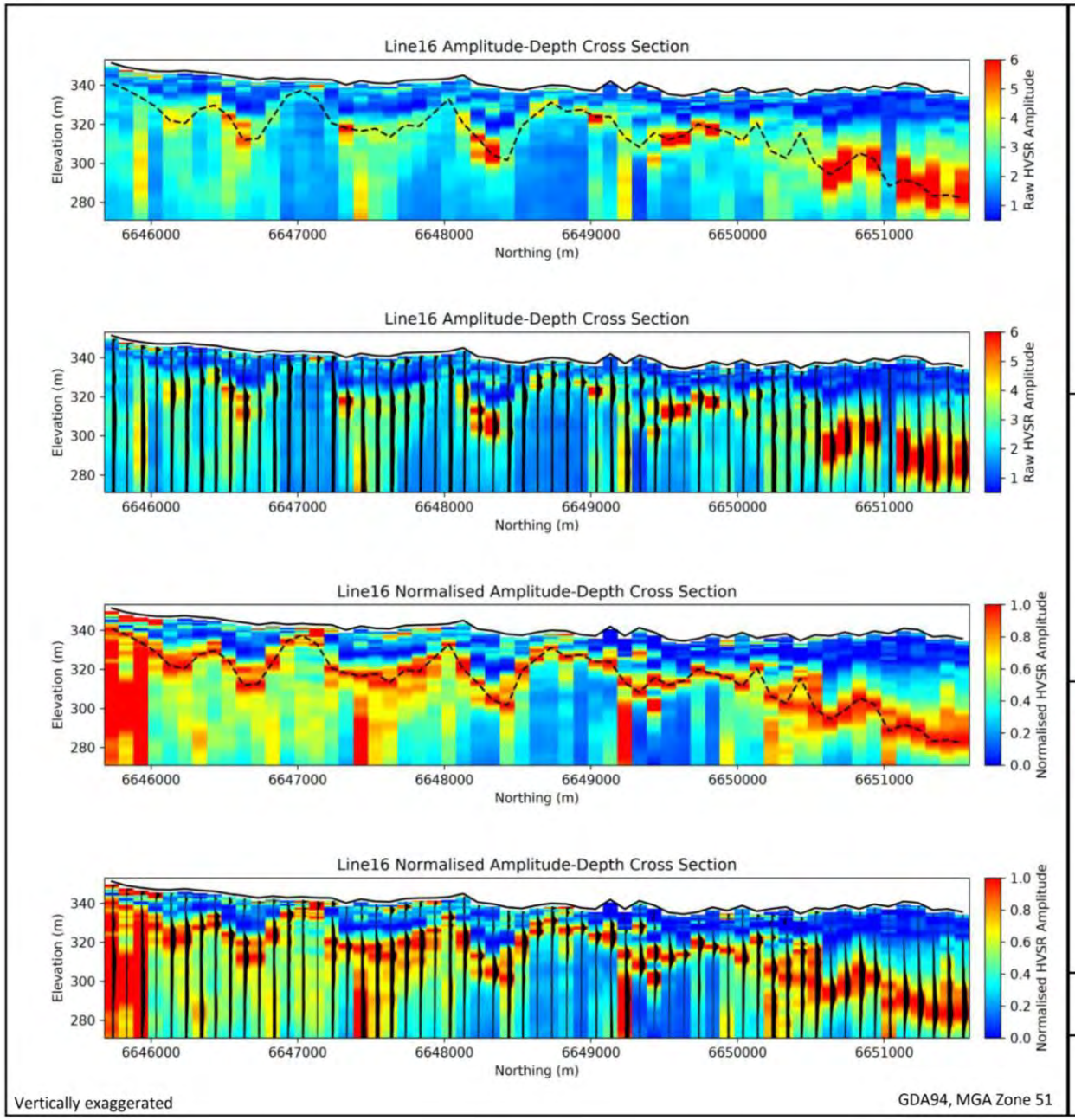
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

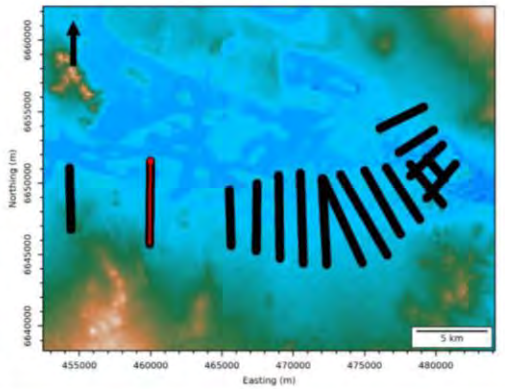
Line: 15

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

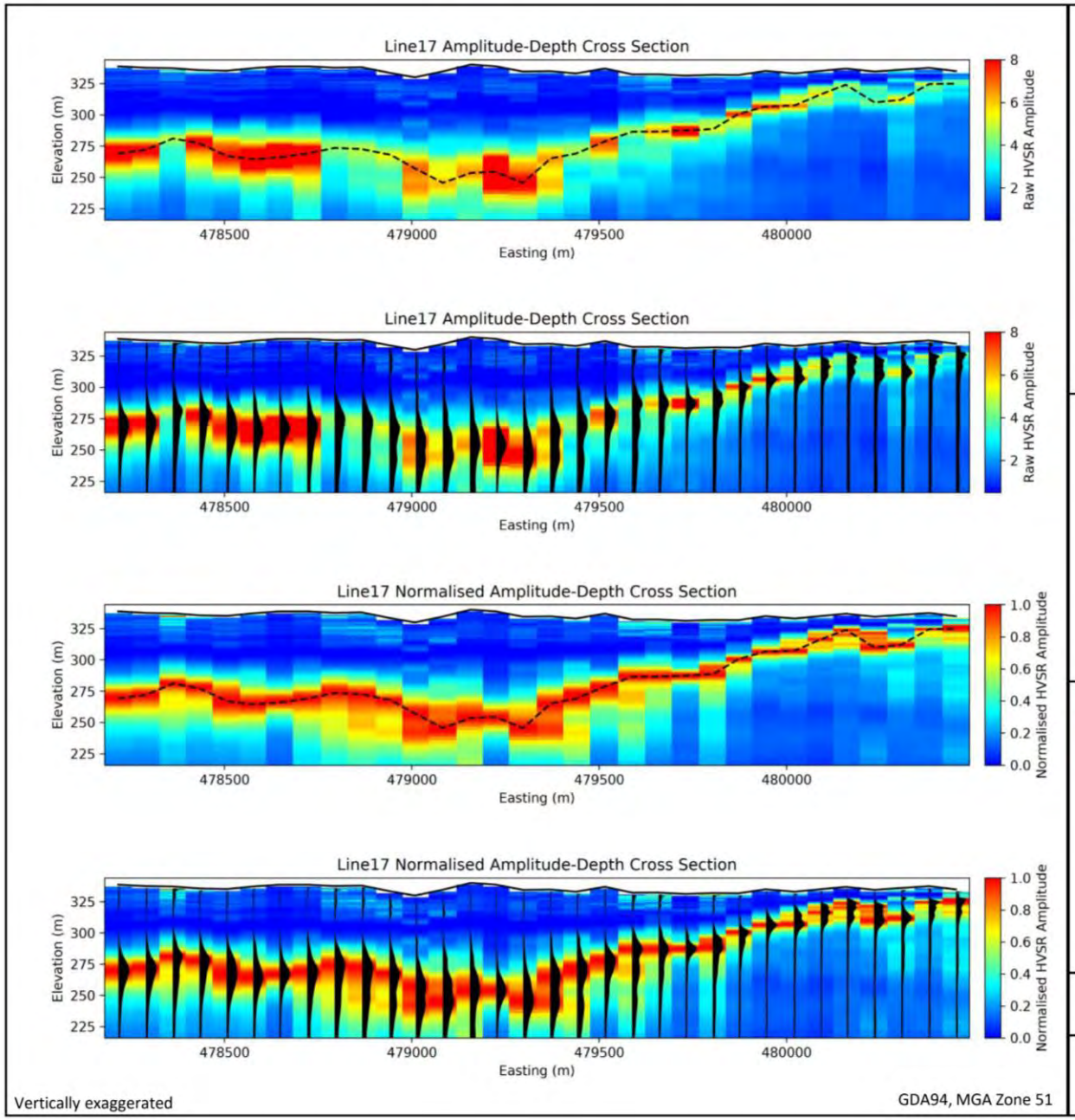
Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

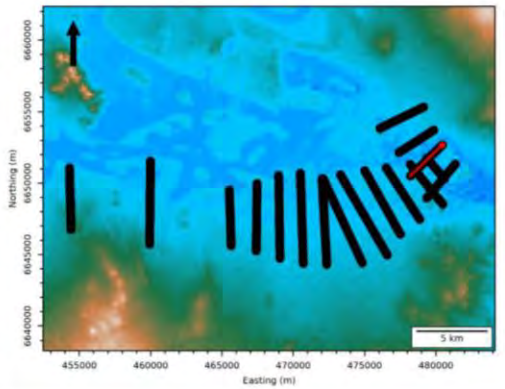
Line: 16

Resource Potentials

Appendix 1 – HVSR Cross-sections For Each Survey Line



Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 21st July – 20th Aug 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

Lake Rebecca – Northern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 17

Resource Potentials

Passive Seismic HVSR Surveying, Data QA/QC, Editing, Processing, Preliminary Velocity Analysis and Results, Southern Survey Area, Rebecca Gold Project, Western Australia

Summary Report
for

RAMELIUS RESOURCES

by

Ismail Yavuz

Resource Potentials
www.respot.com.au

December 2024

Disclaimer: *This report and opinions contained herein are based on the processing and review of data supplied on behalf of **Ramelius Resources Limited**. The authors base their conclusions and recommendations on these data in the format it was provided. The authors do not take any responsibility or liability for any commercial decisions or work carried out by **Ramelius Resources Limited**, any related party, or subsequent parties, or actions resulting from them. This report or its contents cannot be referred to or quoted, whole or in part, in any statement, study, report, prospectus, loan, thesis, or other agreement or document without the expressed written approval of the client and Resource Potentials Pty Ltd.*

Introduction (Slide 1 of 2)

This report builds upon previous reporting by Resource Potentials (Yavuz, 2023) with additional passive seismic survey line transects incorporated and results presented for the southern survey area.

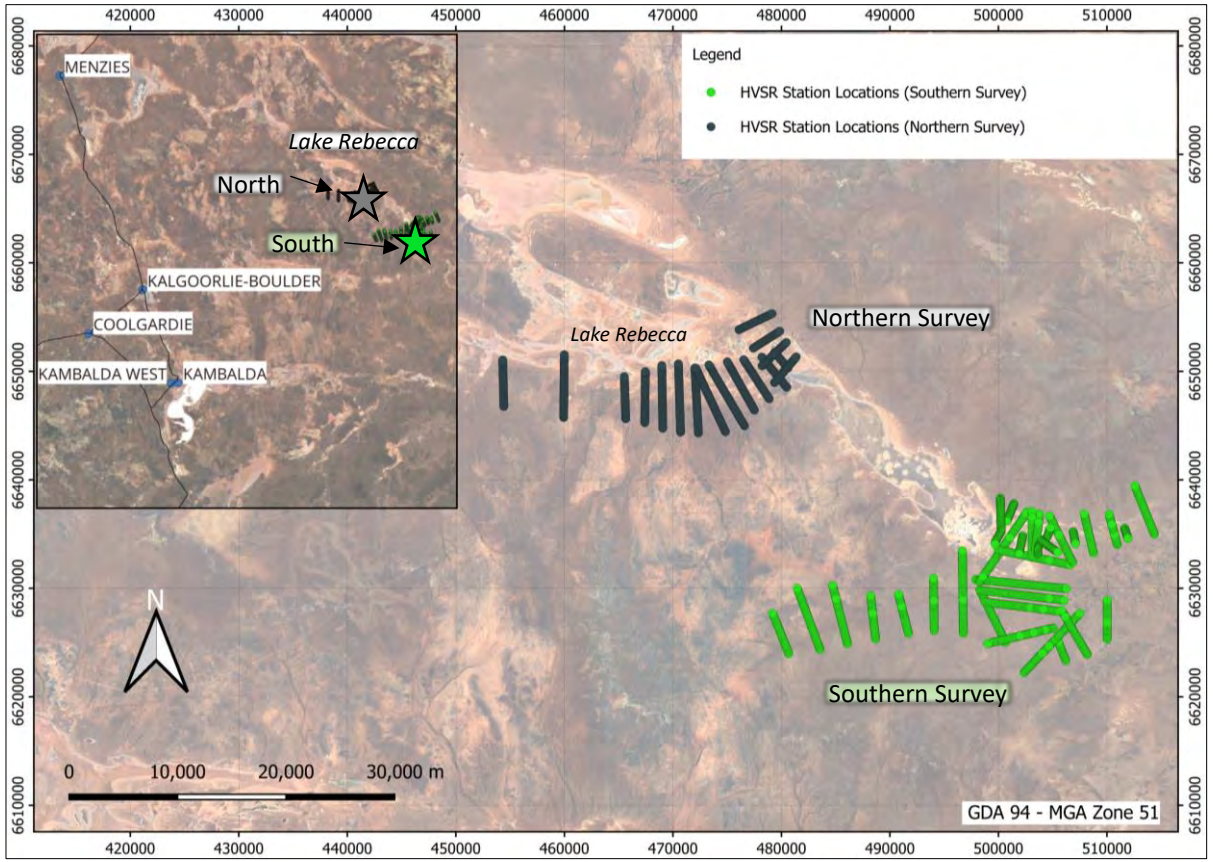
Ramelius Resources Limited (ASX: RMS) conducted passive seismic surveying using the horizontal to vertical spectral ratio (HVSR) method over two survey areas at their Rebecca Gold Project, which is located approximately 115 km NE of Kalgoorlie in Western Australia (see location map to the right).

These surveys were designed for delineating the locations, meander, geometry and thicknesses of paleochannels for water exploration. As requested by RMS, this report focuses on the southern survey area only, and the northern survey area results are summarised in a separate report (Yavuz, 2023).

Tromino® seismometers hired from Resource Potentials (ResPot) were used to collect HVSR survey data along survey lines at both the northern and southern survey areas (see location map right and zoomed-in map on Slide 3). Passive seismic HVSR station recording data were acquired and downloaded by XM Logistics (XML) survey field crew between late April to early July 2023 and follow up infill lines of the southern survey area were acquired during September 2024. The data were provided to ResPot to assess the recordings, provide data QA/QC, propose recording repeat stations, and carry out preliminary data processing and cross-section generation, and provide regular updates showing preliminary results throughout the acquisition periods.

On completion of each HVSR survey area and phase of acquisition, ResPot carried out final data processing and depth conversion on all passive seismic HVSR data bedrock peak frequency responses, with final HVSR amplitude-depth cross-sections generated for each passive seismic survey transect. Drilling data were not available during the initial survey phase for both the northern and southern surveys and therefore constrained velocity analysis for depth conversion of the HVSR data could not be conducted. Instead an average shear wave velocity (V_S) of 400 m/s was used to depth convert all Phase I HVSR data for both the northern and southern areas. This average Vs was later confirmed to be accurate during processing of the southern survey area Phase II data, facilitated by the availability of new drilling data. Further updates to the V_S analysis may be conducted when more fresh bedrock depth from future drilling is available near an HVSR station for calibration.

Overall the HVSR survey results show an undulating acoustic impedance contrast interface layer response or “acoustic bedrock” representing a layer that deepens to define paleochannel structures on the majority of survey lines, likely sitting above weathered and fresh Archean granite-greenstone bedrock. Higher frequency (shallower) HVSR peak responses were also resolved above the bedrock HVSR peaks which could be related to shallower layers from within the sedimentary and regolith deposits, such as sand or gravel, calcrete, silcrete, cementation, silicification layers, etc.



Map showing passive seismic survey line locations where the southern survey stations for this report are shown in green and the northern survey stations forming a separate report are shown in black, overlain a Google Earth satellite image.

*Yavuz, I., 2023, Passive Seismic HVSR Surveying, Data QA/QC, Editing, Processing, Preliminary Velocity Analysis and Results, **Southern Survey Area**, Rebecca Gold Project, Western Australia. Unpublished report by Resource Potentials Pty Ltd for Ramelius Resources Ltd, 39pp

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Introduction (Slide 2 of 2)

Final data products from this study include:

- Raw and processed passive seismic HVSR data in ASCII format for archive and government reporting requirements, along with an excel spreadsheet of all HVSR station coordinates.
- CSV file of the main acoustic impedance contrast layer ("acoustic bedrock") as estimated depth from land surface and in RL elevation based on the SRTM height datum (geoidal height above avg. sea level).
- Raw and normalised HVSR amplitude 3D georeferenced geotiff images of HVSR cross-sections based on RL elevation.
- Raw and normalised HVSR amplitude cross-section image plots with map layout (See also Appendix 1).
- Data grid of acoustic bedrock elevation.

Survey coordinates in this report use the GDA94 datum and MGA Zone 51 projection. Cross-sections are plotted in RL elevation above sea-level using SRTM 1 arc-second (30m cell size resolution) digital elevation data as the surface topography reference (geoidal height datum).

Survey Specifications and Equipment

Both the northern and southern passive seismic HVSR surveys were designed by AQ2 hydrogeologists working with RMS. The HVSR survey line transects at the southern survey area have variable orientations and spacings. Existing geophysical survey data and digital elevation coverage over the area is limited; ground gravity survey data have nominal 2.5 km average grid spacing and airborne magnetic survey data have line spacing ranging from 400 m in the east to 200 m in the west, both considered low resolution. Despite the low resolution of the regional gravity and magnetic data, the surface extents of the Lake Rebecca salt lake playa, coupled with the state-wide magnetic and gravity datasets provide some indications of the possible locations of paleochannel systems (see map image to the right), which are inferred from gravity anomaly lows and blurred magnetic anomaly zones.

All passive seismic HVSR survey data were acquired by XML using a sampling frequency of 128 Hz and an acquisition recording time of 20 minutes per station. Self contained Tromino® ENGY TEB seismometers were used to collect passive seismic HVSR data at fixed recording stations with 100 m along-line station spacing, where each Tromino® was firmly coupled to the ground and covered with a heavy duty bucket weighed down by sand bags in order to shield the Trominos® from wind motion and wayward animals, effectively reducing unwanted noise.

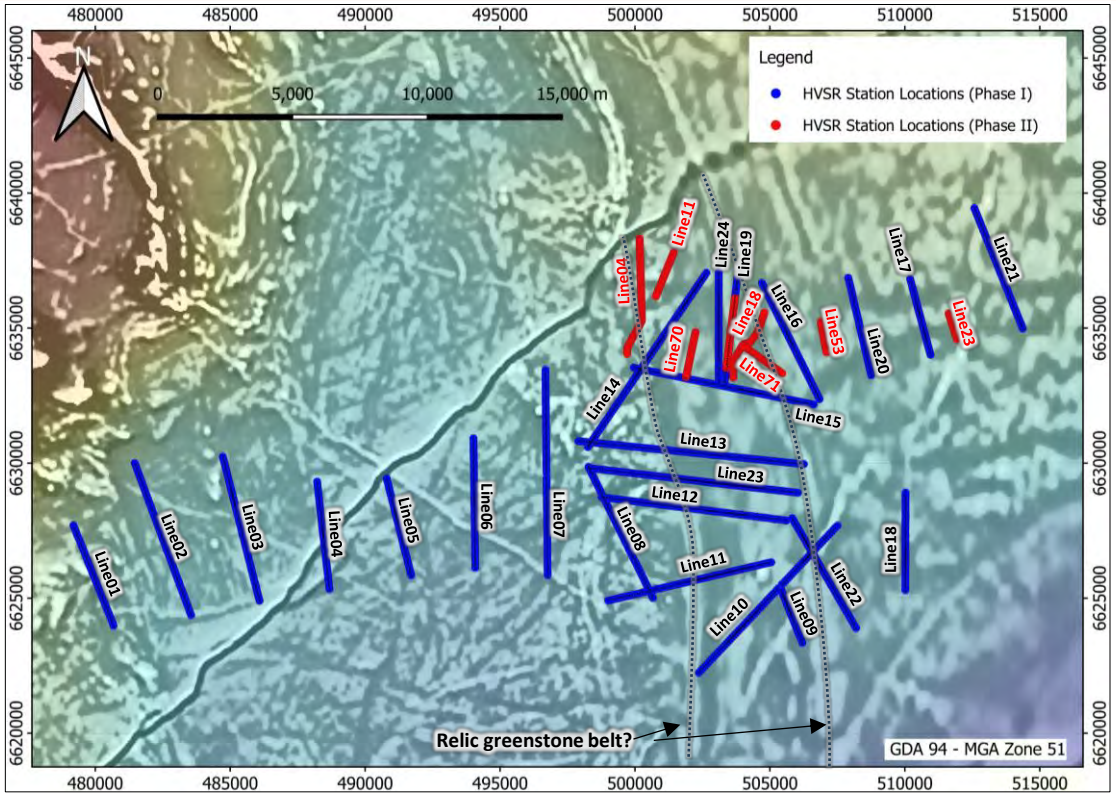
ResPot daily communications between AQ2 Hydrogeologists, RMS and XML, and the quick turnaround of preliminary cross-sections provided daily by ResPot, enabled adjustments to the acquisition plan to help optimise XML field crew efforts as surveying progressed. As a result, areas of interest requiring better than 100 m station spacing were quickly identified, allowing stations to be infilled to 50 m station spacing before the field crew demobilised. Additional survey line transects were also added where needed, and some survey line transects were extended if and when they fell short of closing off paleochannels identified during surveying.

Location information was recorded by the Tromino® units in-build GPS system. Field logs and handheld GPS recordings were also manually recorded for station identity and associated field conditions for each survey station as a failsafe to match recording stations to their respective digitally recorded location and to assist with data processing and generating HVSR peak amplitude cross-sections.

A total of 1,533 HVSR survey stations were acquired along 24 survey line transects totaling 126.8 line-kms at the southern survey area over several weeks during the first phase, and 324 HVSR stations along 8 survey lines totaling 17.3 line-kms were acquired during Phase II. The XML field crew completed the survey in a relatively short time frame considering the scope of the surveys.

Passive seismic survey specifications.

Survey Phase	Survey Line Number	Number of Stations	Approx. Line Length (km)	Survey Phase	Survey Line Number	Number of Stations	Approx. Line Length (km)	Survey Phase	Survey Line Number	Number of Stations	Approx. Line Length(km)
Phase I	01	36	4.0	Phase I	13	85	8.4	Phase II	04	86	4.4
Phase I	02	61	6.0	Phase I	14	114	7.7	Phase II	11	36	1.8
Phase I	03	63	5.5	Phase I	15	79	6.8	Phase II	18	58	2.8
Phase I	04	46	4.0	Phase I	16	56	4.8	Phase II	19	27	2.6
Phase I	05	44	3.4	Phase I	17	41	2.9	Phase II	23	21	1.0
Phase I	06	54	4.8	Phase I	18	45	3.6	Phase II	53	24	1.2
Phase I	07	85	7.6	Phase I	19	39	4.0	Phase II	70	35	1.7
Phase I	08	55	5.4	Phase I	20	38	3.7	Phase II	71	37	1.8
Phase I	09	31	2.1	Phase I	21	49	4.8				
Phase I	10	101	7.5	Phase I	22	64	4.7				
Phase I	11	86	6.2	Phase I	23	114	7.8				
Phase I	12	78	7.0	Phase I	24	69	4.1				
						1,533	126.8 km			324	17.3 km



Map showing southern survey area passive seismic survey station locations (blue and red dots), overlain on a filtered state wide gravity anomaly pseudocolor image semi-transparent over a filtered resolution state wide magnetic anomaly greyscale image. Note the highlighted N-S trending magnetic anomaly trend which crosses through the central lines of the survey area. This appears to be a relic greenstone belt surrounded by granite, which formed a structural weakness zone to guide neotectonic faulting and formation of paleochannels in the Cainozoic, as observed on passive seismic HVSR cross sections shown in this report, see Slide 11 and Appendix 1.

Tromino® ENGY TEB seismometer specifications:

- Manufacturer: MoHo s.r.l.
- Dimensions: 10 x 14 x 8 cm
- Weight: 1.1 kg
- Vibration sensors: 3 orthogonal velocimeters
- Sampling rate: 64 kHz per chn.
- Output sample rate: 128 Hz
- Sensor frequency range: 0.1 - 1024 Hz

Passive Seismic HVSR Survey Method

The passive seismic HVSR technique is based on measuring the local resonant frequency of horizontal and vertically travelling ambient shear waves trapped and amplified within soft slow velocity sedimentary deposits or weathered bedrock (saprolite) sitting over hard and well lithified or fresh bedrock forming an interface having a strong acoustic impedance contrast. The vibration data are analysed for peak resonant frequencies (f_0 in Hz) of the soft cover that are then converted into depth using shear wave velocity (V_s in m/s) to represent the soft sedimentary and regolith cover layer thickness (h in metres), through Equation 1 below:

$$f_0 = V_S / 4h$$ **(Equation 1).**

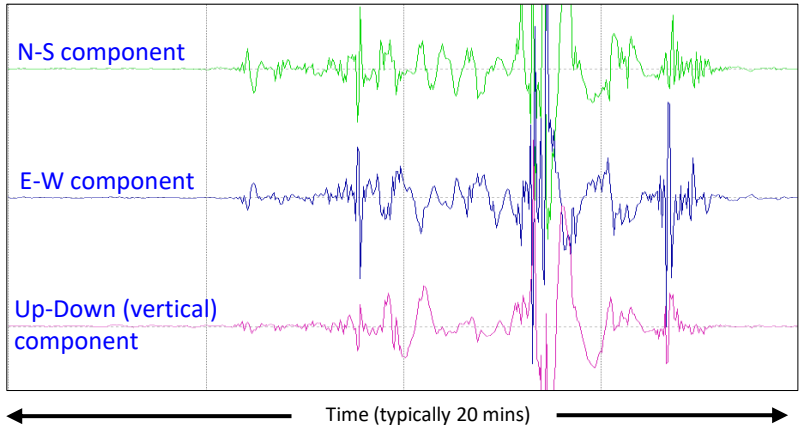
Passive seismic HVSR surveying involves using a seismometer with three axial sensors to record ambient or naturally occurring seismic vibrations in 3 directions from natural sources (wind, ocean waves, micro-seismicity, earth tides, etc.) and far field manmade signals over a range of frequencies (0.1-100 Hz) and over a specific recording time period (generally 10-30 mins). The Tromino® seismometer records three orthogonal components of vibration: two horizontal components (north-south and east-west, or X and Y) and one vertical (up-down, or Z) component (top panel to the right).

The recorded time-series vibration data for each sensor component (top panel to the right) are then transformed into frequency spectra by using a Fast Fourier Transform (FFT) which are presented as frequency-power spectrum plots for all three receiver components (middle panel to the right). Shear wave resonance (as a standing wave) develops within a low velocity and low density geological layer sitting over a higher velocity and higher density layer (e.g., regolith or sedimentary cover over hard and fresh bedrock). This resonance produces a local minimum in the vertical component frequency-power spectrum relative to the horizontal frequency-power spectrum, thereby creating an 'eyelet' shaped separation between the horizontal and vertical vibration component profiles (middle panel to the right).

The horizontal (H) to vertical (V) spectral ratio (HVSR) is then calculated by dividing the geometric average of the horizontal components (N-S and E-W) by the vertical component (up-down) to generate an HVSR profile plot (bottom panel to the right). The HVSR response forms a peak in amplitude at the resonant frequency of the main acoustic bedrock interface (f_0 in bottom panel to the right). It is not uncommon to resolve multiple HVSR peaks which can arise from multiple impedance contrast layer interfaces sitting above the acoustic bedrock layer. These bedrock HVSR peak frequencies are then depth converted using velocity analysis based on velocity assumptions, 1D modelling or drillhole calibration, and can then be displayed alongside each other to produce cross section images or as wiggle trace plots. Depth conversion of the HVSR peak frequency responses are further discussed in detail on Slides 8 and 9, with an HVSR cross section example shown on Slide 10.

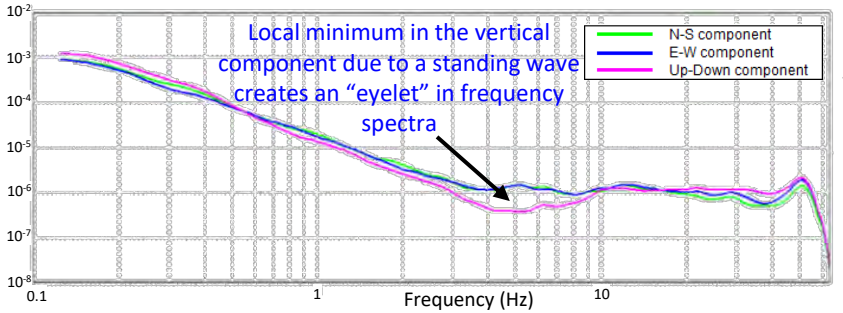
It is important to note that the effects of external noise can alter the observed bedrock peak frequency from the true geological bedrock peak frequency, and data QC is important for assessing noise levels. Furthermore, the accuracy and precision achieved when depth converting HVSR peak frequency data is more reliable at higher frequencies (shallow depths). The following condensed example helps to illustrate this: assuming a constant V_s of 500 m/s and a standard deviation of ± 0.2 Hz when measuring a 2 Hz HVSR peak representing an acoustic bedrock interface at 62.5 m, an average depth difference of ±6.31 m (or approximately 10%) is calculated. However, for an 8 Hz peak representing a shallower acoustic bedrock interface at 15.6 m, under the same assumed standard deviation of ± 0.2 Hz, the depth calculation yields an average depth difference of only ± 0.39 m (or approximately 2.5%).

Measurement of ground vibrations at a recording station in time series



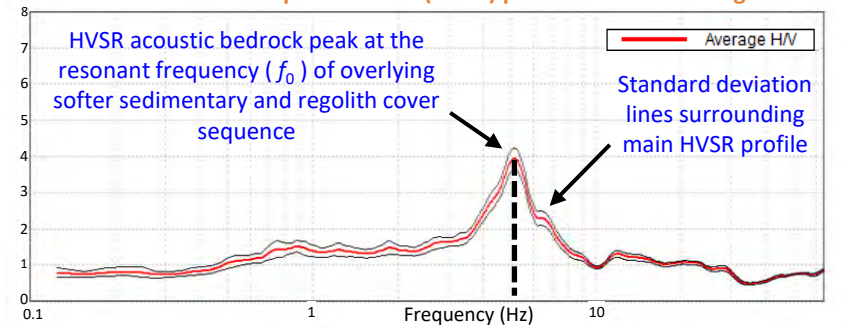
FFT

Frequency power spectrum of the recording station vibration data in three directions



HVSR

Horizontal to Vertical Spectral Ratio (HVSR) profile of the recording station



HVSR Data QA/QC and Editing (Slide 1 of 2)

Passive seismic HVSR time series vibration data files, recording station GPS locations and field notes were provided by XML to ResPot via Dropbox as surveying progressed. These data were sorted into individual passive seismic HVSR station recordings, which were then manually assessed for station location, data quality, noise levels and stuck vibration receiver components.

Noise in passive seismic can arise due to strong wind, poor coupling of the instrument with the ground, anthropogenic activity, operators standing close to the recording instrument, stuck geophone sensors, or readings taken over poor ground conditions, such as sub-crop/out-crop, soft mud, cavernous ground, or positioned above large buried boulders. Therefore, identifying poor quality HVSR data recordings and manually removing noisy segments of data during processing, before the HVSR resonant peak frequency response is calculated, is a key processing step carried out on a station-by-station basis during the survey acquisition period and final processing.

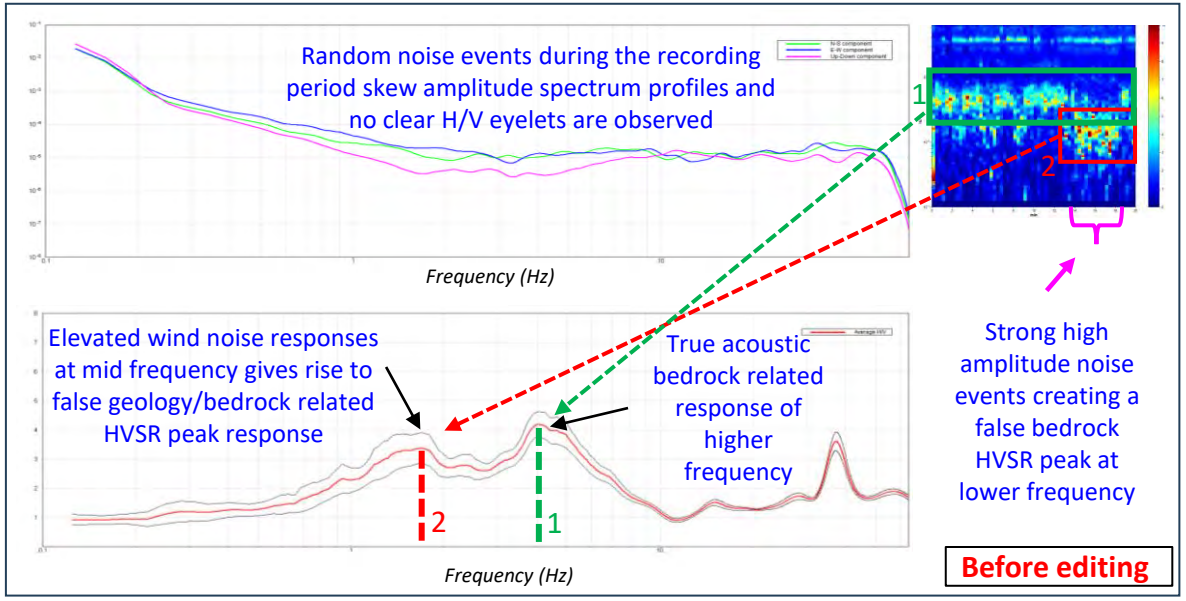
HVSR resonant peak frequency responses were observed to vary across the project area for both phases of the surveying, but overall, moderate-to-high amplitude and low-to-high frequency HVSR resonant responses from deep and shallow acoustic bedrock were identified and later interpreted to mostly correspond to the top of hard acoustic bedrock sitting below softer paleochannel fill or transported sediments. The majority of the HVSR data recordings were of high quality, however some data were observed to be of poor quality and required extensive data editing and cleaning efforts to enhance HVSR bedrock peak frequency responses. A small number of these poor quality HVSR station recordings could not be sufficiently edited due to high amplitude background noise ("noise trains") observed across the full 20 minute recording, mainly resulting from strong wind interference during acquisition. These noise trains showed up on HVSR profiles as high amplitude and low frequency HVSR peak responses that masked HVSR response related to local geology/bedrock. Therefore, these stations recordings were recommended for repeating where recording stations were considered critical for interpretation.

For passive seismic HVSR data editing and cleaning, each 20 minute station recording was divided into 20 second recording segments and displayed as H/V stability plots, as shown as the colour images to the far right, where each column of colour pixels represents the H/V frequency response in the vertical axis over the total 20 min recording time in the horizontal axis. Noisy 20 second recording segments were identified and manually removed to reduce the noise in the combined recording, which effectively removed false HVSR peaks and improved interpretability of HVSR peak responses related to geology.

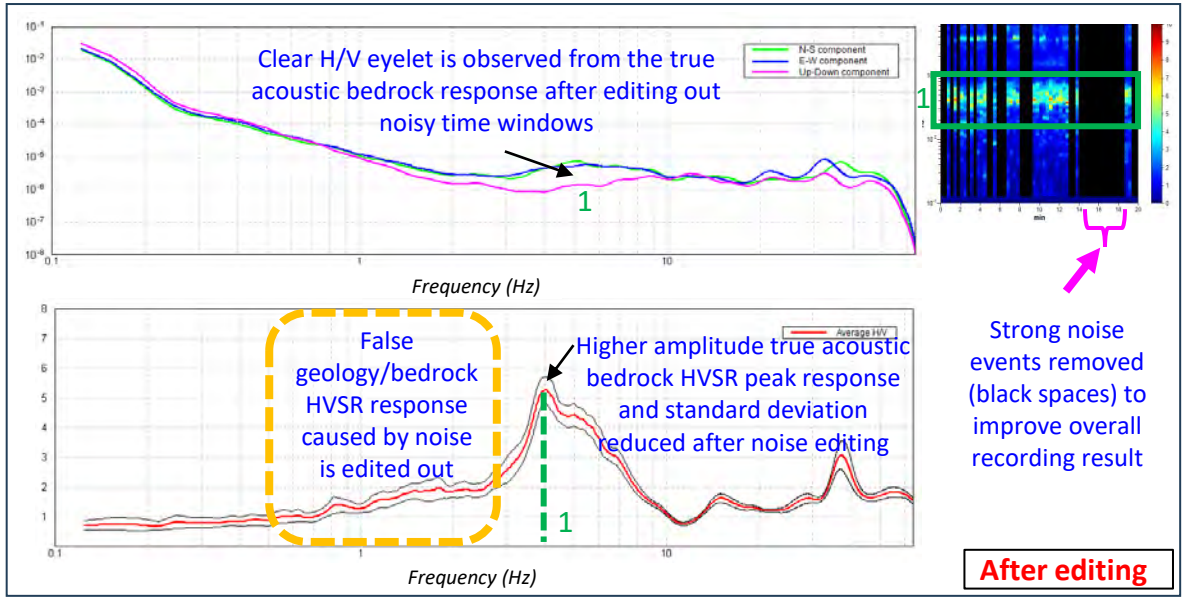
The images to the right show an example of an unedited (top) and edited (bottom) HVSR recording from station 13058 along survey Line 13. This example displays a time period towards the end of the station recording which appears to contain spurious noise, which creates a false low frequency peak to the H/V response at approximately 1.7 Hz which could be interpreted as deeper acoustic bedrock interface. This false HVSR peak was is edited out by removing the noise affected segments of the recording. Also note the reduction of the standard deviation profiles after editing (shown as the black profiles either side of the averaged H/V response profile displayed in red), particularly at low frequency values. Also note the highly improved character of the HVSR peak frequency response and corresponding H/V eyelet, which is clearly identified after editing.

Where the station recordings were too noisy for editing, the stations were recommended for repeating, discussed on Slide 6. Examples of typical cleaned HVSR responses observed in the study area are provided on Slide 7.

Frequency spectra profiles and HVSR profile for Line13 - Station 13058 (before editing)



Frequency spectra profiles and HVSR profile for Line13 - Station 13058 (after editing)



HVSR Data QA/QC and Editing (Slide 2 of 2)

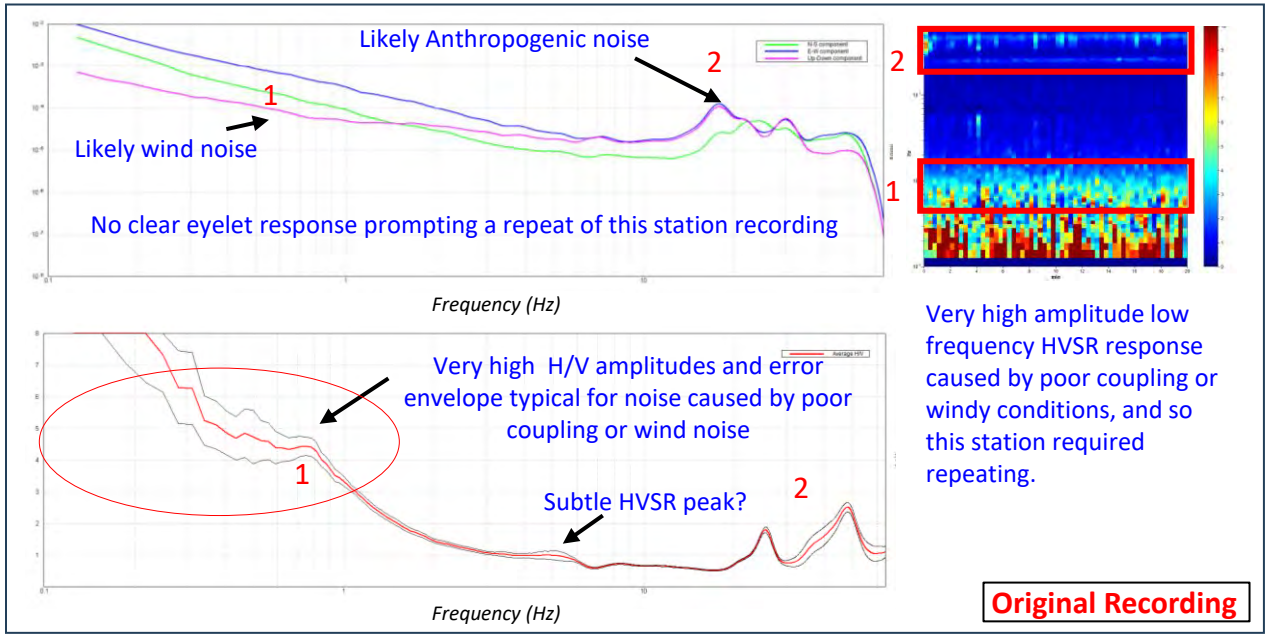
A few passive seismic HVSR recordings acquired during both survey phases contained HVSR responses that were vastly different from neighboring passive seismic HVSR recordings, and which possibly represented stronger periods of wind noise during acquisition, poor coupling of the seismometer with the ground, or areas of sub-crop where no reliable HVSR peak interface existed. These HVSR station recordings may also have been affected by strong anthropogenic noise.

Due to the continuous nature of these noisy responses across the full 20 minute recording time, data editing and cleaning could not be carried out to enhance geological responses, and therefore these survey stations were recommended for repeating. Where time permitted, these were repeated by XML field crew.

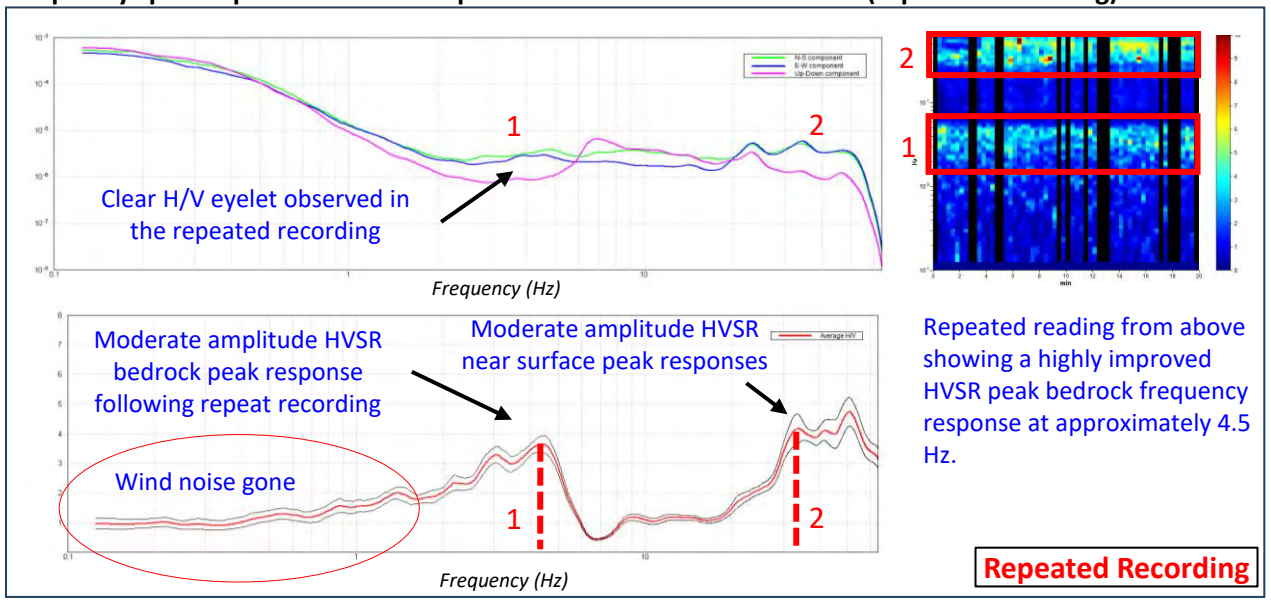
An example of a single HVSR station recording considered to be of poor data quality is displayed to the top-right. This HVSR data recording is characterised by high amplitude HVSR responses at low frequencies, with subtle hints of a deep local geological response at low frequency, which was observed to be very dissimilar to neigbouring station recordings. These characteristics are present throughout the entire recording time and provide little confidence in the station recording. The repeated HVSR station recording example displayed bottom-right below the original bad HVSR recording above. The repeated recording displays a clearer or more distinct HVSR response at low frequency as predicted by neighboring recording stations. Many of the requested repeat station recordings where considered critically located for interpretation of the main paleo-channel axis and repeated provided improved interpretability when compared to the original recordings.

Following manual editing of the passive seismic HVSR data, the recorded HVSR peak frequency data were converted from frequency to depth. The depth conversion process is explained in detail on Slide 8.

Frequency spectra profiles and HVSR profile for Line06 - Station 6051 (original recording)



Frequency spectra profiles and HVSR profile for Line06 - Station 6051R (repeated recording)



HVSR Station Data Observations

HVSR station data profile responses from the Lake Rebecca southern survey area have variable HVSR peak frequency range, HVSR peak amplitude and character, and this is most likely related to the variable bedrock depths and lateral variability of acoustic impedance contrasts between different geological layers and the weathering profile across the survey area. For example, high amplitude HVSR bedrock peak frequency responses can often be attributed to a sharp acoustic impedance contrast between low-density, slower-velocity sedimentary deposits and higher-density, higher-velocity acoustic bedrock, fresh Archean granite-greenstone. Broad and low amplitude HVSR responses may indicate a gradual change in acoustic impedance contrast between geological layers or a gradational weathering profile caused by saprolite formed above the fresh bedrock. Higher levels of wind noise may also mask and subdue the HVSR bedrock peak frequency response.

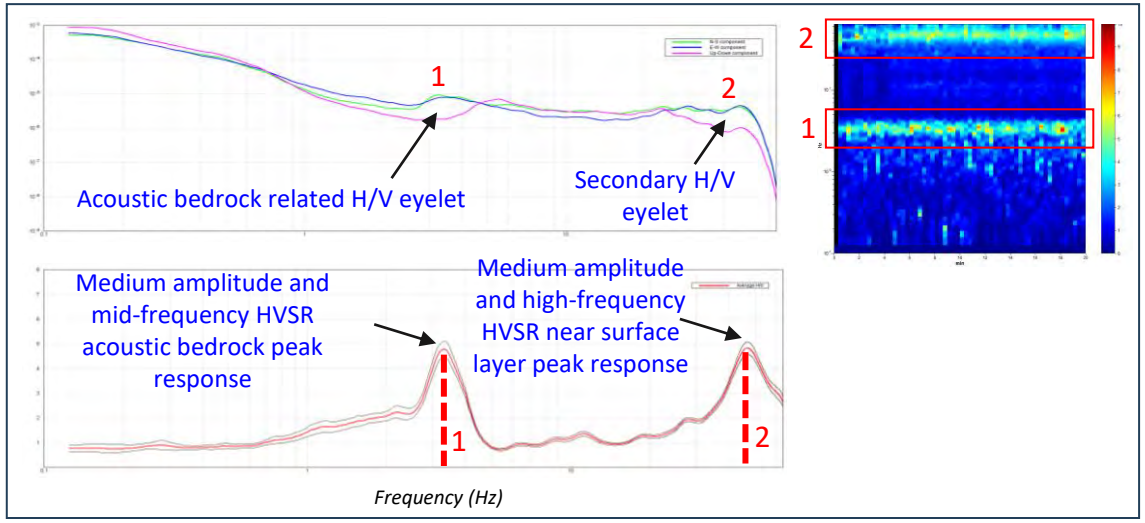
In some geological environments, multiple HVSR peak responses may be observed, with the lowest frequency HVSR response related to acoustic bedrock forming deeper layers, and higher frequency and high amplitude HVSR peak responses above the bedrock peak related to shallow layering within the channel fill/sedimentary deposits, which in this study area could be calcrete, silcrete, cementation, silicification layers, gravel-sand layers, conglomerate, etc. It is also possible that these higher frequency HVSR peak responses could represent modal responses (multiples of the main HVSR resonant peak frequency), and care is required when interpreting these higher frequency HVSR peak responses. HVSR amplitudes less than 1 are indicative of velocity inversions were a layer with higher acoustic impedance layer overlays a a layer with lower acoustic impedance, for instance a mud layering.

The recorded vibration frequency spectra profiles and HVSR profiles below display examples of typical cleaned HVSR station recording responses observed with in the southern survey area from Phase I surveying. These examples are also representative of the follow up Phase II infill surveying and so additional examples are not presented.

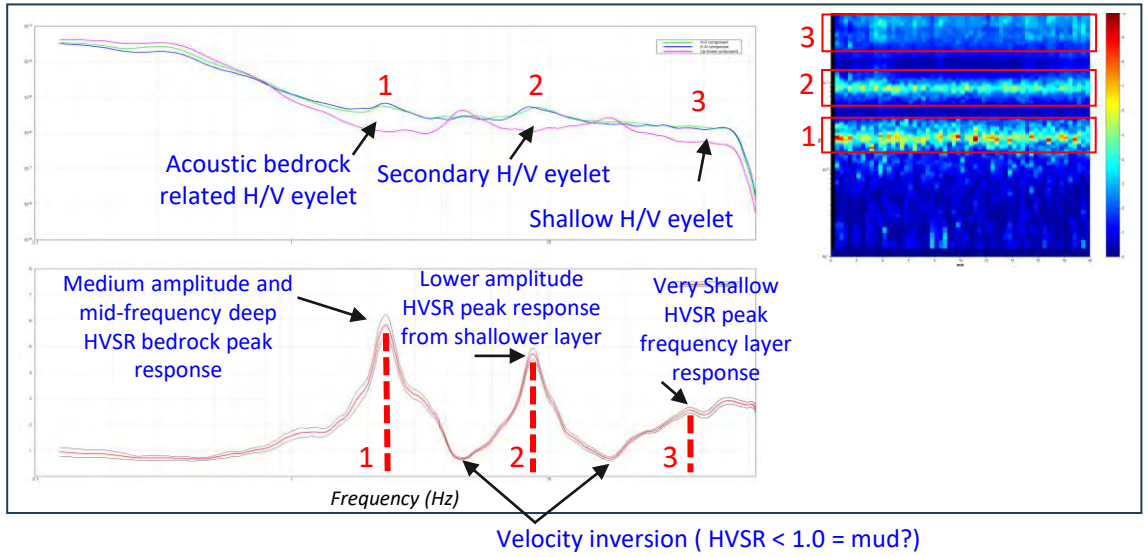
Example 1: *Station 2035 from Line02* – Mid frequency and moderate amplitude HVSR bedrock peak frequency response observed at 3.3 Hz related to deeper acoustic bedrock (fresh granite-greenstone) with overlying paleovalley fill gravels, sand etc. There is also a very high frequency response at 46.9 Hz which may be related to a harder interface close to surface, like a clay hardpan or ferricrete.

Example 2: *Station 6039 from survey Line06* – Multiple HVSR peak frequency responses are observed, including an HVSR bedrock peak frequency response at 2.31 Hz related to deep acoustic bedrock, a mid-frequency broad HVSR peak response at 8.7 Hz, possibly representing a shallow layer interface within the paleochannel fill, and a very high amplitude HVSR peak frequency at 35.4 Hz most likely related to a shallower interface at or close to surface. Velocity inversions between these main acoustic impedance interfaces suggests possible mud layers.

Example 1: Station 2035 from survey Line 02



Example 2: Station 6039 from survey Line 06



Shear Wave Velocity Analysis and 1D Forward Modelling

The conversion of passive seismic HVSR bedrock peak frequency data into depth from surface can be carried out by calibrating measured HVSR bedrock peak frequency responses (f_0 in Hz) from recordings taken next to drillholes with well-lithified fresh or hard acoustic bedrock logged at a known depth, or against depth to hard bedrock information from shallow drilling or mining. The depth to fresh bedrock is best determined from drillholes that have intersected fresh bedrock coincident to passive seismic survey stations, if available. Air core (AC) or rotary air blast (RAB) blade refusal depth can also be considered to represent approximate depth to hard saprock or fresh bedrock. Where no bedrock depth information is available, assumptions can be made from local geology to input an assumed average shear wave velocity (V_s in m/s) for preliminary depth calibration to generate preliminary depth to bedrock estimates, which can be updated later when drillholes data become available.

There are four primary methods of depth calibration that may be used to convert HVSR peak frequency data from frequency domain to depth. The first three methods are referred to as V_s analysis and involve applying a constant average V_s for the entire soft cover sequence layer. A constant average V_s may be calculated by entering logged bedrock depth from drill logs and nearby HVSR peak frequency measurements into Equation 1 (see below), estimated through 1D forward modelling using velocity and density measurements (or assumptions based on local geology), or assumed in areas where geology and regolith are known but there is no drilling data available. A fourth method relies on a trendline relationship using HVSR peak frequency measurements taken at a number of drillholes having a range of known depths to fresh/hard bedrock, where depth vs f_0 data are cross-plotted for regression analysis, more commonly referred to as "trendline analysis". For trendline analysis to work, the HVSR peak frequencies and bedrock depths must cover a range of values, meaning it will not work in perfectly flat bedrock settings. A reasonable correlation coefficient (generally above 0.7) must occur between bedrock depths and HVSR peak frequencies to generate a reliable trendline equation for depth conversion.

***Method 1*: Drillhole calibrated average V_s analysis**

Bedrock depth from one or more drill logs corresponding to nearby HVSR bedrock peak frequency measurements (f_0 in Hz) from a survey area are input into Equation 1 to calculate an average V_s of the soft upper layer, which can then be used in areas away from drilling in a survey area to convert other recorded HVSR peak frequencies to depth (*h* in metres): $\boldsymbol{f_0 = V_s/4h}$ **(Equation 1)** (see example in top right panel).

***Method 2*: Modelling based V_s analysis**

Velocity and density assumptions based on local geology or measurements of logged lithology are used to 1D forward model the subsurface acoustic impedance layering such that the 1D modelled HVSR profiles match the observed HVSR profile data, thereby obtaining a geologically reasonable V_s profile which can then be used in areas away from the modelled station to convert other recorded HVSR peak frequencies to depth using Equation 1 (see example in middle right panel). This method can be updated when drilled bedrock depth information coincident to HVSR recording stations become available. 1D modelling is also more reliable when carried out at a recording station taken at a drillhole into fresh bedrock for better modelling constraint and validating results from Method 1 above.

***Method 3*: Assumed average V_s**

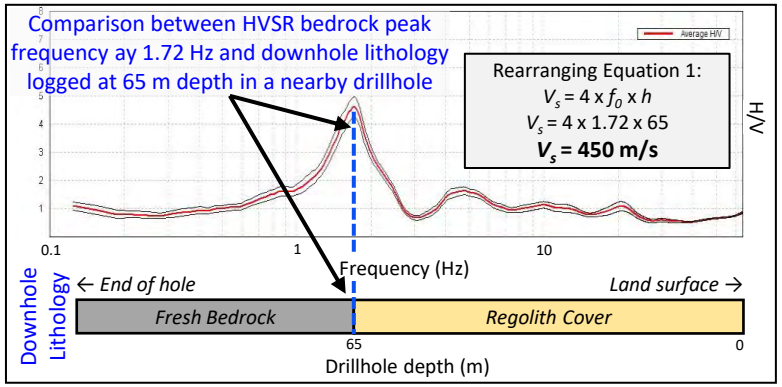
In a survey area where the geology and regolith are generally known, but there is no drilling data in the survey area, one or two assumed average V_s values can be applied to generate preliminary bedrock depth estimates, which can then be revised when drilling data to fresh bedrock become available in the future (not pictured to the right).

***Method 4*: Trendline analysis**

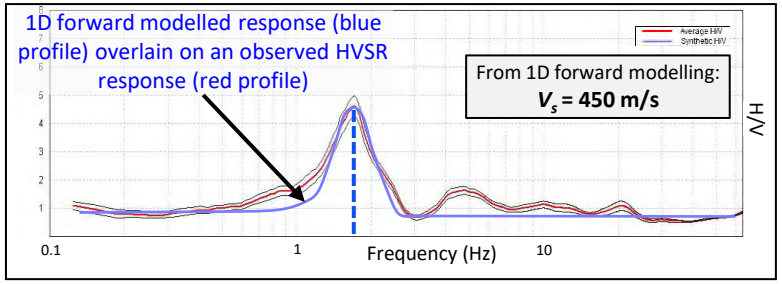
In a survey area which contains a number of drillholes intersecting fresh or hard bedrock across a range of depths, the logged bedrock depths may be plotted against the HVSR bedrock peak frequency (f_0) data recorded at nearby passive seismic HVSR stations to obtain a trendline, if one exists, and an equation in the form $y = ax^b$, where *y* represents bedrock depth in metres, *x* represents f_0 in Hz, and *a* and *b* are constants determined by the regression analysis. Where a reasonable correlation coefficient exists (usually >0.7 is desired), the resultant trendline equation may be used to convert measured HVSR peak frequency readings into fresh bedrock depth for an entire survey area. This equation based method will typically provide a better depth conversion result compared to using a constant average V_s for the cover layer, because it accounts for vertical gradients in V_s arising from greater sediment compaction or decreasing weathering with increasing cover thickness, resulting in increasing V_s with depth (see example in bottom right panel).

Note: The diagrams below contain example data only and are not actual values from this project.

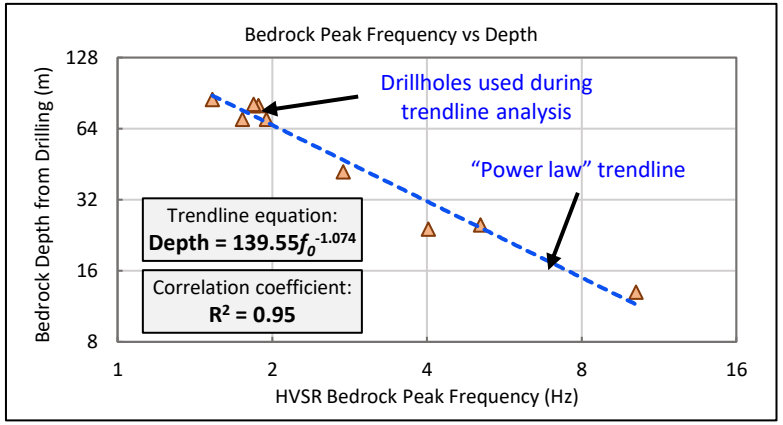
Method 1: Example drillhole calibrated average V_s analysis



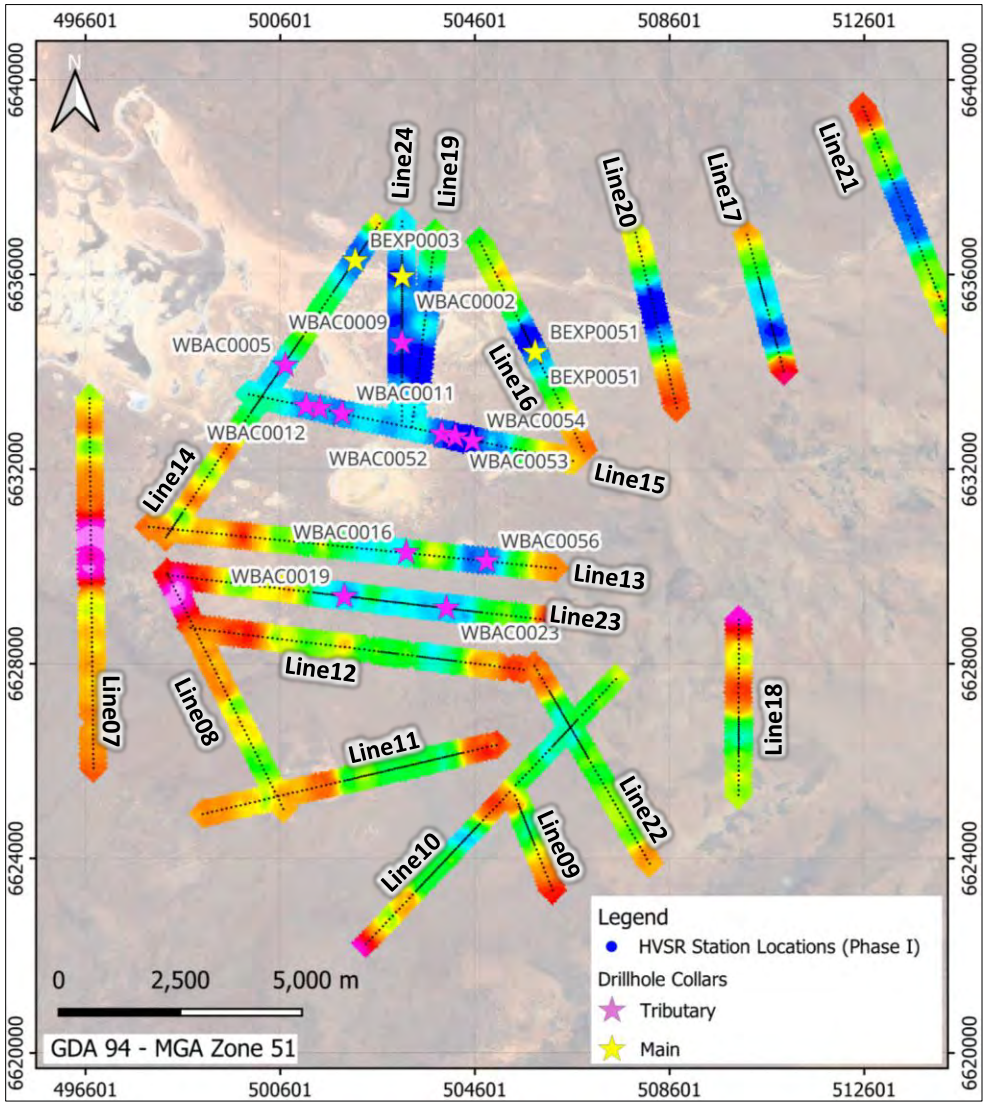
Method 2: Example of 1D modelling for V_s analysis



Method 4: Example of trendline analysis



Drilling Results vs Phase I HVSR Results



Zoomed in map showing drillhole locations planned using the Phase I HVSR survey results, where hotter colours represent elevated acoustic bedrock topography.

Drillholes intercepting fresh bedrock were not available during Phase I of this study preventing accurate HVSR Vs analysis and depth calibration. An assumed constant Vs of 400 m/s, typical for this type of Yilgarn Craton paleochannel geological setting, was therefore applied to depth convert the Phase I dataset. Based on the Phase I results, exploration drill testing in areas of interest were planned and tested by RMS and AQ2. Drillholes targeting the thalwegs of the interpreted main paleochannel (BEXP0003, WBAC0002 and BEXP0051) successfully intercepted fresh bedrock with remarkable accuracy. The difference between predicted and measured depths to fresh bedrock ranged from only 0.4 m to 1.5 m, with interceptions occurring between 68 m to 85 m below ground level (mbgl). Velocity analysis was revisited to incorporate HVSR survey data from Phase I and this current Phase II, and newly acquired drillhole data. This included the 3 drillholes mentioned above and an additional 12 drillholes targeting paleochannel tributary zones. Discrepancies between calculated and measured depths to bedrock for the majority of drillholes acquired over interpreted tributaries suggested that the HVSR method was responding to shallower layers in parts, rather than fresh bedrock. Consequently, Vs analysis was constrained to the drillholes located in the main paleochannel, which intercepted fresh bedrock and a revised constant V_S of 398 m/s was calculated using method 1. Due to the negligible difference (within 0.5%) of this calculated Vs, ResPot recommended continuing with the originally assumed 400 m/s for depth conversions to maintain consistency with previous final products.

It is recommended to continually revisit the HVSR depth conversion process for the southern survey area once more local drilling information intercepting fresh bedrock proximal to good quality HVSR survey stations becomes available.

Bore ID	Paleochannel zone	Depth to fresh bedrock from drilling (mbgl)	Depth to fresh bedrock from passive seismic using Vs = 400 m/s (mbgl)	Difference between Drilled and Passive Seismic	Passive seismic Station Name	Resonant Frequency (Hz)	Calculated Vs (m/s)
BEXP0003	Main	74	74.4	-0.4	Trace 14069	1.344	398
BEXP0051	Main	68	69.54	-1.5	Trace 16050	1.438	391
WBAC0002	Main	85	84.18	0.8	Trace 24063	1.188	404
WBAC0053	Tributary N-S	104	91.41	12.6	Trace 15074	1.094	455
WBAC0052	Tributary N-S	101	88.89	12.1	Trace 15071	1.125	455
WBAC0054	Tributary N-S	98	88.89	9.1	Trace 15048	1.125	441
WBAC0009	Tributary E-W	80	80	0	Trace 24017	1.250	400
WBAC0056	Tributary N-S	96	80	16	Trace 13071	1.250	480
WBAC0023	Tributary N-S	75.5	69.54	6	Trace 23107	1.438	434
WBAC0011	Tributary N-S	60	68.07	-8.1	Trace 15021	1.469	353
WBAC0019	Tributary N-S	91.5	68.07	23.4	Trace 23086	1.469	538
WBAC0012	Tributary N-S	80.5	66.67	13.8	Trace 15016	1.500	483
WBAC0013	Tributary N-S	85	66.67	18.3	Trace 15013	1.500	510
WBAC0005	Tributary E-W	52	62.74	-10.7	Trace 14043	1.594	332
WBAC0016	Tributary N-S	71	53.33	17.7	Trace 13054	1.875	533
						Average All	440
						Average Main	**398 m/s**

Drilling results compared to the PS HVSR Phase I survey data, which were depth converted using an assumed constant average Vs of 400m/s due to the absence of drilling at the time of processing. The difference between predicted and measured depths to fresh bedrock for the main paleochannel zones ranged from only 0.4 m to 1.5 m, with interceptions occurring between 68 m to 85 m below ground level (mbgl). Acoustic bedrock resonant frequencies from these HVSR station recordings range from approximately 1.094 Hz to 1.875 Hz, which does not provide sufficient frequency spread to allow for a reliable trendline equation.

Raw and Normalised Amplitude HVSR Cross Sections

The depth-converted HVSR response data along survey lines are displayed as coloured cross-section images (as pixel plots), with the HVSR amplitude responses displayed as raw amplitude and as normalised amplitude to enhance lateral continuity of HVSR peak responses and to show possible layering within the cover sequence (see example HVSR cross-section plot to the right).

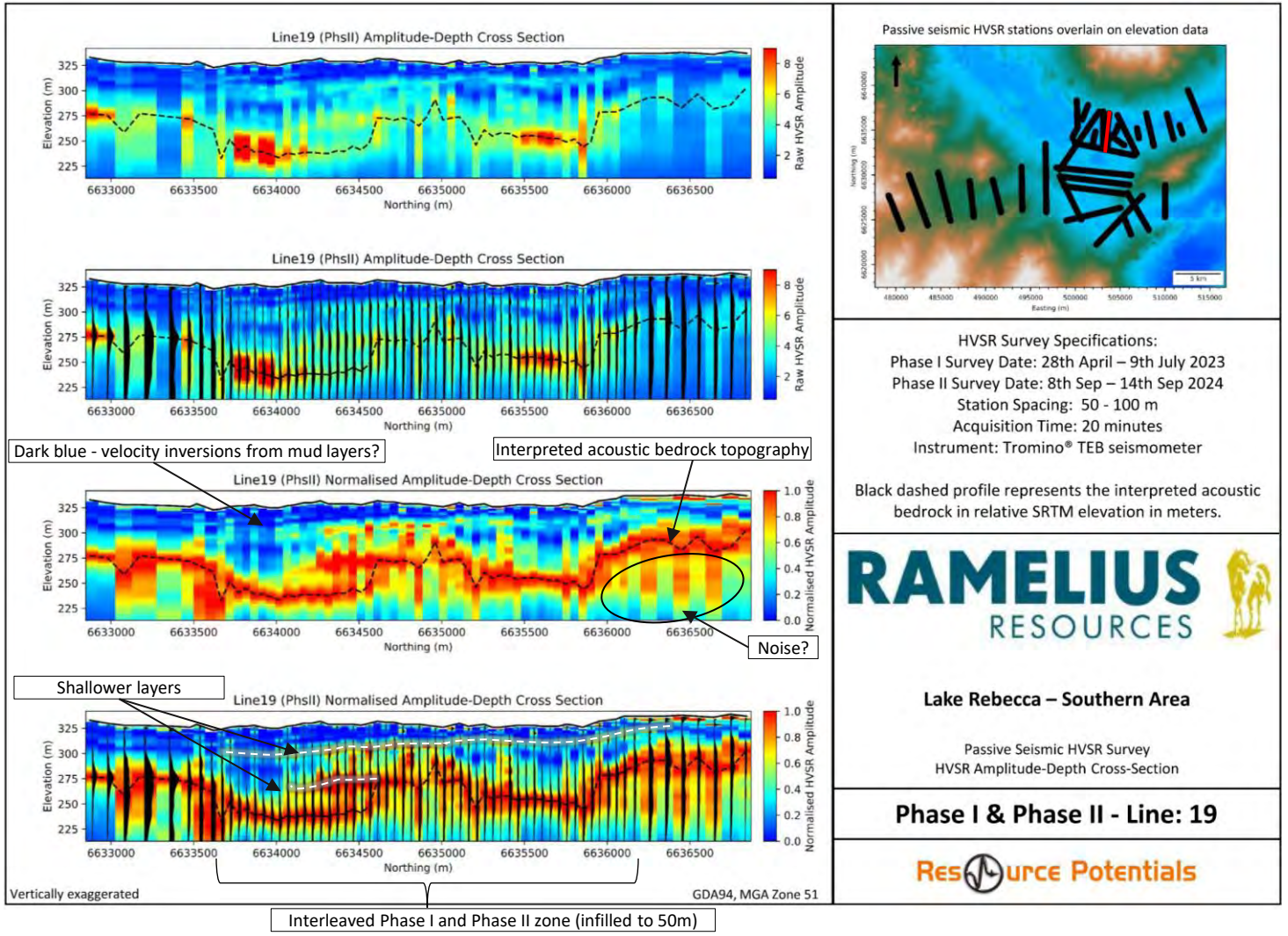
Passive seismic HVSR data were amplitude normalised by applying a filter process that equalises variations in the HVSR peak amplitudes observed at individual recording stations. This amplitude normalisation allows for subtle HVSR resonant peak frequency responses to be amplified and stronger amplitudes to become subdued, enhancing lateral layer continuity along survey transects across the project area. However, in a similar fashion, amplitude normalisation can also enhance noise, where persistent noise oscillating at constant frequency may appear on the amplitude normalised cross-sections as a coherent looking HVSR response between stations that could be misinterpreted as a geological layering to the untrained eye.

HVSR bedrock peak frequency responses for this study were manually interpreted for each HVSR station recording, converted to depth using a constant average V_S of 400m/s (as discussed on Slide 9) and then displayed on final cross-sections as black dashed lines. These dashed lines are interpreted to represent the main 'acoustic bedrock' interfaces but they could also be shifted up or down after velocity calibration using drilling data.

An example multi-plot of HVSR amplitude-depth cross-sections from survey Line 19 is shown to the right as raw (top two sections) and normalised (bottom two sections) HVSR amplitude responses, where hot colours represent zones of higher amplitude and cool colours represent zones of lower amplitude. Very dark blue layers could represent velocity inversion caused by mud layers. Shallower than acoustic bedrock layering is also observed which may represent sand or gravel, calcrete, silcrete, cementation, silicification layers etc. Similar multi-plots were generated for each survey line and accompany this report in PDF format (see also Appendix 1 of this report). 3D georeferenced raw and normalised amplitude cross-section images for all survey lines are also provided in Geotiff format for 3D integration with other project geospatial datasets (for example see Slide 16).

Final calculated depth from surface and RL elevation of the calculated acoustic bedrock were then gridded and imaged in order to assist with interpretation and visualisation of the HVSR survey results as acoustic bedrock topography to identify fresh bedrock elevation low zones and possible fault structures (see example on Slides 12 and 13).

A CSV database of the interpreted main acoustic bedrock as depth from land surface and as RL elevation were generated, along with various products listed on Slide 2. Elevations are referenced to sea level and were obtained from SRTM 1 arc-second (30 m cell size resolution) digital elevation data.



Example map layout image for a passive seismic survey Line19 (Phase I with Phase II infill stations) HVSR cross-sections provided as multi-plot images of raw and normalised HVSR amplitude cross sections with and without HVSR wiggle traces. Note that the elevation is relative to SRTM 1 arc-second (30 m cell size resolution) digital elevation data. A similar multi-plot image is provided for each passive seismic survey line in Appendix 1 and as PNG images accompanying this report.

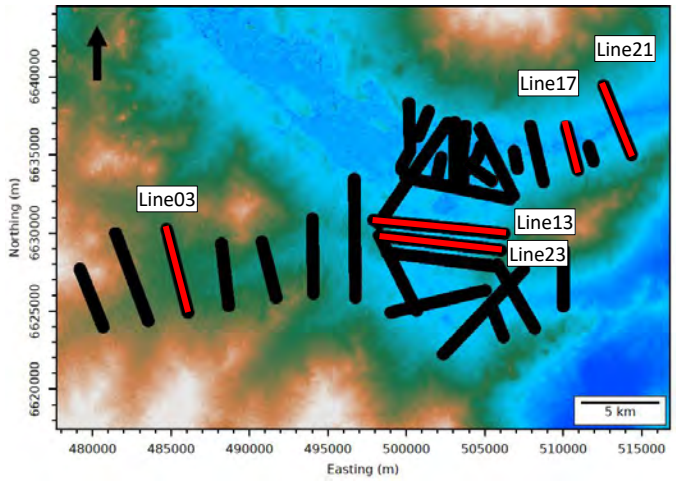
HVSR Survey Results (Slide 1 of 5)

The Lake Rebecca passive seismic HVSR survey results from the southern survey area have successfully resolved an undulating bedrock acoustic impedance contrast interface response on all survey lines relating to the depth from surface, or as RL elevation, of the interpreted acoustic bedrock sitting below softer sedimentary and regolith cover deposits. Calculated depths to acoustic bedrock range from approximately 1.5 m (outcrop/subcrop) to 100 m. When surface topography is taken into consideration, the highest elevations and thinnest cover are resolved on survey Line 07, and the lowest elevations and thickest cover are resolved on survey Line 20. In general, the shape and character of the resolved acoustic bedrock on all survey lines indicates a complex paleochannel system, and possibly U-shaped valleys formed by Permian glacial processes.

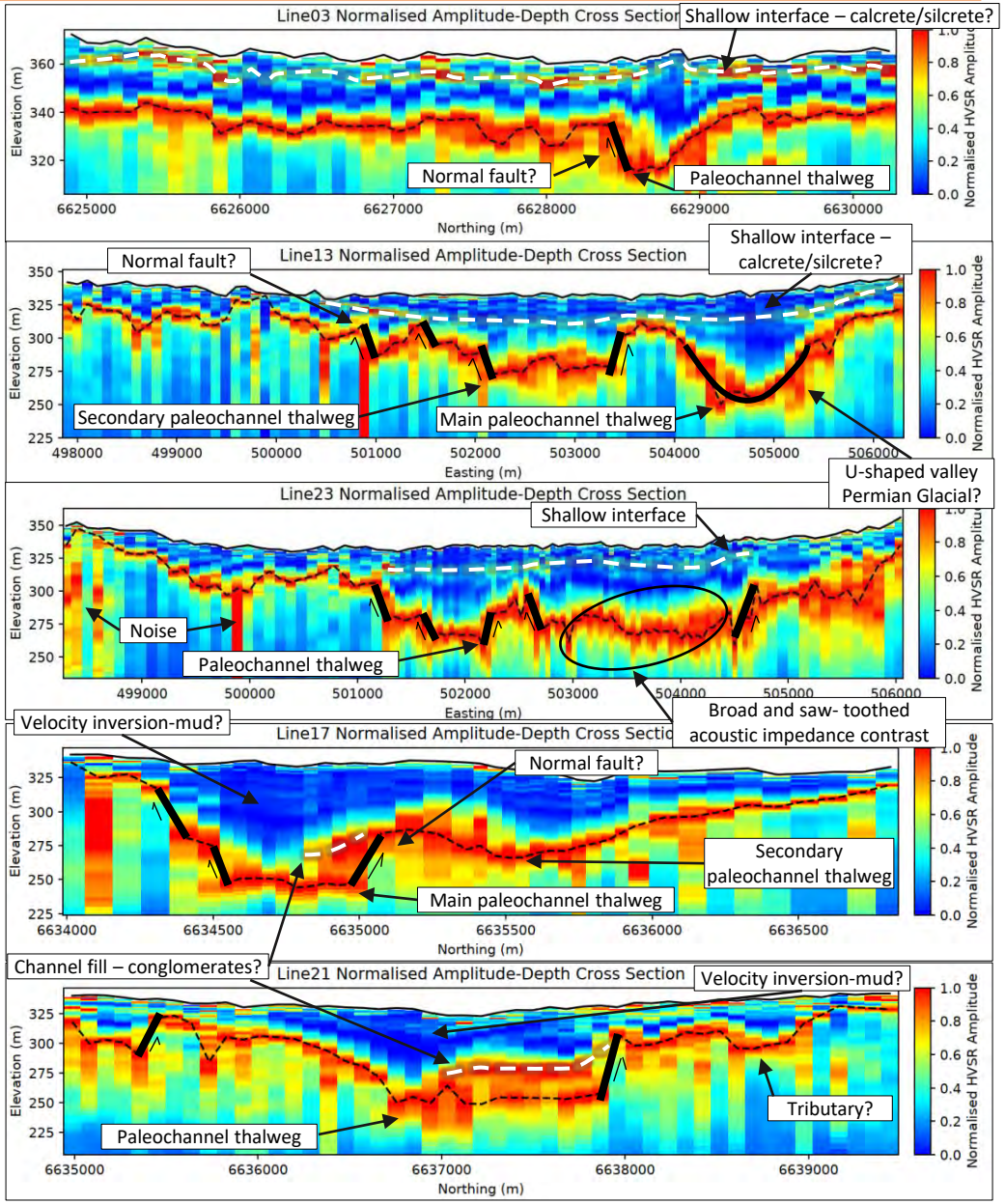
Example normalised HVSR amplitude cross-sections of select survey lines from within the survey area are shown to the right and on the following slide. The main branches of the interpreted paleochannel axis are recognised by the large undulations in acoustic bedrock topography, which can vary between survey lines in both depth and width (see annotations on cross-sections to the right). Smaller scale undulations in the acoustic bedrock to the sides of the main paleochannel axes are also resolved and could represent channel terraces and tributaries, or areas of confluence between two main paleochannels. The paleotopographic surface has a variable nature which could be a reflection of the flow regime or potentially reflect a saw-tooth weathering pattern of the bedrock interface associated with bedrock lithologies, faulting, zones of altered bedrock, or weathering along geological structures.

Shallower acoustic contrast interfaces are also observed along many of the survey line transects (semi continuous white dashed lines on cross-sections to the right), and these shallow layers likely represent localised acoustic impedance contrasts in the sedimentary and regolith cover sequence caused by calcrete, silcrete and hard pan for shallow features, and conglomerates or gravel channel fill for the deeper acoustic impedance contrasts immediately above the main HVSR response (see Line 21 for example). Some possible velocity inversions (deep blue zones) could be caused by soft mud layers in the cover sequence.

Large offsets in the interpreted acoustic bedrock topography between neighbouring stations along the traverse likely indicate the presence of normal faulting formed in the Permian to recent, likely Miocene.



Map showing the locations of displayed example HVSR survey lines shown as cross-sections to the right, overlain on an SRTM elevation image.

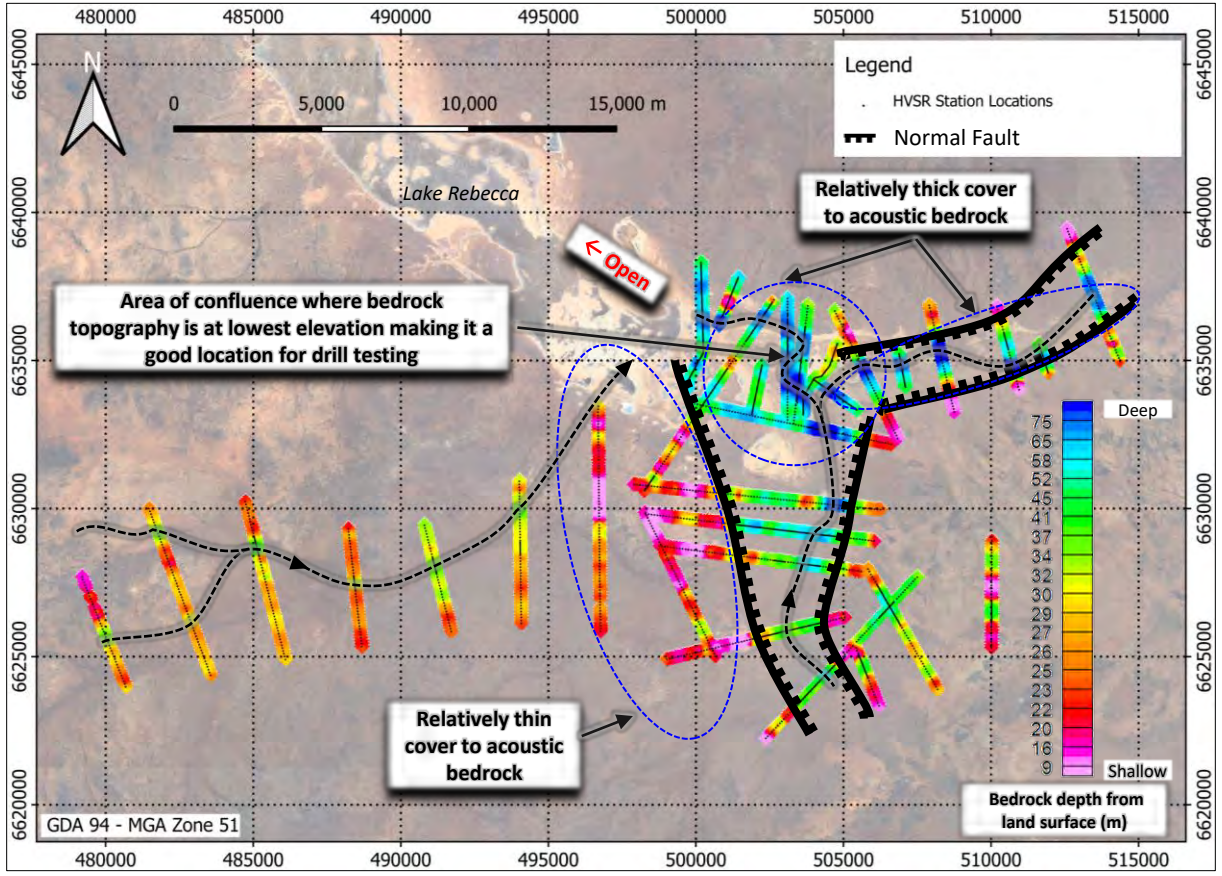


Example HVSR normalised amplitude cross-sections with high-level interpretation features. Elevations are referenced to SRTM data (30m cell size resolution). Survey line locations are shown on the map to the left.

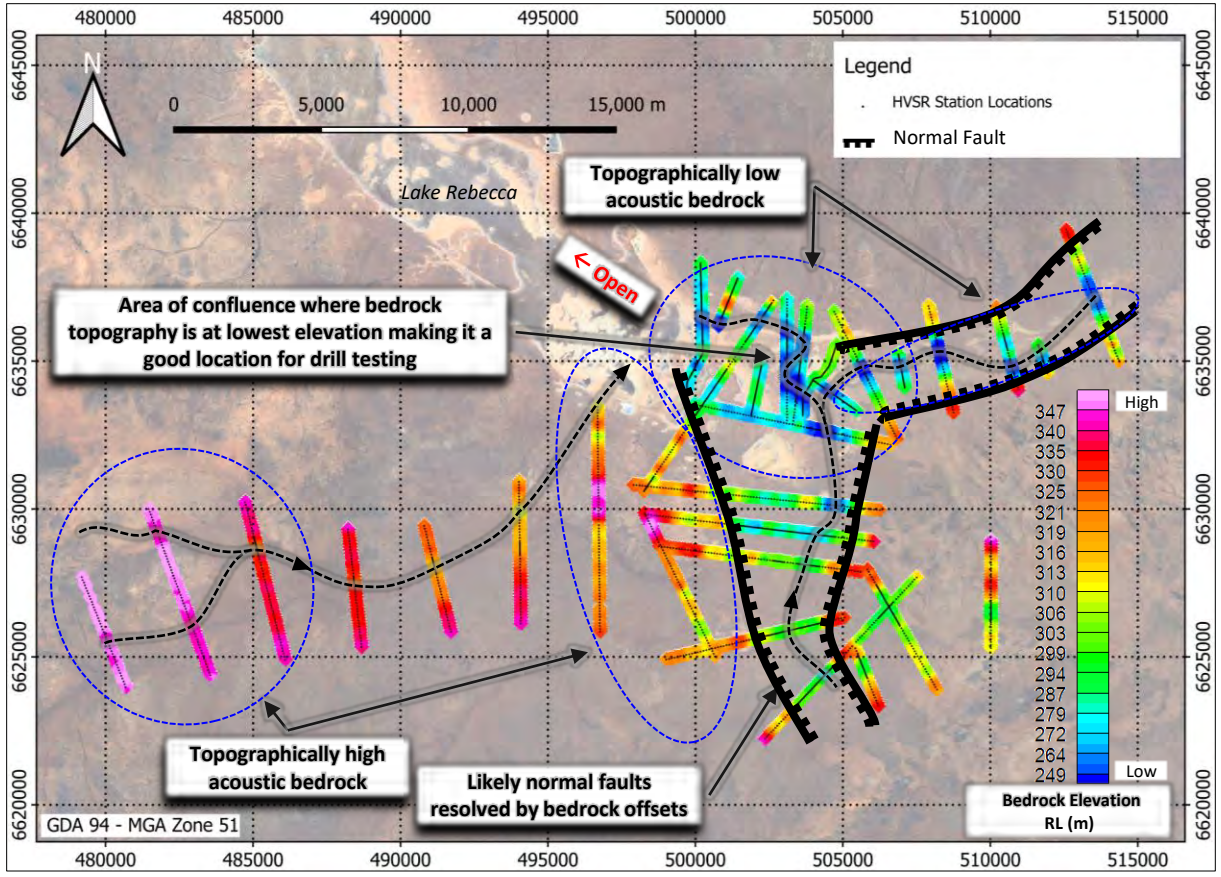
HVSR Survey Results (Slide 2 of 5)

The maps below show colour images of HVSR derived acoustic bedrock results as depth from ground surface (left) and as bedrock topography (right) with interpretation line work overlain. The colour stretch for the depth from land surface is reversed such that hotter colors indicate thinner cover and cooler colors indicate thicker cover. For the bedrock topography image, the hotter colours indicate higher RL values and cooler colours reflect lower RL values. Both images are overlain on a Google Earth satellite image for reference.

These results have helped to highlight a paleochannel system, which can provide RMS and AQ2 with an indication of the size, shape, meander and location of the paleochannel system and paleo water flow direction, which can subsequently be used for water exploration by helping to generate drill targets and help to generate water volume estimations when used in conjunction with other hydrogeological datasets. Whilst these results are very encouraging, the results presented here should be considered as broad-spaced due to the wide survey line spacings, and further HVSR surveying with updated drilling constrained velocity analysis should be considered. Additional HVSR surveying around the deepest sections (lowest elevation and thickest cover) of the paleochannel system by infilling between existing lines may be considered to help map out the areas of interest of the paleochannel system in greater detail if required, and extension survey lines could be considered to close off open zones of paleochannel axes.



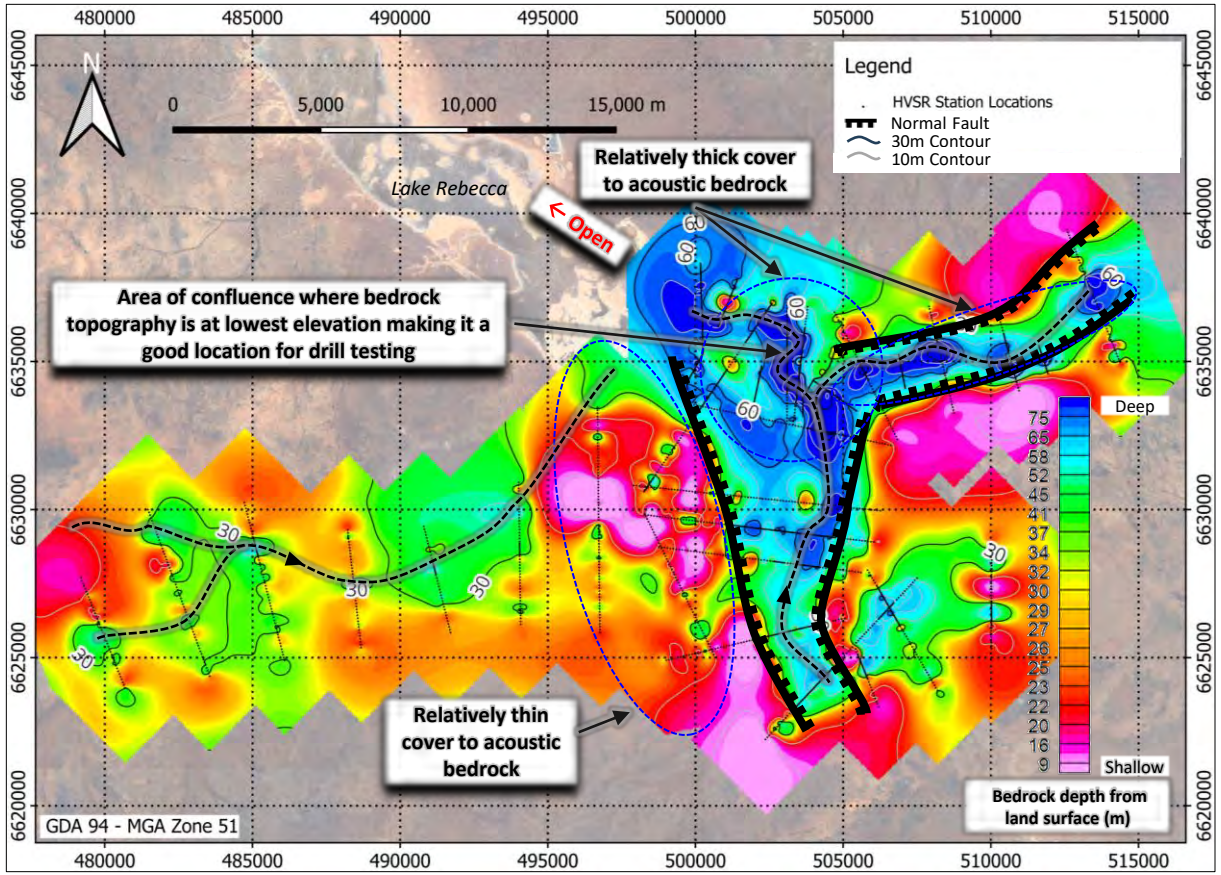
Map showing passive seismic station locations (black dots), image of calculated depth to acoustic bedrock from land surface surrounding survey lines with reversed colour stretch so that deeper bedrock are cooler colours, overlain on a Google Earth satellite image.



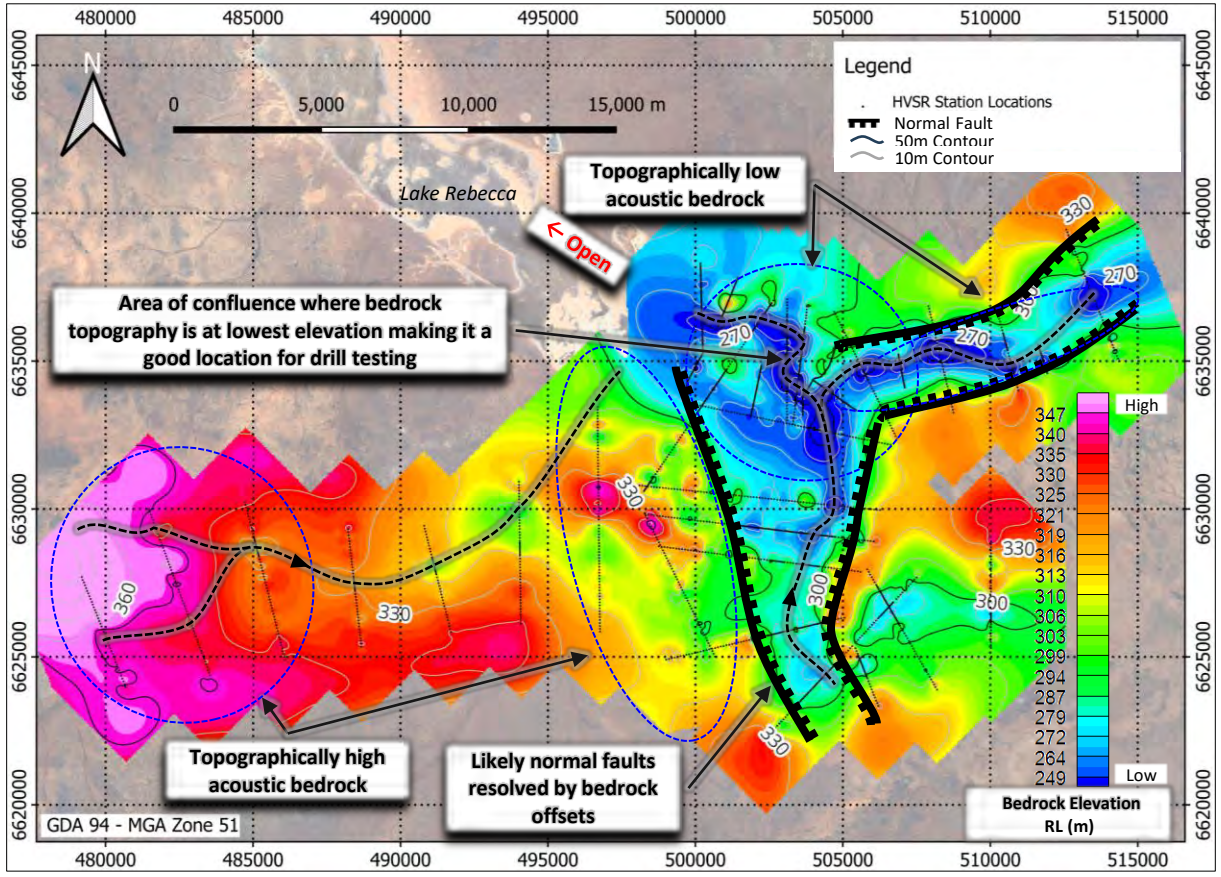
Map showing passive seismic station locations (black dots), image of calculated bedrock elevation RL (m) image surrounding survey lines, overlain on a Google Earth satellite image.

HVSR Survey Results (Slide 3 of 5)

Similar to the previous slide, the map images below show the HVSR derived acoustic bedrock results as colour images of depth from ground surface (below left) and as bedrock topography (below right) with interpretation line work. However, the gridding parameters for these images have been broadened to allow a larger interpolation/extrapolation envelope of 2,500 m around the HVSR survey lines. As a result, the large gaps arising from wide spaced survey lines have been filled with gridded data. However, it is important to note that as a result of the large interpolation/extrapolation distances, the reliability of the interpolated/extrapolated data is dramatically diminished and these images are therefore intended for visual purposes only.



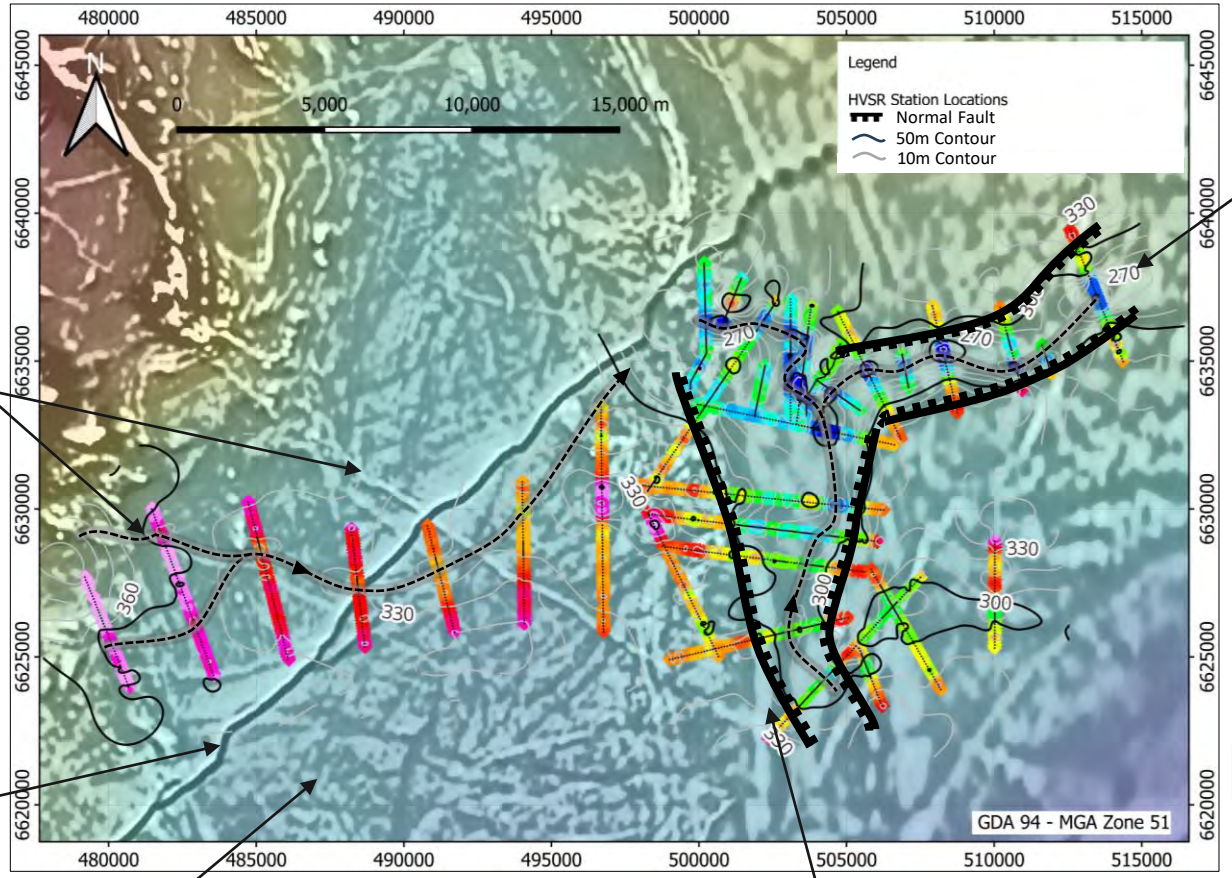
Map showing passive seismic station locations (black dots), gridded calculated depth to acoustic bedrock from land surface with reversed colour stretch, overlain on a Google Earth satellite image.



Map showing passive seismic station locations (black dots), gridded calculated bedrock elevation RL (m), overlain on a Google Earth satellite image.

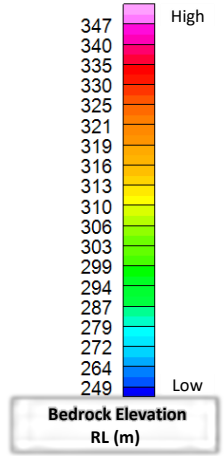
HVSR Survey Results (Slide 4 of 5)

Map showing southern survey area passive seismic station locations (black dots) and interpretation line work, overlain on a filtered state wide gravity (low resolution) anomaly pseudocolor image semi-transparent on top of a filtered low resolution state wide magnetic anomaly greyscale image, which is overlain by a bedrock elevation RL (m) image with broad scale bedrock elevation contours generated using regional gridding. A good correlation is observed between trends of magnetic features and structures in the granite-greenstone bedrock and the HVSR surveyed deep paleochannel zones.



Generally, more 'blurry' magnetic anomaly patterns are observed in this area suggesting either a lower resolution image or a deeper bedrock source under thicker cover. A thicker cover is supported by the lower RL values in the passive seismic results.

Mafic dyke



Reversely magnetized Proterozoic mafic dyke cross-cutting granite-greenstone bedrock

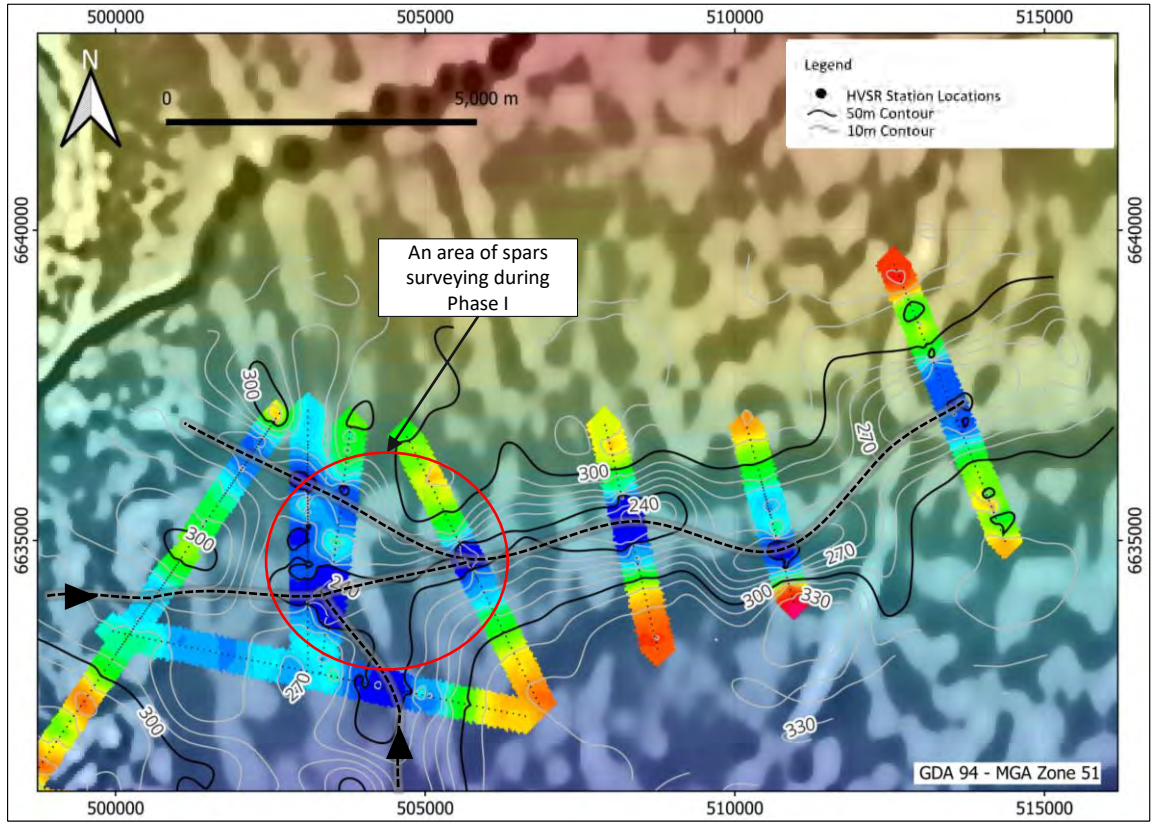
Sharper looking magnetic images in this area suggest shallower bedrock source and thinner cover which is supported by the higher RL values in the passive seismic results

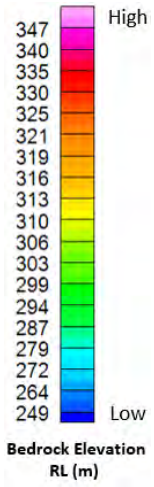
N-S trending magnetic anomaly coincident with younger fault directions

HVSR Survey Results (Slide 5 of 5)

The maps below show zoomed in colour images of the HVSR derived acoustic bedrock topography results from the Phase I study (left) and the follow up Phase II infill (right) for comparison. The HVSR results and interpretation line work are overlain on a filtered state wide gravity (low resolution) anomaly pseudocolor image transparent over a state wide magnetic anomaly greyscale image. Passive seismic station locations are shown as (black dots). A comparison of the results before and after infill show a significant difference in the interpreted paleochannel main axis highlighting the complexity of this area of interest.

Although the Phase II survey lines helped to better define the meander of the interpreted paleochannel, the survey line separation is still considered spars and it is therefore further infilling between spars survey lines is recommended for future survey phases to better define areas of interest.





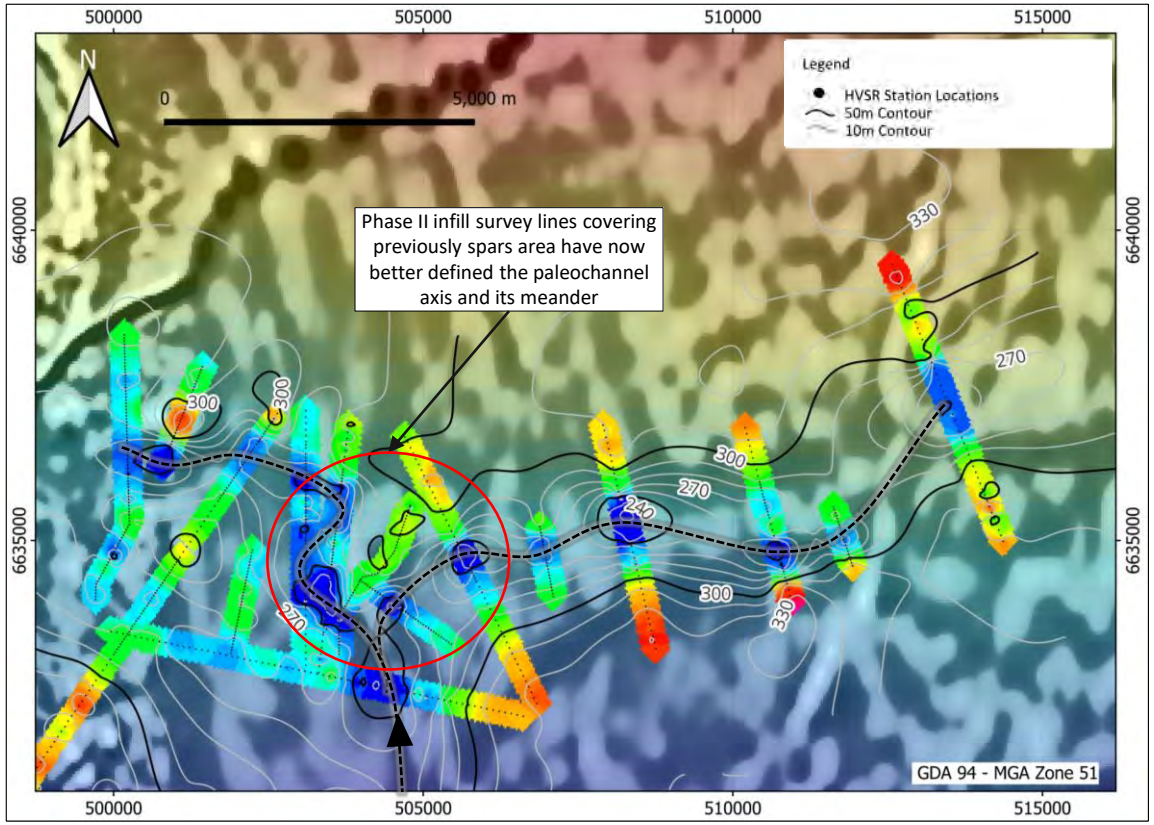
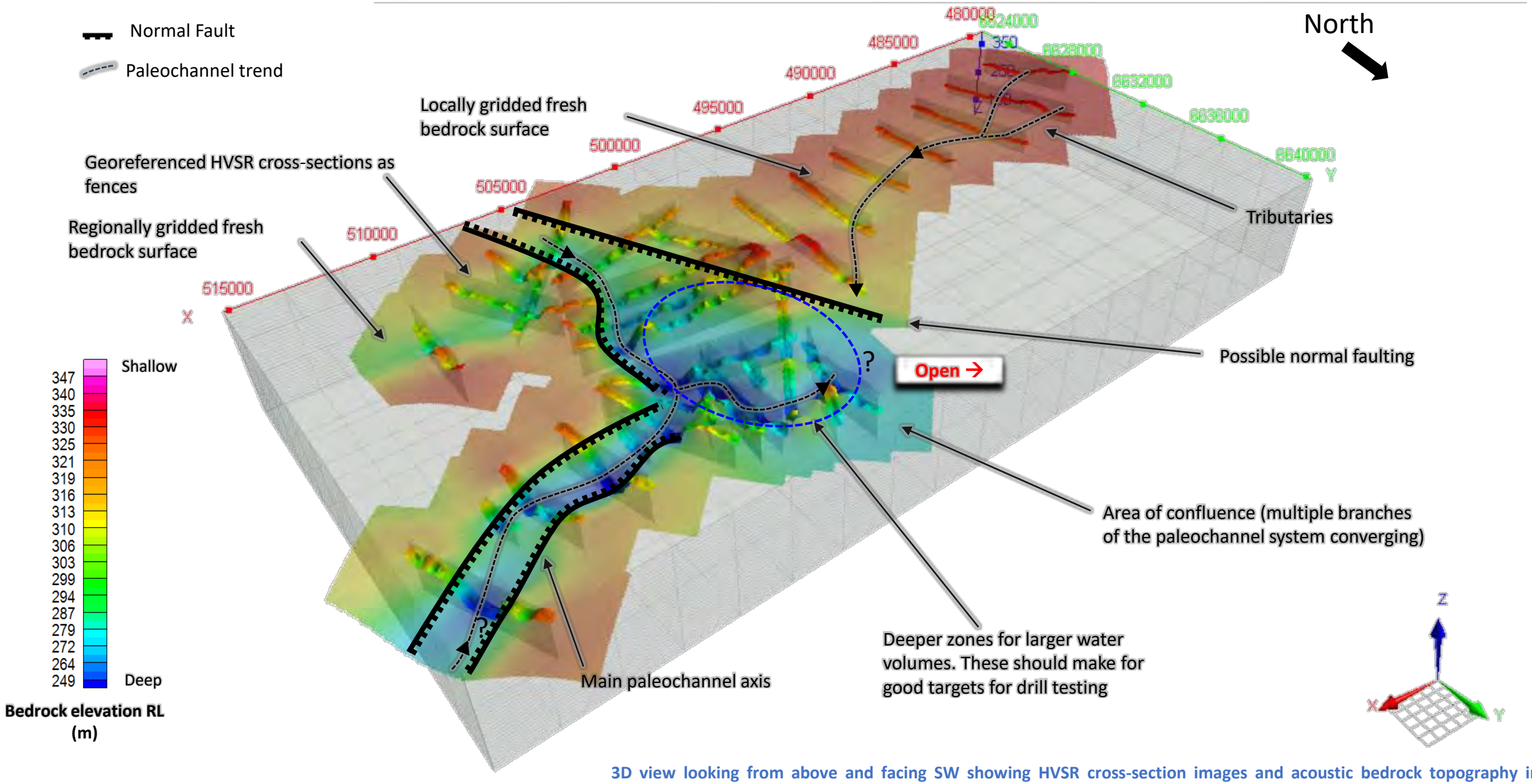


Image showing zoomed area of the main paleochannel resolved during Phase I. Area with spars surveying highlighted with red circle.

Image showing zoomed area of the main paleochannel resolved during Phase II with significantly improved paleochannel definition in an area of infilling.

Example 3D Visualisation of Passive Seismic HVSR Survey Results



3D view looking from above and facing SW showing HVSR cross-section images and acoustic bedrock topography in RL elevation, with interpretation line work.

Conclusions and Recommendations

Passive seismic HVSR surveying at the southern survey area of the RMS Lake Rebecca Gold Project area has delivered excellent results showing this method was successful for resolving and mapping the subsurface location, geometry and preliminary calculated thicknesses of a paleochannel drainage system. These survey results confirm the Tromino® HVSR passive seismic method as a quick, easy and affordable method for detecting acoustic bedrock, allowing for mapping of subsurface paleodrainage and geologically young normal faults in this geological setting.

Besides mapping the broad geometry of paleochannel topography and its tributary like features, by detecting the top of the hard and fresh bedrock sitting below soft regolith and sedimentary cover deposits, the passive seismic HVSR survey was also successful for mapping areas containing possible small and large vertical offsets of the acoustic bedrock which are interpreted to represent Cainozoic neotectonic faulting. Some U-shaped paleochannels identified in the cross-sections may have been initially carved out by Permian glacial processes (see example Survey Line 13).

Secondary HVSR layer responses with higher frequency than the acoustic bedrock response (f_0) were also detected on multiple survey lines are possibly caused by shallower stratigraphic layering within the regolith. The highest frequency of these secondary responses relate to the shallowest layer interfaces and are possibly be caused by calcrete, silcrete, sands-gravels and other hard layers within the regolith at near surface (see example Survey Line13). Features observed between the acoustic bedrock and these shallower layer responses may possibly represent other paleochannel fill deposits such as conglomerate layers (see example Survey Line 21). In addition to these, velocity inversion layers (where HVSR>1) in the HVSR responses were also observed on multiple survey lines which possibly indicate slower velocity layers such as mud layers (see example survey Line 17).

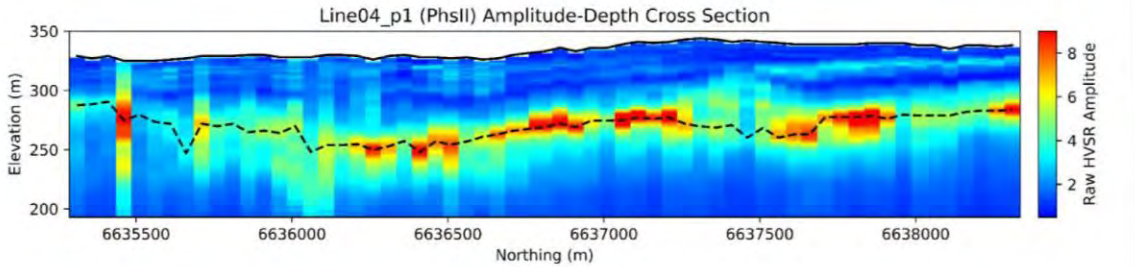
The southern area passive seismic HVSR survey data were planned by AQ2 and RMS and then acquired by XM Logistics field staff from late April to early July 2023 initially using 4x and later 8x Tromino® TEB seismometers, for a total of 1,533 HVSR station recordings acquired along 24 widely spaced survey lines. Follow up surveying was completed September 2024 where 324 HVSR station recordings were collected over 8 survey line transects. The majority of the final HVSR data from both phases of the project were considered to be of excellent quality, with generally mid-to-high amplitude and low-to-moderate frequency HVSR bedrock peak frequency responses observed. Minimal data editing was required to reduce noise and standard deviation and to improve coherent HVSR layer responses, with only a handful of HVSR stations requiring repeating due to high levels of noise/uncertainty. Final HVSR survey data were organised into a database, edited, processed and depth converted using newly acquired drillhole data, which confirmed that the previously assumed constant average V_S of 400 m/s was suitable to produce normalised and raw HVSR amplitude cross-sections for all survey transects.

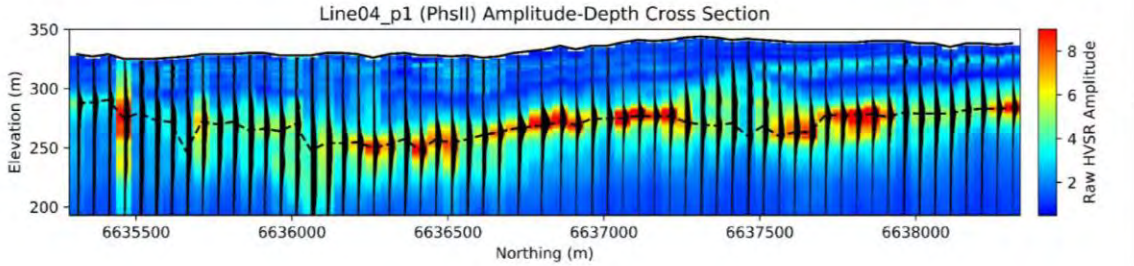
Depth discrepancies between future drilling and the results generated during this study are likely to exist, because a robust trendline equation for depth conversion could not be established from the available data. ResPot recommends revisiting the depth calibration and conversion once more drilling intercepting fresh bedrock proximal to good quality HVSR station recordings becomes available.

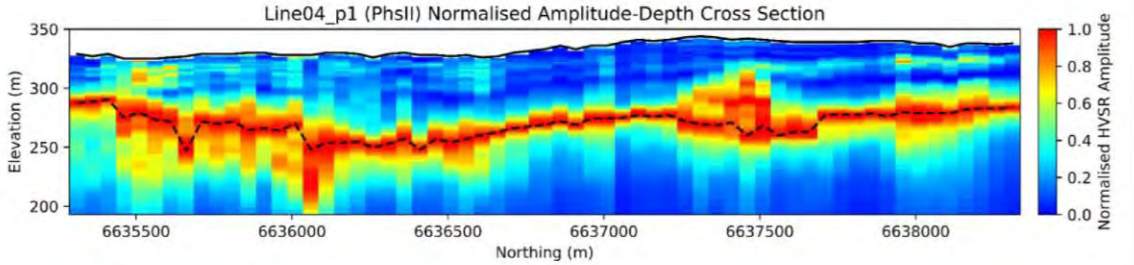
The calculated depths to the acoustic bedrock range from 1.5 m to 100 m from land surface where the deepest resolved acoustic bedrock (when surface topography is considered) located at station 20023 on survey Line 20. This should be a good target location for RMS and AQ2 to consider drillhole testing as final bedrock depths from this test drillhole may be fed back into depth calibration to update calculated HVSR bedrock depths. Calibrating the depth-conversion to shallower HVSR responses, such as calcrete interfaces (etc.), may also allow RMS and AQ2 to estimate volumes of possible shallow aquifer layers between the interpreted HVSR layer interfaces.

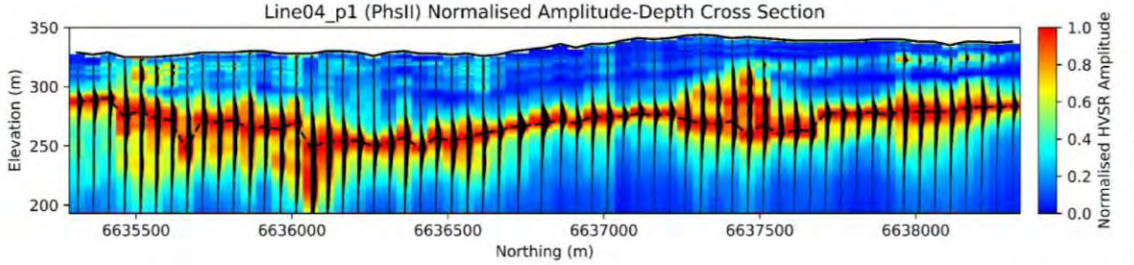
Further value from these passive seismic results may be attained by integrating them with other geospatial datasets, like high resolution airborne magnetics, detailed gravity and airborne electromagnetics, to aid subsurface interpretations of the project area. ResPot recommends additional HVSR surveying to close off the interpreted paleochannel and infill to provide more detail over areas of interest which have low spatial resolution which may allow for better targeting for drill hole planning and aquifer management.

Appendix 1 – HVSR Cross-sections





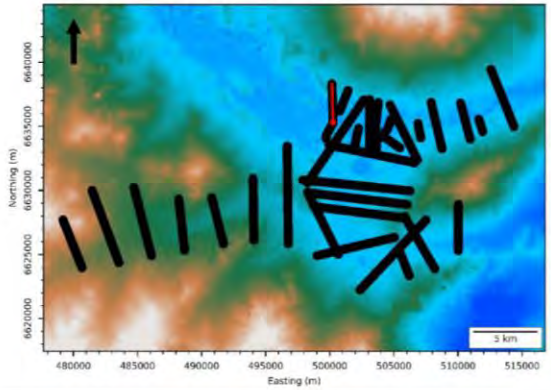




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

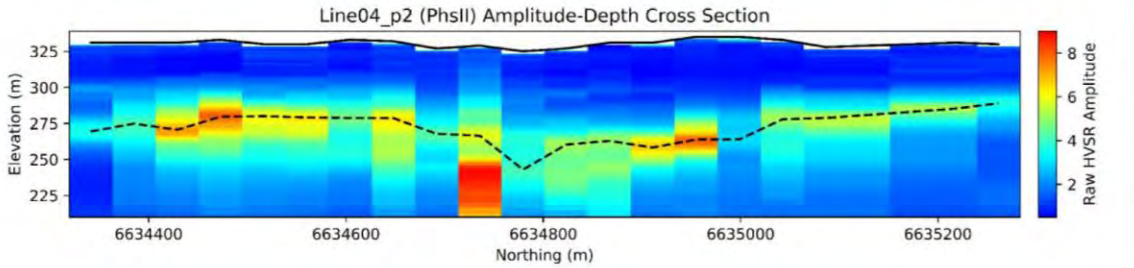
Lake Rebecca – Southern Area

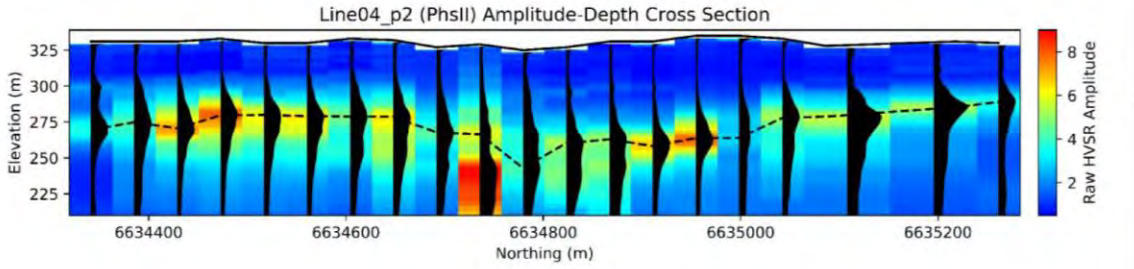
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

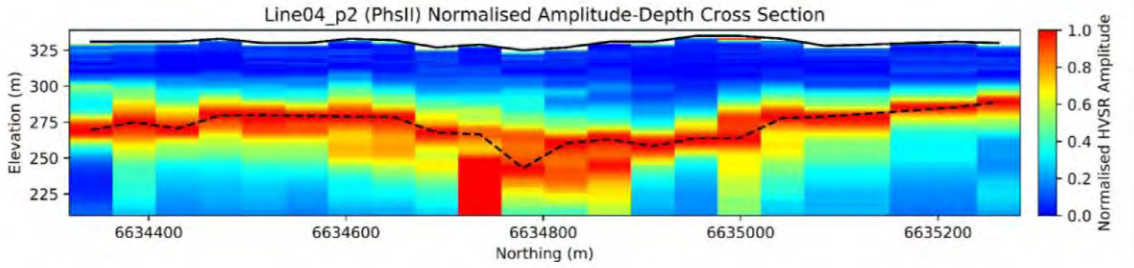
Phase II - Line: 04 part 1

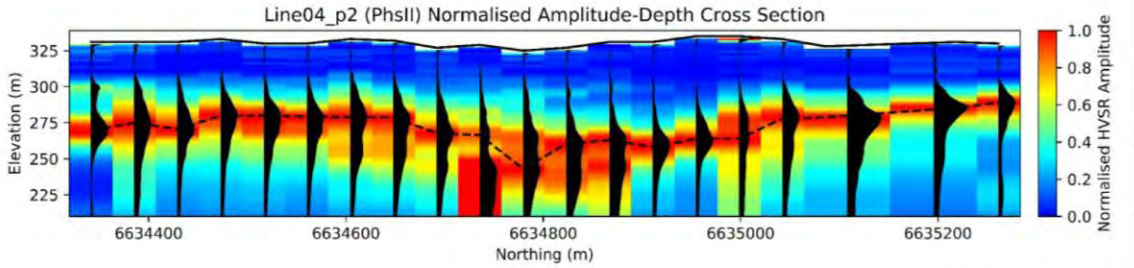
Resource Potentials

Appendix 1 – HVSR Cross-sections





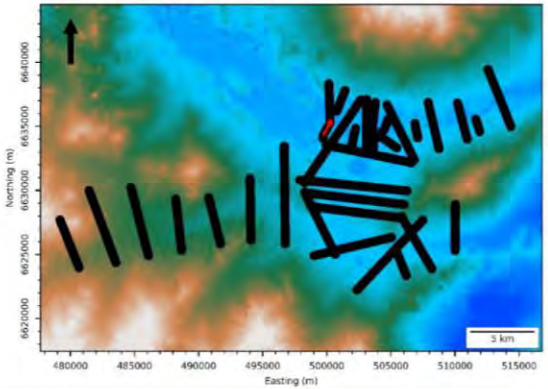




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

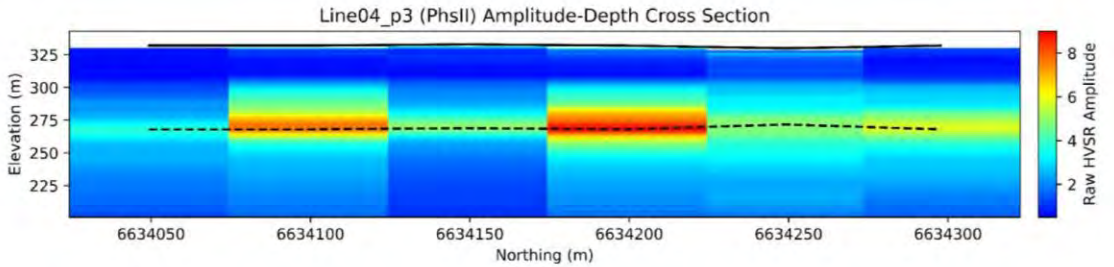
Lake Rebecca – Southern Area

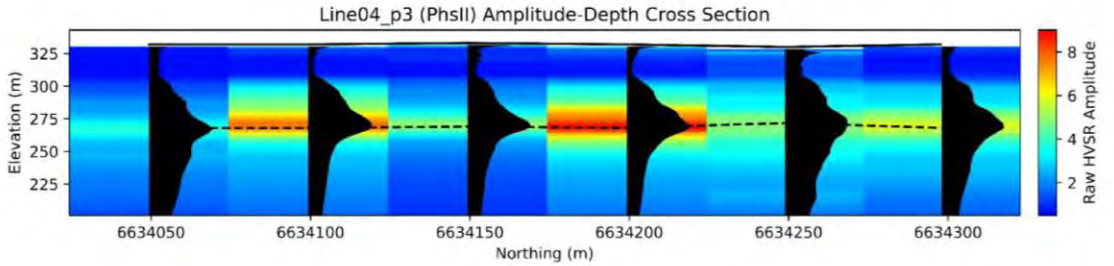
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

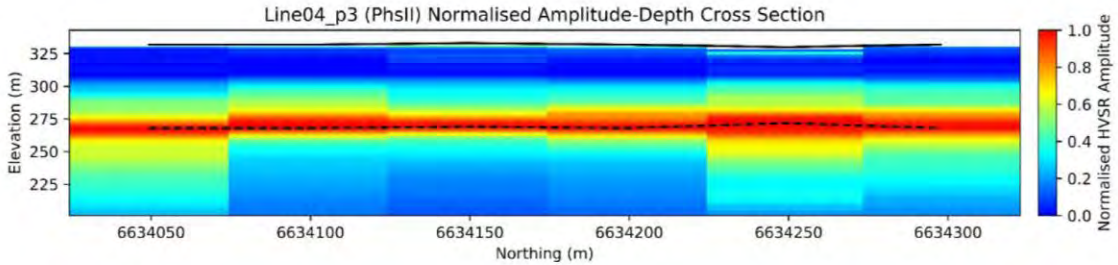
Phase II - Line: 04 part 2

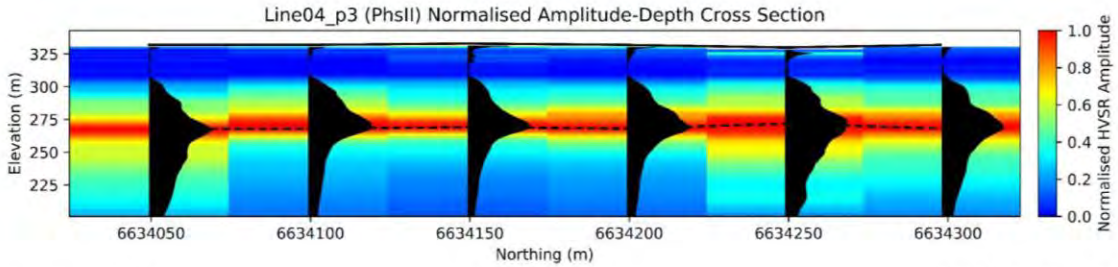
Resource Potentials

Appendix 1 – HVSR Cross-sections





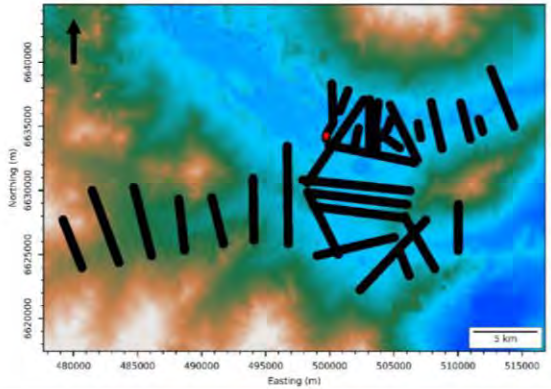




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

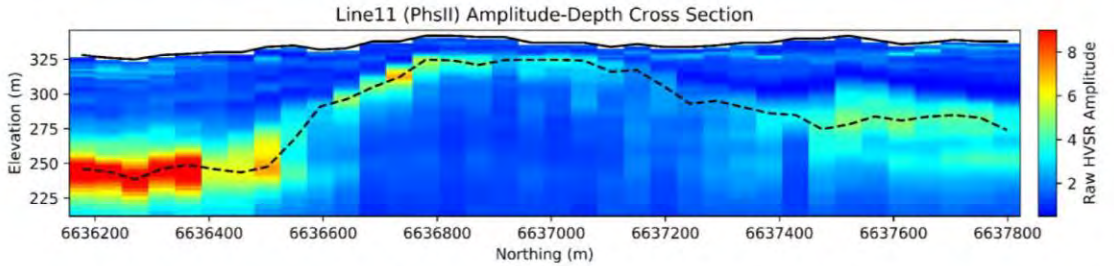
Lake Rebecca – Southern Area

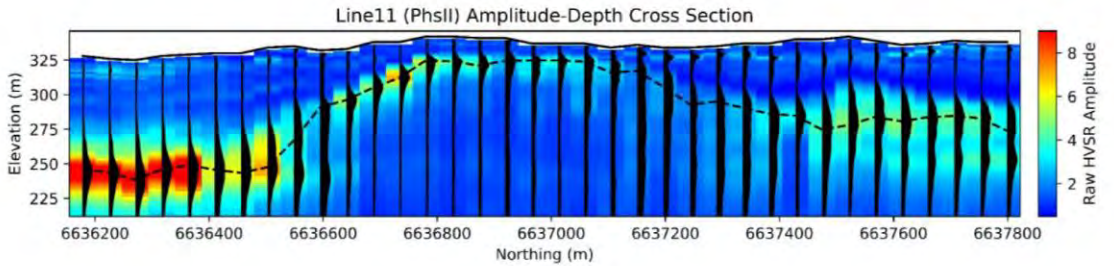
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

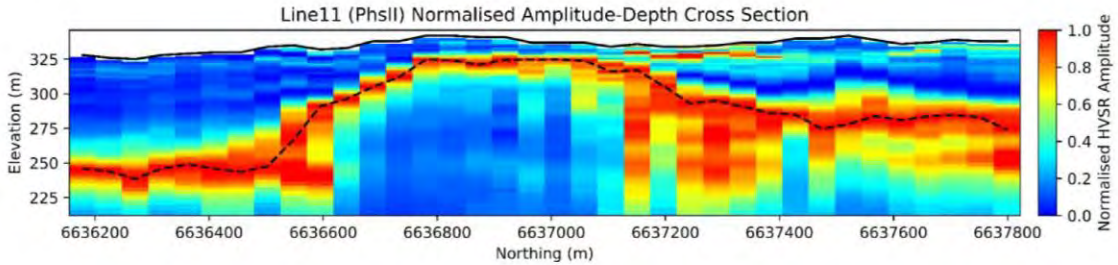
Phase II - Line: 04 part 3

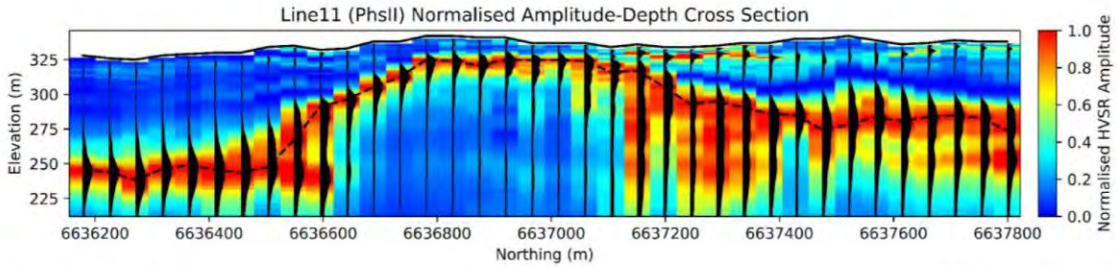
Resource Potentials

Appendix 1 – HVSR Cross-sections





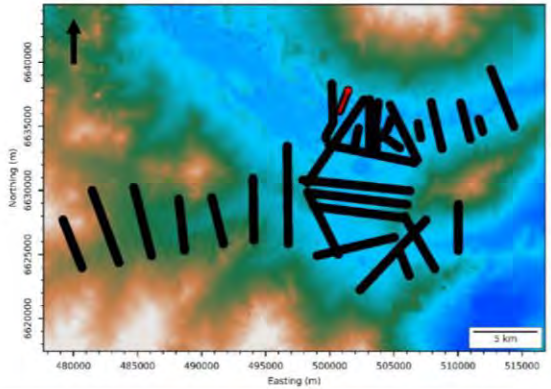




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

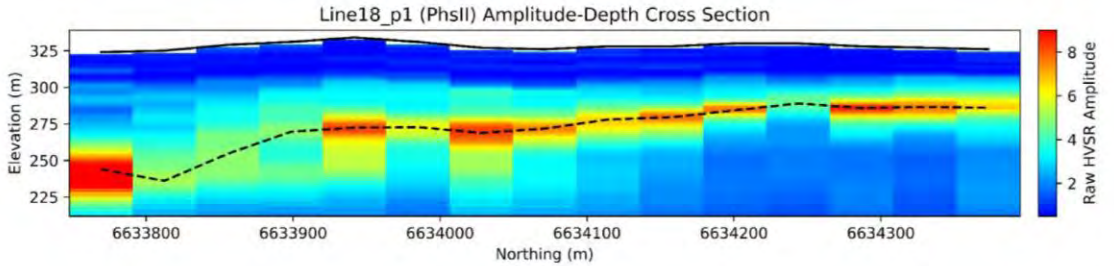
Lake Rebecca – Southern Area

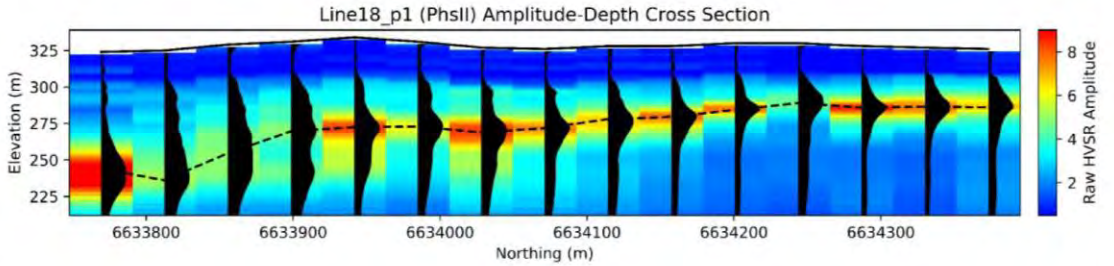
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

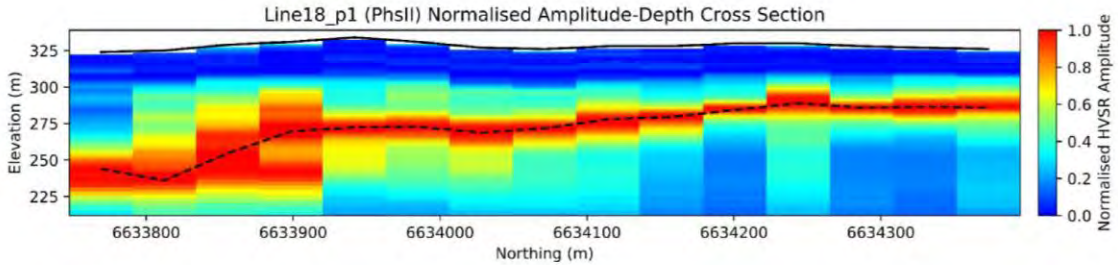
Phase II - Line: 11

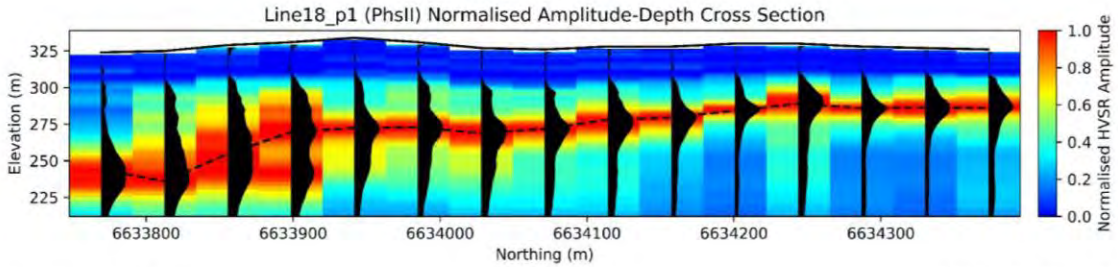
Resource Potentials

Appendix 1 – HVSR Cross-sections





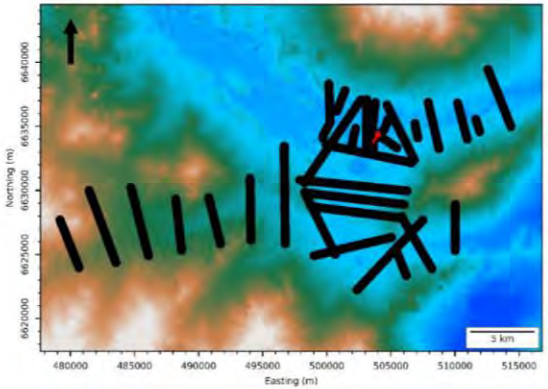




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

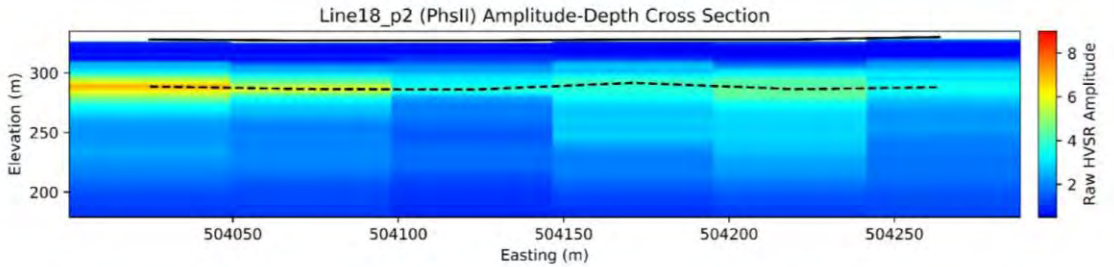
Lake Rebecca – Southern Area

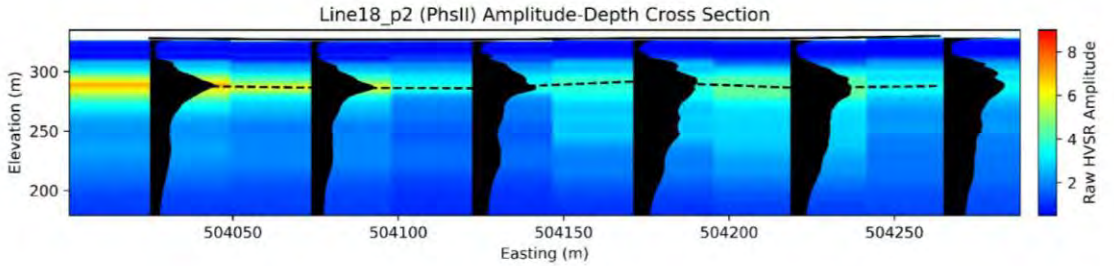
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

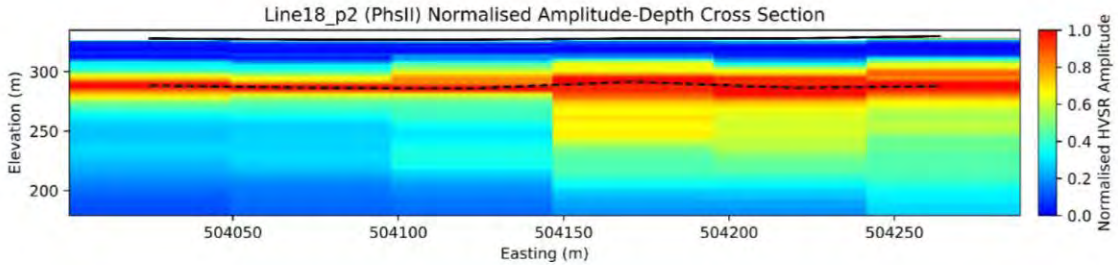
Phase II - Line: 18 part 1

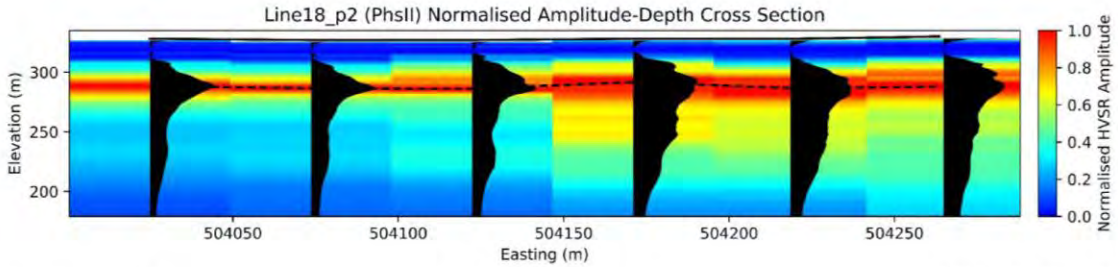
Resource Potentials

Appendix 1 – HVSR Cross-sections





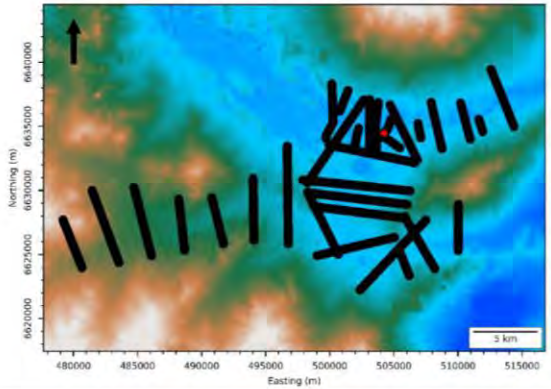




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

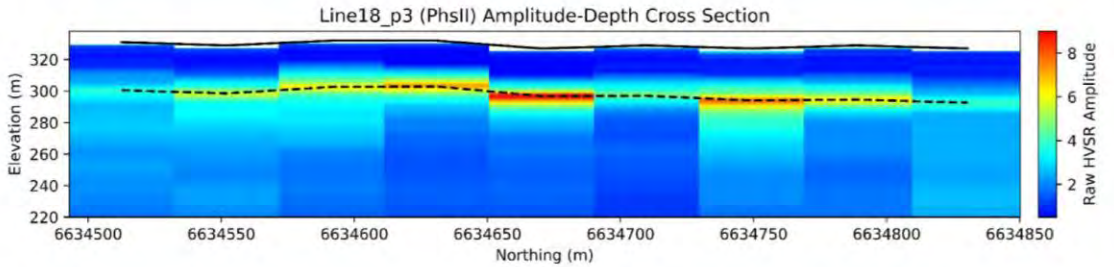
Lake Rebecca – Southern Area

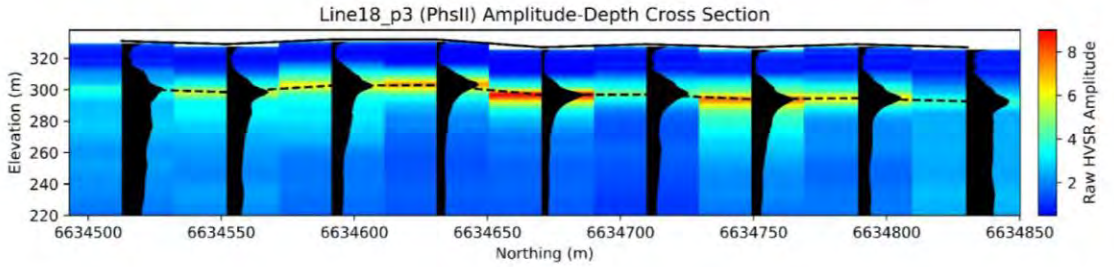
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

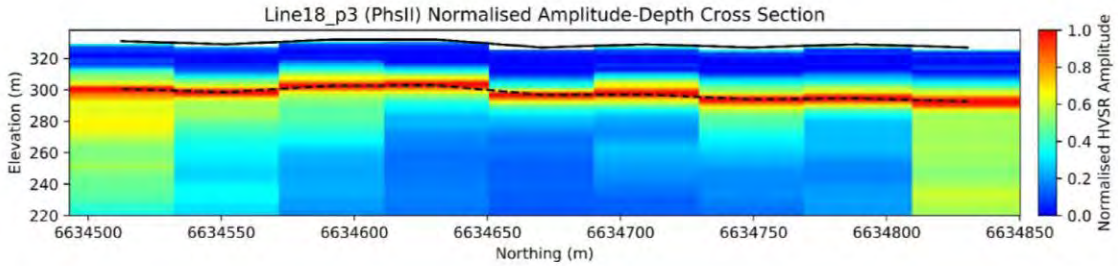
Phase II - Line: 18 part 2

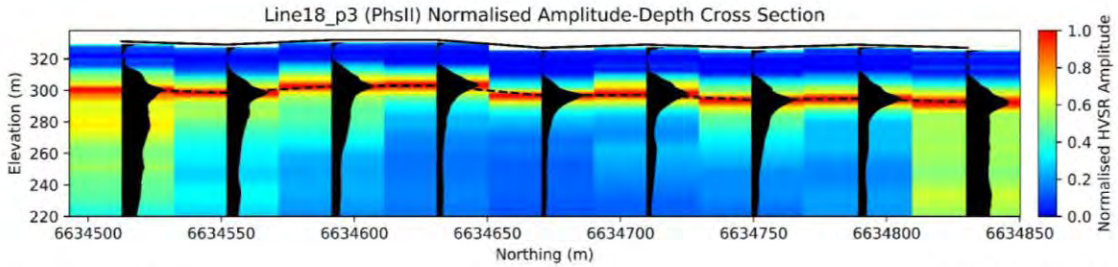
Resource Potentials

Appendix 1 – HVSR Cross-sections





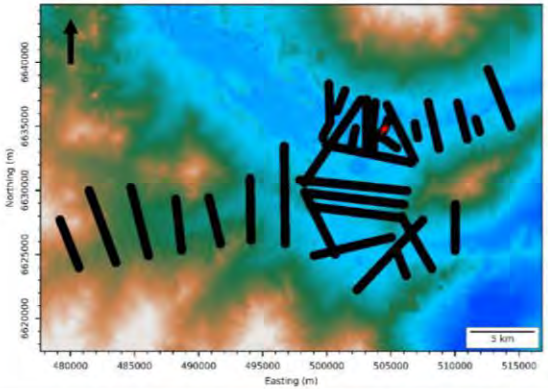




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

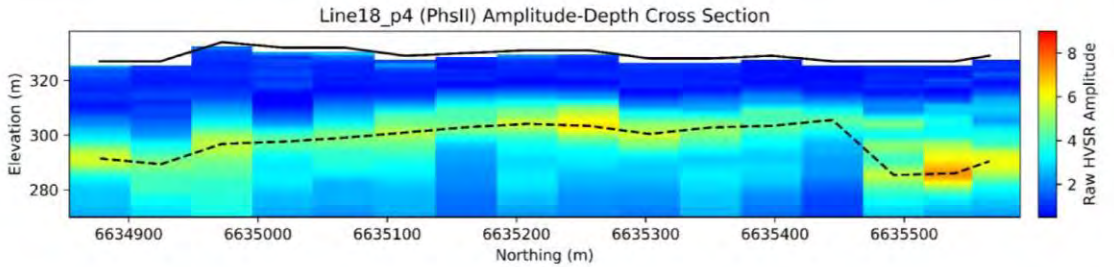
Lake Rebecca – Southern Area

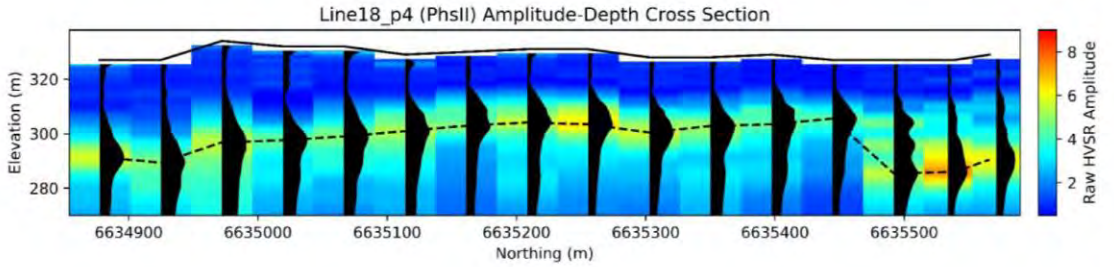
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

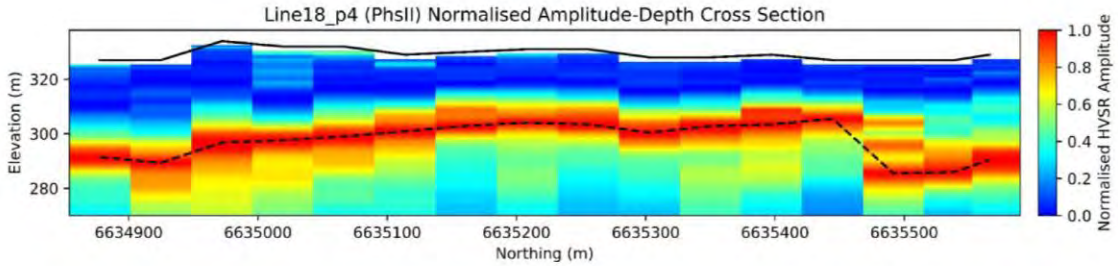
Phase II - Line: 18 part 3

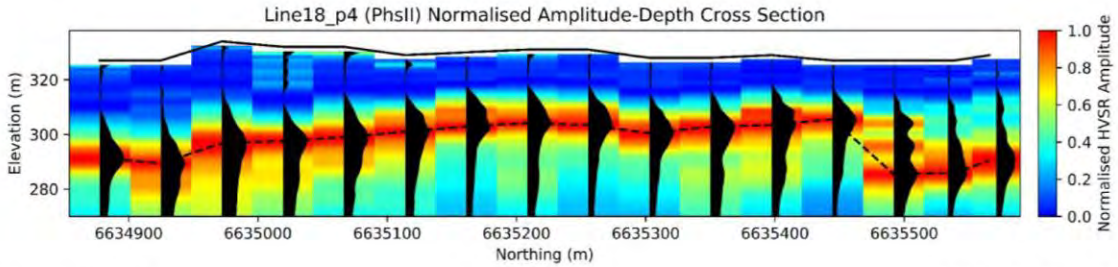
Resource Potentials

Appendix 1 – HVSR Cross-sections





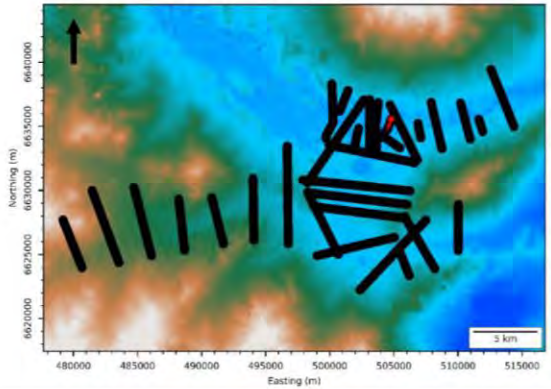




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

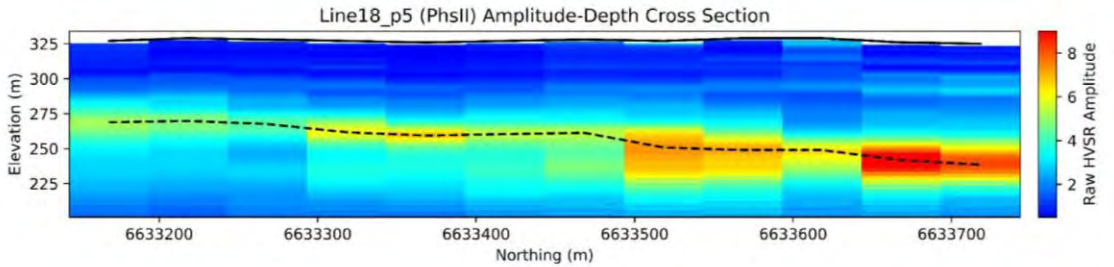
Lake Rebecca – Southern Area

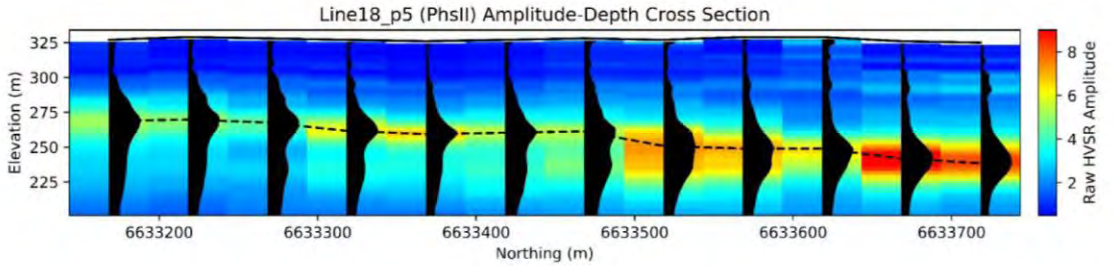
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

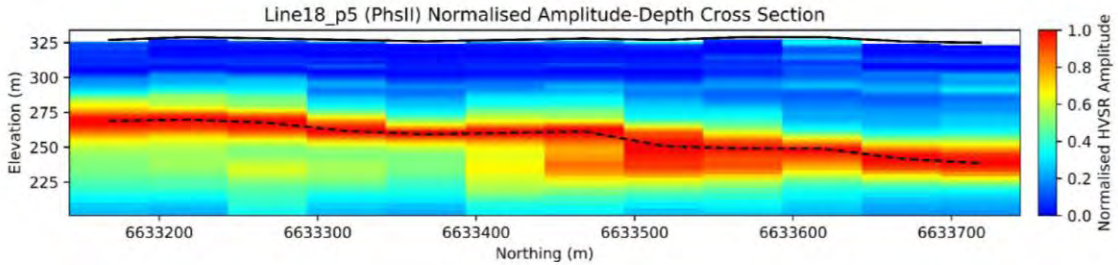
Phase II - Line: 18 part 4

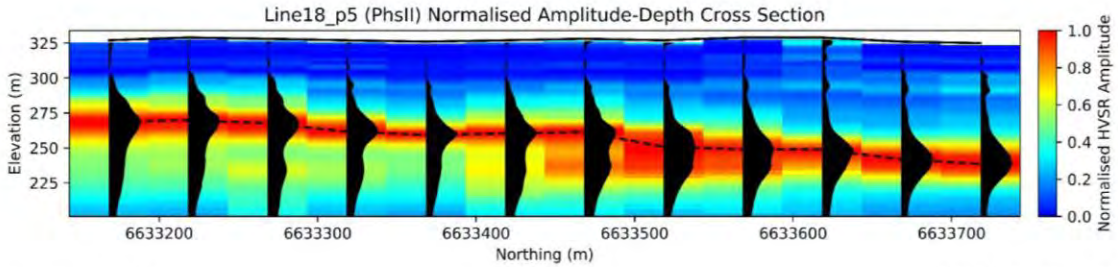
Resource Potentials

Appendix 1 – HVSR Cross-sections





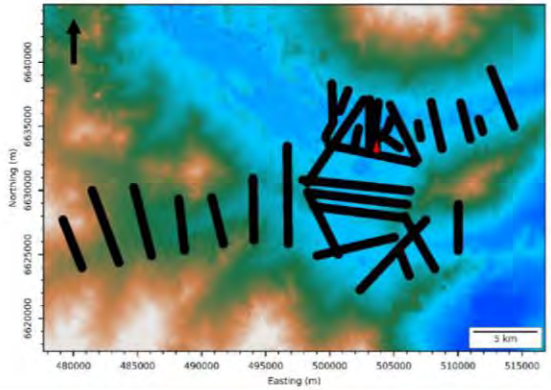




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

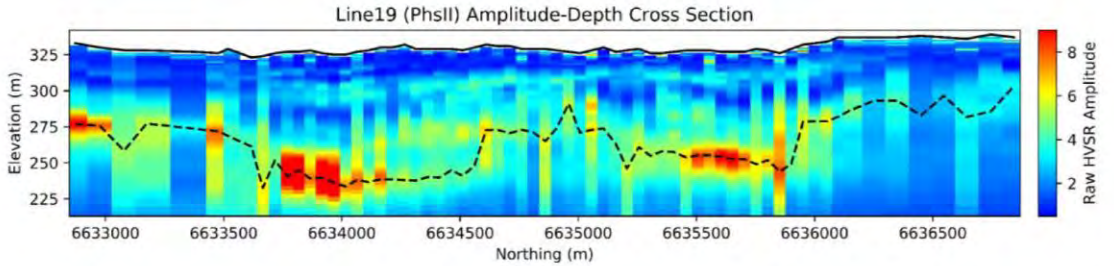
Lake Rebecca – Southern Area

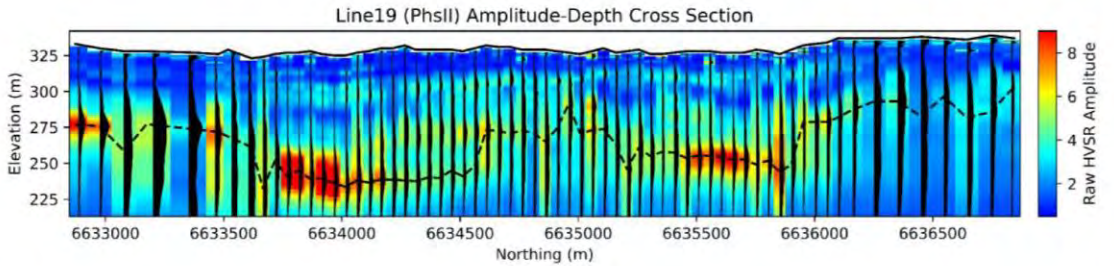
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

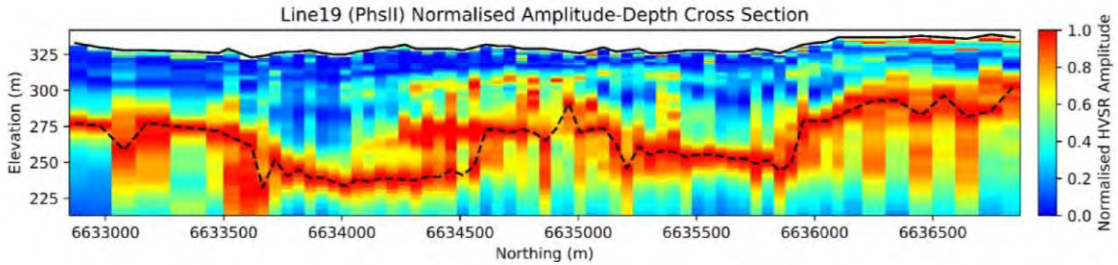
Phase II - Line: 18 part 5

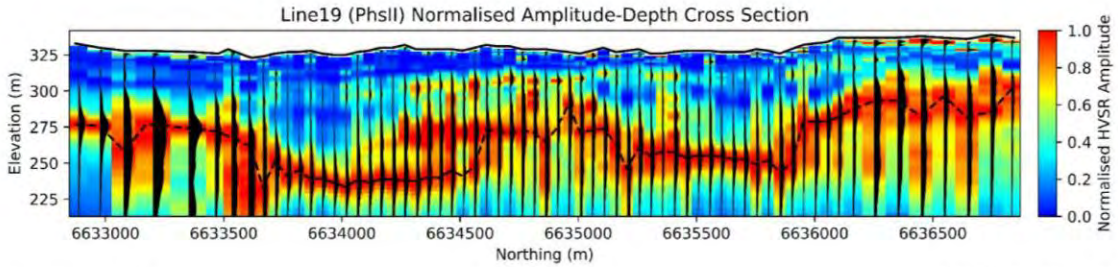
Resource Potentials

Appendix 1 – HVSR Cross-sections





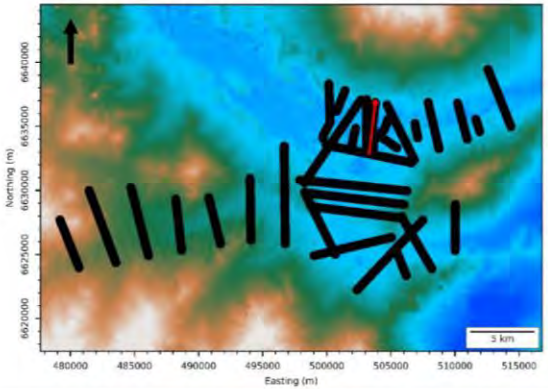




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

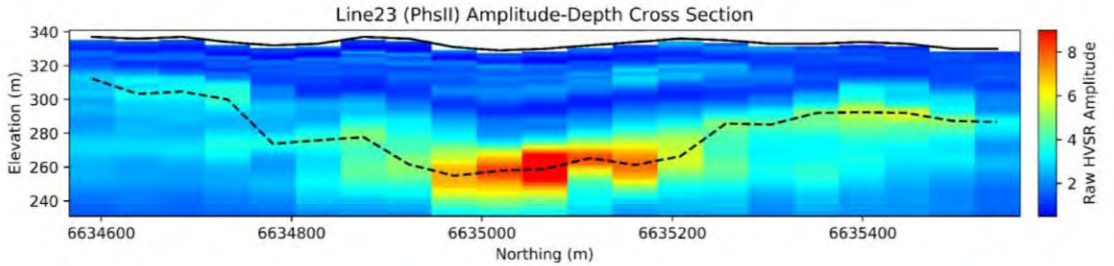
Lake Rebecca – Southern Area

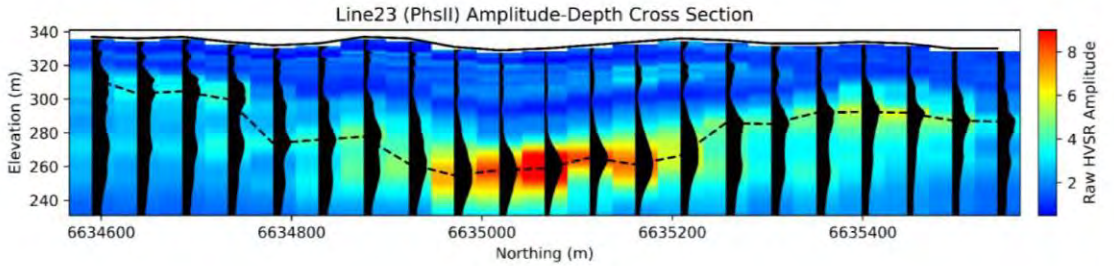
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

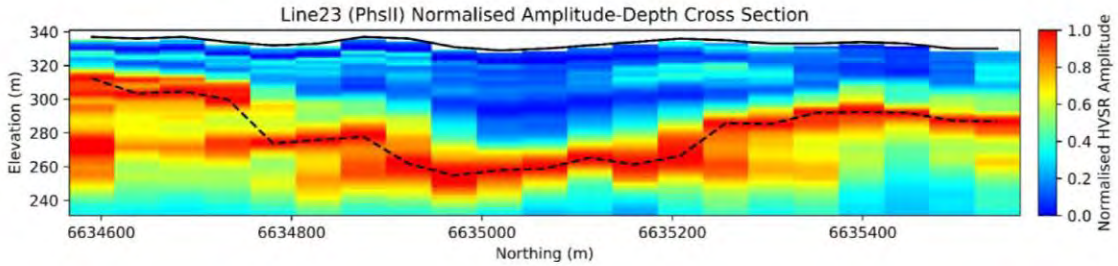
Phase I & Phase II - Line: 19

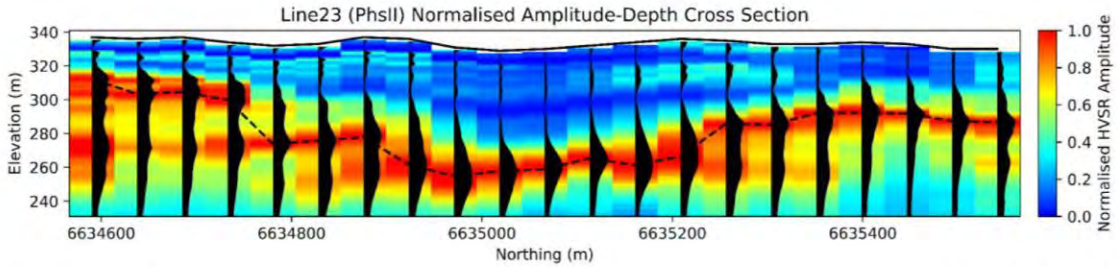
Resource Potentials

Appendix 1 – HVSR Cross-sections





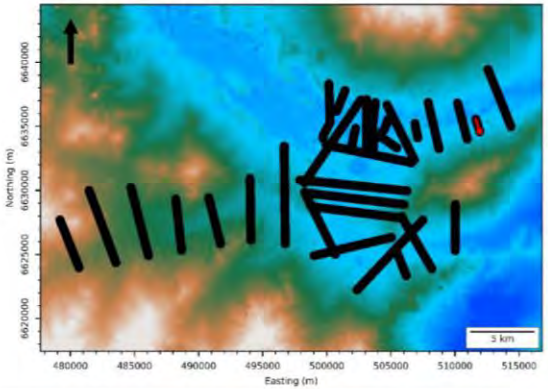




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

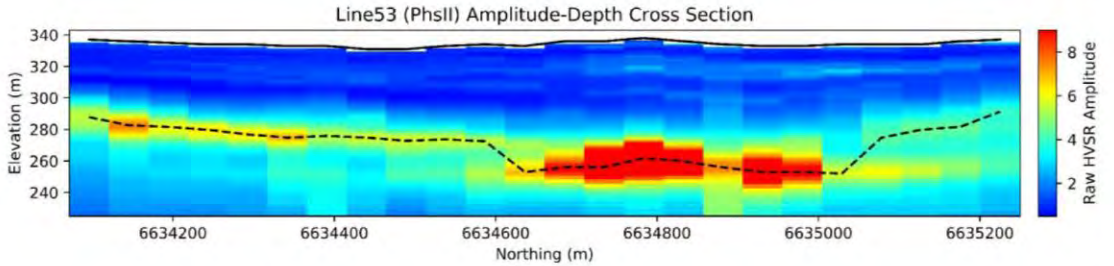
Lake Rebecca – Southern Area

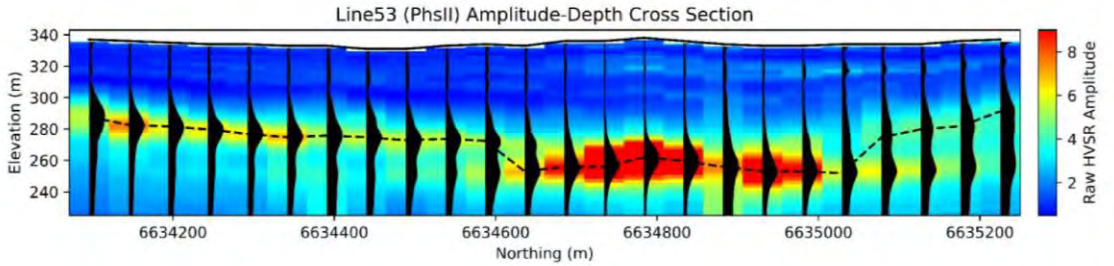
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

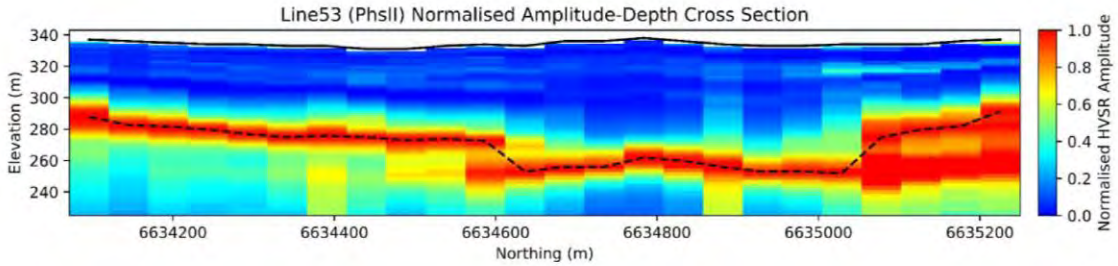
Phase II - Line: 23

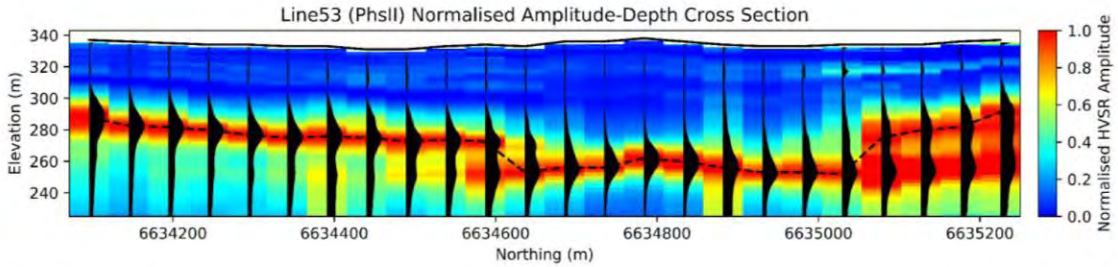
Resource Potentials

Appendix 1 – HVSR Cross-sections





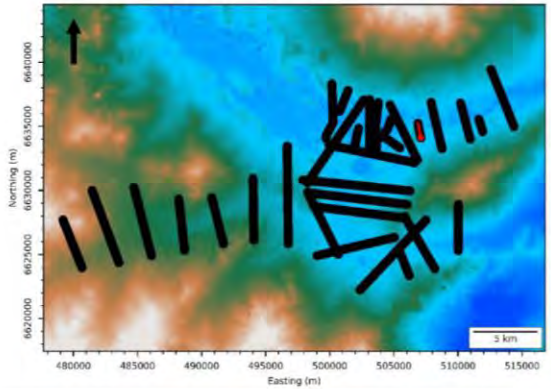




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

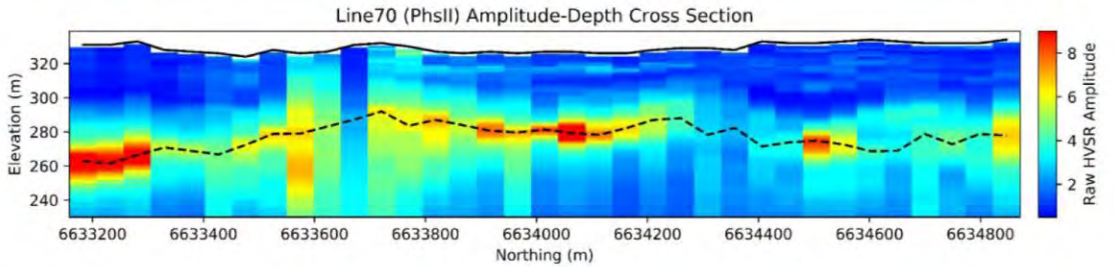
Lake Rebecca – Southern Area

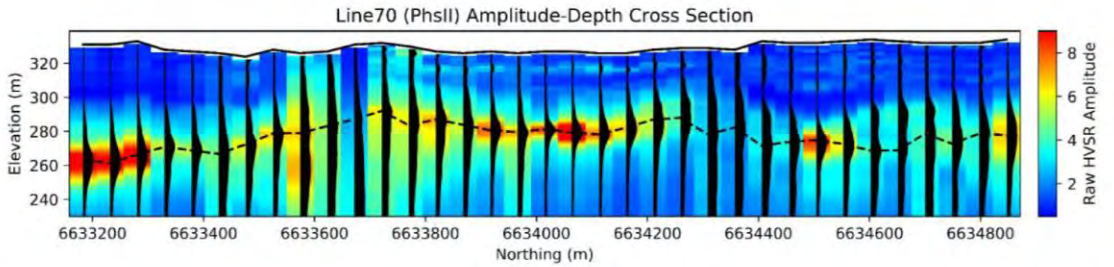
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

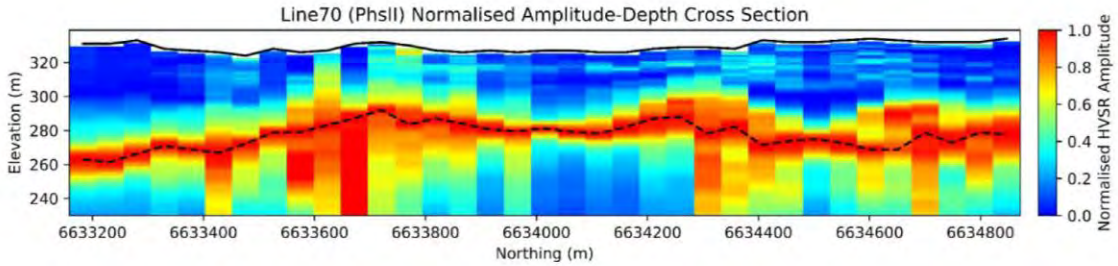
Phase II - Line: 53

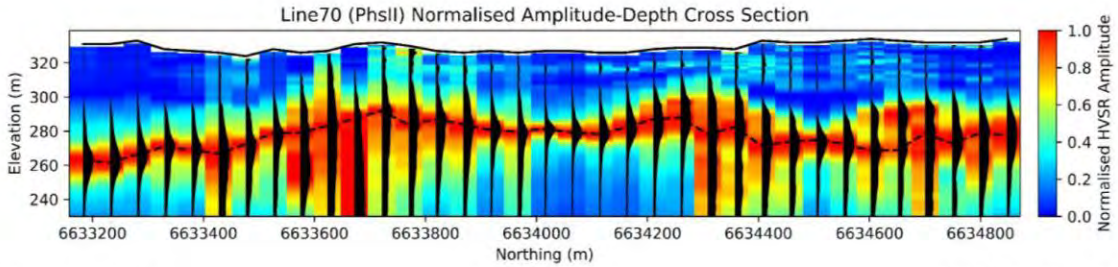
Resource Potentials

Appendix 1 – HVSR Cross-sections





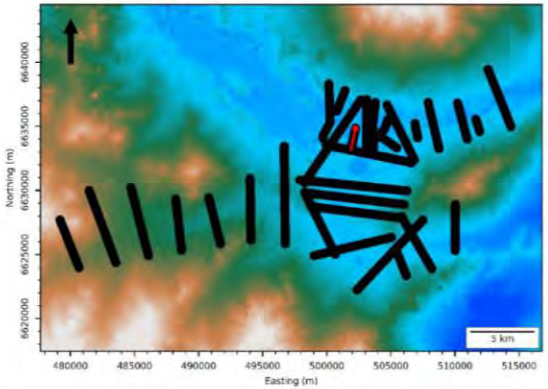




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

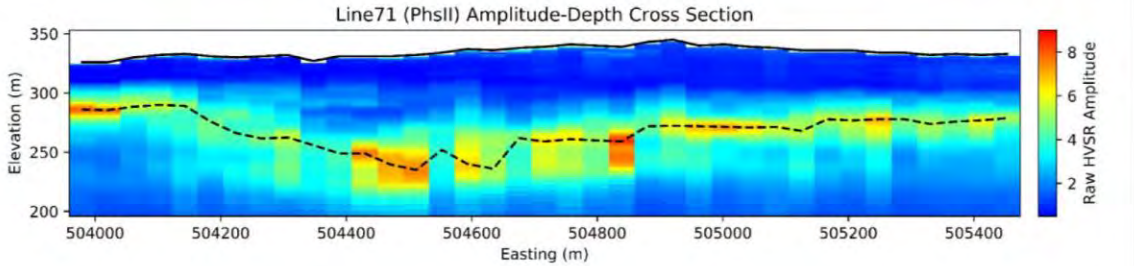
Lake Rebecca – Southern Area

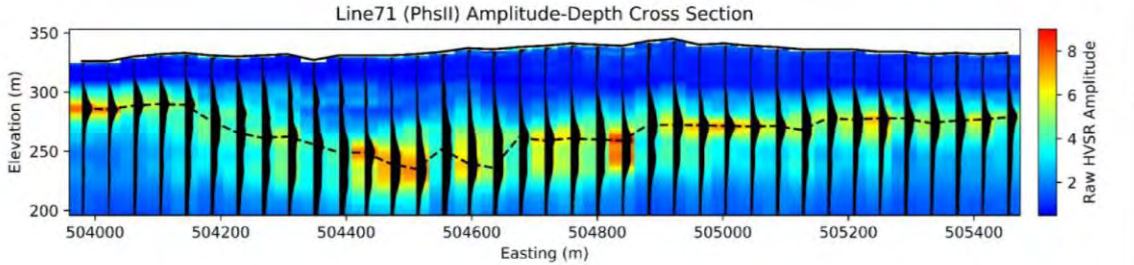
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

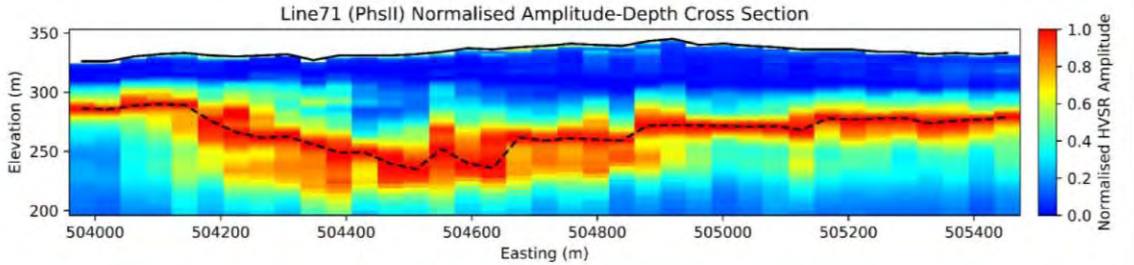
Phase II - Line: 70

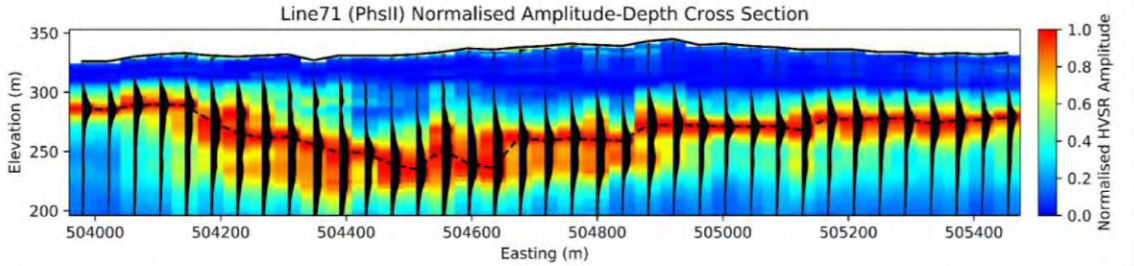
Resource Potentials

Appendix 1 – HVSR Cross-sections





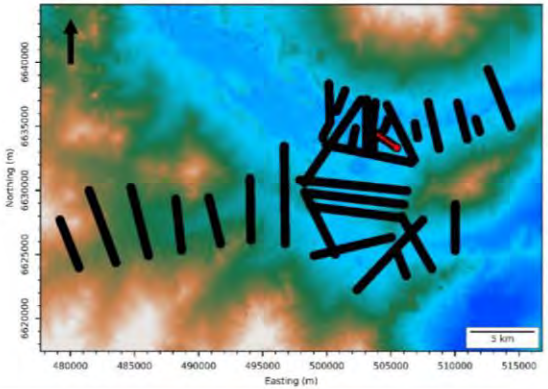




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 8th September – 14th September 2024
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

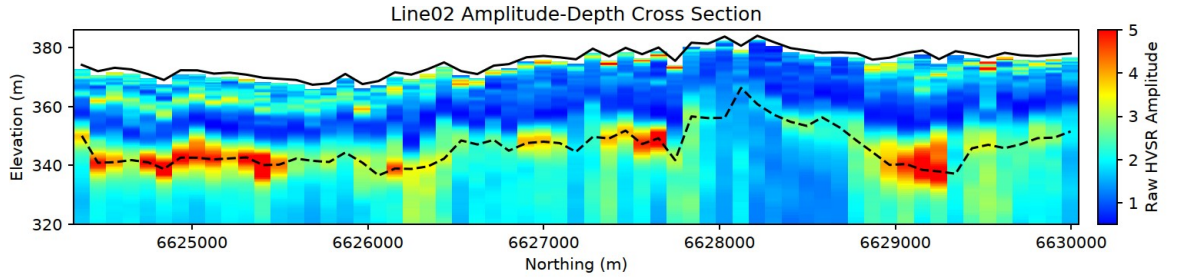
Lake Rebecca – Southern Area

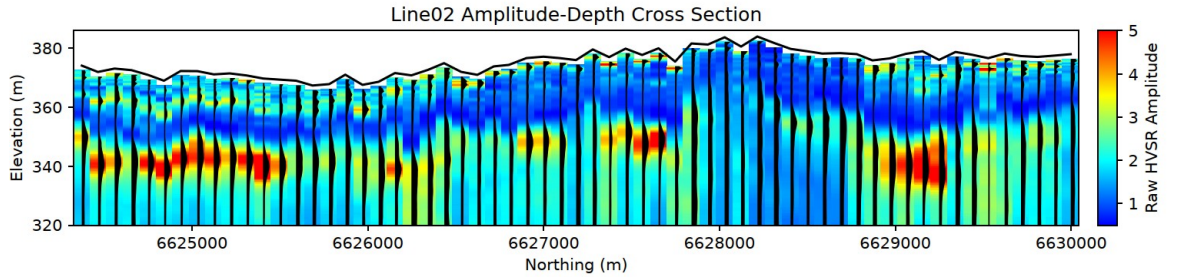
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

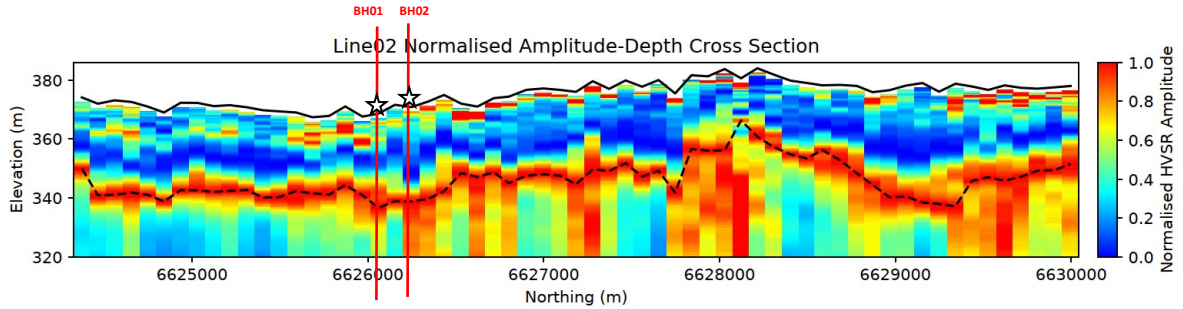
Phase II - Line: 71

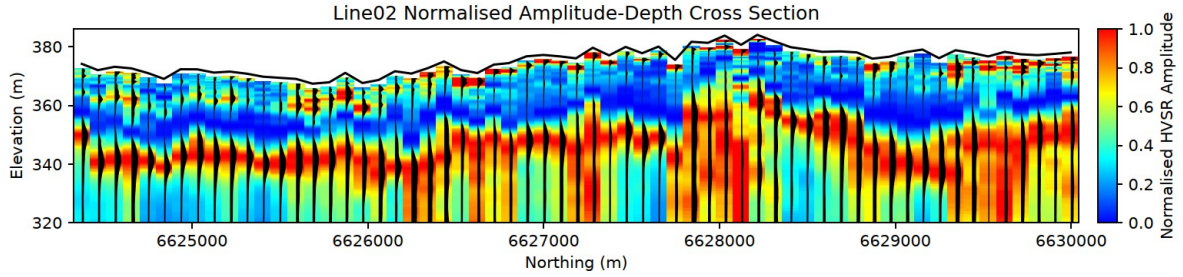
Resource Potentials

APPENDIX C
PASSIVE SEISMIC HVSR SURVEY LINES CROSS SECTIONS WITH EXPLORATION TARGETS





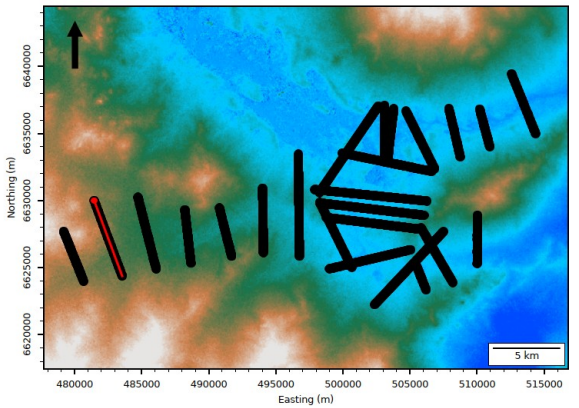




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

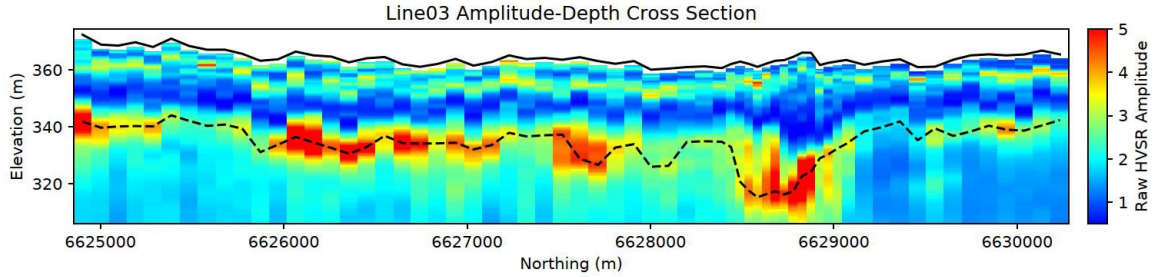
RAMELIUS RESOURCES

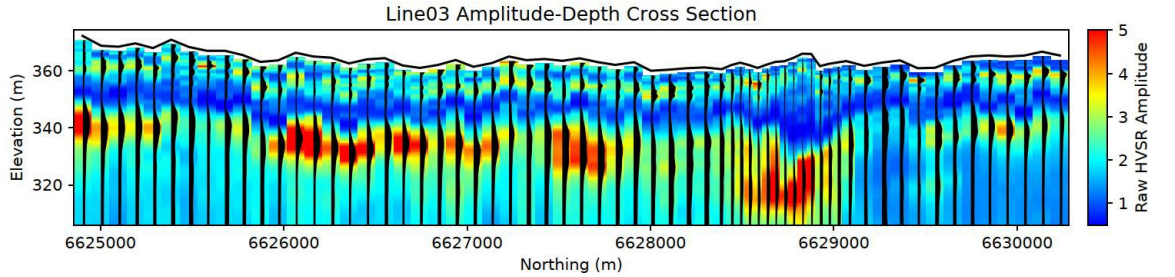
Lake Rebecca – Southern Area

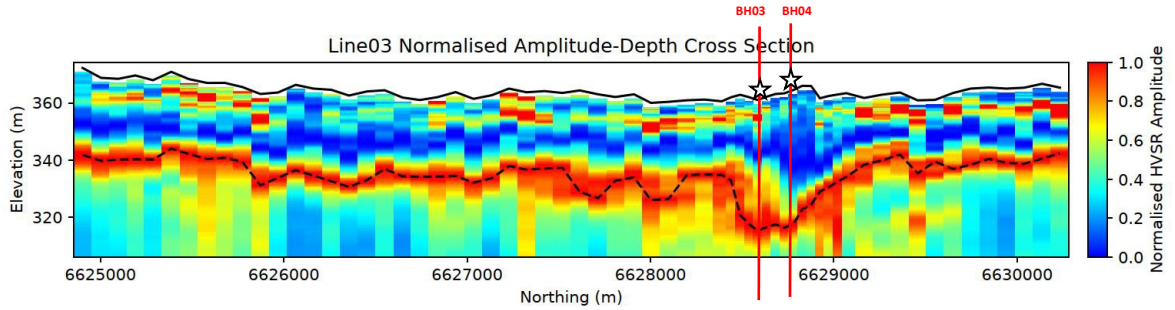
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

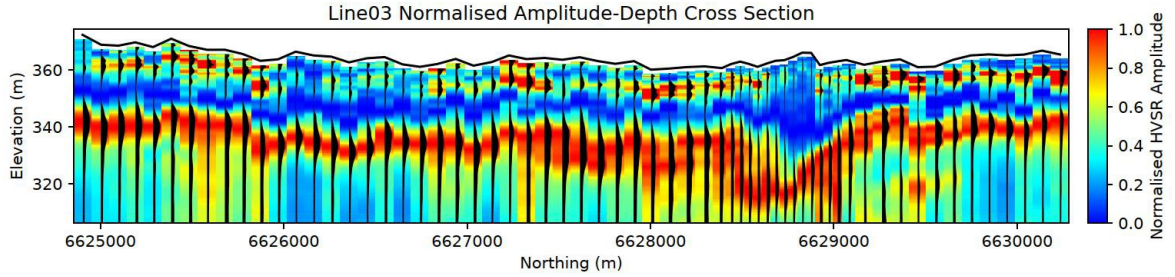
Line: 02

Resource Potentials





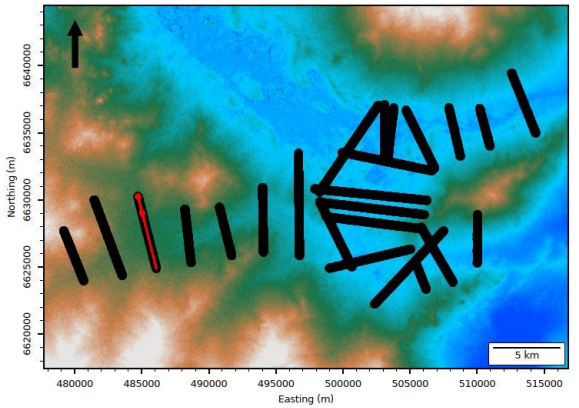




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

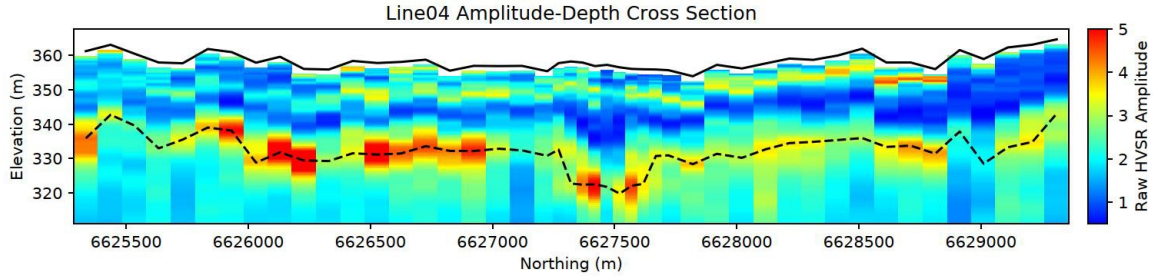
RAMELIUS RESOURCES

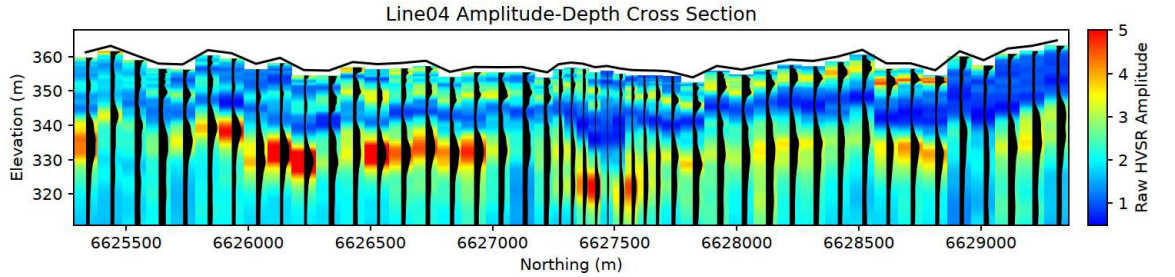
Lake Rebecca – Southern Area

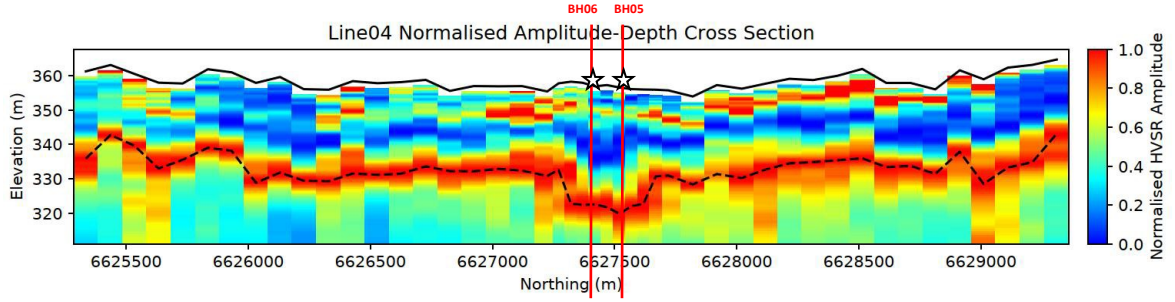
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

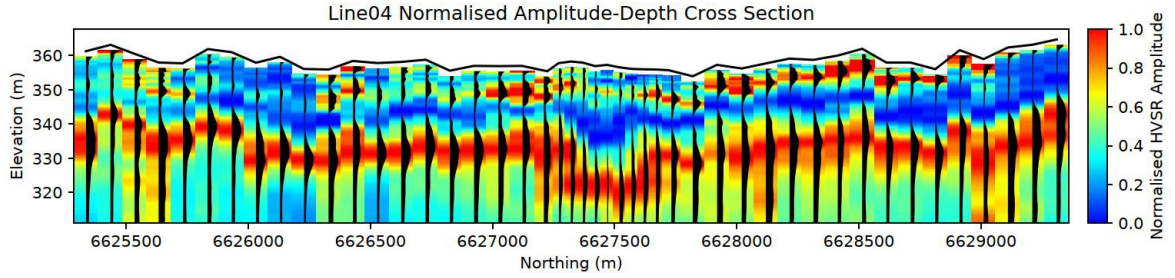
Line: 03

Resource Potentials





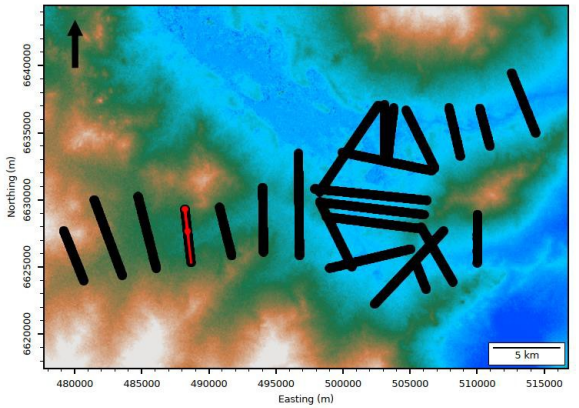




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

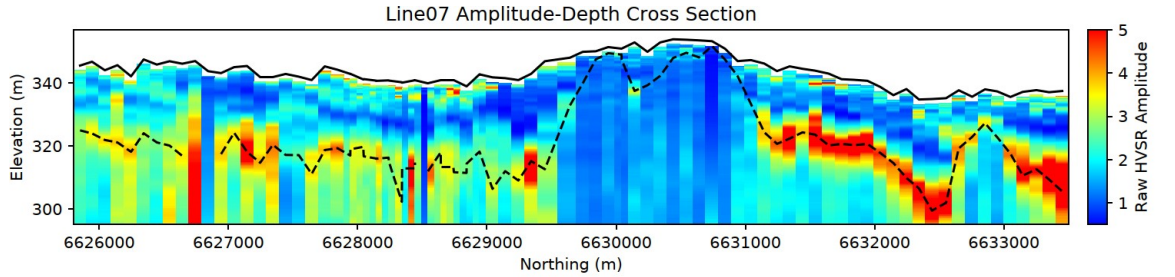
RAMELIUS RESOURCES

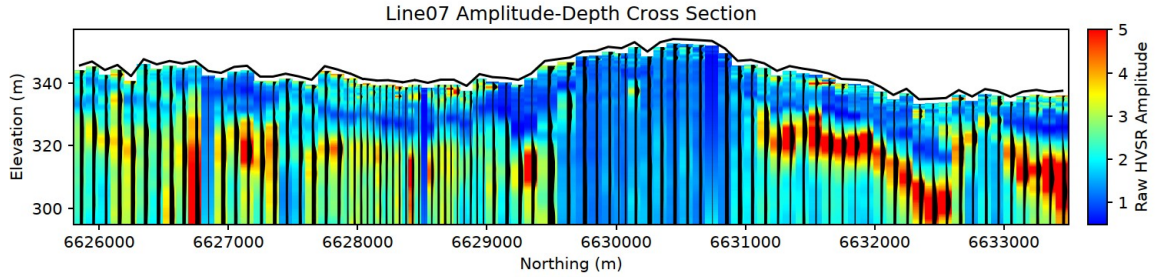
Lake Rebecca – Southern Area

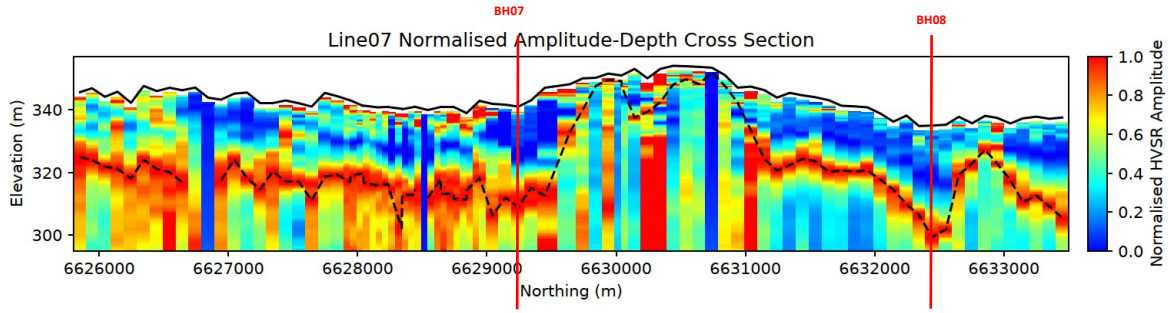
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

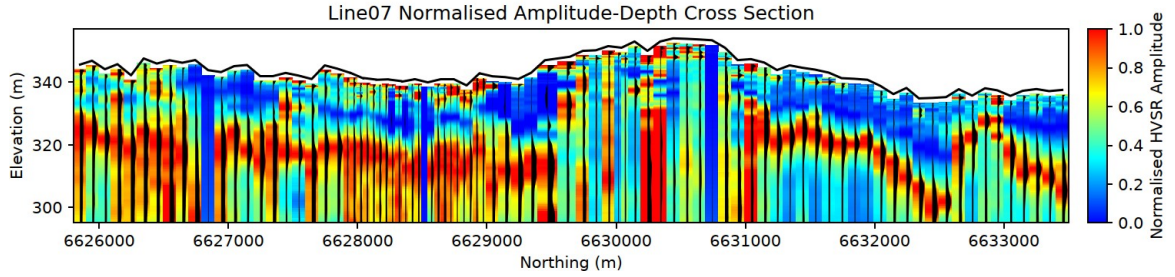
Line: 04

Resource Potentials





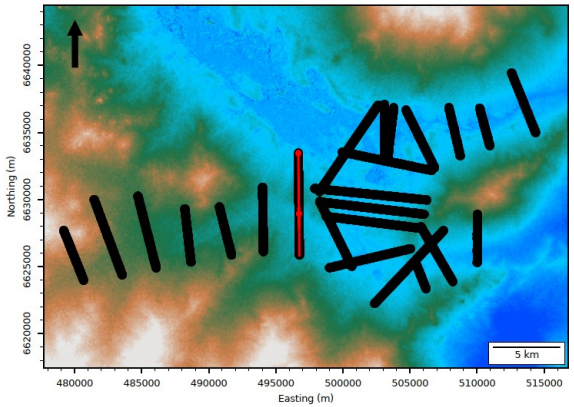




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

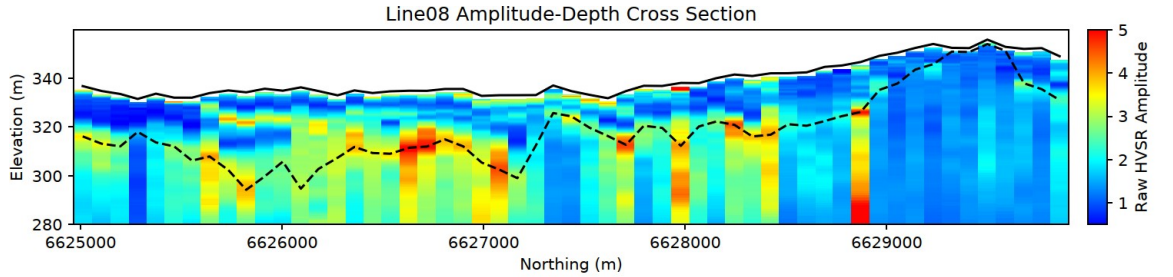
RAMELIUS RESOURCES

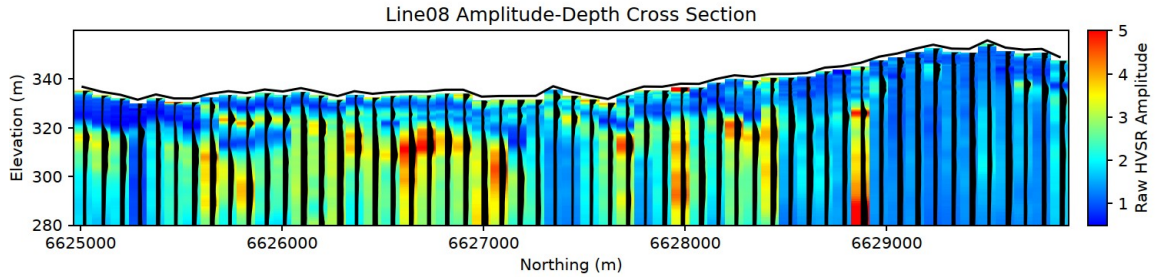
Lake Rebecca – Southern Area

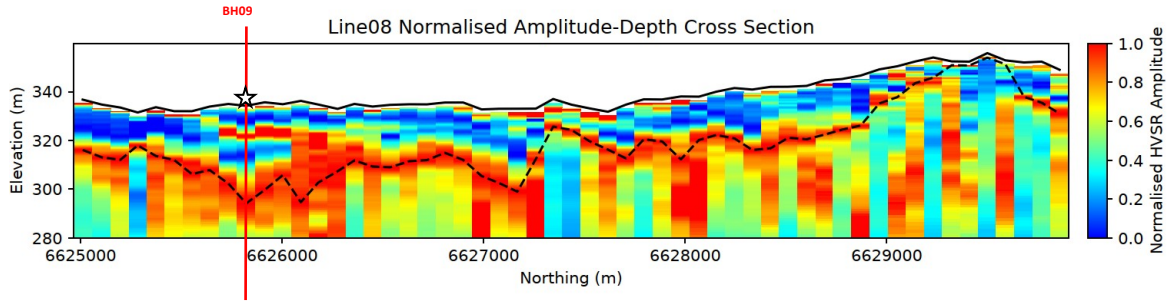
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

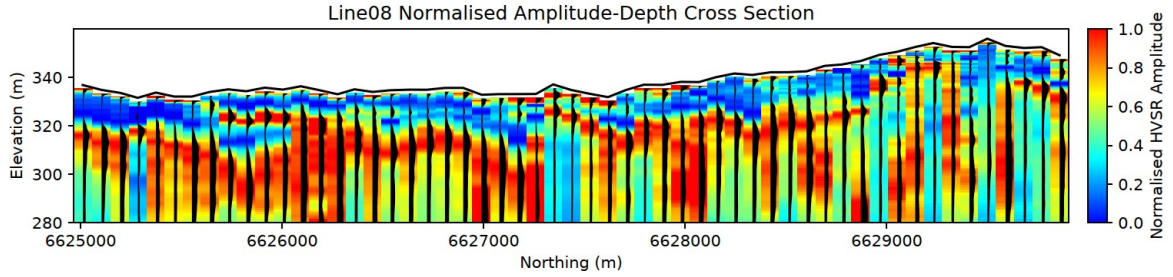
Line: 07

Resource Potentials





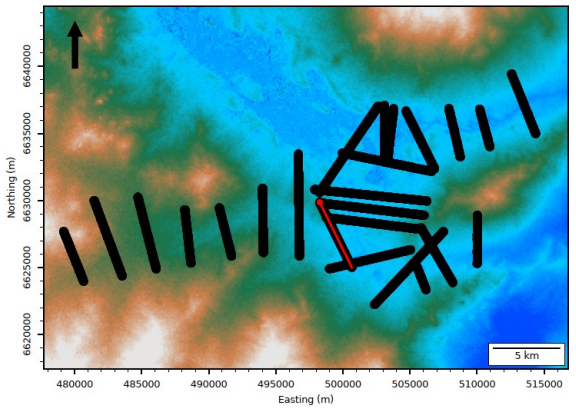




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

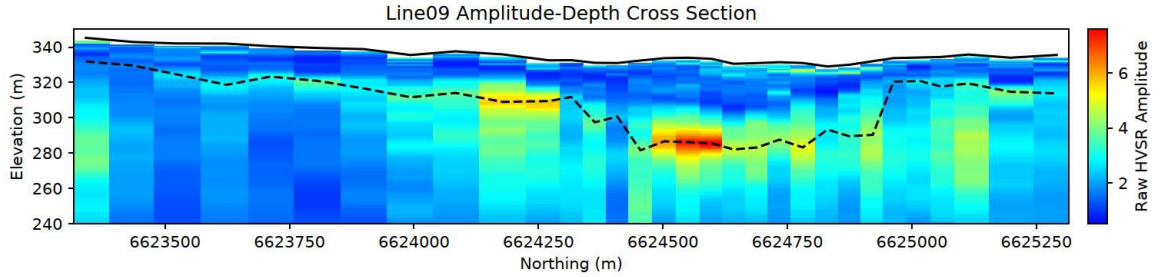
RAMELIUS RESOURCES

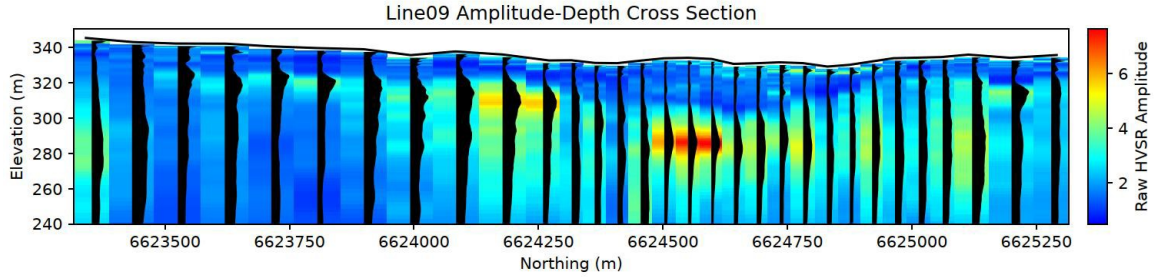
Lake Rebecca – Southern Area

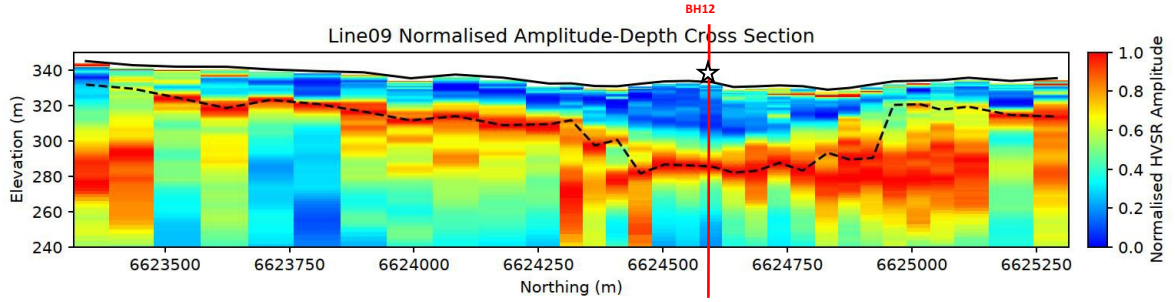
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

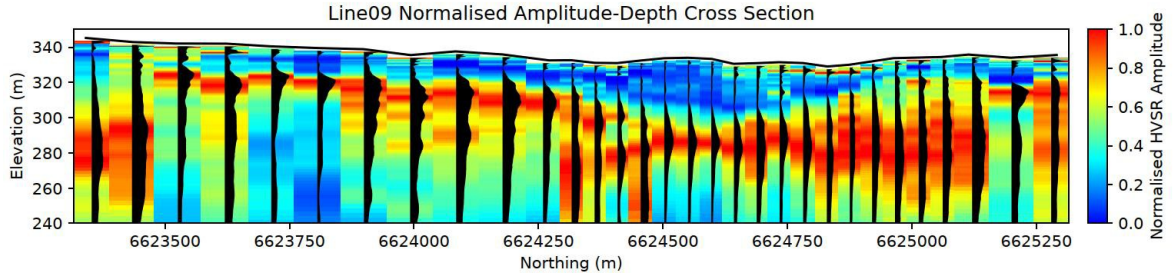
Line: 08

Resource Potentials





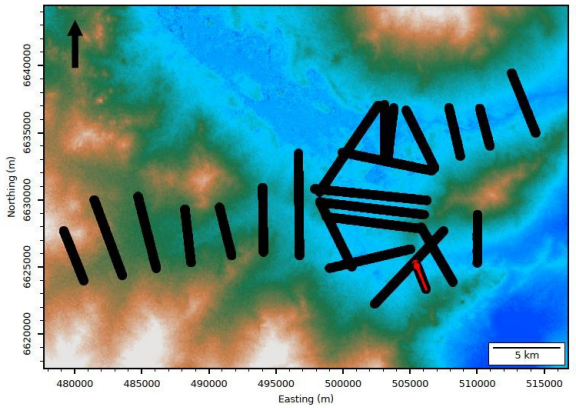




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

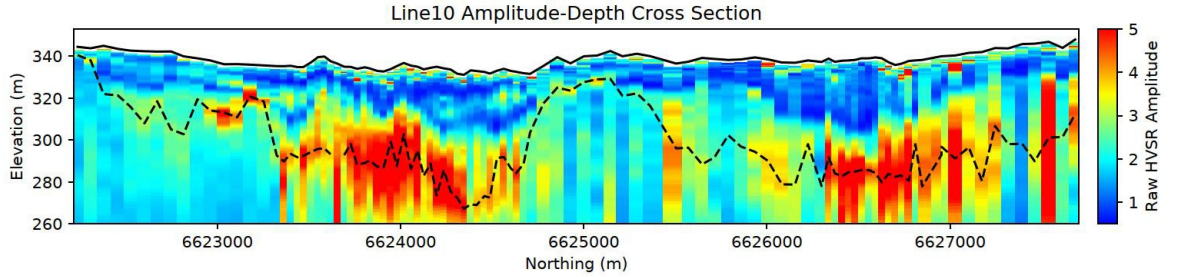
RAMELIUS RESOURCES

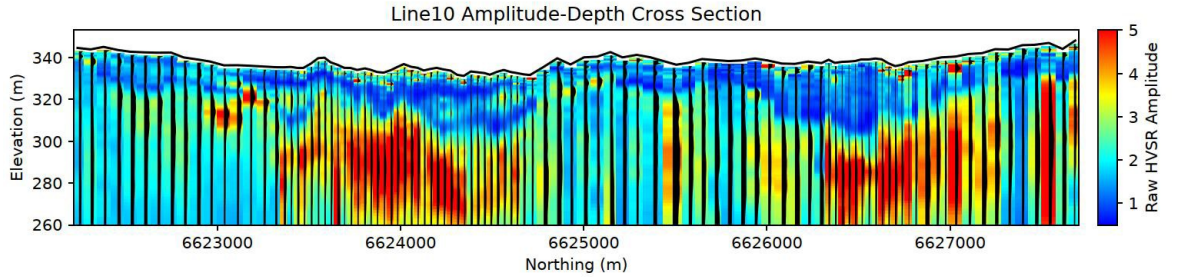
Lake Rebecca – Southern Area

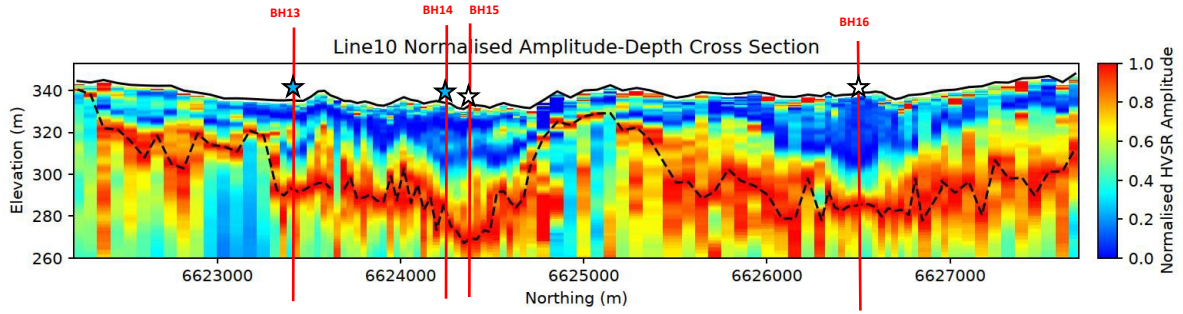
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

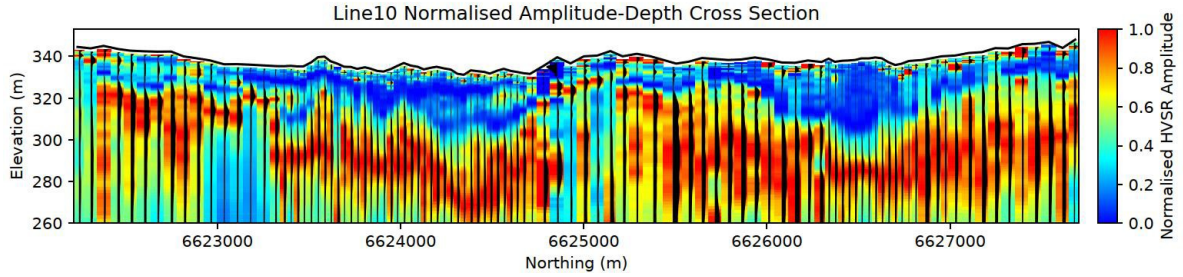
Line: 09

Resource Potentials





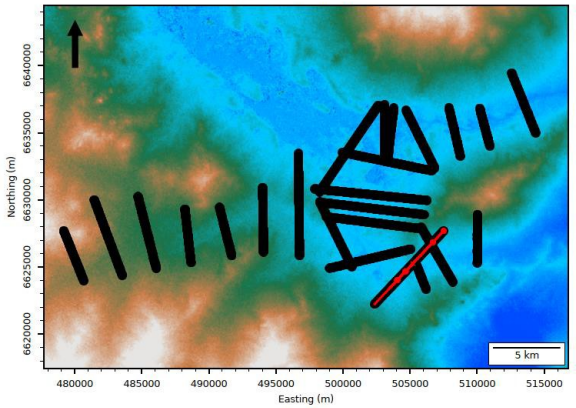




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

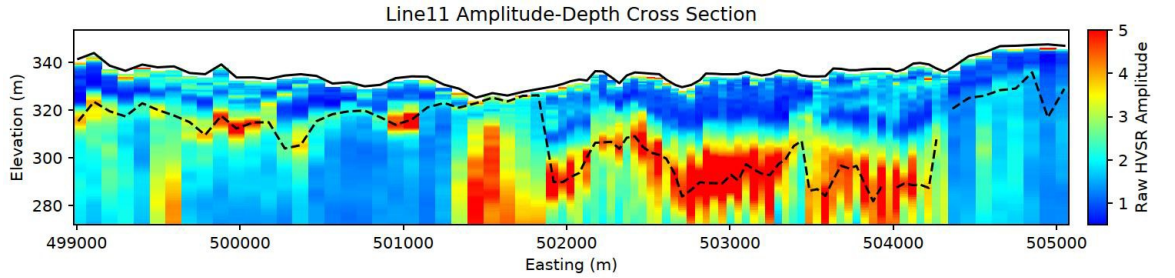
RAMELIUS RESOURCES

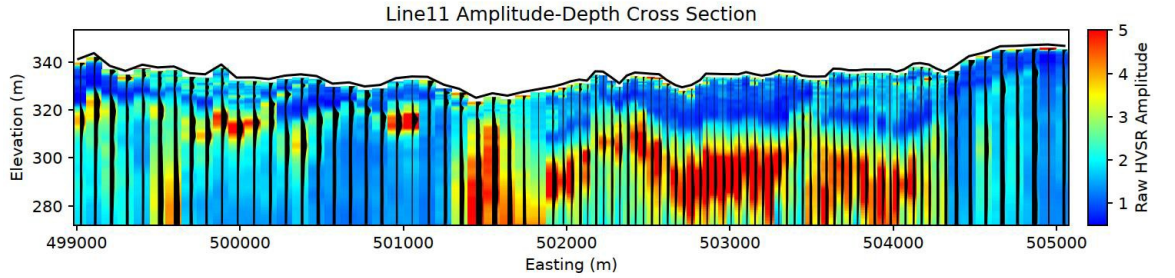
Lake Rebecca – Southern Area

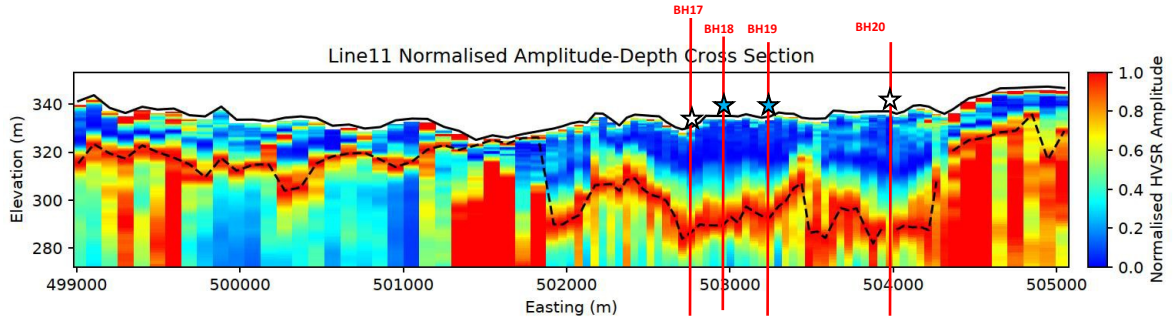
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

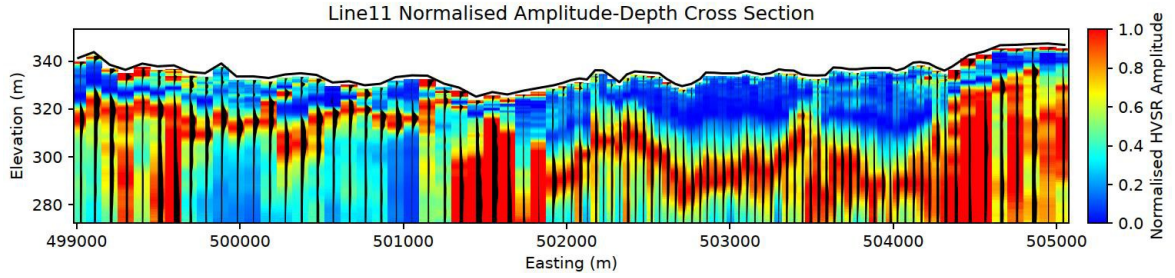
Line: 10

Resource Potentials





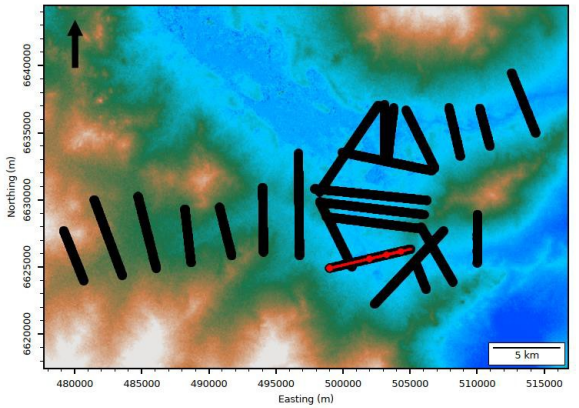




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

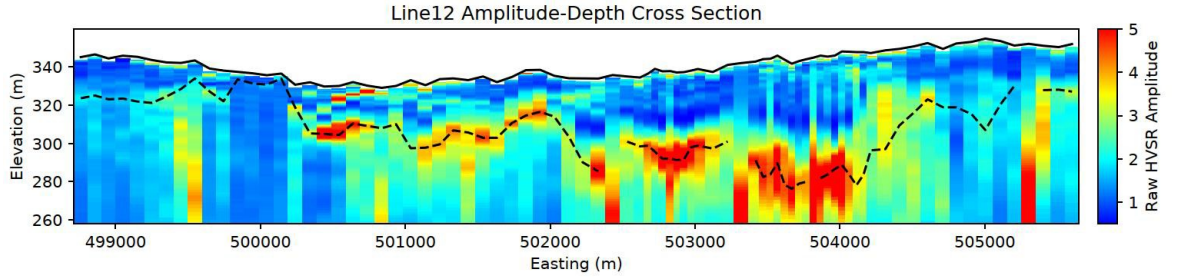
RAMELIUS RESOURCES

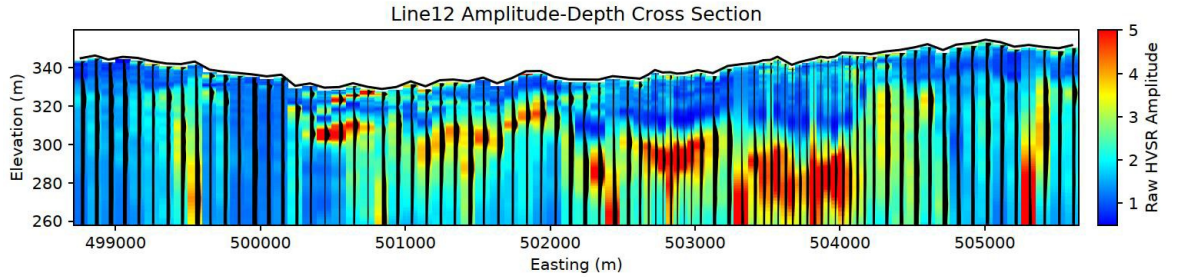
Lake Rebecca – Southern Area

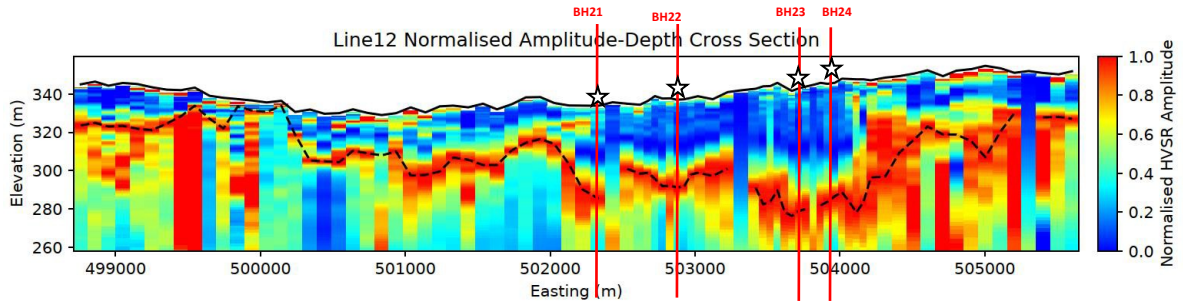
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

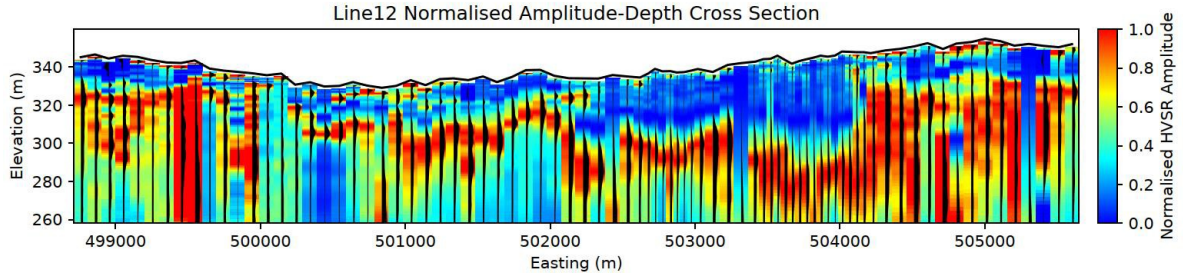
Line: 11

Resource Potentials





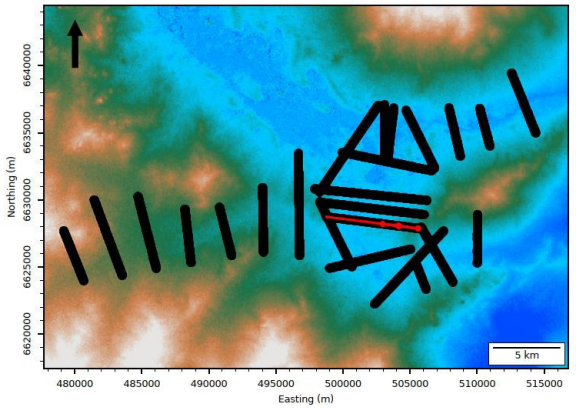




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

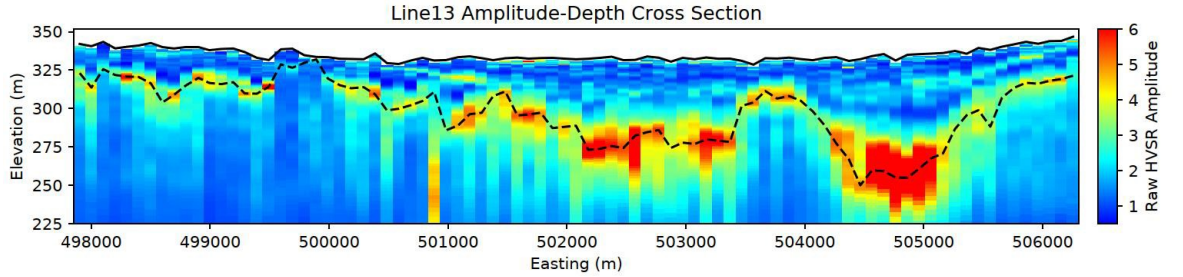
RAMELIUS RESOURCES

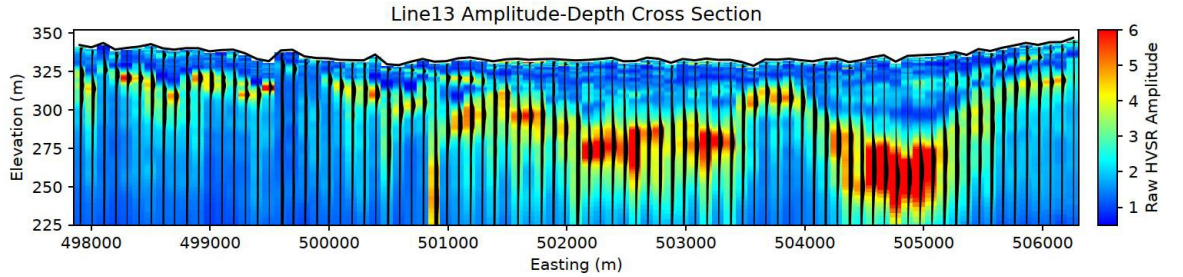
Lake Rebecca – Southern Area

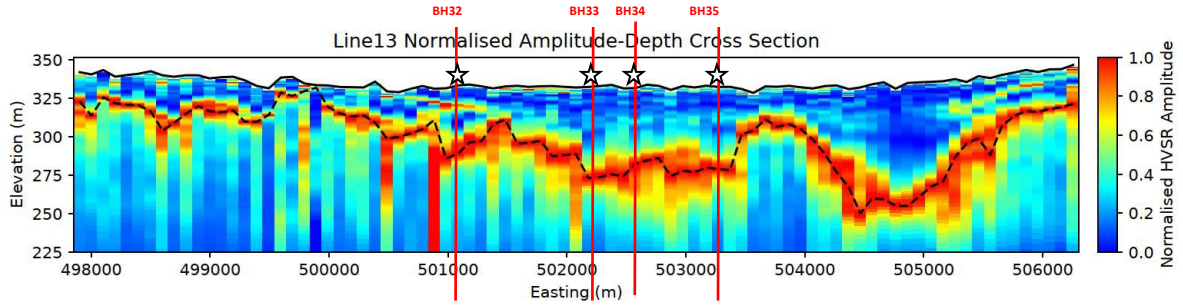
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

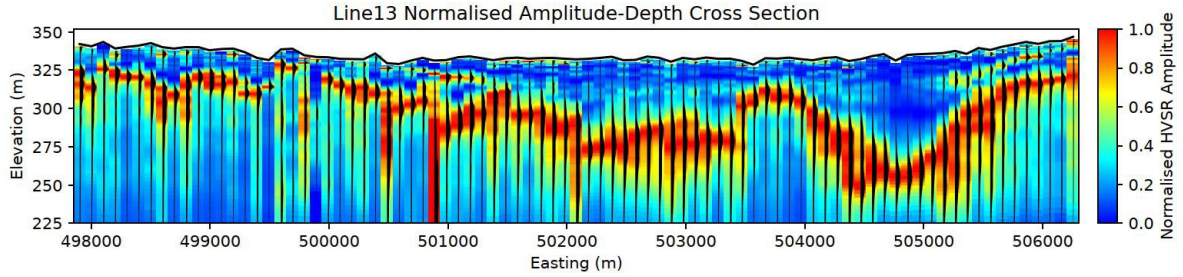
Line: 12

Resource Potentials





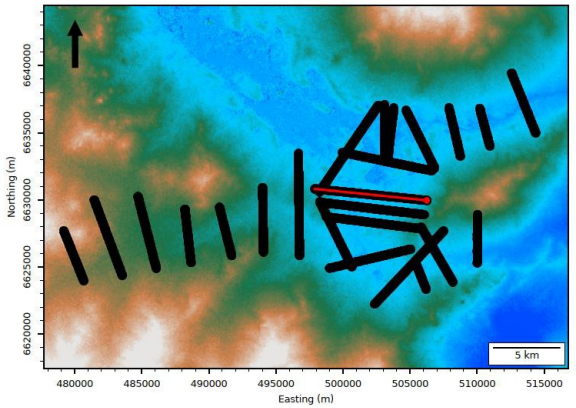




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

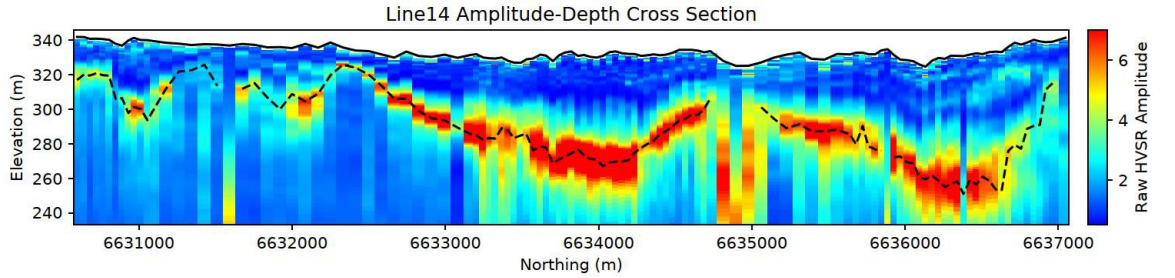
RAMELIUS RESOURCES

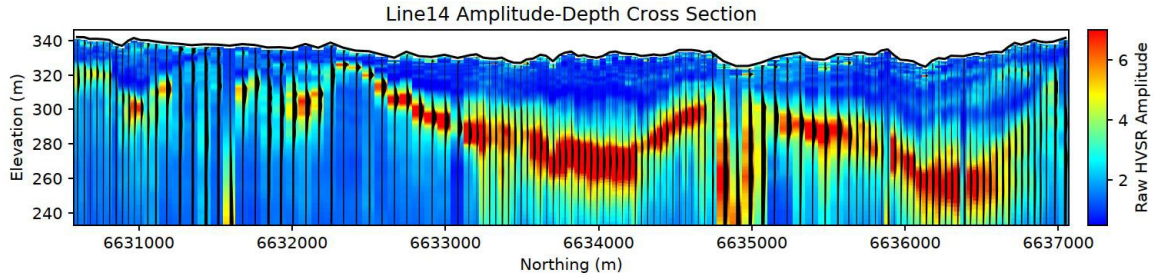
Lake Rebecca – Southern Area

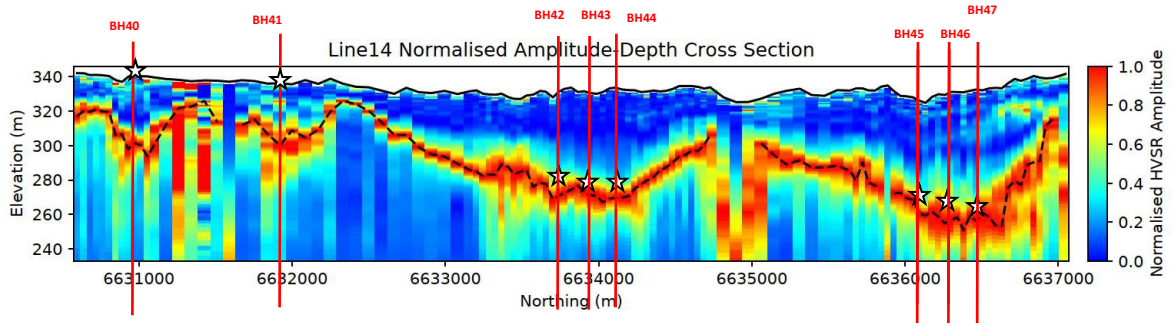
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

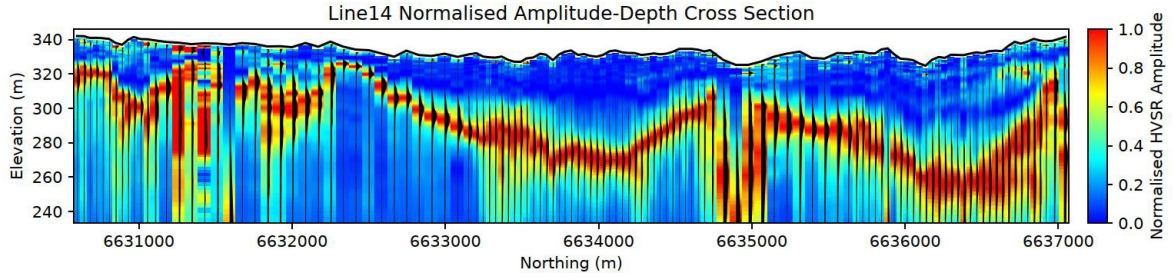
Line: 13

Resource Potentials





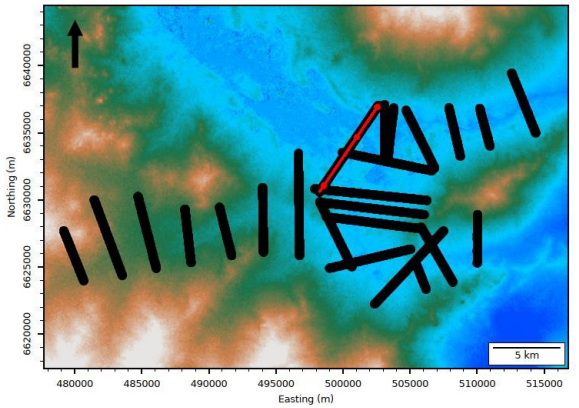




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

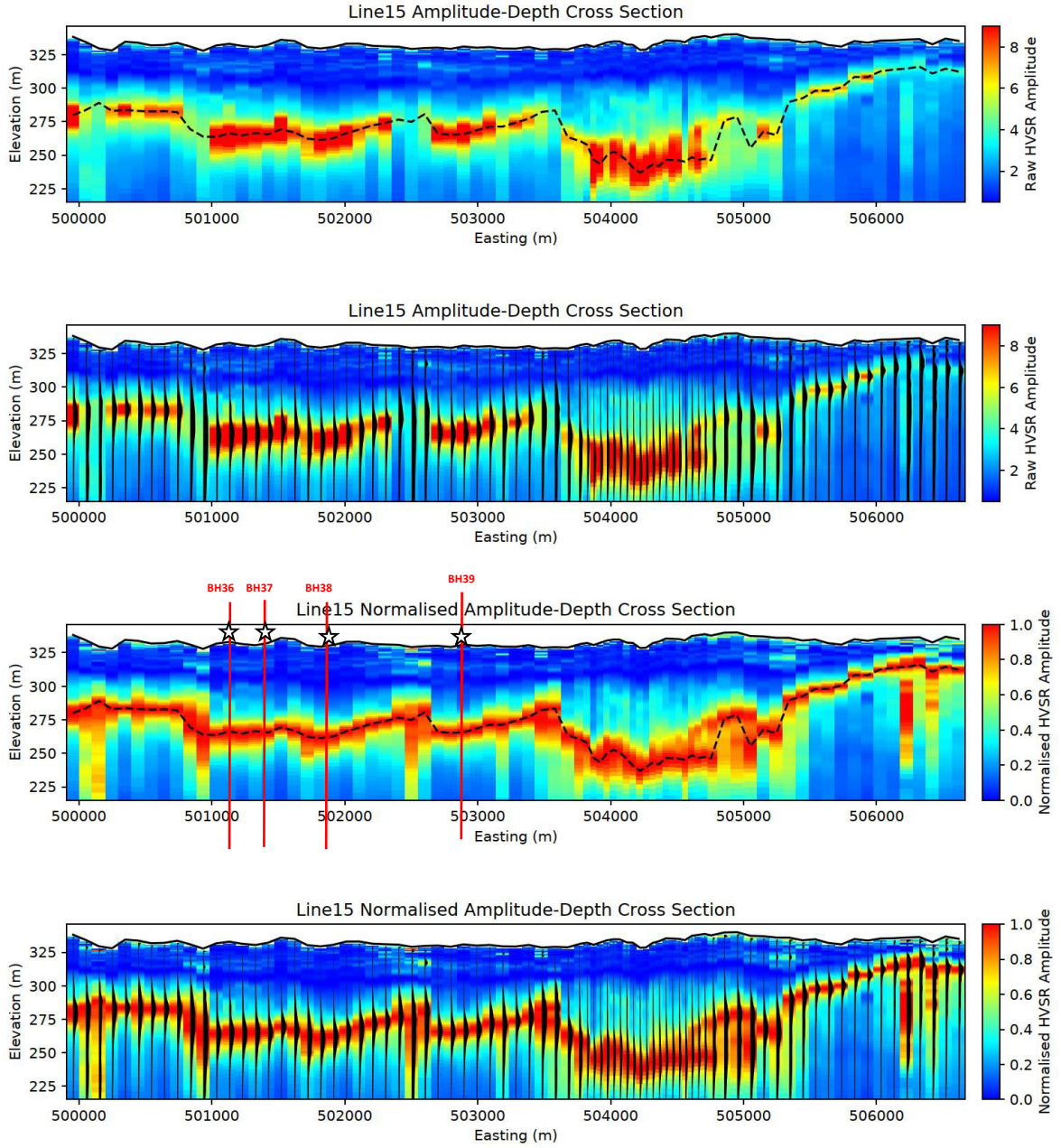
RAMELIUS RESOURCES

Lake Rebecca – Southern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 14

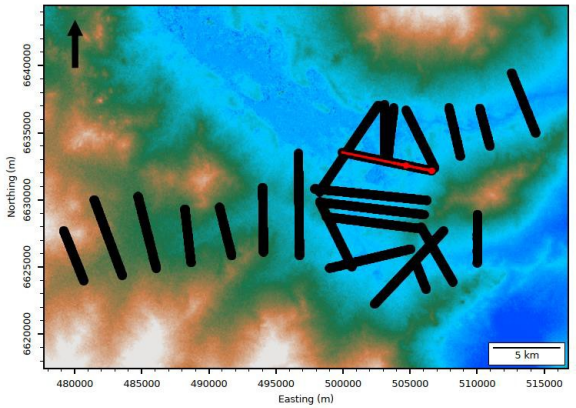
Resource Potentials



Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

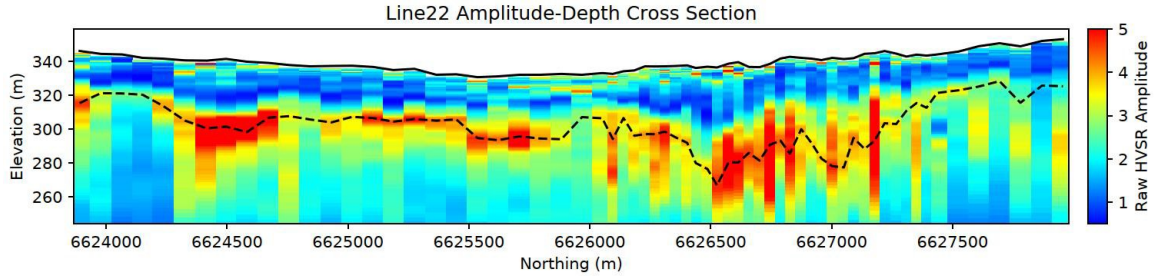
RAMELIUS RESOURCES

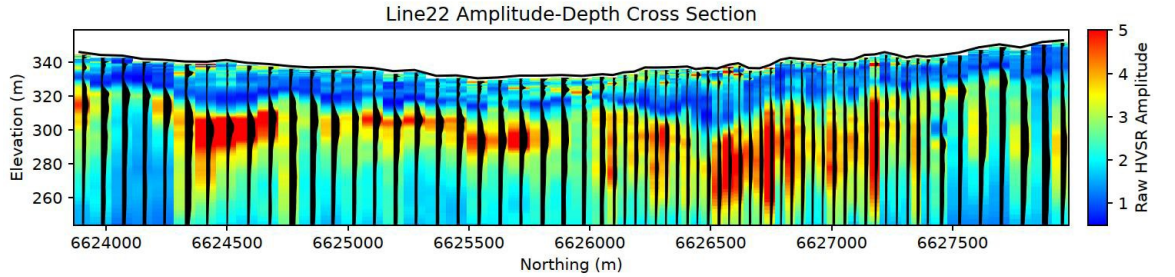
Lake Rebecca – Southern Area

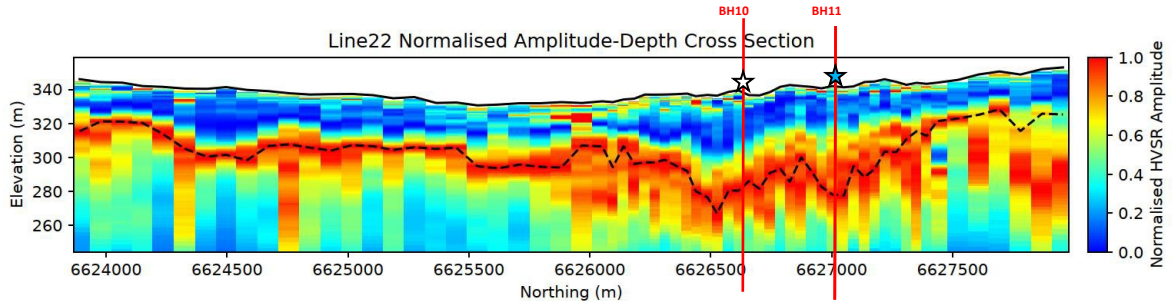
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

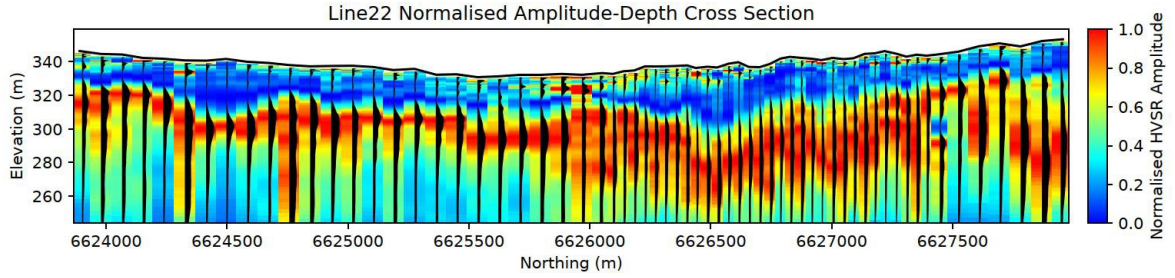
Line: 15

Resource Potentials





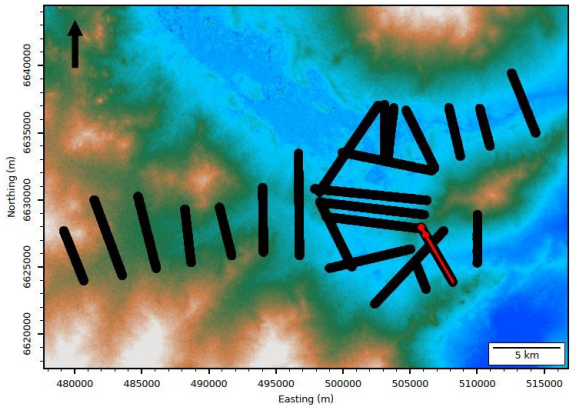




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

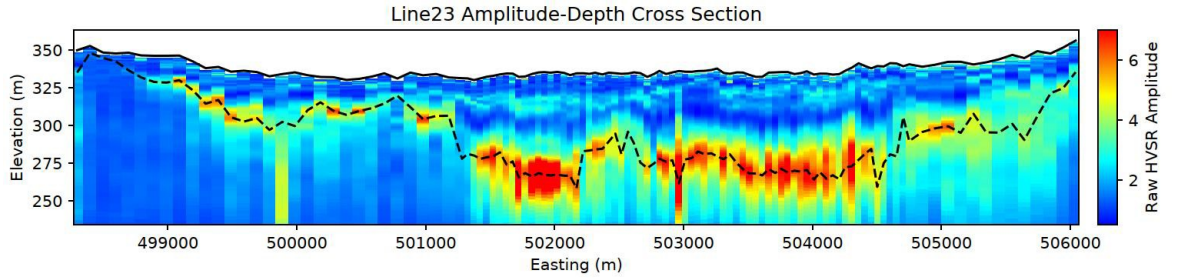
RAMELIUS RESOURCES

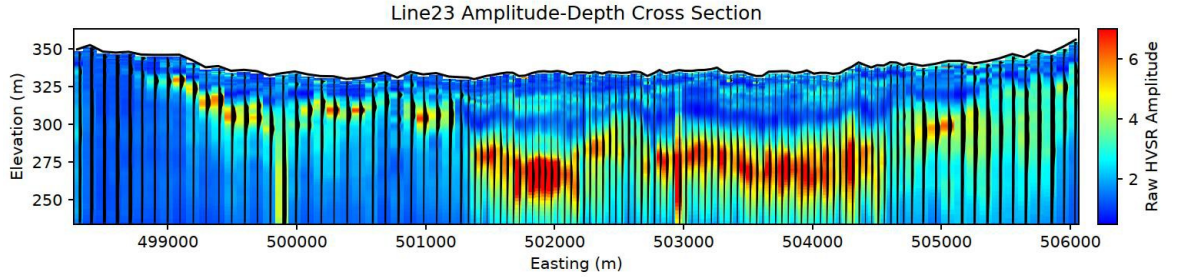
Lake Rebecca – Southern Area

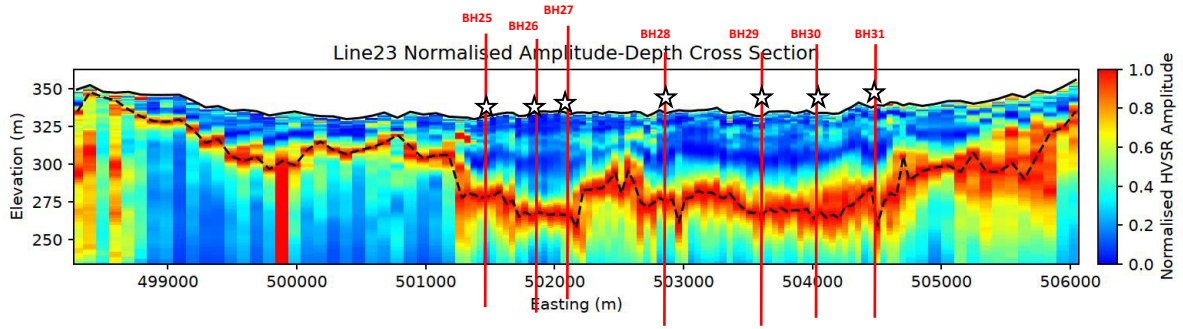
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

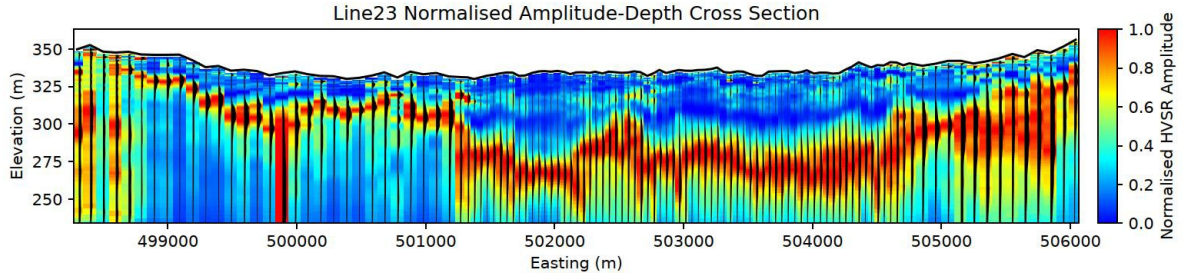
Line: 22

Resource Potentials





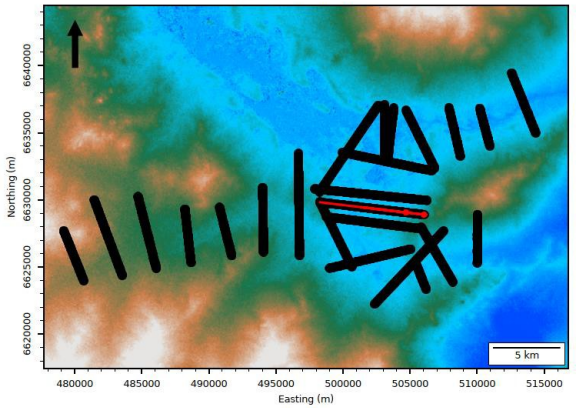




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

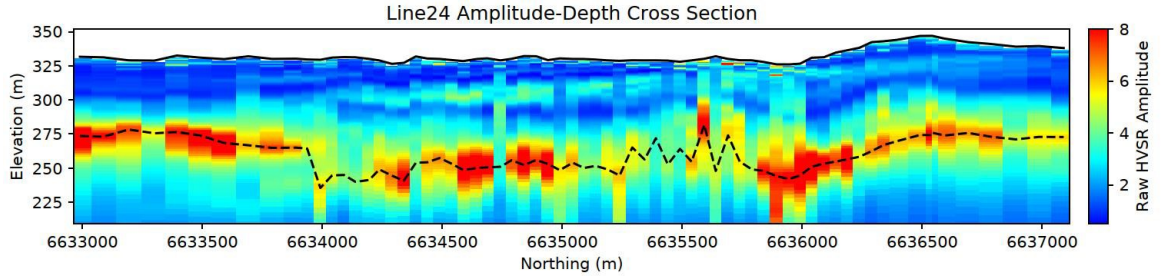
RAMELIUS RESOURCES

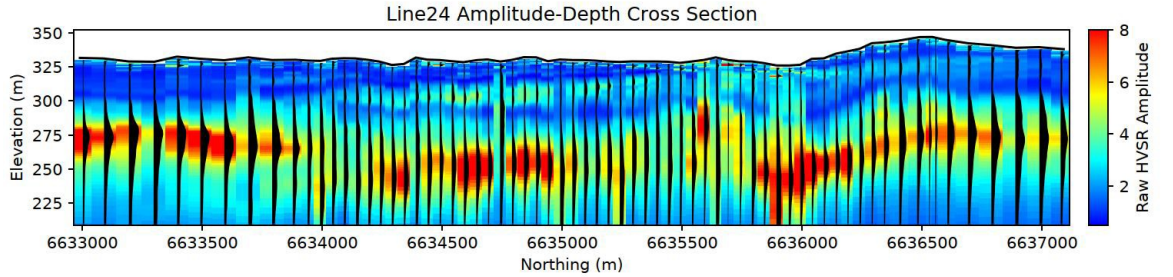
Lake Rebecca – Southern Area

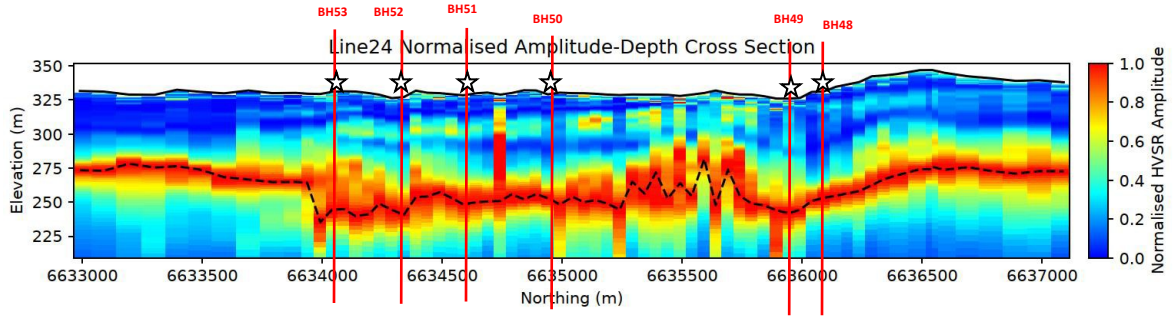
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

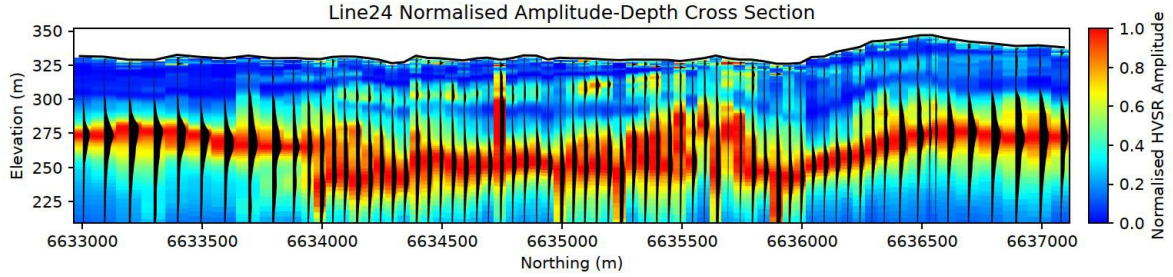
Line: 23

Resource Potentials





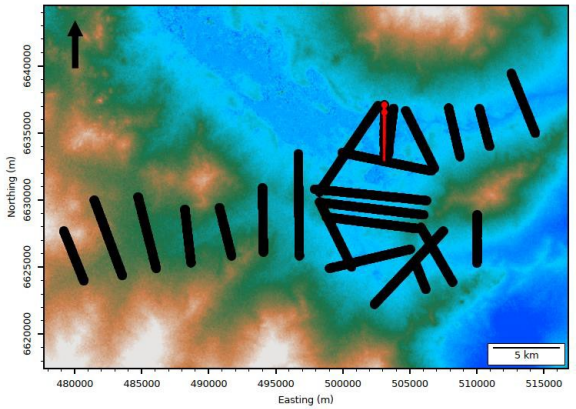




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

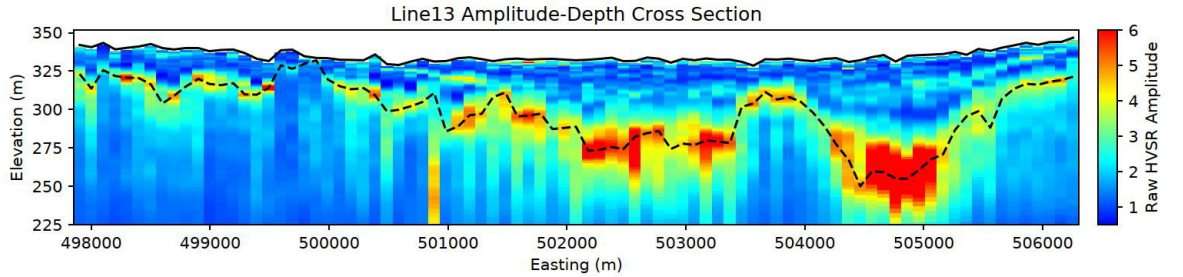
RAMELIUS RESOURCES

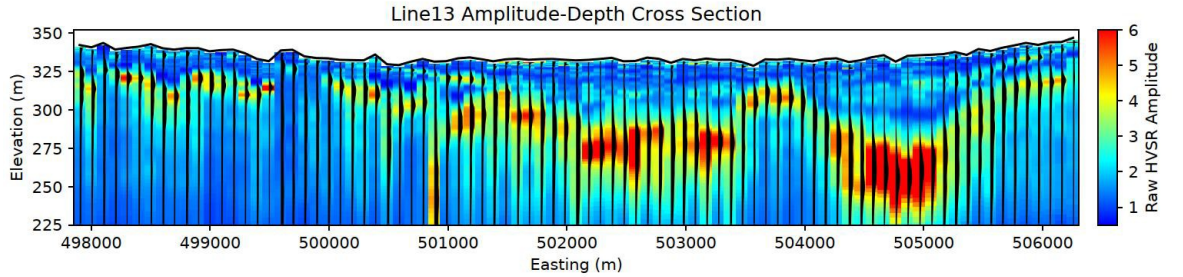
Lake Rebecca – Southern Area

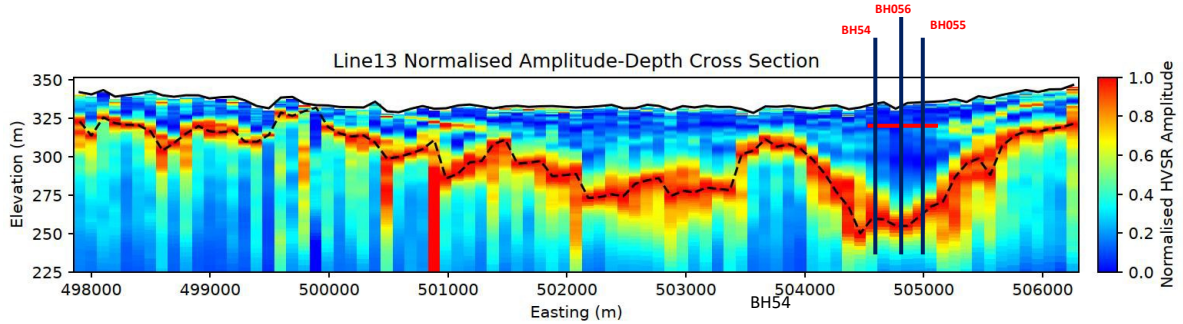
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

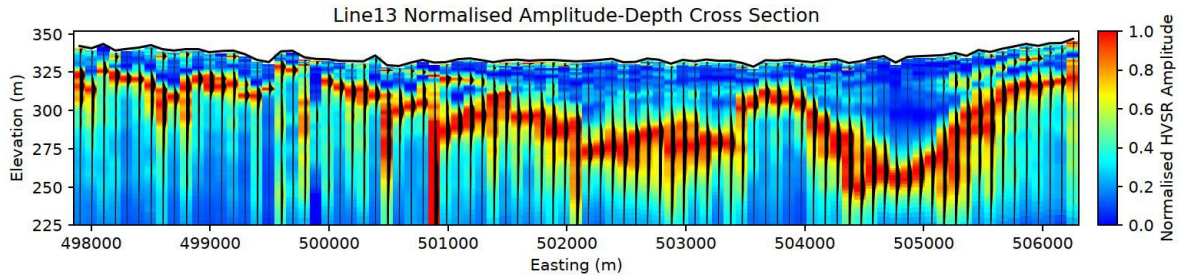
Line: 24

Resource Potentials





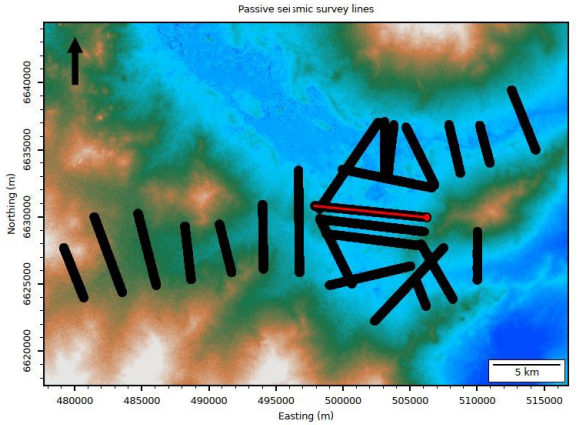




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

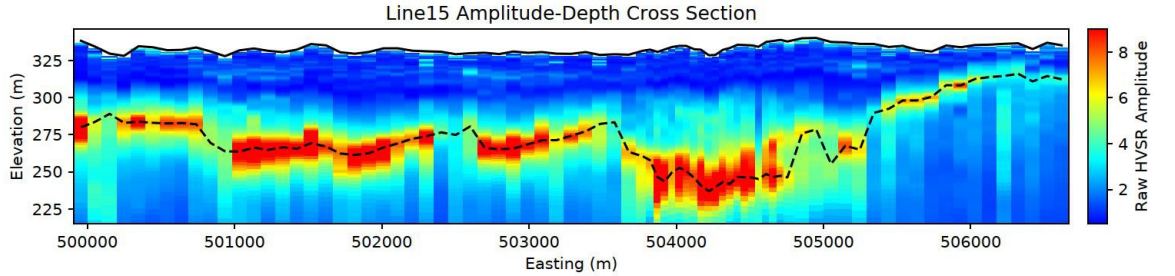
RAMELIUS RESOURCES

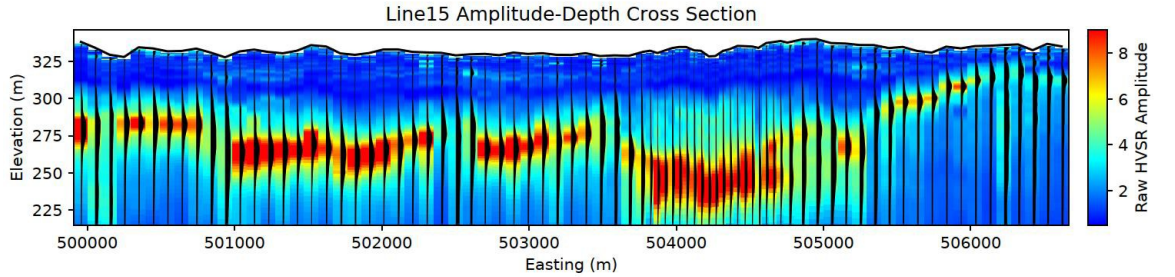
Lake Rebecca – Southern Area

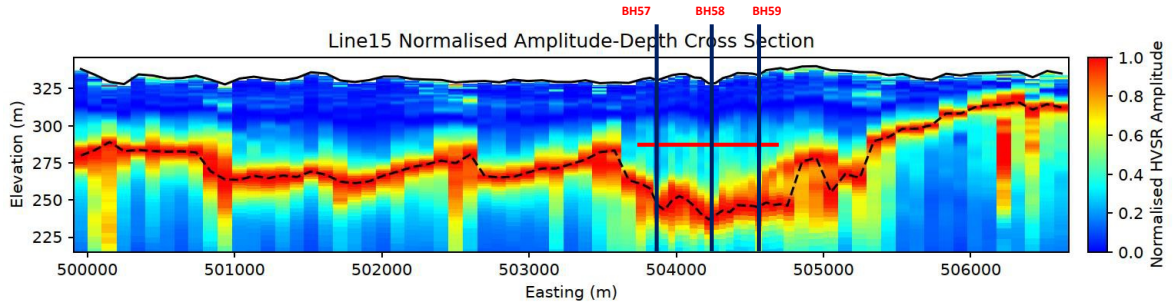
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

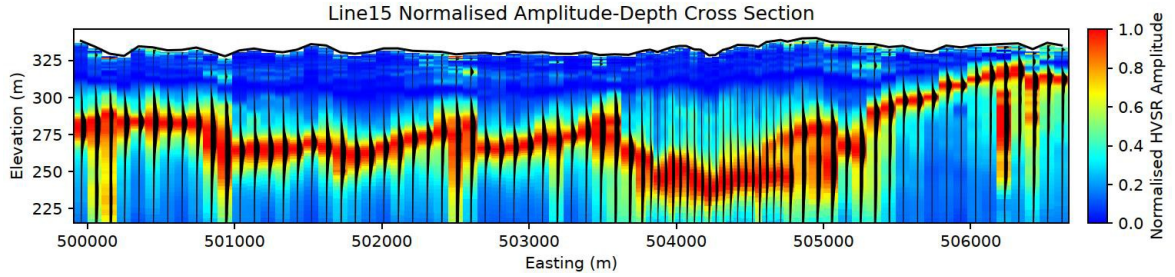
Line: 13

Resource Potentials





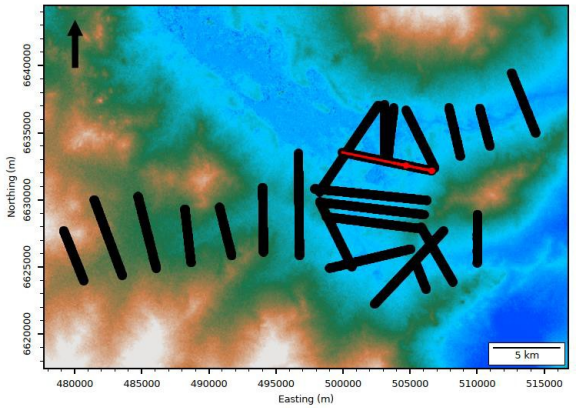




Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

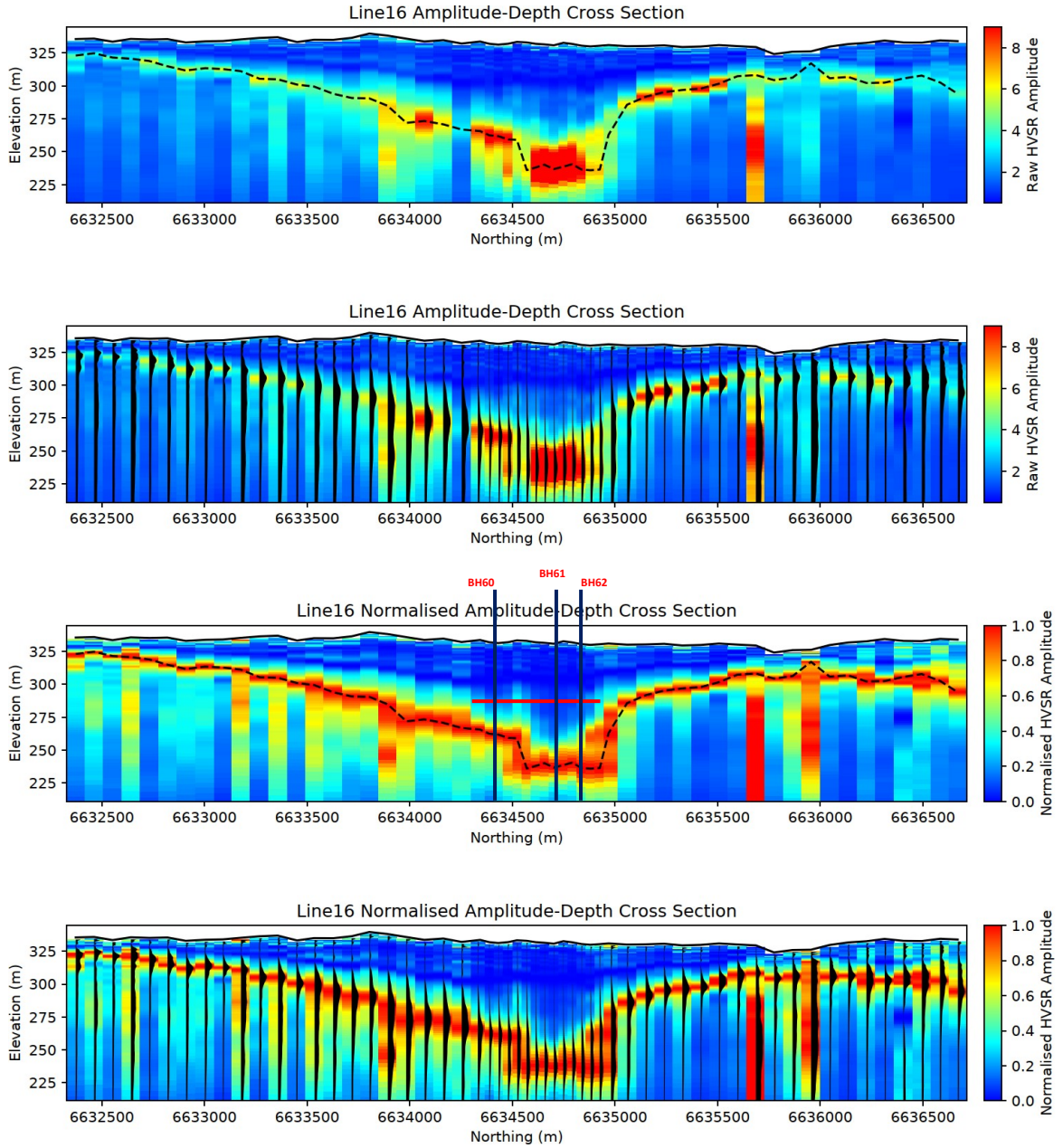
RAMELIUS RESOURCES

Lake Rebecca – Southern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 15

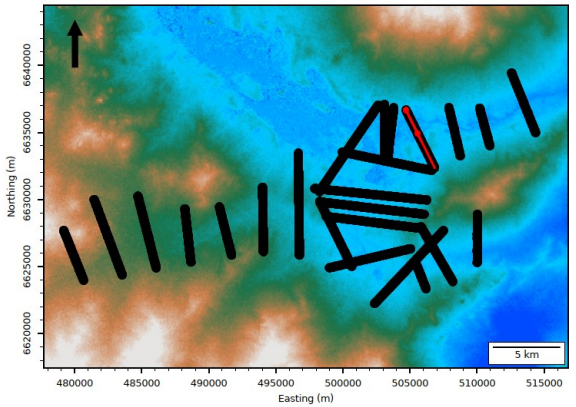
Resource Potentials



Vertically exaggerated

GDA94, MGA Zone 51

Passive seismic HVSR stations overlain on elevation data



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

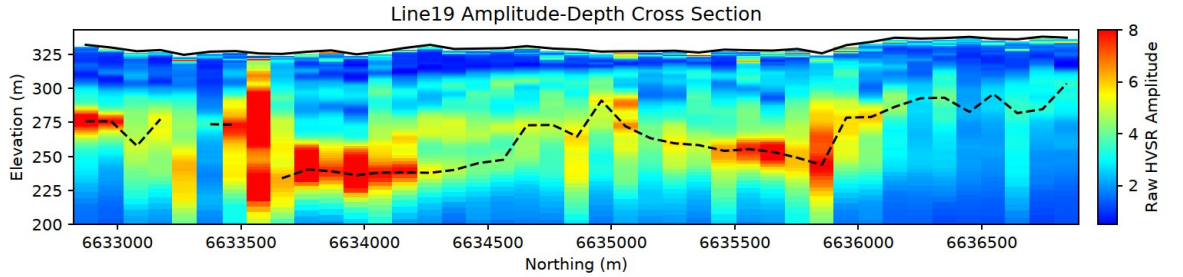
RAMELIUS RESOURCES

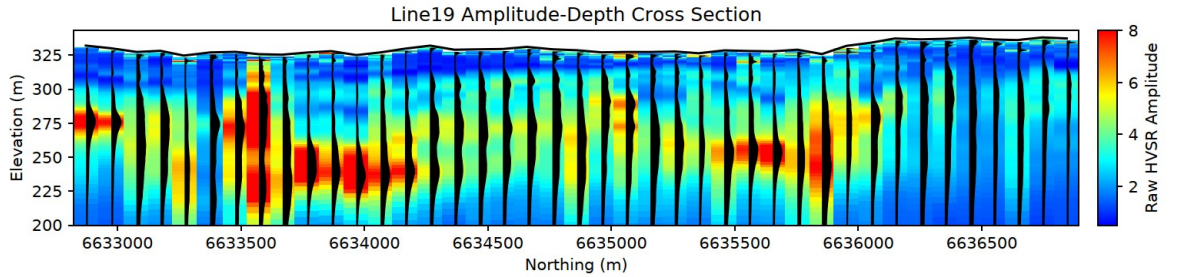
Lake Rebecca – Southern Area

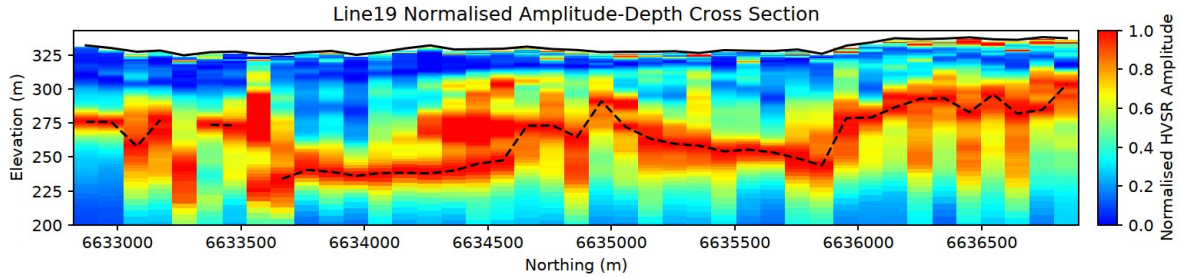
Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

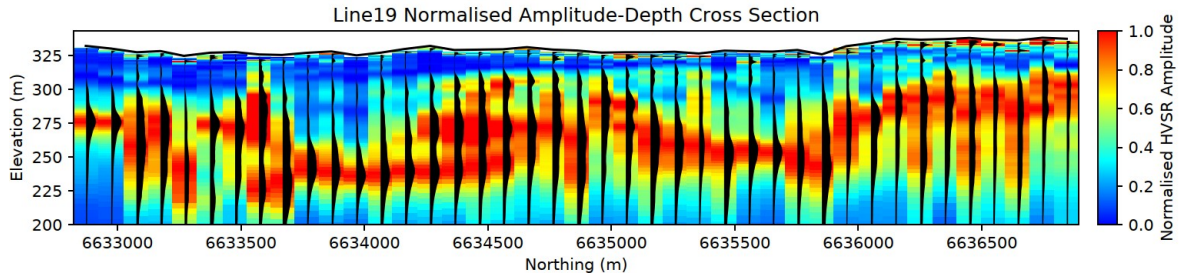
Line: 16

Resource Potentials



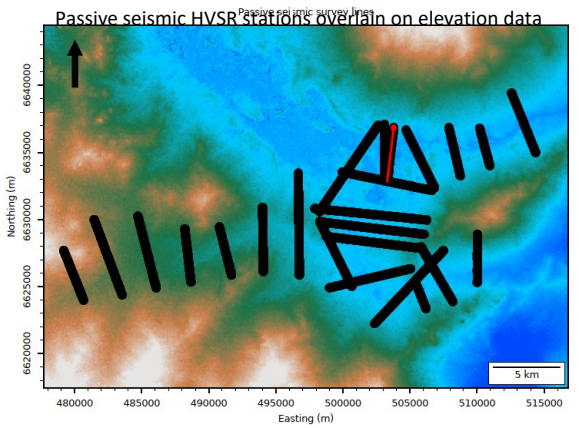






Vertically exaggerated

GDA94, MGA Zone 51



HVSR Survey Specifications:

Survey Date: 28th April – 9th July 2023
Station Spacing: 50 - 100 m
Acquisition Time: 20 minutes
Instrument: Tromino® TEB seismometer

Black dashed profile represents the interpreted acoustic bedrock in relative SRTM elevation in meters.

RAMELIUS RESOURCES

Lake Rebecca – Southern Area

Passive Seismic HVSR Survey
HVSR Amplitude-Depth Cross-Section

Line: 19

Resource Potentials

APPENDIX D
EXPLORATION HOLES BORE LOGS

Level 4, 56 William Street
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COMPOSITE WELL LOG

Bore No: WBAC001

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	12/11/23	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	12/11/23	**Fluid:**	Air	**Elevation:**	334 mAHD
Drilled:	Kenedy Drilling	**Drill Diameter:**	102 (4")	**Easting:**	482920
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6626052
				Projection:	Zone 51

Water Strike (MBGL): n/a

'BH' ID: BH48

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown Aluvium	Open Hole (102 mm; 4")	
1				
2				

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COMPOSITE WELL LOG

Bore No: WBAC0002

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	12/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	12/11/2023	**Fluid:**	Air	**Elevation:**	321 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503107
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6635950
				Projection:	Zone 51

Water Strike (MBGL): 4 mbgl
'BH' ID: BH49

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Red brown silty sandy CLAY. Plastic. Sand ranges from medium to coarse, moderately sorted. Much silt and clay.		
		sandy gravelly CLAY: Clay with minor medium to coarse grained sub angular sand and fine to medium gravel. Poor sorting.		
		sandy silty CLAY: Yellow/brown, semi-plastic CLAY with fine to coarse grained poorly sorted sand and silt.		
10		Sandy Clay: Creamy white/light-grey semi-plastic sandy CLAY. The sand fraction ranges from medium to coarse and is moderately well sorted.		
		sandy gravelly CLAY: Clay with minor sand and gravel. Poor sorting. The sand fraction ranges from medium to coarse grained. Minor fine gravel.		
		clayey SAND: Creamy white/light-grey clayey SAND. Much clay. The sand fraction is moderately well sorted and ranges from medium to coarse grained. The sand grains are sub-angular.		
20		sandy silty CLAY		
		silty sandy CLAY: Creamy white/light grey silty sandy CLAY.		
30		clayey SAND: Creamy white/light-grey poorly sorted clayey SAND. The sand fraction is moderately well sorted and ranges from medium to coarse. Grains are sub-angular. Quartz sand.		
		SAND: Pinkish light grey fine to coarse grained quartz SAND. Poorly sorted.		
40		clayey SAND: Creamy white/light-grey slightly clayey SAND. Sand ranges from fine to coarse in size and is poorly sorted. Sand grains are sub-angular to sub-rounded. Clay is white/kaolinitic. The unit is a fining upwards sequence becoming dominantly coarse grained sand at 44 mbgl.	Open Hole (102 mm ; 4")	
50		sandy CLAY: As above however dominantly CLAY. Clay is dark brown/black in colour.		
		silty CLAY: Drak grey silty CLAY. Semi-plastic.		
60		silty CLAY: Dark olive grey silty CLAY. Plastic.		
		sandy CLAY: Dark olive grey sandy CLAY. The sand fraction is poorly sorted ranging from fine to very coarse grained.		
70		SAND: Fine to granulitic sub angular to sub rounded unconsolidated quartz SAND. Well sorted granulitic sand between 67 - 68 mbgl. Poorly sorted Medium to coarse grained between 68 - 72 mbgl with minor olive grey clay at 72 - 73 mbgl. Fine to medium moderately well sorted sub rounded sand between 72 - 74 mbgl. Fine to coarse grained sand between 74 - 80 mbgl. Fine grained well sorted sand between 80 - 81 mbgl. Medium to coarse grained moderately well sorted sand between 81 - 83 mbgl.		
80		CLAY: Mid-grey plastic amorphous CLAY.	Drilling terminated at 86 mbgl on encountering mafic bedrock.	
		Mafic Bedrock		

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COMPOSITE WELL LOG

Bore No: WBAC0003

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	12/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	12/11/2023	**Fluid:**	Air	**Elevation:**	337 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	502122
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6636270
				Projection:	Zone 51

Water Strike (MBGL): 5 mbgl **'BH' ID:** BH46

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown silty Alluvial soil		
		silty CLAY: Unconsolidated moderate reddish brown silty CLAY with grey soft to plastic mottles. Mottled Clay.		
		sandy silty CLAY: Moderate reddish brown sandy silty CLAY. Very silty and sandy, unconsolidated, soft.		
		silty SAND: Light reddish brown silty SAND. Sand ranges from fine to medium grained and is poorly sorted.		
10		sandy SILT: Light reddish brown unconsolidated sandy SILT. Poorly sorted. Predominantly silt with much sand. Sand is poorly sorted ranging from fine to coarse grained and is sub-rounded.		
		Silty Sand: Limonitic yellow/brown unconsolidated silty SAND.A Fining upwards sequence with predominantly fine grained sand at the top of the unit coarsening to coarse grained sand at the base. Poorly sorted.		
20		Sand: Limonitic yellow/brown very coarse to granulitic unconsolidated quartz sands. Moderately well sorted ranging from very coarse to granulitic in size. Sand grains are sub-rounded.		
		silty SAND: Creamy white/ very light grey silty SAND. Much silt, sand fraction is predominantly very coarse grained.		
30		SAND: Light grey/creamy white moderately well sorted medium to very coarse grained Unconsolidated SAND. Predominantly coarse grained. Sand grains are sub angular to angular.		
		sandy silty CLAY: Creamy white/light grey sandy silty CLAY. Much silt and sand. Sand content reduces with increasing depth.		
40		silty CLAY: Creamy white/light grey sandy silty CLAY	Open Hole (102 mm ; 4")	
50		silty CLAY: Light grey semi-plastic slightly silty unconsolidated CLAY. Minor silt.		
		silty clayey SAND: Creamy white/light grey unconsolidated silty clayey SAND. Poorly sorted. Sand ranges from fine to coarse grained and is subangular.		
60		silty sandy CLAY: very dark grey/black carbonaceous unconsolidated silty sandy CLAY.		
		sandy silty CLAY: creamy white/light grey semi-plastic sandy silty CLAY. Minor black/very dark grey (carbonaceous) coarse lithic grains.		
70		SAND: Granular (very coarse) basal paleochannel SAND. White/tranlucent quartz granules. Well sorted; sub-rounded grains.	Drilling terminated at 78 mbgl due to blade bit refusal	

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COMPOSITE WELL LOG

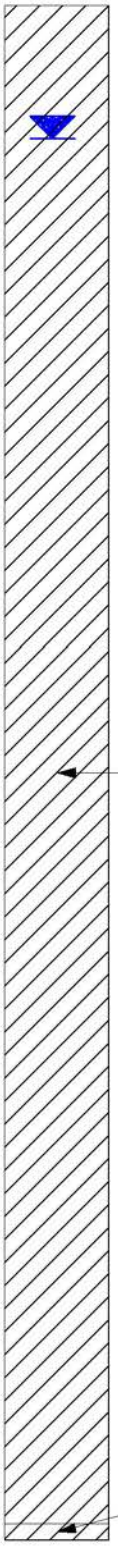
Bore No: WBAC0004

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	12/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	13/11/2023	**Fluid:**	Air	**Elevation:**	337 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	502122
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6636270
				Projection:	Zone 51

Water Strike (MBGL): 8 mbgl
'BH' ID: BH47

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy ALLUVIUM.		
		Alluvium: Semi-consolidated sandy Alluvium. Breakable hard podsols of sandy soil and clasts of dark red/brown siltstone.		
10		sandy SILT: Light reddish brown sandy SILT. Much sand. Sediment is poorly sorted ranging from silt to granulitic sized white/translucent sub-angular quartz grains. The sand fraction is predominatly coarse grained.		
20		silty SAND: Pinkish grey unconsolidated silty SAND. Poorly sorted. Sediment size ranges from silt to coarse sand. Sub-rounded grains. Dominantly medium grained sand.		
		sandy SILT: Pinkish light grey/white sandy SILT. Poorly sorted. Sand fraction ranges from very fine to coarse grained. Sub-rounded to angular grains. Unconsolidated.		
30		silty SAND: white/beige silty SAND. Unconsolidated and poorly sorted. Fine to coarse sub-angular grains.		
40		silty SAND: Pinkish beige very fine to medium grained sand. Much silt. Poorly sorted. Unconsolidated. Sub-rounded grains.		
		silty SAND: Creamy white silty SAND. Much silt. Poorly sorted, fine to coarse grained. Sub-rounded grains. Unconsolidated.		
50		SAND: Unconsolidated paleochannel SAND. Medium to granulitic moderately well sorted,well rounded quartz sand.		
		SAND: Unconsolidated paleochannel SAND. Poorly sorted fine to granulitic quartz sands, sub-rounded grains.		
60		SAND: Poorly sorted fine to granulitic unconsolidated paleochannel SAND.		
		clayey SILT: Dark brown/Black carbonacous unconsolidated very clayey SILT.		
		SAND: Poorly sorted fine to granulitic unconsolidated paleochannel SAND.		
		clayey SILT: Dark brown/Black carbonacous unconsolidated very clayey SILT.		
70		clayey silty SAND: Unconsolidated basal paleochannel SAND. Poorly sorted fine to granulitic sub-angular to sub-rounded quartz sand. Much silt and clay.		
		silty CLAY: Dark grey silty CLAY. Minor medium grained sand. Semi-plastic. Reducing sand and silt content with increasing depth of unit.		
		sandy clayey SILT: Creamy brown/beige silty SAND. Poorly sorted.		
		silty CLAY: Dark grey silty CLAY. Minor medium grained sand. Semi-plastic.		
80		silty SAND: Poorly sorted fine to very coarse quartz sands with much silt and dark grey clay.		
		SAND: Poorly sorted fine to granulitic white/grey to translucent quartz basal paleochannel SAND. High carbonacous content from 82 - 85 mbgl giving dark grey colouration.		
		Conglomerate: Unconsolidated basal paleochannel CONGLOMERATE. Very poorly sorted. Fine grained sand to pebble sized quartz. Around 50 % pebbles (0.6 sphericity; 0.8 roundness).		
90		sandy silty CLAY: Black/very dark grey carbonacous sandy silty CLAY. Minor sand, much silt. Pebble sized siltstone lithic fragments encountered at 92 mbgl.		



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COMPOSITE WELL LOG

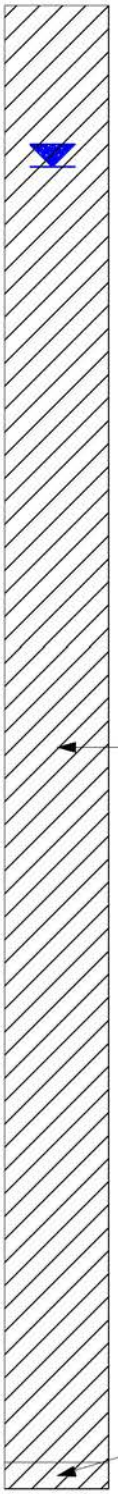
Bore No: WBAC0005

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	13/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	13/11/2023	**Fluid:**	Air	**Elevation:**	332 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	500706
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6634132
				Projection:	Zone 51

Water Strike (MBGL): 6 mbgl **'BH' ID:** BH44

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate pinkish brown sandy alluvial soil with 10 % white medium gravel sized silltstone lithic fragments.		
		silty sandy CLAY: Moderate reddish brown silty sandy CLAY.		
		CLAY: Moderate reddish brown amorphous semi-plastic CLAY.		
10				
		CLAY: Mid grey slightly sandy CLAY. Plastic to stiff. Sand is minor and ranges in size from fine to very coarse and poorly sorted. Increasing consolidation/stiffness with increasing depth.		
20				
30		sandy SILT: Moderate orange/pink sandy SILT. Unconsolidated.		
		SAND: Poorly sorted unconsolidated SAND. Coarse to granulitic sub angular white/translucent quartz sand grains. Moderate sorting.		
40		sandy SILT: Pinkish grey sandy silt. Poorly sorted. Unconsolidated. Sand is sub-angular and ranges in size from fine to coarse.		
		CLAY: Dark grey stiff CLAY with minor fine to medium grained sand and silt. Sand content increases and coarsens from fine to medium grained with depth.		
50				
		GRAVEL: Basal paleochannel GRAVEL. White/translucent quartz gravel with minor (< 10% pebbles). Unconsolidated.		



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COMPOSITE WELL LOG

Bore No: WBAC0006

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	13/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	14/11/2023	**Fluid:**	Air	**Elevation:**	326 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	500504
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6633900
				Projection:	Zone 51

Water Strike (MBGL): 5 mbgl
'BH' ID: BH43

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Light red/pinkish brown sandy Alluvium.		
		Alluvium: Moderate reddish brown sandy Alluvium.		
		silty CLAY: Moderate orange amorphous, plastic, silty CLAY.		
10		CLAY: Light grey amorphous CLAY.		
		CLAY: Moderate orange amorphous soft CLAY		
20				
		CLAY: Light to dark grey amorphous CLAY. Plastic to stiff. Increasing consolidation with depth becoming stiff at 32 mbgl.		
30				Open Hole (102 mm ; 4")
		silty SAND: Moderate orange silty SAND, minor clay. Unconsolidated, poorly sorted. Coarsening upwards sequence. Fine to granulitic quartz sand; sub-angular grains. Predominantly coarse sand.		
40				
		sandy silty CLAY: Light grey silty slightly sandy CLAY. Plastic to stiff.		
50				
		silty clayey SAND: Light grey/creamy beige silty clayey sand. Minor silt, much clay (40 %). Sand ranges from very fine to granulitic in size. Poorly sorted fining upwards sequence. Unconsolidated.		
		Intermediate Bedrock		Drilling terminated at 57 mbgl due to blade bit refusal.

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COMPOSITE WELL LOG

Bore No: WBAC0007

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	14/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	14/11/2023	**Fluid:**	Air	**Elevation:**	332 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	496829
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6629251
				Projection:	Zone 51

Water Strike (MBGL): 9 mbgl
'BH' ID: BH42

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy alluvial SOIL.		
		silty CLAY: Moderate reddish brown plastic silty CLAY.		
10				
		CLAY: Moderate reddish brown plastic amorphous CLAY.		
20		silty CLAY: Mid grey slightly silty CLAY. Plastic to stiff, increasing stiffness/consolidation with depth.		
30				
		silty SAND: pinkish beige very poorly sorted silty SAND. Silt to granulitic sized quartz sand, sub-rounded. Fines upwards.		
40		sandy CLAY: pinkish brown sandy CLAY		
		sandy silty CLAY: Varicoloured (red/brown/mid-grey) poorly sorted sandy silty CLAY.		
50		Saprolitic Clay: Light olive green saprolitic CLAY.		
60				
70				
80				Open Hole (102 mm ; 4"); Drilling terminated at 86 mbgl due to intersecting saprolitic clay.

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COMPOSITE WELL LOG

Bore No: WBAC0008

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	14/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	15/11/2023	**Fluid:**	Air	**Elevation:**	331 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503084
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6634773
				Projection:	Zone 51

Water Strike (MBGL): 8 mbgl
'BH' ID: BH50

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy alluvium.		
		Alluvium: Moderate reddish brown semi-plastic sandy silty clay rich alluvium.		
10		sandy silty CLAY: Moderate orange plastic silty CLAY with Stiff mid grey mottles. Minor sand, much silt. Increasing sand content at 19 mbgl. Fine to very coarse poorly sorted sub-rounded sand. Coarsens towards base of unit.		
20				
30		sandy SILT: light beige/creamy pink SILT with poorly sorted fine to very coarse sub-angular sand. Increasing sand content with depth.		
40		gravelly SAND: Very coarse to granulitic paleochannel sands. Much fine gravel. Very poorly sorted. Dominantly very coarse sand 34 - 35 mbgl. Coarsens to dominantly fine gravel 35 - 36 mbgl, and then fines to dominantly very coarse sand from 37 to 40 mbgl.	Open Hole (102 mm ; 4")	
50		silty SAND: Creamy white/beige silty SAND. Dominantly fine to medium grained with minor (10% coarse grains). Poorly sorted and unconsolidated. Sub rounded grains. Very Silty (45 %)		
60		sandy CLAY: Mustard yellow (limonitic) sandy CLAY. Plastic, very soft.		
		CLAY: Mid to dark grey stiff amorphous CLAY.		
70		CLAY: Light grey slightly amorphous CLAY.	Drilling terminated at 74 mbgl due to intersecting saprolitic Clay.	

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COMPOSITE WELL LOG

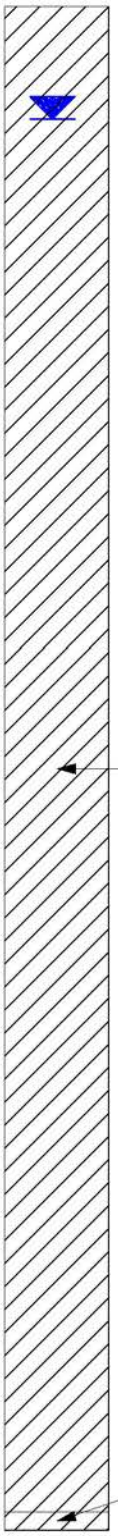
Bore No: WBAC0009

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	15/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	15/11/2023	**Fluid:**	Air	**Elevation:**	329 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503101
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6634597
				Projection:	Zone 51

Water Strike (MBGL): 6 mbgl **'BH' ID:** BH51

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy silty Alluvium. Becoming clayey from 1 mbgl.		
		silty CLAY: Red/moderate orange brown silty CLAY with mid grey stiff mottled clay.		
20		silty sandy CLAY: Pink red silty sandy CLAY, very poorly sorted, containing weathered pebble sized lithic white siltstone/sandstone fragments.		
		sandy SILT: Creamy white sandy SILT. Sand is poorly sorted, fine to medium grained, sub-rounded.		
		Sandstone: Consolidated very fine to very coarse poorly sorted transported limonitic sandstone (gravel sized cuttings). Much moderate pink unconsolidated clay and silt		
		clayey SAND: Very fine to granulitic poorly sorted moderate pink slightly clayey SAND.		
30		Silty Sand: Creamy white silty SAND. Fine to coarse poorly sorted. Unconsolidated. Well Rounded grains.		
		gravelly SAND: Poorly sorted medium to granulitic gravelly SAND. Lithic cemented (white calcrete) poorly sorted (medium to very coarse) sandstone fragments are also present. Very poorly sorted, sub-angular grains.		
40		silty CLAY: Stiff mid-grey silty CLAY.		
		SAND: Coarse to very coarse moderately well sorted quartz SAND. Unconsolidated, sub-angular grains, minor coarse gravel (< 5%).		
		silty SAND: greyish orange/pink silty SAND. Very fine to very coarse poorly sorted sand. Unconsolidated. Sub rounded grains.		
		silty CLAY: Pale pinkish white plastic silty CLAY.		
50		silty SAND: Moderate brown silty SAND. Much silt. Medium to coarse grained poorly sorted sub-rounded sand. 45 % silt from 51 - 54 mbgl.		
		Saprolitic CLAY: Varicoloured saprolitic CLAY sequence ranging in colour from greyish blue to greyish green to mid grey. Amorphous. Plastic.		
60				
70				
80		Felsic Bedrock: Felsic bedrock (quartz, plagioclase feldspar)		



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COMPOSITE WELL LOG

Bore No: WBAC0010

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	15/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	16/11/2023	**Fluid:**	Air	**Elevation:**	329 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503101
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6634332
				Projection:	Zone 51

Water Strike (MBGL): 8 mbgl **'BH' ID:** BH52

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy clayey alluvium.		
		silty CLAY: Mid grey plastic silty CLAY		
		sandy silty CLAY: Light grey sandy silty CLAY.		
10		silty CLAY: Reddish orange to light brown silty CLAY. Unconsolidated, plastic.		
20		silty sandy CLAY: Greyish orange silty sandy CLAY. Poorly sorted, unconsolidated fine to granulitic quartz sand with sub angular grains. Lithic fragments of cemented sandstone of identical composition. Cement is white indicating either silcrete or calcaerous cement.		
		silty clayey SAND: Fine to coarse sub poorly sorted, sub angular, silty clayey SAND. Very clayey. Clay is mid grey. Fining downwards sequence with increasing silt and clay content with depth.		
30		silty sandy CLAY: Mid grey soft unconsolidated silty sandy CLAY. Medium to coarse grained poorly sorted sand.		
		sandy SILT: Mid to light grey sandy SILT. Unconsolidated.		
40		CLAY: Pale olive green amorphous CLAY. Powdery when dry (40 - 43 mbgl) Stiff and consolidated when wet (43 -51 mbgl).		
			Open Hole (102 mm ; 4")	
50		SILT: Greyish orange very slightly sandy SILT. Fine to coarse poorly sorted sub rounded sand (< 10%).		
		silty CLAY: Dusky yellow silty CLAY. Soft to plastic.		
		CLAY: Bluish/greenish grey amorphous CLAY.		
60		CLAY: Light grey amoprhous CLAY,		
70				
80		CONGLOMERATE: Basal paleochannel CONGLOMERATE. Medium grained sand to pebble sized quartz. Poorly sorted. Unconsolidated. Much clay.		
		sandy silty CLAY: Light greenish grey sandy silty CLAY		
		SAND: Basal paleochannel sands. Poorly sorted fine sand to fine gravel sized sub angular to sub rounded quartz.		
		sandy CLAY: Alike overlying unit however clay is dominant.		
90		clayey silty SAND: Much silt. Very poorly sorted very fine to coarse sub rounded quartz sand.		
		silty CLAY	Drilling terminated at 92 mbgl due to a full sump	

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COMPOSITE WELL LOG

Bore No: WBAC0011

Client: Ramelius Resources

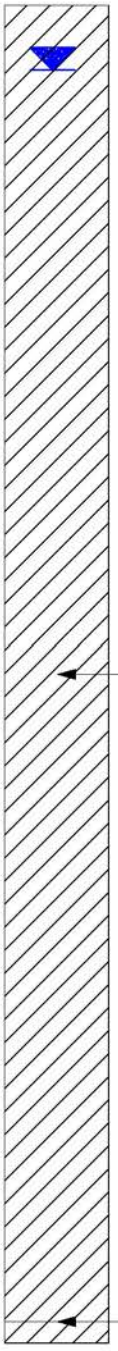
Project: Lake Rebecca Exploration Drilling

Commenced:	16/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	16/11/2023	**Fluid:**	Air	**Elevation:**	330 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	501871
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6633140
				Projection:	Zone 51

Water Strike (MBGL): 3 mbgl

'BH' ID: BH38

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy Alluvium.		
		Alluvium: Silty clayey alluvium with black/dark grey lithic fragments of iron-rich duricrust (ferricrete). Weathered hardground.		
		silty CLAY: Pale reddish brown uncnsolidated soft silty CLAY bearing mid-grey stiff mottles. Much silt. Black/dark grey lithic fragments (ferricrete) are present throughout the unit.		
10		CLAY: Greenish grey amorphous CLAY. Consolidated/unconsolidated in parts. Plastic to very stiff.		
20		silty CLAY: Moderate orange and mid grey silty CLAY. Soft in places, very stiff in others. Increasing consolidation with depth; entirely stiff mid-grey clay below 26 mbgl.		
30		CLAY: Moderate orange unconsolidated amorphous CLAY.		
		silty sandy CLAY: Mid grey silty sandy CLAY. 30 % dominantly medium grained sand; 70 % clay.		
		CLAY: Moderate orange unconsolidated amorphous CLAY.		
40		sandy CLAY: Mid grey sandy CLAY. Much sand. Poorly sorted fine to granulitic sub angular to sub rounded quartz sand.		
		silty CLAY: Mid grey consolidated very stiff silty CLAY.		
50		CONGLOMERATE: Very poorly sorted angular to sub angular pebbles and gravels with minor very coarse grained sand. Dominantly quartzite gravels and pebbles. Unconsolidated paleochannel CONGLOMERATE.		
		silty sandy CLAY: Mid grey silty sandy CLAY. Much sand, dominantly coarse grained.		
		silty SAND: Beige/light brown sandy SILT. Very poorly sorted; fine to very coarse; sub rounded to rounded quartz sand.		
60		SAND: Medium to very coarse poorly sorted sand with sub rounded grains. Unconsolidated. Minor silt.		
		silty CLAY: Moderate orange unconsolidated , soft, silty CLAY.		
		SAND: Very poorly sorted basal paleochannel SAND. Medium to fine gravel translucent/white quartz. Sub rounded grains. Dominantly very coarse to granulitic.		



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COMPOSITE WELL LOG

Bore No: WBAC0012

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	17/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	17/11/2023	**Fluid:**	Air	**Elevation:**	334 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	501415
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6633248
				Projection:	Zone 51

Water Strike (MBGL): 6 mbgl
'BH' ID: BH37

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy, silty, alluvium.		
		clayey SAND: Moderate reddish brown clayey SAND. Much clay. Fine to very coarse poorly sorted sand with sub angular grains.		
		clayey SAND: As above but with lithic fragments of black/dark grey cemented siltstone/iron-rich duricrust (ferricrete).		
		silty sandy CLAY: Moderate reddish orange unconsolidated silty sandy CLAY. Minor silt and sand.		
10		silty CLAY: mottled moderate reddish orange silty CLAY. Semi-consolidated grey plastic silty clay mottles are common and present throughout.		
20		CLAY: Light olive grey amorphous unconsolidated to semi-consolidated CLAY. Soft to plastic.		
30		sandy silty CLAY: Mid to light grey slightly sandy silty CLAY. Stiff/hard and consolidated. Sand content is minor and reduces with depth.		
		silty CLAY: Moderate orange pink silty CLAY. Much silt (45 %). Unconsolidated. Contains very minor poorly sorted fine to coarse sub rounded quartz sand grains.		
40		clayey silty SAND: Very poorly sorted very fine to very coarse sub angular SAND. Much mid grey clay and silt.		
		sandy silty CLAY: Pale olive green slightly sandy silty CLAY. Sand is minor (< 10%) from 41 - 58 mbgl. Sand content increases (to around 35%) after 58 m.	Open Hole (102 mm ; 4")	
50				
60				
70				
		sandy SILT: Much (40%) fine to granulitic very poorly sorted sub rounded quartz sand.		
		silty CLAY: Mid grey silty CLAY.		
		sandy clayey SILT		
80		SAND: Poorly sorted coarse to granulitic basal paleochannel SAND. Sub angular grains. Much silt.	Drilling terminated at 61 mbgl due to	
		Felsic Bedrock		

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COMPOSITE WELL LOG

Bore No: WBAC0013

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	17/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	17/11/2023	**Fluid:**	Air	**Elevation:**	333 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	501135
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6633294
				Projection:	Zone 51

Water Strike (MBGL): 5 mbgl

'BH' ID: BH36

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown sandy alluvium.		
		Alluvium: Moderate reddish brown sandy clayey alluvium.		
		silty CLAY: Moderate reddish orange silty CLAY. Much silt. Plastic to slightly stiff.		
10		CLAY: Moderate reddish orange unconsolidated amorphous CLAY.		
		CLAY: Light olive grey unconsolidated amorphous CLAY. Becoming stiff/semi-consolidated at 20 mbgl .		
20		sandy silty CLAY: Mid to light grey sandy slity CLAY. Semi-consolidated, plastic. Much silt. Approximately 5 - 10 % medium to coarse grained sand.		
30		silty sandy CLAY: Much sand. Poorly sorted very fine to coarse sub rounded quartz sands. Unit behaves as a plastic clay.		
40		silty CLAY: Light reddish brown unconsolidated silty CLAY. Very silty (45 %)	Open Hole (102 mm ; 4")	
50				
60		CLAY: Light reddish brown amorphous CLAY. Powdery when dry, plastic when wetted. Unconsolidated.		
70		silty CLAY: As above but bearing minor silt.		
80		Felsic Bedrock: Angular Quartzite (in-situ).	Drilling terminated	

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COMPOSITE WELL LOG

Bore No: WBAC0014

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	18/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	18/11/2023	**Fluid:**	Air	**Elevation:**	339 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	498531
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6631013
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl

'BH' ID: BH40

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Reddish light brown clayey silty sandy SOIL. 2 cm - 10 cm diameter peds.		
		Gravelly Clay: silty sandy CLAY with silcrete and ferricrete gravel and pebble sized clasts. Lithic fragments are heavily altered; plastic clay lumps retain the original silcrete/ferricrete texture. The unit ranges from clay to coarse gravel in sediment size, very poorly sorted. Approximately 50 % clay. Silcrete and ferricrete hardground is encountered between 3 - 8 mbgl.		
		silty CLAY: Dry powdery slightly silty moderate reddish brown CLAY.		
10		silty CLAY: White slightly silty CLAY (kaolin).		
		CLAY: Moderate reddish brown unconsolidated amorphous CLAY. Dry powder in cuttings		
20				
30				
40				
50				Open Hole (102 mm ; 4")
60				
70				
80				
		silty CLAY: Light olive green silty CLAY. Saprolitic clay.		
90		Intermediate Bedrock: Angular crystalline feldspar and quartz cuttings. Little alteration. Light olive green saprolitic clay is mixed throughout.		Drilling terminated at 92 mbgl due to blade bit refusal whilst intersecting bedrock.

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COMPOSITE WELL LOG

Bore No: WBAC0015

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	18/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	19/11/2023	**Fluid:**	Air	**Elevation:**	334 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	499152
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6631919
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl

'BH' ID: BH51

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown clayey silty sandy alluvium.		
		Alluvium: Light brown sandy, silty, clayey Alluvium. Stiff peds of light brown semi-plastic silty clay are present.		
		clayey SAND: very clayey (40 %) SAND. Fine to very coarse poorly sorted subrounded sand. Moderate reddish brown silty clay with 50 % mid grey semi-consolidated mottles.		
10		CLAY: Varicouloured Clay sequence. Colour ranges from moderate reddish brown to white, to yellowish brown, to pale olive. Amorphous and powder dry.		
20				
30				
40				
		sandy CLAY: Very sandy (40 %) CLAY. Very poorly sorted medium to very coarse grained sands. Angular lithic fragments of cemented medium grained sandstone.		
50		sandy silty CLAY: Limonitic yellow sandy silty CLAY. Minor sand; much silt.		
60		clayey silty SAND: Very poorly sorted fine to coarse grained sub angular quartz sand. Much clay (35 %), much silt.		
		silty CLAY: Limonitic yellow silty CLAY.		
		silty SAND: Medium to coarse grained very poorly sorted sand with minor silt. Rounded to sub rounded grains. Blade bit refused against angular bedrock shown by cuttings.	Open Hole (102 mm ; 4") / Drilling terminated at 68 mbgl due to	

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COMPOSITE WELL LOG

Bore No: WBAC0016

Client: Ramelius Resources

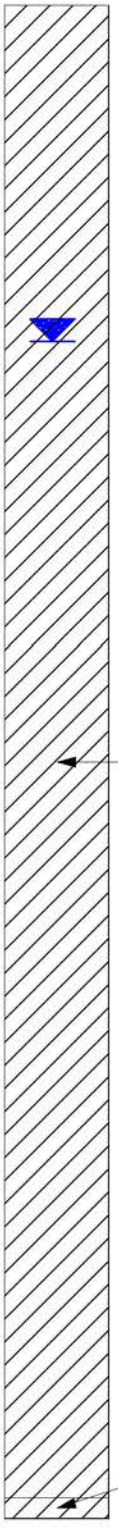
Project: Lake Rebecca Exploration Drilling

Commenced:	19/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	19/11/2023	**Fluid:**	Air	**Elevation:**	329 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503192
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6630280
				Projection:	Zone 51

Water Strike (MBGL): 16 mbgl

'BH' ID: BH35

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown sandy alluvium.		
		silty sandy CLAY: Moderate brown to mid grey mottled silty sandy CLAY. Frequent mid grey stiff mottles throughout the interval. Semi-plastic.		
20		clayey SAND: Very fine to very coarse angular poorly sorted SAND and CLAY. Silcreate/ferricrete hardground weathering profile.		
		silty CLAY: Reddish light brown unconsolidated, dry, silty CLAY. Plastic when wetted.		
30		clayey SAND: Poorly sorted very clayey SAND. Much clay. Medium to granulitic angular quartz sand.		
		sandy CLAY: Poorly sorted sandy CLAY. As above however with dominant clay.		
		CLAY: Dark olive brown amorphous clay		
40		silty CLAY: Light brown silty CLAY.		
50				
		sandy CLAY: Very poorly sorted sandy CLAY. Very sandy. Fine to granulitic angular quartz sand and minor fine quartz gravel.		
60		Saprolitic CLAY: Varicoloured saprolitic clay sequence ranging from reddish light brown to light olive green unconsolidated silty CLAY.		
		Felsic Bedrock: Angular crystalline feldspar and quartz cuttings.		
70				



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COMPOSITE WELL LOG

Bore No: WBAC0017

Client: Ramelius Resources

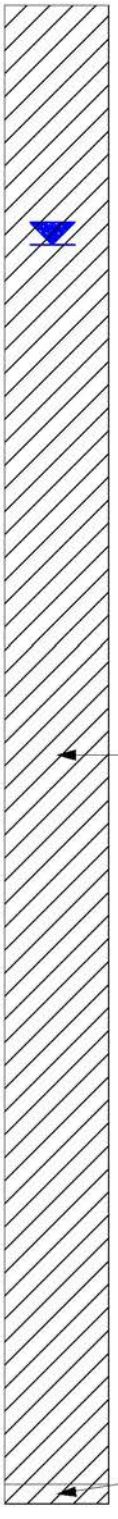
Project: Lake Rebecca Exploration Drilling

Commenced:	19/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	19/11/2023	**Fluid:**	Air	**Elevation:**	328 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	502503
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6630346
				Projection:	Zone 51

Water Strike (MBGL): 12 mbgl

'BH' ID: BH34

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Reddish light brown sandy clayey alluvium.		
		SAND: Slightly Clayey fine to medium grained sub-rounded quartz sand. Limonitic yellow.		
		silty CLAY: Moderate reddish brown silty CLAY. Semi-plastic		
		sandy CLAY: Poorly sorted sandy CLAY. Sand moderately well sorted, fine to medium grained and rounded.		
10		sandy silty CLAY: Reddish light brown unconsolidated sandy silty CLAY. Much silt. Sand is fine to coarse, poorly sorted and sub angular.		
20		silty sandy CLAY: Mid grey silty sandy CLAY. Heavily mottled. Mottles contain lithic fragments of altered black/dark grey and white siltstone (silcrete & ferricrete). Sand is angular and poorly sorted (fine to coarse grained). Weathered hardground.		
		gravelly SAND: Fine to very coarse sub angular to sub rounded poorly sorted sands. Much mid brown clay (40 %). Lithic fine gravel sized fragments of dark grey, black and white cemented sandstone and siltstone (iron/sillica rich duricrust). Weathered hardground.		
30		clayey SAND: As above however lacking lithic fragments/clasts.		
		sandy silty CLAY: Light grey to pale olive green slightly sandy silty CLAY. Stiff and semi consolidated. Becoming very stiff and consolidated from 37 mbgl.		
40		Silty Sand: Fine to very coarse poorly sorted SAND. Grains are sub angular to angular. Angular lithic fine gravel sized fragments of blueish grey cemented siltstone are present. Much silt.		
		sandy silty CLAY: Pale greenish yellow to mid greyish blue slightly sandy silty CLAY.		
50		sandy SILT: Creamy white sandy SILT. Minor medium grained sand.		
		sandy CLAY: Sandy unconsolidated creamy white plastic CLAY. Fine to granulitic poorly sorted quartz sand.		
		LIGNITE: Black Low grade coal (Lignite). Friable/breakable. Plant/root structures are present.		
		clayey SILT: Creamy white clayey SILT.		
60		Gravel and Sand: silty sandy paleochannel GRAVEL. Very poorly sorted. Sub angular to angular sand grains. Greyish/translucent quartz. Minor silt and clay. Unconsolidated. Dominantly granulitic sand to fine gravel sized sediment.		
		silty SAND: Fine to granulitic poorly sorted quartz SAND with silt. Creamy white colouration. Becoming slightly clayey at 67 mbgl.		
70		Gravel and Sand: slightly silty and clayey coarse paleochannel sands. Poorly sorted. Fine quartz gravel present (<5 cm). Sub angular quartz grains. Fining upwards sequence with increasing gravel/granulitic sand content with depth. Unit is dominantly granulitic sand.		
		Gravelly Clay: As above however CLAY dominant.		



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COMPOSITE WELL LOG

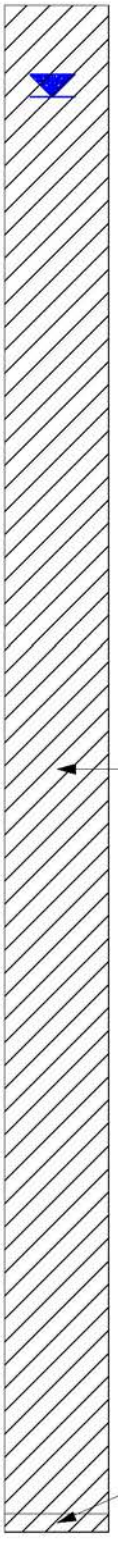
Bore No: WBAC0018

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	19/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	19/11/2023	**Fluid:**	Air	**Elevation:**	333 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	502233
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6630374
				Projection:	Zone 51

Water Strike (MBGL): 5 mbgl
'BH' ID: BH33

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Reddish light brown sandy alluvium.		
		sandy silty CLAY: Reddish light brown semi plastic sandy silty CLAY.		
10				
20		sandy silty CLAY: Mid to light grey slightly sandy silty CLAY. Firm but plastic mid grey clay mottles. Megamottled.		
30		Gravel and Sand: Weathered silcrete and ferricrete hardground. White cemented siltstone (silcrete) and black cemented siltstone (ferricrete) angular sand to gravel sized clasts. Poorly sorted (medium sand to fine gravel).		
		Saprolitic CLAY: moderate greenish yellow to light olive green (glauconitic) silty saprolitic CLAY.		
40				
50				
60				
70				
80				



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COMPOSITE WELL LOG

Bore No: WBAC0019

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	20/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	20/11/2023	**Fluid:**	Air	**Elevation:**	335 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	501917
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6629379
				Projection:	Zone 51

Water Strike (MBGL): 15 mbgl
'BH' ID: BH26

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate pinkish brown sandy alluvium.		
		sandy CLAY: Mid grey semi-consolidated seim-plastic silty clay mottles and reddish brown sandy alluvial soi.		
		clayey SAND: Dry slightly clayey fine to medium grained SAND. Rounded grains. Black and white cemented siltstone (silcrete & ferricrete) angular lithic fragments are present.		
10		sandy CLAY: reddish brown very sandy (30 %) CLAY. Semi-plastic. Occasional stiff mid grey mottles. Sand content reduces with increasing depth.		
		sandy silty CLAY: Mid-grey slightly sandy (<10 %) silty CLAY. White lithic fragments of cemented siltstone (silcrete). Increased sand content between 21 to 23 mbgl.		
20		sandy SILT: sandy SILT. Much fine grained sand. Fine to medium grained well sorted sand. Sub rounded grains.		
		sandy CLAY: Moderate reddish brown silty sandy CLAY. Sand is sub-angular and poorly sorted (fine to coarse grained).		
30		sandy silty CLAY: Mid grey slightly sandy silty CLAY. Slightly to very stiff, consolidated.		
40		sandy CLAY: Mid grey sandy CLAY. Medium to coarse sub angular poorly sorted sand.		
		silty sandy CLAY: Pale greenish yellow silty sandy CLAY. Poorly sorted fine to granulitic sand which is sub angular. Unconsolidated.	Open Hole (102 mm ; 4")	
50		sandy clayey SILT: Light grey sandy clayey SILT. Poorly sorted. Sub angular medium to coarse grained sands. Fragments of light grey/white metamorphosed sandstone (quartzite) at 61 mbgl.		
60		gravelly SAND: Fine to granulitic sand with minor fine quartz gravel. Dominantly granulitic SAND. Sub angular grains. Poorly sorted and unconsolidated.		
		clayey silty gravelly SAND: As above however with increased silt and clay content. Dominantly sub angular coarse to granulitic sands with minor fine quartz gravel.		
70		gravelly SAND: Fine to granulitic sand with minor fine quartz gravel. Dominantly granulitic SAND. Sub angular grains. Poorly sorted and unconsolidated.		
		clayey silty gravelly SAND: As above however with increased silt and clay content. Dominantly sub angular coarse to granulitic sands with minor fine quartz gravel.		
80		saprolitic CLAY: Greyish blue/green saprolitic sandy CLAY. Poorly sorted. Medium to coarse grained quartz sand. Sand coarsens downwards (80 - 85 mbgl) with granulitic sand and fine gravel dominant between 82 - 85 mbgl.		
		Saprolitic Clay: Greenish blue grey sandy silty CLAY. Poorly sorted. Fine to medium grained sub angular sand.		
90		Saprolitic CLAY: Greyish blue green silty CLAY.	Drilling terminated at 92 mbgl due to intersecting	
		Bedrock: Greenish blue/grey feldspar. Angular crystaline rock cuttings.		

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COMPOSITE WELL LOG

Bore No: WBAC0020

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	20/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	20/11/2023	**Fluid:**	Air	**Elevation:**	334 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	502094
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6629370
				Projection:	Zone 51

Water Strike (MBGL): 5 mbgl
'BH' ID: BH27

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown unconsolidated sandy alluvium. Poorly sorted containing silt to coarse-grained sand.		
		Sandy CLAY: Moderate reddish brown silty sandy CLAY. Poorly sorted containing silt to coarse-grained sand.		
		Clayey SAND: Poorly sorted fine to medium-grained SAND with minor clay; sand grains are sub-rounded.		
10		Clayey SILT: Clayey SILT bearing black consolidated clasts of black/dark-grey ferricrete.		
		Sandy CLAY: Moderate Reddish Brown sandy CLAY. 40 % sand. Sand is sub-angular poorly sorted ranging from fine to very coarse. Mid-Grey sandy semi-consolidated mottled clay is present. Black Ferricrete clasts are also present throughout this unit.		
20		Clayey SAND: Poorly sorted fine to medium-grained sub-rounded SAND. Around 40 % clay. Unconsolidated		
		Sandy CLAY: Poorly sorted fine to medium-grained sub-rounded SAND. Around 40 % sand. Unconsolidated		
		Sandy Silt		
30		Silty CLAY: Light bluish grey semi-consolidated stiff silty CLAY.		
		Silty CLAY: White (kaolinitic) semi-consolidated stiff silty CLAY.		
		Silty clayey SAND: Fine to very coarse poorly sorted angular unconsolidated SAND. The unit has around 40 % clay & silt.		
		silty CLAY: moderate greenish yellow silty CLAY.		
40		silty CLAY: White/light-grey kaolinitic silty CLAY.		
		silty sandy CLAY: Moderate greenish yellow silty sandy CLAY. Sand appears dervied from in-situ weathering and is sub-angular and poorly sorted (fine to very coarse-grained). Greenish apperance of unit. Clay is saprolitic/glauconitic.	Open Hole (102 mm ; 4")	
50				
60				
70		Gravel and Sand: Weathered felsic bedrock sandy GRAVEL. Angular gravel with silt and poorly sorted very fine to very coarse angular sands. The unit is not interpreted as paleochannel gravel.		
		Saprolitic CLAY: bluish-grey slightly silty saprolitic CLAY.		
80			Drilling terminated at 85 mbgl due to blade bit refusal.	

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COMPOSITE WELL LOG

Bore No: WBAC0021

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	20/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	20/11/2023	**Fluid:**	Air	**Elevation:**	335
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	502899
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6629260
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH28

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown unconsolidated sandy alluvium. Poorly sorted containing silt to coarse-grained sand.		
		SAND: Fine to very coarse poorly sorted unconsolidated SAND. Sub-rounded to rounded grains.		
		Sandy Clay: Light grey/white slightly gravelly sandy clay. Silcrete gravel.		
10				
		CLAY: Moderate reddish brown amorphous CLAY. Plastic when wet. Unconsolidated and dry in cuttings (powder).		
20				
30				
40				Open Hole (102 mm ; 4")
50				
60				
70				
		Saprolitic CLAY: Light olive green amorphous CLAY. Plastic when wet. Unconsolidated and dry in cuttings (powder).		Drilling terminated at 80 mbgl due to intersecting saprolitic clay.
80				

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COMPOSITE WELL LOG

Bore No: WBAC0022

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	21/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	21/11/2023	**Fluid:**	Air	**Elevation:**	333
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503608
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6629191
				Projection:	Zone 51

Water Strike (MBGL): no data **'BH' ID:** BH29

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown unconsolidated sandy alluvium with 5% grey cemented siltstone clasts.		
		silty CLAY: Moderate reddish brown unconsolidated silty CLAY.		
		silty CLAY: White/light-grey silty semi-consolidated plastic CLAY. The unit contains minor angular silcrete gravel/clasts (5 % - 10 %).		
10		silty CLAY: Dark grey silty CLAY with 10 % ferricrete clasts/gravel.		
		gravelly SAND: Weathered silcrete & ferricrete hardground clasts/gravel with SAND. Sand is poorly sorted (medium to very coarse grained) and angular.		
		sandy CLAY: Moderate reddish brown slightly sandy (< 5%) CLAY. Plastic when wet. Unconsolidated and dry in cuttings (powder).		
20		Saprolitic CLAY: Moderate reddish brown amorphous saprolitic CLAY. Plastic when wet. Unconsolidated and dry in cuttings (powder).		
30				
40			Open Hole (102 mm ; 4")	
50				
60				
70				
80			Drilling terminated at 89 mbgl due to intersecting saprolitic clay.	

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COMPOSITE WELL LOG

Bore No: WBAC0023

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	21/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	21/11/2023	**Fluid:**	Air	**Elevation:**	334 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	504018
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6629139
				Projection:	Zone 51

Water Strike (MBGL): no data
'BH' ID: BH30

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy alluvium.		
		sandy CLAY: Reddish brown semi-consolidated stiff slightly sandy (< 10 %) CLAY.		
		clayey sandy GRAVEL: Medium to very coarse poorly sorted sub-angular sand with clasts of weathered silcrete and ferricrete fragments (fine gravel sized). This unit is very clayey (around 40 %). Weathered hardground.		
10		silty clayey SAND: Slightly silty very clayey poorly sorted sub-angular clayey sands. The unit is meggamottled with mid-grey stiff semi-consolidated silty clay peds present throughout.		
20		silty CLAY: Varicoloured sequence of dry unconsolidated silty CLAY. The unit varies in colour from moderate yellow to light greenish grey to moderate reddish brown.		
30				
40			Open Hole (102 mm ; 4")	
50				
		CLAY: Dusky red unconsolidated dry amorphous CLAY.		
60				
70				
		Felsic Bedrock: Feldspar and Quartz.	Drilling terminated at 76 mbgl due to intersecting bedrock.	

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COMPOSITE WELL LOG

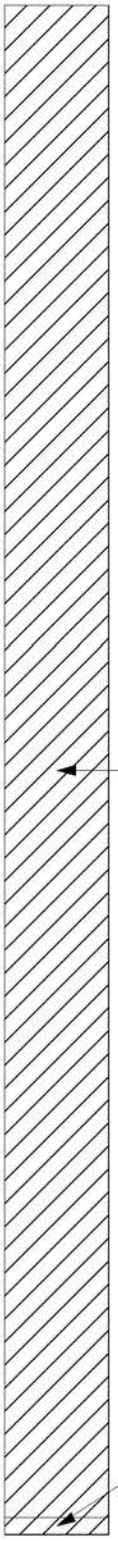
Bore No: WBAC0024

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	22/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	22/11/2023	**Fluid:**	Air	**Elevation:**	339
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	504466
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6629082
				Projection:	Zone 51

Water Strike (MBGL): no data
'BH' ID: BH31

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy alluvium.		
		Alluvium: Moderate reddish brown sandy clayey alluvium.		
		Sandy CLAY: Weathered silcrete and ferricrete hardground. Varying from dark grey to light grey sandy CLAY with clasts of weathered ferricrete and silcrete. Stiff mid-grey clay peds are also present.		
10		clayey SAND: Fine to very coarse grained poorly sorted sand with sub-angular grains. The unit is clay rich (around 40 %) with common stiff mid-grey peds.		
20		CLAY: Moderate reddish brown dry (powder) unconsolidated amorphous CLAY.		
30				
40				
50				
60				
70				
80				



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COMPOSITE WELL LOG

Bore No: WBAC0025

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	22/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	22/11/2023	**Fluid:**	Air	**Elevation:**	334
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	502295
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6628298
				Projection:	Zone 51

Water Strike (MBGL): no data
'BH' ID: BH21

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy alluvium.		
		SAND: Very fine to very coarse poorly sorted unconsolidated sand with sub-rounded grains. Lithic fragments (2 - 8 cm) of ferricrete and silcrete are present throughout. Weathered Hardground.		
		sandy CLAY: As above however clay is dominant and there is a lesser occurrence of silcrete and ferricrete fragments.		
10		CLAY: Moderate reddish brown unconsolidated amorphous CLAY.		
		Gravelly SAND: Slightly clayey silty SAND & GRAVEL interpreted as weathered silcrete and ferricrete hardground. Poorly sorted fine to very coarse sub-angular unconsolidated sand of dark-grey appearance. Consolidated lithic fragments of silcrete and ferricrete.		
		Chert: Cryptocrystalline quartz. White and pale green CHERT with a resinous luster.		
20		sandy CLAY: CLAY with fine to coarse poorly sorted sub-angular sand.		
		silty CLAY: Mid-grey silty CLAY with 2 % - 5 % angular greenish-grey coarse sand to fine gravel-sized crystalline quartz.		
30				
40		CLAY: Moderate reddish brown unconsolidated amorphous CLAY.	Open Hole (102 mm ; 4")	
50				
		silty CLAY: Mid-grey silty CLAY with 2 % - 5 % angular greenish-grey coarse sand to fine gravel-sized crystalline quartz.		
60		Saprolitic CLAY: Light greenish grey unconsolidated amorphous CLAY.		
70		Saprolitic CLAY: Moderate reddish brown unconsolidated amorphous CLAY.		
80		Felsic Bedrock: Weathered basement. Quartz, feldspar (microcline), biotite mica.	Drilling terminated at 80 mbgl due to blade bit refusal.	

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COMPOSITE WELL LOG

Bore No: WBAC0026

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	22/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	22/11/2023	**Fluid:**	Air	**Elevation:**	338
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	502874
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6628223
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH22

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown sandy alluvium.		
		Gravelly SAND: Slightly clayey poorly sorted very fine to very coarse angular to sub-angular SAND with around 40 % fine sub-angular quartz gravel.		
10		silty SAND: Silty medium to coarse-grained poorly sorted sub-angular SAND.		
		clayey SILT: Poorly sorted silt to coarse-grained sand sized sub-angular grains. Dominantly SILT.		
		sandy silty CLAY: Mid-grey CLAY with fine to very coarse poorly sorted sub-angular sand.		
20				
		silty CLAY: Moderate reddish brown unconsolidated silty CLAY.		
30				
			Open Hole (102 mm ; 4")	
40		silty CLAY: Yellowish brown unconsolidated silty CLAY.		
50				
60		Saprolitic CLAY: Light greenish grey unconsolidated amorphous CLAY.		
			Drilling terminated at 68 mbgl due to intersecting bedrock.	
		Felsic Bedrock: Weathered Felsic Basement.		

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COMPOSITE WELL LOG

Bore No: WBAC0027

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	23/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	23/11/2023	**Fluid:**	Air	**Elevation:**	334
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503697
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6628121
				Projection:	Zone 51

Water Strike (MBGL): no data
'BH' ID: BH23

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown clayey alluvium.		
		Alluvium: Moderate reddish brown silty sandy CLAY.		
		Alluvium: Moderate reddish brown unconsolidated sandy.		
		silty gravelly SAND: Very poorly sorted fine to very coarse sub-angular to angular sand with lithic silcrete fragments/gravel. Weathered hardground.		
10		Gravel and Sand: As above however silcrete fragments are dominant over sand. Weathered Hardground.		
		silty gravelly SAND: Fine to very coarse sub-angular sand with minor fine gravel.		
		sandy SILT: Very fine to medium grained poorly sorted sub-angular sand. Dominantly SILT.		
		silty gravelly SAND: Very poorly sorted fine to very coarse sub-angular to angular sand with lithic silcrete fragments/gravel. Weathered hardground.		
20		Clayey Gravel: Fine to medium Ferruginous Gravels and moderate reddish brown clay.		
		Gravel and Sand: Light grey to white slightly clayey sand and lithic fragments of silcrete (silcrete gravel). Fine to coarse sub-angular gravel with minor poorley sorted medium to very coarse sand.		
		silty CLAY: Moderate reddish brown unconsolidated CLAY.		
30				
40				
50				Open Hole (102 mm ; 4")
60		CLAY: Dusky red unconsolidated amorphous CLAY.		
70				
80				
90		Saprolitic CLAY: Light olive green saprolitic/glauconitic silty clay with lithic fragments of altered (chloritized) granitic bedrock.		Drilling terminated at 93 mbgl due to intersecting saprolitic clay and saprock.

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COMPOSITE WELL LOG

Bore No: WBAC0028

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	23/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	23/11/2023	**Fluid:**	Air	**Elevation:**	346 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503968
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6628085
				Projection:	Zone 51

Water Strike (MBGL): No Data
'BH' ID: BH24

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown sandy alluvium. Coarse ferruginous gravel present between 2 m - 3 m.		
		Gravel: Poorly sorted fine to coarse sub-angular ferruginous gravel. Weathered Hardground.		
10		Gravel and Sand: Poorly sorted fine to coarse sub-angular ferruginous sands and gravels with 5% pebbles. Weathered Hardground.		
		Gravel and Sand: Poorly sorted fine to coarse sub-angular ferricrete and silcrete gravels and sands. Weathered Hardground.		
		gravelly SAND: Fine to very coarse angular to sub-angualr poorly sorted sands with ferricrete and silcrete gravel. Weathered Hardground.		
20		Gravel: White fine to coarse poorly sorted angular silcrete GRAVEL with 10% pebbles of identical composition.		
		Gravel and Sand: Poorly sorted fine to coarse ferruginous gravel with 30 % medium to very coarse sub-angular sand.		
		Clayey Gravel: Poorly sorted fine to coarse ferruginous gravel with 30 % medium to very coarse sub-angular sand and moderate reddish brown silty clay.		
30		sandy silty CLAY: Moderate reddish brown Unconsolidated sandy silty CLAY.		
		CLAY: Moderate reddish brown unconsolidated amorphous CLAY.		
40				
50				Open Hole (102 mm ; 4")
60				
70				
80				
90		Saprolitic CLAY: Light olive green saprolitic CLAY.		
100		Saprock: Altered green mafic basement.		Drilling terminated at 101 mbgl due to intersecting altered basement.

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COMPOSITE WELL LOG

Bore No: WBAC0029

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	24/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	24/11/2023	**Fluid:**	Air	**Elevation:**	329
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503968
Logged By:	Tom Onslow	**Drill Bit:**	Blade Bit	**Northing:**	6628085
				Projection:	Zone 51

Water Strike (MBGL): 11 mbgl
'BH' ID: BH17

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown sandy alluvium.		
		silty sandy CLAY: Moderate reddish brown slightly silty sandy CLAY. Sand coarsens downwards from medium grained at 2 m to very coarse grained at 5 m		
		Sandy Clay: Moderate reddish brown stiff sandy CLAY. Medium to coarse grained angular to sub-angular poorly sorted sands. 10 % fine ferruginous gravel.		
		silty SAND: Slightly clayey silty SAND. Very fine to very coarse sub-angular poorly sorted sand with around 30 % silt.		
10		silty CLAY: Mid-grey stiff semi-consolidated slightly sandy silty CLAY.		
		silty CLAY: Moderate reddish brown stiff semi-consolidated CLAY.		
		clayey SILT: Buff white clayey SILT. Very clayey, dry as drilled, amorphous.		
20		silty CLAY: Pink red CLAY, very silty, very plastic. Some minor medium grained sand present.		
		Silty CLAY: Very pale orange silty CLAY. Minor fine grained sand.	Open Hole (102 mm ; 4")	
		silty sandy CLAY: Greyish orange (10yr 7/4) silty sandy CLAY. Poorly sorted, soft, very silty.		
30		silty SAND: orange brown SAND, poorly consolidated, poorly sorted, very silty, mostly composed of medium grained quartz grains, sub-rounded to sub-angular.		
		silty CLAY: Yellow brown silty CLAY, very silty and sandy in places with fine to medium grained quartz grains.		
40		Felsic Bedrock: white brown felsic basement rock.	Drilling terminated at 45 mbgl due to blade bit refusal.	

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COMPOSITE WELL LOG

Bore No: WBAC0030

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	25/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	25/11/2023	**Fluid:**	Air	**Elevation:**	335
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503992
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6626069
				Projection:	Zone 51

Water Strike (MBGL): 3 mbgl
'BH' ID: BH20

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown alluvium. Predominantly composed of silt grade material		
		SILT: Moderate reddish brown SILT. Poorly sorted, poorly consolidated, sandy.		
		SILT: Moderate reddish brown SILT contaning ironstone pebbles.		
		sandy SILT: Red brown poorly sorted unconsolidated sandy SILT		
10		sandy SILT: Red brown to pink red brown sandy SILT. Very sandy, poorly sorted, coarser grained at top of unit (7 - 9 m)		
		silty SAND: Mid red brown silty SAND, very silty, poorly sorted. Predominantly medium sand grade.		
		clayey SILT: Moderate red to buff brown clayey SILT. Very clayey, also sandy in places, poorly sorted.		
20		silty CLAY: Buff yellowish brown to red brown CLAY. Very silty, plastic to stiff, poorly sorted.		
		silty CLAY: Moderate reddish brown silty CLAY. Plastic to stiff, sandy in places, poorly sorted.		
30		silty CLAY: Dark yellowish brown plastic silty CLAY,		
		silty CLAY: Pink red to buff brown silty CLAY, soft, some medium sand grains, moderately sorted.		
		sandy SILT: Creamy white brown SILT, poorly consolidated, poorley to moderately sorted, contains predominantly fine grained sand with some medium grains.		
40		silty SAND: Buff brown to dark red brown SAND, silty, predominantly fine to very fine grained (40 - 45 m), becoming coarser to medium to coarse grained (46 - 48 m), some very coarse grains at the base of the unit. Mostly sub rounded to sub-angular translucent quartz grains with minor lithic grains, poorly to moderately sorted.	Open Hole (102 mm ; 4")	
		sandy clayey SILT: Mustard yellow sandy clayey SILT. Fine to medium sand grains (quartz & lithics) poorly sorted, soft.		
50		SAND: Medium brown SAND. Coarse to very coarse sand grade, some minor silt, moderately sorted, predominantly composed of sub angular to sub-rounded translucent quartz grains		
		sandy clayey SILT: Mustard yellow sandy clayey SILT. Fine to medium sand grains (quartz & lithics) poorley sorted, soft. Becoming red brown to light brown 54 - 56 m		
60		silty SAND: Light brown to medium red brown very silty SAND. Poorly sorted, clast size ranges from silt to granule sized.		
		sandy SILT: Buff to medium brown sandy SILT, unconsolidated, poorly sorted.		
		Saprolitic CLay: Greenish grey CLAY. Soft and amorphous, very silty.		
70		Felsic Bedrock	Drilling terminated at 76 mbgl after intersecting felsic bedrock.	

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COMPOSITE WELL LOG

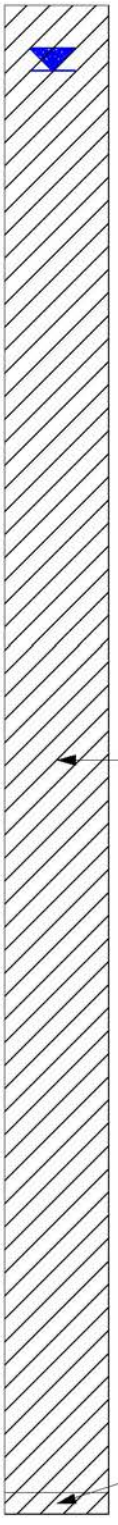
Bore No: WBAC0031

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	25/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	26/11/2023	**Fluid:**	Air	**Elevation:**	333
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	504400
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6624380
				Projection:	Zone 51

Water Strike (MBGL): 3 mbgl
'BH' ID: BH15

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Moderate reddish brown Alluvium, very silty, unconsolidated, poorly sorted, contaning silt to granule sized grains.		
		sandy clayey SILT: Reddish brown SILT, sand & clay rich. Poorly sorted with coarse sand grains. Poorly consolidated.		
10		CLAY: Greenish grey CLAY. Stiff to plastic, very silty, poorly sorted.		
		gravelly CLAY: Greenish grey to red brown gravelly clay. Contains fine sand grade up to pebble sized clasts of weathered felsic rock, very poorly sorted.		
20		silty CLAY: Creamy brown white silty CLAY. Very silty contaning fine to medium sand grains, soft to plastic.		
30		silty CLAY: Buff brown silty CLAY. Very silty, contaning fine to medium sand grains, poorly sorted, soft.		
		silty sandy CLAY: Russet brown silty sandy CLAY. Soft to plastic, poorly sorted.		
40				
50				
60		Saprolitic Clay: Greenish grey saprolitic CLAY. Soft in cuttings, fine grained black mafic grains seen.		
		Mafic Bedrock: Speckled green grey and black mafic bedrock.		



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COMPOSITE WELL LOG

Bore No: WBAC0032

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	26/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	26/11/2023	**Fluid:**	Air	**Elevation:**	335
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	504291
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6624262
				Projection:	Zone 51

Water Strike (MBGL): 3 mbgl
'BH' ID: BH14

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Moderate reddish brown Alluvium, very silty, unconsolidated.		
		sandy clayey SILT: Reddish brown SILT, sand and clay rich, poorly sorted with coarse sand grains and lithic pebbles in places. Poorly consolidated.		
10		silty CLAY: Greenish grey CLAY, stiff to plastic, very silty, poorly sorted, mottled red brown in places.		
20		silty CLAY: Varicoloured silty CLAY sequence ranging from russet red, pale yellow, creamy white mustard, and dark red. Stiff to plastic, dried in cuttings.		
30				
40			Open Hole (102 mm ; 4")	
50		Saprolitic CLAY: Greenish grey saprolitic CLAY. Stiff to soft in cuttings contaning fine grained dark mafic grains.		
60				
70				
80		Mafic Bedrock: Greenish grey mafic bedrock.	Drilling terminated at 69 mbgl after intersecting mafic bedrock	

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COMPOSITE WELL LOG

Bore No: WBAC0033

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	26/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	26/11/2023	**Fluid:**	Air	**Elevation:**	340 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503480
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6623412
				Projection:	Zone 51

Water Strike (MBGL): no data
'BH' ID: BH13

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		clayey SILT: Moderate reddish brown SILT, poorly sorted, grain size ranges from silt to small pebbles, unconsolidated, clay rich.		
		silty sandy CLAY: Greenish grey CLAY, becoming reddish brown towards base, stiff to plastic when wet, poorly sorted, silty and sandy.		
10		sandy silty CLAY: Reddish brown silty CLAY, sandy, soft.		
		silty SAND: Orange brown SAND, very silty, medium to coarse grained, unconsolidated, poorly sorted.		
		Conglomerate: Reddish brown polymitic conglomerate, silty, sandy and with pebble sized siltstone clasts.		
20		CLAY: White CLAY, contaning pebble sized clasts of white saprock. Becomes powdery with drilling.		
30		Saprolitic CLAY: Variated colour sequence of saprolitic CLAY varying in colour from orange brown, creamy white, buff brown, and reddish brown. Soft when dry in cuttings, semi-plastic when wet.	Open Hole (102 mm ; 4")	
40				
50		Saprolitic CLAY: Olive green to dark greebish grey saprolitic CLAY. Buff brown and reddish brown between 50 - 52 m. Changing to olive green below 52 m.		
60			Drilling terminated at 65 mbgl after intersecting saprolitic clay.	

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COMPOSITE WELL LOG

Bore No: WBAC0034

Client: Ramelius Resources

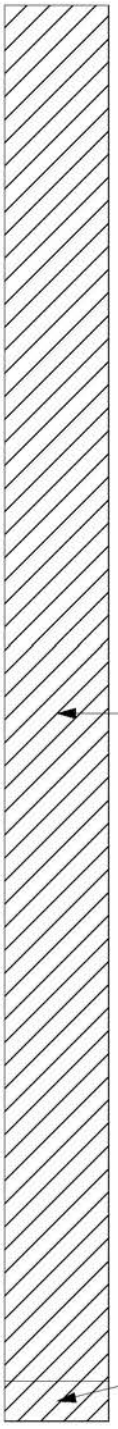
Project: Lake Rebecca Exploration Drilling

Commenced:	27/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	26/11/2023	**Fluid:**	Air	**Elevation:**	332 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	505695
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6624593
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH12

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Reddish brown Alluvium, very silty, unconsolidated.		
		clayey SILT: Moderate reddish brown clayey SILT, soft, poorly sorted with siltstone clasts.		
		gravelly SILT: Moderate reddish brown to orange brown gravelly SILT. Matrix is a dirty reddish brown silt with numerous clasts of red brown siltstone ranging from fine sand grade up to pebble sized clasts. Some granule sized clasts of pale green white weathered felsic rock, poorly to moderately consolidated, very poorly sorted.		
10		clayey SILT: Dark reddish brown clayey silt, poorly consolidated, poorly sorted.		
		clayey SILT: Sequence of varicoloured sandy clayey SILTS ranging from off white to orange brown to reddish brown. Poorly sorted with clast sizes ranging from silt grade up to pebble sizes. Lithic fragments of bleached white felsic rock.		
20		silty SAND: Pale to moderate reddish brown SAND, very silty, poorly sorted, fine to very coarse grained, mdeium translucent quartz, sub-rounded to sub-angular also red lithic siltstone fragments.		
		silty sandy CLAY: Pink red silty sandy CLAY, very poorly sorted, contaning weathered lithic white fragments.		
30		silty sandy CLAY: Creamy white to olive green and pale pink red CLAY, silty, sandy, poorly sorted, soft to plastic, very silty and sandy in places.		
		SAND: Pale buff brown SAND. Composed predominantly of coarse to very coarse grained clear to translucent quartz grains. Contains fragments of white weathered felsic rock, moderately sorted.		



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COMPOSITE WELL LOG

Bore No: WBAC0035

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	27/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	27/11/2023	**Fluid:**	Air	**Elevation:**	339 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	506383
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6626500
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH16

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		SILT: Moderate reddish brown SILT, very poorly sorted with sand grains and clasts of reddish brown siltstone.		
10		silty gravelly SAND: Moderate reddish brown to buff yellow silt to Gravel sequence, very poorly sorted, poorly consolidated.		
		CLAY: Sequence of varicoloured CLAYS, ranging from creamy white, buff brown, buff yellow, mustard (limonitic) yellow and reddish brown. Saprolitic in origin.		
20				
30				
40			Open Hole (102 mm ; 4")	
50		Saprolitic CLAY: Creamy white to off white grey saprolitic clays.		
60				
70		Saprolitic CLAY: Light green to olive green saprolitic CLAY.		
80			Drilling terminated at 80 mbgl due to intersecting saprolitic clay.	

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COMPOSITE WELL LOG

Bore No: WBAC0036

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	27/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	27/11/2023	**Fluid:**	Air	**Elevation:**	338 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	506598
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6626633
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH16

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0 – 6		clayey SILT: Moderate reddish brown SILT, very clayey, poorly sorted.	Open Hole (102 mm ; 4")	
6 – 10		gravelly SILT: Moderate reddish brown to orange brown SILT sequence with sand and granules to pebbles. Poorly sorted and unconsolidated.		
10 – 50		Silty CLAY: Varicoloured sequence of CLAYS ranging from creamy white to rose red, mustard yellow (limonitic), buff brown and reddish brown, very silty throughout. Stiff to plastic when wetted.		
50 – 60		CLAY: Light green to olive green saprolitic CLAY.	Drilling terminated at 60 mbgl due to intersecting saprolitic clay.	

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COMPOSITE WELL LOG

Bore No: WBAC0037

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	27/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	27/11/2023	**Fluid:**	Air	**Elevation:**	342 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	506379
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6627009
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH11

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Mid red brown Alluvium contaning pebbles		
		silty GRAVEL: Buff brown to white brown very silty GRAVEL. Very poorly sorted with siltstone and weathered igneous felsic clasts. Poorly consolidated.		
		SILT: Limonitic yellow to russet red SILT with clasts of felsic rock. Poorly consolidated.		
10		silty CLAY: Reddish brown to dark red brown CLAY, very silty, contaning granule sized clasts of siltstone, moderately sorted, soft in cuttings.		
20				
30			Open Hole (102 mm ; 4")	
40				
50		Saprolitic CLAY: Buff brown to olive green and limonitic yellow saprolitic CLAY.		
60			Drilling terminated at 60 mbgl due to intersecting saprolitic clay.	

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COMPOSITE WELL LOG

Bore No: WBAC0038

Client: Ramelius Resources

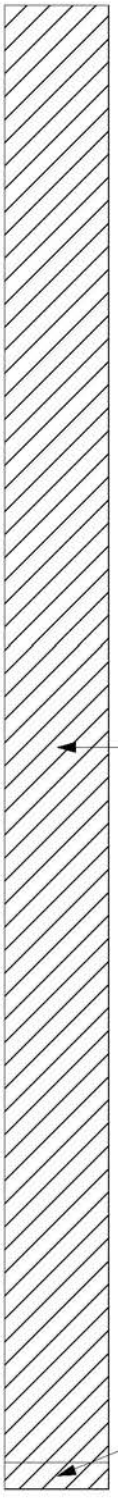
Project: Lake Rebecca Exploration Drilling

Commenced:	28/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	28/11/2023	**Fluid:**	Air	**Elevation:**	341 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	500266
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6625831
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH9

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Silty alluvium with clay.		
		silty sandy CLAY: Reddish brown silty sandy CLAY. Stiff to plastic, poorly sorted with numerous medium sand grains.		
		Silty SAND: Reddish brown orange silty SAND. Predominantly medium grained. Poorly sorted with much silt, unconsolidated, some lithic siltstone granules.		
10		sandy silty CLAY: Reddish brown CLAY. Very silty and sandy, soft to stiff, poorly sorted.		
		Gravel: Reddish brown to grey white GRAVEL and SILTSTONE. Very poorly sorted ranging from silt grade through coarse sand grade to broken (by drilling) grey white siltstone.		
		clayey silty SAND: Light brown white to grey white SAND, fine to mdeium grained, poorly sorted with much silt and clay.		
20		sandy SILT: Creamy white brown SILT. Very sandy with much fine to medium grained sand, poorly consolidated.		
		Gravel and Sand: Reddish brown to pink red sand and gravel, clay rich, very poorly sorted, unconsolidated.		
		silty sandy CLAY: Pink red brown silty sandy CLAY. Poorly consolidated, moderately sorted, very silty with some sand grains.		
30		silty SAND: Reddish brown silty SAND. Moderately sorted becoming coarser grained with depth. Clast size ranges from fine sand at the top to very coarse grained at 34 - 35 mbgl. Unconsolidated.		
		Saprolitic CLAY: Saprolitic CLAY. Creamy brown to buff brown becoming limonitic yellow at base. Soft and poorly consolidated.		
40				
50				



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COMPOSITE WELL LOG

Bore No: WBAC0039

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	29/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	28/11/2023	**Fluid:**	Air	**Elevation:**	343 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	496828
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6629249
				Projection:	Zone 51

Water Strike (MBGL): no data
'BH' ID: BH7

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Reddish brown Alluvium		
		Gravelly SILT: Mid orange brown gravelly SILT. Silt matrix with clasts of weathered leueocratic felsic rock, very poorly sorted, poorly consolidated.		
		SILT: Pale orange white SILT contaning pebble to granule sized clasts of weathered felsic rock.		
		silty CLAY: Reddish brown silty CLAY. Poorly sorted with pebble clasts.		
		silty GRAVEL: Reddish brown to creamy white very silty GRAVEL, very poorly sorted with much silt and clay.		
10		silty CLAY: Pale brown creamy white CLAY, very silty, poorly sorted.		
		clayey silty SAND: Creamy brown to red brown SAND. Clayey in places, very silty, poorly sorted.		
		sandy CLAY: Buff red brown CLAY, sandy with fine grained sand, poorly sorted, poorly consolidated.		
20		CLAY: Creamy white to buff Clay. Sandy in places, plastic, moderately sorted.,		
30				Open Hole (102 mm ; 4")
40				
		Saprolitic CLAY: Olive green to mid brown Saprolitic CLAY.		
50				Drilling terminated at 53 mbgl due to intersecting saprolitic clay.

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COMPOSITE WELL LOG

Bore No: WBAC0040

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	29/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	29/11/2023	**Fluid:**	Air	**Elevation:**	338 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	496692
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6632439
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH8

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Reddish brown Alluvium		
		SILT: Reddish brown to dark red brown SILT, poorly sorted with fine sand and pebbled sized siltstone clasts, poorly consolidated.		
		sandy SILT: Mid red brown SILT, very sandy containing granule to pebble sized clasts of felsic rocks.		
		Clayey SILT: Brown white clay rich SILT. Poorly sorted with some sand and much clay. Poorly consolidated.		
10		CLAY: Varicoloured CLAY sequence ranging in colour from creamy white to limonitic yellow to dark yellow. Soft and poorly consolidated.		
20				
30				Open Hole (102 mm ; 4")
40		Saprolitic CLAY: Light green to olive green saprolitic CLAY.		
50				Drilling terminated at 53 mbgl due to intersecting saprolitic clay.

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COMPOSITE WELL LOG

Bore No: WBAC0041

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	29/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	29/11/2023	**Fluid:**	Air	**Elevation:**	357 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	488456
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6627529
				Projection:	Zone 51

Water Strike (MBGL): no data
'BH' ID: BH5

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Reddish brown ALLUVIUM with siltstone granules.		
		silty CLAY: Grey green CLAY, stiff, very silty		
		SILT: Red brown SILT, unconsolidated, poorly sorted with siltstone granules		
		silty CLAY: Grey green CLAY, soft to plastic, silty, moderately poorly sorted.		
		sandy SILT: Reddish brown SILT. Very sandy contaning granule sized lithic clasts of weathered leucocratic rock.		
10		CONGLOMERATE: Brown green unconsolidated CONGLOMERATE. Mix of silt, sand, gravel and clay. Poorly sorted. Unsuitable for water supply due to high clay content.		
		CONGLOMERATE: Dark red brown CONGLOMERATE, very silty with much clay and sand, poorly sorted.		
		silty SAND: Green white brown SAND, silty, medium to very fine grained, unconsolidated.		
		sandy silty CLAY: Creamy white CLAY, sandy and silty, poorly sorted, soft.		
		CONGLOMERATE: Russet red to pink red unconsolidated CONGLOMERATE. Very silty and poorly sorted.		
20		clayey SILT: Creamy white to creamy light brown clayey SILT. Soft and poorly sorted.		
		silty SAND: Mid brown SAND. Predominantly very fine to fine grained. Silty and poorly sorted		
		CLAY: Orange brown to yellow brown soft CLAY.		
30				Open Hole (102 mm ; 4")
		Saprolitic CLAY: Creamy buff brown to light green soft saprolitic CLAY		
40				
50		Saprolitic CLAY: Olive green soft saprolitic CLAY.		Drilling terminated at 58 mbgl due to intersecting saprolitic clay.

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COMPOSITE WELL LOG

Bore No: WBAC0042

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	30/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	30/11/2023	**Fluid:**	Air	**Elevation:**	347 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	488434
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6627431
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH6

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Red brown silty ALLUVIUM		
		silty CLAY: Grey green CLAY, pale violet in places, silty.		
		silty CLAY: Dark red brown silty CLAY, soft, poorly sorted.		
10		CONGLOMERATE: Dark red brown to light brown CONGLOMERATE, composed of silt, very fine to medium grained sand, and granule to pebble sized clasts of dark red brown siltstone. Poorly consolidated and very poorly sorted.		
20		clayey SILT: Limonitic yellow clayey SILT, poorly sorted, unconsolidated.		
		clayey SILT: Mid red brown SILT, clay rich with grey green clay, poorly sorted and poorly consolidated.		
		sandy SILT: Mid orange brown sandy SILT, clay rich, poorly consolidated and poolry sorted.		
30		Saprolitic CLAY: Olive green to light green soft saprolitic CLAY.	Open Hole (102 mm ; 4")	
40				
50				
			Drilling terminated at 60 mbgl due to intersecting saprolitic clay.	
60				

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COMPOSITE WELL LOG

Bore No: WBAC0043

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	30/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	30/11/2023	**Fluid:**	Air	**Elevation:**	358 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	485108
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6628785
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH4

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Red brown alluvial SILT, moderately sorted with some red brown siltstone clasts.		
		silty CLAY: Mid green grey CLAY, soft to plastic, poorly sorted and very silty.		
		silty GRAVEL: Reddish brown silty GRAVEL, very silty, poorly sorted, poorly consolidated, grain size ranges from silt to granules/pebbles		
		silty CLAY: Mid green grey to reddish brown CLAY, soft, poorly sorted, very silty.		
10		CONGLOMERATE: Red brown to white green CONGLOMERATE, very silty, very poorly sorted, clay rich with yellow green clay. Unsuitable for water supply.		
		CLAY: Varicoloured CLAY sequence (creamy white and reddish brown), soft.		
20		Saprolitic CLAY: Olive green to light green SAPROLITIC CLAY.		
30				Open Hole (102 mm ; 4")
40				
50				
60				Drilling terminated at 60 mbgl due to intersecting saprolitic clay.

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COMPOSITE WELL LOG

Bore No: WBAC0044

Client: Ramelius Resources

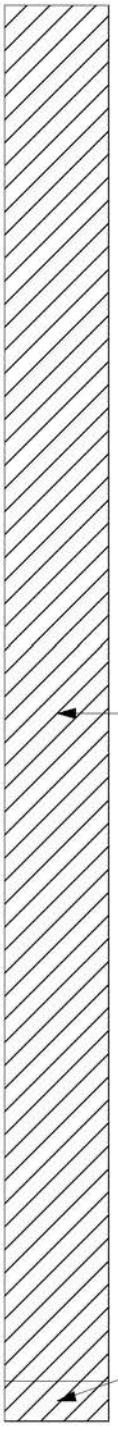
Project: Lake Rebecca Exploration Drilling

Commenced:	30/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	30/11/2023	**Fluid:**	Air	**Elevation:**	357 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	485140
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6628600
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH3

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		silty GRAVEL: Reddish brown silty GRAVEL, clast sizes range from granules up to 15 mm across		
		silty CLAY: Reddish brown silty CLAY, containing pebble sized siltstone clasts up to 12 mm across, stiff to plastic, silty, poorly sorted.		
10		clayey SILT: Pale brown to moderate reddish brown to mid yellow brown CLAY/SILT, poorly sorted with granule sized clasts of red brown siltstone.		
20		Saprolitic CLAY: Light brown to green white to red pink to olive green Saprolitic CLAY, soft.		
30				



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COMPOSITE WELL LOG

Bore No: WBAC0045

Client: Ramelius Resources

Project: Lake Rebecca Exploration Drilling

Commenced:	30/11/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	30/11/2023	**Fluid:**	Air	**Elevation:**	370 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	482919
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6626051
				Projection:	Zone 51

Water Strike (MBGL): no data

'BH' ID: BH1

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		gravelly SILT: Dark red brown gravelly SILT, contaning granule to pebble sized clasts of dark red brown SILTSTONE.		
		SILT: Drark orange brown SILT contaning minor clasts of orange brown SILTSTONE. Poorly sorted and poorly consolidated.		
10		gravelly SILT: Reddish brown gravelly SILT, poorly sorted, unconsolidated.		
		SILT: Reddish brown SILT with occasional granules, poorly sorted, unconsolidated.		
		gravelly SILT: Reddish brown sandy gravelly SILT contaning sub angular to angular clasts of red brown siltstone and light brown cream felsic rocks and quartz grains. Poorly sorted and poorly consolidated.		
20		silty CLAY: Creamy white to mid brown CLAY, poorly sorted, silty contaning granule to pebble sized clasts of quartz and felsic igneous rocks, poorly consolidated, poorly sorted.		Open Hole (102 mm ; 4")
30		Saprolitic CLAY: Creamy white Saprolitic CLAY.		
		Saprolitic CLAY: Dark olive green Saprolitic CLAY.		Drilling terminated at 40 mbgl due to intersecting saprolitic clay.
40				

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COMPOSITE WELL LOG

Bore No: WBAC0046

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	1/12/2023	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	1/12/2023	**Fluid:**	Air	**Elevation:**	371 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	482844
Logged By:	Alastair Hoare	**Drill Bit:**	Blade Bit	**Northing:**	6626250
				Projection:	Zone 51

Water Strike (MBGL): no data **'BH' ID:** BH2

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		SILT: Grey brown red SILT contaning granule to pebble sized clasts.		
		sandy SILT: Dark reddish brown sandy SILT. Predominantly containing granule size red siltstone clasts and buff white felsic clasts. Very poorly sorted and poorly consolidated.		
10				
		CLAY: Light buff brown CLAY, soft with occasional granule sized clasts of felsic igneous rock, moderately sorted.		
20		Saprolitic CLAY: White Saprolitic soft CLAY.		
				Open Hole (102 mm ; 4")
30				
40				
				Drilling terminated at 50 mbgl due to intersecting saprolitic clay.
50				

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COMPOSITE WELL LOG

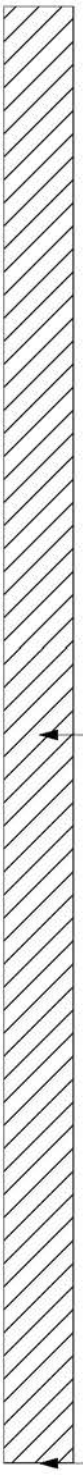
Bore No: WBAC0047

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	02/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	02/02/2024	**Fluid:**	Air	**Elevation:**	329 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503099
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6634073
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl **'BH' ID:** BH53

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Brown-red silts and very fine sub-rounded quartz		
		Clay: Brown-grey sticky clays with sub-angular to sub-rounded lithic fragments and quartz (<5%)		
10		Clayey Silt: Brown-red sticky clays with 20% silt		
		Sandy Silt: Brown-grey, with very fine sands 30%		
		Clay: Turquoise-brown semi-plastic clay with very fine sub-angular mafic fragments (<5%)		
20				



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COMPOSITE WELL LOG

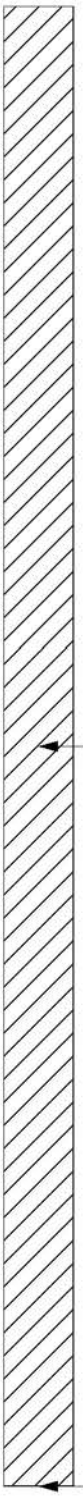
Bore No: WBAC0048

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	02/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	02/02/2024	**Fluid:**	Air	**Elevation:**	332 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	502895
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6632925
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl
'BH' ID: BH39

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Brown-red silts with very fine sub-rounded sands (<5%).		
		Clay: Brown-red sticky clays with <1% very fine quartz		
		Clay: Turquoise-red sticky clay		
10		Clay: Brown-red sticky clay with sub-angular mafic fragments		
		Clay: Grey-red sticky clay, kaolinitic and haematitic alteration		
		Clay: Light Brown-Grey sticky kaolinitic clays		
20		Clay: Dark red and white streaky plastic clays, haematitic alteration.		
		Clay: Turquoise-brown plastic clay with <5% angular mafic fragments <1mm, streaks of haematitic alteration in more consolidated clays.		
30				



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COMPOSITE WELL LOG

Bore No: WBAC0049

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	03/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	04/02/2024	**Fluid:**	Air	**Elevation:**	353 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	505613
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6634844
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl **'BH' ID:** BH62

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Brown-red sandy SILT, very fine, sub-rounded and moderately sorted sands		
		Clay: Brown-grey kaolinitic sticky clay		
		Clay: Brown-red sticky clay		
10		Clay: Brown-turquoise sticky kalonitic clays		
		Clay: Light brown unconsolidated clays		
20		Clay: Light grey-green kaolinitic clay & very fine, sub-angular, moderately sorted mafic fragments (5-15%) often oxidised to haematite		
30		Sand: Light grey medium-coarse, poorly sorted, sub-rounded sands. Increased silts and kaolinitic alteration and oxidation of mafic fragments (34-35m)		
		Sandy Clay: Light grey-brown clay & oxidised orange lithic fragments (10%) & very fine, sub-angular sands (10%). Increased plasticity at 39-40m		
40		Clay: Grey-green sticky clays with 5% oxidised lithic fragments		Open Hole (102mm ; 4")
		Sandy Clay: Grey-green sticky clays with very fine, sub-rounded sands 20%. <5% oxidised lithic fragments		
50		Clay: Dark grey-red plastic clays, streaky haematite alteration		
		Clay: Grey plastic clays with 5% oxidised lithic fragments. Increased plasticity at 53-55m		
		Sand: Grey medium to coarse, moderately sorted, sub-angular quartz		
		Clay: Grey plastic clays with 5% oxidised lithic fragments.		
60		Sand: Grey-yellow coarse to very coarse moderately sorted sub-angular quartz with goethite staining		
		Sand: Light brown-grey medium , well sorted, sub-rounded quartz		
		Sand: Grey poorly sorted, medium to coarse angular quartz		
		Sandy Clay: Grey plastic clay with <5% medium-very coarse angular quartz		
		Clay: Grey plastic clay. Low sample/ liquid sample return 69-73m.		
70		Silty Sand: Dark grey, fine to medium, moderately sorted sub-angular quartz & silts (20%).		
		Sand: Dark grey, medium to very coarse, poorly sorted, sub-angular quartz		
		Silty Sand: Dark grey, fine to medium, moderately sorted sub-angular quartz & silts (20%).		
		Sand: Dark grey, medium to very coarse, poorly sorted, sub-angular quartz		Hole terminated at 78 mbgl, full sump.
80				

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COMPOSITE WELL LOG

Bore No: WBAC0050

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	04/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	04/02/2024	**Fluid:**	Air	**Elevation:**	326 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	505686
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6634697
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl
'BH' ID: BH61

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Red-brown SILT & poorly sorted, sub-rounded quartz (<30%).		
		Clay: Red-brown sticky clay 10% sub-angular, fine lithic fragments. Increasing kaolinitic alteration with depth.		
		Clay: Orange-brown sticky clay. Increasing kaolinitic alteration with depth.		
10		Clay: Brown clay decreased stickiness/ plasticity. 17-18m increased plasticity and kaolinitic alteration.		
20		Clay: Light brown-pink sticky clay with <5% very fine angular lithic fragments.		
		Clay: Light brown-green kaolinitic sticky clay with 10% oxidised lithic fragments.		
30		Clay: Pink-turquoise kaolinitic sticky clays, increased oxidation in lithic fragments.		
		Clay: Light brown-grey sticky clays with <10% lithic fragments altered to haemetite.		
40		Clay: Dark pink-grey plastic clay with streaks of haematitic alteration.		Open Hole (102mm ; 4")
		Clay: Grey-pistachio green plastic clay.		
50		Clay: Grey plastic clay with 5% lithic fragments altered to haemetite.		
		Silty Sand: Light grey, silts to very coarse, sub-angular quartz (very poorly sorted).		
		Sandy Clay: Grey plastic clay & 10% very-coarse sub-angular quartz.		
		Silty Sand: Light grey, silts to very coarse, sub-angular quartz (very poorly sorted).		
60		Sand: Light grey-brown moderately to poorly sorted, very fine to very coarse, sub-angular to sub-rounded quartz with up to 5% oxidised lithic fragments.		
		Silty Sand: Dark grey poorly sorted silts to very coarse sub-rounded quartz		
70		Silty Sand: Dark grey well sorted silts to very fine grained quartz		
		Sand: Dark grey poorly sorted medium to very coarse sub-angular quartz		
		Silty Sand: Dark grey moderately sorted, fine to medium quartz & 20% silts.		
80		Clay: Grey plastic clay & 5% very fine lithic fragments. Low return/ liquid sample at 80-83m.		Hole terminated at 83 mbgl, drill bit refusal.

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COMPOSITE WELL LOG

Bore No: WBAC0051

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	05/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	06/02/2024	**Fluid:**	Air	**Elevation:**	333 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	505835
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6634408
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl **'BH' ID:** BH60

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Brown-red sandy SILT, very fine, sub-rounded and moderately sorted sands		
		Sandy Clay: Light grey-red kaolinitic plastic clay with lithic fragments altered to haemetite 20% medium sub-angular quartz.		
10		Clay: Brown-orange plastic clays.		
20		Clay: Brown-red plastic clays		
		Clay: Brown-grey plastic clays (increased cohesion), 5% oxidised lithic fragments.		
30		Clay: Red-turquoise plastic clays, with streaks of haematitic and limonitic alteration (mottled zone).		
40		Sandy Clay: Red-turquoise plastic clays & medium grained, sub-rounded quartz <20%		
		Sandy Clay: Red-grey plastic clays & 25% medium-coarse, sub-angular quartz. Increased haematite alteration.		
		Clay: Grey plastic clay.		
		Sandy Clay: Red-grey plastic clays & 25% medium-coarse, sub-angular quartz. Increased haematite alteration.		
50		Sand: Light grey, moderately sorted medium-coarse sub-angular quartz.		
		Sandy Clay: Dark grey sticky clay with <10% very fine sands.		
		Sand: Grey moderately sorted, medium to coarse sub-rounded to subangular quartz		
60		Clayey Sand: Grey moderately sorted, medium to coarse sub-rounded to subangular quartz & 30% plastic clay.		
		Sandy Silt: Dark grey silts with <10% moderately sorted medium to coarse sub-rounded sands.		
		Sandy Clay: Grey sticky clay with poorly sorted angular-sub-angular quartz and mafic fragments (30%).		
70		Sand: Poorly sorted, fine-coarse sub-rounded quartz.	Open Hole (102mm ; 4") / Hole terminated at 68 mbgl, blade bit refusal.	

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COMPOSITE WELL LOG

Bore No: WBAC0052

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	06/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	06/06/2024	**Fluid:**	Air	**Elevation:**	320 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	503923
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	663218
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl **'BH' ID:** BH57

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Red-brown SILT		
		Sandy Clay: Brown sticky clay 25% sands		
		Clay: Brown-orange sticky-plastic clays		
10				
20				
		Clay: Pink-turquoise kaolinitic plastic clay with haematitic alteration.		
30				
		Laterite: Dark red-turqouise competent rock, complete pervasive alteration (50:50).		
		Sandy Clay: Brown-grey sandy clay with oxidised lithic fragments.		
		Clay: Dark red-turqouise clay, complete pervasive alteration (50:50).		
40		Clay: Pink sticky clays		
		Clay: Brown-orange sticky-plastic clays		
		Clay: Grey sticky clays		
50			Open Hole (102mm ; 4")	
		Clay: Black sticky clays		
		Clay: Grey sticky clays		
60		Clay: Black sticky clays		
		Clay: Grey sticky clays.		
70				
		Sand: Grey, moderately sorted, fine to medium grained sub-rounded quartz.		
		Clay: Brown-grey sticky clay.		
80		SIlty Sandy Clay: Dark grey-brown sticky clays with silts and fine angular quartz and mafic fragments (<20%).		
90				
		Felsic Bedrock: Dark grey-green, granitic rock with chlorite alteration.	Hole terminated at 102 mbgl, blade bit refusal in fresh/saprock.	
100				

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COMPOSITE WELL LOG

Bore No: WBAC0053

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	06/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	07/02/2024	**Fluid:**	Air	**Elevation:**	321 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	504200
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6632663
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl
'BH' ID: BH58

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Brown-red SILT		
		Clay: Red-Brown sticky clay.		
10				
		Clay: Brown-grey sticky clay.		
20		Clay: Red-grey sticky kaolinitic clay with haematitic alteration.		
30		Clay: Light grey-brown, light talcy clay 5% oxidised lithic fragments.		
		Clay: Brown-grey light talcy clay 10% oxidiesed lithic fragments.		
40		Clay: Yellow plastic clay, pervasive goethitic alteration.		
		Clay: Light grey plastic clay		
50		Clay: Dark brown-grey plastic clay		
		Clay: Grey plastic clay.		
60				Open Hole (102mm ; 4")
70		Silty Sandy Clay: Light grey-black plastic clay with silts and <10% very fine, sub-rounded quartz.		
		Sandy Clay: Grey plastic clay with angular to sub-angular fine quartz (<20%).		
		Sand: Grey moderately sorted, medium to coarse sub-rounded quartz.		
		Clay: Grey-brown plastic clay		
80		Clayey Sand: Grey moderately sorted medium to coarse sub-rounded quartz and 25% sticky clay		
		Clay: Dark grey-brown plastic clay with <2% gravel sized fragments of massive grey very fine grained rock.		
		Sand: Grey moderately sorted, coarse to very coarse quartz.		
90		Clayey Silt: Light grey silt and clays with sub-angular mafic fragments and quartz (<20%).		
		Sand: Grey, moderately sorted, medium to coarse sub-rounded sands.		
		Sandy Clayey Silt: Light grey silt and clays with sub-angular mafic fragments and quartz (<20%).		
		Silty Sandy Clay: Grey sticky clay with sub-angular mafic fragments and quartz (<20%).		
100				
		Gravelly Sand: Grey very poorly sorted coarse sands and gravels, angular to sub-angular and <20% clays.		
		Sand: Grey poorly sorted, fine to coarse sub-angular quartz.		Hole terminated at 113 mbgl, low sample return (111-113m).
110				

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COMPOSITE WELL LOG

Bore No: WBAC0054

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	07/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	07/07/2024	**Fluid:**	Air	**Elevation:**	325 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	504550
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6632579
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl **'BH' ID:** BH59

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion Diagram	Well Completion Notes
0		Alluvium: Red-brown sandy SILT, <10% fine-very fine sub-rounded quartz.		
		Clay: Red-grey sticky kaolinitic clay with haematitic alteration.		
10		Clay: Brown-orange plastic-sticky limonitic clay 5% oxidised lithic fragments. Increasingly plastic from 25m.		
20				
		Clay: Red-Grey sticky -plastic kaolinitic clay with haematite streaks.		
30		Laterite: Red-green competent hardened clay, brecciated with kaolinitic, jarositic, goethitic and haematitic alteration.		
		Clay: Grey competent kaolinitic rock.		
		Clay: Light grey kaolinitc clay.		
40		Clay: Red-grey kaolinitic sticky clay with haemetite alteration.		
		Clay: Light brown-grey sticky clay.		
50				Open Hole (102mm ; 4")
		Clayey Silt: Grey-brown silts with sticky clays.		
		Clay: Dark grey-brown plastic clay.		
		Clay: Light grey sticky clay.		
60				
		Clay: Black plastic clay.		
		Clay: Light Grey plastic clay		
		Clay: Black plastic clay.		
70		Clay: Light Grey plastic clay		
		Clay: Grey plastic clay.		
80		Sandy Clay: Light grey plastic clay with well sorted medium sub-rounded quartz (<25%).		
		Clay: Light grey plastic clay.		
90		Clayey Silt: Dark grey silts, with visible very fine micas.		
		Mafic Bedrock: Black-grey, fine-medium grained mafic rock with <35% felsic minerals.		Hole terminated at 99 mbgl, blade bit refusal in mafic bedrock.
100				

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COMPOSITE WELL LOG

Bore No: WBAC0055

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	07/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	08/02/2024	**Fluid:**	Air	**Elevation:**	329 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	505007
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6630089
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl
'BH' ID: BH55

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Red-brown SILT		
		Clay: Red-brown sticky clay		
		Laterite: Red-grey gravel sized fragments of massive rock with pervasive haemetitic alteration & silts.		
10		Silty Clay: Grey-brown silty clay.		
		Clay: Grey-red sticky clay.		
		Clay: Red-brown sticky clay		
		Clay: Brown-orange plastic clay.		
20		Clay: Red-grey kaolinitic plastic clay with haemetite alteration.		
		Gravelly Clay: Light grey-brown clay with gravel sized clasts of oxidised competent rock.		
		Gravelly Sand: Red-green gravel sized fragments of competent rock with jarositic, haematitic and kaolinitic alteration hosted within coarse sands.		
30		Gravelly Clay: Light grey-brown clay with gravel sized clasts of oxidised competent rock.		
		Silty Clay: Light red-brown sticky clays and silts.		
40		Clay: Light brown sticky clays.		
		Silty Clay: Light red-brown sticky clays and silts.		
50		Clay: Light grey-olive plastic clay with fine pyroxene shaped mafic clasts (<20%).		
		Silty Clay: Red-brown silts and sticky-plastic clays.	Open Hole (102mm ; 4")	
60		Clay: Brown-red sticky-plastic clays		
70		Sandy Clay: Brown-red sticky-plastic clay with 20% fine rounded quartz.		
80				
90		Clay: Brown-green plastic-sticky clay.		
100		Saprolitic Clay: Green-brown saprolitic clay. With fragments of weathered granitic rock.		
110		Felsic bedrock: Green-grey granitic rock with chloritic alteration.	Hole terminated at 113 mbgl, blade bit refusal in granitic saprock.	

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COMPOSITE WELL LOG

Bore No: WBAC0056

Client: Ramelius Resources
Project: Lake Rebecca Exploration Drilling

Commenced:	08/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	08/08/2024	**Fluid:**	Air	**Elevation:**	332 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	504842
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6630104
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl
'BH' ID: BH56

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Brown SILT		
		Clay: Red-Brown plastic clay.		
		Laterite: Light grey-brown kaolinitic clay with gravel sized fragments of massive rock with pervasive haemetite alteration.		
10		Clay: Brown-red limonitic-haematitic altertered kaolinite clays.		
20		Laterite: Red clay with gravel sized fragments of massive rock with pervasive haemetite alteration.		
		Silty Clay: Brown-red silty clay.		
30		Clay: Red-pink plastic clay.		
		Clay: Light grey-brown plastic clay (leached zone).		
40		Clay: Brown-grey sticky-plastic limonitic altered clay with fine mafic fragments (<5%).		
50			Open Hole (102mm ; 4")	
60				
70				
80		Saprolitic Clay: Green-grey sticky clay with fine mafic fragments (<5%).		
90				
		Felsic Bedrock: Dark grey-green, granitic rock with chlorite alteration.	Hole terminated at 97 mbgl, blade bit refusal in weathered granitic rock.	
100				

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COMPOSITE WELL LOG

Bore No: WBAC0057

Client: Ramelius Resources **Project:** Lake Rebecca Exploration Drilling

Commenced:	08/02/2024	**Method:**	Air Core	**Area:**	Lake Rebecca
Completed:	08/02/2024	**Fluid:**	Air	**Elevation:**	330 mAHD
Drilled:	Kennedy Drilling	**Drill Diameter:**	102 mm (4")	**Easting:**	504607
Logged By:	Yannick Magyar	**Drill Bit:**	Blade Bit	**Northing:**	6630134
				Projection:	Zone 51

Water Strike (MBGL): NO DATA mbgl **'BH' ID:** BH54

Depth (mbgl)	Graphic Log	Lithological Description	Well Completion: Diagram	Well Completion: Notes
0		Alluvium: Red-brown SILT.		
		Clay: Red-brown sticky clay.		
		Clay: Red-brown plastic clay.		
10				
20		Clay: Red-brown sticky clay.		
		Silty Clay: Light brown-grey silty clay with oxidised lithic fragments and quartz <10%.		
30		Clay: White kaolinitic clay.		
		Silty Clay: Light brown-grey silty clay with oxidised lithic fragments and quartz <10%.	Open Hole (102mm ; 4")	
40		Clay: White-brown sticky clay.		
		Clay: Yellow sticky clay, goethitic alteration.		
		Clay: White-brown sticky clay.		
50		Lignite: Black, light weight non-graphitic silty material. More consolidated and with <2% streaks of massive pyrite at 54-55m.		
		Silty Clay: Grey silty clay.		
		Clay: Dark grey sticky clay.		
		Sandy Clay: Brown sticky clay with mafic fragments and sub-angular coarse quartz (<15%).		
60		Saprolitic Clay: Dark Brown plastic clay with sub-angular fine mafic fragments (<15%).		
		Saprolitic Clay: Light grey-white sticky clays, containing angular clasts of medium to coarse feldspars and quartz.		
70			Hole terminated at 71 mbgl in saprolitic clay.	

APPENDIX E
PSD ANALYSIS REPORT

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E-Precision Laboratory

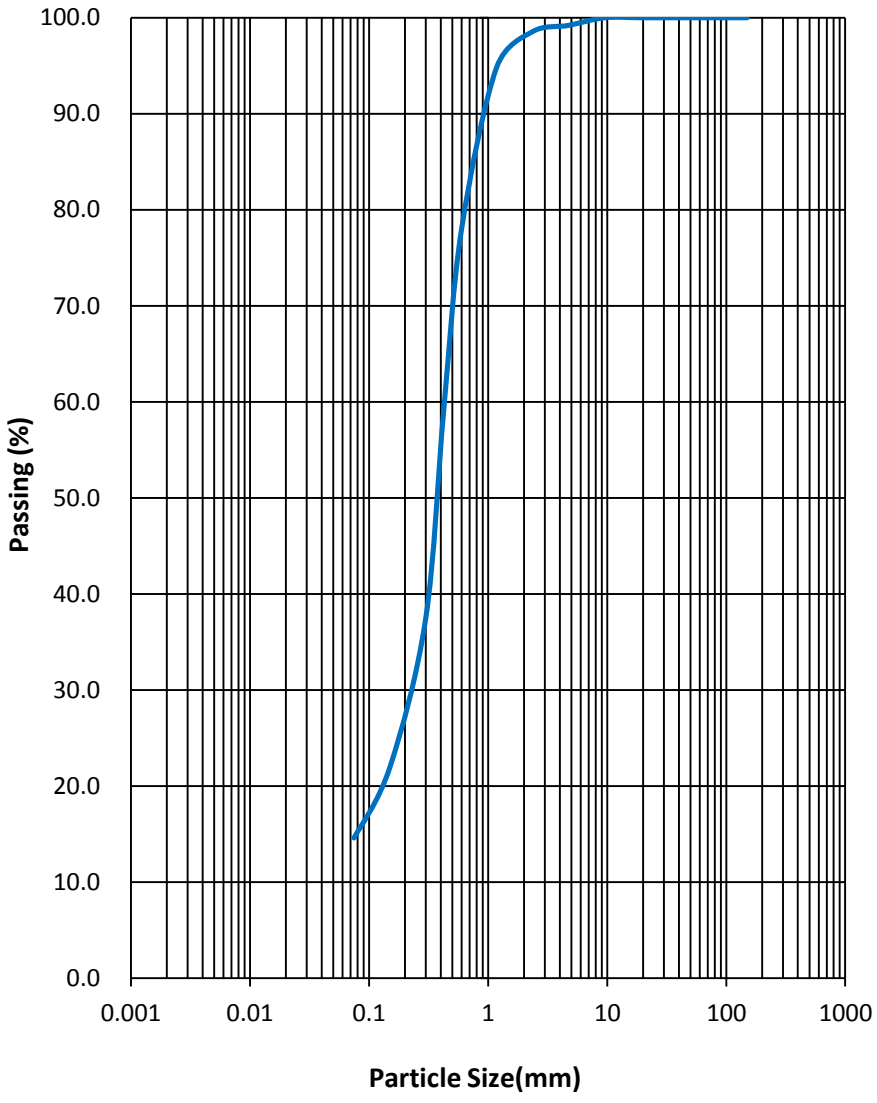
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1

Client:	AQ2	Date Tested:	19/05/2024
Project:	Lake Rebecca Testing 2024	EP Lab Job Number:	AQ2
Sample No:	WBAC0038_BH09	Depth (m):	29.00 - 35.00
Lab ID:	WBAC0038_BH09_PSD	Room Temperature at Test:	19°C
Tested by:	Tokie	2.36mm Particle Density (t/m³):	-
Checked by:	Phil	Moisture Content (%):	-

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	99.2
2.36	98.5
1.18	94.8
0.6	78.0
0.425	59.2
0.3	37.5
0.15	22.0
0.075	14.6

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

Authorized Signature:

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E-Precision Laboratory

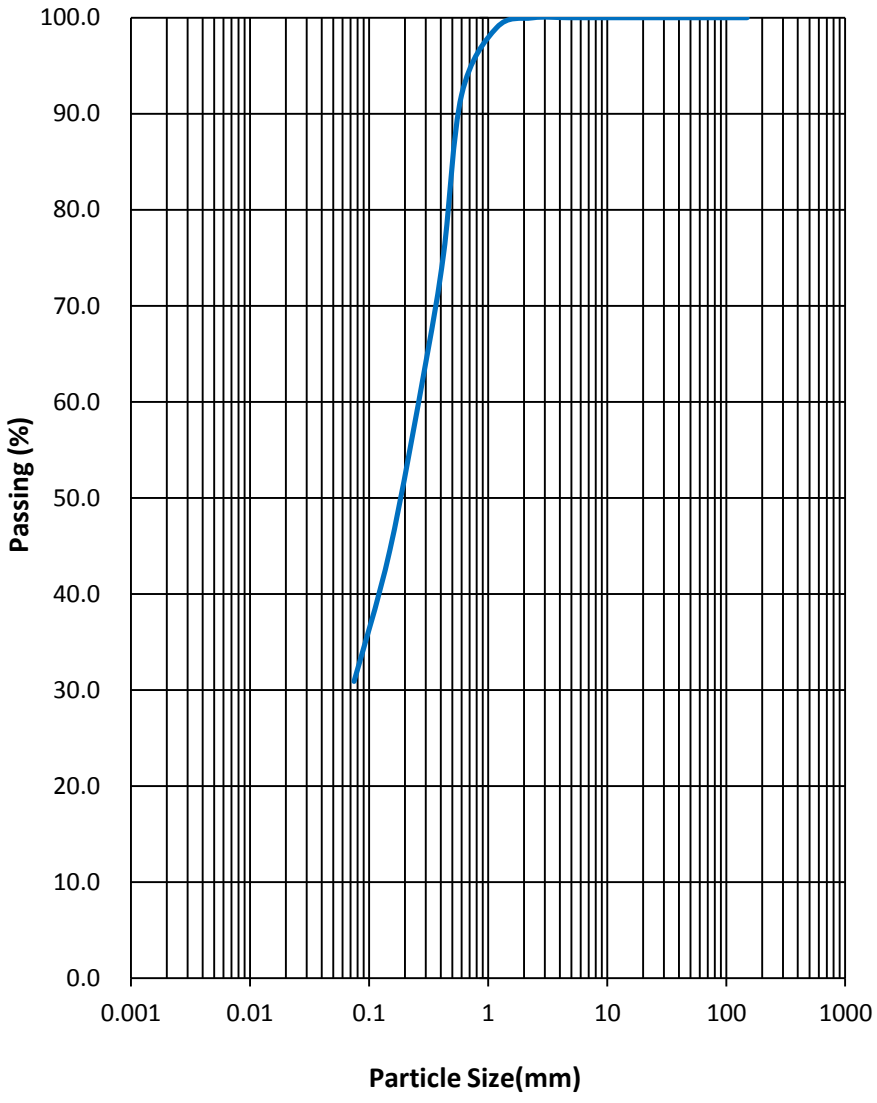
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1

Client:	AQ2	Date Tested:	19/05/2024
Project:	Lake Rebecca Testing 2024	EP Lab Job Number:	AQ2
Sample No:	WBAC0029_BH17	Depth (m):	29.00 - 37.00
Lab ID:	WBAC0029_BH17_PSD	Room Temperature at Test:	19°C
Tested by:	Tokie	2.36mm Particle Density (t/m³):	-
Checked by:	Phil	Moisture Content (%):	-

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	100.0
1.18	99.0
0.6	92.0
0.425	75.6
0.3	64.1
0.15	44.6
0.075	30.9

PSD Graph



Notes:
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Samples supplied by the Client

Authorized Signature:

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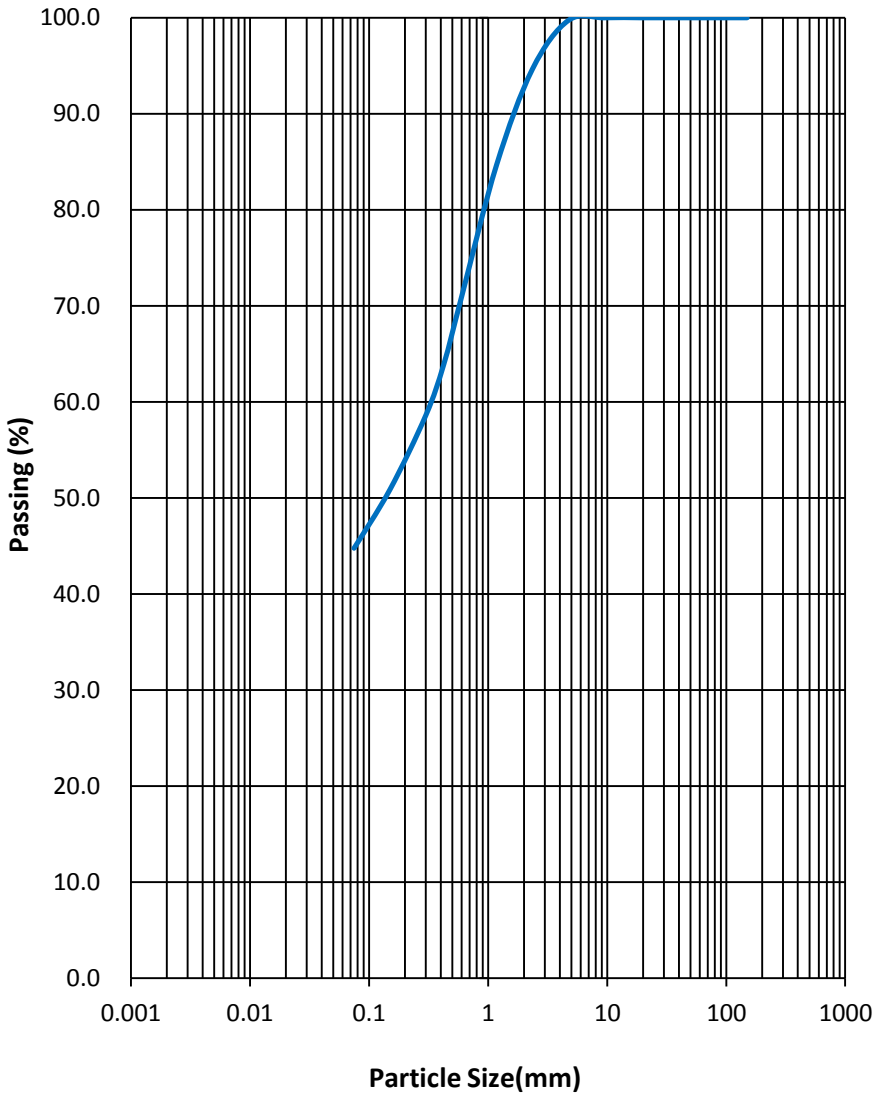
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1

Client:	AQ2	Date Tested:	19/05/2024
Project:	Lake Rebecca Testing 2024	EP Lab Job Number:	AQ2
Sample No:	WBAC0019_BH26	Depth (m):	62.00 - 74.00
Lab ID:	WBAC0019_BH26_PSD	Room Temperature at Test:	19°C
Tested by:	Tokie	2.36mm Particle Density (t/m³):	-
Checked by:	Phil	Moisture Content (%):	-

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	99.7
2.36	94.6
1.18	84.7
0.6	70.9
0.425	63.9
0.3	58.6
0.15	50.8
0.075	44.7

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

Authorized Signature:

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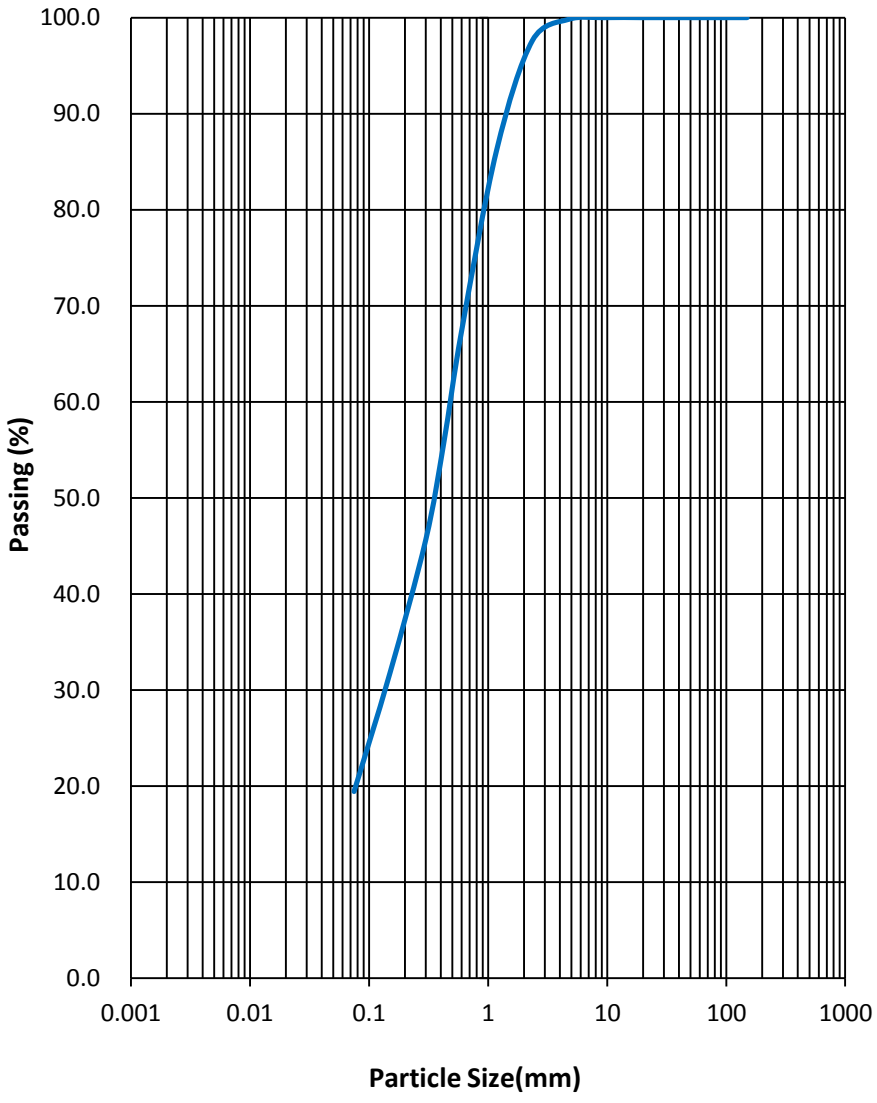
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1

Client:	AQ2	Date Tested:	19/05/2024
Project:	Lake Rebecca Testing 2024	EP Lab Job Number:	AQ2
Sample No:	WBAC0003_BH46	Depth (m):	18.00 - 26.00
Lab ID:	WBAC0003_BH46_PSD	Room Temperature at Test:	19°C
Tested by:	Tokie	2.36mm Particle Density (t/m³):	-
Checked by:	Phil	Moisture Content (%):	-

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	99.8
2.36	97.6
1.18	86.2
0.6	67.4
0.425	55.7
0.3	45.6
0.15	31.7
0.075	19.4

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

Authorized Signature:

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APPENDIX F
PRODUCTION AND MONITORING BORE LOGS

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COMPOSITE WELL LOG

Bore No: BPB004

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

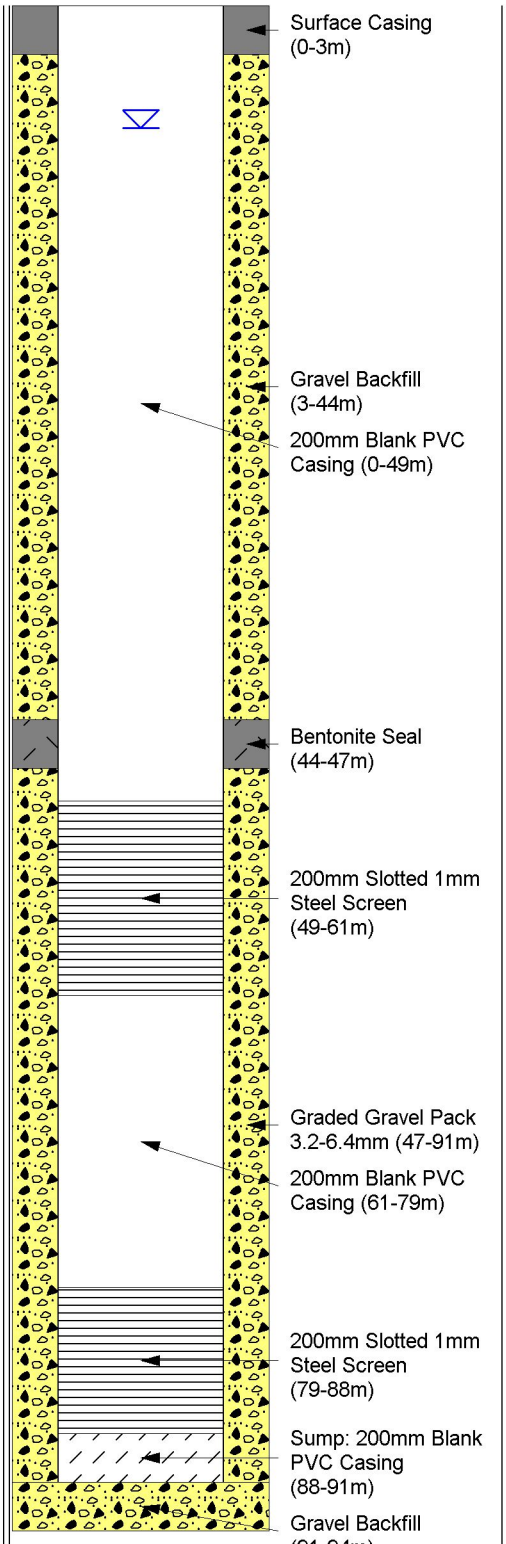
Commenced: 09/05/2024
Completed: 14/05/2024
Drilled: WA Water Bores
Logged By: Tom Onslow

Method: Mud Rotary
Fluid: Mud
Bit Record: 311mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 326.77 mRL
Easting: 502262.8
Northing: 6636480.3
Projection: GDA2020 MGA51

Static Water Level: 7.52 mbgl
Date: 18/05/2024
Remarks: PVC Stick-up = 0.48m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0 – 10	Alluvium		Alluvium: Red-brown poorly sorted clay (20%), silt (60%) to coarse, sub-rounded quartz.				
10 – 20	Transported Sand and Clay		Sand: Yellow-grey well sorted, very coarse (10%) to granule sized (90%), sub-rounded quartz, with reduced sorting and increased fines content with depth.				
20 – 30	Transported Sand and Clay		Silty Sand: Cream-white poorly sorted medium to very coarse, sub rounded quartz with 15-25% silt.				
30 – 40	Transported Sand and Clay		Sandy SIlt: Light pink-grey very poorly sorted, silt to fine gravel sized, sub-angular to sub-rounded quartz with friable siltstone.				
40 – 50	Transported Sand and Clay		Silty Sand: Light pink-grey very poorly sorted silt (30%) to very-coarse and gravel sized, sub-angular to sub-rounded quartz with 5-10% white clay.				
50 – 60	Upper Paleochannel Sand		Gravelly Sandy Clay: Brown-grey kaolitic clay and silt with variable amounts of very poorly sorted sand to gravel sized, sub-angular quartz.				
60 – 70	Upper Paleochannel Sand		Silty Sand: Very poorly sorted, silt (20%) to coarse and granule sized (80%), sub-angular to angular quartz wtih <5% white clay.				
70 – 80	Transported Sand and Clay		Sand: Poorly sorted, very fine to granule sized (80%), sub-rounded to sub-angular quartz with increased fine to medium quartz (61-63m).				
80 – 90	Lower Paleochannel		Silty Clay: Dark grey, carbonaceous, sticky unconsolidated silt and clay. 10% lignite fragments (64-77m).				
90 – 100	Carbonaceous Silt		Silty Sand: Dark grey very poorly sorted sand (55-75%) to fine gravel (5%) sized, sub-rounded to sub-angular quartz with black carbonaceous silt and 5% lignite.				
90 – 100	Carbonaceous Silt		Sandy Silty Clay: Dark grey very poorly sorted, clay (45%) and silt (35%) to granulitic, sub-angular quartz.		Max Airlift: 20 L/s (Visual Estimate) Final Airlift: 20 L/s EC: 201.5 mS/cm pH: 6.34		



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COMPOSITE WELL LOG

Bore No: BPB011

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Driling

Commenced: 25/02/2024
Completed: 02/03/2024
Drilled: WA Water Bores
Logged By: James Whitby

Method: Mud Rotary
Fluid: Mud
Bit Record: 311mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 326.30 mRL
Easting: 501844.2
Northing: 6633142.4
Projection: GDA2020 MGA51

Static Water Level: 7.97 mbgl
Date: 05/03/2024
Remarks: PVC Stick-up = 0.48m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0 – 10	Alluvium		Clay: Red, dry top soil/clay			Surface Casing (0-3m)	
10 – 60	Transported Clay		Clay: Red/green/grey clay with minor fine quartz sand			Gravel Backfill (3-44m); 200mm Blank PVC Casing (0-52m); Bentonite Seal (44-48m); Graded Gravel Pack 3.2-6.4mm (48-61m); 200m Steel Slotted 1mm Casing (52-61m)	
50 – 60	Basal Sand		Sand: Very coarse, poorly sorted, angular quartz sand. Fine sand in first 4 m, and minor clay throughout.		Max Airlift: 17.89 L/s Final Airlift: 14.30 L/s EC: 193.2 mS/cm pH: 6.2		
60	Felsic Basement		Felsic Bedrock: Fresh felsic basement				

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COMPOSITE WELL LOG

Bore No: BPB017

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

Commenced: 30/03/2024
Completed: 05/04/2024
Drilled: WA Water Bores
Logged By: Yannick Magyar

Method: Mud Rotary
Fluid: Mud
Bit Record: 311mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 326.50 mRL
Easting: 502495.9
Northing: 6630351.3
Projection: GDA2020 MGA51

Static Water Level: 8.5 mbgl
Date: 16/05/2024
Remarks: PVC Stick-up = 0.81m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0 – 10	Transported Clay		Alluvium: Red-brown silty clay				Surface Seal (0-3m)
			Clay: Light grey and dark red kaolinitic clay with <20% haematitic laterite fragments and 20% silt		Penetration Rate: 15 min/rod		
10 – 20			Silty Clay: Light grey and dark red kaolinitic clay with haematitic and limonitic alteration				
			Silty Sandy Clay: Light grey and dark red kaolinitic clay with haematitic and limonitic alteration, 20% silt and <5% angular, medium-coarse quartz				
20 – 30			Silty Sandy Clay: Light grey-red sticky soft clay and silt with <10% medium-coarse grained sub-angular quartz and 10% lateritic fragmets.				
			Clay: Light grey sticky clay and gravel sized laterite <10%		Penetration Rate: 45 min/rod		
30 – 40			Silty Clay: Light grey-red soft clay and silt, 20% lateritic fragments				Gravel Backfill (3-60m)
			Clay: Light grey sticky clay with minor lateritic fragments and minor <5% angular, very fine to medium grained quartz				200mm Blank PVC Casing (0-68m)
40 – 50			Clay: Yellow-grey stricky clay (goethitic alteration), increased stickyness observed from 50-62m				
50 – 60							
60 – 70			Sandy Clay: Light grey sticky clay with 30% angular to sub-angular, moderately sorted, medium-coarse grained quartz				Bentonite Seal (60-65m)
	Basal Sand		Clayey Sand: Coarse to very coarse, angular to sub-angular quartz with 30% sticky grey clay		Penetration Rate: 60 min/rod Max Airlift: 2.94 L/s Final Airlift: 2.61 L/s EC: 179.4 mS/cm pH: 6.82		Graded Gravel Pack 3.2-6.4mm (65-77m)
70 – 80			Gravelly Sand: Poorly sorted, medium grained to gravel sized angular to sub-angular quartz with 10% sticky grey clay				200mm Steel 1mm Screen (68-77m)
	Felsic Bedrock		Felsic Bedrock: Grey-green angular feldspars and quartz with intergranular chloritically altered mafic minerals (10%)				
80 – 90							

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COMPOSITE WELL LOG

Bore No: BPB050

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

Commenced: 27/04/2024
Completed: 04/05/2024
Drilled: WA Water Bores
Logged By: Yannick Magyar

Method: Mud Rotary
Fluid: Mud
Bit Record: 311mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 325.41 mRL
Easting: 505685.3
Northing: 6634740.1
Projection: GDA2020 MGA51

Static Water Level: 7.89 mbgl
Date: 17/05/2024
Remarks: PVC Stick-up = 0.60m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0	Alluvium		Alluvium: Red-brown silt with medium, sub-angular quartz.				
10	Transported Clays and Sands		Clay: Brown-grey sticky to plastic clay with <5% very poorly sorted, fine to gravel sized, sub-rounded quartz (7-8m) and <5% lateritic fragments (11-12m).				
20					Penetration rate: >60 min/rod		
30			Clay: Grey-red plastic clay with streaks of haematite and limonite staining.				Gravel Backfill (3-52m)
			Sandy Clay: Turquoise-red sticky clay with patchy haematite staining and 10% poorly sorted, fine to coarse, sub-angular quartz.				200mm Blank PVC Casing (0-59m)
40			Clay: Turquoise-brown sticky clay with patches of haematite and limonite staining. Pervasive red, haematite staining (35-42m).				
50			Clayey Silt: Brown silt with 35% grey sticky clay.				
			Sandy Clay: Grey sticky clay with <20% medium, sub-angular quartz and 5% oxidised lithic fragments.				Bentonite Seal (52-57m)
60	Basal Gravels and Sands		Clayey Sand: Grey poorly sorted medium to very-coarse sub-angular quartz with 30% sticky grey clay.				
			Silty Gravelly Sand: Grey-brown medium grained to gravel sized (10%), sub-angular quartz with 30% sticky grey clay.		Penetration rate: 20 min/rod		Graded Gravel Pack 3.2-6.4mm (57-77m)
70			Gravel: Brown-grey, well sorted, sub-angular quartz gravel with <5% sticky clay. 10% clay 61-62m.				200mm Slotted 1mm Steel Screen (59-77m)
			Sandy Gravel: Grey-black moderately sorted, sub-angular quartz gravel (85%) and very-coarse sand (10%) with friable black siltstone (5%).		Max Airlift: 52.2 L/s Final Airlift: 52.2 L/s EC: 187.0 mS/cm pH: 6.63		
80							Gravel Backfill (77-84m)
			Clayey Gravel: Grey-brown sub-angular quartz gravel with up to 30% sticky brown clay and 5-10% black carbonaceous siltstone.				
90							

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COMPOSITE WELL LOG

Bore No: BMB004S

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

Commenced: 14/05/2024
Completed: 15/05/2024
Drilled: WA Water Bores
Logged By: Tom Onslow

Method: Mud Rotary
Fluid: Mud
Bit Record: 165mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 326.77 mRL
Easting: 502280.3
Northing: 6636483.6
Projection: GDA2020 MGA51

Static Water Level: 5.98 mbgl
Date: 19/05/2024
Remarks: PVC Stick-up = 0.74m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0	Alluvium		Alluvium: Red-brown silt with minor sand, soil horizon A (0-2m), soil horizon B (2-4m) increased clay.			Surface Seal (0-3m)	
	Transported Clay		Sandy Silty Clay: Grey plastic clay (80%) with poorly sorted silt (10%) to coarse, sub-angular quartz. Colour change from 8m to green-yellow (10Y 7/4 Munsell).			Gravel Backfill (3-7m); 50mm Blank PVC Casing (0-12m); Bentonite Seal (7-10m)	
10	Upper Paleochannel Sand		Sand: Yellow-green poorly sorted, fine to granule sized (mainly coarse), sub-rounded to rounded quartz with limonite and chlorite staining.			Graded Gravel Pack 3.2-6.4mm (10-18m); 50mm Slotted 1mm PVC Casing (12-18m)	
			Gravelly Sand: Red-brown poorly sorted, medium to gravel (10%) and granule sized (80%), sub-angular quartz with iron oxide staining.				
			Sand: Very poorly sorted, fine-medium (15%) to very coarse (70%) and granule sized, sub-angular quartz.				
20			Silty Sand: Clear very poorly sorted, very fine ot granule sized, sub-rounded to sub-angular quartz with white silt.		Max Airlift: 1.71 L/s Final Airlift: 1.52 L/s EC: 167.8 mS/cm pH: 5.26	Gravel Backfill (18-24m)	
	Transported Silt and Clay		Clayey Silty Sand: Very poorly sorted, very fine to granule sized, sub-rounded to sub-angular quartz with 20% kaolin-rich clay and 40% silt.				
			Clayey Silt: White silt with kaolin-rich clay (45%).				
30							

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COMPOSITE WELL LOG

Bore No: BMB004D

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

Commenced: 16/05/2024
Completed: 18/05/2024
Drilled: WA Water Bores
Logged By: Tom Onslow

Method: Mud Rotary
Fluid: Mud
Bit Record: 165mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 326.79 mRL
Easting: 502274.9
Northing: 6636482.6
Projection: GDA2020 MGA51

Static Water Level: 7.54 mbgl
Date: 18/05/2024
Remarks: PVC Stick-up = 0.72m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0 – 3			Alluvium: Red-brown clayey silt with 10% fine to coarse quartz.			Surface Casing (0-3m)	
3 – 10	Transported Silt and Sand		Sandy Silty Clay: Brown-grey plastic clay with 35% silt and 20% poorly sorted, very fine to very coarse, sub-angular quartz.				
10 – 20	Transported Silt and Sand		Sand: Brown-grey, poorly sorted fine to granule sized, sub-angular to sub-rounded quartz with limonitic staining.				
20 – 30	Transported Silt and Sand		Sandy Clay: White plastic clay with <20% very poorly sorted, very fine to granule sized, sub-rounded quartz.			Gravel Backfill (3-48m)	
30 – 40	Upper Paleochannel Sand		Clayey Silty Sand: White-grey very poorly sorted, very fine to granule sized, sub-angular to sub-rounded quartz with 5-10% white plastic clay and 10% silt.			50mm Blank PVC Casing (0-53m)	
40 – 50	Upper Paleochannel Sand		Silty Sand: Grey very poorly sorted, very fine to granule sized, sub-angular to sub-rounded quartz with 15% silt.				
50 – 60	Upper Paleochannel Sand		Clayey Silty Sand: White-grey very poorly sorted, very fine to granule sized, sub-rounded quartz with 30-40% silt and clay.			Bentonite Seal (48-51m)	
60 – 70	Upper Paleochannel Sand		Sandy Clayey Silt: White silt with 20% kaolin rich clay and 10% poorly sorted, very fine to very coarse quartz.				
70 – 80	Transported Clay		Silty Sand: Grey very poorly sorted, very fine to granule sized, sub-rounded quartz with 5-15% silt. 40-41m white plastic clay.				
80 – 90	Transported Clay		Sand: Grey poorly sorted very fine to granule sized, sub-angular to sub-rounded quartz.			Graded Gravel Pack 3.2-6.4mm (51-89m)	
90 – 93	Transported Clay		Silty Sandy Clay: Dark grey, carbonaceous clay and silt (5% lignite) with poorly sorted, medium to coarse, sub-angular quartz (10%).			50mm Slotted 1mm PVC Screen (53-89m)	
93 – 95	Carbonaceous Silt		Silty Sand: Dark grey very poorly sorted carbonaceous silt to granule sized, sub-angular quartz.		Max Airlift: 2.0 L/s (Visual estimate) Final Airlift: 2.0 L/s EC: 194.9 mS/cm pH: 6.77		
95 – 100	Carbonaceous Silt		Silty Sandy Clay: Grey clay with minor lignite and carbonaceous silt and 15% fine to coarse, sub-angular quartz.			Gravel Backfill (89-93m)	

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COMPOSITE WELL LOG

Bore No: BMB005

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

Commenced: 22/02/2024
Completed: 25/02/2024
Drilled: WA Water Bores
Logged By: James Whitby

Method: Mud Rotary
Fluid: Mud
Bit Record: 165mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 325.56 mRL
Easting: 500644.7
Northing: 6634095.7
Projection: GDA2020 MGA51

Static Water Level: 5.88 mbgl
Date: 16/05/2024
Remarks: PVC stickup = 0.78m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0 – 30	Transported Clay		Clay: Brown-grey clay			Surface Casing (0-3m); Gravel Backfill (3-28m); 50mm Blank PVC Casing (0-34m); Bentonite Seal (28-30m)	
30 – 40	Perched Sand		Clayey Sand: Medium to coarse, angular, poorly sorted quartz sand with red-white clay		Max Airlift: 2 L/s Final Airlift: 2 L/s EC: 180.0 mS/cm pH: 6.51	Graded Gravel Pack 3.2-6.4mm (30-54m); 50mm Slotted PVC Casing 1mm (34-40m)	
40 – 50	Clay		Clay: Grey Clay			Gravel Backfill (40-54m)	
50 – 60	Felsic Basement		Felsic Bedrock: Fresh felsic basement				

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COMPOSITE WELL LOG

Bore No: BMB008

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

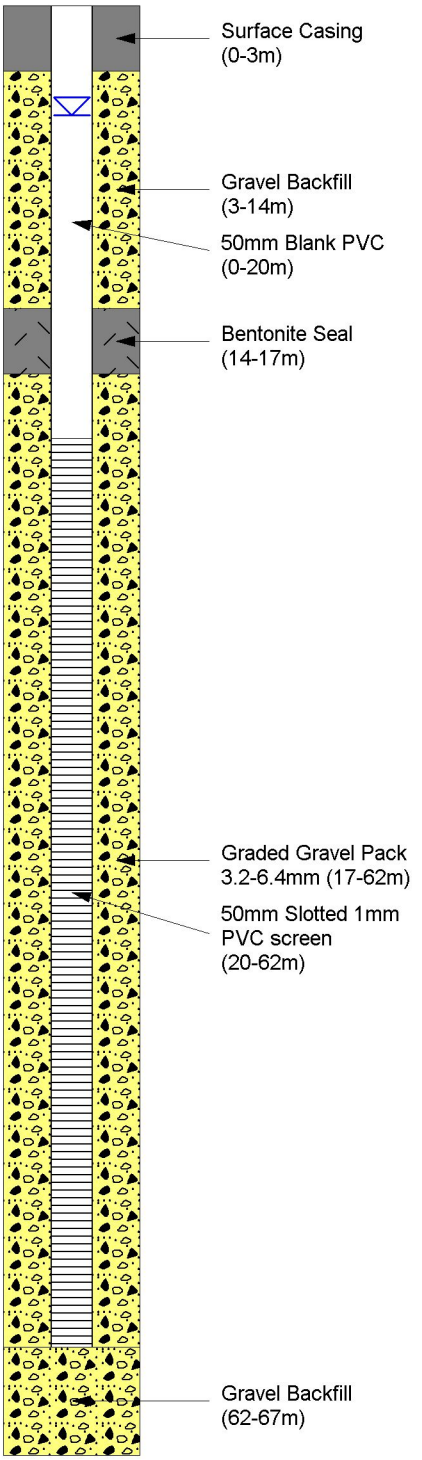
Commenced: 18/04/2024
Completed: 22/04/2024
Drilled: WA Water Bores
Logged By: Tom Onslow

Method: Mud Rotary
Fluid: Mud
Bit Record: 165mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 325.40 mRL
Easting: 503100.2
Northing: 663475.0
Projection: GDA2020 MGA51

Static Water Level: 5.05 mbgl
Date: 17/05/2024
Remarks: PVC Stick-up = 0.67m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0	Alluvium		Alluvium : Reddish brown alluvial soil. Poorly sorted (clay, silt, sand). Dominantly silt. Soil Horizon A (0-2m) Soil Horizon B (2-4).				
10	Transported Clay		Silty Clay: Light brown (5 YR 5/6) to grey silty plastic clay. pure clay (no silt) from 9-10 m.				
			Silty Sandy Clay: Mid-grey plastic clay with poorly sorted, silt to medium, sub-rounded quartz.				
20			Sandy Gravelly Clay: Mid grey plastic clay with very poorly sorted fine to coarse gravel-sized quartz and gravel-sized lithic fragments of friable cemented sandstone.				
			Sandy Gravel: Very poorly sorted, fine to very coarse quartz (20%) with gravel-sized lithic fragments (70%) and 10% clay.				
30			Gravelly Sand: Translucent well sorted, unconsolidated, very coarse to granule (80%) gravel sized (10%), sub-rounded to sub-angular granulitic quartz with 10% fine gravel.				
			Sand: Transulcent moderately sorted, unconsolidated very coarse (50%) to granule sized (50%), sub-angular to sub-rounded granulitic quartz sand.				
40	Basal sands		Silty Sand: Translucent, unconsolidated, very poorly sorted silt (10%) to granule sized, sub-angular quartz with 5% clay.				
			Sand: Poorly sorted, silt (5%) to very coarse (15%) and granule sized (80%) quartz.				
50			Silty Sand: Translucent , unconsolidated, very poorly sorted, silt (10-20%) to dominantly very-coarse and granule sized, sub-rounded quartz with <15% clay.				
			Sand: Unconsolidated, moderately sorted, fine (10%) to coarse and very coarse, sub-rounded quartz sand. Increase in fines content (silt + very fine sand) from 62-64 m.				
60			Clay: Medium-dark grey plastic clay becomming very dark at 66 m.				
70					Max Airlift: 1.75 L/s Final Airlift: 1.68 L/s EC: 170.3 mS/cm pH: 6.99		



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COMPOSITE WELL LOG

Bore No: BMB011

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

Commenced: 02/03/2024
Completed: 05/03/2024
Drilled: WA Water Bores
Logged By: Yannick Magyar

Method: Mud Rotary
Fluid: Mud
Bit Record: 165mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 326.33 mRL
Easting: 501845.4
Northing: 6633135.1
Projection: GDA2020 MGA51

Static Water Level: 7.85 mbgl
Date: 17/05/2024
Remarks: PVC Stick-up = 0.67m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0	Transported Clay and Sand		Alluvium: Red-Brown SILT			Surface Casing (0-3m)	
10			Clay: Light grey plastic clay with some brown-red competent lateritic fragments (2-4m)				
			Clay: Brown-orange plastic clay				
20			Clay: Mottled grey to red-brown plastic clay, coming in and out of haematitic to limonitic oxidation		Penetration rate: 30 min/rod Penetration rate: 25 min/rod	Gravel Backfill (3-45m) 50mm Blank PVC Casing (0-52m)	
30					Penetration rate: 25 min/rod		
			Sandy Clay: Grey sticky clay with 35% sub-rounded medium-coarse sand				
40			Clay: Medium to dark grey sticky clay				
					Penetration rate: 50 min/rod	Bentonite Seal (45-48m)	
50			Sandy Clay: Grey sticky clay with 35% sub-rounded fine sand				
	Basal Sand		Clayey Silty Sand: Grey very fine sub-rounded sand (40%) with sticky grey clay (30%) and silt (30%)				
			Sand: Grey to white angular to sub-angular medium to coarse quartz		Max Airlift: 2.0 L/s Final Airlift: 2.0 L/s EC: 190.7 mS/cm pH: 6.28	Graded Gravel Pack 3.2-6.4mm (48-61m) 50mm Slotted PVC Casing 1mm (52-61m)	
60			Sand: Grey medium grained well sorted sub-angular quartz				
	Felsic Basement		Granitic Bedrock: Light grey, angular felsic mineral clasts				

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COMPOSITE WELL LOG

Bore No: BMB017

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

Commenced: 08/03/2024
Completed: 05/04/2023
Drilled: WA Water Bores
Logged By: Alastair Hoare

Method: Mud Rotary
Fluid: Mud
Bit Record: 165mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 326.58 mRL
Easting: 502505.9
Northing: 6630345.2
Projection: GDA2020 MGA51

Static Water Level: 7.91 mbgl
Date: 16/05/2024
Remarks: PVC Stick-up = 0.65m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0			Alluvium: Red-brown SILT			Surface Casing (0-3m)	
	Transported Clay		Clay: Red-brown to light grey clay and Lateritic gravel (<20%)				
10			Sandy Clay: Light grey sticky clay with various degrees of haematitic oxidation (mottled zone) and <20% lateritic gravels				
			Silty Clay: Red-brown semi-plastic silty clay				
			Sandy Silty Clay: Light green-grey sandy silty clay changing to red-brown silty clay, semi-plastic, with poorly sorted fine to coarse sands				
20					Penetration rate: 25 min/rod		
	Gravel		Clayey Sandy Gravel: Grey-red very poorly sorted, fine to very coarse sub-angular to sub-rounded sands and granule sized fragments of grey-red siltstone with clays			Gravel Backfill (3-56m)	
30						50mm Blank PVC Casing (0-52m)	
	Transported Clay		Clay: Light grey-green semi-plastic clay, medium grained sands encountered at bottom of interval				
40			Silty Sandy Gravel: Light grey, very poorly sorted silts to granule sized clasts of siltstone				
			Clayey Silty Sand: Orange-grey clayey sandy silt, semi-consolidated and poorly sorted				
50			Silty Sandy Clay: Yellow-grey silty sandy clay, poorly sorted, semi-plastic clay with fine to medium grained sand and granule sized sub-angular quartz grains.				
						Bentonite Seal (56-59m)	
60			Silty Sandy Clay: Yellow-grey silty clay with poorly sorted sands				
	Basal sands and gravels		Sand: Cream-grey moderately sorted, medium to coarse grained unconsolidated sand			Graded Gravel Pack 3.2-6.4mm (59-77m)	
70			Silty Sandy Clay: Yellow-grey soft silty sandy clay with gravels encountered in final meter.		Max Airlift: 1 L/s Final Airlift: 1 L/s EC: 175.8 mS/cm pH: 5.75	50mm Blank PVC Casing (52-77m)	
			Sandy Gravel: Orange-brown, poorly sorted, fine ot coarse grained sand and granule sized quartz, sub-angular to angular. Grain size increasing with depth.			Gravel Backfill (74-77m)	
80							

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COMPOSITE WELL LOG

Bore No: BMB019

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

Commenced: 06/04/2024
Completed: 10/04/2024
Drilled: WA Water Bores
Logged By: Yannick Magyar

Method: Mud Rotary
Fluid: Mud
Bit Record: 165mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 326.95 mRL
Easting: 501928.0
Northing: 6629374.8
Projection: GDA2020 MGA51

Static Water Level: 8.53 mbgl
Date: 16/05/2023
Remarks: PVC Stick-up = 0.75m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0 – 10	Transported Clay		Alluvium: Red-Brown silt with <5% fine sand			Surface Casing (0-3m)	
			Clay: Grey-Brown sticky kaolinitic clay with limonitic alteration and 10-20% gravel sized lateritic fragments (reduced limonitic alteration below 6m), 5% sub-rounded medium grained quartz (13-17m).				
10 – 20			Sandy Clay: Light Grey, kaolinitic clay with 10% dark red haematitic laterite and <5% medium grained sub-angular quartz (increasing to 10% from 27m)				
20 – 30			Clayey Sand: Grey, moderately sorted, medium to coarse, angular to sub-angular quartz (>50%) and light grey plastic clay		Penetration rate: 20 min/rod	Gravel Backfill (3-54m)	
			Sandy Clay: Light grey sticky clay with <20% moderately sorted, medium to coarse, angular to sub-angular quartz. Gravel sized, angular to sub-angular quartz (25%) and gravel sized mafic lithic fragments (10%) at 39-40m.			50mm Blank PVC Casing (0-60m)	
30 – 40			Sandy Clay: Grey sticky clay with moderately sorted, medium to coarse, angular to sub-angular quartz (10-20%)				
40 – 50			Sandy Gravelly Clay: Grey-Green sticky clay with moderately sorted, coarse to gravel sized, angular to sub-angular quartz (35%).				
50 – 60			Clayey Sandy Gravel: Grey, poorly sorted, very coarse to gravel sized, angular to sub-angular quartz with 25% clay		Penetration rate: 30 min/rod	Bentonite Seal (54-57m)	
	Saprolite		Gravel: Grey-Brown angular to sub-angular poorly sorted quartz and feldspar gravel with <10% clay		Max Airlift: 0.90 L/s Final Airlift: 0.71 L/s EC: 179.0 mS/cm pH: 6.61	Graded Gravel Pack 3.2-6.4mm (57-66m)	
60 – 70			Saprolitic Clay: Green-Grey sticky clays with medium to gravel sized quartz and feldspar (35-65%).			50mm Slotted 1mm PVC Casing (60-66m)	
70 – 80	Bedrock		Bedrock: Dark-Grey silicified angular lithic fragments with 10% quartz			Gravel Backfill (66-83m)	
80 – 90							

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COMPOSITE WELL LOG

Bore No: BMB030

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

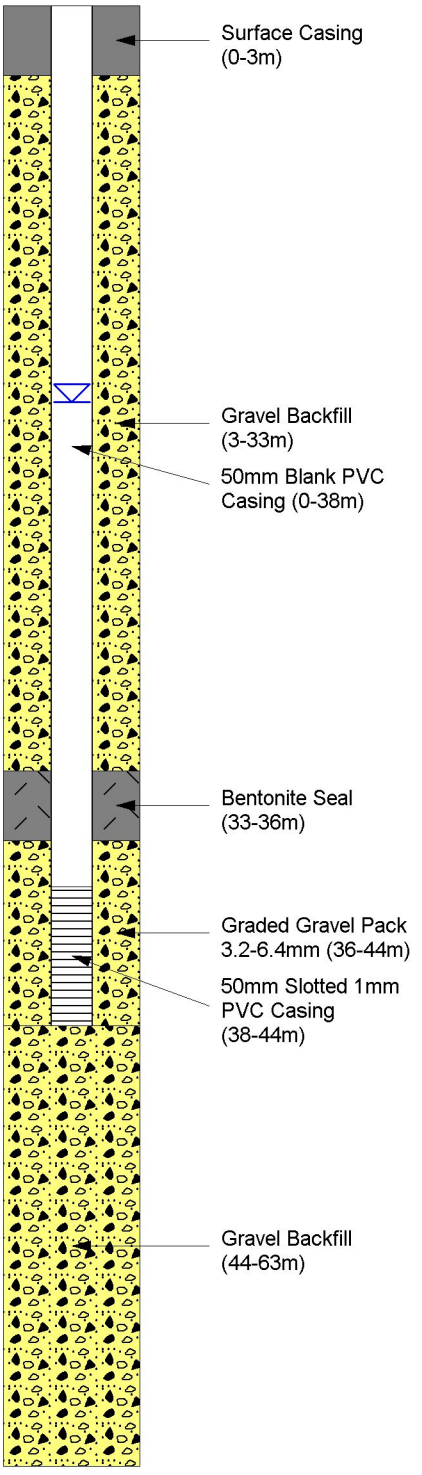
Commenced: 10/04/2024
Completed: 18/04/2024
Drilled: WA Water Bores
Logged By: Tom Onslow

Method: Mud Rotary
Fluid: Mud
Bit Record: 165mm
Bit Record 2:

Area: Lake Rebecca
Elevation: 330.12 mRL
Easting: 503994.8
Northing: 6626082.2
Projection: GDA2020 MGA51

Static Water Level: 17.08 mbgl
Date: 16/05/2024
Remarks: PVC Stick-up = 0.80m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0 – 10	Alluvium		Alluvium: Red-Brown clayey silt. Unconsolidated and poorly sorted. 10% coarse-grained iron-stained sand between 4 - 5 mbgl.				
10 – 20	Laterite		Laterite: Red-brown coarse sand to pebble-sized angular fragments of friable material. 5-10% sub-angluar medium to granulitic sized quartz and 10% silt.				
			Siltstone: White with very fine-grained sand with light grey/white (carbonate poor) siliceous cement.				
			Laterite: Red-dark brown iron-rich hardground angular fragments. Geothite and dark red heamatite staining.				
20 – 30	Transported Clay		Silty Clay: Mid-grey plastic silty clay (60%) and angular fragments of white or dark red/brown duricrust (18-21m).				
			No Sample				
			Clay: Mid-grey to buff yellowish-brown semi-consolidated clay. Red/purple colour from 26 m.				
40	Basal Sand		Silty Sand: Very poorly sorted, very fine to granulitic sized, angular to sub-angular quartz sand with up to 20% silt (40-41m).				
	Clay		Sandy Silty Clay: Grey-yellow silty clay with haematite and limonite stained silt to fine gravel-sized angular quartz.				
50	Saprolite		Saprolitic Clay: Greyish yellow/green sticky semi-plastic clay with 10% leucocratic quartzite chips.				
			Quartzite. Granoblastic texture of fused medium-grained (0.75 - 1.0 mm) equigranular crystals.				
60			Saprolitic Clay: Greyish yellow/green semi-plastic saprolitic clay (75%) and quartzite chips (25%).				
					High permeability/ drilling fluid loss (15-22mbgl)		
					Max Airlift: 0.82 L/s Final Airlift: 0.71 L/s EC: 139.2 mS/cm pH: 4.47		



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COMPOSITE WELL LOG

Bore No: BMB050

Client: Ramelius Resources
Project: Lake Rebecca Water Bore Drilling

Commenced: 24/04/2024
Completed: 27/04/2024
Drilled: WA Water Bores
Logged By: Yannick Magyar

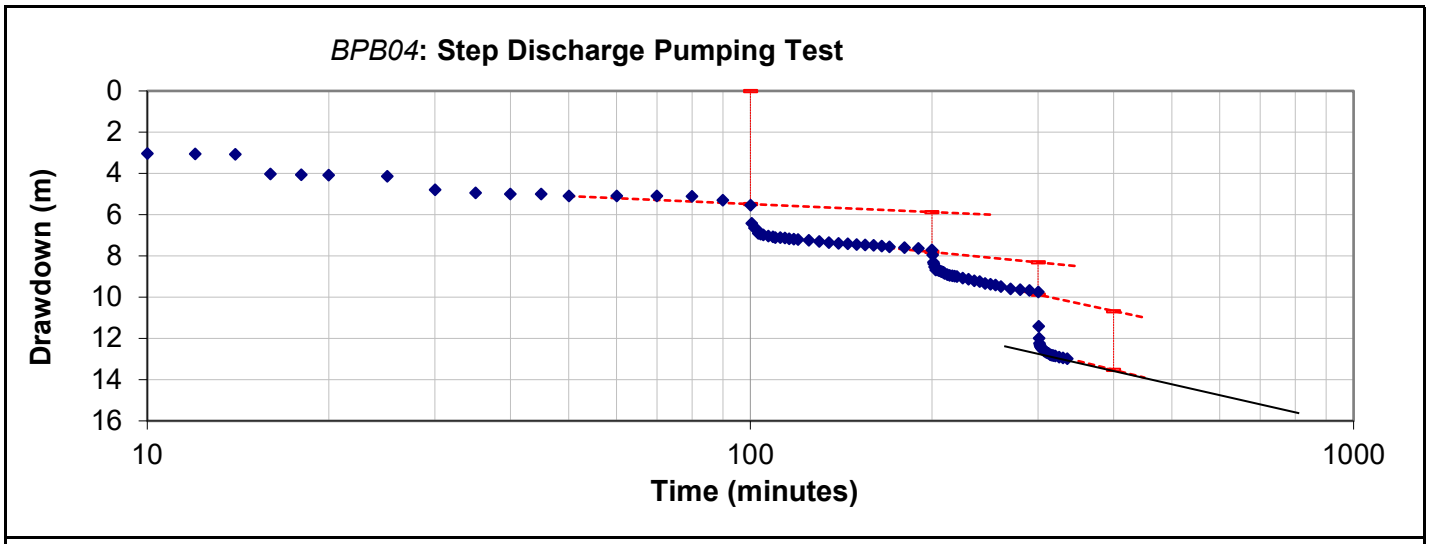
Method: Mud Rotary
Fluid: Mud
Bit Record: 165mm
Bit Record 2:

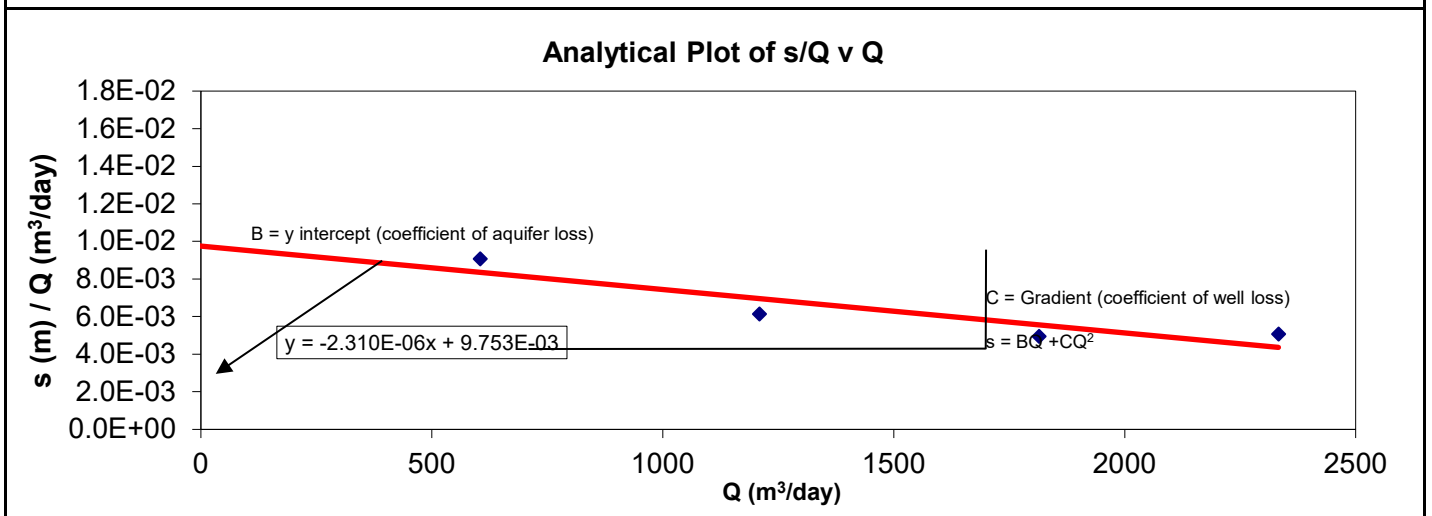
Area: Lake Rebecca
Elevation: 325.42 mRL
Easting: 505688.3
Northing: 6634730.7
Projection: GDA2020 MGA51

Static Water Level: 7.87 mbgl
Date: 17/05/2024
Remarks: PVC Stick-up = 0.71m

Depth (mbgl)	Strat	Graphic Log	Lithological Description	Aquifer	Field Notes	Well Completion: Diagram	Well Completion: Notes
0 – 3	Transported Clay		Alluvium: Red-brown silt and fine angular sand.			Surface Casing	(0-3m)
3 – 10	Transported Clay		Clay: Grey-red plastic clay changing from haematitic to limonitic staining with depth.				
10 – 20	Transported Clay		Clay: Brown-orange plastic clay, pervasive limonitic staining.				
20 – 30	Transported Clay		Clay: Grey-brown plastic clay with variable limonitic staining.			Gravel Backfill	(3-53m)
30 – 40	Transported Clay		Clay: Light grey-red plastic clay with streaks of haematite staining.			50mm Blank PVC	(0-59m)
40 – 50	Transported Clay		Clay: Grey-red plastic clay with haematite and limonite staining.				
50 – 53	Transported Clay		Sandy Clay: Grey-red plastic clay with 5% sub-rounded fine sand.		Penetration rate: 30 min/rod	Bentonite Seal	(53-56m)
53 – 60	Basal Sands and Gravels		Clayey Sand: Grey-brown, moderately sorted, medium to coarse, sub-angular quartz with iron oxide staining and 35% sticky clay				
60 – 70	Basal Sands and Gravels		Gravelly Sand: Grey-brown, poorly sorted, medium to gravel sized, sub-rounded quartz, 40% silt (62-64m).			Graded Gravel Pack	3.2-6.4mm (56-77m)
70 – 77	Basal Sands and Gravels		Silty Gravelly Sand: Dark grey-black, moderately sorted, medium to gravel sized (10%), sub-rounded quartz with up to 10% black silt.			50mm Slotted 1mm PVC	(59-77m)
77 – 80	Basal Sands and Gravels		Gravelly Sand: Grey, poorly sorted very fine (80%) to gravel sized, sub-angular quartz.		Max Airlift: 2.0 L/s Final Airlift: 2.0 L/s EC: 194.7 mS/cm pH: 6.78	Gravel Backfill	(77-82m)
80 – 90	Saprolitic Clay		Saprolitic Clay: Grey, sticky clay with gravel sized clasts of quartz (<25%)				

APPENDIX G
RESULTS OF HYDRAULIC TESTING





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)
C = Gradient (coefficient of turbulent flow loss or apparent well loss)
s = Drawdown in the borehole
P = Value determined using Rorabaugh's method of superposition

Components of Jacob's (1947) equation BQ and CQ^2 are termed the aquifer loss and apparent well loss respectively. They give an indication of the proportion of total drawdown caused by laminar and turbulent flow.

Please note:
1. In thin or fissured aquifers large components of well loss are due to high flow velocities in the aquifer rather than inefficient bore design. Therefore, the term "apparent well loss" is better than well loss.
2. In aquifers where the flow horizons are vertically anisotropic, changes in bore performance often relate to changes in the rest water level with respect to the primary aquifer horizons.

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

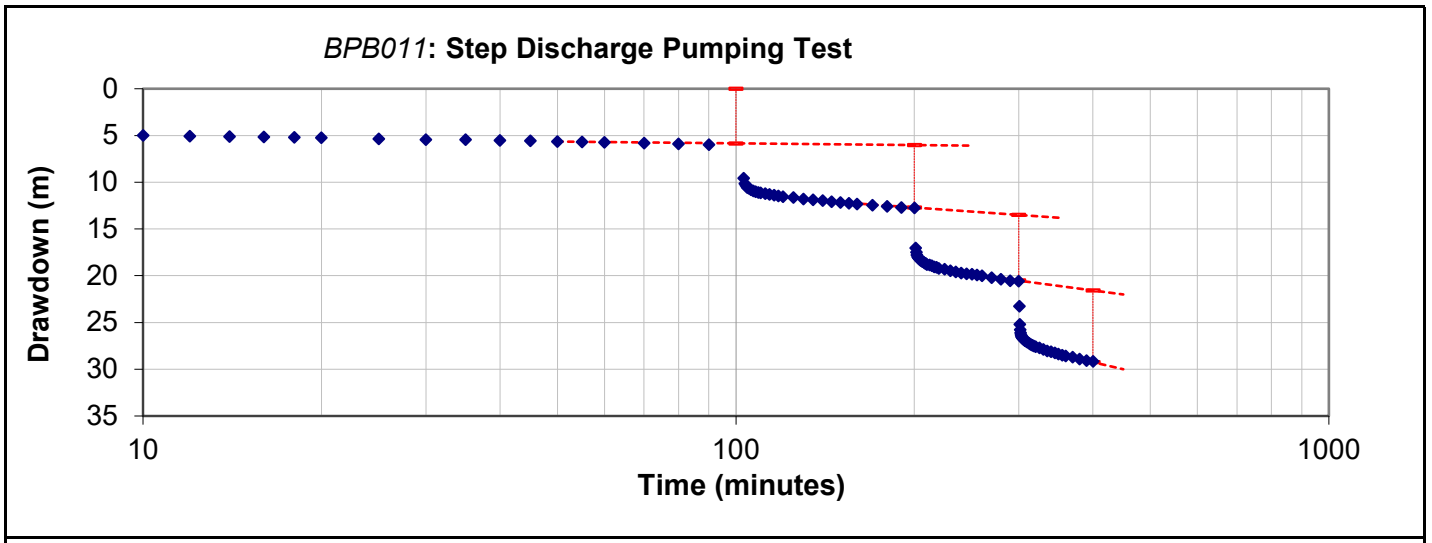
From plot of s/Q v Q (trend line equation):

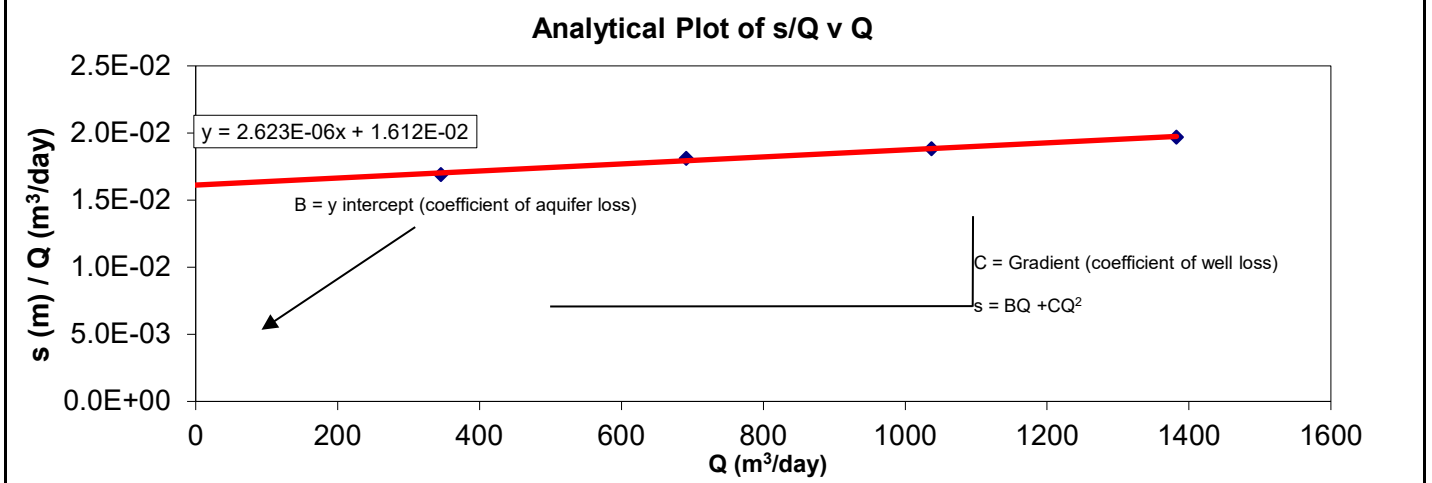
Intercept (B) 9.753E-03
Gradient (C) -2.310E-06

ANALYSIS TABLE

Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Measured Incremental Drawdown (metres)	Corrected Drawdown (metres)	Predicted Drawdown (metres)	s/Q	Apparent Efficiency (Ew) %
1	7.0	605	5.49	5.49	5.05	9.07E-03	116.7
2	14.0	1210	1.93	7.42	8.42	6.13E-03	140.2
3	21.0	1814	1.57	8.99	10.09	4.96E-03	175.4
4	27.0	2333	2.85	11.84	10.18	5.08E-03	223.5





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)
C = Gradient (coefficient of turbulent flow loss or apparent well loss)
s = Drawdown in the borehole
P = Value determined using Rorabaugh's method of superposition

Components of Jacob's (1947) equation BQ and CQ^2 are termed the aquifer loss and apparent well loss respectively. They give an indication of the proportion of total drawdown caused by laminar and turbulent flow.

Please note:
1. In thin or fissured aquifers large components of well loss are due to high flow velocities in the aquifer rather than inefficient bore design. Therefore, the term "apparent well loss" is better than well loss.
2. In aquifers where the flow horizons are vertically anisotropic, changes in bore performance often relate to changes in the rest water level with respect to the primary aquifer horizons.

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

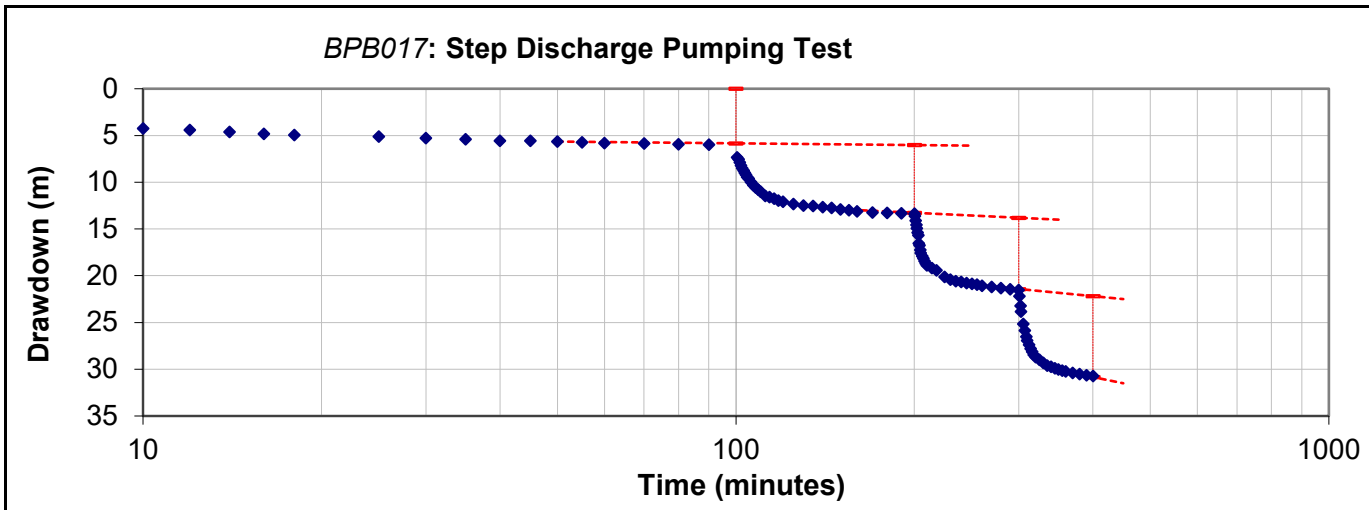
From plot of s/Q v Q (trend line equation):

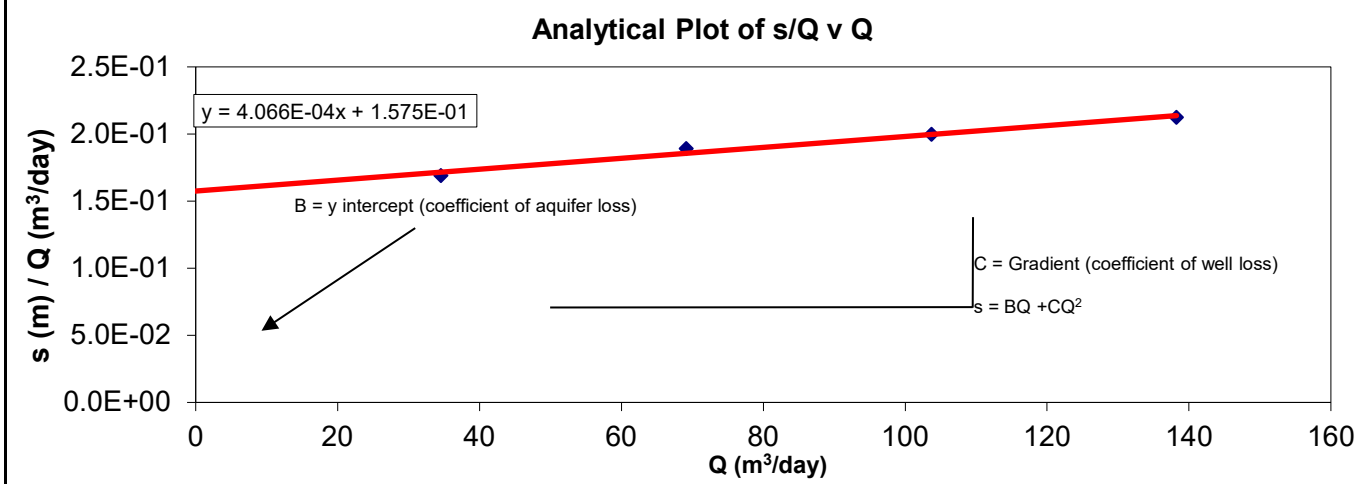
Intercept (B) 1.612E-02
Gradient (C) 2.623E-06

ANALYSIS TABLE

Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Measured Incremental Drawdown (metres)	Corrected Drawdown (metres)	Predicted Drawdown (metres)	s/Q	Apparent Efficiency (Ew) %
1	4.0	346	5.84	5.84	5.88	1.69E-02	94.7
2	8.0	691	6.67	12.52	12.40	1.81E-02	89.9
3	12.0	1037	7.02	19.53	19.53	1.88E-02	85.6
4	16.0	1382	7.68	27.21	27.30	1.97E-02	81.6





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)
C = Gradient (coefficient of turbulent flow loss or apparent well loss)
s = Drawdown in the borehole
P = Value determined using Rorabaugh's method of superposition

Components of Jacob's (1947) equation BQ and CQ^2 are termed the aquifer loss and apparent well loss respectively. They give an indication of the proportion of total drawdown caused by laminar and turbulent flow.

Please note:
1. In thin or fissured aquifers large components of well loss are due to high flow velocities in the aquifer rather than inefficient bore design. Therefore, the term "apparent well loss" is better than well loss.
2. In aquifers where the flow horizons are vertically anisotropic, changes in bore performance often relate to changes in the rest water level with respect to the primary aquifer horizons.

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

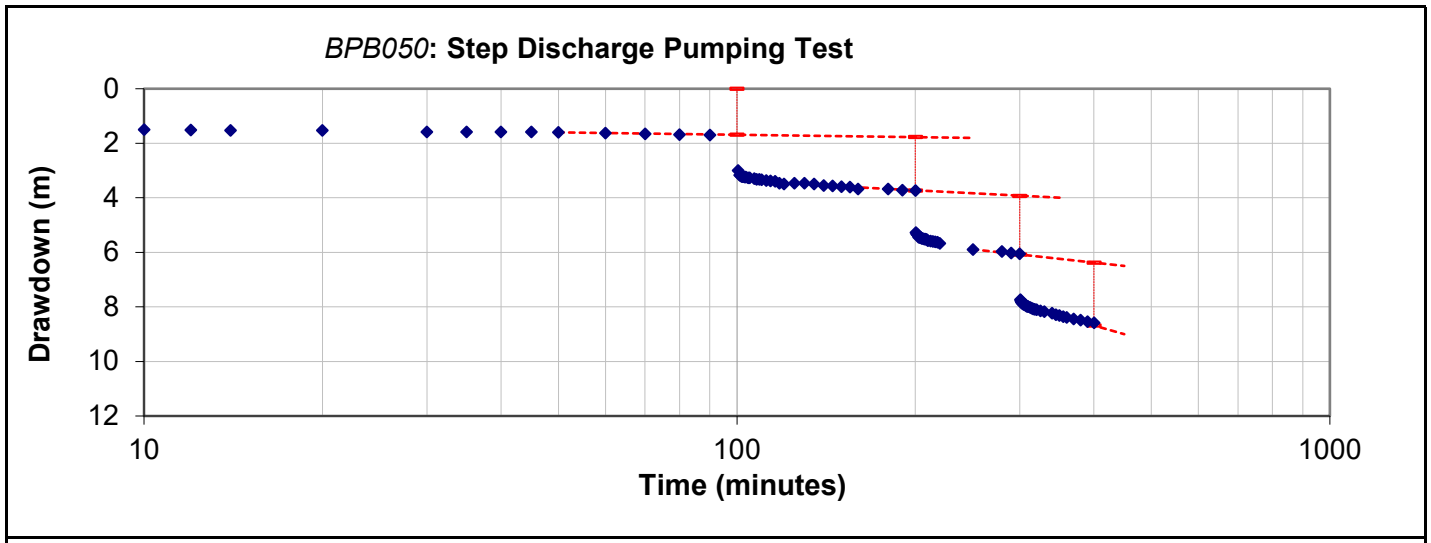
From plot of s/Q v Q (trend line equation):

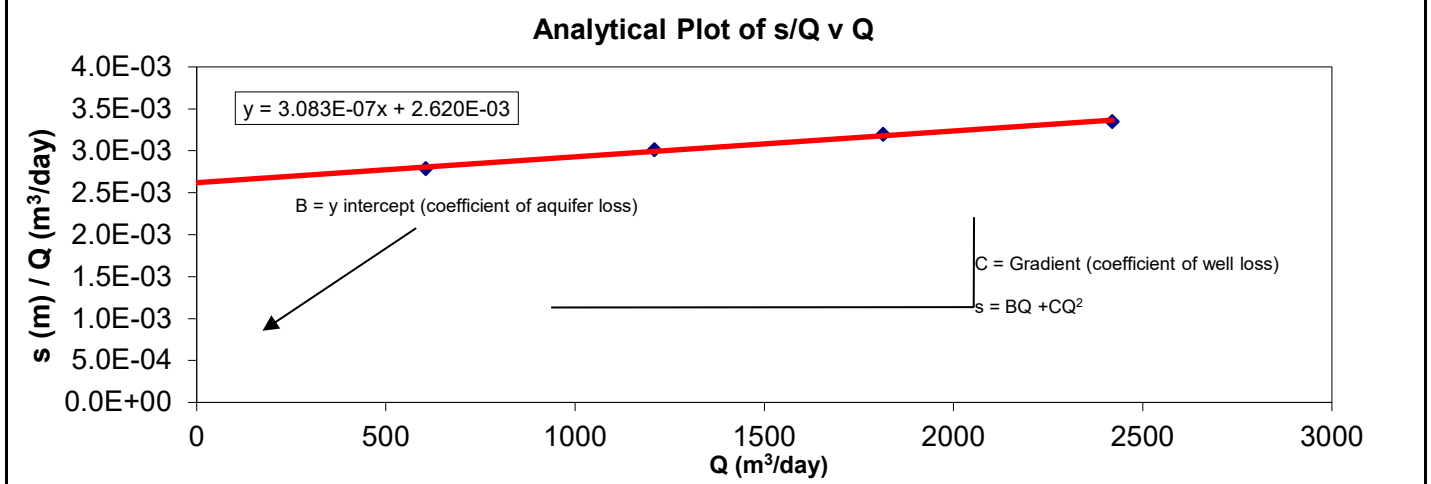
Intercept (B) 1.575E-01
Gradient (C) 4.066E-04

ANALYSIS TABLE

Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Measured Incremental Drawdown (metres)	Corrected Drawdown (metres)	Predicted Drawdown (metres)	s/Q	Apparent Efficiency (Ew) %
1	0.4	35	5.84	5.84	5.93	1.69E-01	91.8
2	0.8	69	7.24	13.08	12.83	1.89E-01	84.9
3	1.2	104	7.63	20.71	20.70	2.00E-01	78.9
4	1.6	138	8.65	29.37	29.54	2.12E-01	73.7





$s_{w(n)} = BQ_n + CQ_n^P$ (Rorabaugh's equation)

Where: B = Intercept with y axis (coefficient of aquifer loss or laminar flow)
C = Gradient (coefficient of turbulent flow loss or apparent well loss)
s = Drawdown in the borehole
P = Value determined using Rorabaugh's method of superposition

Components of Jacob's (1947) equation BQ and CQ^2 are termed the aquifer loss and apparent well loss respectively. They give an indication of the proportion of total drawdown caused by laminar and turbulent flow.

Please note:
1. In thin or fissured aquifers large components of well loss are due to high flow velocities in the aquifer rather than inefficient bore design. Therefore, the term "apparent well loss" is better than well loss.
2. In aquifers where the flow horizons are vertically anisotropic, changes in bore performance often relate to changes in the rest water level with respect to the primary aquifer horizons.

$Ew = (BQ/(BQ + CQ^P)) \times 100$

Ew or Well Efficiency represents the proportion of drawdown caused by laminar flow

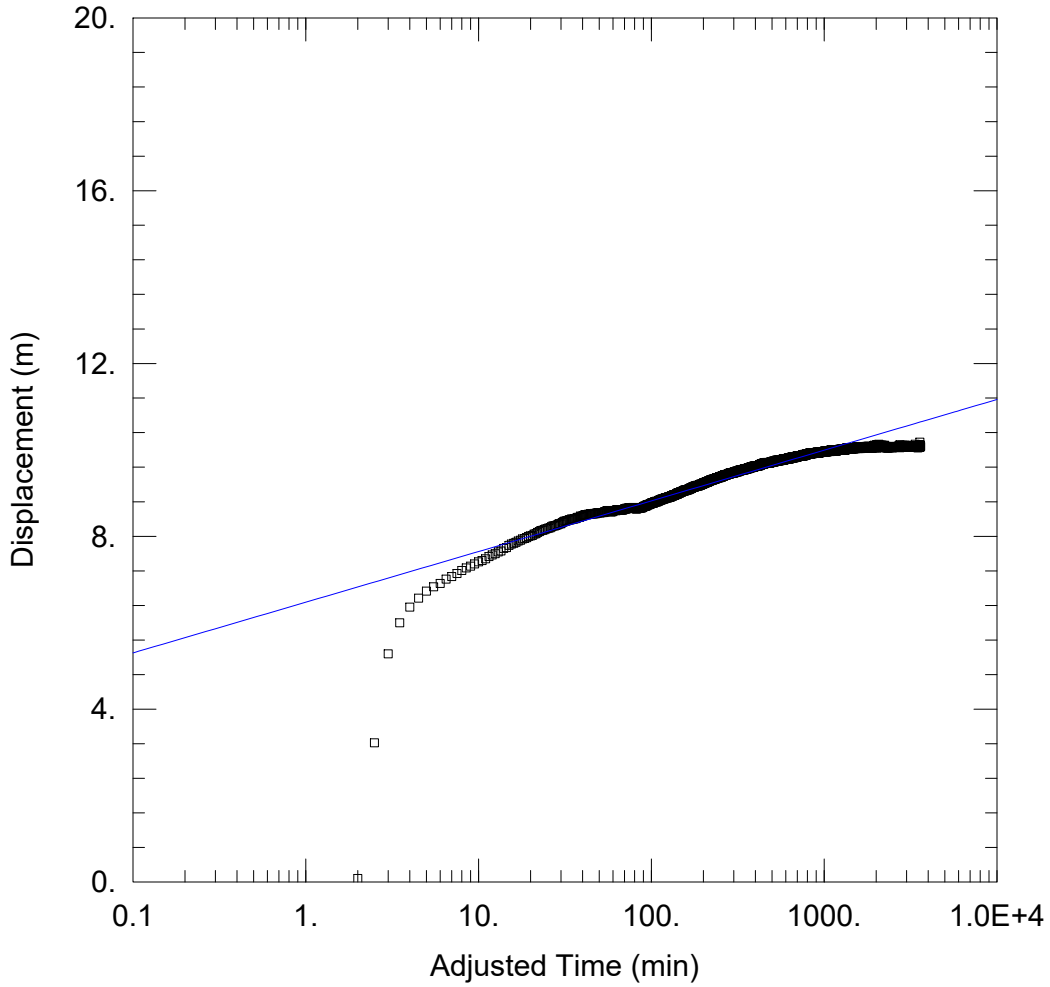
From plot of s/Q v Q (trend line equation):

Intercept (B) 2.620E-03
Gradient (C) 3.083E-07

ANALYSIS TABLE

Calculation of well efficiency and comparison of observed and predicted drawdowns

Step (60 minute duration)	Discharge (l/s)	Discharge (Q) (m^3/d)	Measured Incremental Drawdown (metres)	Corrected Drawdown (metres)	Predicted Drawdown (metres)	s/Q	Apparent Efficiency (Ew) %
1	7.0	605	1.69	1.69	1.70	2.79E-03	93.4
2	14.0	1210	1.96	3.64	3.62	3.01E-03	87.5
3	21.0	1814	2.15	5.80	5.77	3.19E-03	82.4
4	28.0	2419	2.30	8.10	8.14	3.35E-03	77.8



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB004
Test Date: 13/08/24

AQUIFER DATA

Saturated Thickness: 25. m

Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477

Observation Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477

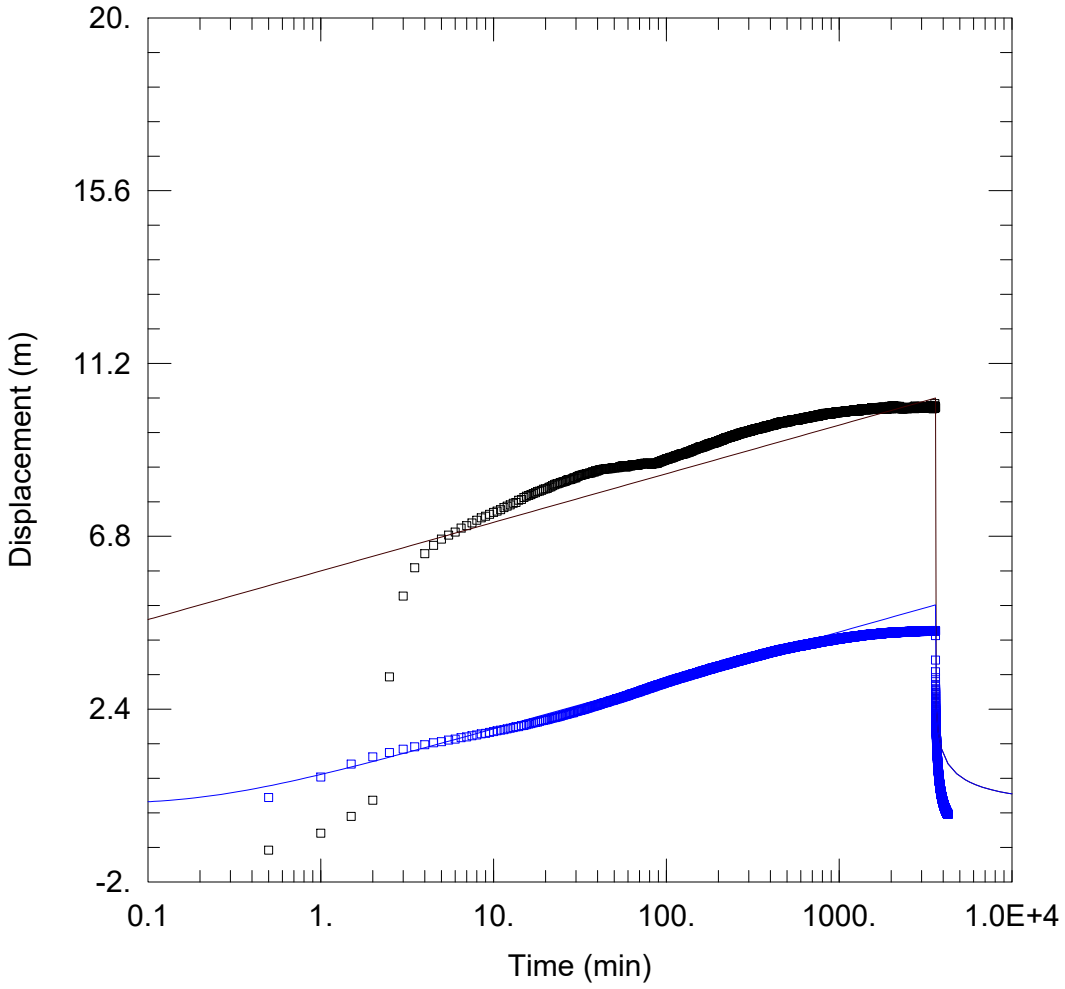
SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Jacob

T = 283.4 m^2/day

S = 0.0001338



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB004
Test Date: 13/08/24

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477

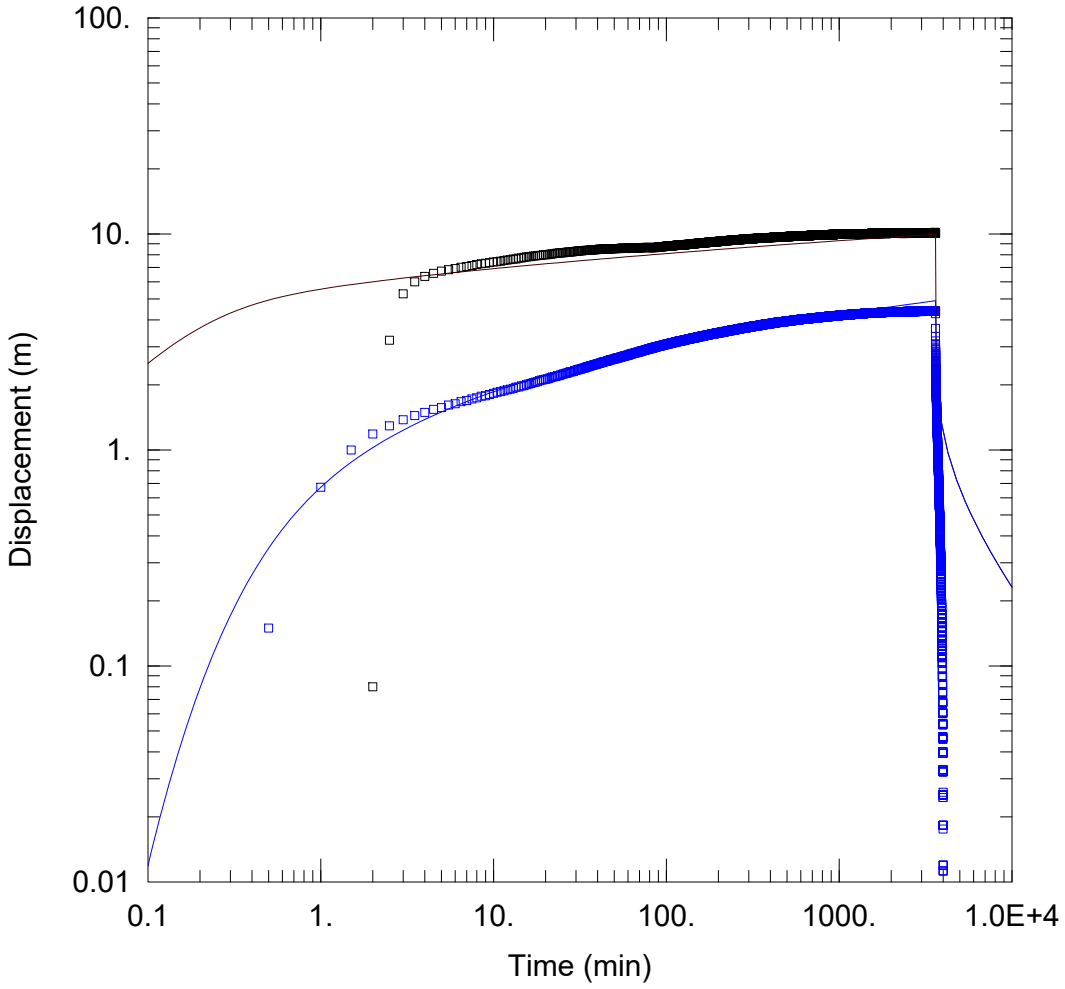
Observation Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477
BMB004D	502275	6636483
BMB004S	502280	6636483

SOLUTION

Aquifer Model: Confined
T = 268.6 m^2/day
Kz/Kr = 0.01

Solution Method: Theis
S = 0.0006944
b = 25. m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB004
Test Date: 13/08/24

AQUIFER DATA

Saturated Thickness: 25. m

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477

Observation Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477
BMB004D	502275	6636483
BMB004S	502280	6636483

SOLUTION

Aquifer Model: Confined

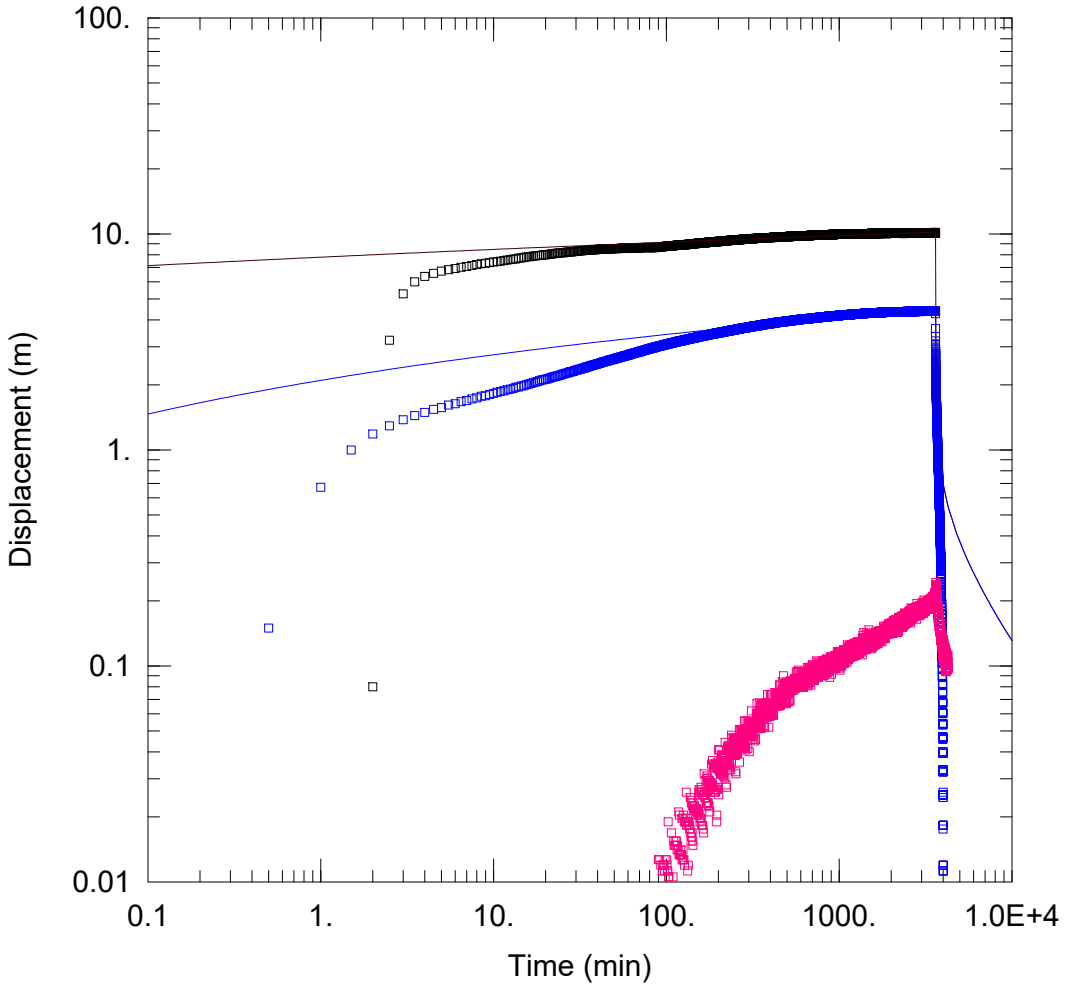
Solution Method: Papadopulos-Cooper

T = 279.7 m^2/day

S = 0.0006573

r(w) = 0.1 m

r(c) = 0.1 m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB004
Test Date: 13/08/24

AQUIFER DATA

Saturated Thickness: 25. m
Aquitard Thickness (b'): 50. m

Anisotropy Ratio (Kz/Kr): 0.1
Aquitard Thickness (b"): 5. m

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477

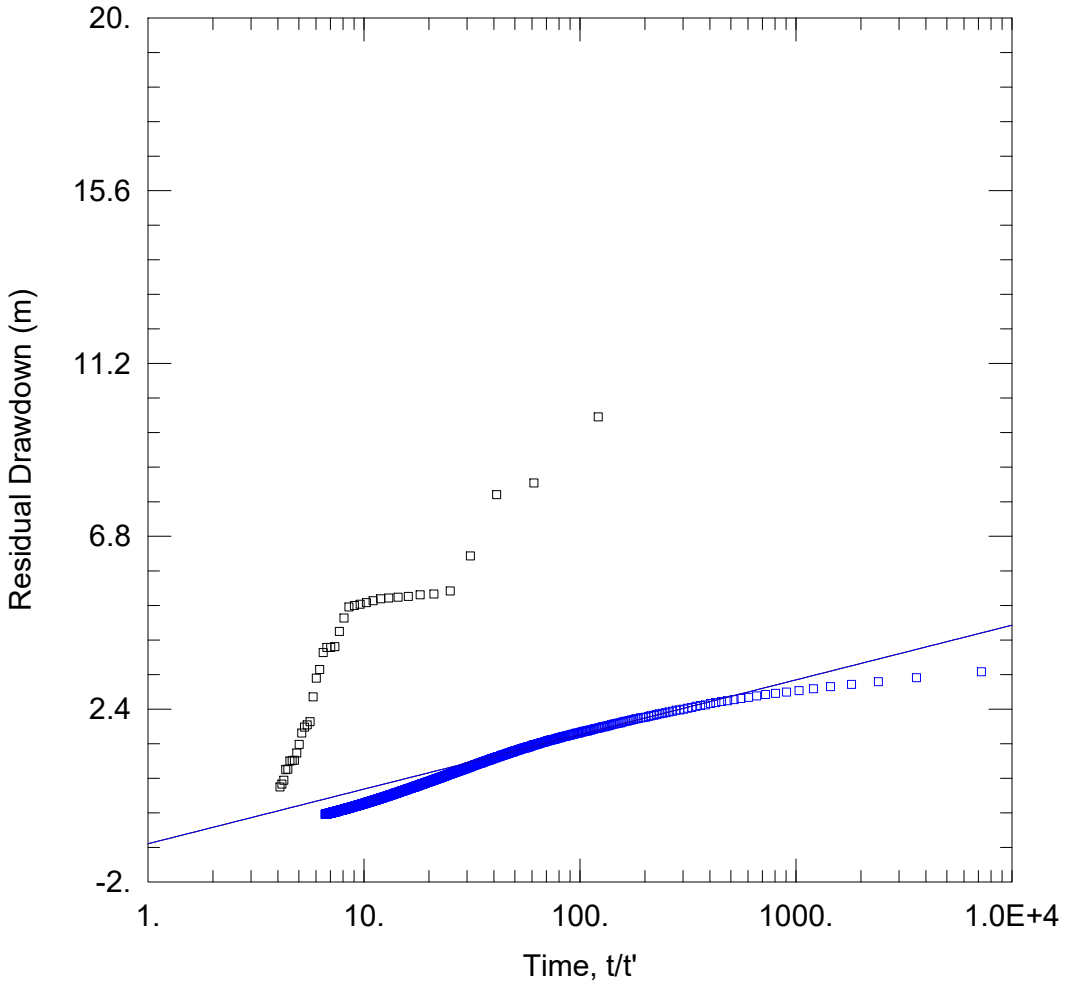
Observation Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477
BMB004D	502275	6636483
BMB004S	502280	6636483

SOLUTION

Aquifer Model: Leaky
Solution Method: Neuman-Witherspoon

T = 246.9 m^2/day



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB004
Test Date: 13/08/24

AQUIFER DATA

Saturated Thickness: 25. m

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477

Observation Wells

Well Name	X (m)	Y (m)
BPB004	502263	6636477
BMB004D	502275	6636483
BMB004S	502280	6636483

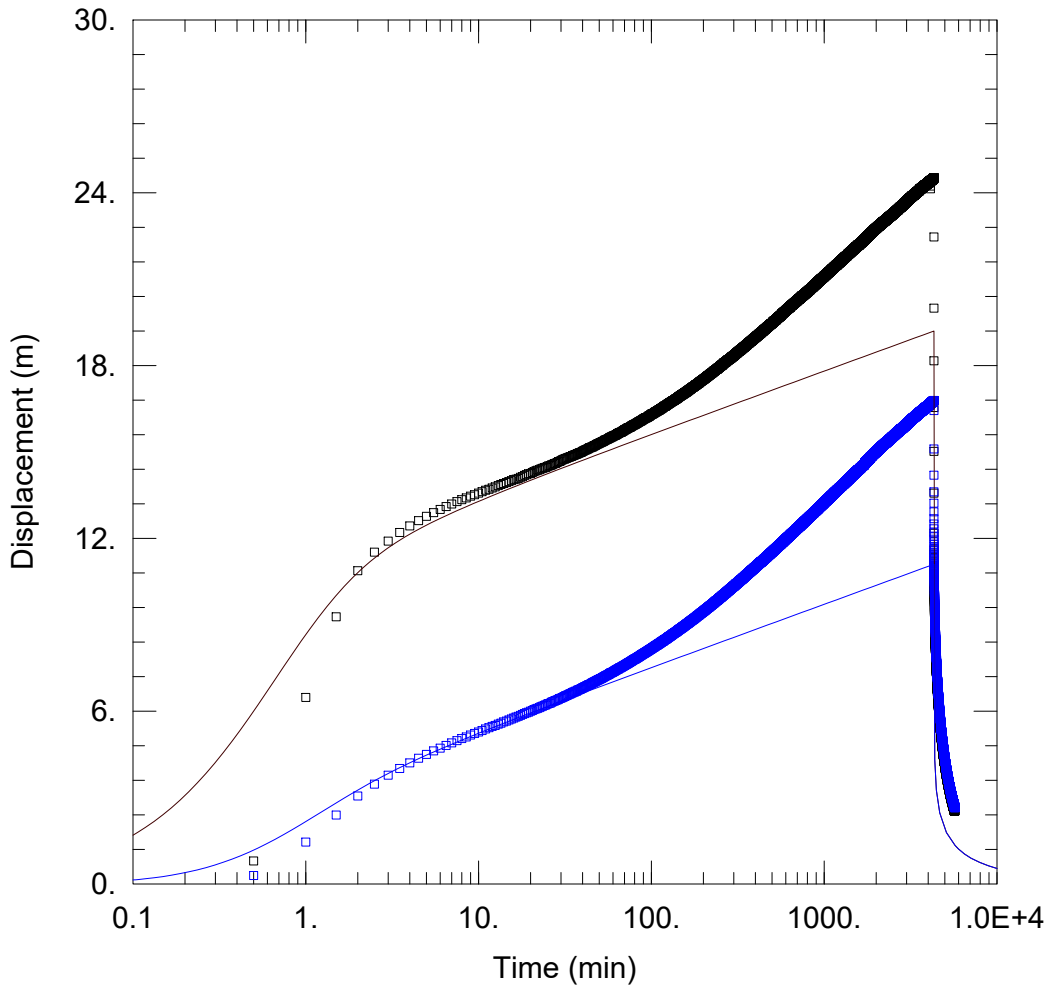
SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 239. m^2/day

S/S' = 5.488



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB011
Test Date: 13/08/24

AQUIFER DATA

Saturated Thickness: 8. m

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB011	501844	6633142

Observation Wells

Well Name	X (m)	Y (m)
BPB011	501844	6633142
BMB011	501845	6633135

SOLUTION

Aquifer Model: Confined

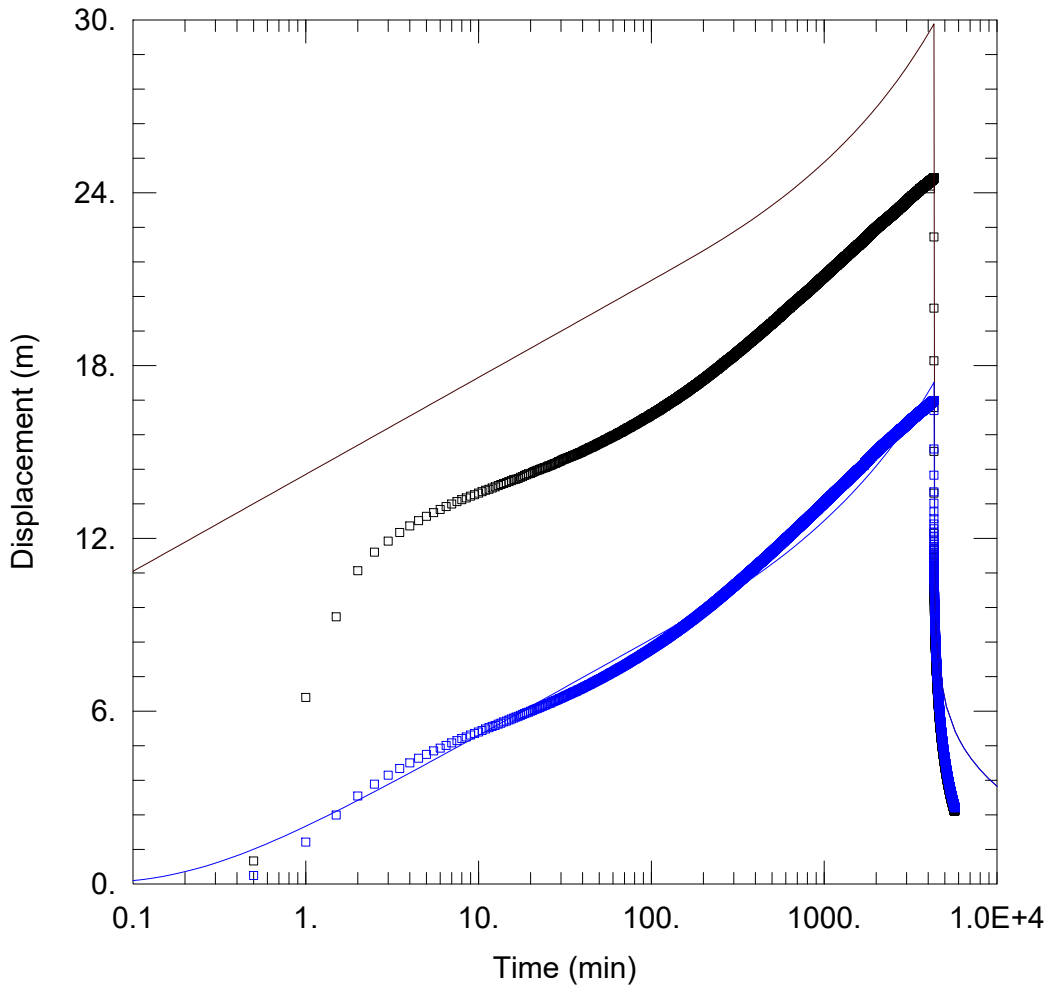
Solution Method: Papadopulos-Cooper

T = 72.31 m^2/day

S = 8.287E-5

r(w) = 0.1 m

r(c) = 0.1 m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB011
Test Date: 13/08/24

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB011	501844	6633142

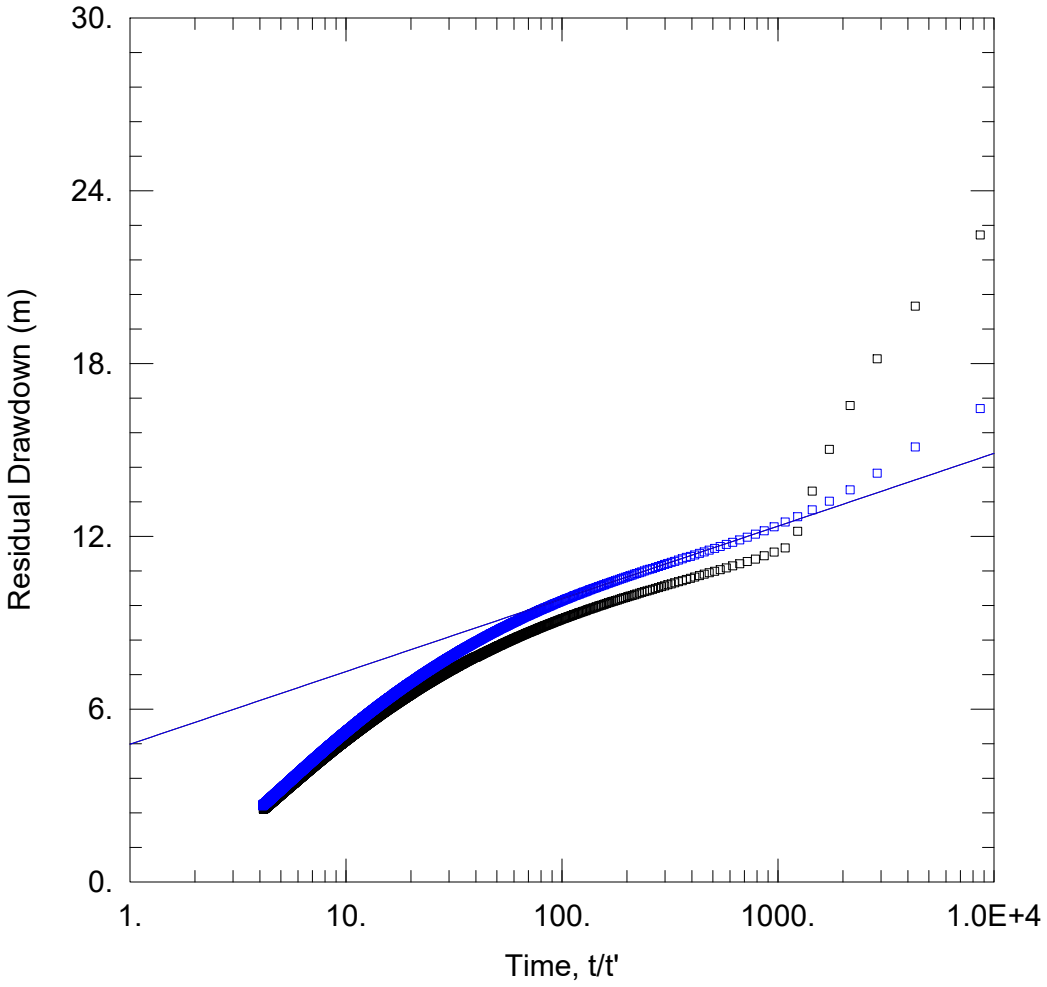
Observation Wells

Well Name	X (m)	Y (m)
▫ BPB011	501844	6633142
▫ BMB011	501845	6633135

SOLUTION

Aquifer Model: Confined
T = 47.03 m^2/day
Kz/Kr = 0.1

Solution Method: Theis
S = 0.0004377
b = 8. m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB011
Test Date: 13/08/24

AQUIFER DATA

Saturated Thickness: 8. m

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB011	501844	6633142

Observation Wells

Well Name	X (m)	Y (m)
BPB011	501844	6633142
BMB011	501845	6633135

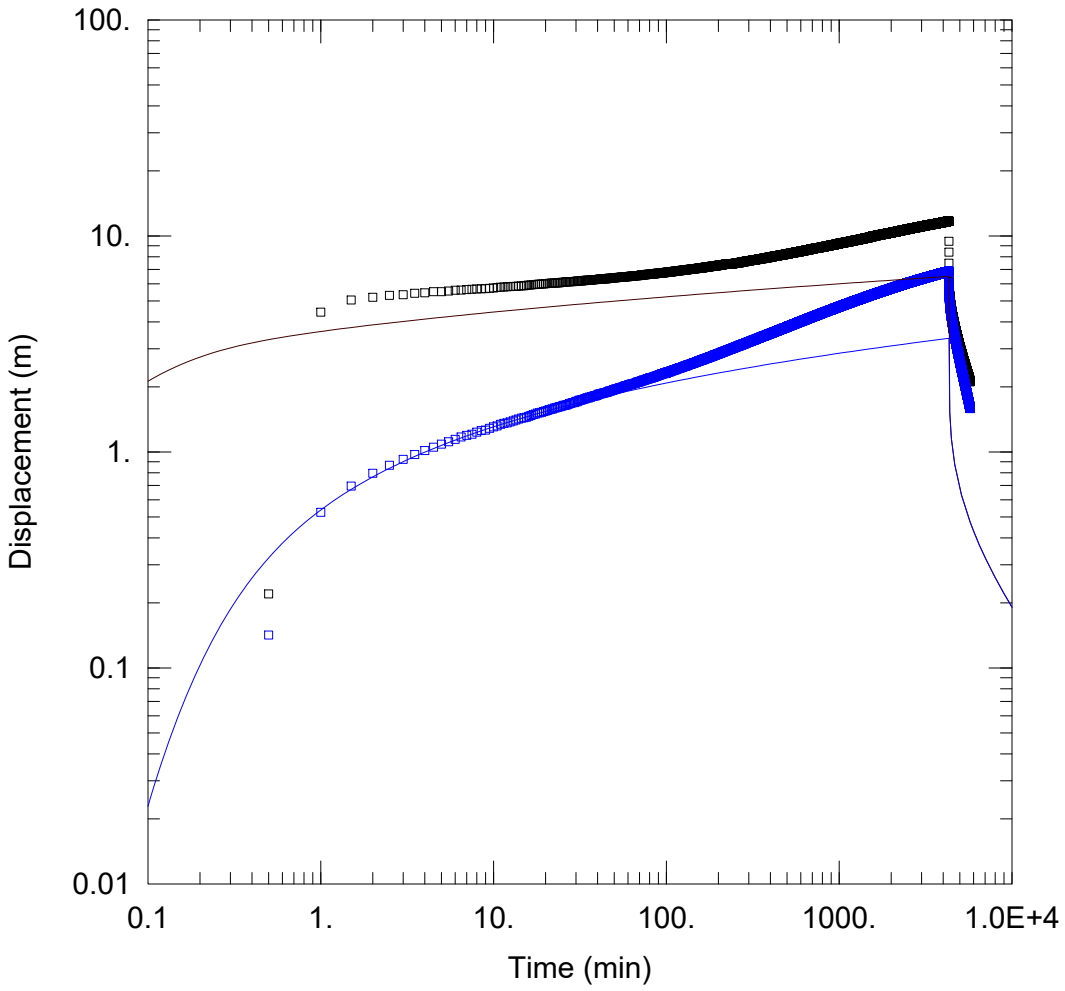
SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 62.72 m^2/day

S/S' = 0.01278



WELL TEST ANALYSIS

Data Set: C:\Users\Basia.Kozikowska\Desktop\Ramelius TP\BPB050\analysis\BPB050b.aqt
Date: 10/12/25 Time: 21:17:44

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB050
Test Date: 13/08/24

AQUIFER DATA

Saturated Thickness: 20. m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB050	505685	6634740

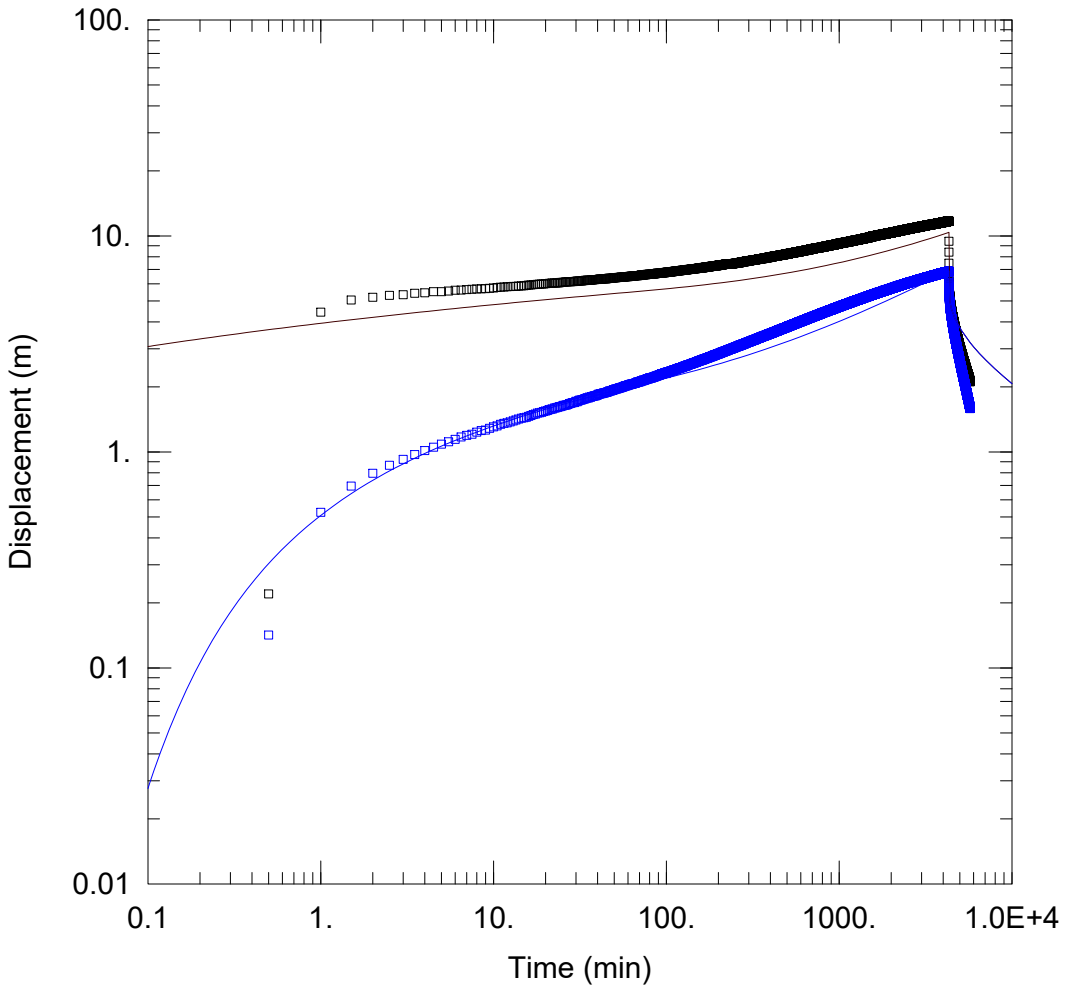
Observation Wells

Well Name	X (m)	Y (m)
▫ BPB050	505685	6634740
▫ BMB050	505688	6634730

SOLUTION

Aquifer Model: Confined Solution Method: Papadopulos-Cooper

T = 488.6 m^2/day S = 0.001459
r(w) = 0.1 m r(c) = 0.1 m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB050
Test Date: 13/08/24

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB050	505685	6634740

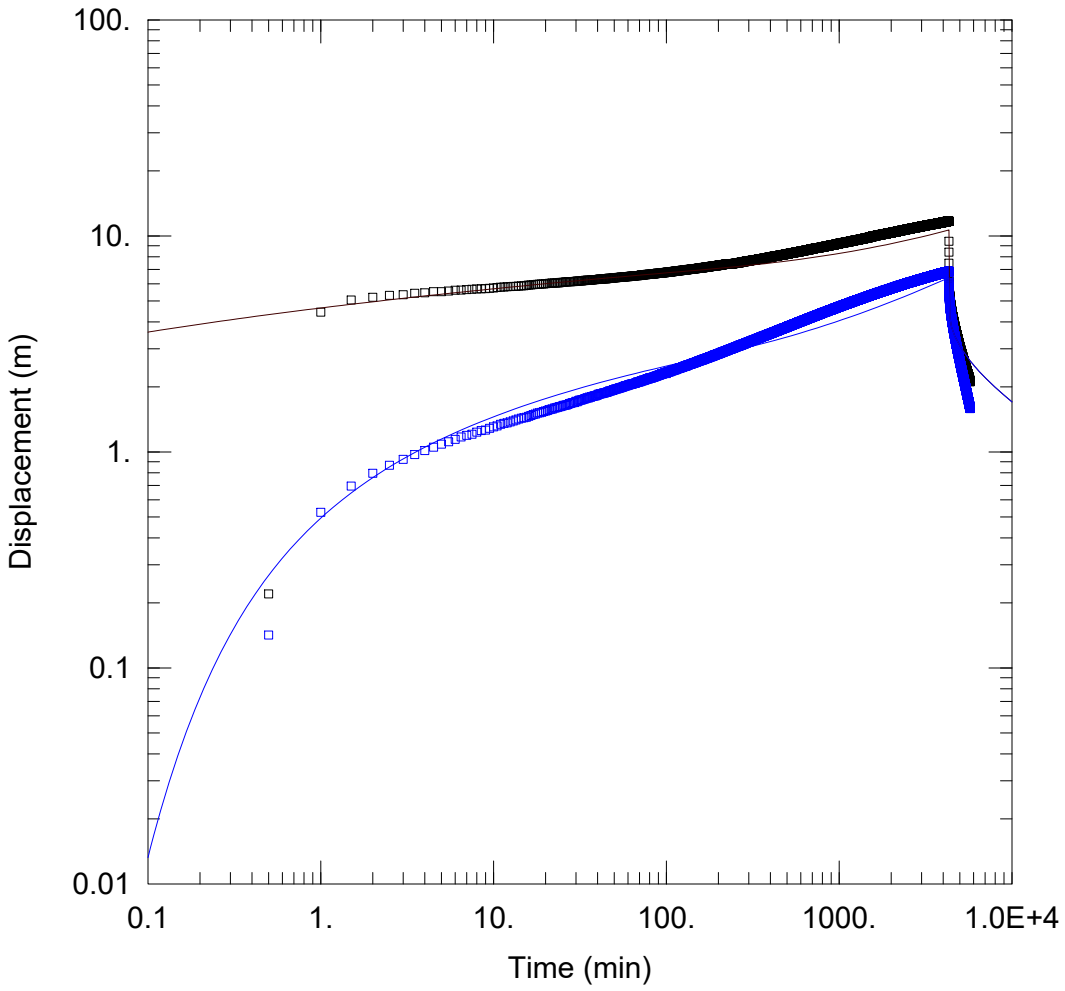
Observation Wells

Well Name	X (m)	Y (m)
▫ BPB050	505685	6634740
▫ BMB050	505688	6634730

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 439.2 m^2/day
S = 0.001914
Kz/Kr = 0.1
b = 20. m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB050
Test Date: 13/08/24

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB050	505685	6634740

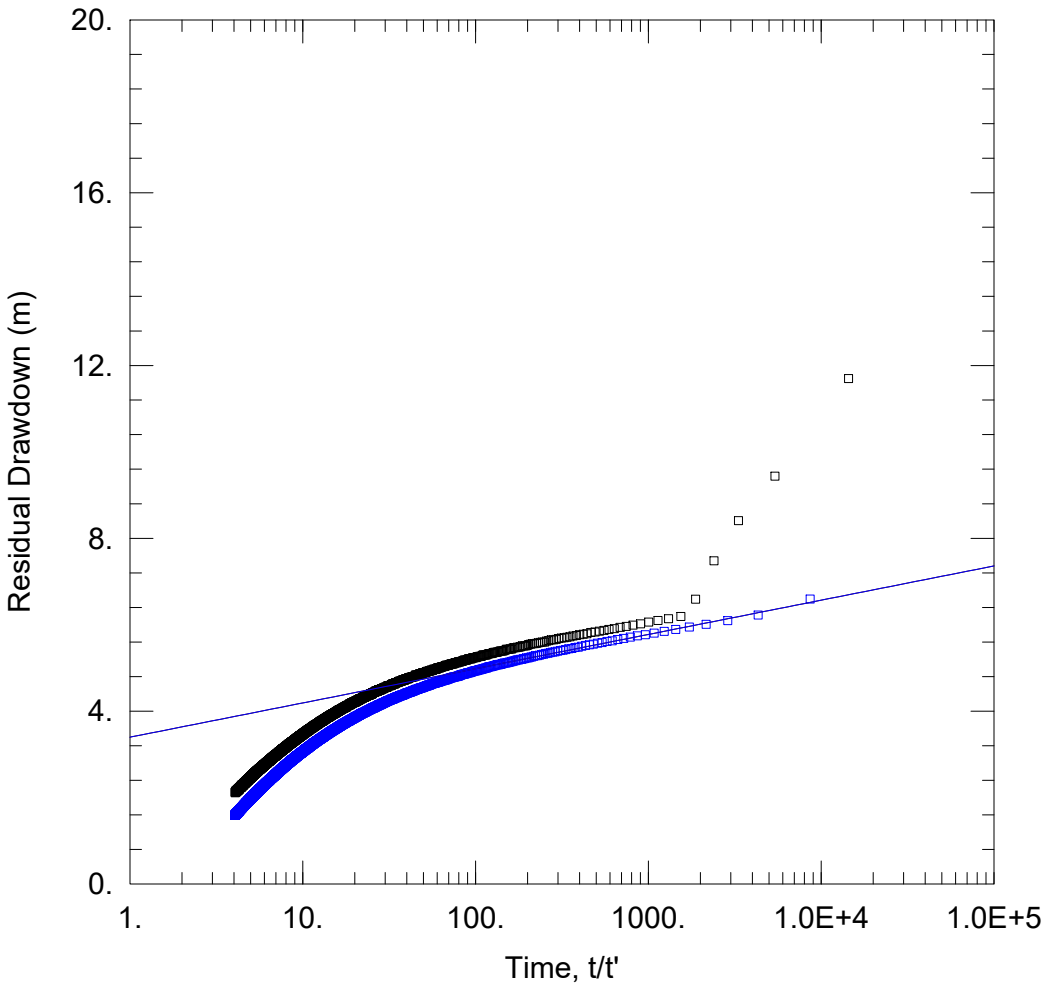
Observation Wells

Well Name	X (m)	Y (m)
▫ BPB050	505685	6634740
▫ BMB050	505688	6634730

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 361.2 m^2/day
S = 0.002196
Kz/Kr = 0.1
b = 20. m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: AQ2
Client: Ramelius
Project: 472C
Location: Lake Rebecca
Test Well: BPB050
Test Date: 13/08/24

AQUIFER DATA

Saturated Thickness: 20. m

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BPB050	505685	6634740

Observation Wells

Well Name	X (m)	Y (m)
BPB050	505685	6634740
BMB050	505688	6634730

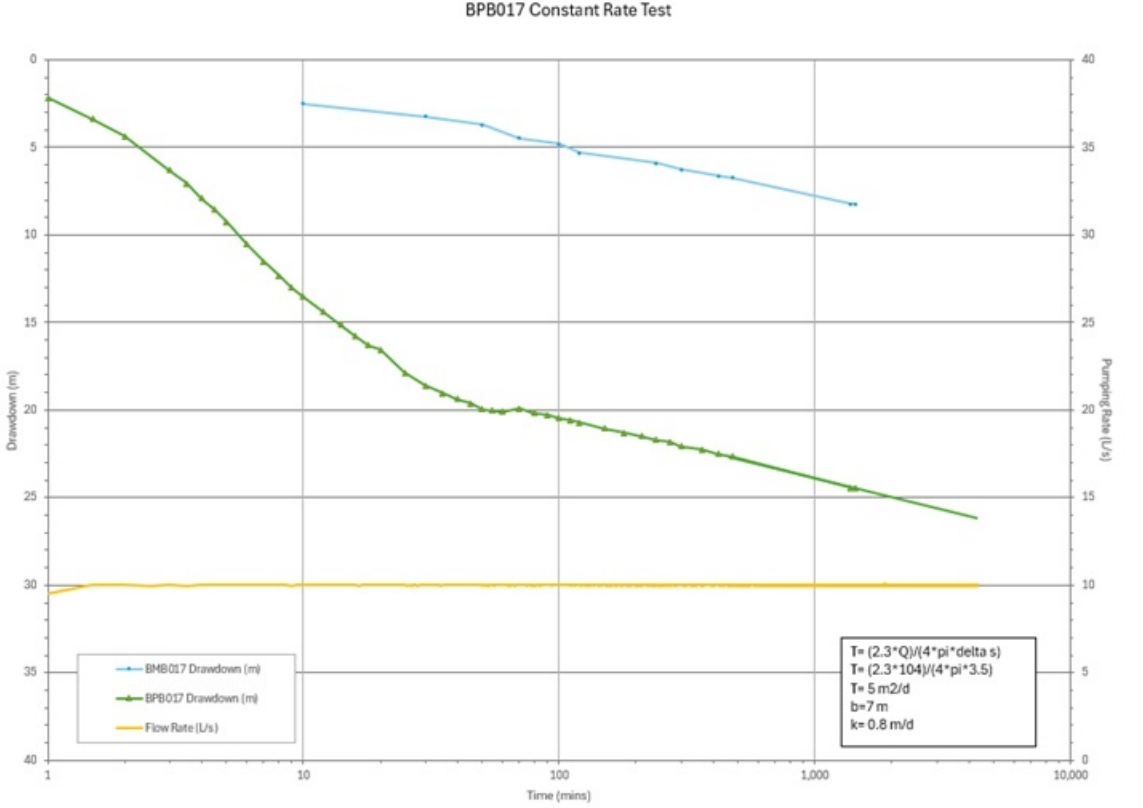
SOLUTION

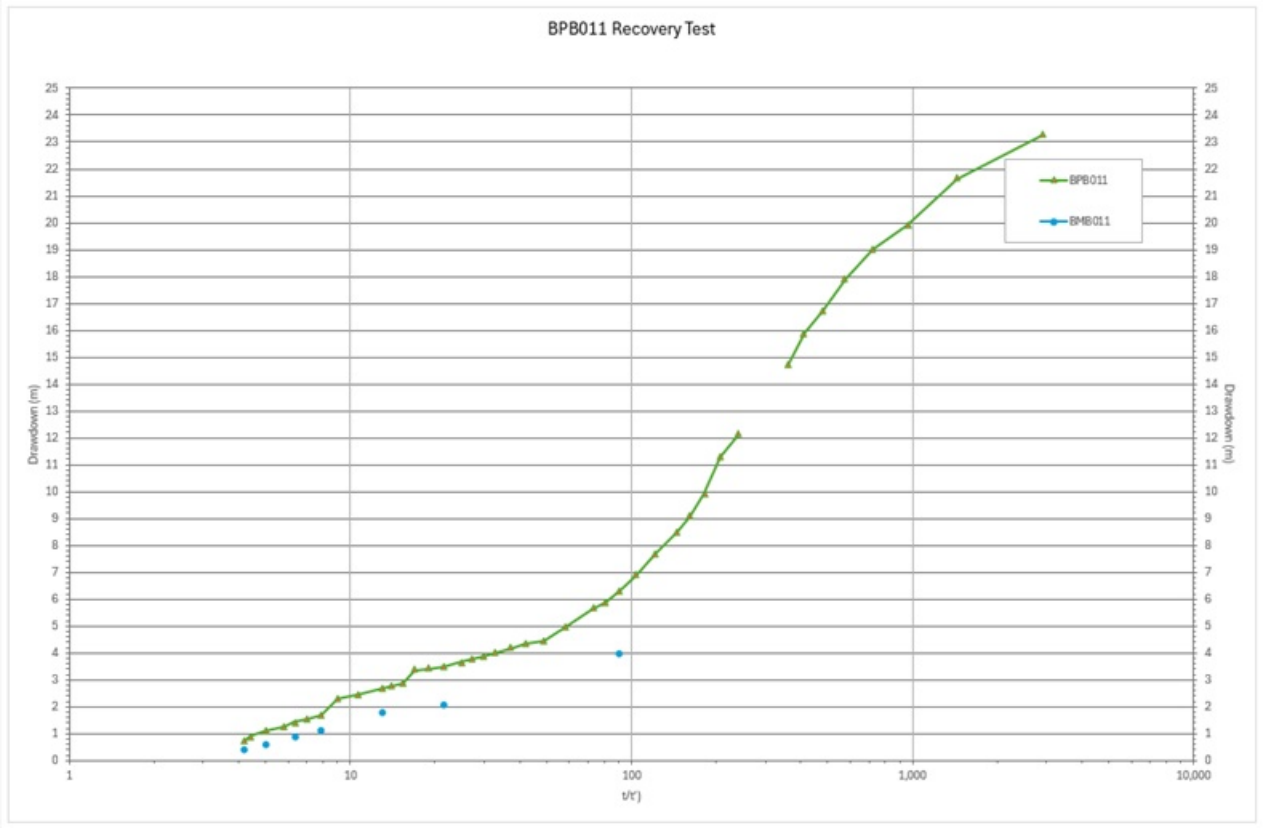
Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 479.3 m^2/day

S/S' = 5.2E-5


BPB017 Constant Rate Test
Drawdown (m)
Pumping Rate (L/s)
Time (mins)
0
5
10
15
20
25
30
35
40
1
10
100
1,000
10,000
BMB017 Drawdown (m)
BPB017 Drawdown (m)
Flow Rate (L/s)
T= (2.3*Q)/(4*pi*delta s)
T= (2.3*104)/(4*pi*3.5)
T= 5 m2/d
b=7 m
k= 0.8 m/d


BPB011 Recovery Test
Drawdown (m)
t/t'
BPB011
BMB011

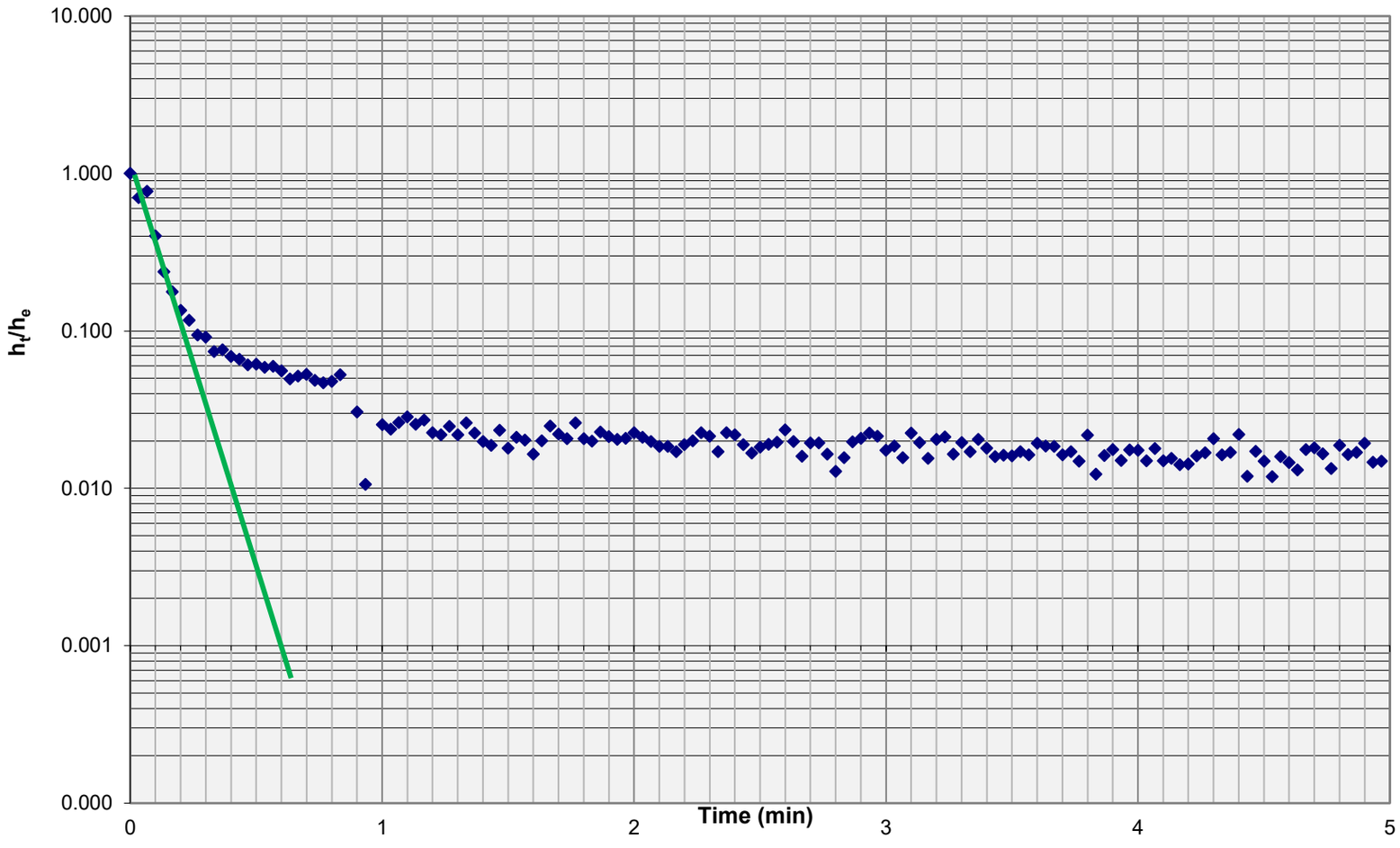
FALLING HEAD TEST

AQ2

Bore No:	BMB004S	Test No:	BMB004S (1/1)	Job No:	472	Date:	19-May-24	Logged by:	YM

Borehole co-ordinates: **Easting:**	502282	**Northing:**	6636481	Collar elevation (m):	316
Depth to top of test section (m):	12			Length of test section, **L** (m):	6
Depth of static water level, H_w (m):	18.13			Radius of borehole, **r** (m):	0.0825
Excess head, h_e (m):	0.84			Radius of standpipe or casing, r_c (m):	0.025

Head - time graph (slope of graph is S)



Calculations:

Early Time

h_1	1.00
t_1	0.0
h_2	0.12
t_2	0.2
S	3.9E+00
k (m/s)	**0.000055**

m/d	**4.72**
T (m2/d)	28.34

Permeability, k = 0.133 x S x (rc2/L), (m/sec)
where S = (log (h1/h2)/(t2 - t1),
(ie slope of plot, t in mins)

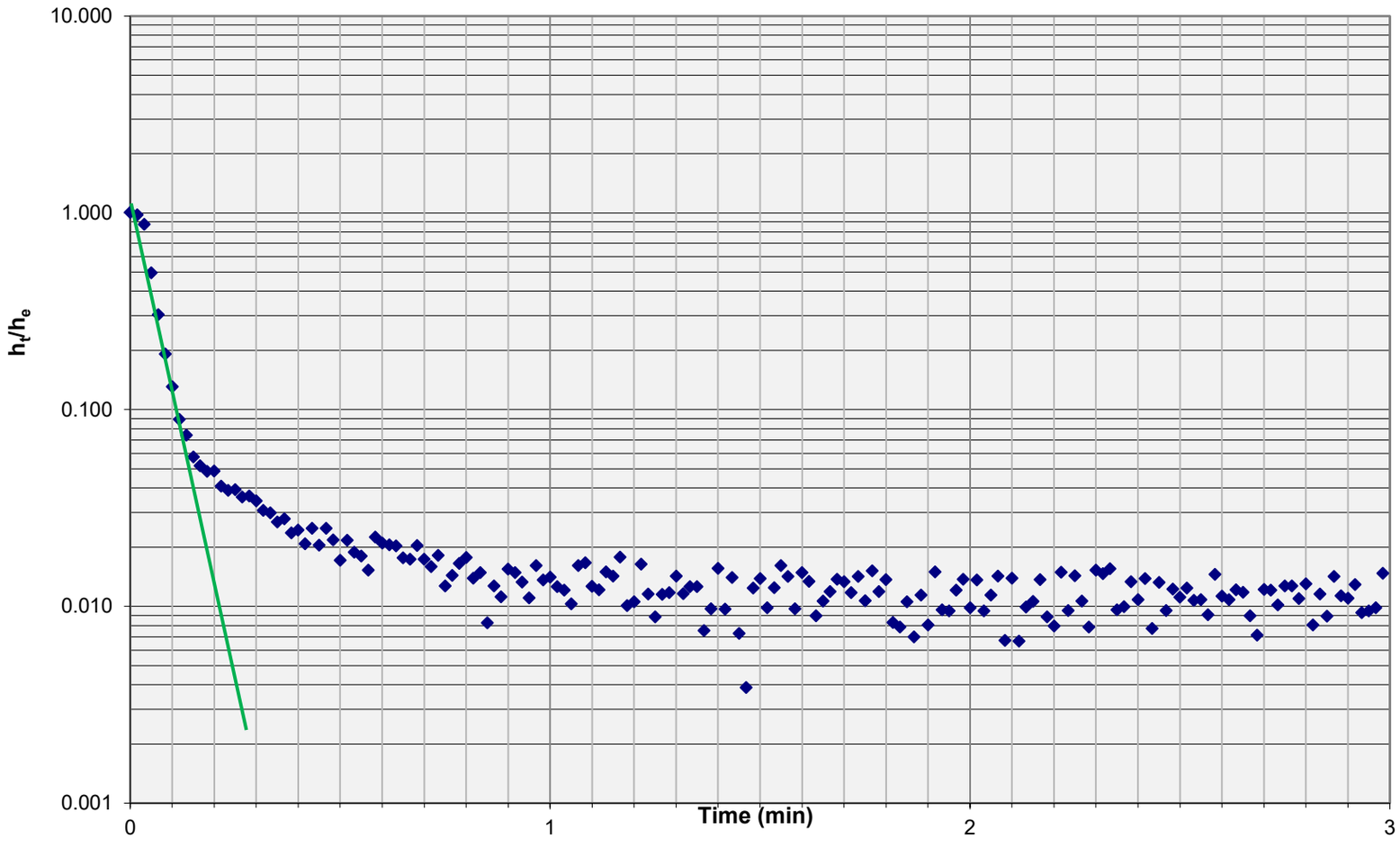
Notes: Screened within upper paleochannel sand
Method: Hvorslev slug test.

FALLING HEAD TEST

Bore No:	BMB005	Test No:	BMB005 (2/2)	Job No:	472	Date:	28-Apr-24	Logged by:	YM

Borehole co-ordinates: **Easting:**	500645	**Northing:**	6634092	Collar elevation (m):	333
Depth to top of test section (m):	34			Length of test section, **L** (m):	6
Depth of static water level, H_w (m):	25.82			Radius of borehole, **r** (m):	0.0825
Excess head, h_e (m):	0.89			Radius of standpipe or casing, r_c (m):	0.025

Head - time graph (slope of graph is S)



Calculations:

Early Time

h_1	1.00
t_1	0.0
h_2	0.05
t_2	0.2
S	7.8E+00
k (m/s)	**0.00011**

m/d	**9.34**
T (m2/d)	56.06

Permeability, k = 0.133 x S x (rc2/L), (m/sec)
where S = (log (h1/h2)/(t2 - t1),
(ie slope of plot, t in mins)

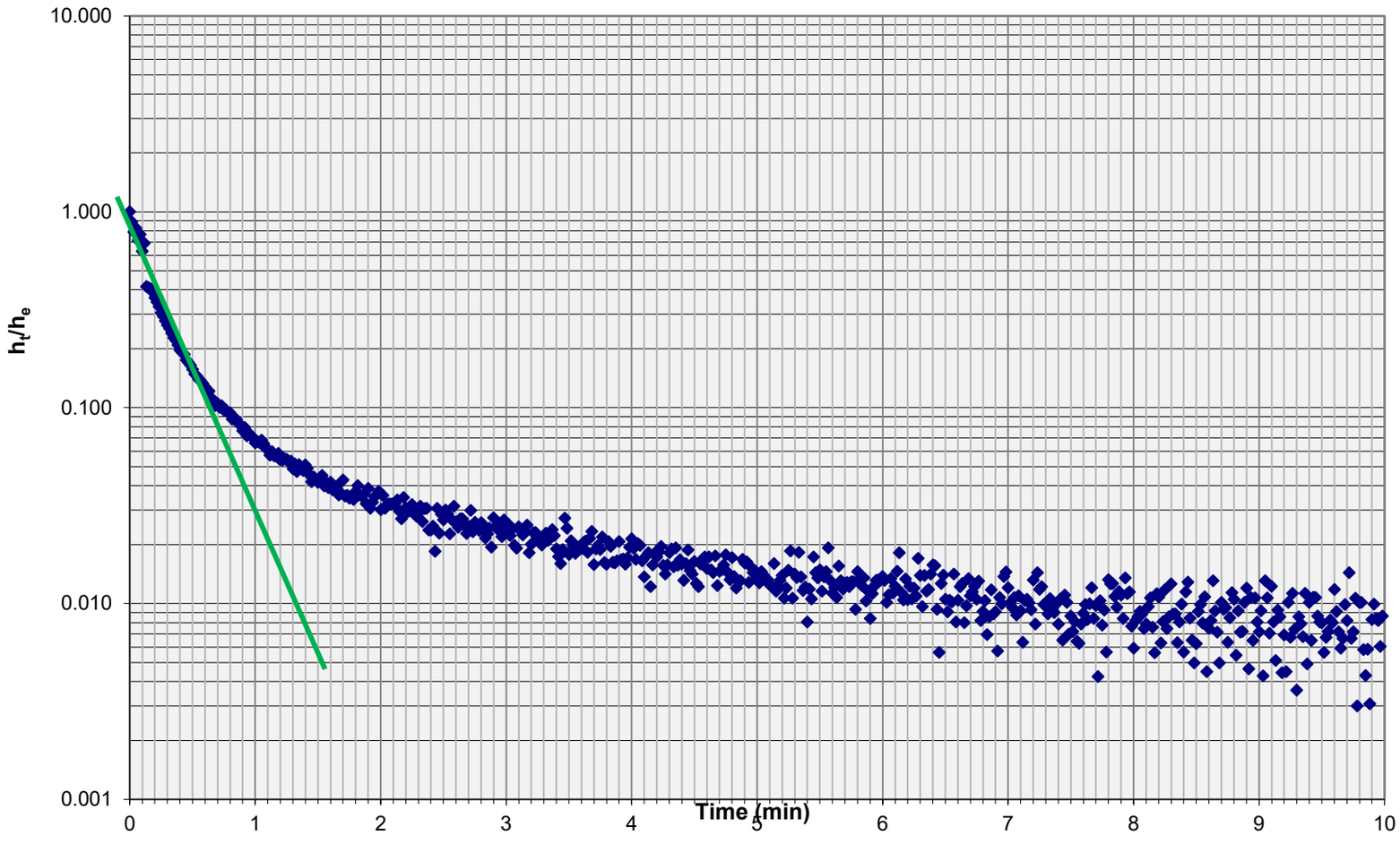
Notes: Screened within perched sand aquifer
Method: Hvorslev slug test, Test 2/2.

FALLING HEAD TEST

Bore No:	BMB019	Test No:	BMB019 Slug	Job No:	472	Date:	24-Apr-24	Logged by:	YM

Borehole co-ordinates: **Easting:**	501922	**Northing:**	6629376	Collar elevation (m):	326
Depth to top of test section (m):	6			Length of test section, **L** (m):	6
Depth of static water level, H_w (m):	17.656			Radius of borehole, **r** (m):	0.165
Excess head, h_e (m):	0.86			Radius of standpipe or casing, r_c (m):	0.025

Head - time graph (slope of graph is S)



Calculations:

Early Time

h_1	0.41
t_1	0.1
h_2	0.10
t_2	0.7
S	1.1E+00
k (m/s)	**0.00**

m/d	**1.33**
T (m2/d)	8.01

Permeability, k = 0.133 x S x (rc2/L), (m/sec)
where S = (log (h1/h2)/(t2 - t1),
(ie slope of plot, t in mins)

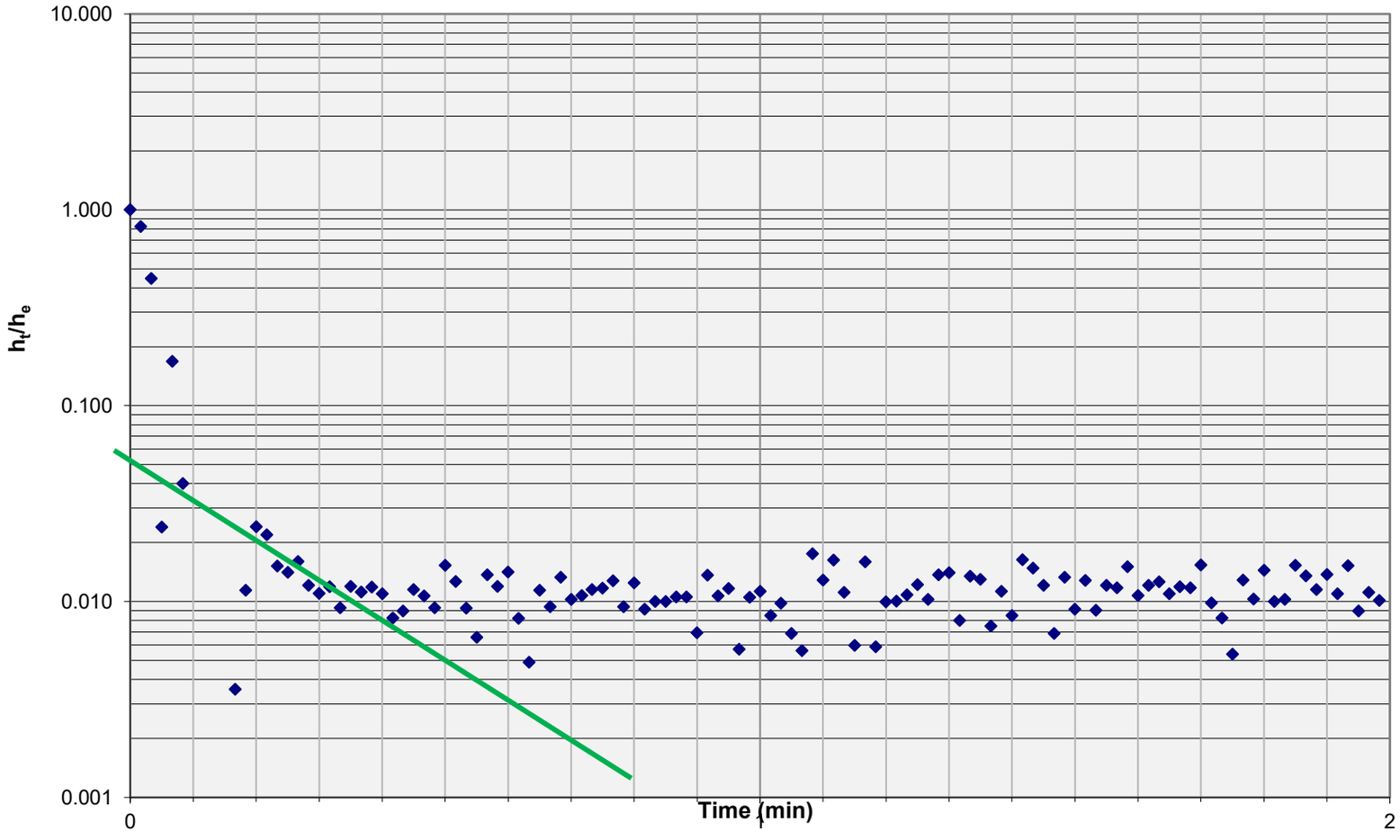
Notes: Screened within granitic gravel, Method: Hvorslev slug test.

FALLING HEAD TEST

Bore No:	BMB030	Test No:	BMB030 (1)	Job No:	472	Date:	24-Apr-24	Logged by:	YM

Borehole co-ordinates: **Easting:**	503997	**Northing:**	6629371	Collar elevation (m):	330
Depth to top of test section (m):	38			Length of test section, **L** (m):	6
Depth of static water level, H_w (m):	19.14			Radius of borehole, **r** (m):	0.0825
Excess head, h_e (m):	0.78			Radius of standpipe or casing, r_c (m):	0.025

Head - time graph (slope of graph is S)



Calculations:

	Early Time
h_1	0.04
t_1	0.1
h_2	0.01
t_2	0.37
S	2.4E+00
k (m/s)	**0.00**

m/d **2.92**

T (m2/d) 17.51

Permeability, k = 0.133 x S x (rc2/L), (m/sec)
where S = (log (h1/h2)/(t2 - t1),
(ie slope of plot, t in mins)

Notes: Screened within paleochannel sand,
Method: Hvorslev slug test, Test 1/3.

APPENDIX H
RESULTS OF CHEMICAL ANALYSIS

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Yannick Magyar	Manager	Merene Hwang
Client	AQ2	Laboratory	SGS Perth Environmental
Address	PO BOX 976 SOUTH PERTH WA 6951	Address	28 Reid Rd Perth Airport WA 6105
Telephone	61 8 93238821	Telephone	(08) 9373 3500
Facsimile	(Not specified)	Facsimile	(08) 9373 3556
Email	yannick.magyar@aq2.com.au	Email	au.environmental.perth@sgs.com
Project	**472C LAKE REBECCA**	SGS Reference	**PE175933 R1**
Order Number	**472C LAKE REBECCA**	Date Received	21 May 2024
Samples	5	Date Reported	03 Sep 2024

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(898/20210).

Metals: LORs raised due to high conductivity.
Metals: The over range results on ICPMS Method AN318 were reported using ICPOES method AN320.

The upper limit for Conductivity in Water is 100,000 uS/cm. Any result above this is an estimate. This will also cause the TDS on EC ratio to bias high.
This report cancels and supersedes the report No.PE175933 R0. dated 29/05/2024 due to client request Reporting of Nitrite and metals.

SIGNATORIES

Hue Thanh LY
Metals Team Leader

Louise HOPE
Laboratory Technician

Melissa WHITE
Laboratory Technician

Murray O'NEILL
Lab Technician-Nutrients Signatory

Ohmar DAVID
Metals Chemist

Parameter	Units	LOR	Sample Number: PE175933.001 Sample Matrix: Water Sample Date: 15/5/24 13:49 Sample Name: BMB004S	PE175933.002 Water 17/4/24 10:50 BMB030	PE175933.003 Water 21/4/24 13:30 BMB008	PE175933.004 Water 30/3/24 13:08 BMB005
pH in water Method: AN101 Tested: 23/5/2024						
pH**	pH Units	0.1	**4.8**	**4.4**	**6.9**	**6.8**
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 23/5/2024						
Conductivity @ 25 C	µS/cm	2	**170000**	**150000**	**190000**	**200000**
Total Dissolved Solids (by calculation)	mg/L	2	**100000**	**90000**	**110000**	**120000**
Alkalinity Method: AN135 Tested: 23/5/2024						
Carbonate Alkalinity as CO3	mg/L	1	<1	<1	<1	<1
Bicarbonate Alkalinity as HCO3	mg/L	5	<5	<5	**67**	**72**
Sulfate in water Method: AN275 Tested: 24/5/2024						
Sulfate, SO4	mg/L	1	**12000**	**11000**	**15000**	**15000**
Chloride by Discrete Analyser in Water Method: AN274 Tested: 24/5/2024						
Chloride, Cl	mg/L	1	**91000**	**80000**	**110000**	**120000**
Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 24/5/2024						
Calcium, Ca	mg/L	0.2	**460**	**410**	**620**	**680**
Magnesium, Mg	mg/L	0.1	**5400**	**4400**	**6500**	**6800**
Potassium, K	mg/L	0.1	**750**	**560**	**910**	**1200**
Sodium, Na	mg/L	0.5	**43000**	**37000**	**53000**	**58000**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	PE175933.001 Water 15/5/24 13:49 BMB004S	PE175933.002 Water 17/4/24 10:50 BMB030	PE175933.003 Water 21/4/24 13:30 BMB008	PE175933.004 Water 30/3/24 13:08 BMB005
Trace Metals (Dissolved) in Water by ICPMS Method: AN318 Tested: 24/5/2024							
Aluminium	µg/L	5		**6400**	**8100**	<500↑	**1100**
Arsenic	µg/L	1		<100↑	<100↑	<100↑	<100↑
Barium	µg/L	1		<100↑	<100↑	<100↑	<100↑
Beryllium	µg/L	1		<100↑	<100↑	<100↑	<100↑
Cadmium	µg/L	0.1		<10↑	<10↑	<10↑	<10↑
Chromium	µg/L	1		<100↑	<100↑	<100↑	<100↑
Cobalt	µg/L	1		<100↑	<100↑	<100↑	<100↑
Copper	µg/L	1		<100↑	<100↑	<100↑	<100↑
Iron	µg/L	5		<500↑	**1500**	<500↑	<500↑
Lead	µg/L	1		<100↑	<100↑	<100↑	<100↑
Nickel	µg/L	1		**100**	<100↑	<100↑	<100↑
Selenium	µg/L	1		<100↑	<100↑	<100↑	<100↑
Vanadium	µg/L	1		<100↑	<100↑	<100↑	<100↑
Zinc	µg/L	5		<500↑	<500↑	<500↑	<500↑
Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA Method: AN258 Tested: 24/5/2024							
Nitrite Nitrogen, NO_2 as N	mg/L	0.05		<0.05	<0.05	<0.05	<0.05
Nitrate Nitrogen, NO_3 as N	mg/L	0.05		**1.9**	<0.05	**1.5**	<0.05

Parameter	Units	LOR	Sample Number: PE175933.005 Sample Matrix: Water Sample Date: 10/4/24 11:08 Sample Name: BMB019
pH in water Method: AN101 Tested: 23/5/2024			
pH**	pH Units	0.1	**6.4**
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 23/5/2024			
Conductivity @ 25 C	µS/cm	2	**190000**
Total Dissolved Solids (by calculation)	mg/L	2	**110000**
Alkalinity Method: AN135 Tested: 23/5/2024			
Carbonate Alkalinity as CO3	mg/L	1	<1
Bicarbonate Alkalinity as HCO3	mg/L	5	**25**
Sulfate in water Method: AN275 Tested: 24/5/2024			
Sulfate, SO4	mg/L	1	**15000**
Chloride by Discrete Analyser in Water Method: AN274 Tested: 24/5/2024			
Chloride, Cl	mg/L	1	**110000**
Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 24/5/2024			
Calcium, Ca	mg/L	0.2	**520**
Magnesium, Mg	mg/L	0.1	**5500**
Potassium, K	mg/L	0.1	**750**
Sodium, Na	mg/L	0.5	**54000**

Parameter	Units	LOR	Sample Number PE175933.005 Sample Matrix Water Sample Date 10/4/24 11:08 Sample Name BMB019
Trace Metals (Dissolved) in Water by ICPMS Method: AN318 Tested: 24/5/2024			
Aluminium	µg/L	5	<500↑
Arsenic	µg/L	1	<100↑
Barium	µg/L	1	<100↑
Beryllium	µg/L	1	<100↑
Cadmium	µg/L	0.1	<10↑
Chromium	µg/L	1	<100↑
Cobalt	µg/L	1	<100↑
Copper	µg/L	1	<100↑
Iron	µg/L	5	<500↑
Lead	µg/L	1	<100↑
Nickel	µg/L	1	<100↑
Selenium	µg/L	1	<100↑
Vanadium	µg/L	1	<100↑
Zinc	µg/L	5	<500↑
Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA Method: AN258 Tested: 24/5/2024			
Nitrite Nitrogen, NO_2 as N	mg/L	0.05	<0.05
Nitrate Nitrogen, NO_3 as N	mg/L	0.05	<0.05

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula：*the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

No QC samples were reported for this job.

METHOD	METHODOLOGY SUMMARY
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Total Dissolved Salts can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. SGS use 0.6. Reference APHA 2510 B.
AN106	Salinity may be calculated in terms of NaCl from the sample conductivity. This assumes all soluble salts present, measured by the conductivity, are present as NaCl.
AN135	Alkalinity (and forms of) by Titration: The sample is titrated with standard acid to pH 8.3 (P titre) and pH 4.5 (T titre) and permanent and/or total alkalinity calculated. The results are expressed as equivalents of calcium carbonate or recalculated as bicarbonate, carbonate and hydroxide. Reference APHA 2320. Internal Reference AN135
AN258	Nitrate and Nitrite by FIA: In an acidic medium, nitrate is reduced quantitatively to nitrite by cadmium metal. This nitrite plus any original nitrite is determined as an intense red-pink azo dye at 540 nm following diazotisation with sulphanilamide and subsequent coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. Without the cadmium reduction only the original nitrite is determined. Reference APHA 4500-NO3- F.
AN274	Chloride by Discrete Analyse: Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulfate by Discrete Analyse: sulfate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulfate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.
AN318	Determination of elements at trace level in waters by ICP-MS technique,, referenced to USEPA 6020B and USEPA 200.8 (5.4).
AN320	Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components .
AN320	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.
Calculation	Free and Total Carbon Dioxide may be calculated using alkalinity forms only when the samples TDS is <500mg/L. If TDS is >500mg/L free or total carbon dioxide cannot be reported. APHA4500CO2 D.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
***	Indicates that both * and ** apply.	NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
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Email	alastair.hoare@aq2.com.au	Email	au.environmental.perth@sgs.com
Project	**LAKE REBECCA TEST PUMPING**	SGS Reference	**PE177971 R0**
Order Number	**LAKE REBECCA TEST PUMPING**	Date Received	02 Sep 2024
Samples	4	Date Reported	09 Sep 2024

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(898/20210).

Samples analysed out of holding time for Nitrate and Nitrite.
Metals: LORs raised due to high conductivity.
The upper limit for Conductivity in Water is 100,000 uS/cm. Any result above this is an estimate. This will also cause the TDS on EC ratio to bias high.

SIGNATORIES

Louise HOPE
Laboratory Technician

Melissa WHITE
Laboratory Technician

Ohmar DAVID
Metals Chemist

Salim Shiraz ARSIWALA
Laboratory Technician

Sanaa HUSSAIN
Chemist

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name PE177971.001 Water 13 Aug 2024 BPB004	PE177971.002 Water 20 Aug 2024 BPB050	PE177971.003 Water 26 Aug 2024 BPB011	PE177971.004 Water 30 Aug 2024 BPB017
pH in water Method: AN101 Tested: 2/9/2024						
pH**	pH Units	0.1	**6.1**	**6.2**	**6.2**	**6.1**
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 2/9/2024						
Conductivity @ 25 C	µS/cm	2	**210000**	**200000**	**210000**	**190000**
Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 4/9/2024						
Calcium, Ca	mg/L	0.2	**480**	**540**	**570**	**490**
Magnesium, Mg	mg/L	0.1	**9600**	**8300**	**8500**	**6900**
Potassium, K	mg/L	0.1	**1400**	**1200**	**1300**	**820**
Sodium, Na	mg/L	0.5	**72000**	**64000**	**68000**	**53000**
Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA Method: AN258 Tested: 3/9/2024						
Nitrate Nitrogen, NO_3 as N	mg/L	0.05	<0.05	**0.11**	<0.05	**0.26**
Chloride by Discrete Analyser in Water Method: AN274 Tested: 4/9/2024						
Chloride, Cl	mg/L	1	**150000**	**130000**	**130000**	**110000**
Trace Metals (Dissolved) in Water by ICPMS TQe Method: AN318 Tested: 4/9/2024						
Iron	µg/L	5	**2100**	**700**	**2500**	<500↑
Manganese	µg/L	1	**930**	**820**	**610**	**2100**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	PE177971.001 Water 13 Aug 2024 BPB004	PE177971.002 Water 20 Aug 2024 BPB050	PE177971.003 Water 26 Aug 2024 BPB011	PE177971.004 Water 30 Aug 2024 BPB017
Total Dissolved Solids (TDS) in water Method: AN113 Tested: 3/9/2024							
Total Dissolved Solids Dried at 175-185°C	mg/L	10		**270000**	**240000**	**250000**	**200000**
Sulfate in water Method: AN275 Tested: 4/9/2024							
Sulfate, SO4	mg/L	1		**18000**	**17000**	**17000**	**15000**
Reactive Silica by Discrete Analyser Method: AN270 Tested: 5/9/2024							
Reactive Silica, SiO_2	mg/L	0.1		**5.6**	**10**	**8.3**	**20**
Alkalinity Method: AN135 Tested: 2/9/2024							
Bicarbonate Alkalinity as HCO3	mg/L	5		**71**	**53**	**74**	**39**
Carbonate Alkalinity as CO3	mg/L	5		<5	<5	<5	<5
Hydroxide Alkalinity as OH	mg/L	5		<5	<5	<5	<5
Total Alkalinity as CaCO3	mg/L	5		**59**	**43**	**61**	**32**

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Alkalinity Method: ME-(AU)-[ENV]AN135

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Bicarbonate Alkalinity as HCO3	LB221258	mg/L	5	<5		
Carbonate Alkalinity as CO3	LB221258	mg/L	5	<5		
Hydroxide Alkalinity as OH	LB221258	mg/L	5	<5		
Total Alkalinity as CaCO3	LB221258	mg/L	5	<5	2 - 5%	101%

Chloride by Discrete Analyser in Water Method: ME-(AU)-[ENV]AN274

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Chloride, Cl	LB221287	mg/L	1	<1	0 - 2%	101 - 102%	72 - 82%

Conductivity and TDS by Calculation - Water Method: ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity @ 25 C	LB221260	µS/cm	2	<2	0%	99%

Metals in Water (Dissolved) by ICPOES Method: ME-(AU)-[ENV]AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Calcium, Ca	LB221282	mg/L	0.2	<0.2	1%	103%	93%
Magnesium, Mg	LB221282	mg/L	0.1	<0.1	1%	102%	97%
Potassium, K	LB221282	mg/L	0.1	<0.1	1%	103%	90%
Sodium, Na	LB221282	mg/L	0.5	<0.5	1%	99%	86%

Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA Method: ME-(AU)-[ENV]AN258

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Nitrate Nitrogen, NO_3 as N	LB221267	mg/L	0.05	<0.05	NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

pH in water **Method: ME-(AU)-[ENV]AN101**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH**	LB221260	pH Units	0.1	5.6	0 - 1%	101%

Reactive Silica by Discrete Analyser **Method: ME-(AU)-[ENV]AN270**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Reactive Silica, SiO_2	LB221316	mg/L	0.1	<0.10	0%	104%	105%

Sulfate in water **Method: ME-(AU)-[ENV]AN275**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Sulfate, SO4	LB221287	mg/L	1	<1	1 - 8%	96 - 99%	86 - 90%

Total Dissolved Solids (TDS) in water **Method: ME-(AU)-[ENV]AN113**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Total Dissolved Solids Dried at 175-185°C	LB221247	mg/L	10	<10	0%	95%	97%	2%

Trace Metals (Dissolved) in Water by ICPMS TQe **Method: ME-(AU)-[ENV]AN318**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Iron	LB221276	µg/L	5	<5	0%	99%
Manganese	LB221276	µg/L	1	<1	1%	91%

METHOD	METHODOLOGY SUMMARY
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Total Dissolved Salts can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. SGS use 0.6. Reference APHA 2510 B.
AN106	Salinity may be calculated in terms of NaCl from the sample conductivity. This assumes all soluble salts present, measured by the conductivity, are present as NaCl.
AN113	Total Dissolved Solids: A well-mixed filtered sample of known volume is evaporated to dryness at 180°C and the residue weighed. Approximate methods for correlating chemical analysis with dissolved solids are available. Reference APHA 2540 C.
AN113	The Total Dissolved Solids residue may also be ignited at 550 C and volatile TDS (Organic TDS) and non-volatile TDS (Inorganic) can be determined.
AN135	Alkalinity (and forms of) by Titration: The sample is titrated with standard acid to pH 8.3 (P titre) and pH 4.5 (T titre) and permanent and/or total alkalinity calculated. The results are expressed as equivalents of calcium carbonate or recalculated as bicarbonate, carbonate and hydroxide. Reference APHA 2320. Internal Reference AN135
AN258	Nitrate and Nitrite by FIA: In an acidic medium, nitrate is reduced quantitatively to nitrite by cadmium metal. This nitrite plus any original nitrite is determined as an intense red-pink azo dye at 540 nm following diazotisation with sulphanilamide and subsequent coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. Without the cadmium reduction only the original nitrite is determined. Reference APHA 4500-NO3- F.
AN270	Reactive forms of silicon in acid solution below pH 2 react with ammonium molybdate ions to form a yellow silicomolybdate which is then reduced with ascorbic acid to produce a blue silicomolybdate complex. Oxalic acid is added to destroy any molybdophosphoric acid. Colourimetric determination by Discrete Analyser.
AN274	Chloride by Discrete Analyse: Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulfate by Discrete Analyse: sulfate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulfate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.
AN318	Determination of elements at trace level in waters by ICP-MS technique, referenced to USEPA 6020B and USEPA 200.8 (5.4).
AN320	Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components .

METHOD	METHODOLOGY SUMMARY
AN320	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.
Calculation	Free and Total Carbon Dioxide may be calculated using alkalinity forms only when the samples TDS is <500mg/L. If TDS is >500mg/L free or total carbon dioxide cannot be reported . APHA4500CO2 D.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
***	Indicates that both * and ** apply.	NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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APPENDIX I
SRO ANALYSIS

Source Reliable Output Calculations **Bore No:** BPB004

Notes:
Calculates SRO and expected pumping water levels for newly constructed bores
Pumping Test Analysis must have been undertaken first
Pumping water levels calculated from assumed average conditions - as seen during drilling
Assumes transient radial flow conditions prevail (eg Theis Equation)

Data Input

Rest Water Level = 8.1 mbgl Top of Aquifer/Max PWL = 84 mbgl

Step Test Data

Enter parameters of step test equation $s=BQ+CQ^2$

B =	9.75E-03	
C =	-2.31E-06	
valid time	100	mins

Constant Rate Test Data

Enter parameters from constant rate analysis

T =	250	m^2/d	(transmissivity)
s =	2.00E-03		(storativity)
r =	0.1	m	(radius of bore)

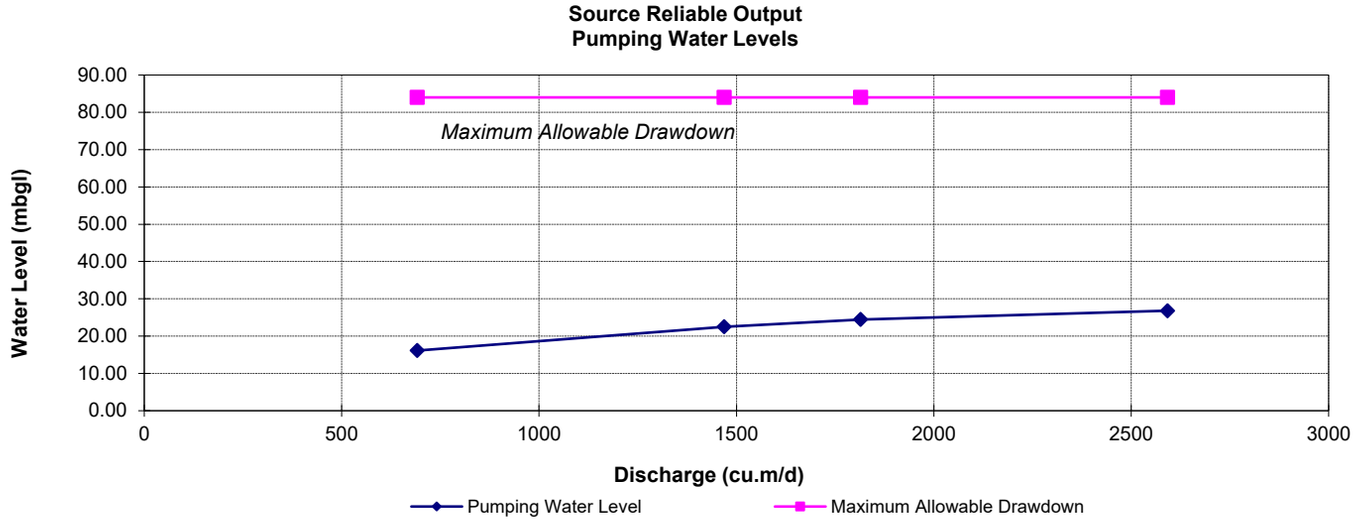
Enter Operational Data

Assumed period between recharge events t2 = 3650 days
Range of discharges to be considered Are there interference effects (Y/N) N

Q1	691	m^3/d	8 L/s	Dist to first bore	m
Q2	1469	m^3/d	17 L/s	pumping rate	m^3/d
Q3	1814	m^3/d	21 L/s	Dist to second bore	m
Q4	2592	m^3/d	30 L/s	pumping rate	m^3/d

Calculations of Drawdown

Discharge L/s	Discharge m3/d	Short Term Drawdown	Long Term Drawdown	Interference Effects	Total Drawdown	Pumping Water Level
8	691	5.64	2.39	0.00	8.03	16.13
17	1469	9.34	5.08	0.00	14.42	22.52
21	1814	10.09	6.27	0.00	16.36	24.46
30	2592	9.76	8.96	0.00	18.72	26.82



Source Reliable Output Calculations **Bore No:** BPB011

Notes:
Calculates SRO and expected pumping water levels for newly constructed bores
Pumping Test Analysis must have been undertaken first
Pumping water levels calculated from assumed average conditions - as seen during drilling
Assumes transient radial flow conditions prevail (eg Theis Equation)

Data Input

Rest Water Level = 8.4 mbgl Top of Aquifer/Max PWL = 56 mbgl

Step Test Data

Enter parameters of step test equation $s=BQ+CQ^2$

B =	1.61E-02	
C =	2.62E-06	
valid time	100	mins

Constant Rate Test Data

Enter parameters from constant rate analysis

T =	72	m^2/d	(transmissivity)
s =	4.00E-04		(storativity)
r =	0.1	m	(radius of bore)

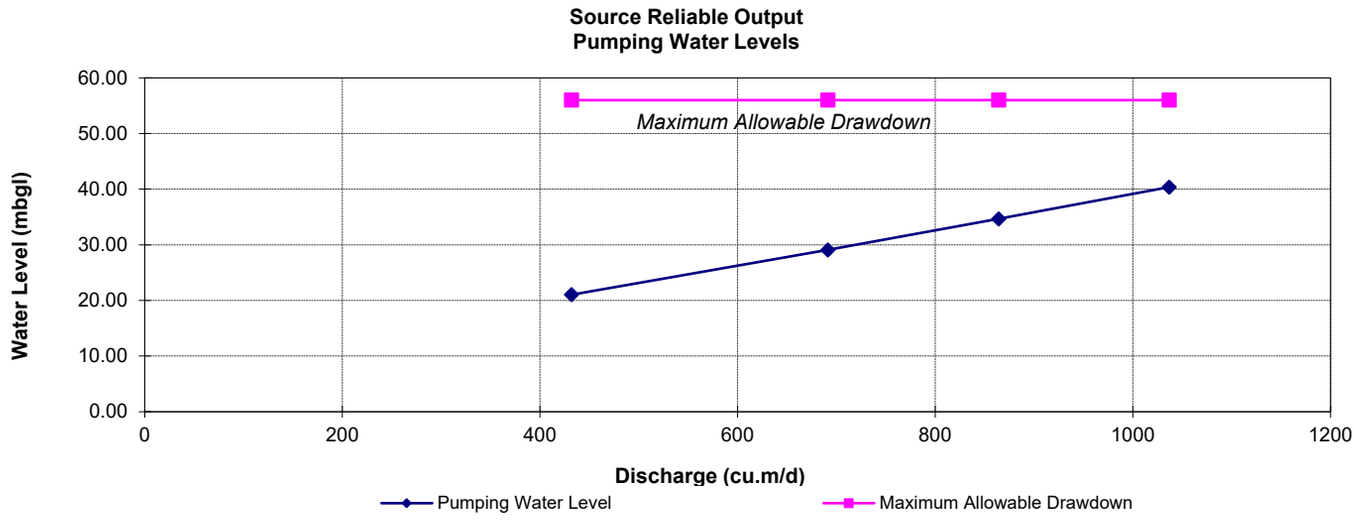
Enter Operational Data

Assumed period between recharge events t2 = 3650 days
Range of discharges to be considered Are there interference effects (Y/N) N

Q1	432	m^3/d	5 L/s	Dist to first bore	m
Q2	691	m^3/d	8 L/s	pumping rate	m^3/d
Q3	864	m^3/d	10 L/s	Dist to second bore	m
Q4	1037	m^3/d	12 L/s	pumping rate	m^3/d

Calculations of Drawdown

Discharge L/s	Discharge m3/d	Short Term Drawdown	Long Term Drawdown	Interference Effects	Total Drawdown	Pumping Water Level
5	432	7.45	5.18	0.00	12.64	21.04
8	691	12.40	8.29	0.00	20.69	29.09
10	864	15.89	10.37	0.00	26.25	34.65
12	1037	19.53	12.44	0.00	31.97	40.37



Source Reliable Output Calculations **Bore No:** BPB050

Notes:
Calculates SRO and expected pumping water levels for newly constructed bores
Pumping Test Analysis must have been undertaken first
Pumping water levels calculated from assumed average conditions - as seen during drilling
Assumes transient radial flow conditions prevail (eg Theis Equation)

Data Input

Rest Water Level = 8.1 mbgl Top of Aquifer/Max PWL = 72 mbgl

Step Test Data

Enter parameters of step test equation $s=BQ+CQ^2$

B =	2.62E-03	
C =	3.08E-07	
valid time	100	mins

Constant Rate Test Data

Enter parameters from constant rate analysis

T =	400	m^2/d	(transmissivity)
s =	2.00E-03		(storativity)
r =	0.1	m	(radius of bore)

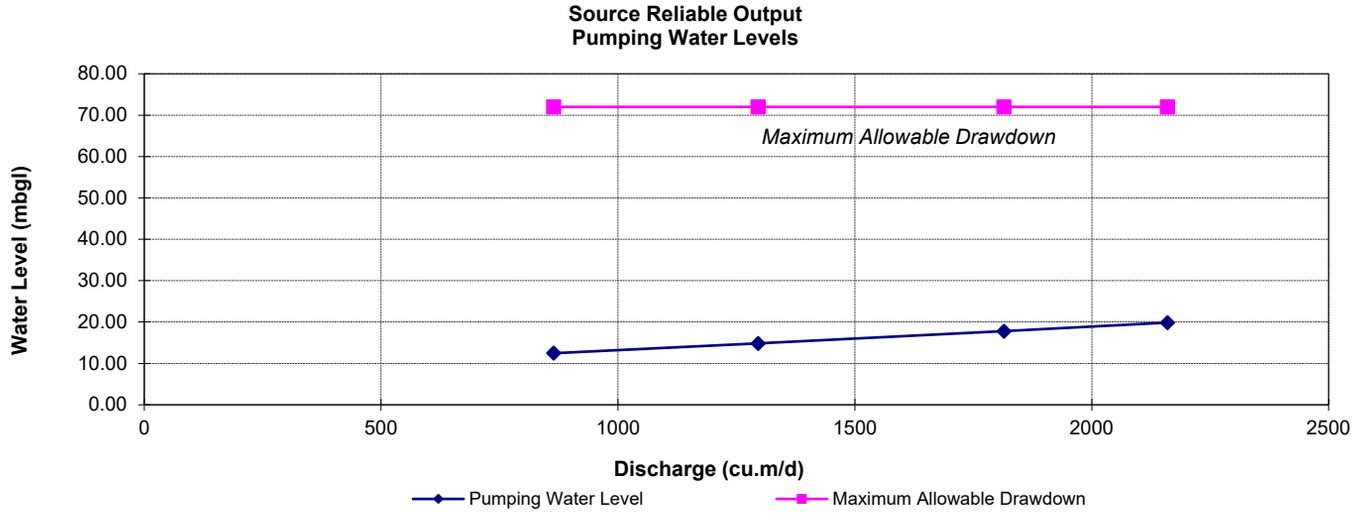
Enter Operational Data

Assumed period between recharge events t2 = 3650 days
Range of discharges to be considered Are there interference effects (Y/N) N

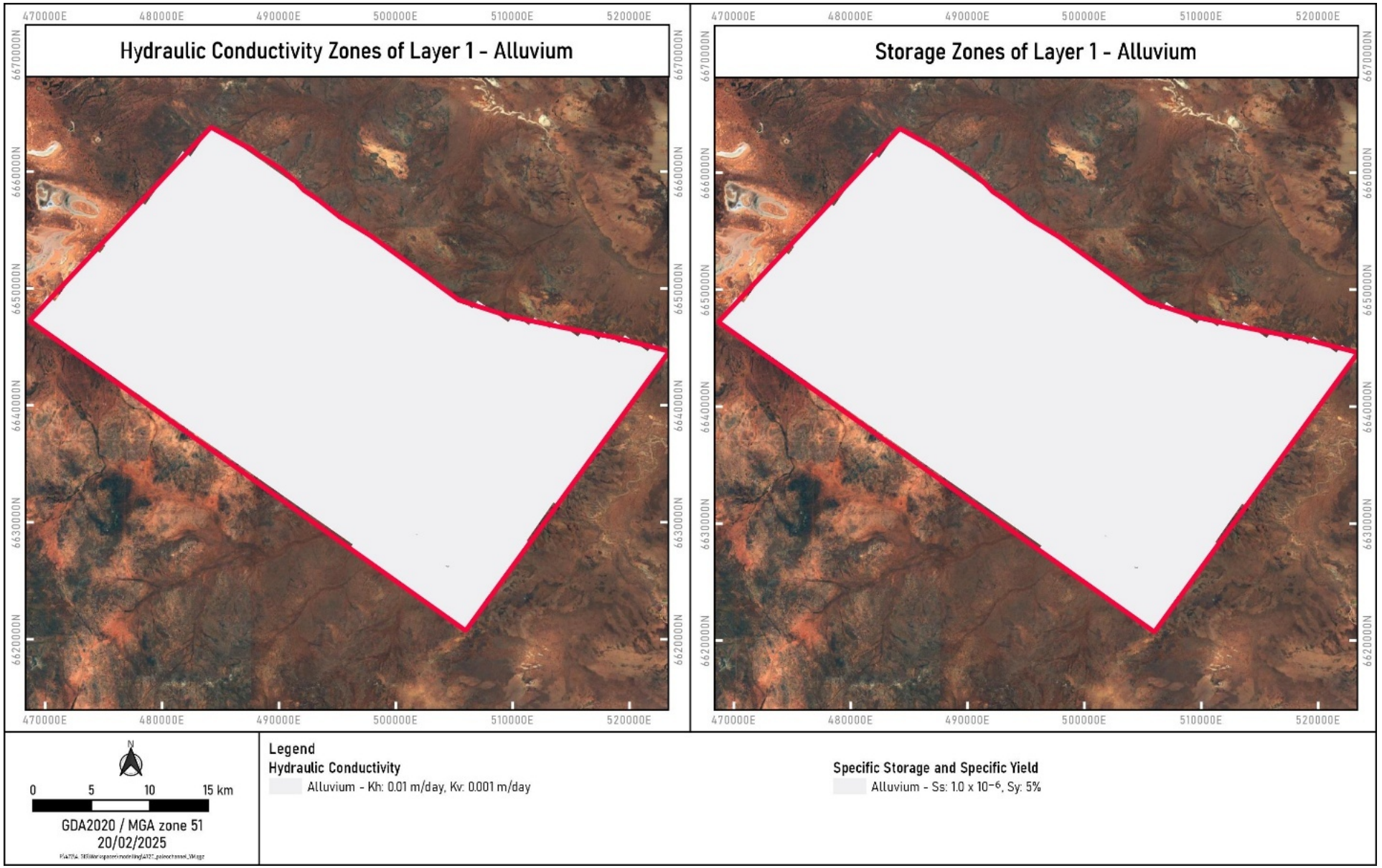
Q1	864	m^3/d	10 L/s	Dist to first bore	m
Q2	1296	m^3/d	15 L/s	pumping rate	m^3/d
Q3	1814	m^3/d	21 L/s	Dist to second bore	m
Q4	2160	m^3/d	25 L/s	pumping rate	m^3/d

Calculations of Drawdown

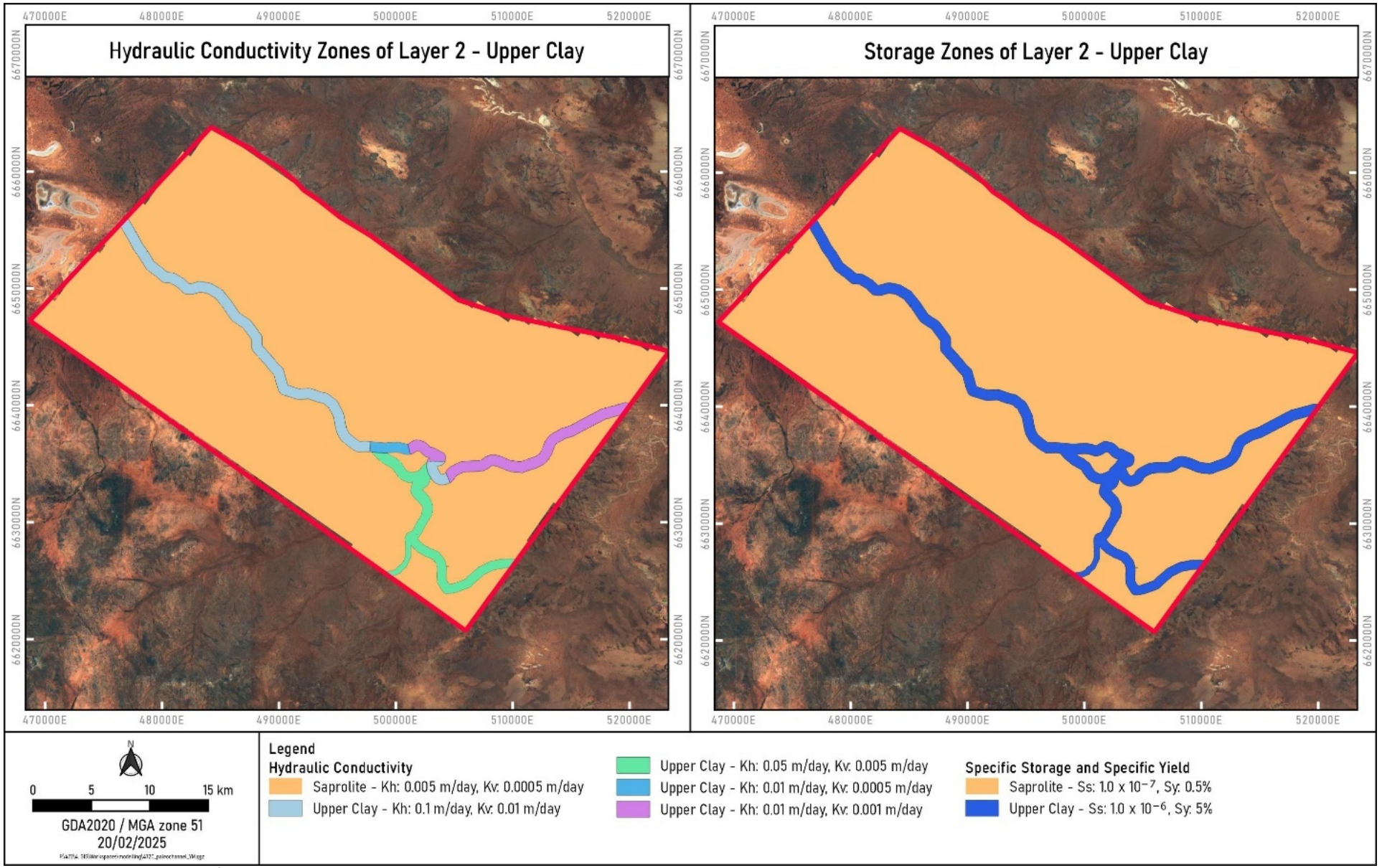
Discharge	Discharge	Short Term	Long Term	Interference	Total	Pumping
L/s	m3/d	Drawdown	Drawdown	Effects	Drawdown	Water Level
10	864	2.49	1.87	0.00	4.36	12.46
15	1296	3.91	2.80	0.00	6.71	14.81
21	1814	5.77	3.92	0.00	9.69	17.79
25	2160	7.10	4.67	0.00	11.76	19.86



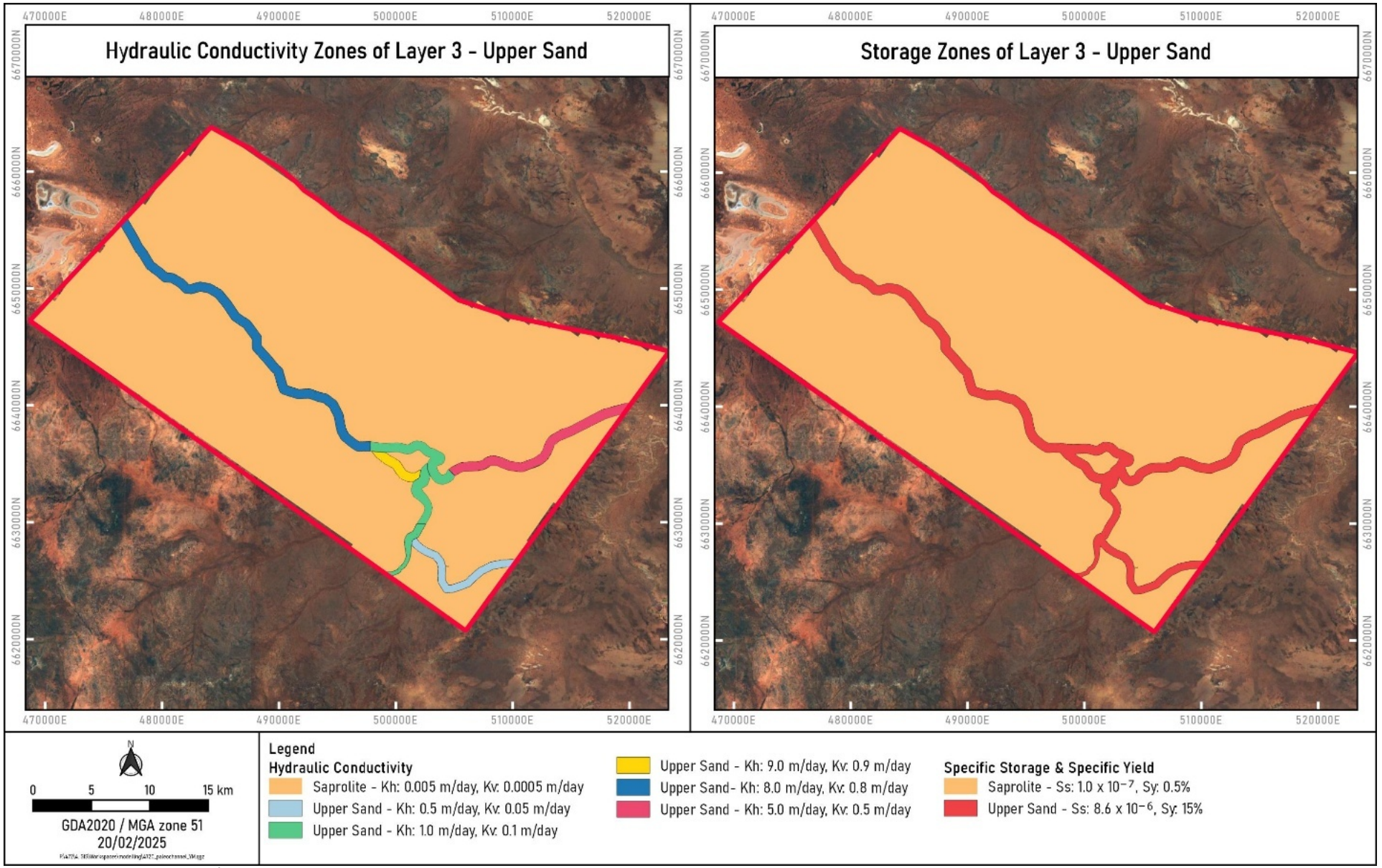
APPENDIX J
NUMERICAL MODEL LAYERS AND AQUIFER PROPERTY ZONES



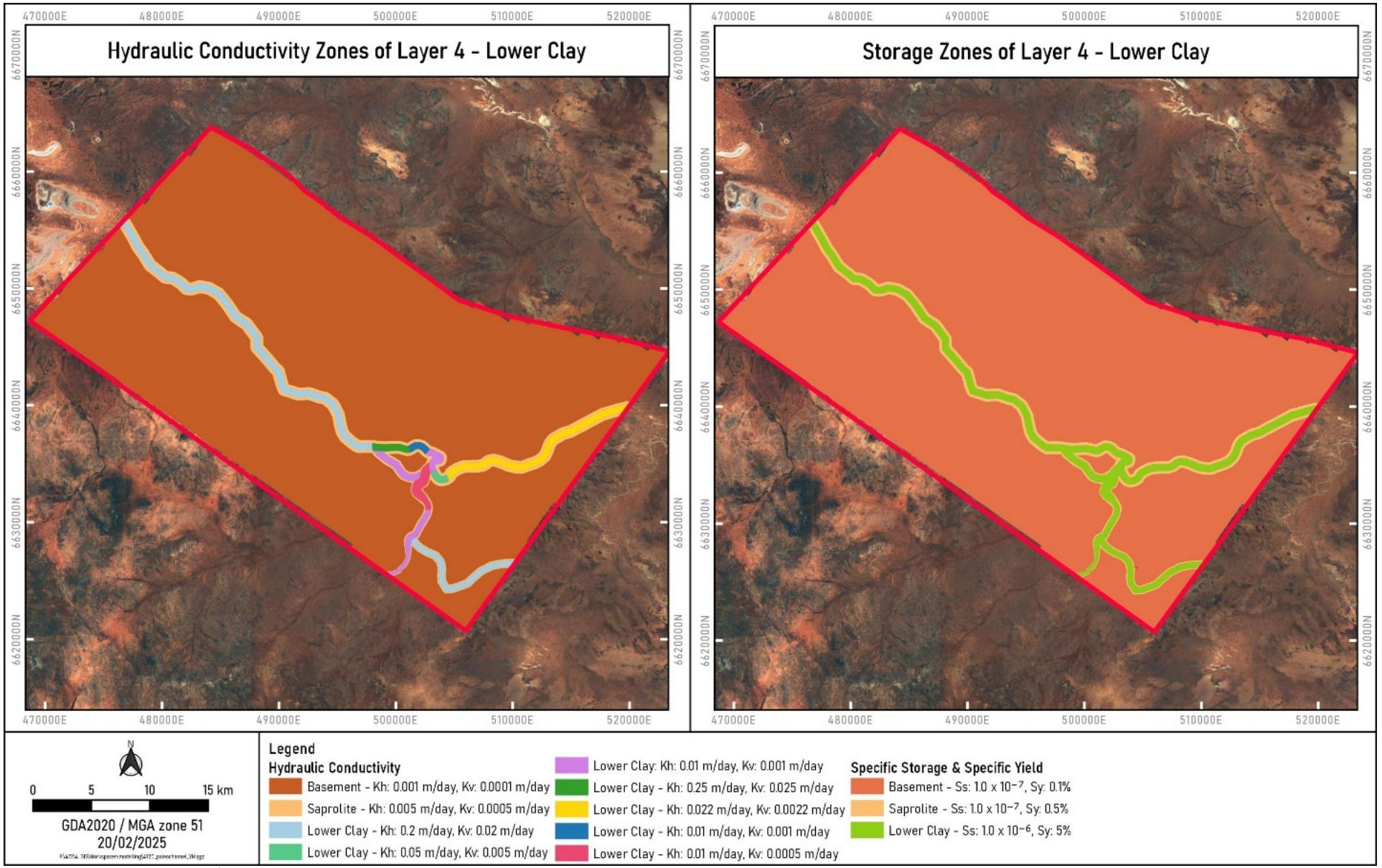
Note: Specific storage not used for model layer 1



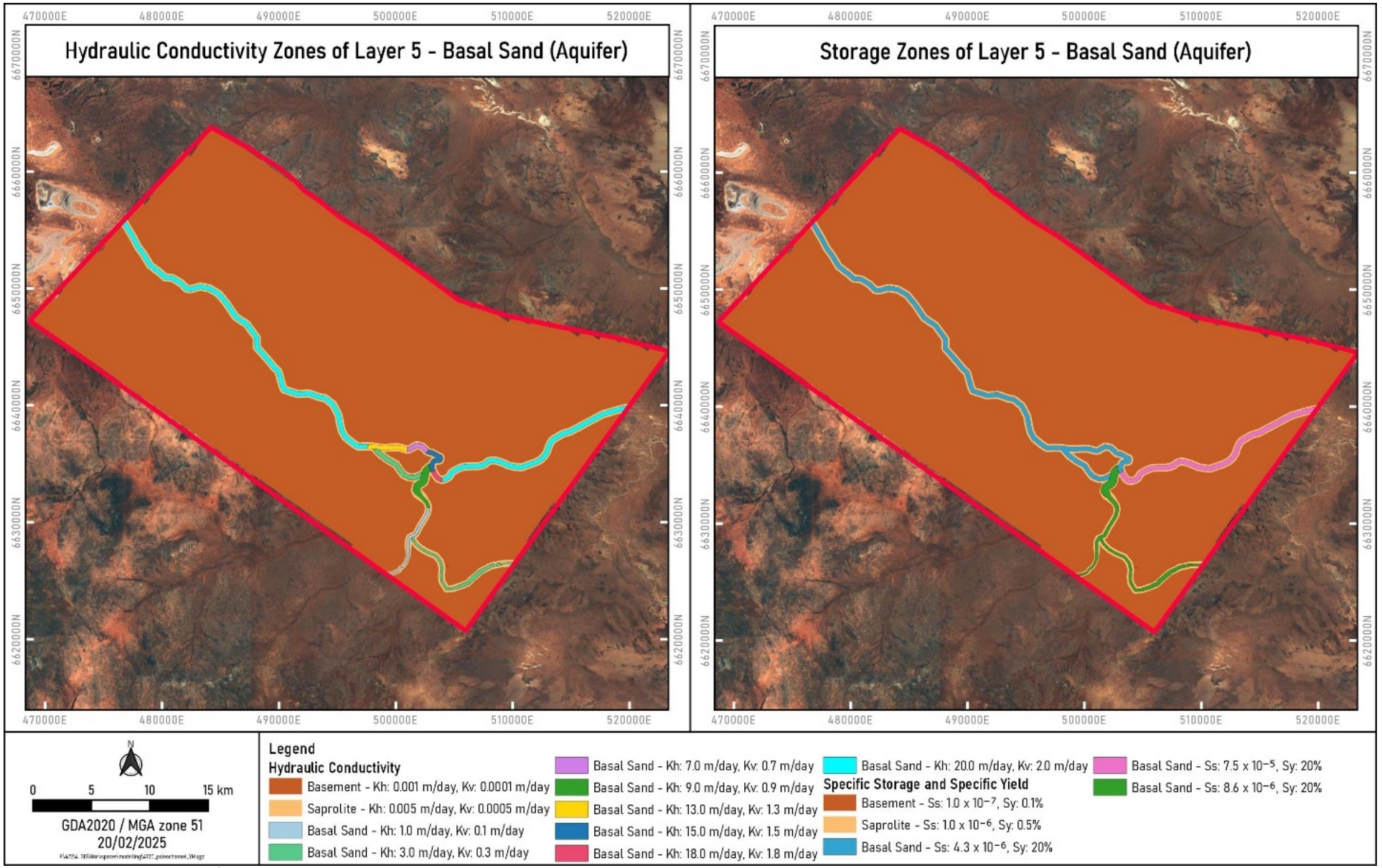
Note: Specific storage units m^{-1}



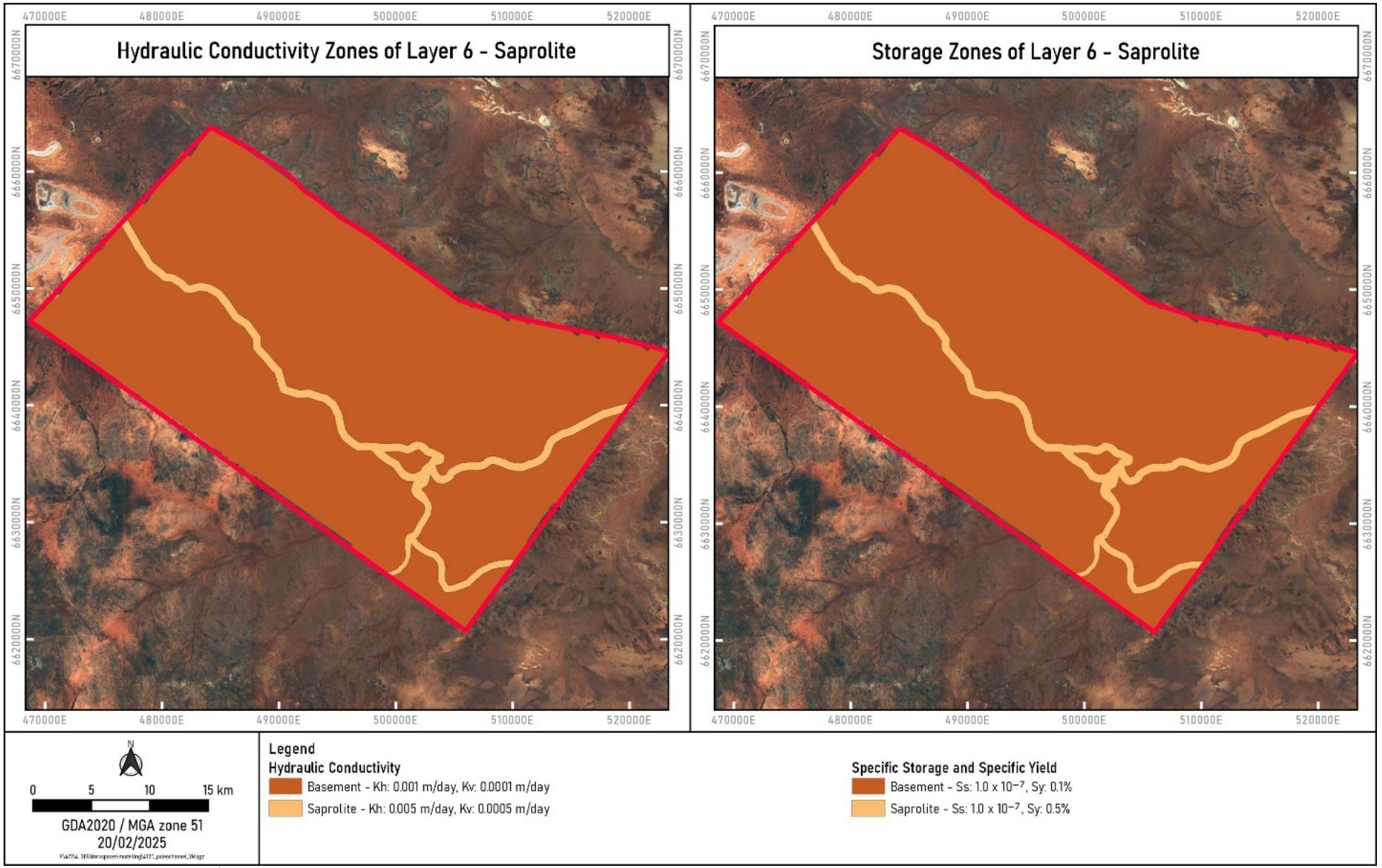
Note: Specific storage units m^{-1}



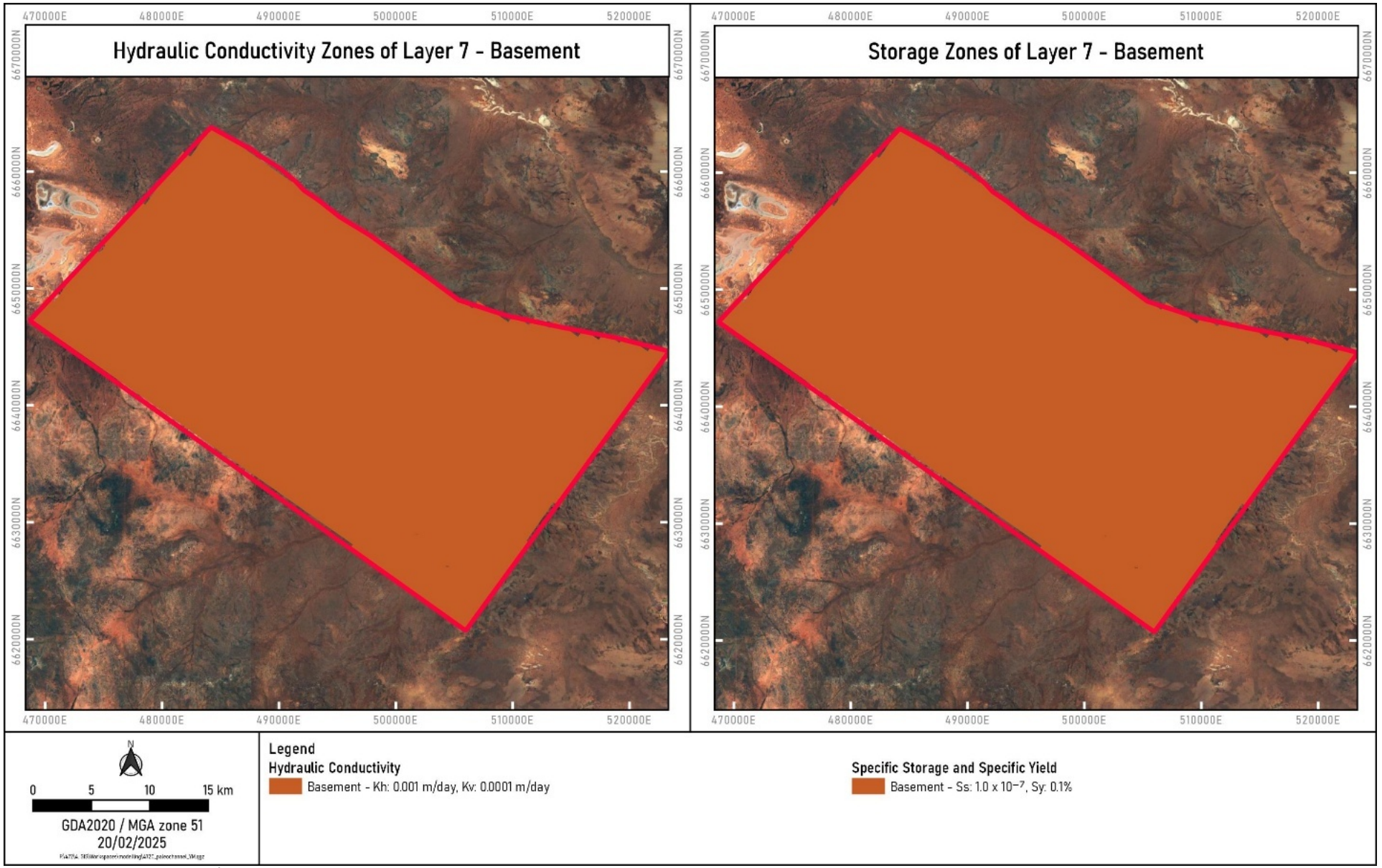
Note: Specific storage units m^{-1}



Note: Specific storage units m^{-1}



Note: Specific storage units m^{-1}



Note: Specific storage units m^{-1}