**Date**: 19 December 2025

**RE**: Gemini Coal Mine | Draft Underground Water Impact Report (UWIR) | Public Consultation

MAGNETIC SOUTH

Public Notice

Pursuant to Section 382 of the Water Act 2000

**RE: Publication of Underground Water Impact Report**

In accordance with the requirements of Section 381 and 382 of the Water Act 2000 Magnetic South Pty Ltd has developed a draft Underground Water Impact Report (UWIR) for its Gemini Coal Mine (ML700056) operation within the boundary of the area identified in the map below as the study area. A more detailed map is contained within the draft report.

It is advised that any person may make a submission about the application during the submission period, which is 20 business days from the publication date of this notice.

In accordance with the Water Act 2000, submissions must be ***properly made***, meeting all of the following requirements:

- is made by the individual or entity invited to make the submission
- is in writing and signed by each individual or entity that made the submission
- is received on or before the last day for the making of the submission
- states the name and address of each individual or entity that made the submission
- states the grounds of the submission and the facts and circumstances relied on in support of the grounds
- is received by the person stated in the notice inviting the submission

Submissions must be properly made, in writing and received on or before 4.30pm on 23 January 2026.

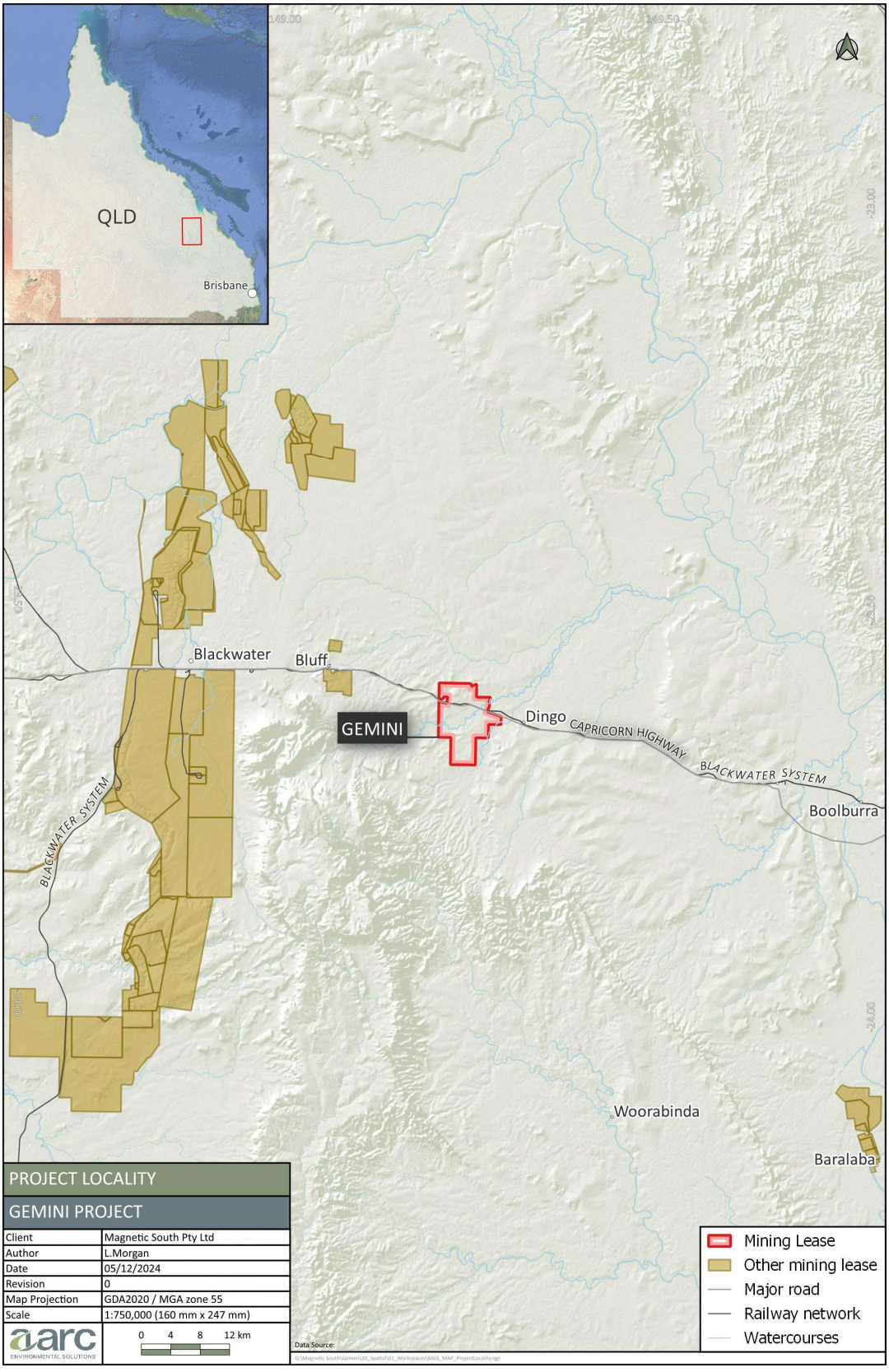
The UWIR and details on how to make a submission may be accessed at:

https://www.magnetic-south.com.au/gemini-project

or a copy may be requested by emailing contact@magnetic-south.com.au

Written submissions on the UWIR may be made to Magnetic South Pty Ltd via email or post to:
Magnetic South Pty Ltd, PO Box 15836, Brisbane City East QLD 4002

Please note that as required by section 382(3)(d) of the Water Act 2000 copies of all received submissions must be provided to the chief executive at undergroundwater@detsi.qld.gov.au. The submissions will be considered as part of the assessment process for the UWIR.


QLD
Brisbane
Blackwater
Bluff
GEMINI
Dingo
CAPRICORN HIGHWAY
BLACKWATER SYSTEM
BLACKWATER SYSTEM
Boolburra
Woorabinda
Baralaba
PROJECT LOCALITY
GEMINI PROJECT
Client | Magnetic South Pty Ltd
Author | L.Morgan
Date | 05/12/2024
Revision | 0
Map Projection | GDA2020 / MGA zone 55
Scale | 1:750,000 (160 mm x 247 mm)
0 4 8 12 km
Data Source:
Mining Lease
Other mining lease
Major road
Railway network
Watercourses

# REPORT ON

## GEMINI PROJECT

## UNDERGROUND WATER IMPACT REPORT

## For: Magnetic South Pty Ltd

Project number: 4175

Date: 01/05/2025

ABN: 50 627 068 866 www.hydrogeologist.com.au info@hydrogeologist.com.au

1/149 Boundary Road, Bardon. QLD. 4065 P.O. Box 108, The Gap. QLD. 4061

# Table of contents

# Table of contents (continued)

## Figure list

## Table list

# Abbreviation list

| Abbreviation | Full Term |
|---|---|
| AHD | Australian Height Datum |
| ANZG | Australian and New Zealand Guidelines |
| BoM | Bureau of Meteorology |
| CMA | Cumulative Management Area |
| CRD | Cumulative Rainfall Departure |
| DES | Department of Environment and Science |
| DETSI | Department of Environment, Tourism, Science and Innovation |
| EA | Environmental Authority |
| EC | Electrical Conductivity |
| EP Act | Environmental Protection Act (1994) |
| EPOLA Act | Environmental Protection (Underground Water Management) and Other Legislation Amendment Act (2016) |
| GDA94 | Geocentric Datum of Australia 1994 |
| GDE | Groundwater Dependent Ecosystem |
| IAA | Immediately Affected Area |
| JBT | JBT Consulting Pty Ltd |
| K (or Kx, Kz) | Hydraulic Conductivity (horizontal or vertical) |
| LTAA | Long Term Affected Area |
| mAHD | Metres Above Australian Height Datum |
| mbgl | Metres Below Ground Level |
| ML | Mining Lease |
| MODFLOW | Modular Three-Dimensional Finite-Difference Groundwater Flow Model |
| Mtpa | Million Tonnes Per Annum |
| OGIA | Office of Groundwater Impact Assessment |
| PCI | Pulverised Coal Injection |
| ROM | Run of Mine |
| SEEP/W | Software for seepage modelling |
| Ss | Specific Storage |
| Sy | Specific Yield |
| UWIR | Underground Water Impact Report |
| WaTERS | Water Tracking and Electronic Reporting System |

# Gemini Project

# Underground Water Impact Report

*Prepared for*

## Magnetic South Pty Ltd

# 1. Introduction

As part of the Project approval conditions **hydrogeologist.com.au** has developed an underground water impact report (UWIR) for the Project, on behalf of Magnetic South.

The UWIR is a requirement of the Department of Environment, Tourism, Science and Innovation (DETSI) to meet the legislative requirements of the *Environmental Protection (Underground Water Management) and Other Legislation Amendment Act 2016* (EPOLA Act), which was an amendment of the *Environmental Protection Act 1994* (EP Act) and Chapter 3 of the *Water Act 2000* (Water Act).

The *Mineral Resources Act 1989* (Qld) (MR Act) entitles the holder of a mining lease to take or interfere with underground water (i.e., groundwater) as part of approved mining operations. This entitlement is termed the mining lease holder's 'underground water rights'. Groundwater that is taken or interfered with while exercising the underground water rights is termed 'associated water'. The holder of a mining lease or mineral development licence is entitled to use associated water for any purpose. In order to exercise the underground water rights for the project, the proponent must comply with its reporting obligations under Chapter 3 of the Water Act which requires preparing an initial UWIR for the project. The process for the UWIR is as follows.

Prior to exercising the underground water rights for the project, the proponent is required to:

- prepare a draft of the initial UWIR;
- publicly exhibit the draft initial UWIR;
- prepare a response to any submissions (a statement of submissions) on the draft UWIR; and
- submit the draft UWIR and statement of submissions to DETSI for review and approval.

## 1.1. Groundwater impact assessment

A groundwater impact assessment was completed by JBT Consulting Pty Ltd (JBT) in October 2019 (JBT, 2019) for the Gemini Coal Project. The mine pit names have been changed since previous reporting. The two mine pits have been renamed, AB Pit is now Mine B and C Pit is now Mine A.

The Project groundwater impact assessment was completed in 2019 (JBT, 2019) and provided an assessment of:

- the regional and mine-scale geology and hydrogeology;
- the installation of a groundwater monitoring bore network, designed to provide water level and water quality data from all groundwater units at site;
- a program of hydraulic testing on the groundwater monitoring bores to provide permeability data;
- water level and water quality data obtained from the groundwater monitoring bores;
- regional groundwater occurrence and use;
- a conceptual groundwater model for the site; and

- groundwater modelling undertaken to provide predictions of:
    - the rate of groundwater inflow to the mined voids; and
    - the extent of groundwater level impacts from mining, to provide prediction of the potential for impact on sensitive environmental receptors, such as landholder bores and groundwater dependent ecosystems (GDEs).

A groundwater modelling component to simulate impacts to the Project was completed to estimate the extent of water level impact from the proposed project. A historic 2D SEEP/W groundwater model was developed by JBT for the Project groundwater impact assessment but was based on a historic mine plan. To support this UWIR, a 2D numerical model has been developed using MODFLOW and is based on the latest mine plan. Certain modelling assumptions and geology layers were adopted from the historic 2D SEEP/W groundwater model.

# 2. Legislative requirements of a UWIR

DETSI provides a guideline to assist resource tenure holders in the development of an UWIR within the framework outlined in the Water Act (DES, 2024). The document provides guidance on the information required to be included in an UWIR and outlines the expectations of DETSI.

The objective will be to develop an UWIR for the project in accordance with the guidelines provided by DETSI and within the framework provided by the Water Act. The requirements for a UWIR are defined in the Queensland Government guideline for underground water impact reports and final reports (DES, 2021). The guideline is designed to assist resource tenure holders in the development of UWIRs and final reports within the framework provided by the Water Act and complimented by requirements under the EP Act. According to the guidelines, an UWIR must contain the following information:

- Part A: Information about underground water extractions resulting from the exercise of underground water rights.

  *To meet the requirements under section 376(a) of the Water Act, an UWIR must include the following:*

  *1. the quantity of underground water produced or taken from the area because of the exercise of underground water rights; and*

  *2. an estimate of the quantity of water to be produced or taken because of the exercise of underground water rights for a three year period starting on the consultation day for the report.*

- Part B: Information about aquifers affected, or likely to be affected.

  *For each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights, an UWIR must include:*

  *1. A description of the aquifer;*

  *2. An analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers; and*

  *3. An analysis of the trends in water level change for the aquifer because of the exercise of underground water rights.*

- Part C: Maps showing the area of the affected aquifer(s) where underground water levels are expected to decline.

  *To meet the requirements of the Water Act, an UWIR must include the following:*

  *1. Maps showing the Immediately Affected Area (IAA) and the Long Term Affected Area (LTAA) (sections 376(b)(iv) and 376(b)(v) of the Water Act);*

  *2. A description of the methods used to produce these maps (section 376(c) of the Water Act);*

  *3. Information about all water bores in the IAA (including the number of bores in the area, maps showing the location of these bores and the authorised use of each bore) (section 376(d) of the Water Act); and*

  *4. A program for conducting an annual review of the accuracy of maps produced and giving the chief executive a summary of the outcome of each review, including a statement of whether there has been a material change in the information or predictions used to prepare the maps (section 376(e) of the Water Act).*

- Part D: An assessment of the impacts to the environmental values from the exercise of underground water rights.

  *To meet the requirements of the Water Act, an UWIR must include the following:*

  *1. a description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights (section 376(da) of the Water Act);*

  *2. an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights (section 376(db) of the Water Act)—*

  *i. for a three year period starting on the consultation day for the report; and*

  *ii. over the projected life of the resource tenure.*

- Part E: A water monitoring strategy.

  *To meet the requirements of the Water Act, an UWIR must include the following:*

  1. *a rationale for the strategy;*
  2. *a timetable for strategy;*
  3. *the parameters to be measured;*
  4. *the locations for taking measurements;*
  5. *the frequency of the measurements;*
  6. *a program for the responsible tenure holder or holders to undertake a baseline assessment for each water bore that is outside the area of a resource tenure, but within the predicted LTAA; and*
  7. *a program for reporting to the OGIA about the implementation of the monitoring strategy.*

- Part F: A spring impact management strategy.

  *To meet the requirements of the Water Act, an UWIR must include the following:*

  1. *The details of the spring, including its location;*
  2. *An assessment of the connectivity between the spring and the aquifer(s) over which the spring is located;*
  3. *The predicted risk to, and likely impact on, the ecosystem and cultural and spiritual values of the spring because of the decline in water level of the aquifer over which the spring is located;*
  4. *A strategy for preventing or mitigating the predicted impacts outlined above; or if a strategy for preventing or mitigating the predicted impacts is not included, the reason for not including the strategy;*
  5. *A timetable for implementing the strategy; and*
  6. *A program for reporting to Office of Groundwater Impact Assessment (OGIA) about the implementation of the strategy.*

- Part G: For a Cumulative Management Area (CMA), assignment of responsibilities to resource tenure holders.

  Part G is not applicable in this instance as the area is not part of a cumulative management area.

## 2.1. Report structure

This UWIR report has been structured according to the outline suggested by DESI (2021):

- Section 4 (Part A) includes information about the underground water extractions resulting from the exercise of underground water rights;
- Section 5 (Part B) includes information about the aquifers affected, or likely to be affected;
- Section 6 (Part C) includes maps showing the area of the affected aquifer(s) where underground water levels are expected to decline;
- Section 7 (Part D) includes an assessment of the impacts to the environmental values from the exercise of the underground water rights;
- Section 8 (Part E) details the water monitoring strategy for the project; and
- Section 9 (Part F) details the spring impact management strategy for the project. As there are no springs identified in the region there is no spring management strategy presented.

# 3. Project area

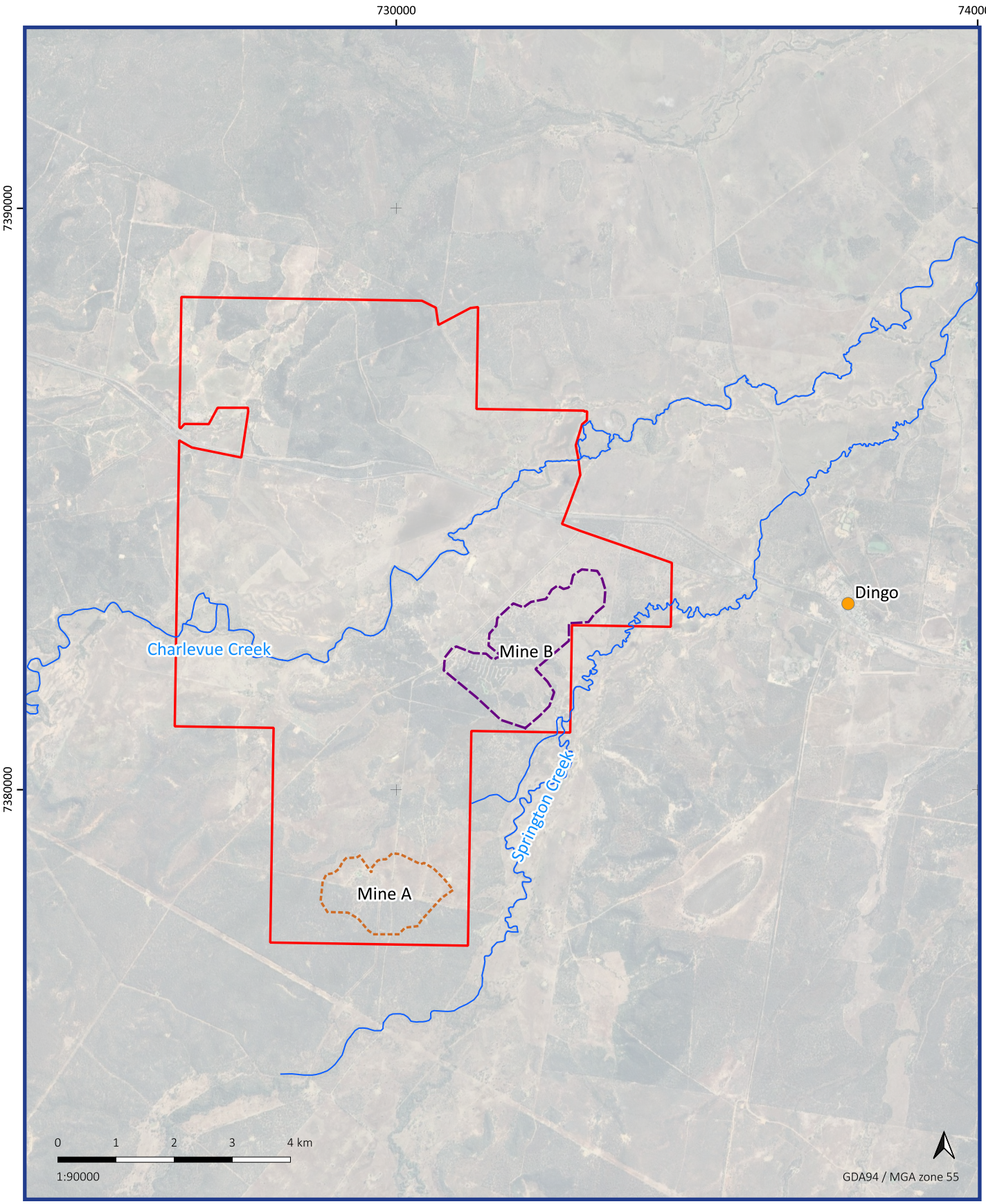
## 3.1. Project description

Magnetic South Pty Ltd (Magnetic South) is developing the Gemini Project (the Project), an open cut metallurgical coal mine located in Mining Lease (ML) 700056. The Project is located approximately 150 km to the east of Rockhampton and 8 km west of the town of Dingo, as shown in Figure 3-1.

The Project is a greenfield open cut mine to produce Pulverised Coal Injection (PCI) coal and Coking Coal products for export for steel production. The Project term is anticipated to be 25 years from grant of the ML with this term including initial construction, mine operation and rehabilitation activities. The two open cut mine pits called Mine A and Mine B, are to be mined as a truck and shovel operation at an average of 1.9 million tonnes per annum (Mtpa) ROM coal. The mine schedule includes Mine A from year 1 to 7, and Mine B from year 8 to 21.

## 3.2. Catchment hydrology

The Project mining areas are located between Charlevue Creek and Springton Creek. Within the ML, Springton and Charlevue Creeks have well defined channels that cross alluvial floodplains. All local waterways including the Charlevue Creek and Springton Creek are ephemeral, with flow generally occurring after high intensity or long-term sustained rainfall events. The creeks flow to the northeast following topography which is generally flat between the two creeks. Within the ML the topography slopes gently from southwest to northeast at an elevation change of approximately 148 mAHD to 114 mAHD (metres Australian Height Datum), as shown in Figure 3-2.






**Project location**

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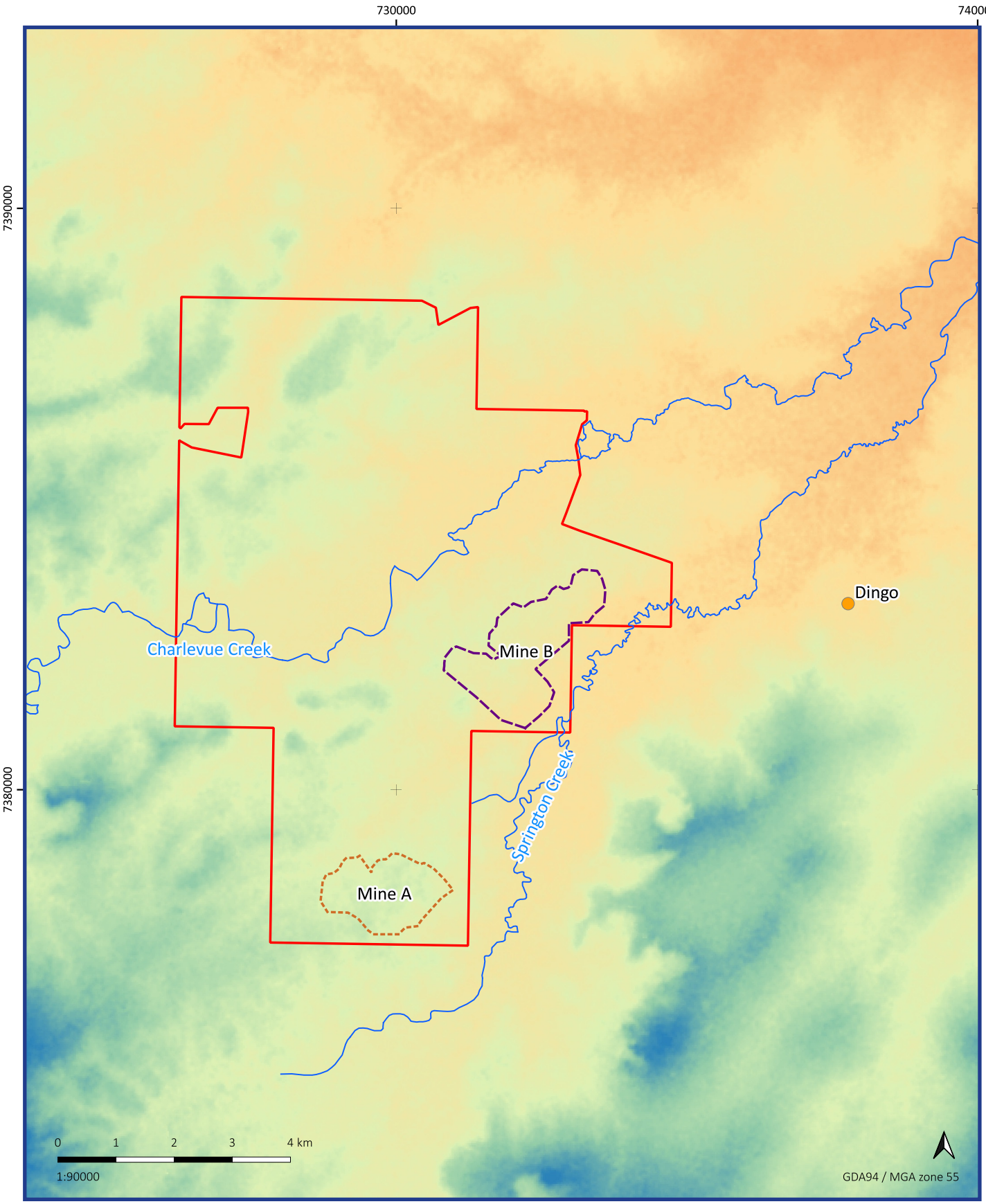
**Figure 3 - 1**

19/12/2024






**Topography**

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**Figure 3 - 2**

10/02/2025

- Town
- Watercourse
- Mining lease - 700056
- Mine A
- Mine B

**Topography (mAHD)**

| | |
|---|---|
| 50 | 140 |
| 80 | 170 |
| 110 | 200 |

## 3.3. Climate

Rainfall data for the Project was obtained from the Queensland Government SILO Data Drill website for the year 1900 to 2024. The SILO data accesses grids of climate data available from surrounding Bureau of Meteorology (BoM) point observations and then creates interpolated climate values for a site-specific location. The SILO data site coordinates are 23.65°, 149.30°. The interpolated climate data are calculated for the site-specific location using splining and kriging techniques, based on the proximity of surrounding BoM point observations. The site specific average monthly SILO climate data is listed in Table 3-1, which shows that evaporation exceeds rainfall for every month of the year.

Monthly rainfall data and the Cumulative Rainfall Departure (CRD) curve is shown in Figure 3-3. The CRD is calculated by subtracting the long-term average monthly rainfall from the actual monthly rainfall, to provide a monthly departure from average conditions. Periods of below average rainfall are represented as downward trending slopes and above average rainfall as upward trending slopes. The CRD curve is used in groundwater investigations due to the potential correlation between the CRD and groundwater level trends.

The CRD curve shows an upward trend from 1949 to 1991 due to above average rainfall over that period but has been in decline due to generally below average rainfall conditions from 1992 to 2007. The overall recent trend of the CRD curve has been declining from April 2013 to October 2024. This decline is primarily driven by multiple below average rainfall events.

**Table 3-1 Average monthly SILO climate data**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Rainfall (mm)*** | | | | | | | | | | | | |
| | 110.8 | 98.5 | 72.0 | 34.4 | 32.0 | 33.9 | 26.5 | 20.8 | 22.7 | 45.1 | 61.0 | 100.5 |
| ***Evaporation (mm)*** | | | | | | | | | | | | |
| | 226.3 | 184.1 | 188.8 | 150.1 | 117.0 | 93.6 | 101.7 | 130.7 | 170.2 | 210.8 | 222.5 | 236.8 |

*Note: Average data from SILO data for the period 1900 to 2024*

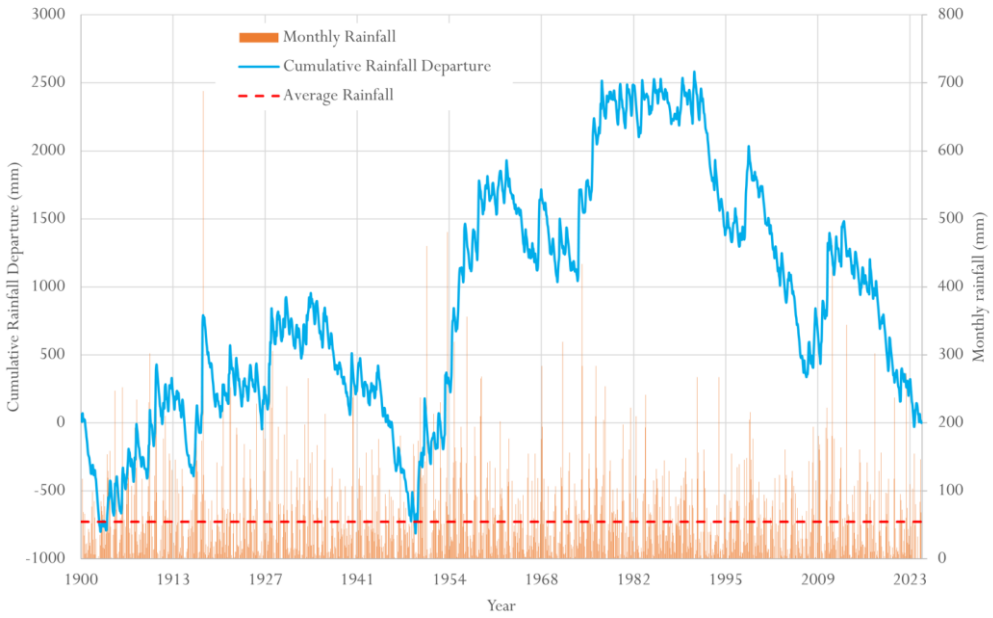



**Figure 3-3 Rainfall and cumulative rainfall departure curve**

# 4. Part A – Water extractions

The rate of groundwater inflow to the mined voids Mine A and Mine B during the operational period of mining was predicted with the 2D numerical model. The modelled inflow rates for each mining year and for each pit are listed below in Table 4-1.

**Table 4-1 Modelled inflow rates**

| Year | Mine A | Mine B |
|---|---|---|
| | Modelled inflow rate $m^3$/day | Modelled inflow rate $m^3$/day |
| 1 | 1128.7 | 0.0 |
| 2 | 739.0 | 0.0 |
| 3 | 727.8 | 0.0 |
| 4 | 1030.4 | 0.0 |
| 5 | 933.7 | 0.0 |
| 6 | 581.3 | 0.0 |
| 7 | 395.0 | 0.0 |
| 8 | 325.0 | 1049.1 |
| 9 | 305.3 | 1363.9 |
| 10 | 290.5 | 1468.8 |
| 11 | 279.2 | 1731.1 |
| 12 | 271.2 | 2124.5 |
| 13 | 265.0 | 2518.0 |
| 14 | 259.6 | 2281.9 |
| 15 | 254.8 | 2045.8 |
| 16 | 250.5 | 2124.5 |
| 17 | 246.8 | 2203.2 |
| 18 | 244.0 | 1783.6 |
| 19 | 241.7 | 1363.9 |
| 20 | 239.6 | 1363.9 |
| 21 | 237.6 | 734.2 |

# 5. Part B – Aquifer information and underground water flow

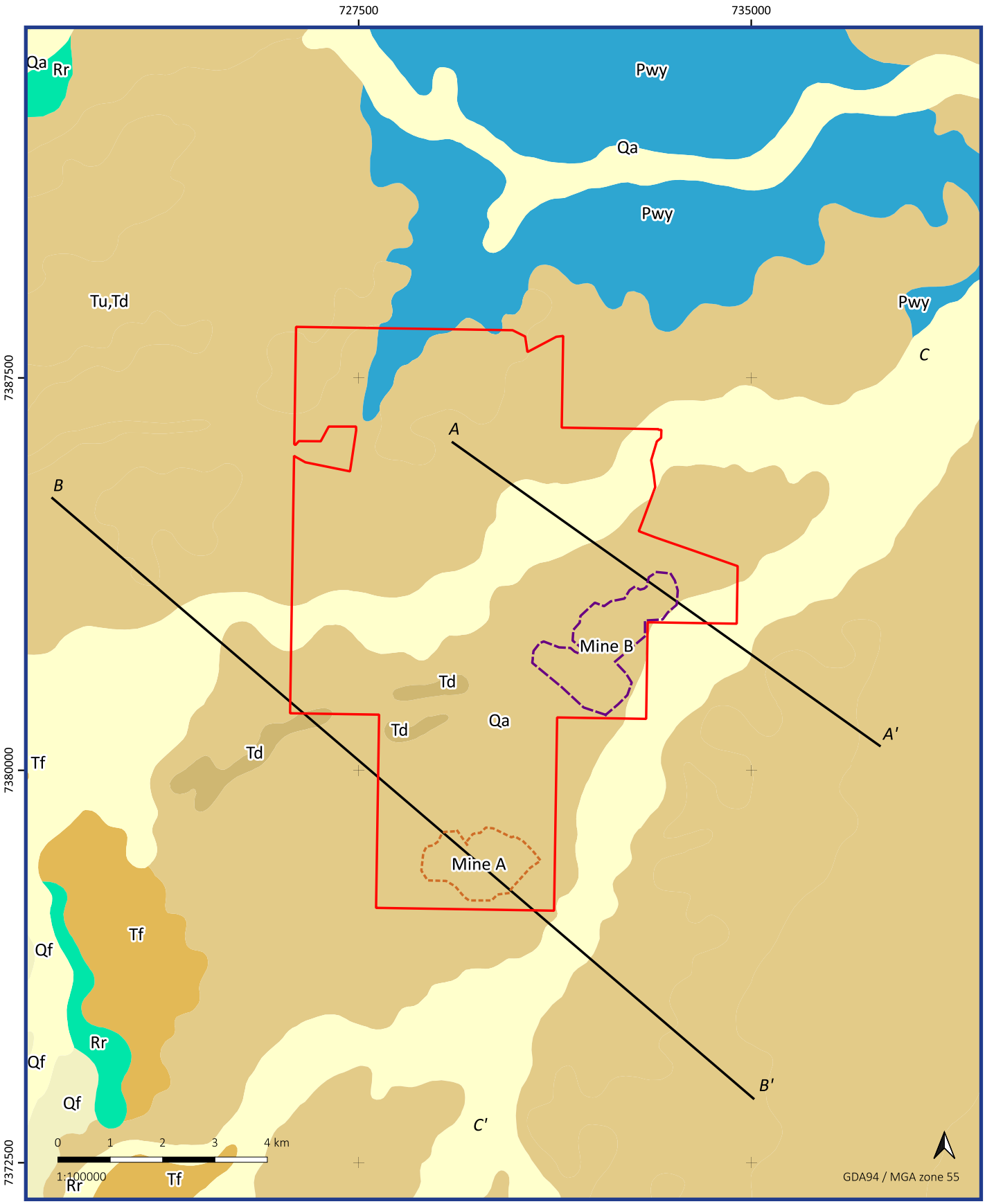
## 5.1. Geology

The surface geology at site is shown in Figure 5-1 and the geology listed in Table 5-1. The surface geology predominantly comprises sediments of the Tertiary Duaringa Formation and Quaternary alluvium associated with ephemeral creeks including Charlevue Creek and Springton Creek. At one location north of Mine A, a small area of remnant basalt has been identified from drilling, measuring approximately 600 m long and 200 m wide with a thickness of approximately 20 m (JBT, 2019). Extensive geological drilling across the project area has shown no other evidence of basaltic flows or intrusions (JTB, 2019).

The Permian strata have undergone intense structural deformation, resulting in folding and faulting of the unit. Multiple reverse angle faults are present within the deposit, with displacements on some faults estimated to be more than 100 m (JBT, 2019). The Gemini coal deposit is hosted within the Permian Rangal Coal Measures and within the Yarrabee Structural Zone. Seven seams or seam groups have been identified, which belong to either the Rangal Coal Measures or the underlying Burngrove Formation (JBT, 2019). The two mining areas (Mine A and Mine B) are located in areas where folding has brought the coal seams close to surface at depths that can be economically mined. In descending stratigraphic order, the seams include the Aries, Castor, Pollux, Orion, Pisces, Virgo and Leo seams.

**Table 5-1 Geology**

| Geological age | Formation | Coal seams | Lithology | Typical thickness at site (m) |
|---|---|---|---|---|
| Quaternary | Alluvium | | Unconsolidated soil, silt clay, sand and gravel associated with current surface drainage systems, e.g. Charlevue Creek and Springton Creek | 1.5 |
| Tertiary | Duaringa Formation | | Mudstone, sandstone, conglomerate, siltstone | 15 - 30 |
| | Basalt | | Minor basalt at one location north of Mine A. | 20 |
| Triassic | Rewan Formation | | Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate at base | 0 - 50 |
| Permian | Rangal Coal Measures | Aries Upper | Feldspathic and lithic sandstone, carbonaceous mudstone, siltstone, tuff and coal seams.<br>Includes the Aries, Castor and Pollux coal seam, which are the target coal seam for mining at the Gemini Project | 2.1 |
| | | Aries lower | | 4 |
| | | Castor Upper | | 1.6 |
| | | Castor Lower | | 2 |
| | | Pollux Upper | | 1.9 |
| | | Pollux Lower Upper | | 2.9 |
| | | Pollux Lower Lower | | 3.5 |
| | | Orion | | 6.1 |
| | | Pisces Upper | | 1.7 |
| | | Pisces Lower | | 0.7 |
| | Burngrove Formation | Virgo | Mudstone, siltstone, coal, tuff. | 2.8 |
| | | Leo | | 4.4 |
| | Gyranda Formation | | Siltstone and shale with minor tuff and volcanilithic sandstone and rare coal | 0 to 100 + |






**Geology**

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**Figure 5 - 1**

19/12/2024

- Mining lease - 700056
- Mine A
- Mine B
- Cross section
- Qa - Alluvium
- Tu, Td - Duaringa Formation
- Tf - Rudite
- Pwy - Gyranda Formation

Simplified preliminary conceptual cross sections are shown for the groundwater system from west to east in Figure 5-2 through Mine B and west to east in Figure 5-3 through Mine A. These cross sections are reproduced from JBT (2019). Cross section locations are shown in Figure 5-1.

Figure 5-2 and Figure 5-3 shows the project location in relation to the underlying Bowen Basin solid geology (i.e. the surficial unconsolidated Quaternary and Tertiary units have been removed, revealing the relationship between the underlying Triassic and Permian strata as well as the prevalence of regional-scale faults) (JBT, 2019). The two mining areas are located where folding has brought the coal seams close to surface at depths that can be economically mined. The Gemini coal deposit is hosted within the Permian strata which belong to the Rangal Coal Measures and the underlying Burngrove Formation.

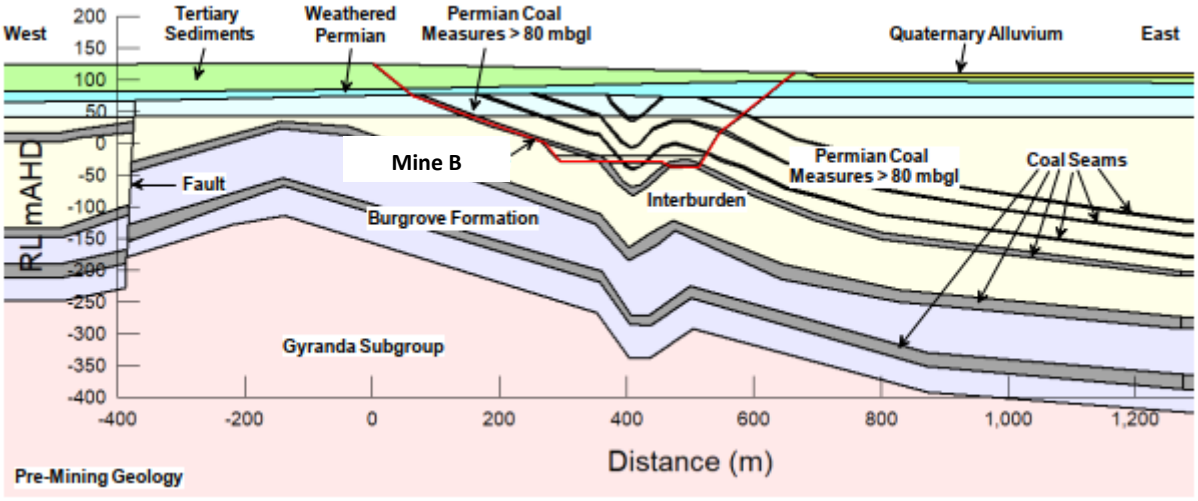



**Figure 5-2 Cross Section A - A' for Mine B (JBT, 2019)**

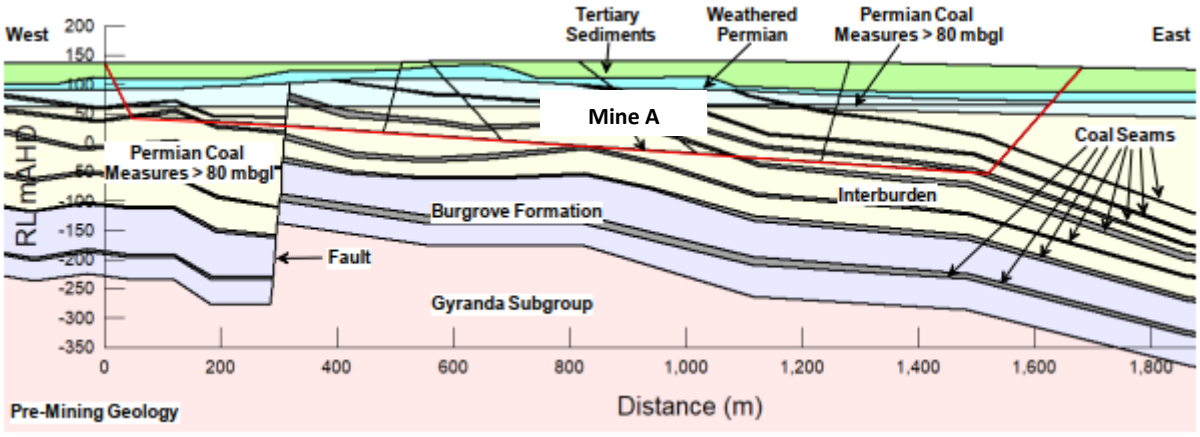



**Figure 5-3 Cross Section B - B' for Mine A (JBT, 2019)**

## 5.2. Overview of aquifers

In the Project area, groundwater occurs within the Quaternary alluvium, Tertiary sediments and Permian coal measures. The mapped surface geology is shown in Figure 5-1.

### 5.2.1. Quaternary alluvium

Groundwater occurs within the Quaternary alluvium associated with the Charlevue Creek and Springton Creek. The water level within the alluvium ranges from approximately 10 m to 14 m below ground level (mbgl) for bores adjacent to the creek channels.

### 5.2.2. Tertiary sediments

Groundwater in the region exists in the Tertiary sediments. There are dry bores within the Tertiary sediments and there is a significant reduction in the level of the base of Tertiary to the west and north-west of Mine B, where the base of Tertiary reduces from approximately 100 mAHD to 70-80 mAHD (JBT, 2019). A continuous water surface may not exist in the Tertiary sediments and the elevation of the base of Tertiary will be a control on the presence of groundwater within the sediments (JBT, 2019).

A minor area of Tertiary basalt is present to the north of Mine A. The basalt is interpreted to be dry and of limited extent and is therefore not considered as a groundwater unit at the Project site. One groundwater monitoring bore has been located within the basalt called DW7105W1. The bore is 23 m deep, and the basalt is dry at the bore location. The basalt flow is interpreted to be dry (as it is above the regional groundwater level) and of limited extent and is therefore not an important groundwater feature within the project area (JBT, 2019).

### 5.2.3. Permian coal measures

Groundwater in the region exists in the confined Permian sandstone, siltstone and mudstone units and associated coal seams of the Rangal Coal Measures or the underlying Burngrove Formation. The coal seams represent low permeability, confined aquifers within the Permian coal measures. The Permian interburden units generally form aquitards that limit vertical inter-mixing between the low permeability coal seam aquifers.

## 5.3. Groundwater monitoring network

The groundwater monitoring network comprises of 38 monitoring bores at 17 sites as shown in Figure 5-4, with details provided in Table 5-2. The monitoring network was designed to allow hydraulic testing, groundwater level and quality monitoring of all groundwater units encountered at site and includes:

- two bores within Quaternary alluvium;
- ten bores within Tertiary deposits (nine bores within Tertiary sediments and one bore (DW7105W1) in Tertiary basalt;
- twenty-three bores within Permian coal seams; and
- three bores within the Permian overburden/interburden strata.

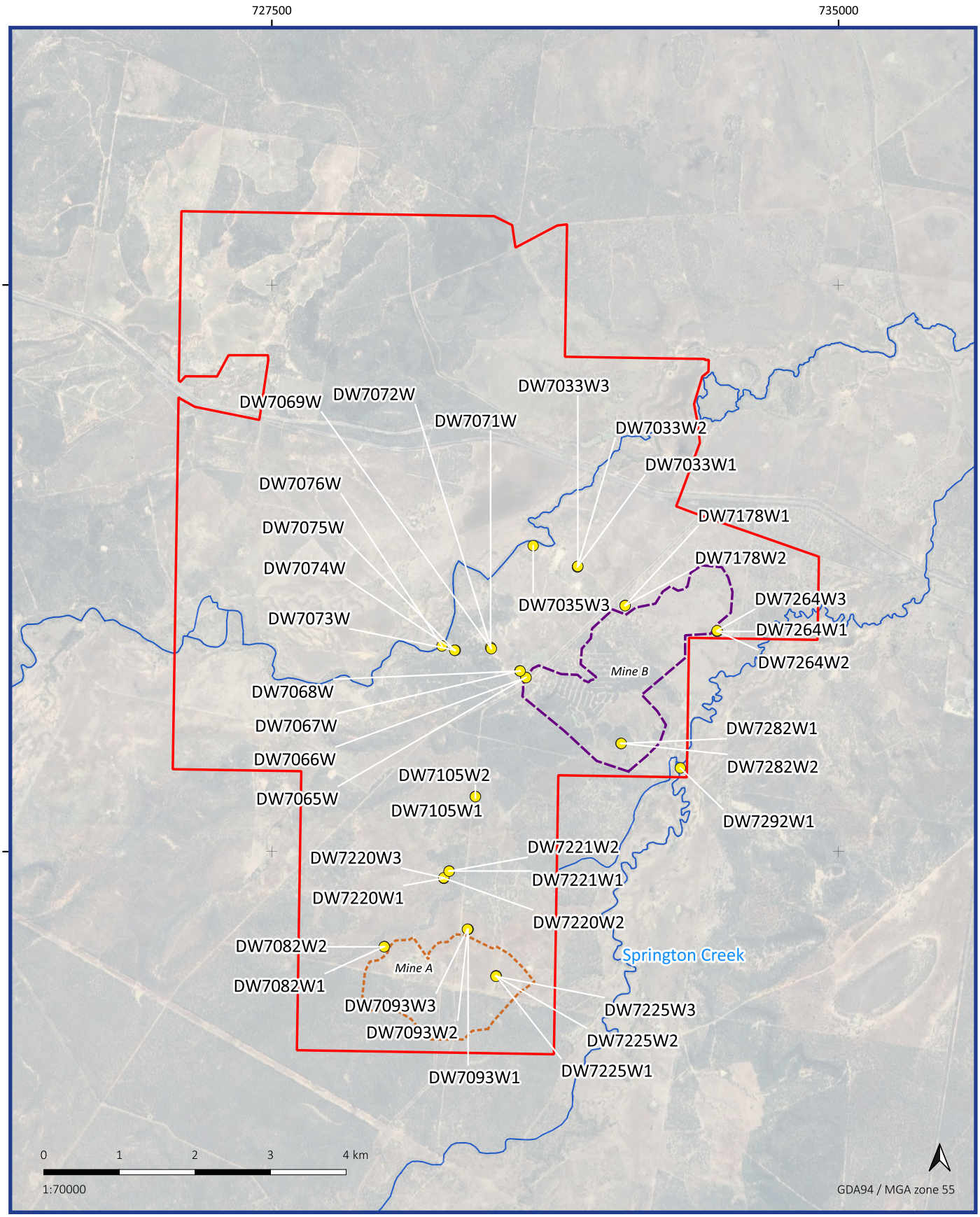
Table 5-2 Groundwater monitoring network details

| Monitoring bore | Hydrogeological unit | Easting | Northing | Elevation (mAHD) | Depth (mTOC) |
|---|---|---|---|---|---|
| DW7065W | Aries 3 Seam | 730861 | 7382308 | 136.65 | 77.27 |
| DW7066W | Tertiary sediments | 730864 | 7382305 | 137.19 | 17.35 |
| DW7067W | Aries 3 Seam | 730782 | 7382395 | 134.81 | 100.14 |
| DW7068W | Tertiary sediments | 730786 | 7382392 | 134.94 | 47.5 |
| DW7069W | Pollux Upper Seam | 730398 | 7382700 | 133.46 | 71.38 |
| DW7071W | Aries 3 Seam | 730395 | 7382704 | 133.22 | 31.59 |
| DW7072W | Tertiary sediments | 730404 | 7382688 | 133.14 | 14.01 |
| DW7073W | Castor/ Pollux Seams | 729927 | 7382667 | 123.04 | 82.1 |
| DW7074W | Castor Upper Seams | 729923 | 7382667 | 122.94 | 55.78 |
| DW7075W | Tertiary sediments | 729919 | 7382667 | 122.83 | 14.03 |
| DW7076W | Quaternary alluvium | 729751 | 7382724 | 120.82 | 12 |
| DW7033W1 | Tertiary sediments | 731544 | 7383769 | 125.44 | 45.23 |
| DW7033W2 | Orion 5 Seam | 731547 | 7383774 | 125.46 | 74.77 |
| DW7033W3 | Interburden | 731549 | 7383778 | 125.47 | 81 |
| DW7035W3 | Orion 1 Seam | 730958 | 7384051 | 117.73 | 48.47 |
| DW7082W1 | Castor Lower Seam | 728990 | 7378747 | 136.34 | 40.58 |
| DW7082W2 | Pollux Upper Seam | 728987 | 7378743 | 136.32 | 59.17 |
| DW7093W1 | Pollux Lower Upper Seam | 730097 | 7378975 | 140.14 | 87.3 |
| DW7093W2 | Interburden | 730093 | 7378974 | 140.14 | 99.2 |
| DW7093W3 | Pollux Lower Lower Seam | 730089 | 7378975 | 140.17 | 123.25 |
| DW7105W1 | Tertiary basalt | 730193 | 7380734 | 129.62 | 23.04 |
| DW7105W2 | Pollux Lower Upper Seam | 730194 | 7380730 | 129.72 | 69.25 |
| DW7178W1 | Tertiary sediments | 732175 | 7383261 | 129.62 | 51.15 |
| DW7178W2 | Pollux Lower Upper Seam | 732175 | 7383257 | 129.66 | 58.69 |
| DW7220W1 | Tertiary sediments | 729776 | 7379649 | 129.72 | 26.5 |
| DW7220W2 | Castor Seam | 729776 | 7379652 | 129.62 | 38.4 |
| DW7220W3 | Pollux Lower Upper Seam | 729775 | 7379656 | 129.67 | 75.08 |
| DW7221W1 | Aries 3 Seam | 729847 | 7379746 | 130.34 | 50.43 |
| DW7221W2 | Castor Seam | 729846 | 7379743 | 130.32 | 72.36 |
| DW7225W1 | Tertiary sediments | 730468 | 7378360 | 141.7 | 37 |
| DW7225W2 | Aries 3 Seam | 730467 | 7378356 | 141.76 | 78.9 |
| DW7225W3 | Castor Seam | 730466 | 7378352 | 141.74 | 112.8 |
| DW7264W1 | Tertiary sediments | 733393 | 7382916 | 113.16 | 14 |
| DW7264W2 | Aries 1 Seam | 733392 | 7382922 | 113.22 | 104.21 |
| DW7264W3 | Aries 3 Seam | 733392 | 7382926 | 113.24 | 136.7 |
| DW7282W1 | Overburden | 732120 | 7381434 | 116.84 | 43.03 |
| DW7282W2 | Aries 3 Seam | 732124 | 7381434 | 116.82 | 89.91 |
| DW7292W1 | Quaternary alluvium | 732906 | 7381109 | 114.41 | 15 |

***Notes***: *Coordinates are in GDA2020*

*mbgl – metres below ground level*

*mAHD – metres above Australian Height Datum*






**Groundwater monitoring network**

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**Figure 5 - 4**

19/12/2024

- Bore
- Watercourse
- Mining lease - 700056
- Mine A
- Mine B

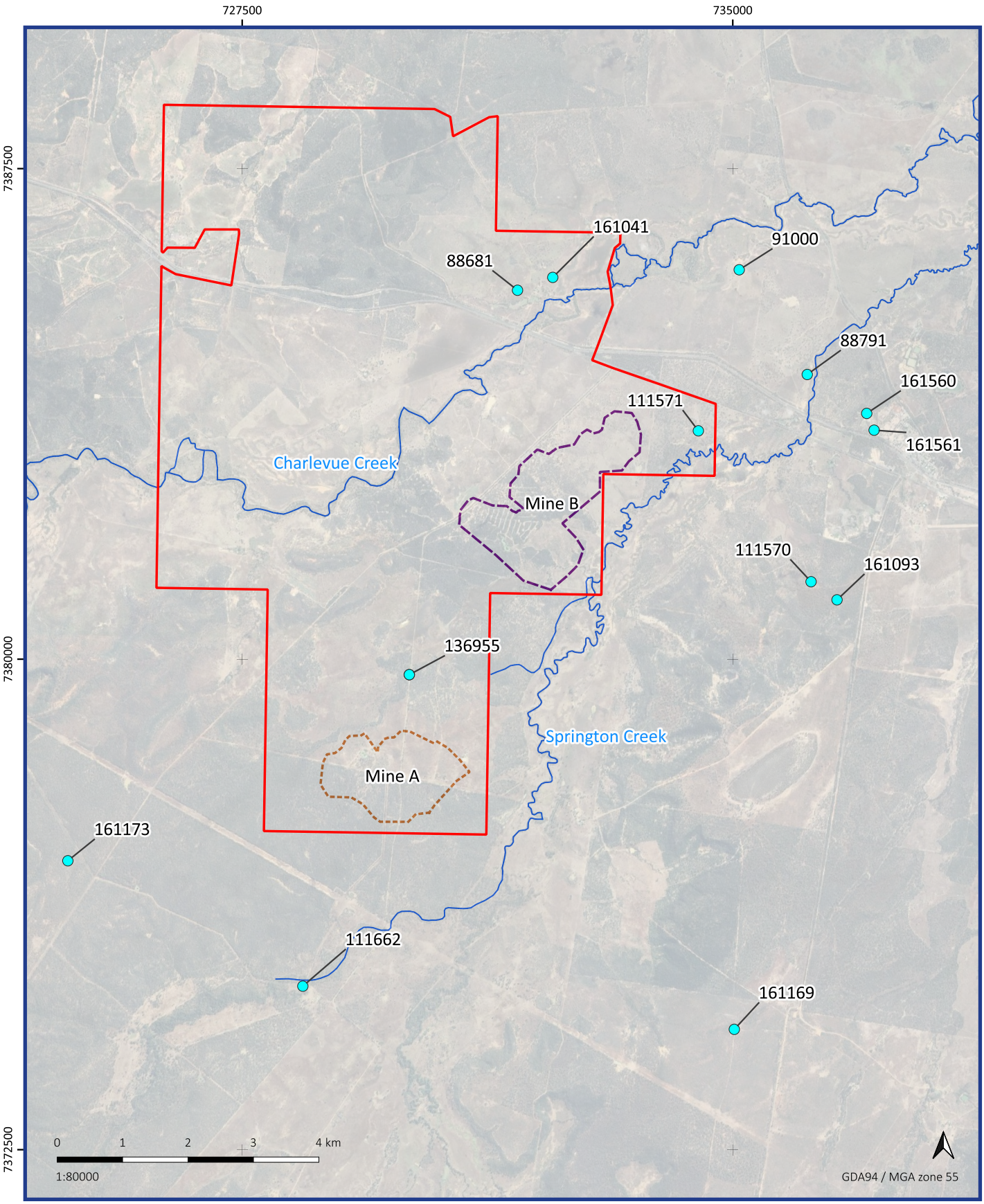
## 5.4. Registered bores

Table 5-3 lists the 13 registered bores that are within, or close to the Project. The bore locations are shown in Figure 5-5. Eight bores are listed as existing and used for water supply and two bores are monitoring. Three bores are listed as abandoned.

**Table 5-3 Registered bores**

| Registered bore | Aquifer | Role | Status | Easting | Northing |
|---|---|---|---|---|---|
| 136955 | Tertiary-Undefined | Water Supply | Existing | 730055 | 7379765 |
| 111662 | Tertiary-Undefined | Water Supply | Existing | 728427 | 7375003 |
| 88681 | Duaringa Formation | Water Supply | Existing | 731709 | 7385642 |
| 88791 | Duaringa Formation | Water Supply | Existing | 736138 | 7384354 |
| 91000 | Duaringa Formation | Water Supply | Abandoned / usable | 735098 | 7385955 |
| 161041 | Duaringa Formation | Water Supply | Existing | 732248 | 7385839 |
| 161560 | Unknown | Sub-Artesian Monitoring | Existing | 737047 | 7383759 |
| 161561 | Unknown | Sub-Artesian Monitoring | Existing | 737160 | 7383503 |
| 111570 | Tertiary-Undefined | Water Supply | Existing | 736196 | 7381186 |
| 161093 | Tertiary Mafic Volcanics | Water Supply | Existing | 736593 | 7380909 |
| 161173 | Unknown | Water Supply | Abandoned / destroyed | 724835 | 7376920 |
| 161169 | Tertiary-Undefined | Water Supply | Existing | 735023 | 7374343 |
| 111571 | Unknown | Unknown | Abandoned / destroyed | 734473 | 7383493 |

***Note**: Coordinates are in GDA2020*






**Groundwater registered bores**

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**Figure 5 - 5**

01/04/2025

- Registered bores
- Watercourses
- Mining lease - 700056
- Mine A
- Mine B

## 5.5. Groundwater level trends

Groundwater level data is available between 2018 and 2024. Groundwater elevations for bores screened in the Quaternary alluvium are shown in Figure 5-6. Bore DW7076W is screened within Quaternary alluvium adjacent to Charlevue Creek. Bore DW7292W1 is screened within Quaternary alluvium adjacent to Springton Creek. The measured depth to groundwater in the alluvium bores close to the creeks is between 110 m AHD (DW7076W, adjacent to Charlevue Creek) and 100 m AHD (bore DW7292W1, adjacent to Springton Creek).

Groundwater elevations for bores screened in the Tertiary sediments are shown in Figure 5-7. The water level with the Tertiary sediments ranges from 88 mAHD to 119 mAHD (where water is present). Four bores were dry for the monitoring period including DW7066W, DW7072W, DW7075W and DW7105W1. The dry bores are located west and south-west of Mine B in an elevated area. The presence of water within the Tertiary sediments is related to the RL of the base of Tertiary and from review of available data it is assessed that it is probable that the Tertiary sediments are dry above 120 mAHD and likely dry above 110 mAHD (JBT, 2019).

Groundwater elevations for bores screened in the Permian coal seams are shown in Figure 5-8 to Figure 5-11 for the different coal seams. The groundwater elevations in the coal measures ranges from 87.7 mAHD to 109 mAHD in the Aries Seam, 79.1 mAHD to 118.8 mAHD in the Castor Seam, 94 mAHD to 95 mAHD in the Orion Seam and 89.2 mAHD to 118.7 mAHD in the Pollux Seam. One bore DW7071W at a depth of 31.59 m and screened in the Aries Coal Seam was dry for the monitoring period.

## 5.6. Groundwater contours and flow directions

Figure 5-12 shows the groundwater elevation contours for the Tertiary sediments. Groundwater elevation is around 112 mAHD to the southwest and 90 mAHD in the north of the Project area. The groundwater flow direction in the Tertiary sediments is from the southwest to northeast following topography.

Figure 5-13 shows the groundwater elevation contours for the Permian coal measures. The groundwater flow direction in the Permian strata is from the southwest to northeast following topography. A depression is centred on the area where the Mine B is proposed to be developed.

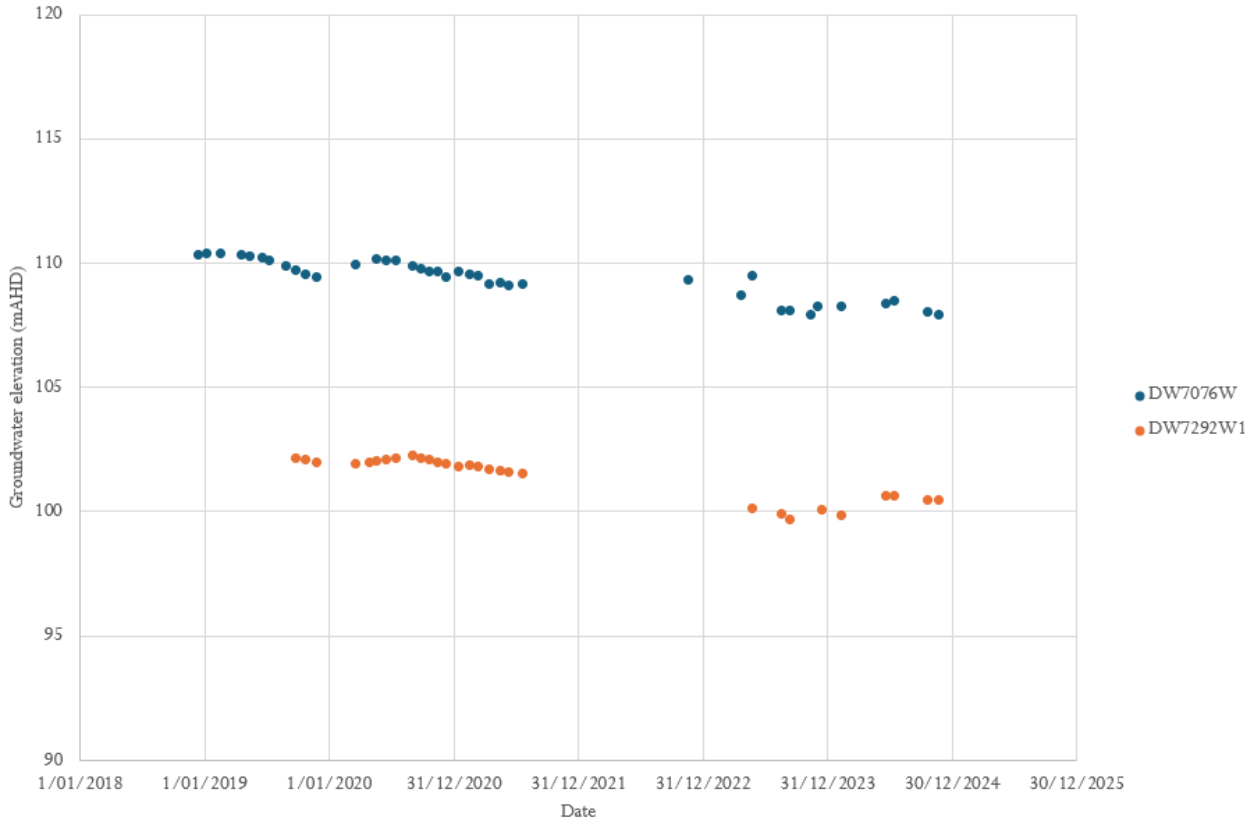



**Figure 5-6 Groundwater elevation for Quaternary alluvium**


**Figure 5-7 Groundwater elevation for Tertiary sediments**

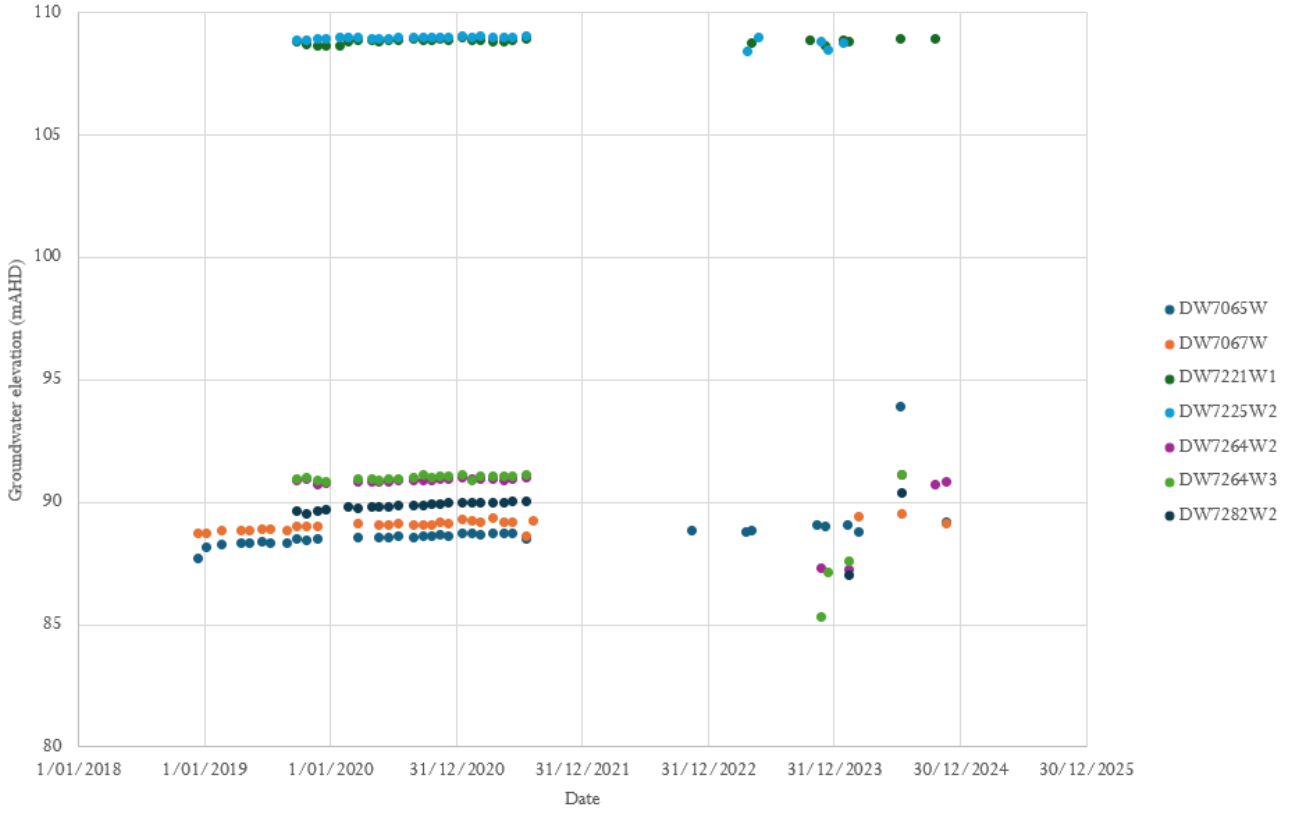



**Figure 5-8 Groundwater elevation for Permian coal measures – Aries Seam**

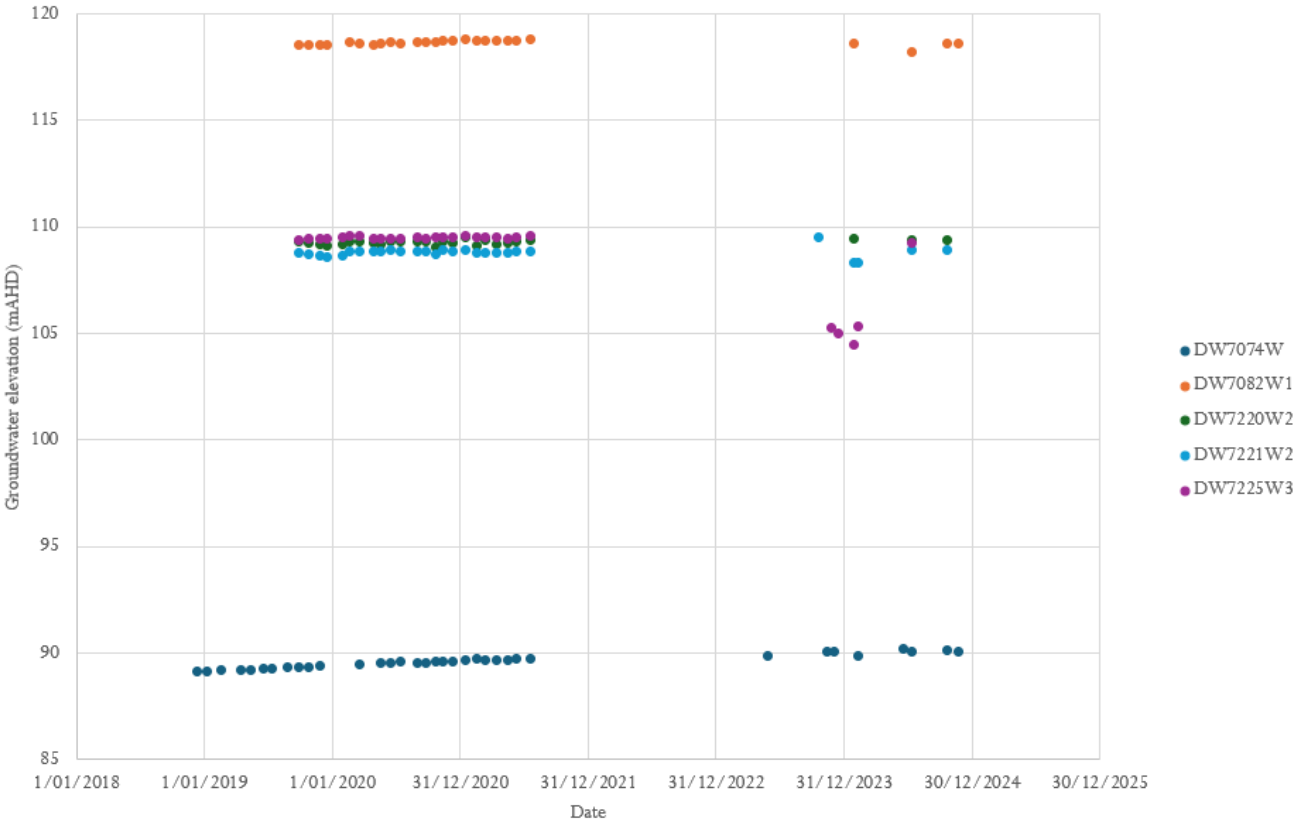



**Figure 5-9 Groundwater elevation for Permian coal measures – Castor Seam**

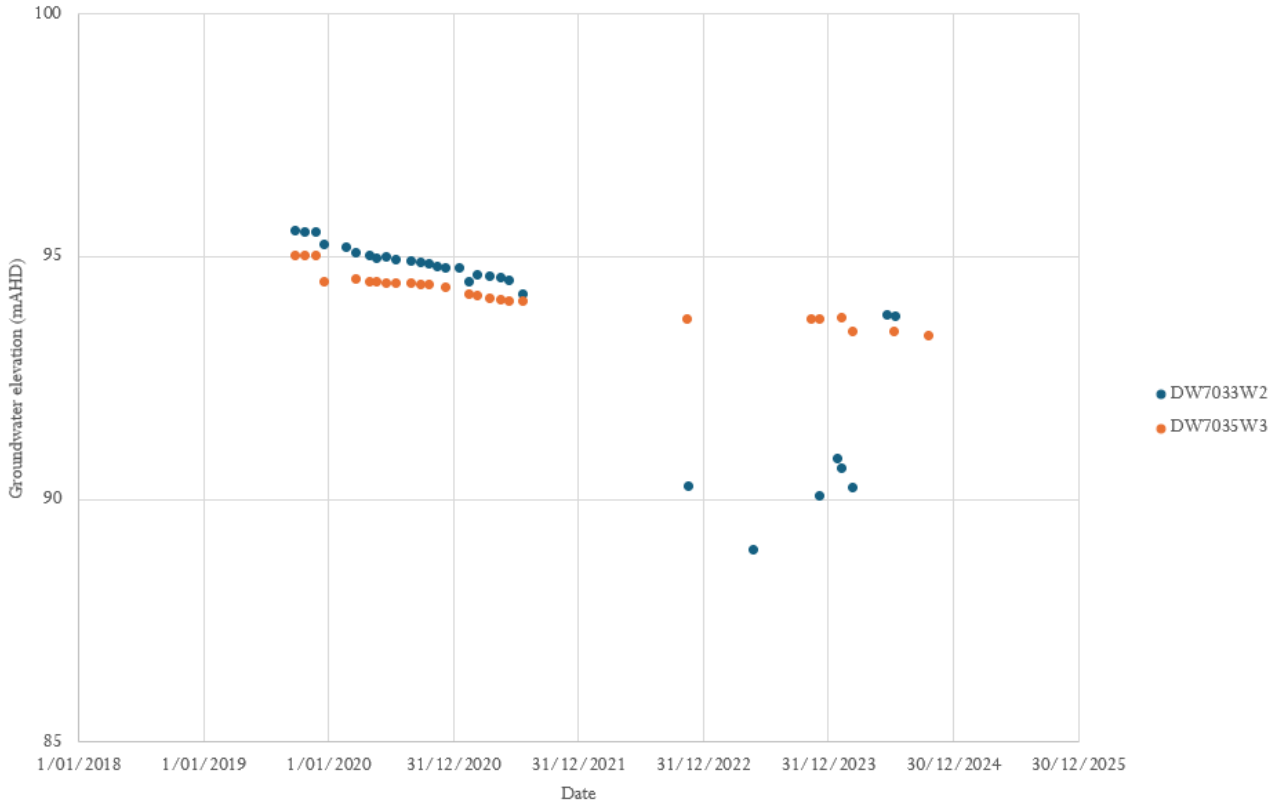
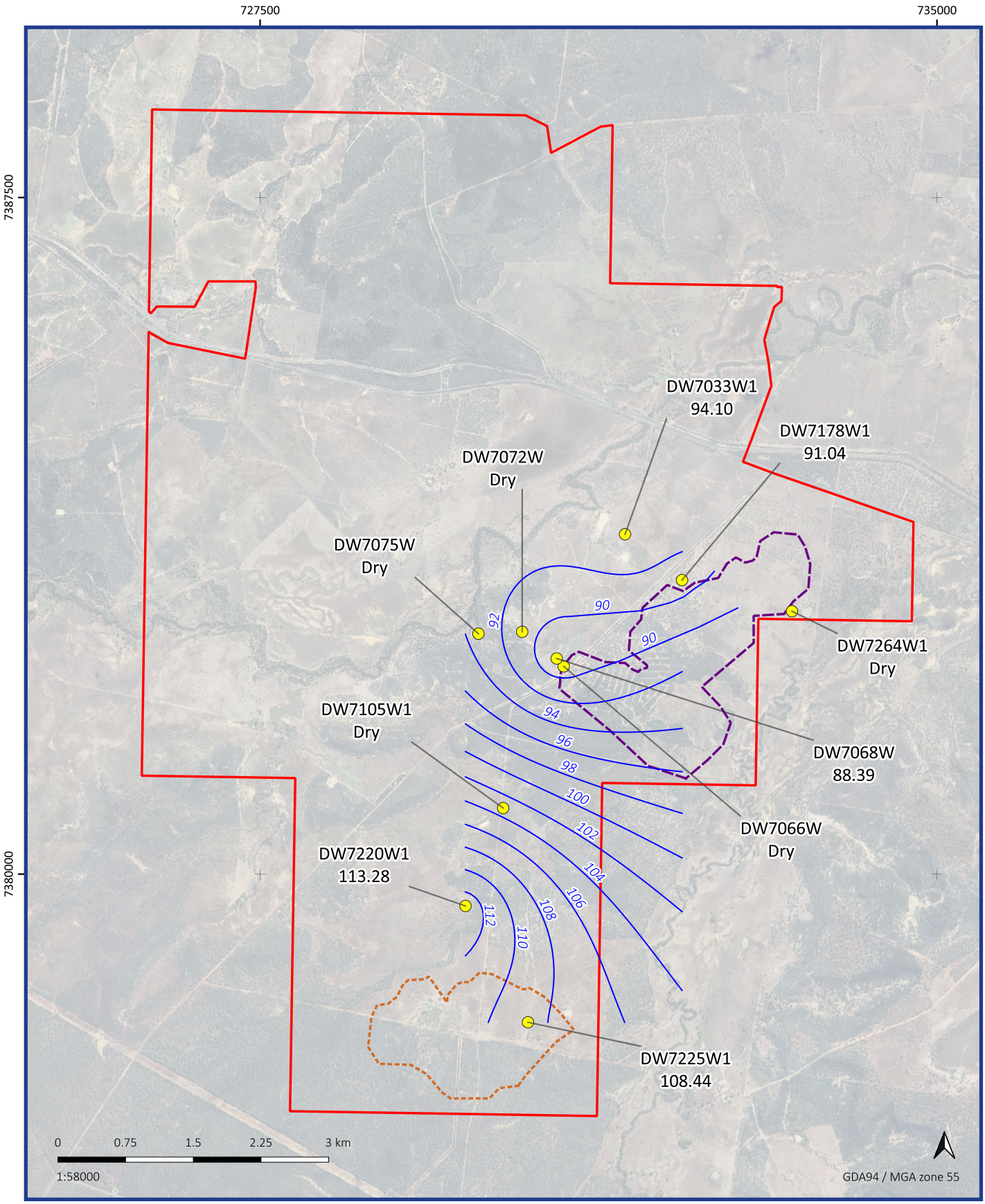



**Figure 5-10 Groundwater elevation for Permian coal measures – Orion Seam**


**Figure 5-11 Groundwater elevation for Permian coal measures – Pollux Seam**






**Groundwater elevation contours for Tertiary sediments**

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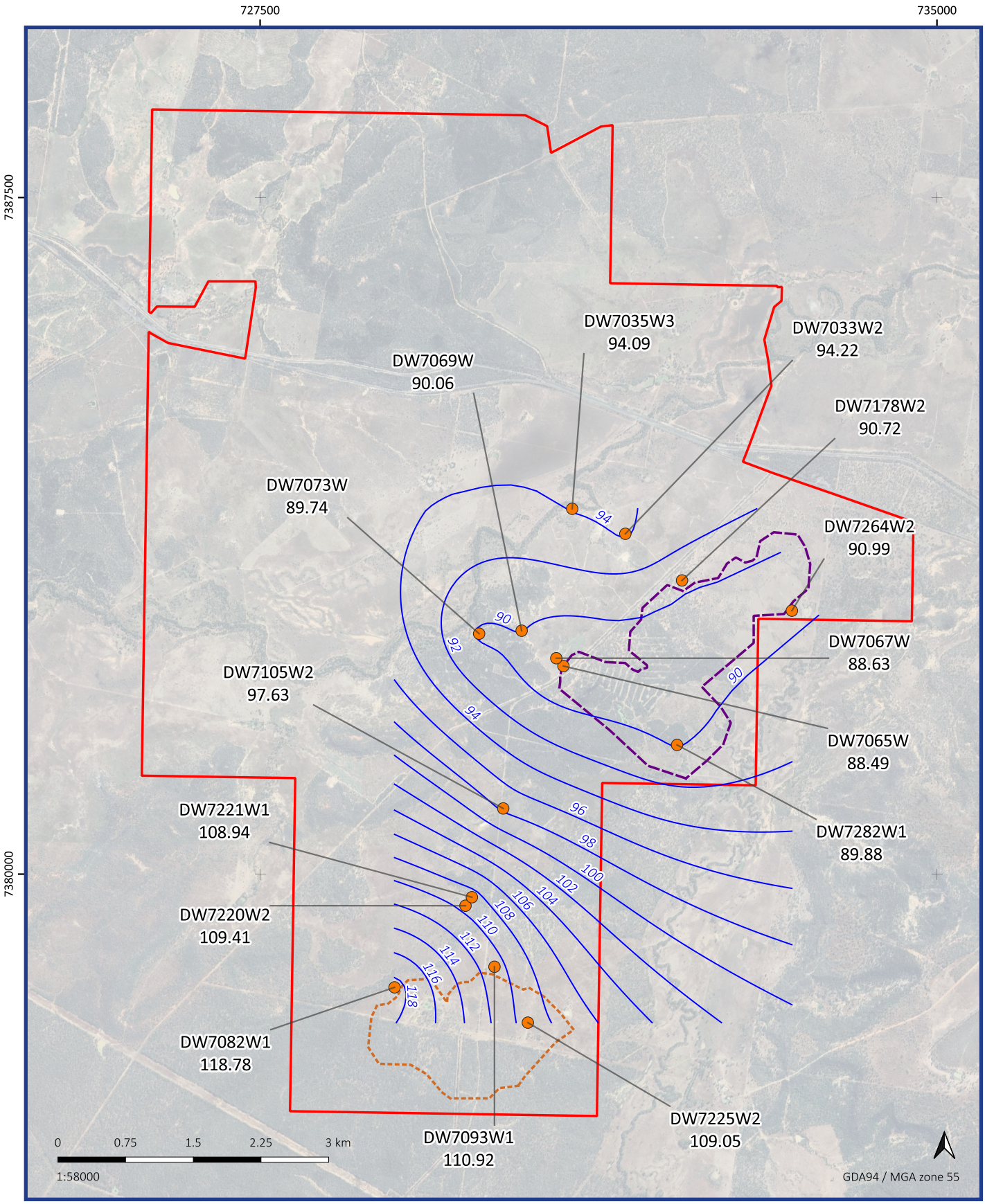
**Figure 5 - 12**

01/04/2025

- Tertiary monitoring bore locations
- Contour (mAHD)
- Mining lease - 700056
- Mine A
- Mine B

*SWL (mAHD) readings taken July 2021






**Groundwater elevation contours for Permian coal measures**

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**Figure 5 - 13**

01/04/2025

- Coal Seam monitoring bore locations
- Contour (mAHD)
- Mining lease - 700056
- Mine A
- Mine B

*SWL (mAHD) readings taken July 2021

## 5.7. Hydraulic properties

Permeability testing was undertaken on 25 monitoring bores to obtain site specific hydraulic conductivity data from all groundwater units within the Project. The results for each bore tested are shown below in Table 5-4. Included are the air-lift yields undertaken at the completion of drilling and prior to bore construction.

**Table 5-4 Monitoring bore permeability and air lift yields**

| Monitoring bore | Hydrogeological unit | Hydraulic conductivity (m/day) | Air lift yield (L/sec)* |
|---|---|---|---|
| DW7292W1 | Quaternary alluvium | 0.097 | - |
| DW7220W1 | Tertiary sediments | 0.045 | 0.01 |
| DW7225W1 | Tertiary sediments | 0.444 | 0.01 |
| DW7282W1 | Overburden | 0.027 | 0.01 |
| DW7033W1 | Tertiary sediments | 0.703 | 2.25 |
| DW7178W1 | Tertiary sediments | 3.805 | 0.46 |
| DW7220W2 | Castor Seam | 0.012 | 0.01 |
| DW7082W1 | Castor Lower Seam | 5.387 | 2.18 |
| DW7035W3 | Orion 1 Seam | 1.593 | 0.01 |
| DW7221W1 | Aries 3 Seam | 0.286 | 0.01 |
| DW7178W2 | Pollux Lower Upper Seam | 0.532 | 0.33 |
| DW7082W2 | Pollux Upper Seam | 1.855 | 1.84 |
| DW7105W2 | Pollux Lower Upper Seam | 0.066 | 0.01 |
| DW7221W2 | Castor Seam | 0.243 | 1.53 |
| DW7033W2 | Orion 5 Seam | 0.061 | 2.18 |
| DW7220W3 | Pollux Lower Upper Seam | 0.293 | 1.53 |
| DW7225W2 | Aries 3 Seam | 2.141 | 7.73 |
| DW7093W1 | Pollux Lower Upper Seam | 0.022 | 0.61 |
| DW7282W2 | Aries 3 Seam | 0.245 | 0.22 |
| DW7264W2 | Aries 1 Seam | 0.009 | 0.22 |
| DW7225W3 | Castor Seam | 0.002 | - |
| DW7093W3 | Pollux Lower Lower Seam | 0.039 | 0.33 |
| DW7264W3 | Aries 3 Seam | 0.011 | 0.22 |
| DW7033W3 | Interburden | 0.002 | 2.25 |
| DW7093W2 | Interburden | 0.001** | - |

***Notes***: ** Air Lift Yield data was obtained from the base of bore prior to bore construction and therefore represents the yield of the entire open interval*

*** Data could not be analysed due to lack of recovery over test period – K set at low value of 0.001 m/day*

Summary data for each groundwater unit are discussed further below and are provided in Table 5-5. Observations from the testing and analysis, are summarised below:

- hydraulic conductivity for the one bore screened in the Quaternary alluvium is 0.097 m/day;
- hydraulic conductivity for the four bores screened in the Tertiary sediments ranges from 0.045 m/day to 3.805 m/day;
- hydraulic conductivity for the seventeen bores screened in the coal seams ranges from 0.002 m/day to 5.387 m/day;
- for coal seam bores that are screened above 80 mbgl the hydraulic conductivity ranges from 0.012 m/day to 5.387 m/day;
- for coal seam bores that are screened below 80 mbgl the hydraulic conductivity ranges from 0.002 m/day to 0.24 m/day; and
- results indicate a groundwater system of relatively low to moderate hydraulic conductivity.

**Table 5-5 Summary of hydrogeological unit permeability and air lift yield**

| Hydrogeological unit | Number of tests | Hydraulic conductivity (m/day) | | | Average air- lift yield (L/sec) |
|---|---|---|---|---|---|
| | | Minimum | Maximum | Average | |
| Quaternary Alluvium | 1 | 0.097 | - | - | - |
| Tertiary | 4 | 0.045 | 3.805 | 1.0048 | 0.548 |
| Permian Coal Seams | 17 | 0.002 | 5.387 | 0.75 | 1.185 |
| Coal Seams <80 mbgl | 11 | 0.012 | 5.387 | 1.133 | 1.578 |
| Coal Seams >80 mbgl | 6 | 0.002 | 0.245 | 0.054 | 0.32 |
| Permian Interburden | 2 | 0.001 | 0.002 | - | - |

## 5.8. Groundwater recharge and discharge

### 5.8.1. Recharge

Recharge is predominantly via rainfall and downward seepage from the ephemeral creeks, including the Charlevue Creek and Springton Creek, which generally flow after high intensity or long-term sustained rainfall events. Recharge occurs directly to the Tertiary and Quaternary groundwater units, with the Permian strata being preferentially recharged in areas where the coal seams subcrop beneath Tertiary or Quaternary sediments.

### 5.8.2. Discharge

The Charlevue Creek and Springton Creek would receive baseflow discharge from the Quaternary alluvium particularly in topographically lower areas where the water table rises above ground elevation.

## 5.9. Groundwater quality

Groundwater quality data is available between 2018 and 2024. Observations from review of the data area are summarised as follows:

- pH (Field):
    - Quaternary alluvium - the pH ranges from 5.46 to 7.49, with a mean of 6.7;
    - Tertiary sediments - the pH ranges from 5.39 to 8.5, with a mean of 6.46; and
    - Coal seams - the pH ranges from 5.39 to 8.5, with a mean of 6.6.
- Electrical conductivity (EC – lab):
    - Quaternary alluvium - the EC at bore DW7076W (Charlevue Creek alluvium) ranges from 12,700 µS/cm to 16,600 µS/cm, with a mean of 14,481 µS/cm. The EC at bore DW7292W1 (Springton Creek alluvium) ranges from 1,560 µS/cm to 5,980 µS/cm, with a mean of 2,133 µS/cm.
    - Tertiary sediments - the EC ranges from 1,140 µS/cm to 26,200 µS/cm, with a mean of 12,455 µS/cm.
    - Coal seams - the EC ranges from 328 µS/cm to 32,800 µS/cm, with a mean of 25,693 µS/cm.

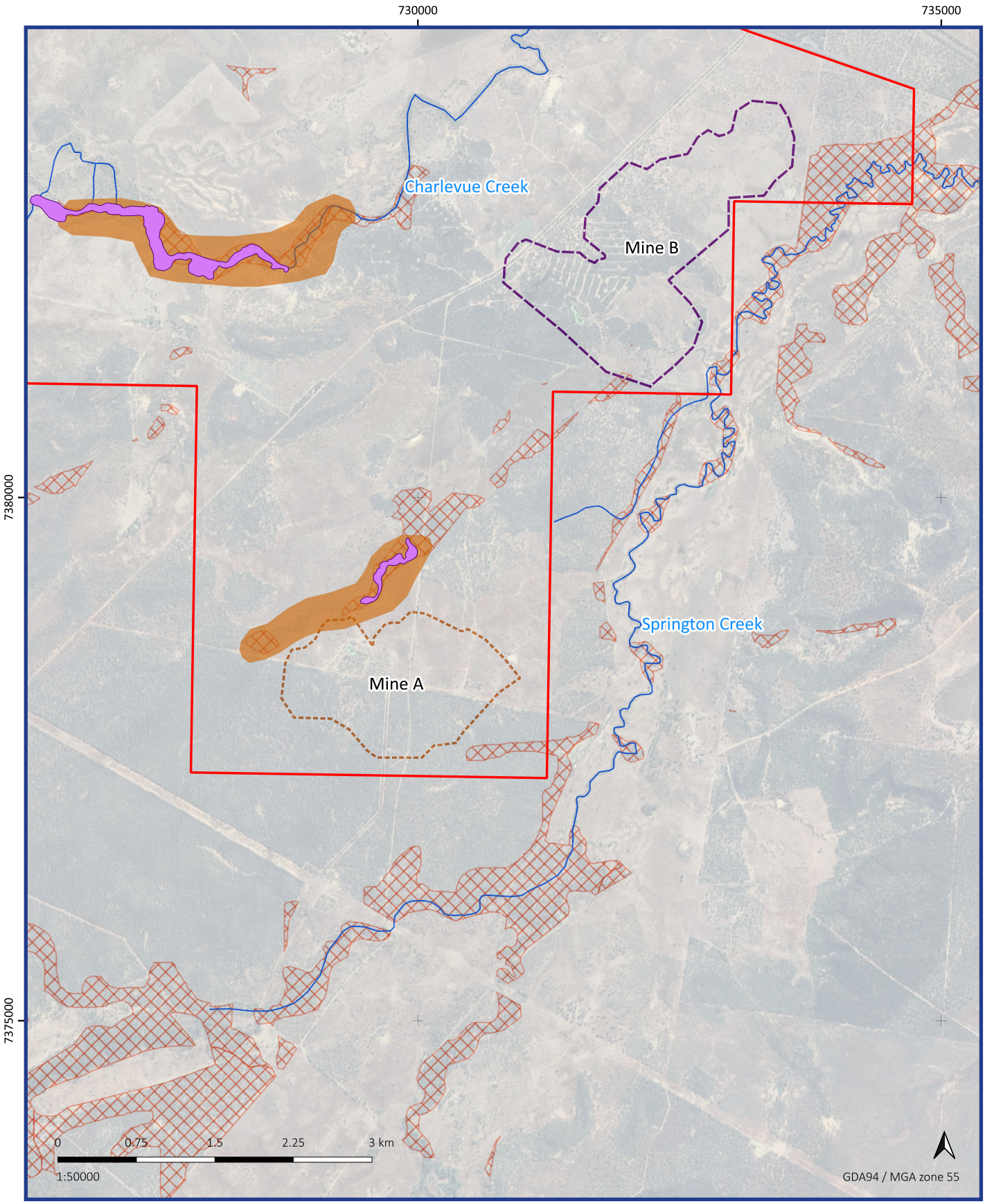
## 5.10. Groundwater Dependant Ecosystems

The Bureau of Meteorology (BoM) Groundwater Dependent Ecosystems (GDE) Atlas was developed as a national dataset of Australian GDEs to inform groundwater planning and management. There are no high or medium potential terrestrial or aquatic GDEs mapped in the area (Figure 5-14). There are low potential terrestrial GDEs mapped, and these are associated with fluctuating intermittently saturated alluvial aquifers.

An assessment of the presence of GDEs within the Project area was completed by 3D Environmental and a summary of the assessment is listed below (AARC, 2020b):

*The study confirmed that the Charlevue Creek GDE area is hosted in an area of recent river alluvium which forms a flood terrace that is dissected by the channel of Charlevue Creek and traversed by a series of flood overflow channels. The GDE area is supported by an unconfined, fresh and seasonal alluvial aquifer that is perched above the regional groundwater table associated with Tertiary, Permian and older alluvial sediments. The supporting perched aquifer is conceptualised to be seasonally recharged during surface flows including flood events and associated rainfall. Based on salinity data and stable isotope comparisons between twig xylem and groundwater samples, it is inferred that the perched aquifer is hydraulically disconnected from the regional Tertiary and alluvial aquifers which hold groundwater with salinity values that range from mildly to highly toxic to trees. Based on stable isotope data, there is no indication that trees at this site, nor any tree sampled during the GDE assessment is utilising groundwater associated with the regional Tertiary, alluvial or Permian coal seam aquifers to any significant degree.*

Potential GDEs from the 3D Environmental assessment are shown in Figure 5-14. There are two areas of alluvial perched groundwater systems and confirmed terrestrial GDE areas (AARC, 2020b).






## Groundwater Dependent Ecosystems

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**Figure 5 - 14**

16/04/2025

- Watercourses
- Mining lease - 700056
- Mine A
- Mine B
- Low potential Terrestrial GDE - from regional studies
- Location of confirmed terrestrial GDE areas (3D Environmental, 2020)
- Location of potential terrestrial GDE areas (3D Environmental, 2020)

## 5.11. Conceptual groundwater model summary – pre-mining

Key features of the hydrogeological conceptualisation are as follows:

- The surface geology predominantly comprises sediments of the Tertiary Duaringa Formation and Quaternary alluvium associated with ephemeral creeks including Charlevue Creek and Springton Creek.
- Tertiary deposits are present across the Project area that comprise sediments of the Duaringa Formation. The Tertiary sediments are variably saturated and the elevation of the base of Tertiary is a control on the occurrence of water within the sediments.
- A minor area of Tertiary basalt is present to the north of Mine A. The basalt is interpreted to be dry and of limited extent and not considered as a groundwater unit at the site.
- The Permian strata are heavily faulted and folded, and mining occurs where the coal seams are close to surface.
- The direction of groundwater flow is generally from southwest to northeast.
- Hydraulic conductivity data indicates a groundwater system of relatively low to moderate hydraulic conductivity. The shallow coal seams less than 80 mbgl have a higher hydraulic conductivity and are higher yielding than the coal seams greater than 80 mbgl.
- Groundwater is present in the Quaternary alluvium adjacent to Charlevue Creek and Springton Creek. Groundwater is in the Tertiary sediments however dry bores are located west and south-west of Mine B in an elevated area. Within the Permian strata the coal seams are the primary conduits for groundwater flow. This interpretation is supported by hydraulic conductivity data from site testing, which indicates a much lower hydraulic conductivity of interburden/ overburden units relative to the hydraulic conductivity of the coal seams.
- Recharge to the Quaternary alluvium and Tertiary sediments occurs via direct rainfall. The rate of recharge to the Quaternary alluvium and Tertiary sediments is calculated by the CMB method to be in the order 0.07% to 0.12% of average annual rainfall reporting as recharge to the groundwater units. The coal seams are recharged in subcrop areas where they directly underlay Tertiary sediments and/or Quaternary alluvium. The rate of recharge to the Permian strata is calculated by the CMB method to be in the order 0.05% of average annual rainfall reporting as recharge to the groundwater units.
- The low rate of recharge is consistent with the observation of elevated salinity in the shallow sediments, with an elevated EC range for the Quaternary alluvium and for the Tertiary sediments from. The high EC recorded is interpreted to be reflective of a low rate of groundwater recharge and high residence times for groundwater.

# 6. Part C - Predictions of groundwater impacts

## 6.1. Groundwater model

A historic 2D SEEP/W groundwater model was developed by JBT for the Project groundwater impact assessment but was based on a historic mine plan (Appendix A). For this UWIR, two 2D numerical model groundwater models were developed for the UWIR using MODFLOW. The same modelling assumptions and geology layers were adopted from the historic 2D SEEP/W groundwater models, including:

- model alignment;
- hydraulic properties;
- representation of faulting; and
- boundary conditions including recharge, starting (initial) groundwater levels and drain conductance.

The location of the two numerical model sections generated for the study are shown in Figure 6-1, including:

- northwest-southeast cross section through Mine B; and
- northwest-southeast cross section through Mine A.

The two cross sections align with the coal seams dipping from the northwest to the southeast for both Mine A and Mine B. The cross sections are parallel to the dip of the coal seams (perpendicular to the strike) and both model alignments are suitable for determining the groundwater drawdown from mining.

For each of the two cross-sections, a 2D numerical model was constructed. Each model consisted of a single row of rectangular cells (50 x 50 m). The groundwater model mining stages were the same as the mine schedule including Mine A year 1 to 7 and Mine B year 8 to 21.

## 6.2. Model A (Mine A, Section B-B')

The details of the Mine A model are as follows:

- Length 17800 m, 17 layers, 3060 cells, 21 annual stress periods.
- Initial conditions starting head elevation at 99.9 mAHD.
- General head boundary head at starting head elevation, conductance factor of 10.0 $m^2$/day.
- Recharge at a uniform 0.07% of rainfall (678 mm/year).
- Evapotranspiration (ET) value of average annual ET at 2024 mm/year. Evapotranspiration value was applied to topographic surface with pan factor 0.8 and extinction depth of 2 m. In the mining pit areas, the evapotranspiration surface was at the elevation of the pit floor with pan factor of 0.5 and extinction depth of 0.1 m.
- Drain boundary condition set at the pit floor elevation with conductance of 100 $m^2$/day.
- Table 6-1 lists the Model A structure and layer thickness.
- Table 6-2 lists the Model A hydraulic properties.

Table 6-1 Model A structure and layer thickness

| Layer | Unit | Cell number | Minimum thickness (m) | Average thickness (m) | Maximum thickness (m) |
|---|---|---|---|---|---|
| 1 | weathered profile | 361 | 4.63 | 26.18 | 46.08 |
| 2 | overburden | 106 | 0.50 | 137.29 | 274.85 |
| 3 | coal seam (C1) | 106 | 1.38 | 3.24 | 3.50 |
| 4 | interburden | 130 | 4.13 | 22.62 | 76.77 |
| 5 | coal seam (C2) | 130 | 1.50 | 4.24 | 9.03 |
| 6 | interburden | 154 | 1.95 | 22.30 | 95.15 |
| 7 | coal seam (C3) | 154 | 1.11 | 4.17 | 10.19 |
| 8 | interburden | 156 | 3.98 | 16.60 | 52.92 |
| 9 | coal seam (C4) | 158 | 1.50 | 4.86 | 11.14 |
| 10 | interburden | 161 | 3.05 | 28.72 | 94.83 |
| 11 | coal seam (C5) | 163 | 2.00 | 4.84 | 8.73 |
| 12 | interburden | 171 | 1.21 | 35.10 | 55.32 |
| 13 | coal seam (C6) | 172 | 1.20 | 5.06 | 9.72 |
| 14 | interburden | 186 | 3.32 | 57.43 | 97.65 |
| 15 | coal seam (C7) | 188 | 1.73 | 6.38 | 14.70 |
| 16 | underburden | 203 | 4.21 | 49.68 | 81.13 |
| 17 | underburden | 361 | 150.00 | 150.00 | 150.00 |

Table 6-2 Model A hydraulic properties

| Layer | Unit | Kx (m/day) | Kz (m/day) | Ss | Sy |
|---|---|---|---|---|---|
| 1 | weathered profile | 0.100000 | 0.005000 | 0.000100 | 0.010000 |
| 2 | overburden | 0.010000 | 0.000100 | 0.000010 | 0.010000 |
| 3 | coal seam (C1) | 0.370000 | 0.003700 | 0.000010 | 0.020000 |
| 4 | interburden | 0.010000 | 0.000100 | 0.000010 | 0.010000 |
| 5 | coal seam (C2) | 0.370000 | 0.003700 | 0.000010 | 0.020000 |
| 6 | interburden | 0.001000 | 0.000010 | 0.000010 | 0.010000 |
| 7 | coal seam (C3) | 0.020000 | 0.000200 | 0.000010 | 0.020000 |
| 8 | interburden | 0.001000 | 0.000010 | 0.000010 | 0.010000 |
| 9 | coal seam (C4) | 0.020000 | 0.000200 | 0.000010 | 0.020000 |
| 10 | interburden | 0.001000 | 0.000010 | 0.000010 | 0.010000 |
| 11 | coal seam (C5) | 0.020000 | 0.000200 | 0.000010 | 0.020000 |
| 12 | interburden | 0.001000 | 0.000010 | 0.000010 | 0.010000 |
| 13 | coal seam (C6) | 0.020000 | 0.000200 | 0.000010 | 0.020000 |
| 14 | interburden | 0.001000 | 0.000010 | 0.000010 | 0.010000 |
| 15 | coal seam (C7) | 0.020000 | 0.000200 | 0.000010 | 0.020000 |
| 16 | underburden | 0.001000 | 0.000010 | 0.000010 | 0.010000 |
| 17 | underburden | 0.100000 | 0.005000 | 0.000100 | 0.010000 |

## 6.3. Model B (Mine B, section A-A')

The details of the Mine B model are as follows:

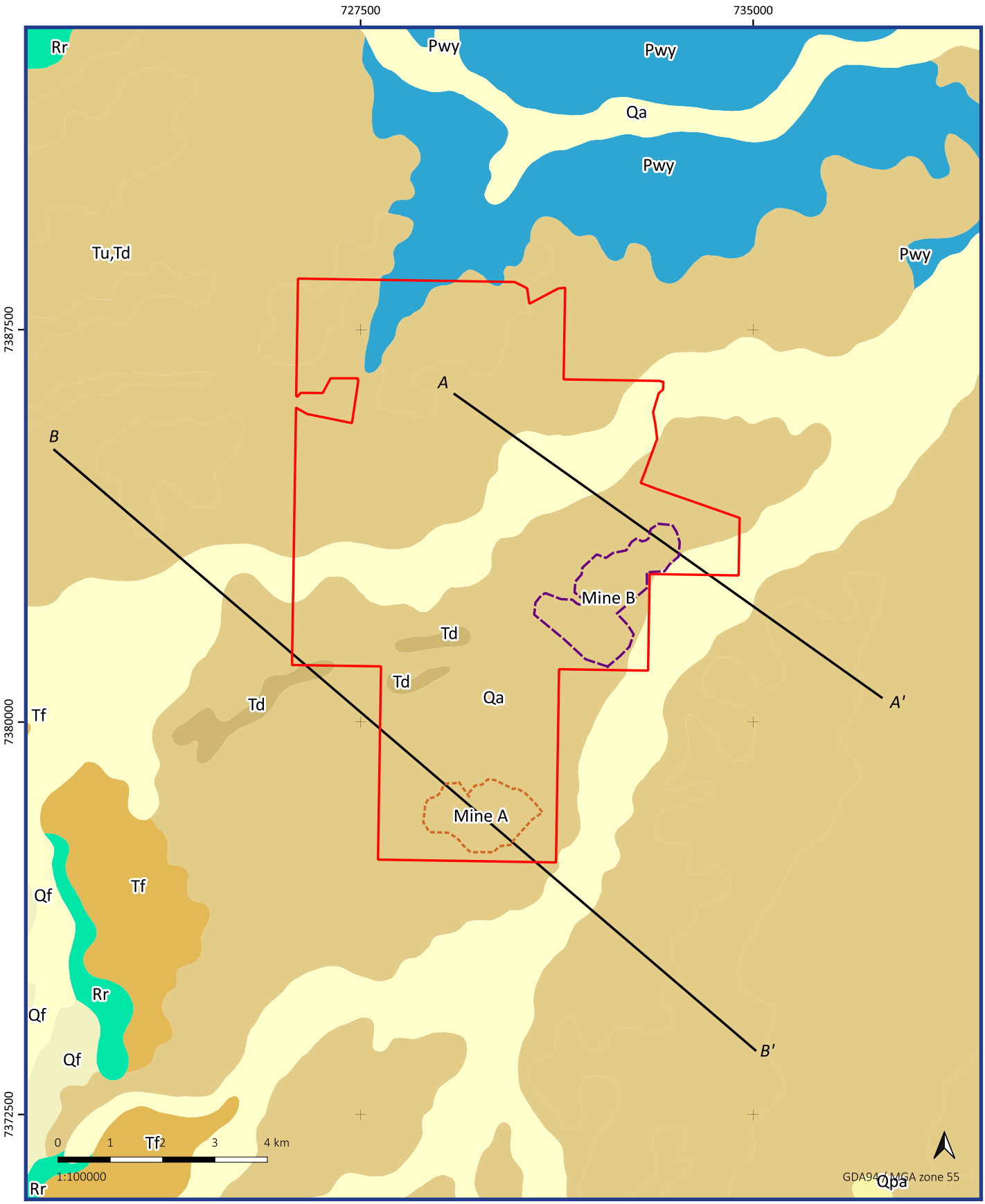
- Length 5500 m, 17 layers, 1289 cells, 21 annual stress periods.
- Initial conditions starting head elevation at 97.0 mAHD.
- General head boundary head at starting head elevation, conductance factor of 10.0 $m^2$/day.
- Recharge at a uniform 0.12% of rainfall (678 mm/year).
- Evapotranspiration value of average annual ET at 2024 mm/year. Evapotranspiration value was applied to topographic surface with pan factor 0.8 and extinction depth of 2 m. In the mining pit areas, the evapotranspiration surface was at the elevation of the pit floor with pan factor of 0.5 and extinction depth of 0.1 m.
- Drain boundary condition set at the pit floor elevation with conductance of 100 $m^2$/day.
- Table 6-3 lists the Model A structure and layer thickness.
- Table 6-4 lists the Model A hydraulic properties.

**Table 6-3 Model B structure and layer thickness**

| Layer | Unit | Cell number | Minimum thickness (m) | Average thickness (m) | Maximum thickness (m) |
|---|---|---|---|---|---|
| 1 | alluvium | 42 | 3.05 | 6.57 | 14.42 |
| 2 | tertiary / weathered profile | 115 | 5.66 | 24.95 | 43.79 |
| 3 | weathered Permian | 115 | 9.93 | 17.89 | 25.11 |
| 4 | overburden | 50 | 16.28 | 120.39 | 196.16 |
| 5 | coal seam (C1) | 50 | 1.35 | 4.80 | 9.43 |
| 6 | interburden | 54 | 15.75 | 26.37 | 52.76 |
| 7 | coal seam (C2) | 55 | 0.48 | 4.31 | 7.88 |
| 8 | interburden | 56 | 12.68 | 32.14 | 42.30 |
| 9 | coal seam (C3) | 56 | 2.44 | 3.49 | 4.09 |
| 10 | interburden | 66 | 1.76 | 24.27 | 48.94 |
| 11 | coal seam (C4) | 67 | 3.49 | 9.30 | 14.02 |
| 12 | interburden | 86 | 0.33 | 75.03 | 166.77 |
| 13 | coal seam (C5) | 87 | 5.65 | 17.67 | 24.68 |
| 14 | interburden | 90 | 8.05 | 71.38 | 102.51 |
| 15 | coal seam (C6) | 92 | 9.29 | 24.71 | 35.19 |
| 16 | interburden | 93 | 10.03 | 33.30 | 52.51 |
| 17 | underburden | 115 | 150.00 | 150.00 | 150.00 |

Table 6-4 Model B hydraulic properties

| Layer | Unit | Kx (m/day) | Kz (m/day) | Ss | Sy |
|---|---|---|---|---|---|
| 1 | weathered profile | 0.100000 | 0.005000 | 0.000010 | 0.080000 |
| 2 | overburden | 0.030000 | 0.001500 | 0.000010 | 0.005000 |
| 3 | coal seam (C1) | 0.010000 | 0.000500 | 0.000010 | 0.005000 |
| 4 | interburden | 0.010000 | 0.000100 | 0.000010 | 0.005000 |
| 5 | coal seam (C2) | 0.370000 | 0.003700 | 0.000010 | 0.005000 |
| 6 | interburden | 0.010000 | 0.000100 | 0.000010 | 0.005000 |
| 7 | coal seam (C3) | 0.370000 | 0.003700 | 0.000010 | 0.005000 |
| 8 | interburden | 0.001000 | 0.000010 | 0.000010 | 0.005000 |
| 9 | coal seam (C4) | 0.020000 | 0.000200 | 0.000010 | 0.005000 |
| 10 | interburden | 0.001000 | 0.000010 | 0.000010 | 0.005000 |
| 11 | coal seam (C5) | 0.020000 | 0.000200 | 0.000010 | 0.005000 |
| 12 | interburden | 0.001000 | 0.000010 | 0.000010 | 0.005000 |
| 13 | coal seam (C6) | 0.020000 | 0.000200 | 0.000010 | 0.005000 |
| 14 | interburden | 0.001000 | 0.000010 | 0.000010 | 0.005000 |
| 15 | coal seam (C7) | 0.020000 | 0.000200 | 0.000010 | 0.005000 |
| 16 | underburden | 0.001000 | 0.000010 | 0.000010 | 0.005000 |
| 17 | underburden | 0.001000 | 0.000010 | 0.000010 | 0.005000 |






## Model cross sections

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**Figure 6 - 1**

31/03/2025

- Cross section
- Mine A
- Mine B
- Mining lease - 700056
- Qa - Alluvium
- Tu, Td - Duaringa Formation
- Tf - Rudite
- Pwy - Gyranda Formation

## 6.4. Model results

The UWIR requires certain model outputs to be provided and presented, these are:

- immediately affected area (IAA) presented as depressurisation in Years 1, 2 and 3 of the operation; and
- long term affected area (LTAA) presented as depressurisation at the end of mining.

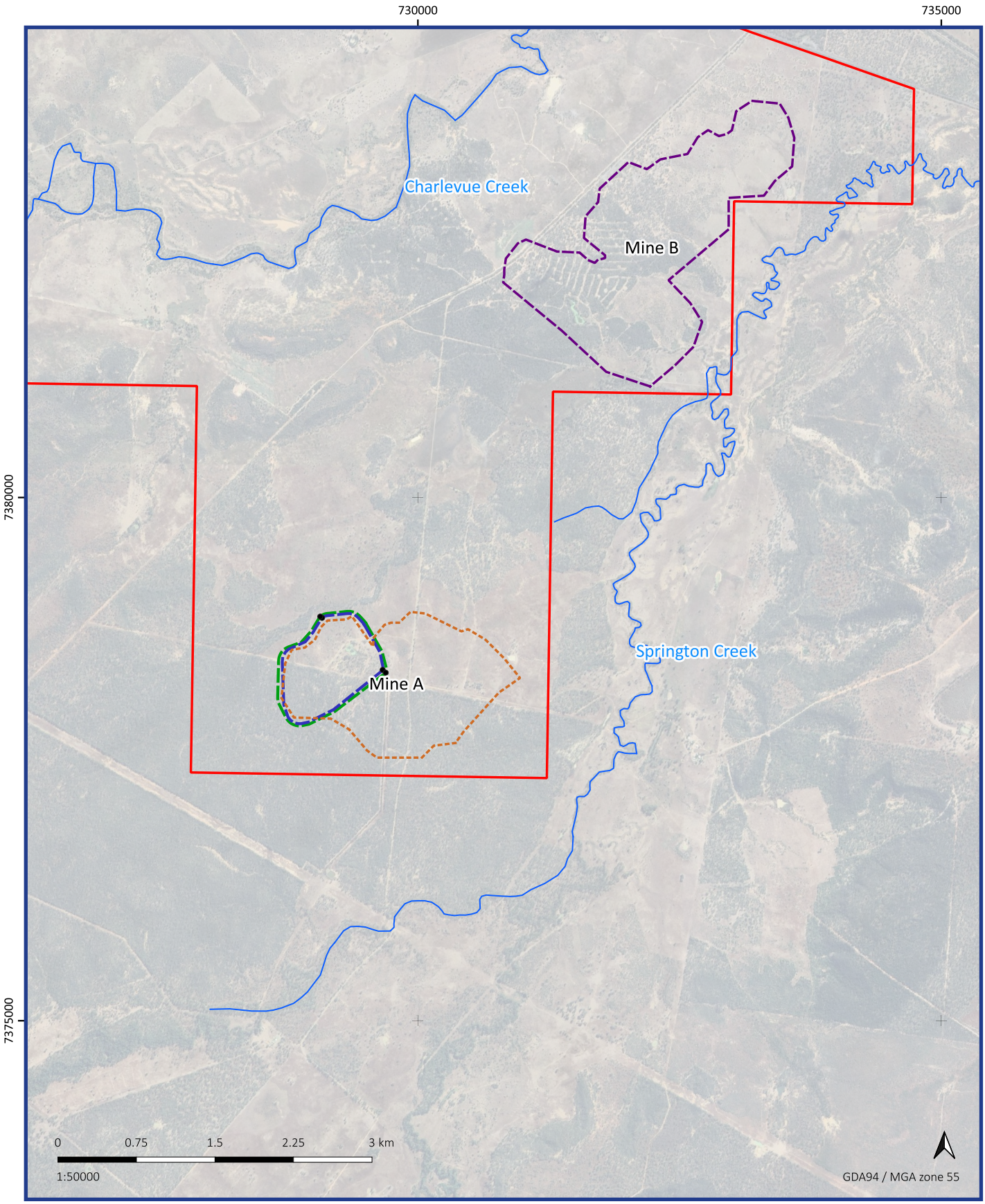
The groundwater model output was processed to provide the above specific items. The extent of drawdown for the IAA presented as depressurisation in Years 1, 2 and 3 of the operation is shown in Figure 6-2 to Figure 6-4.

The LTAA presented as depressurisation at the end of mining is shown in Figure 6-5. The contours are based on extrapolation of data points from each of the cross sections. The extent and shape of the drawdown contours around Mine B is influenced by the depth of mining, and the sub crop extent of the coal seams along the western pit edge. To the east, the coal seams extend down dip allowing drawdown to propagate further.

The IAA is defined under the Water Act as the area where the predicted drawdown exceeds the applicable bore trigger threshold within the next three years. Under the Water Act the bore trigger threshold for unconsolidated sediments is 2 m and for consolidated sediments is 5 m.

The extent of drawdown for the IAA and LTAA is summarised below:

- IAA presented as depressurisation in Year 1 of the operation edge of Mine A to edge of 2 m and 5 m depressurisation is localised around Mine A extending to approximately 75 m to the north west;
- IAA presented as depressurisation in Year 2 of the operation edge of Mine A to edge of 2 m and 5 m depressurisation extends to the northwest to approximately 80 m and 350 m, respectively, and to the southwest 200 m and 550 m, respectively;
- IAA presented as depressurisation in Year 3 of the operation edge of Mine A to edge of 2 m and 5 m depressurisation extends to approximately 740 m and 1050 m, respectively;
- LTAA presented as depressurisation at the end of mining centre of Mine A to edge of 2 m and 5 m depressurisation extends to the northwest to approximately 1700 m and 2500 m, respectively, and to the southeast at 3600 m and 5500 m, respectively; and
- LTAA presented as depressurisation at the end of mining centre of Mine B to edge of 2 m and 5 m depressurisation extends to the southwest at 1800 m and 2200 m, respectively.






**Immediately affected area depressurisation in Year 1 of the operation**

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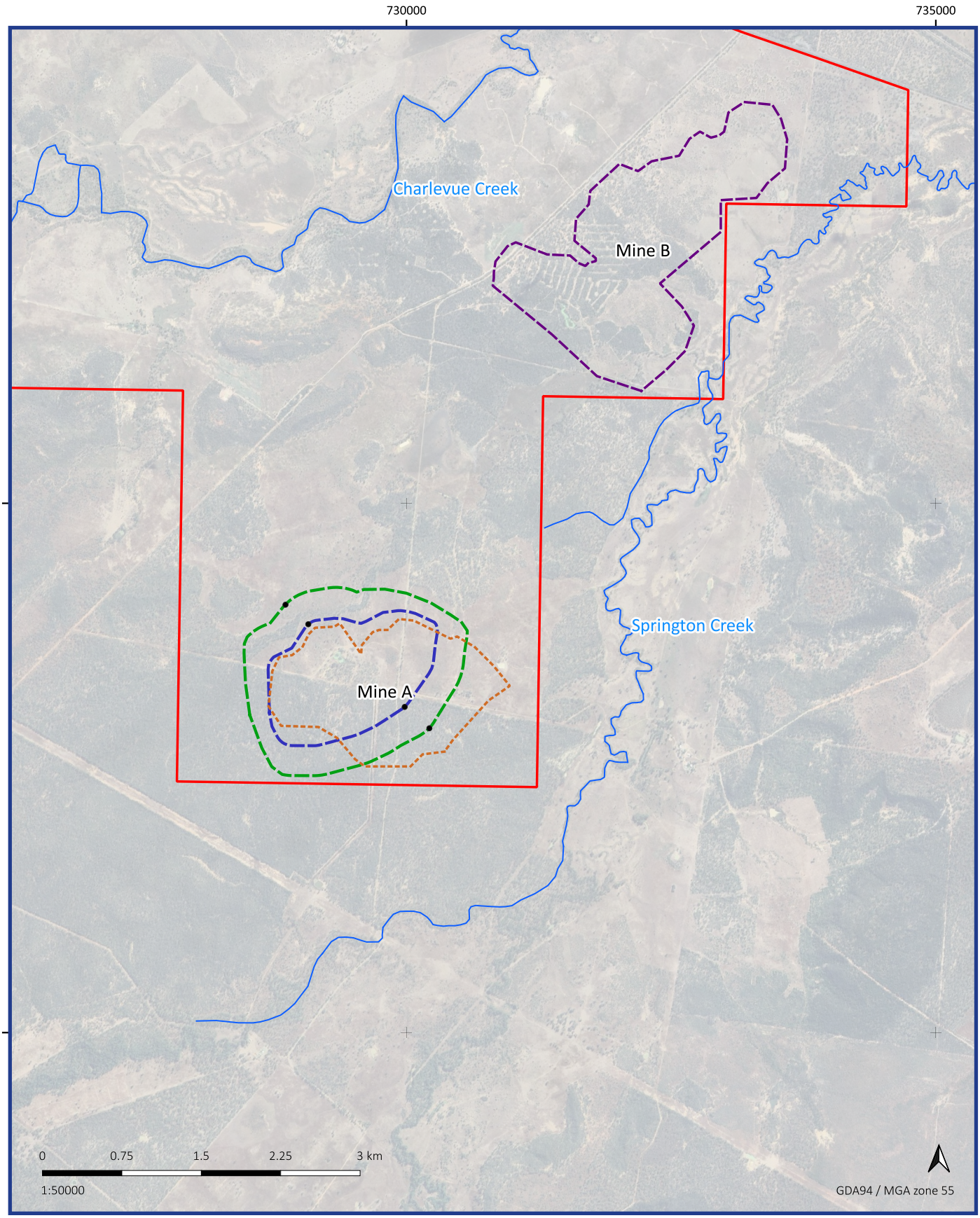
**Figure 6 - 2**

01/04/2025

- Watercourses
- Mining lease - 700056
- Mine A
- Mine B

**Immediately affected area**

- Data points
- Year 1 - 5 m depressurisation
- Year 1 - 2 m depressurisation






**Immediately affected area depressurisation in Year 2 of the operation**

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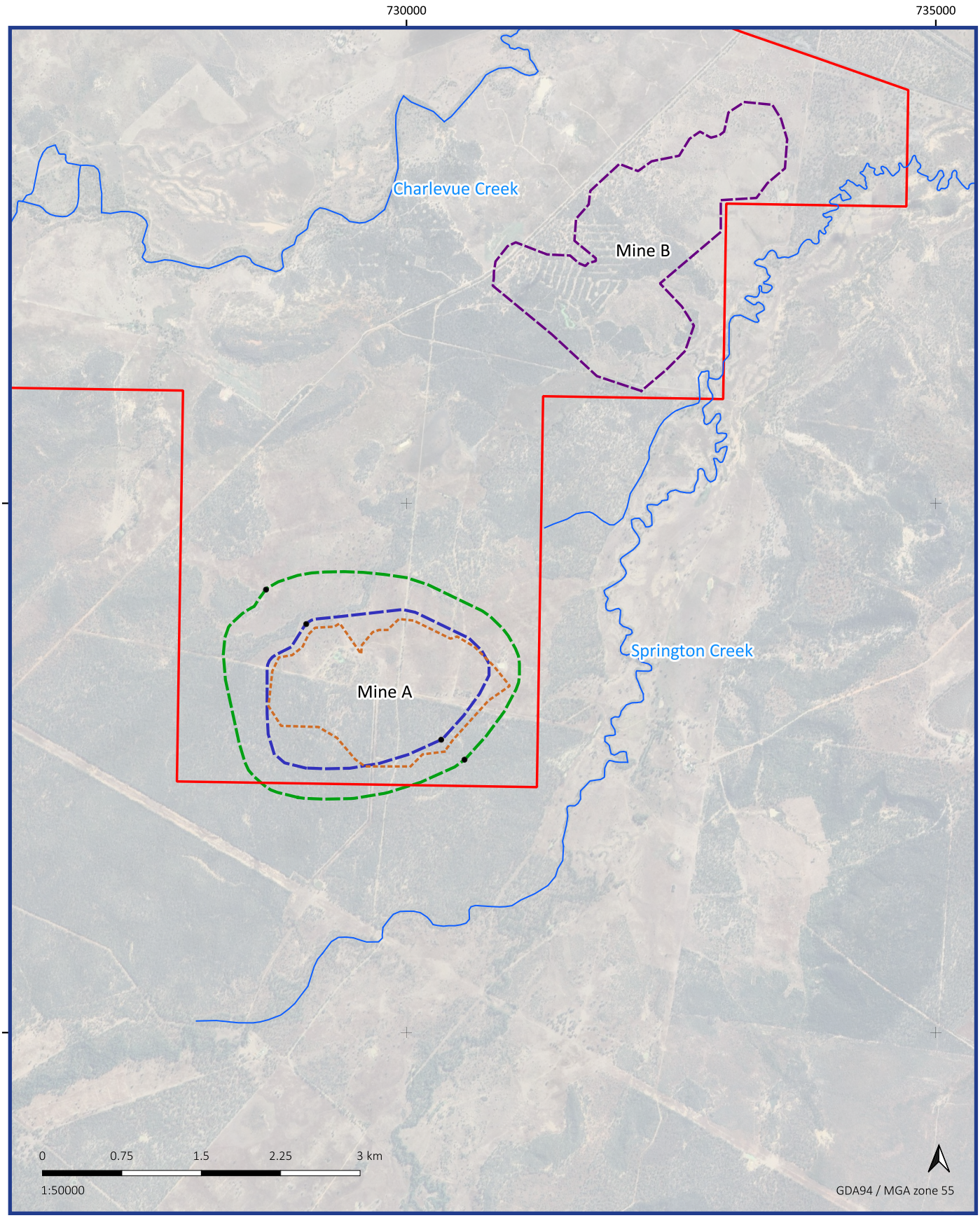
**Figure 6 - 3**

01/04/2025

- Watercourses
- Mining lease - 700056
- Mine A
- Mine B

**Immediately affected area**

- Data points
- Year 2 - 5 m depressurisation
- Year 2 - 2 m depressurisation






**Immediately affected area depressurisation in Year 3 of the operation**

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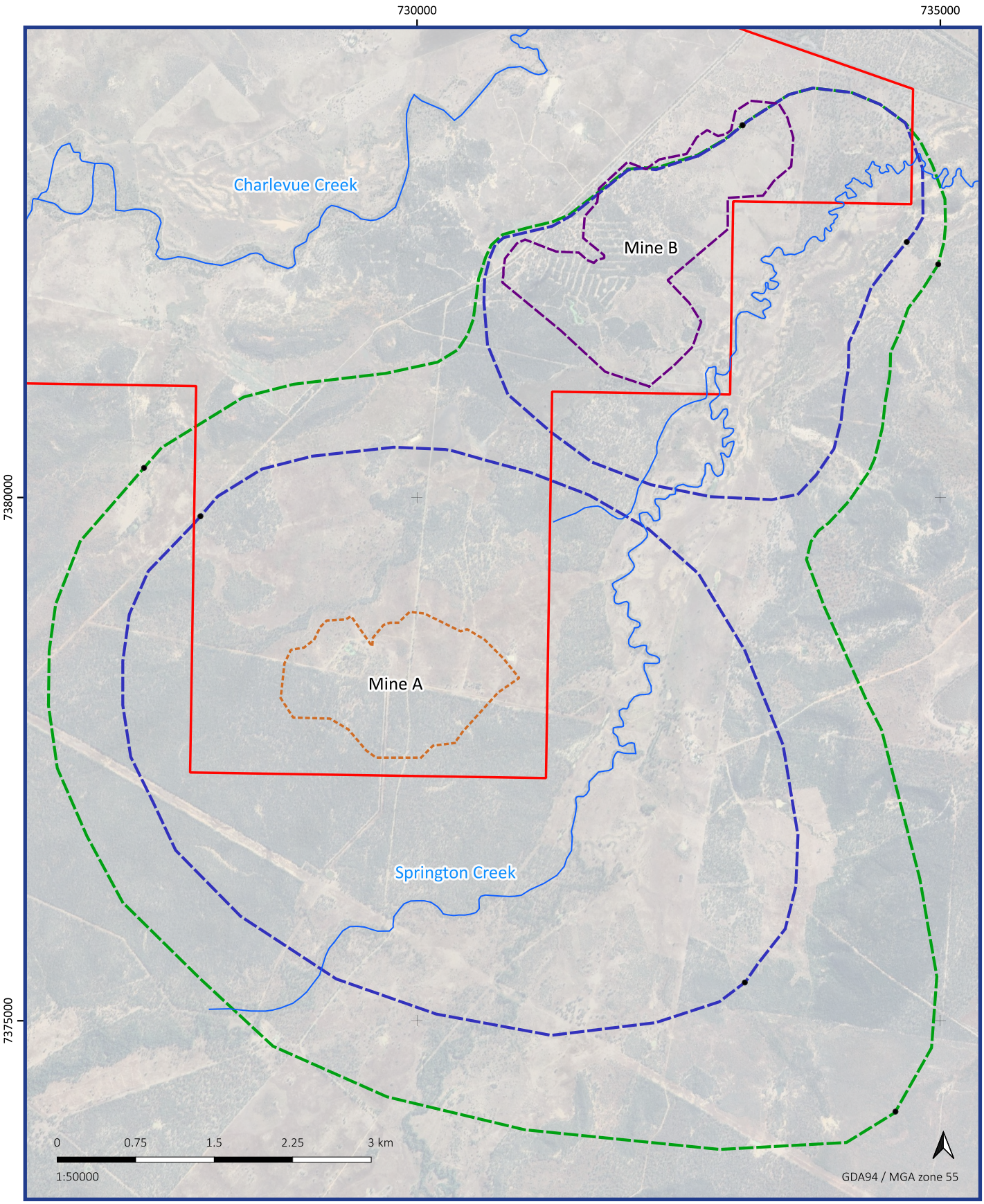
**Figure 6 - 4**

01/04/2025

- Watercourses
- Mining lease - 700056
- Mine A
- Mine B

**Immediately affected area**

- Data points
- Year 3 - 5 m depressurisation
- Year 3 - 2 m depressurisation






**Long term affected area depressurisation at the end of mining**

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**Figure 6 - 5**

01/04/2025

- Watercourses
- Mining lease - 700056
- Mine A
- Mine B

**Long term affected area**

- Data points
- 5 m depressurisation
- 2 m depressurisation

# 7. Part D - Impacts to the environmental values

The Project is located within the Mackenzie Southern Tributaries of the Mackenzie River sub-basin. The listed Mackenzie River sub-basin environmental values for groundwater include aquatic ecosystems, irrigation, farm supply/use, stock water, drinking water, industrial use and cultural and spiritual values. There are no known or reported industrial and cultural or spiritual listed values for groundwater in the area.

## 7.1. Impacts on existing groundwater users

No landholder bores or existing groundwater users are in the IAA 2 m depressurisation extent in Year 1, 2 and 3 of the operation as shown in Figure 7-1. No landholder bores or existing groundwater users are in the IAA 5 m depressurisation in Year 1, 2 and 3 of the operation as shown in Figure 7-2.

Table 7-1 lists the three registered bores that are within the 2 m and 5 m LTAA depressurisation at the end of mining. The bore locations are shown in Figure 7-3. The following summarises the impacts to groundwater users:

- registered bores 136955 and 11662 are located on land that is owned by Magnetic South; and
- registered bore 111571 is listed as abandoned and destroyed.

**Table 7-1 Registered bores**

| Registered bore | Aquifer | Role | Status | Easting | Northing |
|---|---|---|---|---|---|
| 136955 | Tertiary-Undefined | Water Supply | Existing | 730055 | 7379765 |
| 111662 | Tertiary-Undefined | Water Supply | Existing | 728427 | 7375003 |
| 111571 | Unknown | Unknown | Abandoned / destroyed | 734473 | 7383493 |

***Note**: Coordinates are in GDA2020*

### 7.1.1. Impacts on groundwater dependant ecosystems

The water level drawdown associated with mining is predicted to be in excess of 5 m at some locations below Springton Creek only and not Charlevue Creek. Potential GDEs from the 3D Environmental assessment are shown in Figure 5-14.

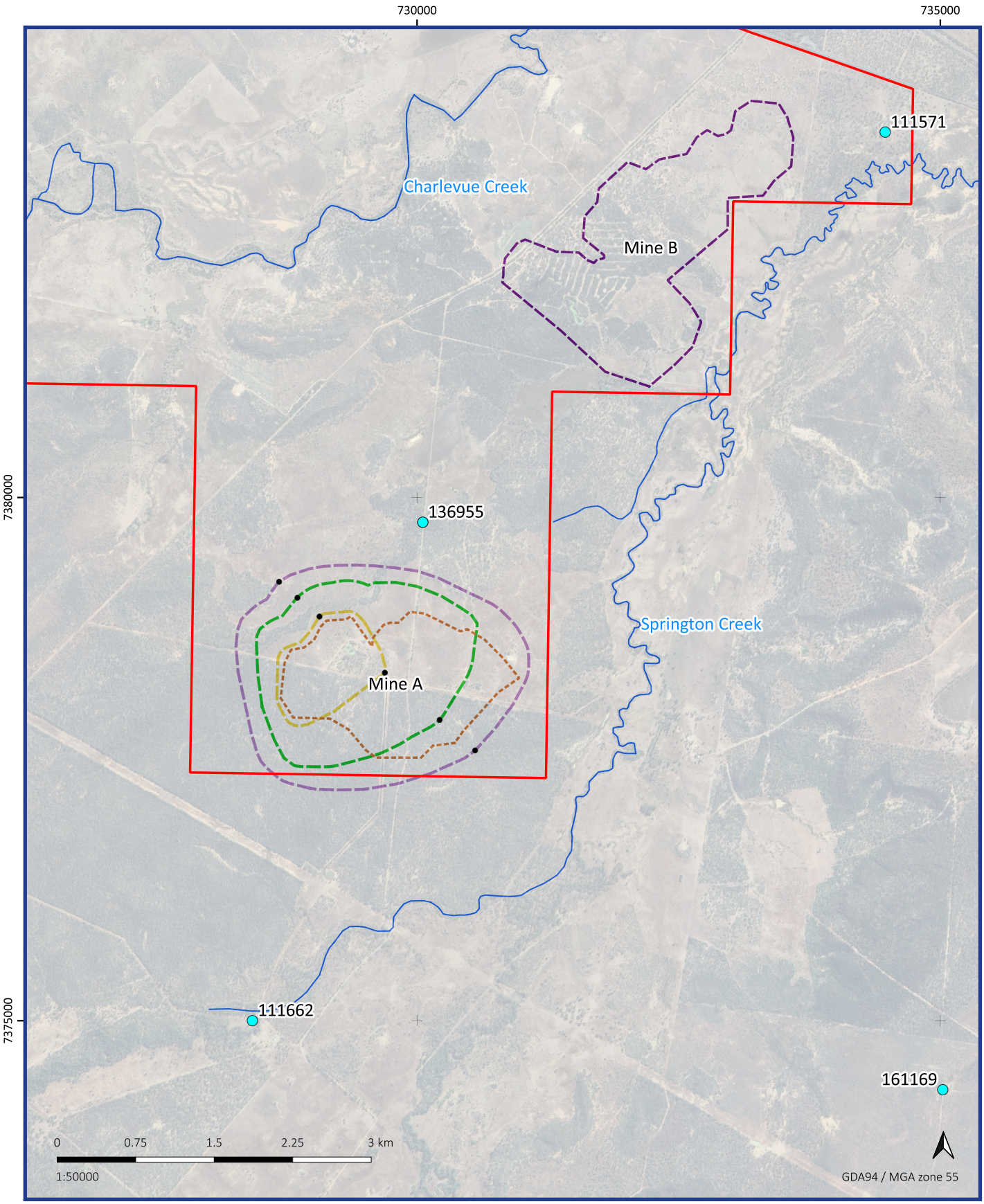
The Groundwater Dependent Ecosystem Assessment identified two areas within the study area containing terrestrial GDEs, both dependent on alluvial perched groundwater systems that recharge from surface flow (Figure 5-14). One of these GDEs is located within Charlevue Creek whilst the other GDE is situated within a tributary of Springton Creek.

Based on the location of the aquifer, salinity data and stable isotope comparisons between water sampled from the trees and groundwater, it is concluded that both perched aquifers are hydraulically disconnected from the regional groundwater table (AARC, 2020a). Furthermore, the results indicate that the trees sampled are not utilising groundwater from the regional Tertiary sediments, alluvium or Permian coal seams to any significant degree (AARC, 2020a).

The potential for the mining operation to impact this type of potential low GDE is summarised from the groundwater impact assessment as follows:

- Springton Creek is ephemeral which means it has flowing water only during or for a short duration after precipitation events in a typical year;
- the recharge of sandy lenses is controlled by surface flows and surface water infiltration into the soil profile;
- the groundwater in the alluvial systems is subject to natural fluctuations in volume in response to changing seasonal conditions and may be dry for significant periods; and
- tree species are likely resilient and have capacity to adapt to the possible minor reductions in soil moisture availability that may propagate in areas of predicted drawdown.

It is interpreted that the risk posed by drawdown from the mining operation to the potential GDE is very low.






**Registered bores IAA 2 m depressurisation in Year 1, 2 and 3 of the operation**

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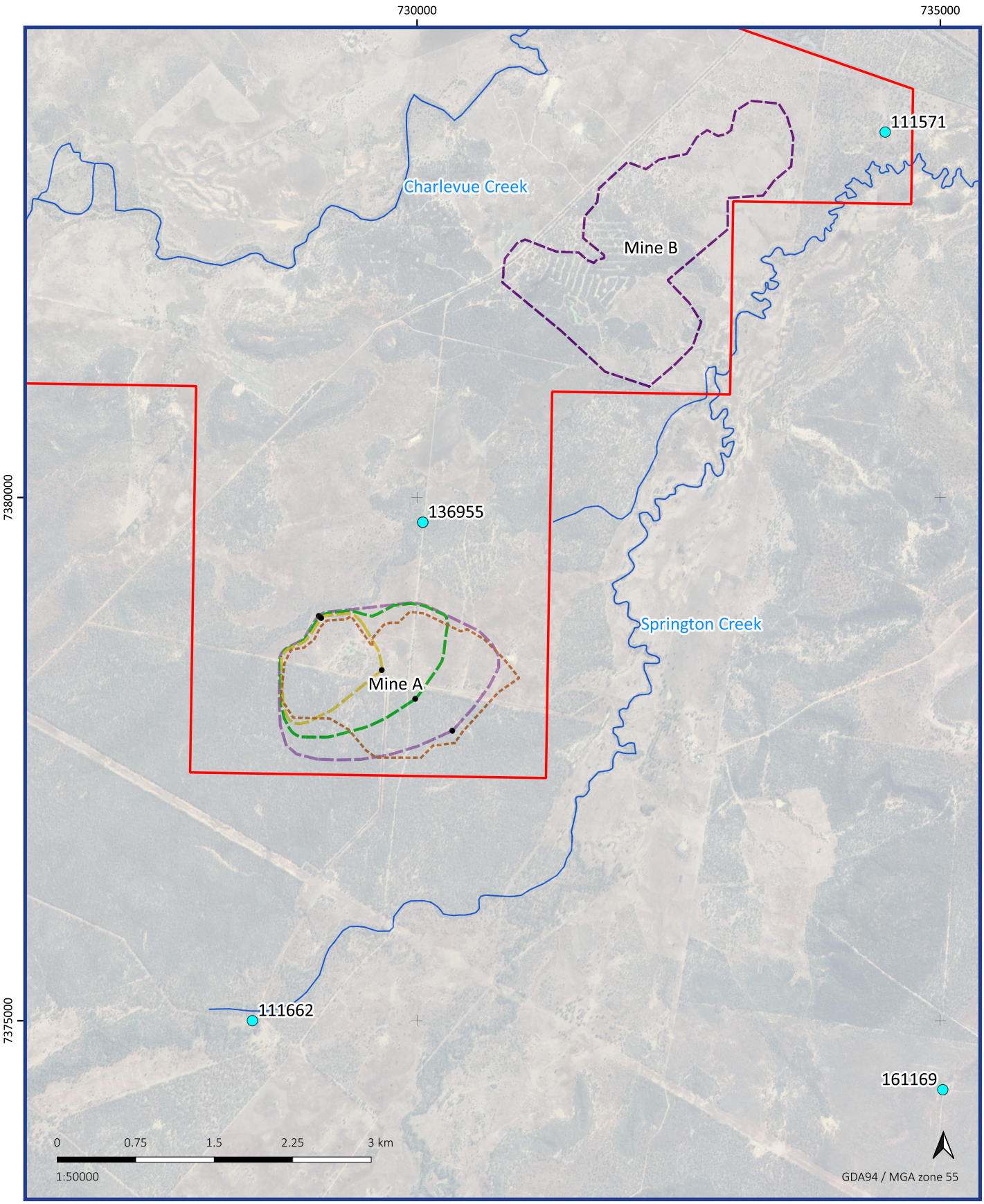
**Figure 7 - 1**

01/04/2025

- Registered bores
- Watercourses
- Mining lease - 700056
- Mine A
- Mine B

**IAA**

- Data points
- Year 1 - 2 m depressurisation
- Year 2 - 2 m depressurisation
- Year 3 - 2 m depressurisation






**Registered bores IAA 5 m depressurisation in Year 1, 2 and 3 of the operation**

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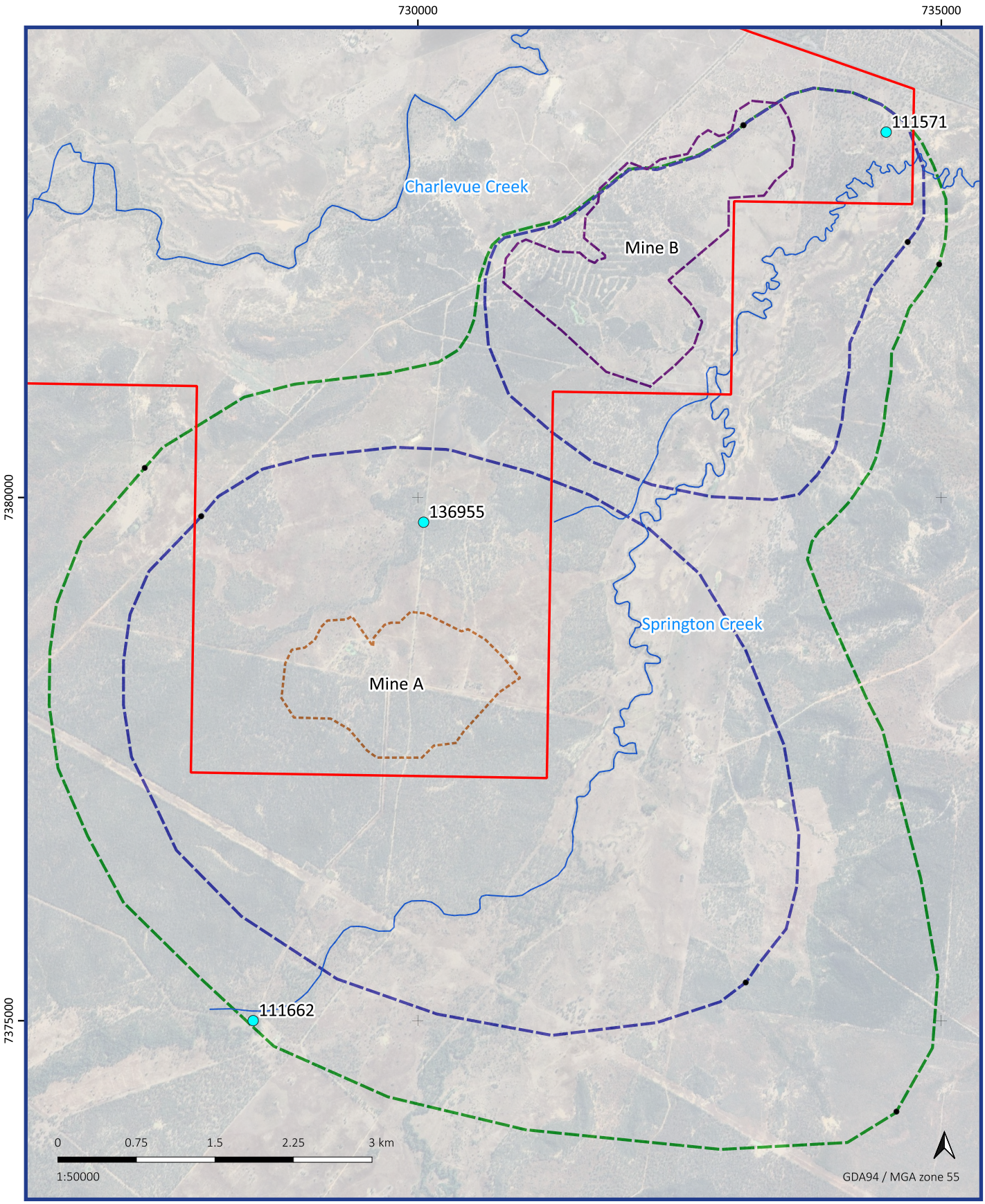
**Figure 7 - 2**

01/04/2025

- Registered bores
- Watercourses
- Mining lease - 700056
- Mine A
- Mine B

**IAA**

- Data points
- Year 1 - 5 m depressurisation
- Year 2 - 5 m depressurisation
- Year 3 - 5 m depressurisation






**Registered bores LTAA depressurisation at the end of mining**

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**Figure 7 - 3**

02/04/2025

- Registered bores
- Watercourses
- Mining lease - 700056
- Mine A
- Mine B

**Long term affected area**

- Data points
- 5 m depressurisation
- 2 m depressurisation

# 8. Part E - Water monitoring strategy

## 8.1. Rationale and strategy

The underground water monitoring strategy is designed to monitor changes in the IAA and LTAA. The monitoring program has two objectives:

- observe groundwater level changes in order to measure drawdown; and
- observe the changes in groundwater availability for GDEs.

The purpose of the groundwater monitoring program is to assess:

- the level of observed drawdown against predictions to ensure that the impacts do not exceed the acceptable limits; and
- changes in water quality over time to ensure there is no significant impact on environmental values or beneficial use.

## 8.2. Groundwater monitoring program

As part of the Project approval conditions, a groundwater monitoring program has been prepared by **hydrogeologist.com.au**, on behalf of Magnetic South (Hydrogeologist.com.au, 2024). The Gemini Project groundwater monitoring program details the following information:

- identified groundwater monitoring locations and frequency;
- identify potential sources of contamination to groundwater from the activity;
- ensures that all potential groundwater impacts due to the activity are identified, monitored and mitigated;
- documents sampling and monitoring methodology;
- ensures that adequate groundwater monitoring and data analysis is undertaken to achieve the following objectives:
    - establish baseline (not mine affected) datasets from existing monitoring bores;
    - detect any impacts to groundwater levels due to the mining activity;
    - detect any impacts to groundwater quality due to the mining activity;
    - determine trends in groundwater quality; and
    - determine trends in groundwater level.
- includes an appropriate quality assurance and quality control program;
- includes a conceptual groundwater model; and
- includes a review process to improve the program.

## 8.3. Monitoring program and timetable

Groundwater level and quality monitoring should be undertaken on a quarterly basis at the bore locations, frequency and analytes listed in Table 8-1 and shown in Figure 8-1.

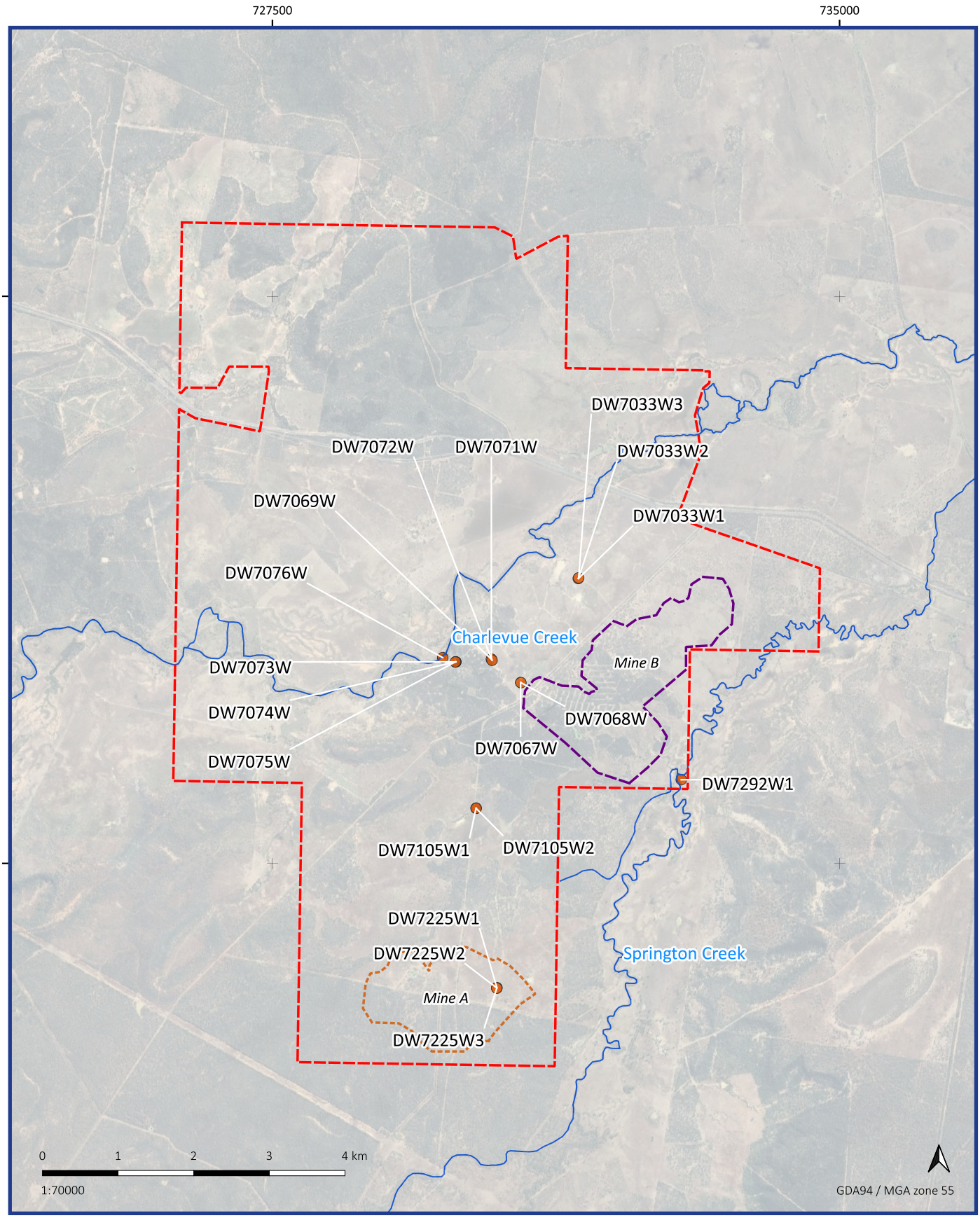
**Table 8-1 Groundwater monitoring locations, frequency and analytes**

| Bore ID | Easting | Northing | Monitoring frequency | Analytes |
|---|---|---|---|---|
| DW7067W | 730782 | 7382395 | Quarterly | |
| DW7068W | 730786 | 7382392 | Quarterly | |
| DW7069W | 730398 | 7382700 | Quarterly | Field Electrical Conductivity |
| DW7071W | 730395 | 7382704 | Quarterly | Field pH |
| DW7072W | 730404 | 7382688 | Quarterly | Sulphate |
| DW7073W | 729927 | 7382667 | Quarterly | Aluminium |
| DW7074W | 729923 | 7382667 | Quarterly | Arsenic |
| DW7075W | 729919 | 7382667 | Quarterly | Chromium |
| DW7076W | 729751 | 7382724 | Quarterly | Cobalt |
| DW7033W1 | 731544 | 7383769 | Quarterly | Copper |
| DW7033W2 | 731547 | 7383774 | Quarterly | Manganese |
| DW7033W3 | 731549 | 7383778 | Quarterly | Molybdenum |
| DW7105W1 | 730193 | 7380734 | Quarterly | Nickel |
| DW7105W2 | 730194 | 7380730 | Quarterly | Selenium (total) |
| DW7225W1 | 730468 | 7378360 | Quarterly | Zinc |
| DW7225W2 | 730467 | 7378356 | Quarterly | |
| DW7225W3 | 730466 | 7378352 | Quarterly | |
| DW7292W1 | 732906 | 7381109 | Quarterly | |

***Note**: Coordinates are in GDA2020*

## 8.4. Storage and publishing of monitoring data

Magnetic South will maintain a groundwater database including groundwater level and quality database against which any potential changes to groundwater can be monitored during subsequent mining operations and into closure. Magnetic South will ensure the groundwater monitoring program is implemented, reports are prepared and relevant parties notified of any limits exceeded.






**Groundwater monitoring locations**

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**Figure 8 - 1**

19/12/2024

- Sampling location
- Mine A
- Mine B
- Mining lease - 700056

# 9. Part F - Spring impact management strategy

There are no springs in the Gemini Project region and therefore no spring impact management strategy has been developed.

# 10. References

AARC, 2020a. EA Application December 2020. Section 6.0 Flora and Fauna, Page 150 to 224.

AARC, 2020b. EA Application December 2020. Appendix F Groundwater Dependent Ecosystem Assessment. 3D Environmental, Gemini Project – Groundwater Dependent Ecosystem Assessment.

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Hydrogeologist, 2024. 4175_Magnetic South Gemini Project Groundwater monitoring program (final). December 2024.

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