

RIO TINTO COPPER RTC

Rimfire H3 Assessment

2025 Update

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Synopsis

Rio Tinto Winu Pty Limited (RTC) is planning to develop a copper-gold mine and associated infrastructure based on the Winu deposit, located approximately 320 km east of Port Hedland in the Pilbara region of Western Australia.

As groundwater supply is a critical resource for the planned development, characterisation of the local and regional aquifer systems is a key component of the baseline assessment for the Winu Project area.

This report presents the findings of a hydrogeological assessment (H3-level) conducted in the Rimfire target area, located approximately 30 km east-southeast of the main Winu project site.

The assessment included the installation of (7) reverse circulation (RC) drillholes, three (3) monitoring bores, and two (2) production bores. A 30-day constant rate pumping test was carried out on both production bores.

The hydrogeological conceptual model identifies and describes the key hydrostratigraphic units and their roles within the groundwater system, particularly in relation to their potential as water sources for mining supply.

Groundwater is primarily stored and transmitted in the shallow, moderately to highly weathered granite and metasediments. The underlying fresh basement contributes little to no flow. The overlying aeolian sands and silcrete are largely unsaturated and do not play a significant role in groundwater availability.

Pumping test results showed both drawdown and mounding effects in surrounding monitoring bores. Initial analysis was conducted using Aqtesolv software, followed by numerical modelling using a block model approach. This model assessed the contrast between weathered and fresh fractured rock horizons, regional groundwater gradients, throughflow conditions, and borefield-scale abstraction.

The block model was successfully calibrated to observed groundwater responses during the pumping tests.

Predictive simulations based on a nominal borefield of nine production bores suggest that the aquifer system in the Rimfire area is capable of sustaining groundwater abstraction to meet project demands. This includes a theoretical maximum requirement of up to 2.8 gigalitres per annum (GL/a), continuously over 32 years, assuming that hydrogeological conditions in the Rimfire area are representative of the broader study area.

Long-term recovery simulations, based on 32 years of constant abstraction at 2.8 GL/a and a 230-year simulated recovery period, indicate that groundwater levels would recover to within two metres of pre-pumping levels after approximately 50 years, and to within one metre in approximately 100 years post-closure.

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1. Introduction

1.1 Overview

Rio Tinto Winu Pty Limited (RTC) is planning to develop a copper-gold mine and associated infrastructure based on the Winu deposit, located approximately 320 km east of Port Hedland in the Pilbara region of Western Australia. The Winu Project is located on land traditionally owned by the Nyangumarta and Martu peoples.

As groundwater supply represents a critical resource for the planned development, characterisation of the local and regional aquifer systems is a key component of the baseline assessment in the Winu Project area. Worley was contracted by RTC to support a hydrogeological field investigation program with the aim of improving the understanding of groundwater resources available to the Winu Project.

Potential regional water sources being investigated are referred to as the Wallal, Rimfire, and Texas targets.

This report presents the investigations conducted at the Rimfire target area, situated approximately 30 km to the east-southeast of the main Winu project (Figure 1-1).

1.2 Purpose and scope of this study

Between 2020 and 2024, three stages of intrusive hydrogeological investigations at Rimfire included:

1. Exploratory reverse-circulation (RC) drilling
2. Installation of three monitoring bores and two production bores
3. Test pumping

With the site data, the assessment included the following scope of works:

1. Analysis of the pumping test and future water demand
2. Development of a conceptual hydrogeological model
3. Additional analysis using numerical modelling to account for known complexities of the aquifer system:
 - a. Develop a numerical block model
 - b. Provide forward predictions to estimate the potential impacts and extents of drawdown
4. A hydrogeological assessment of the potential impacts of the proposed abstraction on the aquifer, environment, and surrounding users

As far as possible, this report has been prepared according to the requirements of the Department of Water and Environmental Regulation (DWER) Policy 5.12 for basic hydrogeological assessment (H3).

1.3 Borefield water demand

An extensive water balance assessment has been completed for the project (covered by separate reporting) including a probabilistic evaluation of the impacts of variable climate conditions and uncertainties in dewatering rates. Standard probabilistic analysis of the potential range of borefield demand indicated that for the:

- **Median case (P50):** The borefield would be required from Year 17, with demands steadily increasing to 1.5 GL/a by Year 26, then declining to around 1.2 GL/a thereafter.
- **High case (P90) maximum case:** The borefield would be required from Year 13 with demands steadily increasing to 2 GL/a in Year 26, then declining to approximately 1.7 GL/a thereafter.

A theoretical worst-case (in terms of water supply) was also assessed assumed consistently low dewatering rate (P10). This scenario predicted:

- **Peak case:** The borefield use would occur intermittently and at low rates from Years 4 to 11, increasing to over 2.5 GL/a from Year 21, with a peak of 2.8 GL/a sustained over three years.

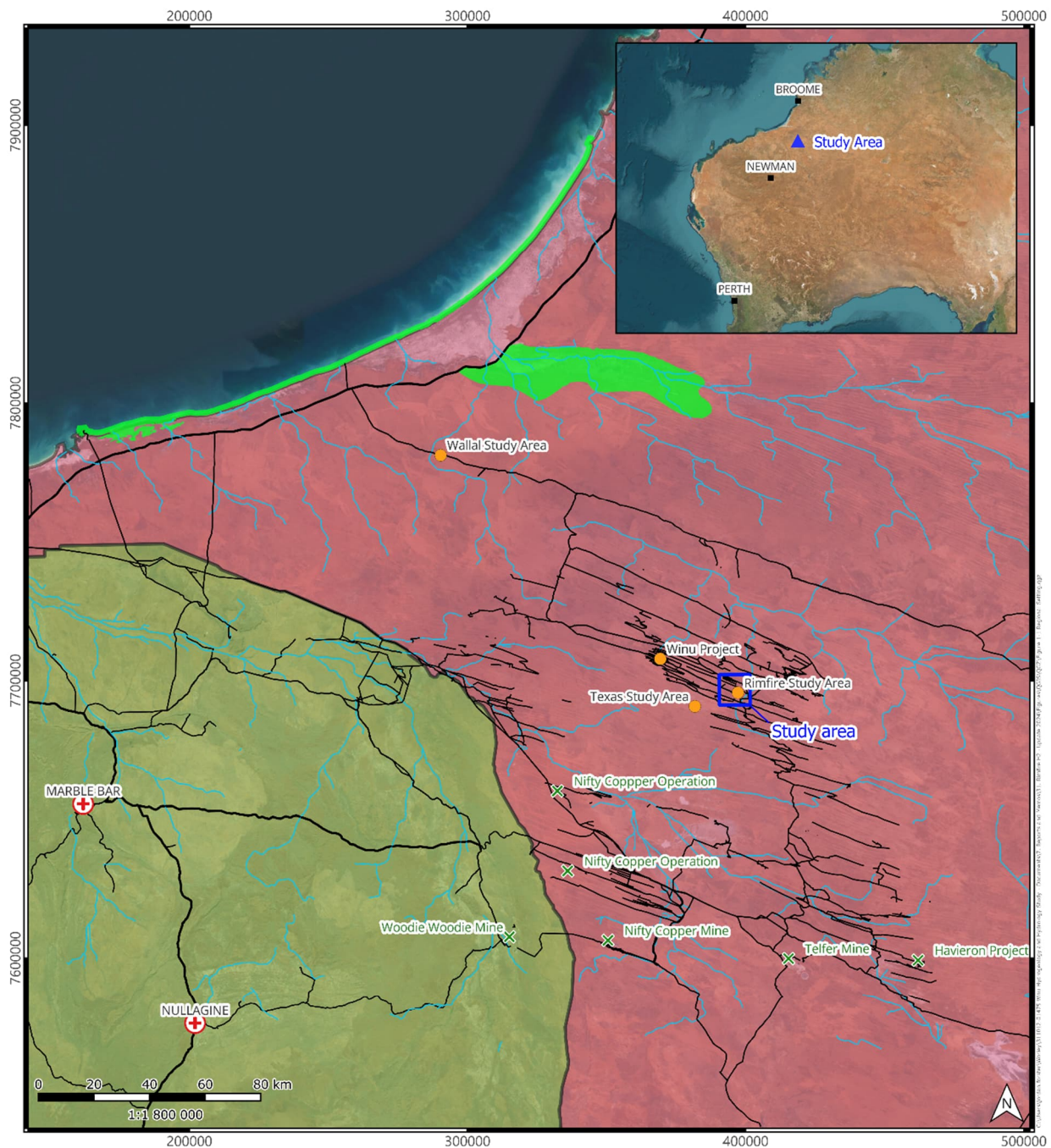
For the purposes of this study, and to conservatively assess drawdown impacts on local and regional aquifers, an extreme worst-case pumping scenario was adopted, whereby borefield abstraction was simulated at 2.8 GL/a for the full life of mine.

1.4 Location and setting

Investigations in the Rimfire area operate under 26D licence "CAW207856" ("the 26D licence"), on tenement number E45/2876, which is owned Rio Tinto Copper (RTC).

Rimfire is located within the Martu Ngurrara native Title determination (WAD6110/1998).

The Rimfire Project area ("Rimfire") is situated approximately 30 km southeast of the Winu Project, within the Canning-Kimberley Groundwater Management area, and the broader Canning-Basin (Figure 1-1).



Legend

- Site locations
- ⊕ Townships
- ✕ Existing mining projects
- Local road
- State road
- Surface water drainage
- Study area
- RAMSAR wetlands
- Groundwater areas
- Canning-Kimberley
- Pilbara

Regional Setting

Rimfire H3 Hydrogeological Assessment

Project No. 311012-01475	Client Rio Tinto Copper	Figure No. 1-1
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Notes:
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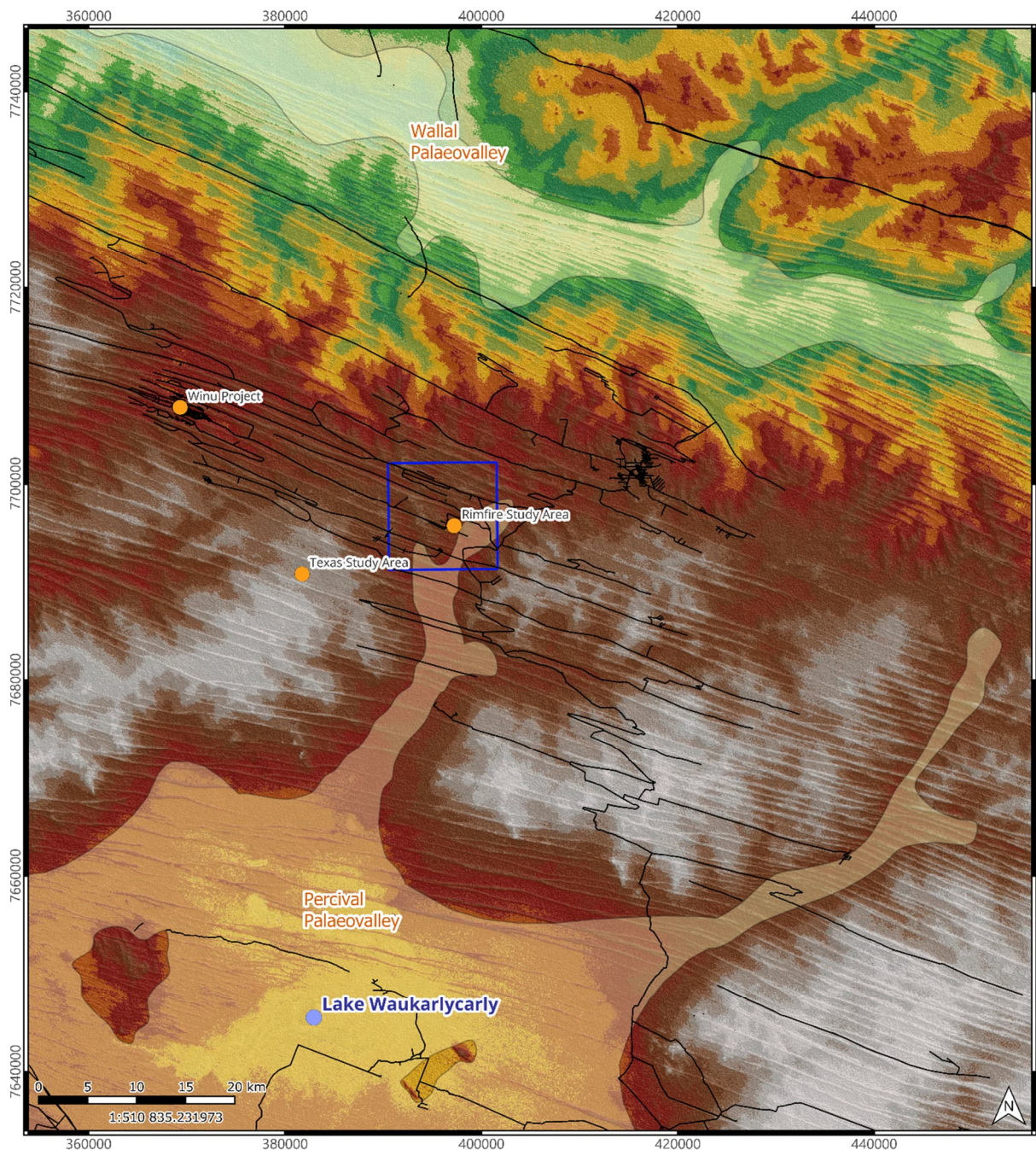
Figure 1-1 Regional setting

1.5 Topography

The area comprises flat to gently undulating red sand plains, with occasional clay pans and gravel pisolite cover. Narrow longitudinal dunes, oriented in a west-northwest to east-southeast direction, occur throughout the area. The dunes are typically 5 to 15 m high, with a width of between 30 to 50 m.

Surface elevations surrounding Winu are relatively planar and gently slope in a north-westerly direction towards the Indian Ocean coastline. Topography ranges between 245 to 300 m AHD (Figure 1-2).

Elevation data within the study area was sourced from the publicly available Shuttle Radar Topography Mission (SRTM) data, with a spatial resolution of 1-arc second or approximately 30 m.



Legend

● Site locations	Elevation (m AHD)	 240 - 250
● Lake Waukarlycarly	 ≤ 180	 250 - 260
— Tracks	 180 - 190	 260 - 270
 Study area	 190 - 200	 270 - 280
 WASANT Palaeovalleys 2012	 200 - 210	 280 - 290
	 210 - 220	 290 - 300
	 220 - 230	 300 - 310
	 230 - 240	 310 - 320
		 > 320

Topography

Rimfire H3 Hydrogeological Assessment

Project No. 311012-01475	Client Rio Tinto Copper	Figure No 1-2
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Figure 1-2 Topography of the study area

2. Climate

2.1 Rainfall, temperature and evaporation

The Project is located in an arid environment within the Great Sandy Desert bioregion of Western Australia, which can experience high intensity rainfall events often associated with cyclonic activity, typically between the months of December and April.

The nearest BoM rainfall station Telfer Aero (ID: 13030) is located 100 km south of Winu (Map 1, Appendix A), where daily rainfall data has been recorded from January 1974 to the present.

Figure 2-1 presents the annual rainfall by water year (October to September) and monthly rainfall totals over the same period. The overall average annual rainfall (by water year) is 362 mm. Higher rainfall was recorded for the period from 2000 to 2019 (average 393 mm), before again trending to the lower long-term average (362 mm) since 2019 (Worley, 2024a)

Variability in annual rainfall experienced in the region is substantial, with some years annual totals occurring practically in one or two months.

Key climatic information from the BoM database is presented Table 2-1:

Table 2-1 BoM Telfer Aero climate data (Worley, 2024a)

Parameter	Value
Mean annual rainfall	362 mm/y
Average synthetic pan evapotranspiration	3,353 mm/y
Average maximum and minimum temperature in January	36.5 °C and 21.1 °C
Average maximum and minimum temperature in July	18.6 °C and 5.5 °C

The average maximum and minimum temperatures in January are 36.5 °C and 21.1 °C respectively, and the average maximum and minimum temperature in July are 18.6 °C and 5.5 °C respectively.

Average evaporation between 1974 and 1995 (recorded at the Telfer Aero weather station) was 4,125 mm/yr, which is approximately 10 times the average annual rainfall.

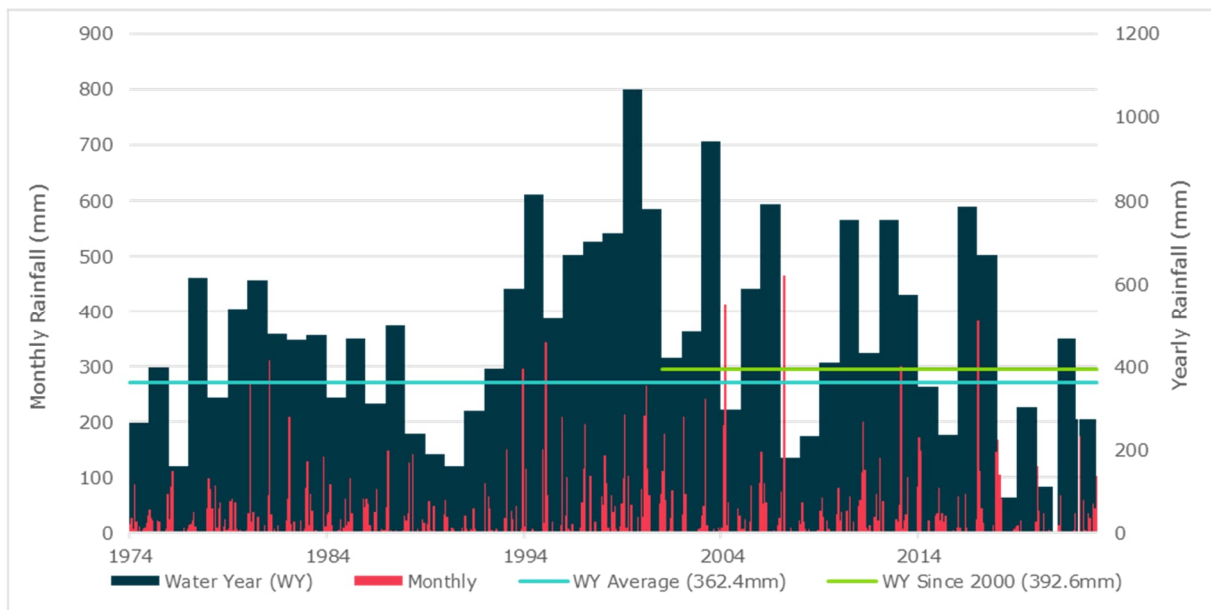


Figure 2-1 Average monthly and annual rainfall (by hydrological year) recorded at Telfer Aero (BoM 13030) (Worley, 2024a)

2.2 Hydrology

2.2.1 Surface water features and drainage

With the dune dominated topography across the area and aeolian sand cover extending to depths of 10 m BGL, there are no clearly defined surface water courses.

Internal drainage systems have resulted in the formation of several claypans across the region, which are likely associated with localised areas of ephemeral, perched watertable which expresses at surface after high rainfall events (Figure 2-2).

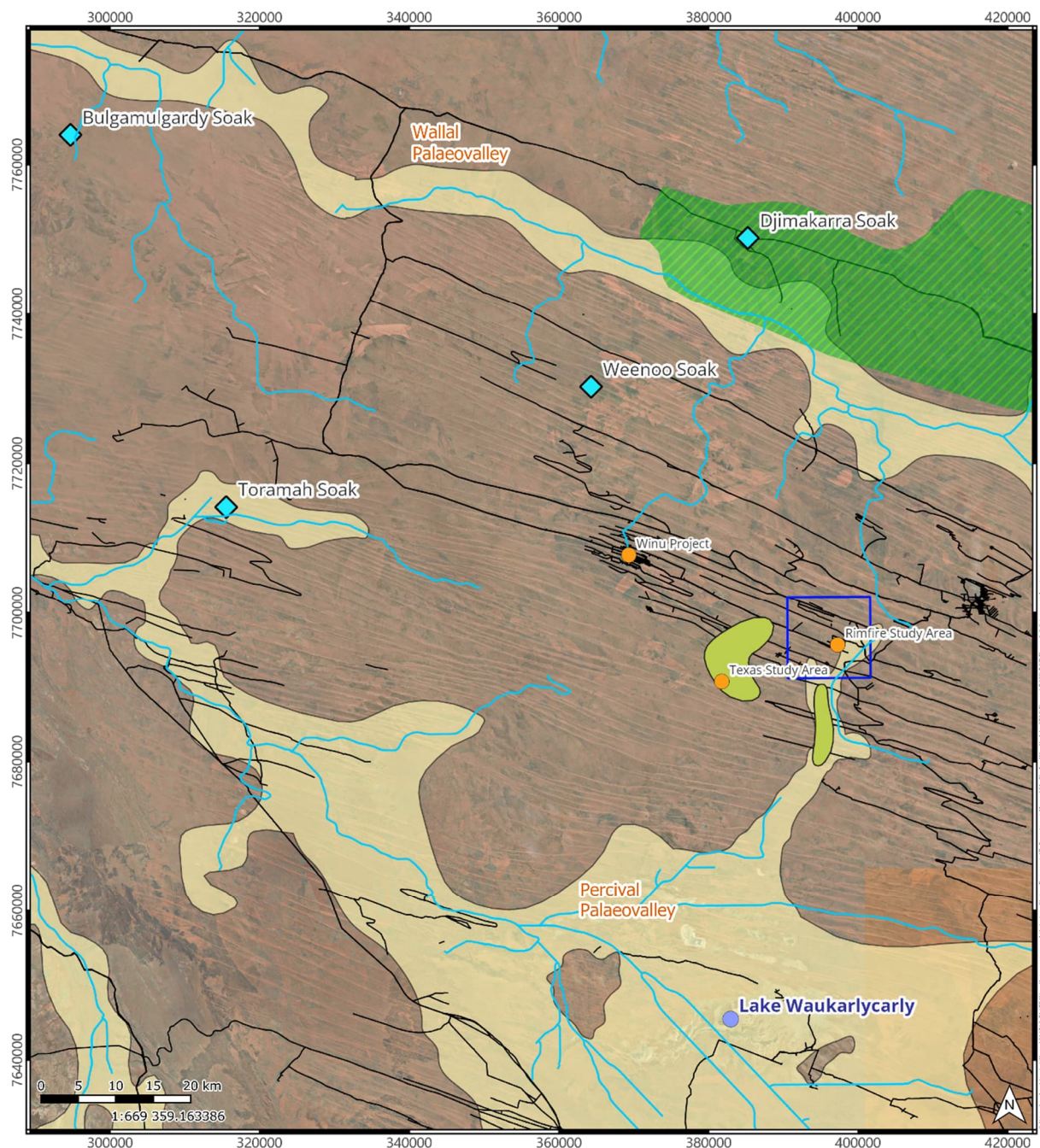
Aerial electromagnetic surveys and watershed analysis performed using the SRTM elevation data suggest a potential drainage pathway that coincides with the Percival Palaeovalley in the southeast of the study area (Figure 2-3).

Surface water features (Figure 2-3) are few in the area surrounding Winu and include:

- Soaks: Weenoo, Toramah, Djimakarra and Bulgamulgardy Soaks
- Claypans: South-east of Winu mining area
- Oakover River located approximately 100 km west of Winu
- Mandora Salt Marsh Ramsar wetland area located over 100 km north of Winu
- Lake Waukarlycarly located approximately 60 km south of Winu
- Wallal and Percival palaeovalley systems (WASANT, 2012)



Figure 2-2 Localised claypan in the Winu east area (S: 20.83, E: 121.86, WGS84)



Legend

- Site locations
- Surface drainage
- ◆ Soaks
- Lake Waukarlycarly
- Claypan occurrence area
- GDE boundaries
- Study area
- Tracks
- WASANT Palaeovalleys 2012

Surface water and drainage features

Rimfire H3 Hydrogeological Assessment

Project No.	Client	Figure No
311012-01475	Rio Tinto Copper	2-3

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Figure 2-3 Claypan and soak locations around the study area

2.2.2 Surface water quality

No surface water quality data has been collected within the Rimfire study area to date, however Toramah Soak approximately 80 km west of the study area was sampled in May 2021 (Golder, 2022a). The soak was dry during sampling, and shallow groundwater was collected from a hand-augured hole at a depth of 0.72 m.

Toramah Soak and its physical setting appear analogous to the claypans which occur to the west and south of the Rimfire study area and may provide an indication of surface/shallow groundwater quality of the Rimfire area. However, it acknowledged that with the distance between the two areas, there may also be some significant differences between water quality parameters. The previous conceptualisation (Golder 2022) suggested that these surface water features were localised and formed by surface water runoff, separate from the deeper regional water table.

Field and laboratory water quality parameters from the Toramah Soak are summarised in Table 2-2 and Table 2-3. Full laboratory analyses results are provided in Appendix B.

Table 2-2 Field water quality parameters obtained from Toramah Soak (Golder, 2021)

Parameter	Unit	Value
Temperature	°C	26.4
pH	pH unit	9.6
Electrical conductivity (EC)	µS/cm	11,531
Total dissolved solids (TDS)	mg/L	7,286
Oxygen reduction potential (ORP)	mV	48.1
Dissolved oxygen (%)	%	22.2
Dissolved oxygen (mg/L)	mg/L	1.7

Table 2-3 Water quality parameters obtained from laboratory analyses from Toramah Soak (Golder, 2021)

Parameter	Unit	Value
pH	pH unit	9.4
EC (@ 25°C)	µS/cm	11,800
TDS (@ 180°C)	mg/L	8,370
Suspended solids	mg/L	94,700
Turbidity	NTU	46,800
Calcium	mg/L	2
Magnesium	mg/L	<1
Sodium	mg/L	2,450
Potassium	mg/L	431
Total alkalinity as CaCO ₃	mg/L	3,350
Sulphate as SO ₄ (turbidimetric)	mg/L	997
Chloride	mg/L	1,930

3. Hydrogeology

3.1 Geological overview

3.1.1 Regional geology

The Rimfire study area is situated within the Anketell Shelf sub-division of the Canning Basin, which comprises metasedimentary and igneous intrusive rocks.

Rimfire is located along the eastern margin of the Anketell fault, which forms a distinct structural boundary separating the stratigraphic units of the Barnicarndy Graben (previously named Waukarlycarly Embayment by GSWA in 2021) in the west, to those of the Anketell Shelf in the east.

Regional tectonic movement and development of the present-day Anketell Shelf and Barnicarndy Graben created structural, brittle deformations within the Proterozoic basement (metasediments). The brittle deformations are inferred to have enhanced permeability in both the fresh and weathered metasediments (Golder, 2022a).

The geology of the area is broadly similar to the main Winu project area 30 km to the west, albeit with added complexities at a local scale arising from the intrusion of a granitic pluton into the metasedimentary basement.

A broad scale bedrock geology and structural map of the north-eastern Paterson Province encompassing the Rimfire project area has been produced by RTX (2016) and is shown in Figure 3-1.

3.1.2 Lithology

There are six (6) key identified geological units at Winu. These are described in Table 3-1 from surface to deepest (youngest to oldest), with typical unit thicknesses based on drilling data acquired during the field campaigns. Bore logs of the hydrogeological bores completed to date are included in Appendix C.

Table 3-1 Lithological descriptions of the main geological units encountered at the Winu study area

Lithology	Thickness (m)	Description
Quaternary aeolian sand	0 to 10	Fine to medium grained aeolian sand, typically reddish-brown, well sorted, minor silt
Unconfined sandstone and silcrete	10 to 30	Silty sandstone with high silt content reducing with depth, quartz sand grains, colour ranges between white to pink, fine to coarse grained, poorly sorted, subangular to subrounded grains Silcrete and hematitic silcrete (ferricrete) typically occur within the top 10 to 20 m of the interval, colour ranges between white to reddish brown
Permian mudstone	0 to 500	Very fine, reduced to oxidised mudstone, present to the west of the main Winu area. Regional interpretations of Czarnota et al. (2009), report the depth to basement to the west of the Anketell Shelf as generally less than 250 m, whilst the interpretation by Alavi (2013)

Lithology	Thickness (m)	Description
		notes a depth of up to 500 m. This unit pinches out to the east and is a discontinuous, low permeability unit, incorporating clay, claystone, diamictite, and conglomerate (fine-grained, matrix supported) facies
Mafic intrusions within the Proterozoic metasediments	5 to 40	Black to grey, fine grained, slightly weathered to fresh, hornblende phenocrysts, micaceous/schistose in some intervals
Granite and felsic intrusions within the Proterozoic metasediments	5 to 80	Moderately weathered to highly weathered granite/felsic intervals, typically occurring between 20 and 80 m BGL, light brown to tan, occurs as variably consolidated sandy silt comprising quartz and feldspar grains, little to no biotite visible, fines content reducing with depth as weathering decreases
Proterozoic metasediment	> 300	Moderately weathered to fresh metasedimentary intervals, medium grained, dark grey, biotitic, metasiltsstones and metasandstones

3.1.3 Geological lineaments

In the Rimfire area, geological lineaments identified using aeromagnetic data generally show a strong west-northwest trend, with minor lineaments extending radially from the broadly circular granitic pluton intrusion at the centre of the Rimfire study area.

RTX (2022) produced a regional structural dataset delineating lineaments around the Paterson region, based on interpretation of drilling and geophysical data and mapped local and regional structures (faults, dykes etc). These structures have been overlain on a regional aeromagnetic dataset which show a strong correlation with several magnetic zones and lineaments (Figure 3-1).

These lineaments generally show a strong northwest to southeast trend, with minor faults cross cutting major structures. Lineaments likely comprise faults and fractures which have the potential to store and convey water. Previous studies (Advisian, 2022a) and (Advisian, 2023d) show a correlation between structures and higher yielding bores (Figure 3-2).

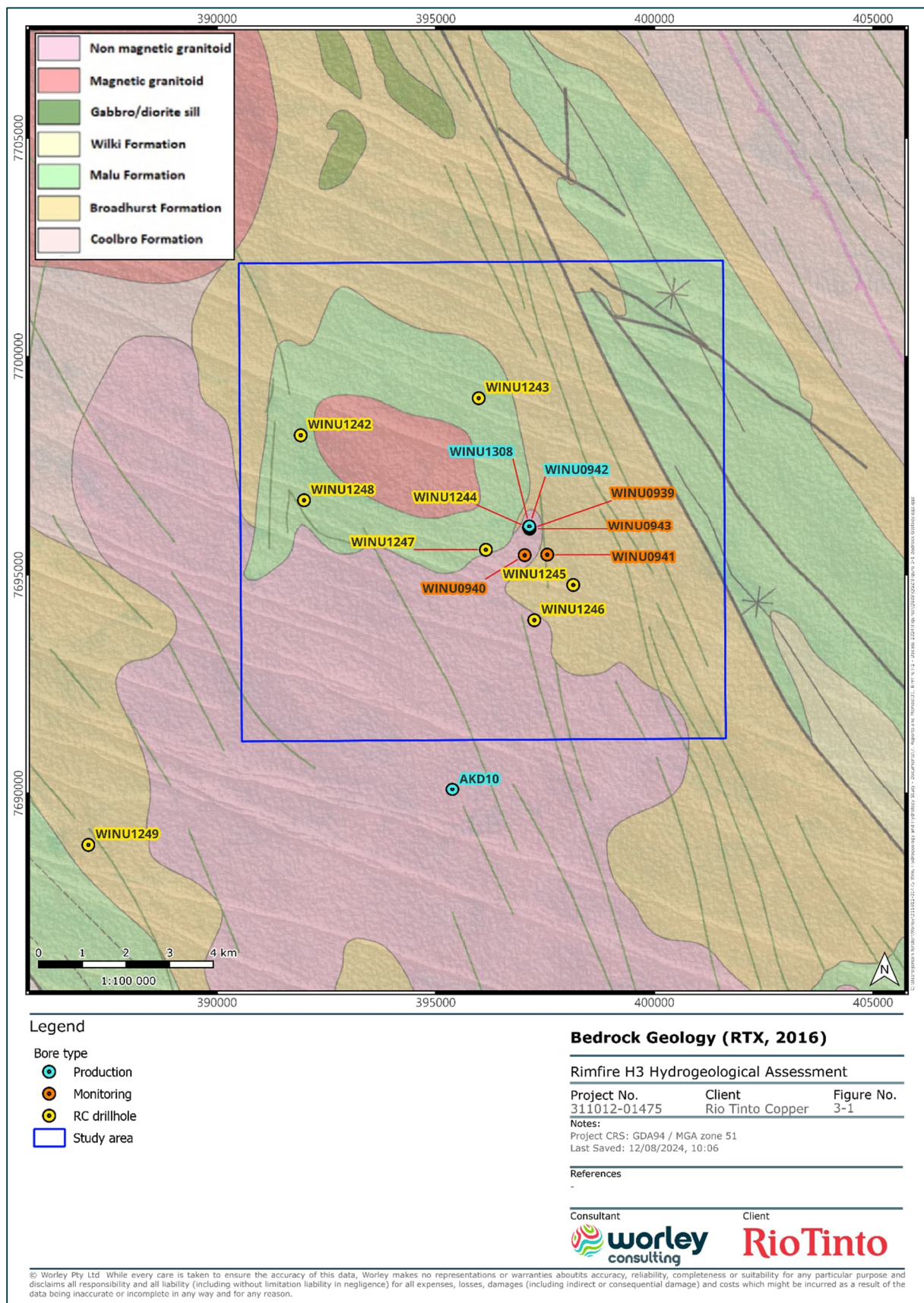
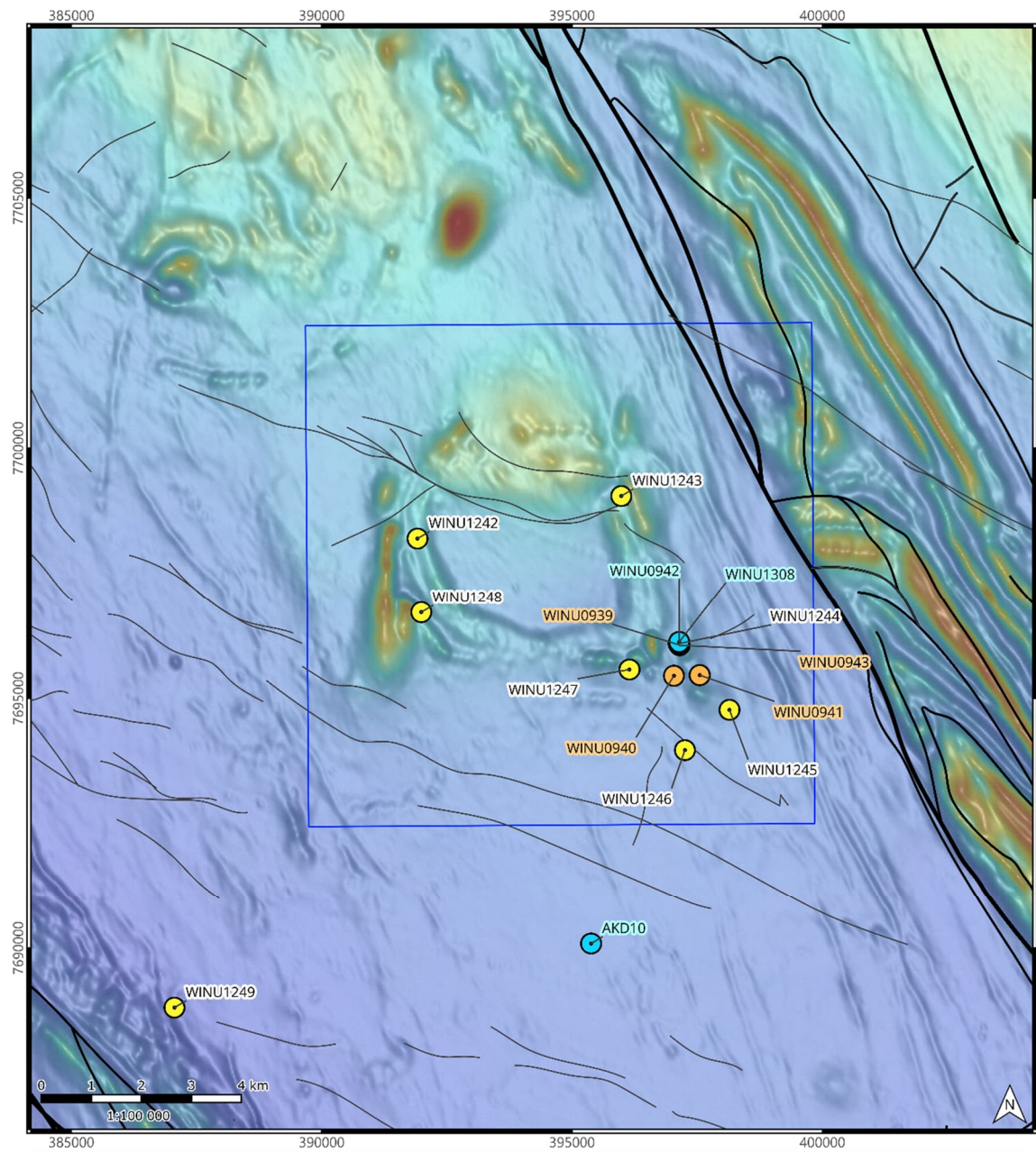


Figure 3-1 Rimfire bedrock geology



Legend

Bore type	Paterson Structure March 2022	Study area
 Production	 Fault Zone; Fault/Shear	
 Monitoring	 Fault; Normal; Thrust	
 RC drillhole	 Minor Fault	

Geological Lineaments

Rimfire H3 Hydrogeological Assessment

Project No. 311012-01475	Client Rio Tinto Copper	Figure No. 3-2
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Notes:
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References

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Figure 3-2 Interpreted geological structures in the eastern Rimfire area against aeromagnetic imagery

3.1.4 Percival Palaeochannel

Airborne transient electromagnetics data (TEM) for the Rimfire area (file: "Paterson_East_xCite_SkyTEM_Merge_Z_dBdt_219_060_SunAngle_HistNorm") provides an insight to the nature of the subsurface soil profile. The areas of high conductivity along the Percival Palaeochannel are interpreted as an increased clay content and corresponds with the inferred palaeochannel presented in the WASANT Palaeovalley Map (Bell et al, 2012).

The extent of the palaeochannel has been delineated based on this dataset and is referred to as the Inferred Percival Palaeochannel in the Rimfire study area in this report (Figure 3-3).

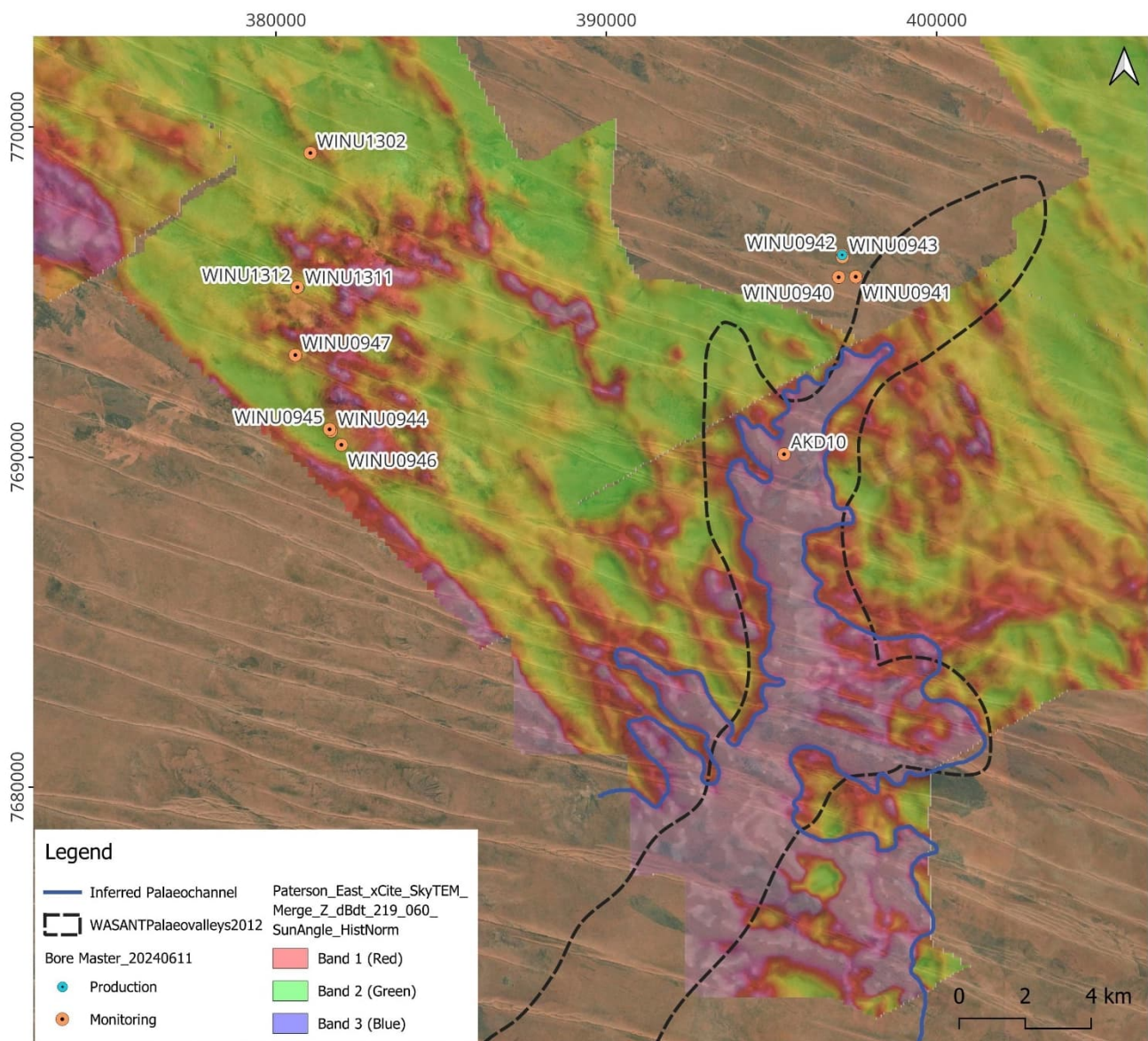


Figure 3-3 Inferred Percival Palaeochannel in the Rimfire area

3.2 Hydrostratigraphic units

With the results from drilling programs between 2020 and 2024 the study area can be classified into six (6) hydrostratigraphic units (HSU) based on lithology and their hydrogeological function (Table 3-2).

Mafic intrusive units encountered at several locations are considered relatively sparsely distributed and unlikely to act as significant confining units. However, locally, they may function as partially impermeable flow barriers and compartmentalise groundwater flow.

A conceptual cross section across the Rimfire area, showing the spatial configuration of the various units, is included in Figure 3-4.

As discussed in Section 3.1.3, lineaments also likely comprise faults and fractures within the weathered metasediment and granite have the potential to store and convey water. The primary water supply targets in the Rimfire area are the weathered granites and metasediments, particularly where they are coincident with lineaments.

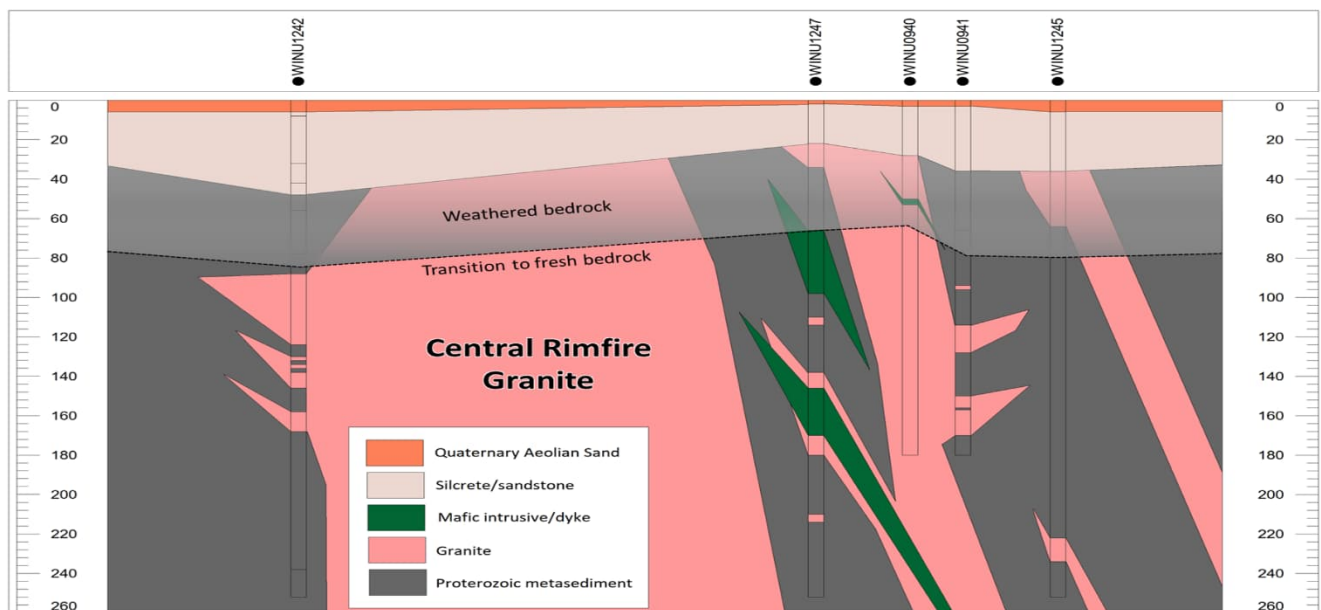
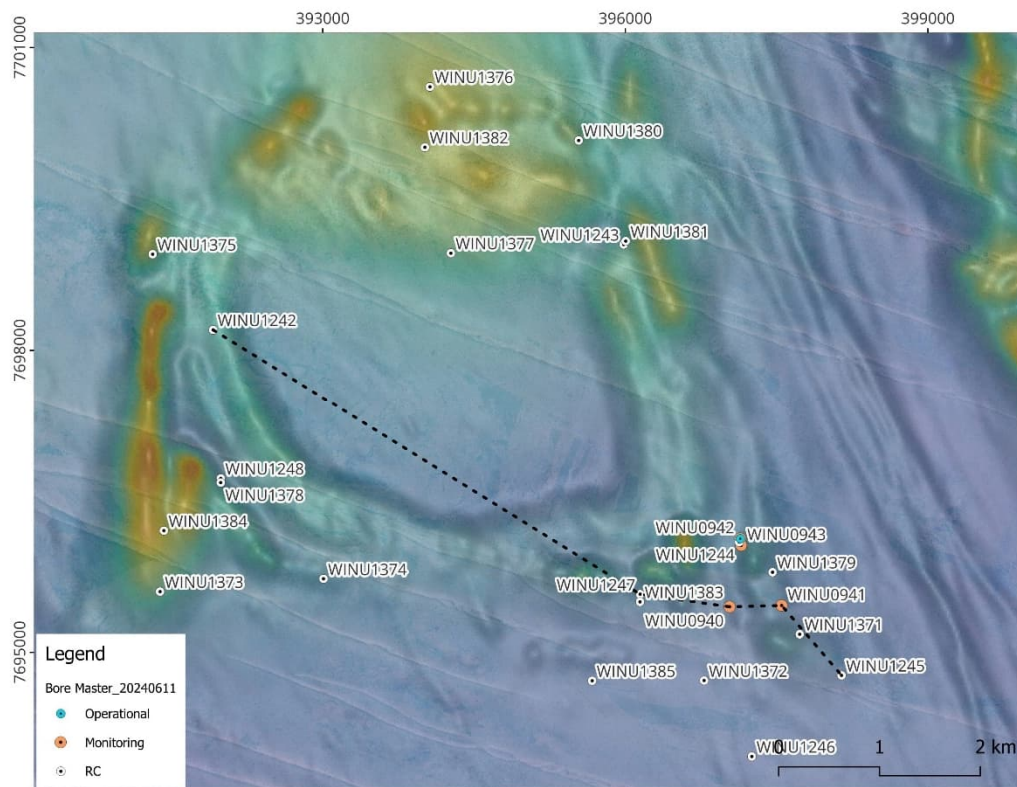


Figure 3-4 Conceptual cross section through the Rimfire area

Table 3-2 Description, thickness, and hydrogeological function of hydrostratigraphic units within the study area

Hydrostratigraphic unit (HSU)	Lithology	Thickness (m)	Hydrogeological function	Description
Quaternary aeolian sand / silcrete / sandstone	Silty sand, very fine to medium grained and variable ferricrete	0 to 30	Unsaturated	Occurs over majority of the study area, unsaturated except following periods of increased rainfall
Permian mudstone	Mudstone, claystone, diamictite	0 to 250	Sedimentary aquitard	Discontinuous, low permeability confining unit not found at Rimfire
Weathered metasediment	Moderately to highly weathered metasediment	20 to 80	Aquifer	The weathered zones function as an unconfined primary aquifer
Fresh metasediment	Slightly weathered to fresh metasediment, massive, fine to coarse grained	>80	Fractured aquifer	Fresh metasediments are inferred to act as a fractured aquifer
Weathered granite	Moderately to highly weathered granite, generally occurs as quartz, feldspar, and biotite in a matrix	20 to 80	Aquifer	Exists over the granitic plutons only and acts as a primary weathered aquifer
Fresh granite	Slightly weathered to fresh granite, massive, fine to coarse grained	>80	Fractured aquifer	Fresh granite is inferred to be a fractured aquifer

3.3 Groundwater recharge

Recharge to the groundwater system at Rimfire has not been quantified due to the lack of significant rainfall events following the completion of the monitoring bores which would provide the basis for evaluation of recharge signals in groundwater levels.

Recharge is likely a combination of direct vertical infiltration and lateral throughflow from outcrop/subcrop(s) in the southeast.

The groundwater table is approximately 17 m BGL or deeper and there is no consistent confining layer.

Although not ideally distributed, chloride concentrations recorded at WINU0940, WINU0941, WINU0942, and WINU0943 (between 90 to 330 mg/L) show a decreasing trend toward the southeast, in the direction of the subcrop/outcrop indicated by satellite imagery (Figure 3-5).

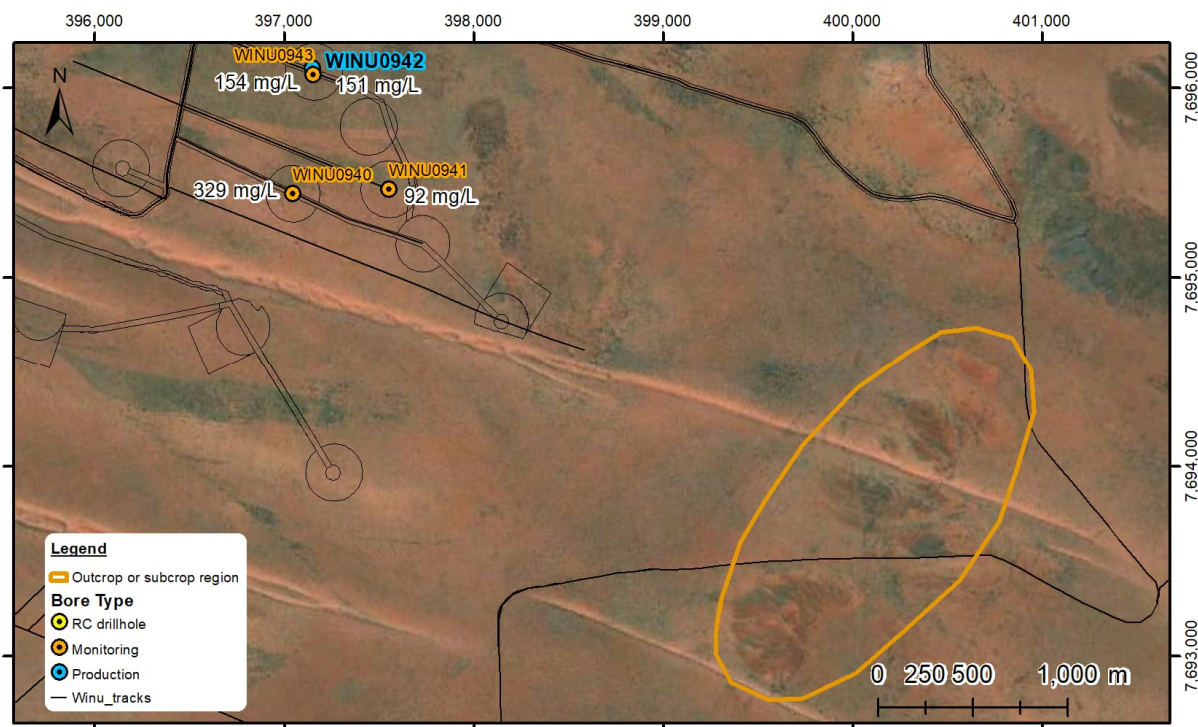


Figure 3-5 Subcrop/outcrop location and groundwater chloride concentrations

Groundwater chloride concentrations indicate a minor diffuse recharge input in the order of 1 to 2% of annual rainfall, ie. 3 to 6 mm/yr. These average values are the result of occasional high rainfall events.

3.4 Groundwater levels and flow directions

Groundwater flow directions are interpolated from measured groundwater levels in observation bores at the Rimfire, Winu aerodrome, and Texas areas (Figure 3-6, and tabulated in Appendix G). The interpreted water level contours suggest:

- Groundwater flow direction is regionally from the south-southeast to the north-northwest, aligned with the inferred recharge source(s) in the southeast
- The groundwater gradient across the Rimfire study area is approximately 0.0025 (i.e., 2.5 m drop over a distance of 1000 m)
- Locally there may be some flow southeast toward the Percival Palaeovalley, the lowest topographical feature in the area and where groundwater is close to surface.

3.5 Discharge and losses

The discharge mechanisms within the study area are expected to occur through three main pathways:

- Lateral flow
- Evaporation and evapotranspiration
- Abstraction for mining purposes

Lateral flow is the main natural mechanism of groundwater loss from Rimfire. Using the following parameters, an estimated daily outflow flux (Q , m³/d) from the weathered metasediment/granite layer was calculated using Darcy's law as being 15 m³/d/km, whereby:

$$Q = K * I * A$$

- K : Bulk hydraulic conductivity of 0.12 m/d (represents the weighted average conductivity of the weathered metasediment and weathered granite lithologies based on area, see Section 9.3.4)
- I : Groundwater flow gradient of 0.0025 (i.e., 2.5 m vertical difference over 1000 m)
- A : Nominal cross-sectional area of 50,000 m² (aquifer saturated thickness of 50 m, length of 1 km)

Evaporation and evapotranspiration (EVT) losses are minor in comparison to lateral flow due to groundwater levels in the study area being below 17 m BGL, beyond the functional effects of evapotranspirative processes. However, approximately 2 km south of the study area, coincident with the Percival Palaeovalley and bore AKD10, EVT losses are theoretically possible due to the shallow groundwater level (<5 m BGL).

Groundwater abstraction will be required for dewatering and water supply to support the Winu Project, when in operation. No other mining operations are expected to require groundwater in the vicinity of Rimfire.

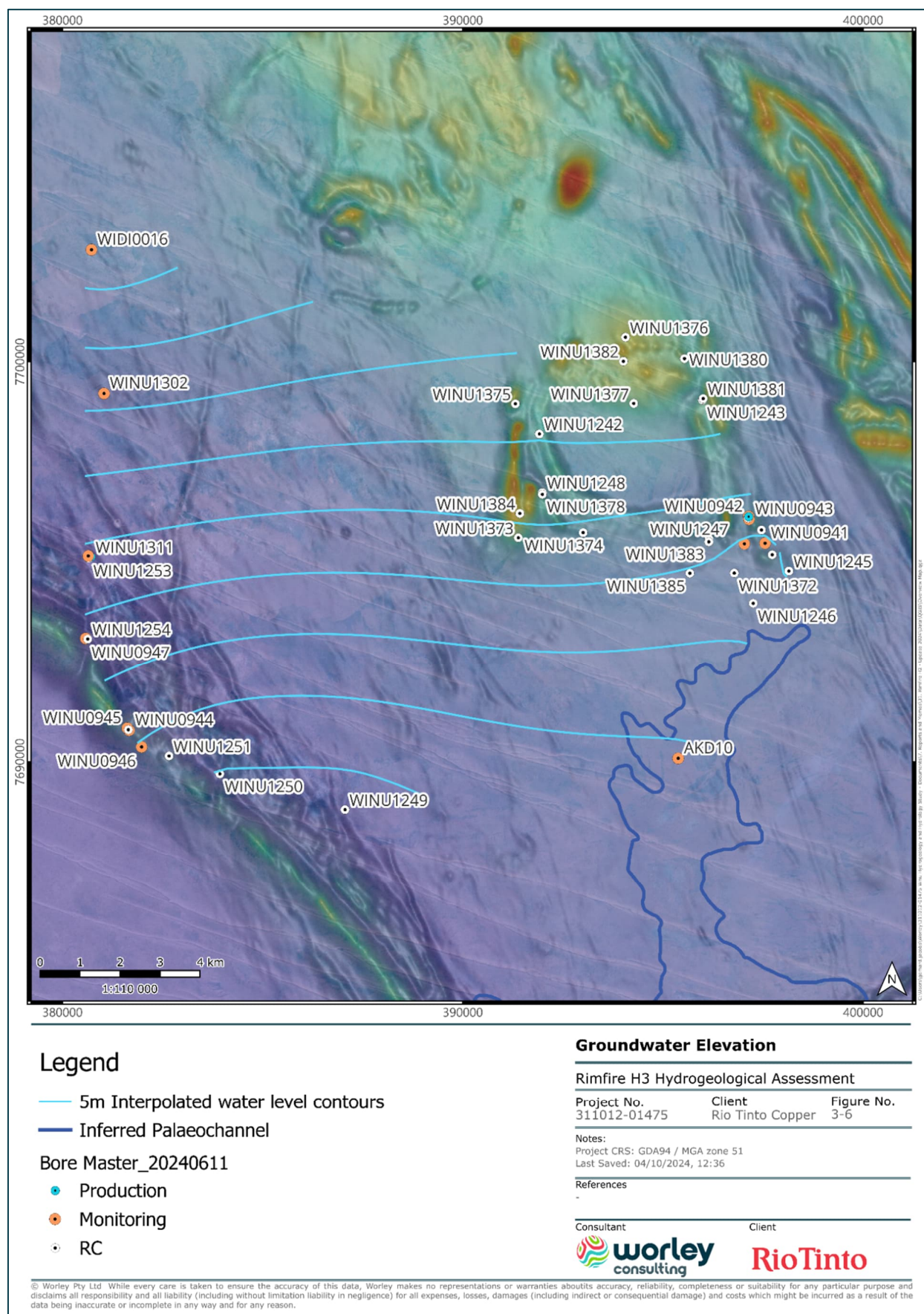


Figure 3-6 Groundwater levels (m AHD) around the Rimfire study area

3.6 Groundwater-surface water interaction

No significant groundwater surface water interaction is likely within the study area based on the observed water levels deeper than 17 m BGL and the absence of any surface hydrological features (i.e., soaks and claypans).

An exception may be to the southeast of the project area where groundwater level in bore AKD10 (taken on 21/3/2023) is 3.82 m BTOC. The shallow groundwater occurrence is currently poorly understood; however it is considered due to topography (low depressions), and potentially perched groundwater levels within the Percival Palaeovalley (Bell, Kilgour, English, Woodgate, & Lewis, 2012).

Groundwater surface water interaction is likely to be spatially constrained to minor areas with shallow groundwater levels, and limited during and immediately following periods of intense rainfall and/or cyclonic events.

4. Existing groundwater use

4.1 Groundwater use

The closest groundwater allocation to the study area is Winu, with a current abstraction entitlement of 0.3 GL/a (300,000 kL/a) under groundwater licence GWL201165(7).

There are currently seven (7) active groundwater abstraction sites (operational bores) at Winu with a combined use of approximately 0.06 GL/a (60,000 kL/a) (Worley, 2024a)

Aside from pumping tests, abstracted groundwater is being used at Winu for:

- Potable water supply for the accommodation camp
- Dust suppression and earthworks
- Road construction and maintenance
- Drilling operations and bore construction
- General operation

4.2 Other groundwater users

4.2.1 Pastoral

Interrogation of the online Water Information Reporting (WIR) tool provided by the Department of Water and Environmental Regulation (DWER) did not list any bores to supply pastoral stations.

4.2.2 Mining – third parties

Aside from the local development of the Winu project, the closest third-party mines to the Rimfire area are:

- Nifty Copper Mine, operated by Cyprum Metals Ltd (90 km south-west)
- Telfer Mine, operated by Newcrest Mining Ltd (100 km south-southeast)
- Havieron Project, JV between Newcrest Mining Ltd and Greatland Pty Ltd (120 km south-east)
- Woodie Woodie Mine, operated by Pilbara Manganese Pty Ltd (120 km south-west)

Their locations relative to the Rimfire project area are shown in Map 2, Appendix A.

4.2.3 Aboriginal communities

The nearest Aboriginal communities are Warralong (~220 km west of Winu); Punmu (~205 km southeast of Winu); and Yandaringa (~185 km north of Winu) (Department of Planning, Lands and Heritage, 2020).

No other Aboriginal communities are known to exist near Winu. There are no nearby Aboriginal communities utilising groundwater other than the Kunawarritji Aboriginal Corporation, 250 km southeast of Winu (Golder, 2022a).

4.2.4 Environmental receptors

The online Groundwater Dependent Ecosystem Atlas (GDE Atlas) tool hosted by BoM was used to identify potential GDEs (aquatic, terrestrial, or subterranean) in proximity to the Rimfire study area.

The Weenoo and Djimarakka soaks, located 45 km and 55 km north-west of Rimfire, are supported by incident rainfall and surface water runoff collected in topographic depressions, and are not groundwater dependent (Golder , 2022a).

No Priority Ecological Communities (PEC) or Threatened Ecological Communities (TE) were identified in the Rimfire area.

The GDE potential of the Percival Palaeovalley within the Rimfire study area has not yet been conclusively assessed. Western Botanical (2025) has recently carried out a botanical survey of all Winu Project areas, including the Rimfire, and identified a shrubland community over the Percival Palaeovalley.

The study concluded that “further studies would be required to quantitatively assess whether the vegetation in this area is groundwater dependent”, while noting that *Melaleuca lasiandra* – the shrubland species found here – is not typically recognised a significant GDE indicator.

A summary table of potential GDE areas is provided on Table 4-1. The location of the GDE areas, soaks, and palaeovalley systems are shown in Figure 2-3.

Table 4-1 GDE potential around the Rimfire study area (using data from BoM, 2023)

ID	Distance from Rimfire	Description	GDE potential	River region
1	35 km north	Mosaic: Hummock grassland, low tree steppe; eucalyptus over feathertop between dunes/ Hummock grasslands, patchy shrub steppe; <i>Acacia pachycarpa</i> over	Low	Sandy Desert
2	45 km east	Mosaic: Hummock grassland, low tree steppe; eucalyptus over feathertop between dunes/ Hummock grasslands, patchy shrub steppe; <i>Acacia pachycarpa</i> over	Low	Sandy Desert
3	Present within Rimfire area	Mosaic: P19 – <i>Melaleuca lasiandra</i> Shrubland over <i>Triodia schinzii</i> within the Percival Palaeovalley perched aquifer	TBA	Sandy Desert

Biota Environmental Sciences, (2022) completed a subterranean fauna desktop study and basic survey to assess the likelihood that stygobitic fauna (stygofauna: aquatic subterranean fauna) or troglobitic fauna (troglofauna: air-breathing fauna above water table) occur within the study area.

The study was based on collated information from government databases, previous sampling and publicly available information. The basic survey also involved low intensity sampling for troglofauna and stygofauna within the study area to verify the findings of the desktop study.

No troglobitic or stygobitic fauna were found at or around the Winu proposed mining area to date. The Biota Environmental Sciences (2022) report concluded that it is unlikely that subterranean fauna occur in most geological units of the study area.

Recent sampling at Rimfire has found indications of stygofauna, however, further work is required to understand the species and potential habitats.

4.3 Groundwater extraction and licensing

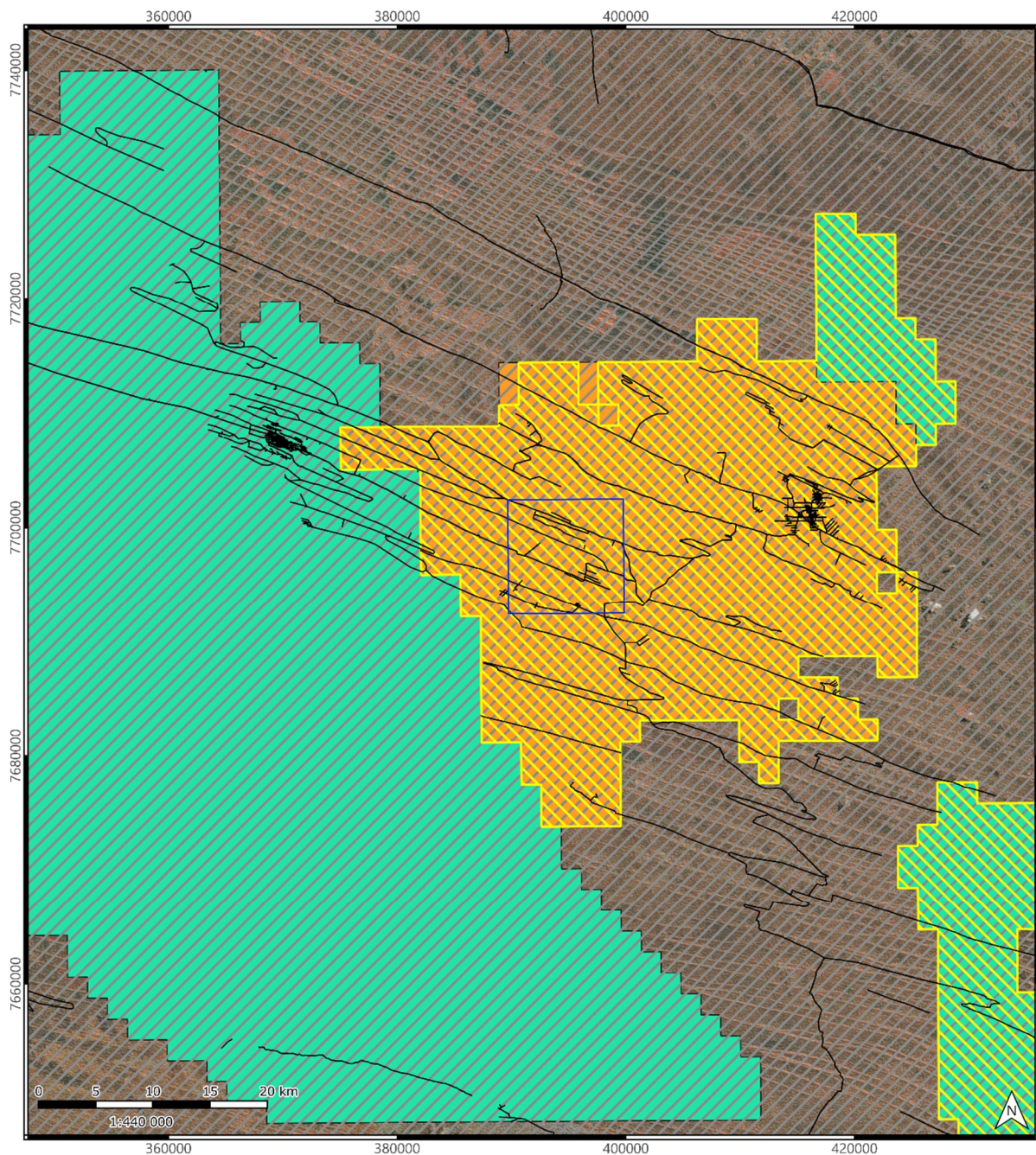
There are three active groundwater licences in the vicinity of the study area, with three licences issued to Rio Tinto Exploration Pty Ltd. A summary of the active licences is presented on Table 4-2, and shown spatially in Figure 4-1.

Groundwater extraction allowed by these licences has been permitted within the Canning-Wallal aquifer.

The total allocation for all three active licences across both aquifers is 0.3315 GL and is allocated to the Canning-Wallal aquifer.

Table 4-2 Active groundwater licences within the study area

Licence number	Licensed party	Issue date	Expiry date	Licensed aquifer	Annual allocation (GL)
200009	Rio Tinto Exploration Pty Limited	22/06/2017	21/06/2027	Canning - Wallal	0.0015
201165(7)	Rio Tinto Exploration Pty Limited	18/12/2023	17/12/2025	Canning - Wallal	0.3
206212	Rio Tinto Exploration Pty Limited	9/08/2021	8/08/2031	Canning – Wallal	0.03



Legend

- Roads and tracks
- Study area
- Groundwater licence**
 - 179796 - New Standard Onshore; 0.00035 GL/yr
 - 200009 - RTX; 0.0015 GL/yr
 - 201165 - RTX; 0.3 GL/yr
 - 206212 - RTX; 0.03 GL/yr

Groundwater Licences

Rimfire H3 Hydrogeological Assessment

Project No. 311012-01475 Client Rio Tinto Copper Figure No. 4-1

Notes:
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References

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Figure 4-1 Groundwater licences around the Rimfire study area

5. Groundwater investigations

Hydrogeological investigation for the Winu Project were completed by Advisian (rebranded as Worley Consulting) between 2022 and 2024.

Hydrogeological investigations included:

- Hydrogeological drilling
- Logging of lithology
- Hydrogeological bore installation and development of monitoring and production bores
- Water quality sampling
- Aquifer testing (pumping tests)
- Groundwater level monitoring

The reports describing the hydrogeological investigations completed for the Rimfire Project is listed on Table 5-1.

Table 5-1 Summary of groundwater investigation reports related to Rimfire study area

Author	Date	Title	Reference
Golder	2021	Winu regional water supply options and selection of drillhole investigation sites	(Golder, 2021)
Golder	2022	H3 Hydrogeological Assessment of the Winu Project	(Golder , 2022a)
Advisian	2023	Rimfire target identification based on RC drilling results	(Advisian, 2023b)
Advisian	2023	Rimfire Bore Redesign for 26D	(Advisian, 2023a)
Advisian	2024	Winu Annual Aquifer Review	(Worley, 2024a)

6. Hydrogeological drilling

6.1 Intrusive investigations

Drilling investigations completed within the Rimfire area are summarised in Table 6-1, with drillholes locations presented in Figure 6-1.

All bore logs are shown in Appendix C.

Table 6-1 Summary of drilling investigations completed within Rimfire study area

Year	Bore type	Purpose
2022-2023	11 RC	RTC groundwater exploration
	16 RC	RTC stygofauna investigation
	3 Monitoring Bores	RTC groundwater investigation
	1 Production Bore	
2024	1 Production Bore (WINU1308)	

6.1.1 Reported airlift yields during drilling

Bore construction details for all bores within the Rimfire study area are provided in Table 6-2, as well as RC holes that had recorded airlift data from drilling. Maximum bore airlift yields during development and RC hole airlift yields are presented on Figure 6-1, overlayed on inferred bedrock geology.

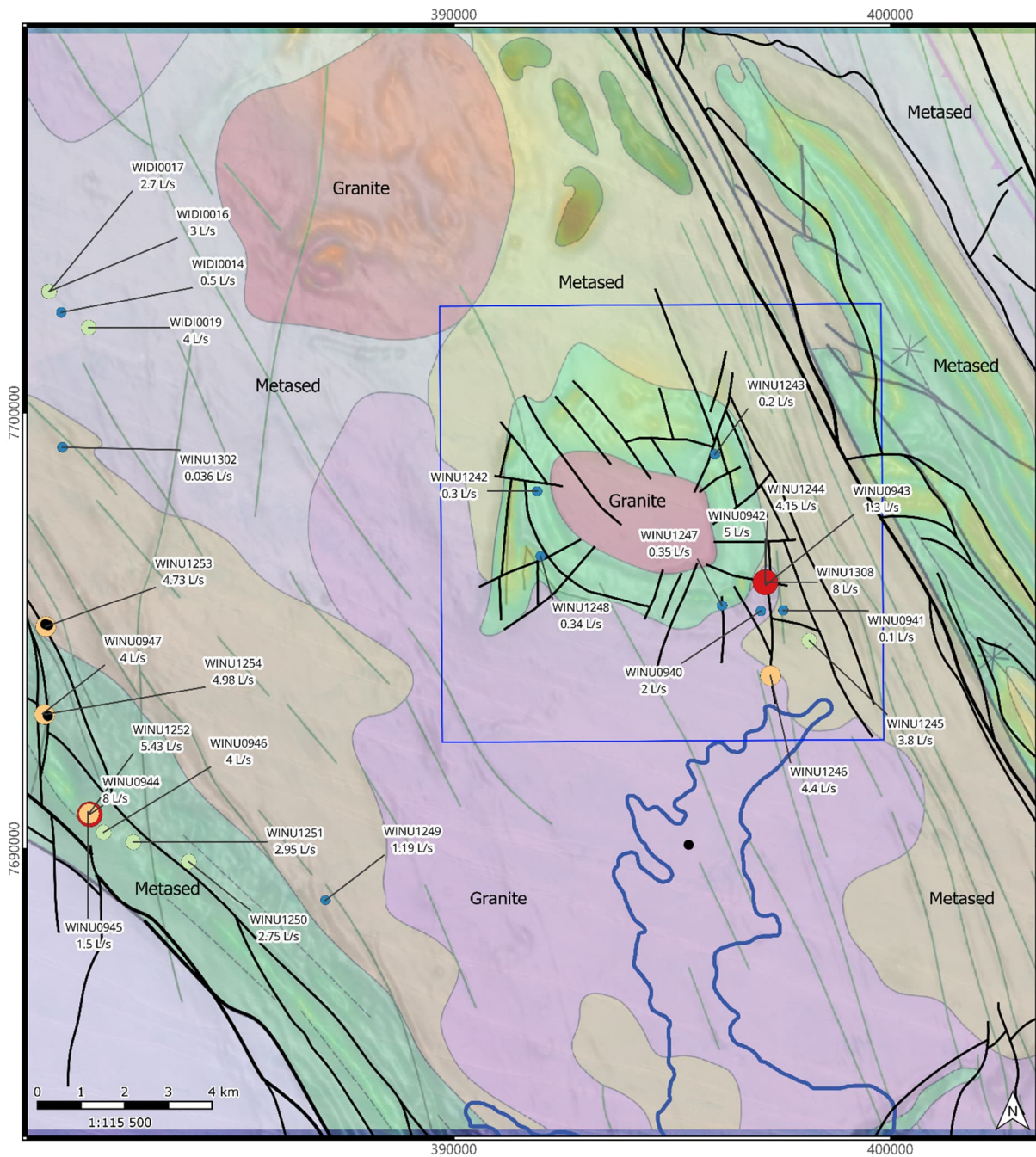
Airlift yields within the study area vary between 0.1 L/s (WINU0941) and 8 L/s (WINU1308), with an average of 4 L/s.

Table 6-2 Rimfire hydrogeological drilling and construction summary

Borehole ID	Easting	Northing	TOC (m AHD)	Date completed	Bore depth (m)	Drilling method	Design screen size and type	Screen from (m BGL)	Screen to (m BGL)	Screen length (m)	Screened/ monitored aquifer	Airlift (L/s)	Final pH	EC (µS/cm)
WINU0940	397045	7695444	262.05	13/05/2023	180	Mud rotary/air percussion	100mm PN18 PVC threaded 1mm-slotted	156	180	24	Rimfire Granite	2	8.01	1254
WINU0941	397554	7695467	259.02	24/06/2023	180	Mud rotary/air percussion	100mm PN18 PVC threaded 1mm-slotted	156	180	24	Rimfire Granite / Metasediment	0.1	8.34	674
WINU0942	397148	7696106	261.35	24/06/2023	201.6	Mud rotary/air percussion	10" stainless steel wire wound 1mm screens; Surelock	80	200	120	Rimfire Granite / Metasediment	5	8.24	783
WINU0943	397152	7696072	261.32	2/07/2023	129	Mud rotary/air percussion	100mm PN18 PVC threaded 1mm-slotted	105	129	24	Rimfire Granite / Metasediment	1.3	8.05	899
WINU1242	391913	7698203	268.17	11/11/2022	252	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	0.3	8.41	1409
WINU1243	395983	7699049	269.56	30/11/2022	228	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	0.2	8.63	710
WINU1244	397128	7696092	260.94	26/11/2022	252	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	4.15	7.4	756
WINU1245	398144	7694771	258.6	22/11/2022	252	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	3.8	8.1	591
WINU1246	397254	7693967	260.86	15/11/2022	246	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	4.4	7.8	1931
WINU1247	396146	7695576	272.27	19/11/2022	252	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	0.35	8.1	1346
WINU1248	391988	7696723	265.24	13/11/2022	252	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	0.34	8	1153
WINU1308	397140	7696125	TBC	6/05/2024	140	Mud rotary/air percussion	10" PN18 PVC threaded 1.5mm-slotted	30	138	108	Rimfire Granite / Metasediment	8	8.09	903
RFRN0002	394180	7700373	266.52	30/03/2021	210	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	6.6	NR	NR
RFRS0001	397368	7696006	259.58	28/03/2021	120	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	5	NR	NR
RFRS0002	396438	7696350	265.31	30/03/2021	102	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	5	NR	NR
RFRN0003	395096	7699356	269.00	06/04/2021	216	Reverse circulation	N/A	N/A	N/A	N/A	Full sequence	0.4	NR	NR

Eastings and northings in GDA94 Z51

NR – Not recorded



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Figure 6-1 Borehole locations within the Rimfire study area

7. Aquifer testing

7.1 Pumping test details

Two pumping tests were completed at Rimfire between July 2023 and June 2024 (Table 7-1).

WINU1308 was a redrill of WINU0942, approximately 5 m away from it. Testing at WINU0942 suggested the bore was inefficient due to the depth of the protection casing and grout isolating water bearing strata, resulting in a poor yield and limited drawdown observed in monitoring bores.

The improved design of WINU1308 resulted in a markedly higher yield and good hydraulic connection between the pumping bore and monitoring locations.

Table 7-1 Summary of pumping tests at Rimfire

	Test 1	Test 2
Pumping bore	WINU0942	WINU1308
No. of monitored bores / RC holes (including PB)	12	20
SRT date	11 July 2023	15 May 2024
SRT pumping duration (min)	415	480
CRT start date	12 July 2023	18 May 2024
CRT end date	8 August 2023	17 June 2024
CRT rate (L/s)	4	16.5 to 18
CRT pumping duration (days)	27	30
No. days recovery (95%)	1	1
Maximum drawdown in production bore (m)	82.22	29.61

7.2 Step-rate tests (SRT)

For both bores a step rate test (SRT) was carried out using five (5) progressively increasing pumping steps (rates), with a duration of between 15 and 100 minutes.

Details of the SRT steps and drawdown observations are shown on Table 7-2 and plots of observed drawdown during each SRT and recovery are presented in Figure 7-1 for WINU0942 and Figure 7-2 for WINU1308. The results from the SRT were used to select an initial pumping rate for each constant rate test (CRT)

Table 7-2 Step-rate test pumping rates and drawdown observations for each step

Pump test – pumping bore	SWL at start of test (m BRL)	Pump inlet depth (m BRL)	Step	Pumping rate (L/s)	Duration of step (mins)	PWL at end of step (m BRL)	Total drawdown (m)	Step drawdown (m)
WINU0942	23.48	152.4	1	3	100	60.86	37.38	37.38
			2	4	100	83.65	60.17	22.79
			3	5	100	116.32	92.84	32.67
			4	5.5	100	140.29	116.81	23.97
			5	6	15	148.37	124.89	8.08
WINU1308	24.97	113.5	1	7	100	27.48	2.51	2.51
			2	9	80	28.53	3.56	1.05
			3	12	100	31.35	6.38	2.82
			4	15	100	37.7	12.73	6.35
			5	18	100	46.04	21.07	8.34

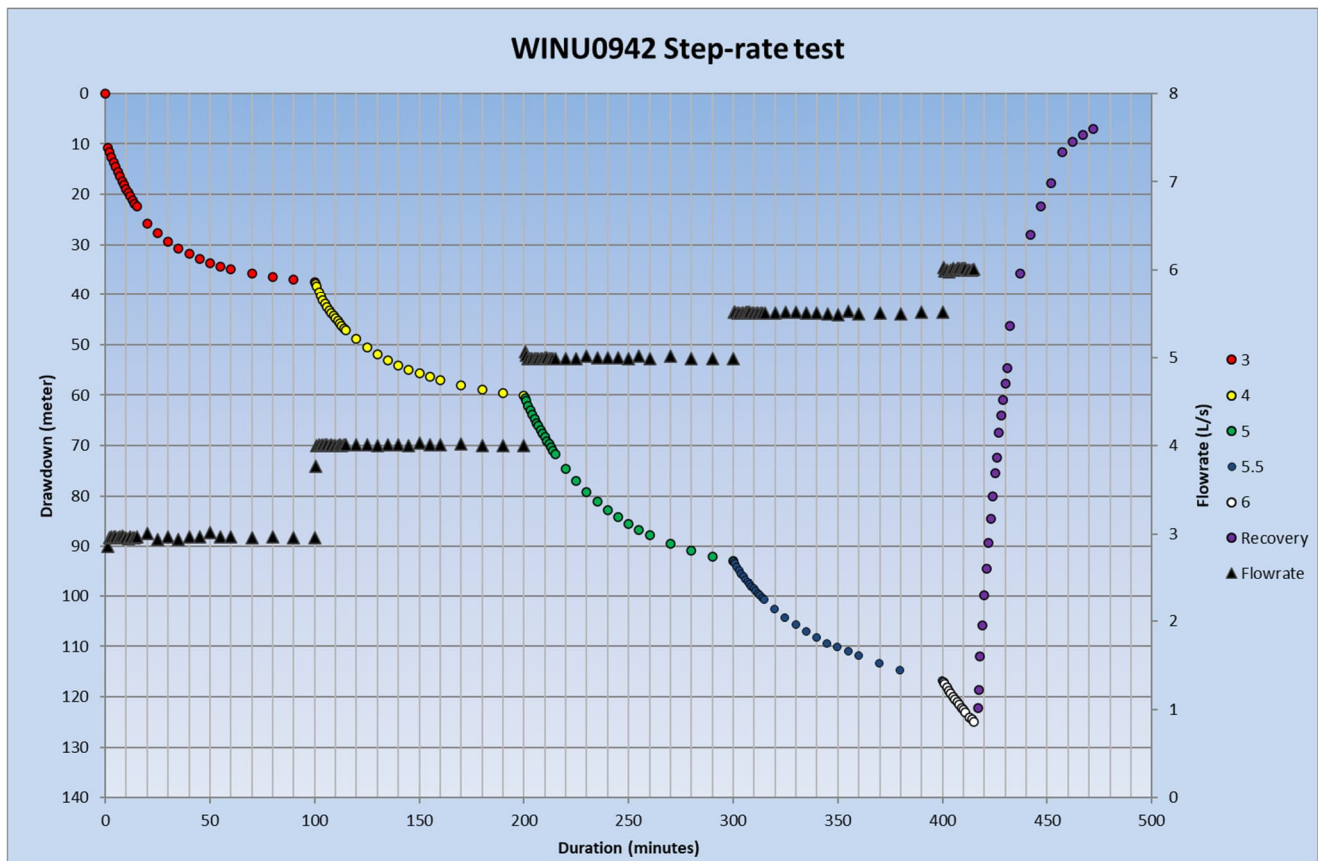


Figure 7-1 WINU0942 step-rate test results

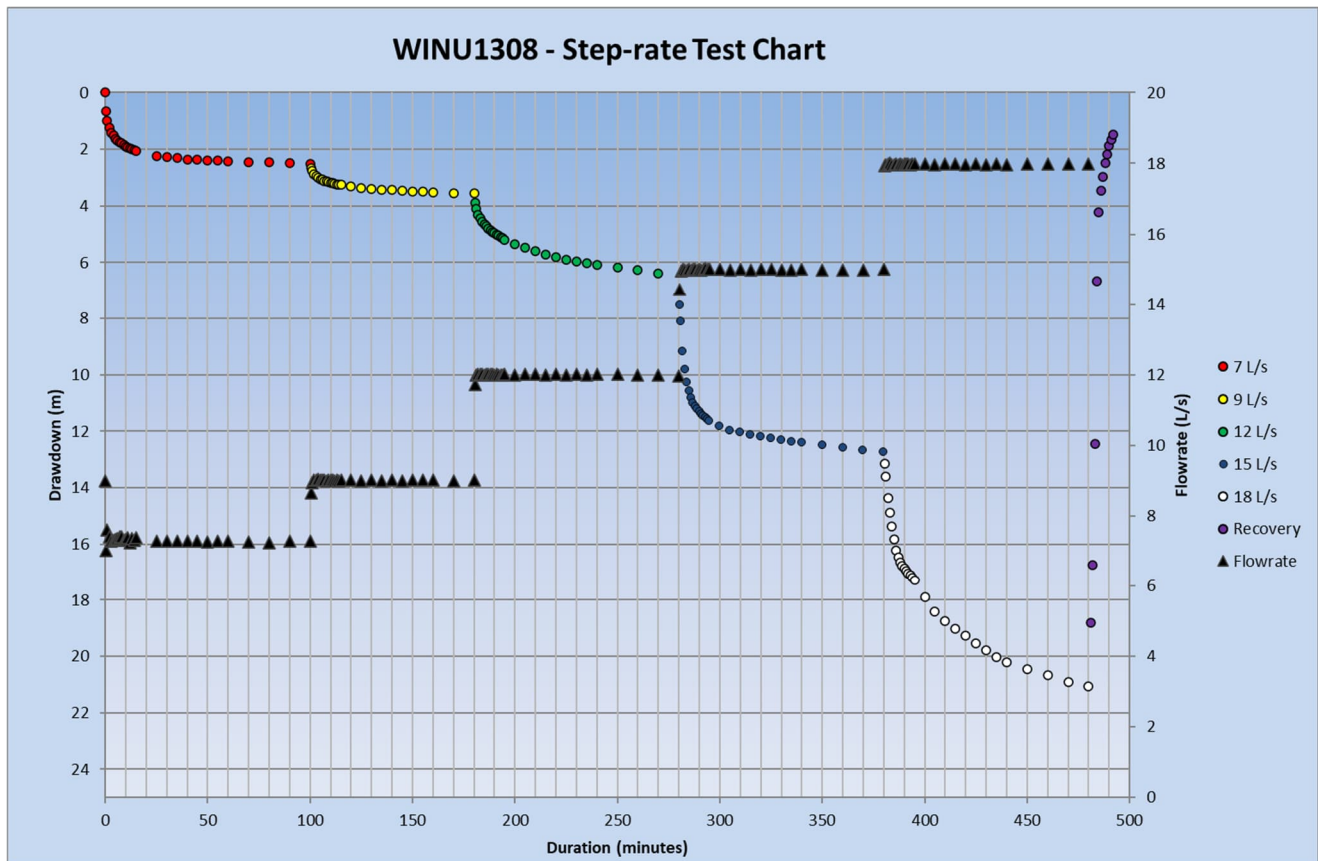


Figure 7-2 WINU1308 step-rate test results

7.3 Constant-rate tests (CRT)

Two CRTs were completed to evaluate the performance of each production bore over a multi-day test, and to stress the surrounding aquifer to allow appraisal of the hydraulic properties of the aquifer system affected by pumping.

Water level changes during each CRT were recorded in the pumped bore and at multiple monitoring locations using a combination of pressure loggers, VWPs, and manual water level measurements.

Test details and monitoring responses are summarised in Table 7-3 and Table 7-4. Drawdown plots for the WINU0942 CRT and WINU1308 CRT are presented in Figure 7-3 to Figure 7-6.

Table 7-3 Drawdown measurements for each monitoring site at end of WINU0942 CRT

Borehole/ drillhole ID	Hole type	Distance from PB (m)	Screened aquifer/ formation	Drawdown at end of CRT (m)	Response observed? (Y/N)
WINU0942	PB	0 (PB)	Granite/Metased	82.22	Y
WINU0943	MB	34	Granite/Metased	1.30	Y
WINU1244	RC	24	Full sequence	0.55	Y
WINU0940	MB	670	Granite	0.15	Y
WINU0941	MB	757	Granite/Metased	-	N
WINU1247	RC	1134	Full sequence	-	N
WINU1245	RC	1665	Full sequence	-	N
WINU1246	RC	2141	Full sequence	-	N
WINU1243	RC	3166	Full sequence	-	N
WINU1248	RC	5197	Full sequence	-	N
WINU1242	RC	5640	Full sequence	-	N
AKD10	MB	6268	Unknown	-	N

Table 7-4 Drawdown measurements for each monitoring site at end of WINU1308 CRT

Borehole/drillhole ID	Hole type	Distance from PB (m)	Screened aquifer/ formation	Drawdown at end of CRT (m)	Response observed? (Y/N)
WINU1308	PB	0 (PB)	Full sequence	29.64	Y
WINU0942	PB	3	Granite/Metased	4.53	Y
WINU1244	RC	35	Full sequence	4.32	Y
WINU0943	MB	66	Granite/Metased	4.32	Y
WINU0940	MB	683	Granite	0.2	Y
AKD10	MB	6287	Unknown	0.12	Y
WINU0941*	MB	778	Granite/Metased	-0.39	Y
WINU1379*	RC	461	Sandstone/Granite	-5.44	Y
WINU1371	RC	1115	Granite	-	N
WINU1247	RC	1136	Full sequence	-	N
WINU1383	RC	1176	Gneiss/Granite	-	N
WINU1372	RC	1450	Claystone/Granite	-	N
WINU1245	RC	1686	Full sequence	-	N
WINU1246	RC	2161	Full sequence	-	N
WINU1381	RC	3170	Claystone/Granite	-	N
WINU1377	RC	4038	Metasediment	-	N
WINU1374	RC	4153	Sandstone/ Claystone/ Granite	-	N
WINU1378	RC	5184	Sandstone/Claystone	-	N
WINU1373	RC	5779	Full sequence	-	N

* Mounding has been observed in these bores due to infiltration from the pump test discharge

PB – Production bore; MB – Monitoring bore; RC – Reverse-circulation drillhole

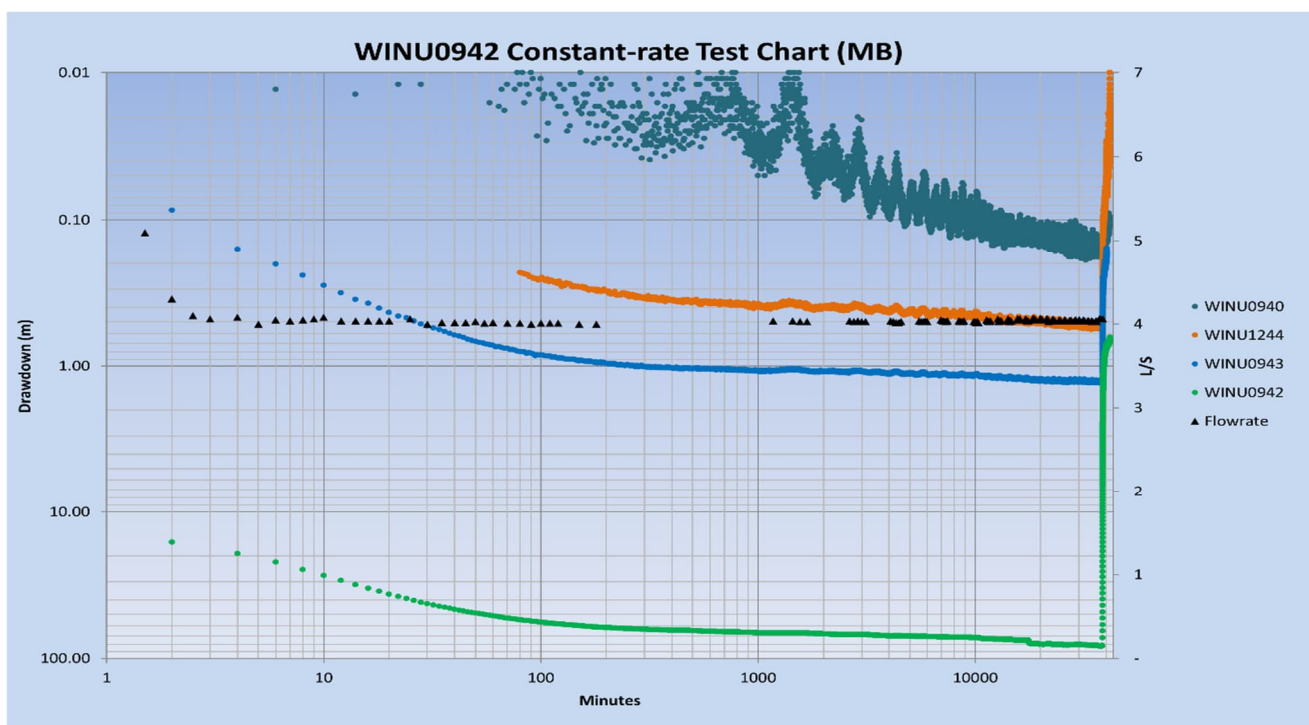


Figure 7-3 WINU0942 CRT: Drawdown and recovery data for WINU0942 (PB) and monitoring bores

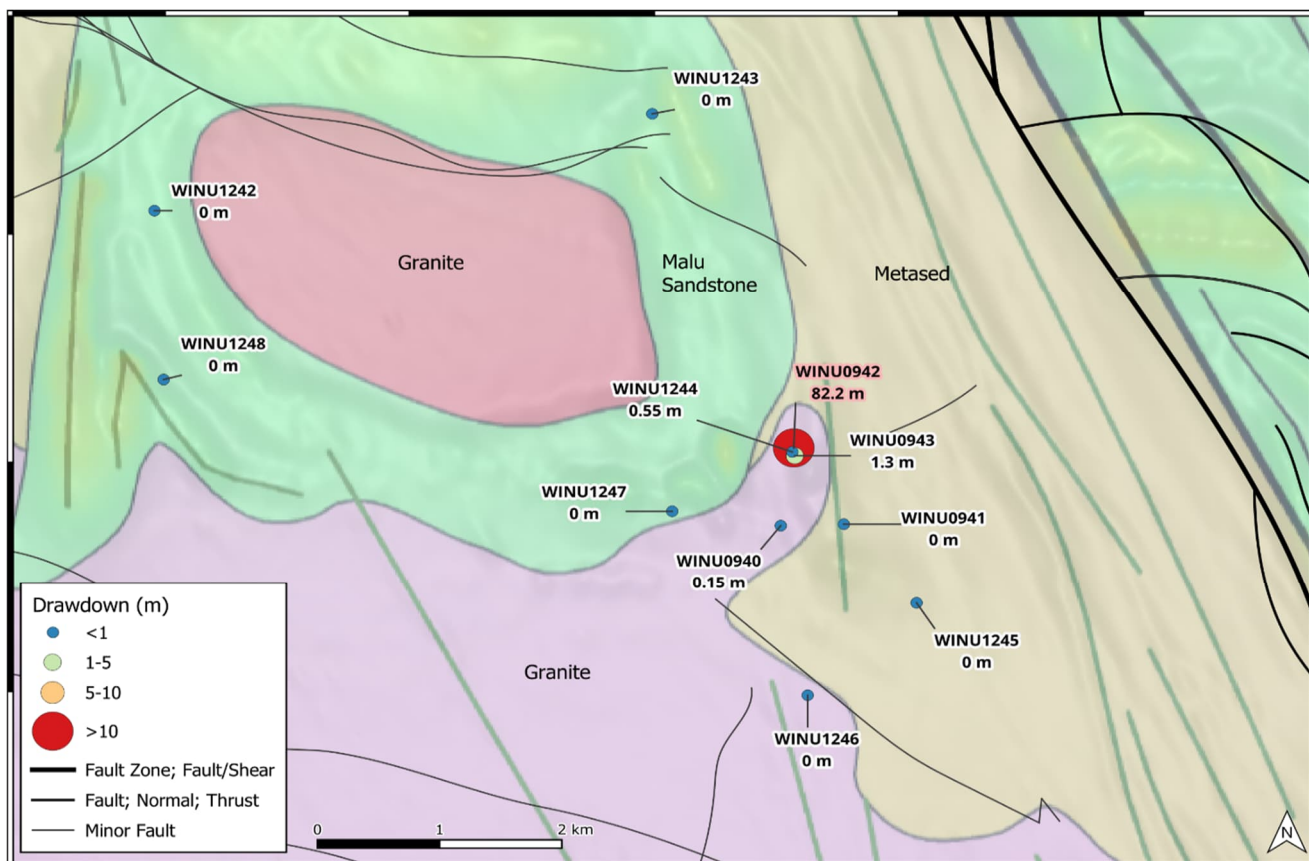


Figure 7-4 WINU0942 CRT: Spatial drawdown distribution at the end of the CRT against bedrock geology

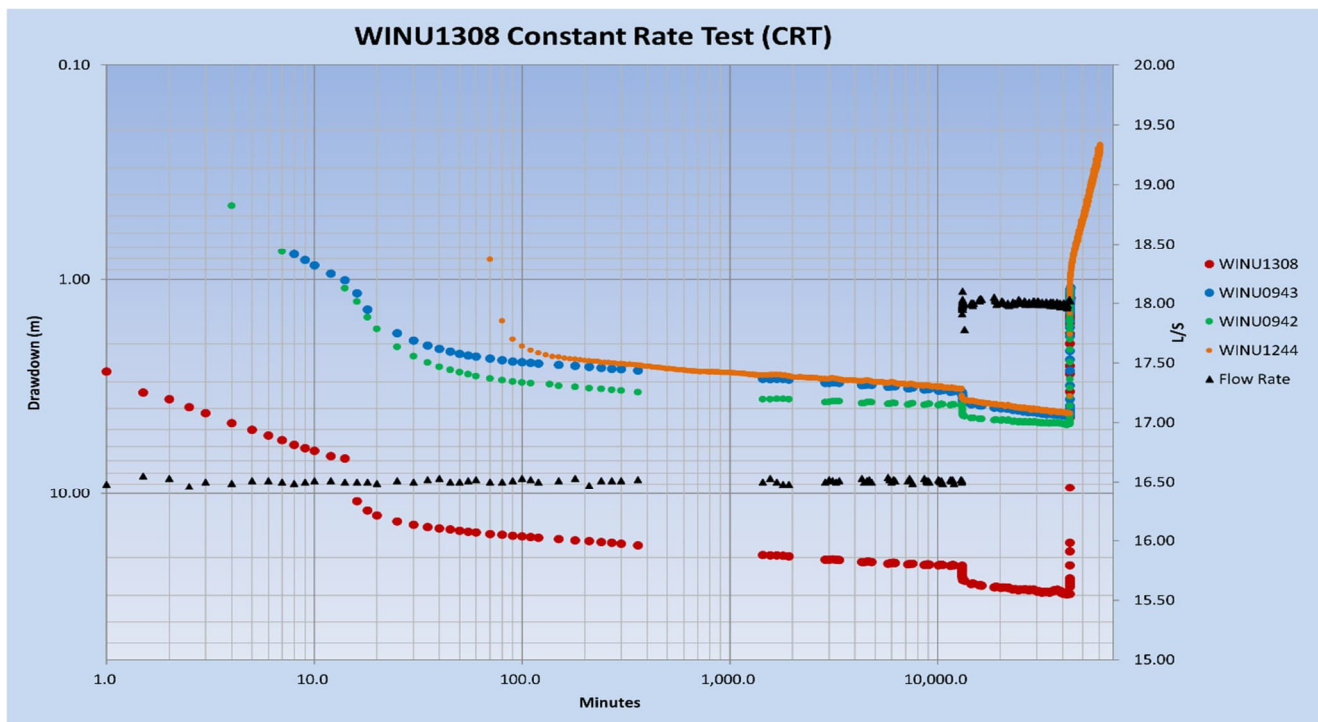


Figure 7-5 WINU01308 CRT: Drawdown and recovery data for WINU1308 and monitoring bores

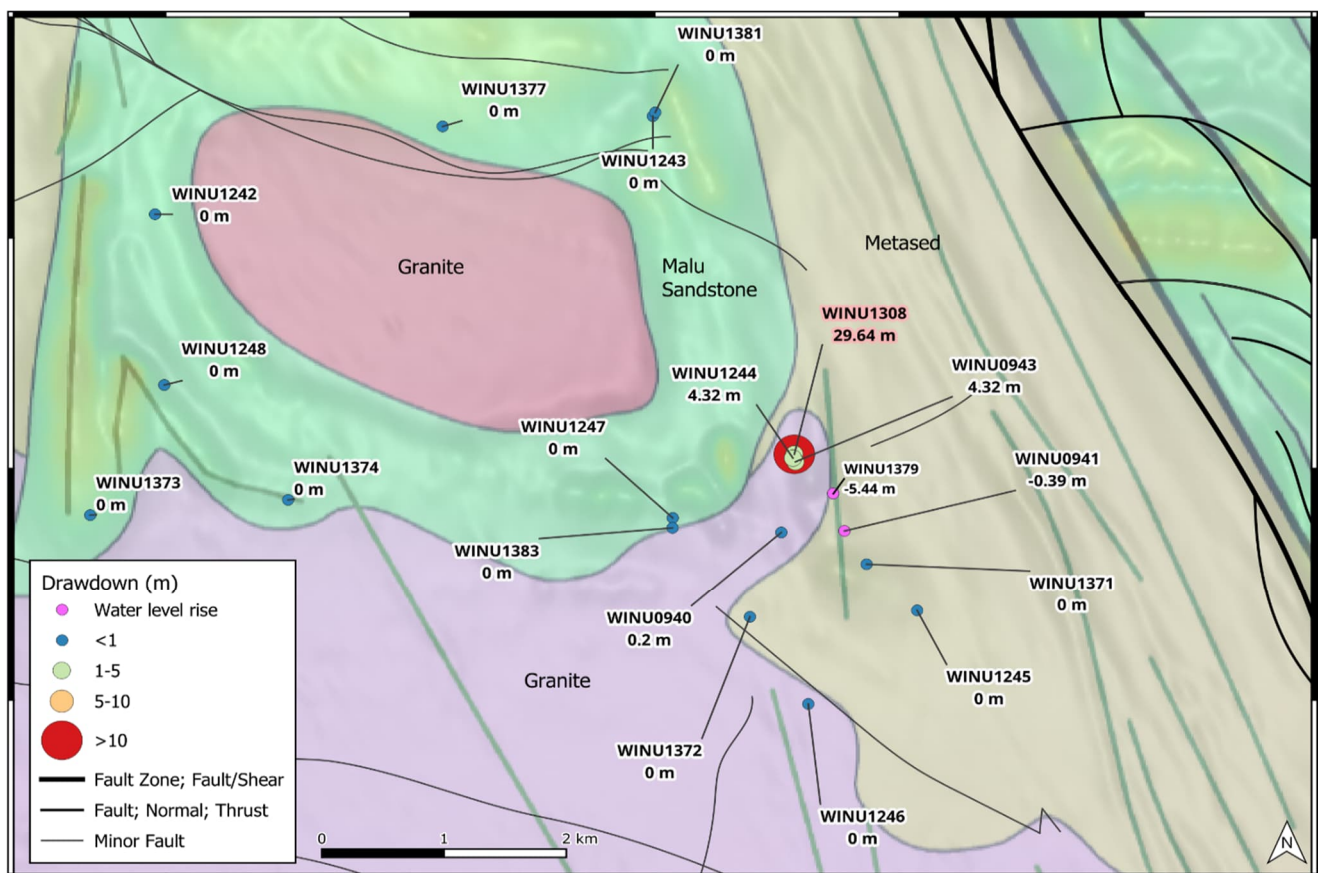


Figure 7-6 WINU01308 CRT: Drawdown distribution at the end of the CRT against bedrock geology

7.4 Test interpretation

The pumping and recovery data collected during the CRT were analysed using Aqtesolv Pro software (Duffield, 2007).

Data for WINU1308 was analysed using several analytic solutions which are summarised on and shown in Appendix E. Test pumping results for WINU0942 are not presented due to construction flaws and poor connectivity observed during pumping test.

Key observations from the analyses are as follows:

- A change in drawdown at $t=10$ minutes is likely attributed to well development and has a negligible effect on test results
- Transmissivity of the highly weathered granite aquifer estimated using the Moench (1997) solution is in the order of $420 \text{ m}^2/\text{d}$, assuming 115 m saturation (conductivity of 3.6 m/d)
 - However, the main contributing aquifer (highly weathered horizon) lies between 30 to 80 m, and therefore local hydraulic conductivities can be as high as 8 m/d
- Storage coefficient estimated using the Moench solution is 1.5×10^{-5}
- The specific yield is estimated as less than 2%

Mounding was observed during pumping test at WINU0941 and WINU1379, indicating infiltration from the pumping discharge. Mounding results were not analysed in Aqtesolv, hydraulic parameters were rather estimated through calibration of the numerical block model (Section 9).

While the bores were located on lineaments, the majority of water yield is interpreted to be from the highly weathered granite and metasediments aquifer with relatively little from the fractured rock below.

Table 7-5 Results of WINU0942 CRT analysis

BH ID	Screened HSU	Method	T (m^2/d)	S (1/m)	Sy
WINU1308 (Production bore) / WINU0942	Granite / metasediment	Moench unconfined (1997)	389	1.48×10^{-4}	0.004
(Observation bores) WINU0943 / WINU1244	Granite / metasediment	Moench unconfined (1997)	420	1.52×10^{-5}	0.004

8. Groundwater chemistry

8.1 Field parameters

Field parameters have been obtained from 11 RC drillholes and boreholes that were installed during the 2022-2023 field hydrogeological program. Samples were collected during the end-of-hole airlift and results are presented in Appendix F. The spatial distribution of electrical conductivity data is shown in Figure 8-1.

8.2 Groundwater analyses

In addition, six groundwater samples were taken, three during the WINU0942 and WINU1308 CRT, and three from the monitoring bores following the completion of the CRT. All samples were sent for laboratory analysis. A Piper plot summarising the results is shown in Figure 8-2.

General observations on groundwater chemistry (from laboratory analytical results) are presented below:

- Groundwater samples in the Rimfire area reflect fresh groundwater quality, with an electrical conductivity between 580 to 1,330 $\mu\text{S}/\text{cm}$
- pH is generally neutral to slightly basic, between 7.4 and 8.0 pH
- Groundwater EC and pH do not appear to have an obvious spatial or vertical trend, nor lithological association
- Piper plot analysis confirms a dominant sodium chloride signature (Figure 8-2)
 - The high sodium chloride relative to other major ions suggests the presence of dissolved salt in the groundwater system, which is likely attributed to evapoconcentration and flushing of salts present in the unsaturated zone
- The major ion composition of groundwater from WINU0942 indicates an approximately equal amount of sodium, chloride, and bicarbonate
 - Mean sodium concentrations are 115 mg/L, and ranges between 90 and 180 mg/L
 - Mean chloride concentrations (an indicator of recharge) are 170 mg/L, with a range of n 90 to 330 mg/L
 - Mean sulphate as SO_4 concentrations are 45 mg/L, ranging between 30 and 80 mg/L
- Concentrations of dissolved metals are generally below detection limits

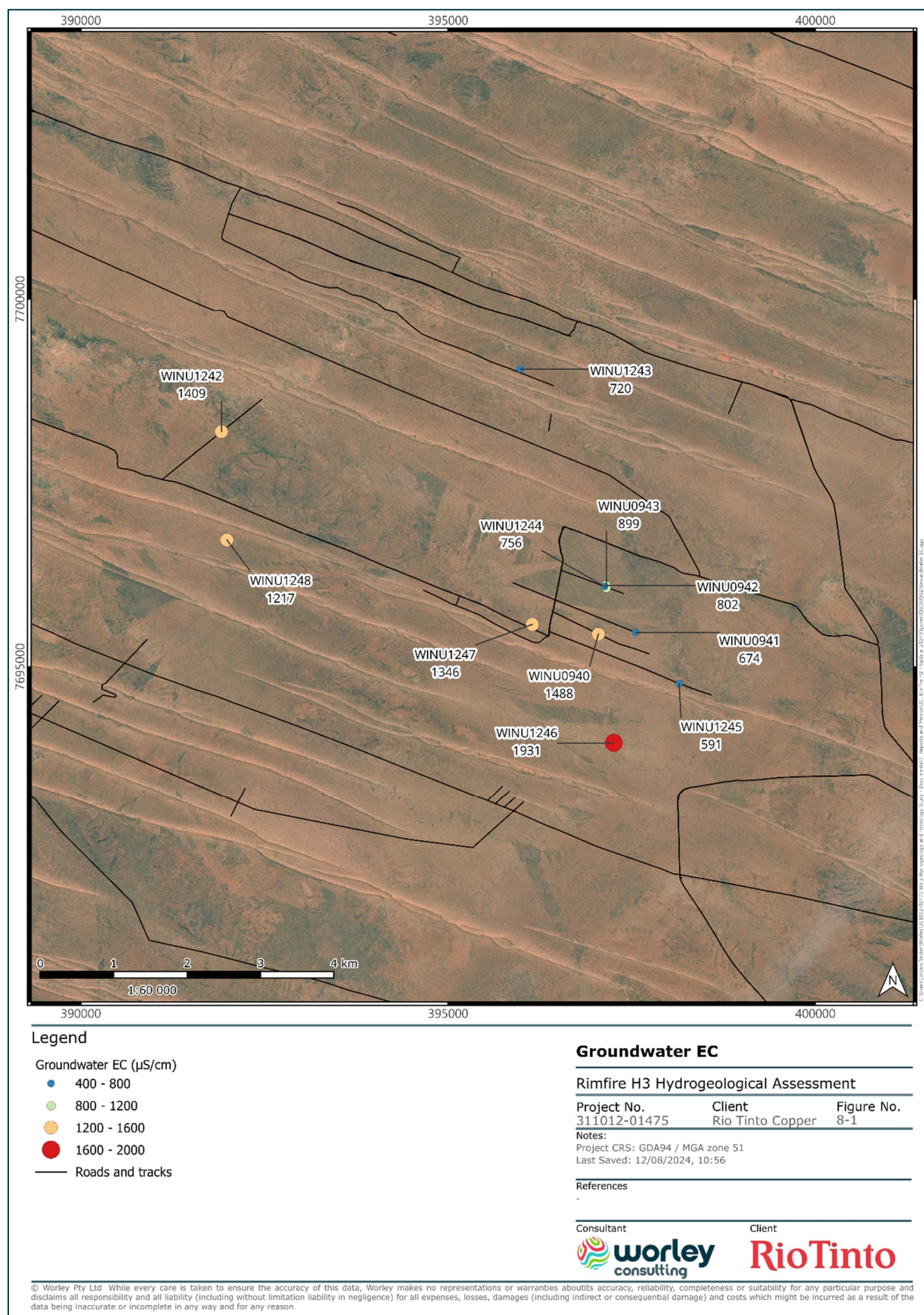


Figure 8-1 Groundwater EC from borehole locations

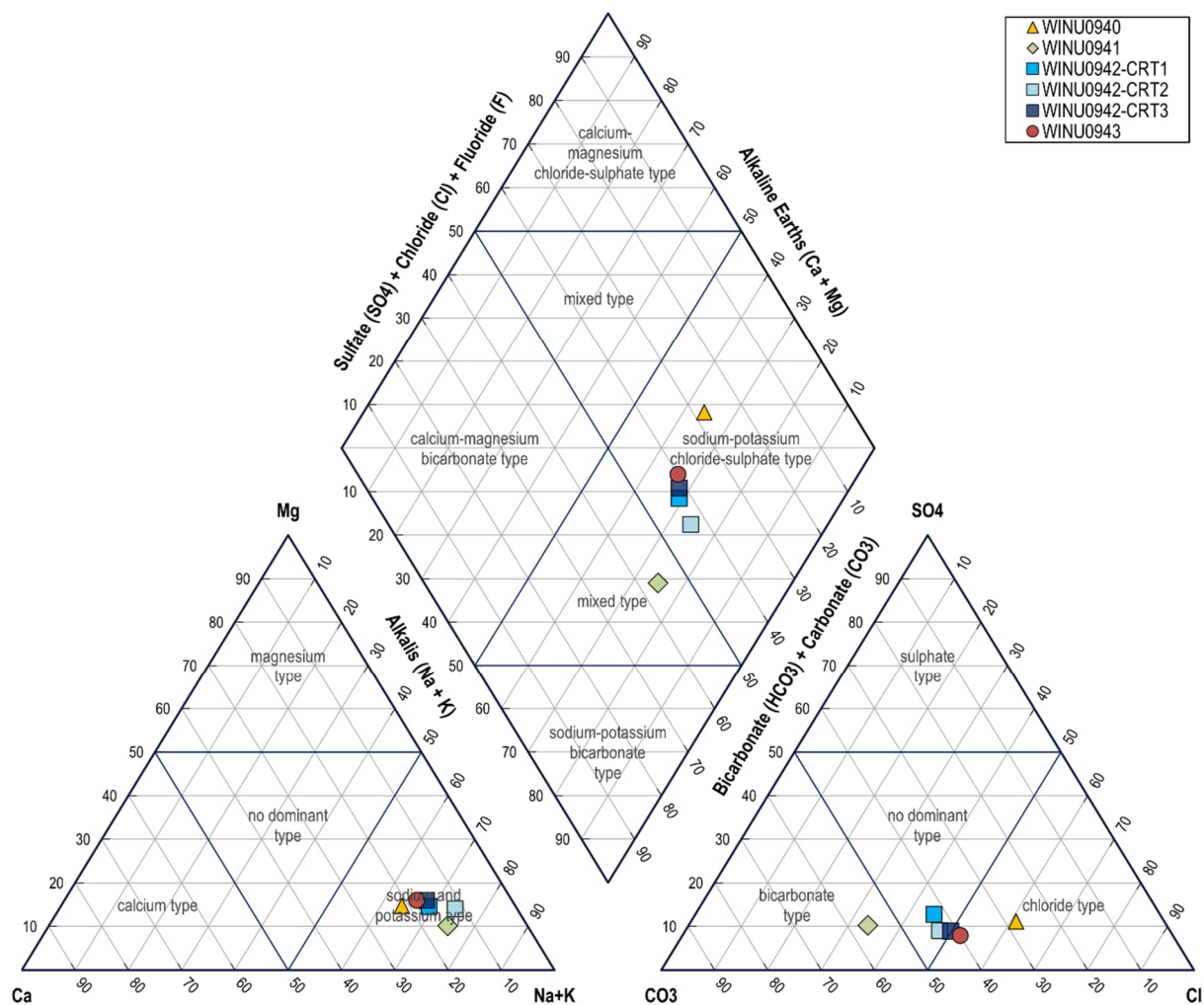


Figure 8-2 Piper diagram representation of groundwater samples taken during WINU0942 CRT

9. Numerical modelling

9.1 Introduction

The numerical modelling presented in this study is presented as an alternative and a useful extension of analytical approaches, which cannot readily include or readily represent some of the additional complexities that may be important for the hydrogeological setting. These include:

- Spatial variability (although kept limited) in aquifer properties
- Representation of regional throughflow
- Cumulative effects of concurrent pumping from several production bores
- Infiltration (mounding) effects resulting from pumping discharge occurring near some monitoring bores
- Transient nature of pumping and the following recovery

The model domain in this sense represents a block model, with applied vertical stratification based on major HSUs, and a prescribed steady-state throughflow occurring from south to north.

9.2 Key hydrogeological processes and flows

In development of the hydrogeological conceptual model, key groundwater flow processes were identified and are presented as follows:

- The aquifer system comprises six hydrostratigraphic units which are (from surface to depth): transported sand and silcrete/sandstone, weathered granite, weathered metasediments and fresh basement units.
- The silcrete unit is not currently conceptualised as being a confining layer due to the spatial variability of the unit, and the shallow depth of occurrence in some areas, preventing the layer from confining the underlying aquifer. Like the aeolian sand overlying it, it is largely unsaturated.
- Mounding observed in WINU1379 also indicate infiltration through this layer (or through gravel pack of that bore).
- West-northwest trending lineaments, and minor lineaments extending radially from the broadly circular granitic pluton intrusion at the centre of the Rimfire study area are interpreted as faults and fractures. Where these intersect sandstone, weathered basement, and fresh basement they are considered a fractured rock aquifer overprinting the hydrostratigraphic sequence.
- The groundwater flow generally toward the northwest, toward the Wallal palaeovalley system located approximately 30 km to the north.
- The study area is considered an open system, with inflows into the system being driven by episodic rainfall recharge, but mainly through lateral throughflow. Outflows from the system occur primarily through lateral outflow to the north, with minor discharge via evaporation and evapotranspiration toward the south where water levels are shallow.
- Recharge signals from rainfall events could not be reliably estimated due to the lack of long-term groundwater level monitoring, however the diffuse vertical recharge mechanism cannot be ruled out. Lateral inflow rates within the weathered metasediment/granite layer are estimated as 30 m³/d/km.

The key elements pertaining to hydrogeological conceptualisation are summarised in Table 9-1 and presented in Figure 9-1.

Table 9-1 Conceptual hydrogeology summary

Conceptual hydrogeology element/feature	Description
Study domain	The study domain is defined by the spatial distribution of RC drilling and boreholes that surround the main Rimfire granite intrusion. Rimfire is located 27 km to the east of the main Winu area, encompassing an area of approximately 100 km ² (i.e., 10 km by 10 km)
Hydrostratigraphic units (HSU)	The hydrostratigraphic profile from surface: Quaternary aeolian sand, silcrete/sandstone Weathered metasediment Weathered granite Fresh metasediment Fresh granite Structural features – faults: Faulting in the area generally trends southeast-northwest, with minor occurrence of north-northwest structures radially around the periphery of the main granite intrusion Evidence of folding is also apparent on the western and eastern margins of the main granite intrusion
Hydraulic properties	Hydraulic properties have been assessed for the highly weathered granite. Hydraulic parameters ranges estimated through Aqtesolv analyses during the pumping test on WINU1308 are: Transmissivity (T): 420 m²/d Horizontal hydraulic conductivity (Kh): 3.5 m/d Specific yield of less than 2%
Groundwater recharge	Recharge estimate to the groundwater system as a result of discrete rainfall events is not available at present due to the lack of monitoring of significant rainfall events following the completion of the monitoring bores. Taking into consideration groundwater levels are 17 m BGL toward the southeast of the study area, and the absence of a confining layer, recharge to the aquifer system has the potential to occur as rainwater can potentially flow through the transported cover and saprolite unrestricted. Chloride method estimates are in several millimetres per year on average. Assessment of satellite imagery and chloride concentrations suggest that outcrop/subcrop(s) located approximately 3.5 km to the southeast may be the local recharge area for the groundwater system. Groundwater throughflow is currently considered to be the principal source of recharge.
Groundwater discharge	Lateral outflow is expected to be the main mechanism of groundwater loss from the area in the absence of any significant abstraction or EVT occurring. Using Darcy's law, the outflow flux from the study area is estimated to be in the order of 15 m³/d/km. Evaporation and evapotranspiration (EVT) losses are expected to be minor in comparison to lateral outflow due to groundwater levels in the study area generally being below 15 m BGL, beyond the usual extinction depth of the EVT processes. Approximately 2 km south of the study area, coincident with the Percival Palaeovalley, EVT losses are likely to be present due to the occurrence of shallow groundwater, between 5 to 10 m BGL. The potential EVT rate is an order of magnitude higher than rainfall, and it is likely that most of the rainfall will be removed by this process, with the potential exception of rainfall produced during cyclonic events. The main losses via groundwater abstraction for mining purposes would be Winu, when in operation. No other mining operations are known to extract groundwater in the immediate vicinity of Rimfire.
Groundwater flow directions, and	Groundwater flow is from the south-southeast to north-northwest based on groundwater level contours produced for the area.

water levels	The groundwater gradient is approximately 2.5 m per 1000 m (0.0025). Shallow groundwater levels in the southeast correlate with the occurrence of the Percival Palaeovalley system. Together with anomalies in the groundwater contours, these suggest the presence of a shallow or perched groundwater system.
Groundwater surface water interaction	Groundwater surface water interaction is unlikely within the majority of the study area based on the observed water levels which range between 17 to 43 m BGL and the lack of any surface hydrological features (i.e., soaks and claypans). There may be some occasional interaction approximately 2 km south of the study area where groundwater levels are shallow (below 5 m BGL). This interaction is temporally limited, occurring during and immediately following periods of intense rainfall and/or cyclonic events.
Groundwater quality and salinity	Groundwater in the Rimfire area is fresh, with an EC ranging between 580 and 1,330 $\mu\text{S}/\text{cm}$, and a neutral to slightly basic pH between 7.4 to 8.0. Groundwater has largely a sodium-potassium chloride signature, which indicates the presence of dissolved salt in the system, likely attributed to factors relating to evapoconcentration and/or episodic flushing of salts from unsaturated zone.
Groundwater abstraction	Rio Tinto Copper is the closest groundwater user in proximity to the Rimfire area, with an annual abstraction of approximately 60,000 kL/a being drawn from seven bores in the Winu project area. No other active groundwater users could be identified within the Rimfire study area.
Environmental and third-party receptors	Two potential groundwater dependent ecosystems (GDEs) are present within 50 km to the north and east of the Rimfire area, which consist of vegetation GDE types, supporting grasslands and low tree steppe (eucalyptus and acacia). The GDE potential of these systems is deemed to be low (based on GDE Atlas tool rating, BoM). The Weenoo Soak and Djimakarra Soak occur to the northwest of the Rimfire area, at a distance of approximately 50 km. They are assessed to be supported by infiltrated rainfall and surface water runoff and are not groundwater dependent (Golder, 2022). No study has been conducted to date to assess the GDE potential of the Percival Palaeovalley within the Rimfire study area. However, based on the shallow groundwater levels recorded at bore AKD10 (3.82 m BTOC, taken on 21/3/2023) located 2 km south of the study area, it is possible that groundwater contained within the Percival Palaeovalley system (WASANT, 2012) may be supporting potential GDEs in the area. Aside from the Winu project, the closest third-party mines are the Nifty Copper Mine, Telfer Mine, Havieron Project, and Woodie Woodie Mine, which are located at least 90 km to the south. The Rimfire study area is not situated within a WA Pastoral Lease.

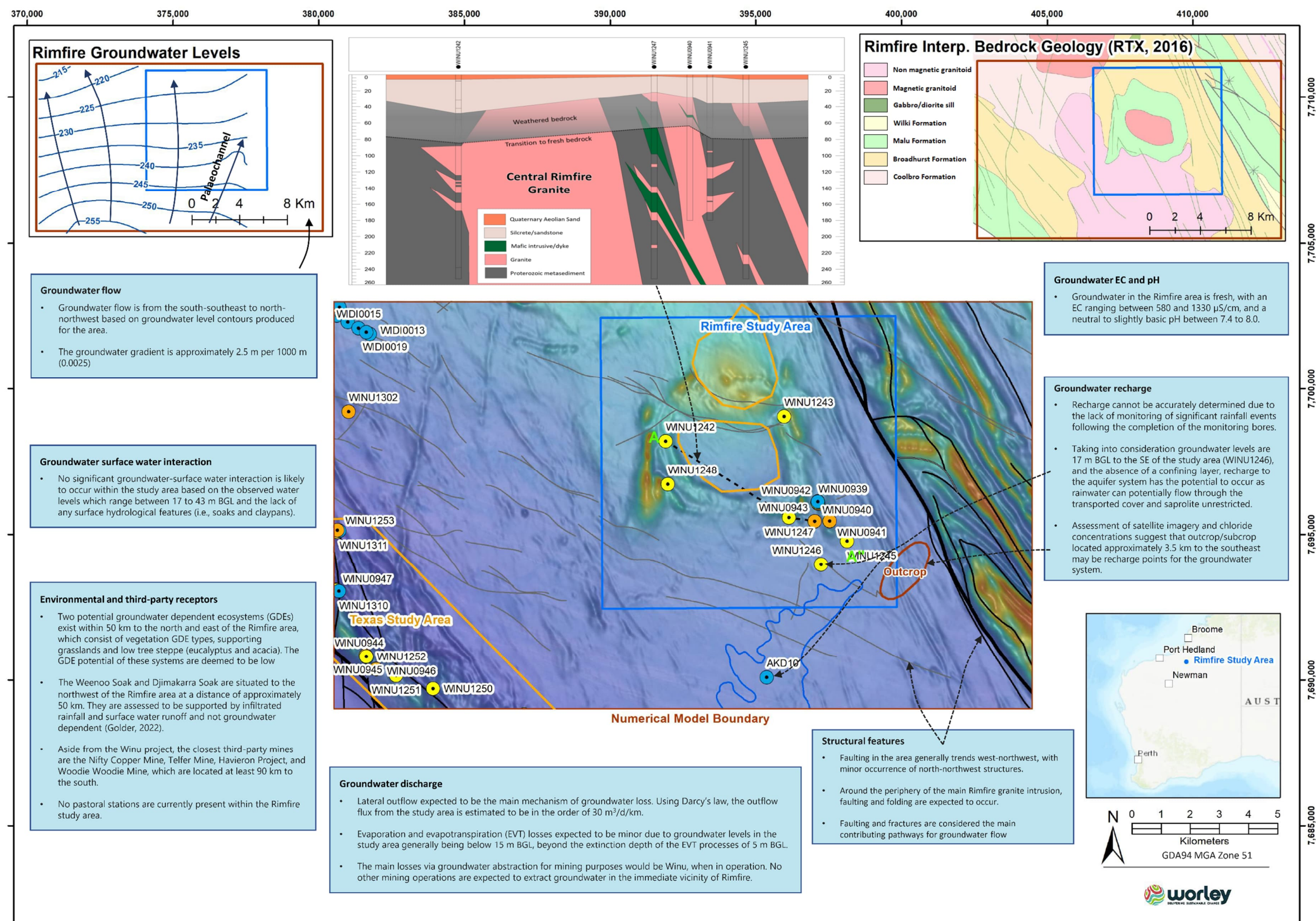


Figure 9-1 Rimfire study area hydrogeological conceptualisation

9.3 Numerical model development

9.3.1 Numerical block model

A simple block model was developed to provide an indication of potential drawdown impacts caused by abstraction from a nominal borefield in the Rimfire project area.

The model was developed using Groundwater Vistas 8 (GV8) software, developed by Environmental Simulations Inc. (ESI), using the MODFLOW-USG platform.

The model domain is 50 km by 50 km (model area of 2,500 km²), centred on the Rimfire area (Figure 9-2). The model grid has been rotated by 30 degrees anti-clockwise to align with regional geological structures and groundwater flow. The large model domain has been selected to facilitate the assessment of long-term pumping from a simulated borefield without influence from boundary conditions.

The model comprises a total of 73,100 cells, divided across 10 layers. A nominal grid spacing of 1,000 m has been used, which has been refined to approximately 4 m in the area surrounding WINU1308 and other monitoring bores.

9.3.2 Approach

The regional geological mapping conducted by RTX in 2016, which delineated the boundaries of several metasedimentary and granitoid units in the area has formed the basis of the model design. Some of these lithological boundaries have been validated using drilling data (where available) that was acquired during the 2022-2024 field hydrogeological drilling campaign for the Rimfire and Texas areas which showed an acceptable correlation for the scale of the modelling.

The modelling steps followed were:

- Numerical model construction in Modflow-USG: model setup and definition of boundaries and hydrogeological units (HSUs) based on the 3D conceptual model and model stresses.
- Steady-state calibration: developed and run to verify and test the model construction, provide initial water level through matching regional observed vs simulated groundwater levels at a single point of time.
- Transient calibration: to calibrate aquifer parameters such as hydraulic conductivity, specific storage and specific yield using the Rimfire pumping test (WINU1308).
- Predictive modelling: simulation of the borefield water supply to estimate the extent of drawdowns and borefield capacity; and groundwater recovery post-pumping.

9.3.3 Model layers

The model comprises ten (10) layers, based on the HSUs summarised in Table 9-2. Layer elevations and thicknesses were developed from 2D geology surface mapping, bore logs and screened depth. The block model layer structure in 3D is shown in Figure 9-3 and Figure 9-4 shows a representative cross section through the model in the main Winu project area.

Table 9-2 Model layers and HSUs

Model layer	HSU	Layer depth (m BGL)
1-2	Quaternary aeolian sand/ silcrete/sandstone	0 to 30
3-4	Highly to moderately weathered granite and metasediment (mudstone is captured in these layers to the west)	30 to 80
5-10	Slightly weathered to fresh granite and metasediment (mudstone is captured in these layers to the west)	80 to 300

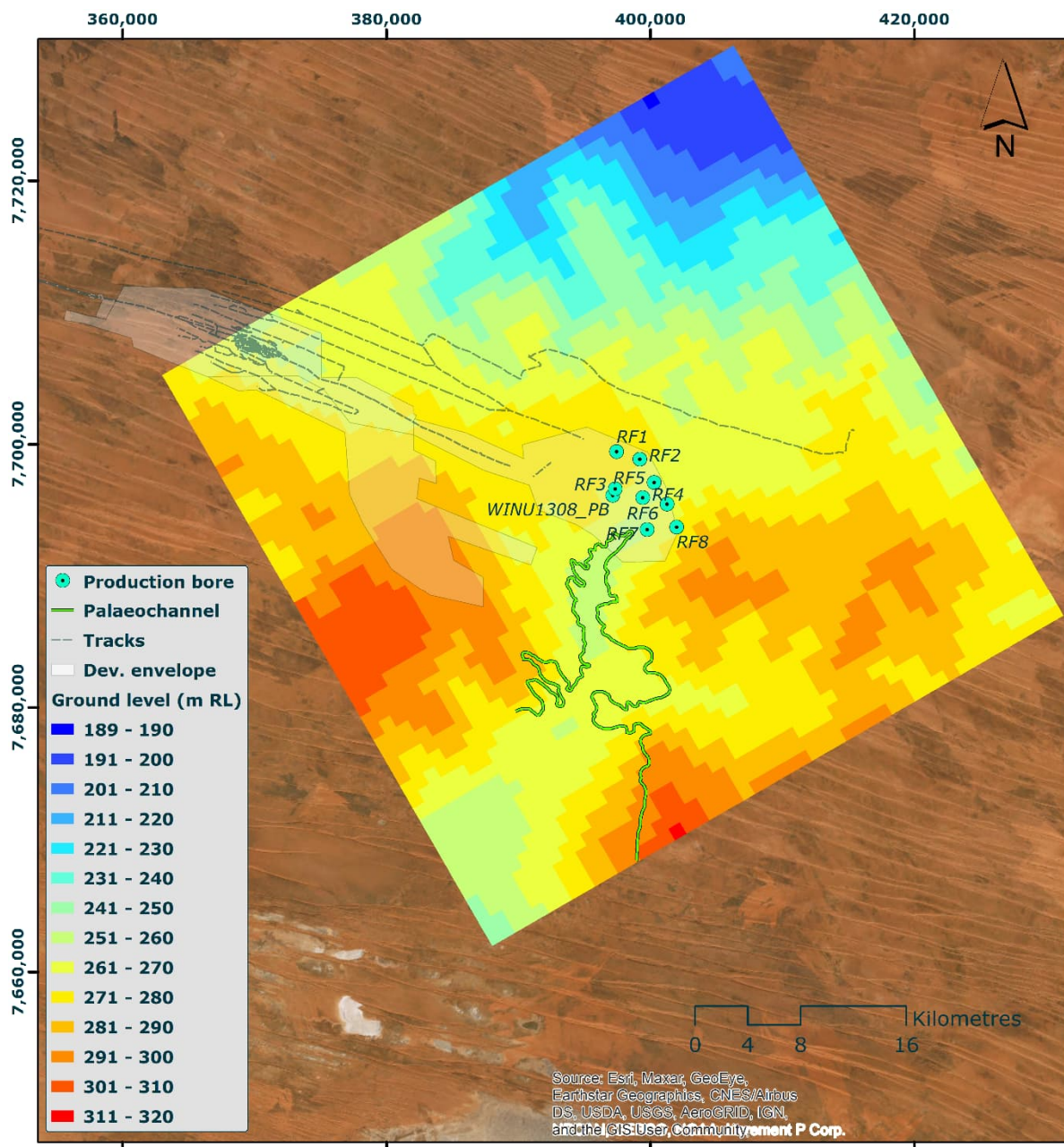


Figure 9-2 Block model domain and top layer elevations

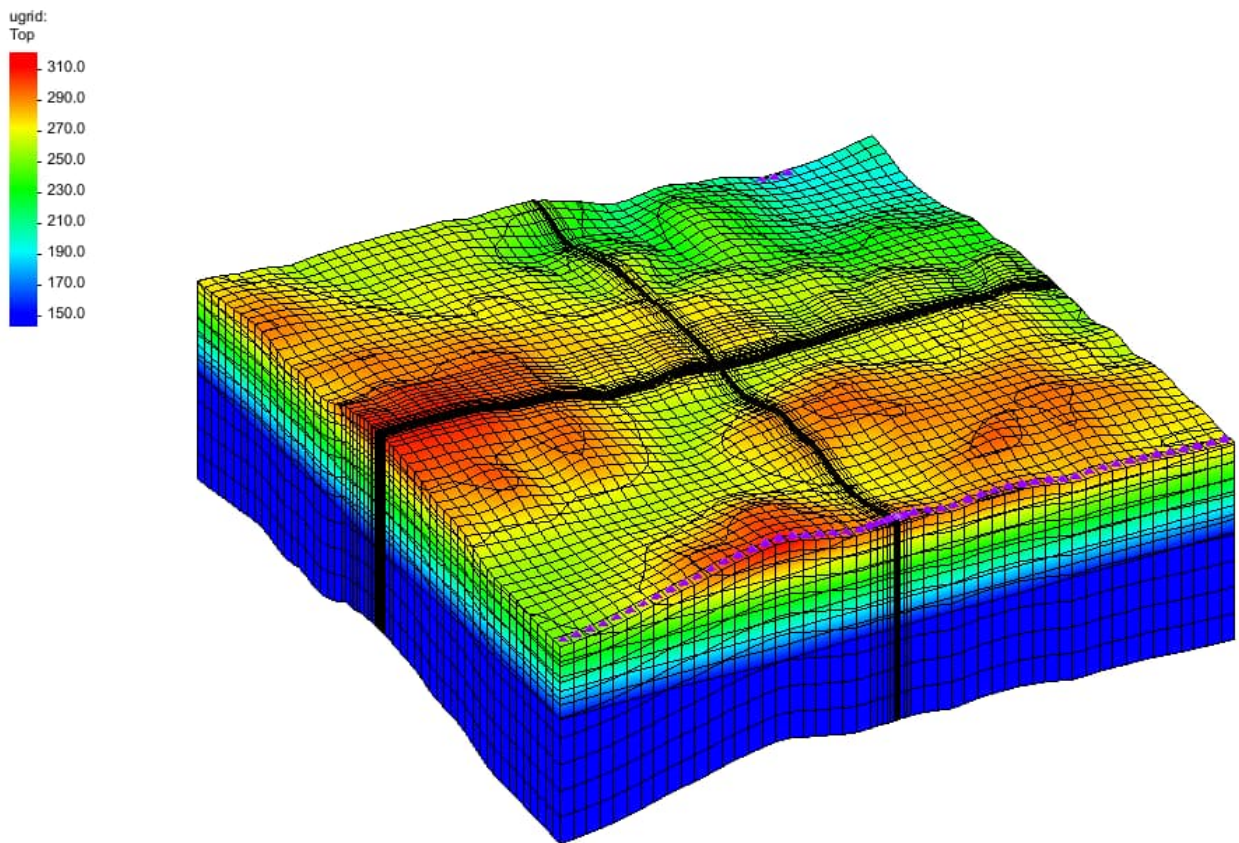


Figure 9-3 Block model grid; top of the model reflects ground elevations

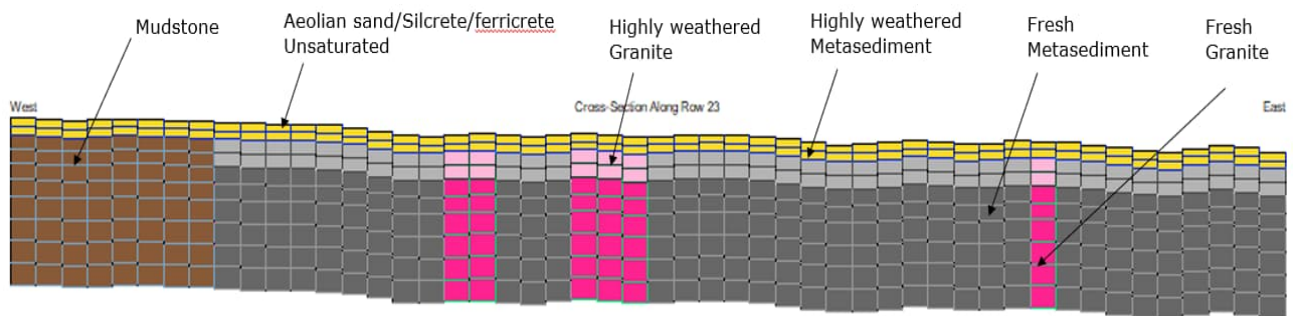


Figure 9-4 Cross section through numerical block model

9.3.4 Aquifer parameter zones

Initial hydraulic properties are based on the those compiled in Section 7.4 and further adjusted through calibration. Hydraulic properties for the fresh unweathered basement are adopted from the Winu model.

9.3.5 Boundary conditions

The block model uses the following boundary condition packages:

- Constant Head (CH) package
- WEL package
- Recharge package
- Evapotranspiration (EVT) package

Constant head boundary cells (CHs) are assigned along the northwest and southeast of the model (Figure 9-5) to invoke the regional groundwater throughflow. CHs were adjusted during calibration to simulate regional groundwater flow, gradient and levels.

Groundwater pumping is simulated in the model using the WEL package. Inputs to the model include bore location, screened interval, and a time series of pumping rates for WINU1308, and for nominal borefield during predictive simulations.

Infiltration of water generated during the pumping test is simulated through a recharge zone, with recharge rate converted over the discharge area results in a total infiltration of 45,000 kL or 17 L/s during test.

The EVT package is used to represent the near-surface evaporation (where shallow water is available), and possibly low shrub/grass evapotranspiration where present. It uses a nominal ET rate of 10 mm/d and extinction depth of 1.5 m. Due to generally deeper water levels, EVT is only active in small areas of topographic low in the southern part of the model, consistent with the contemporary surface drainage channel developed on top of the Percival Palaeovalley.

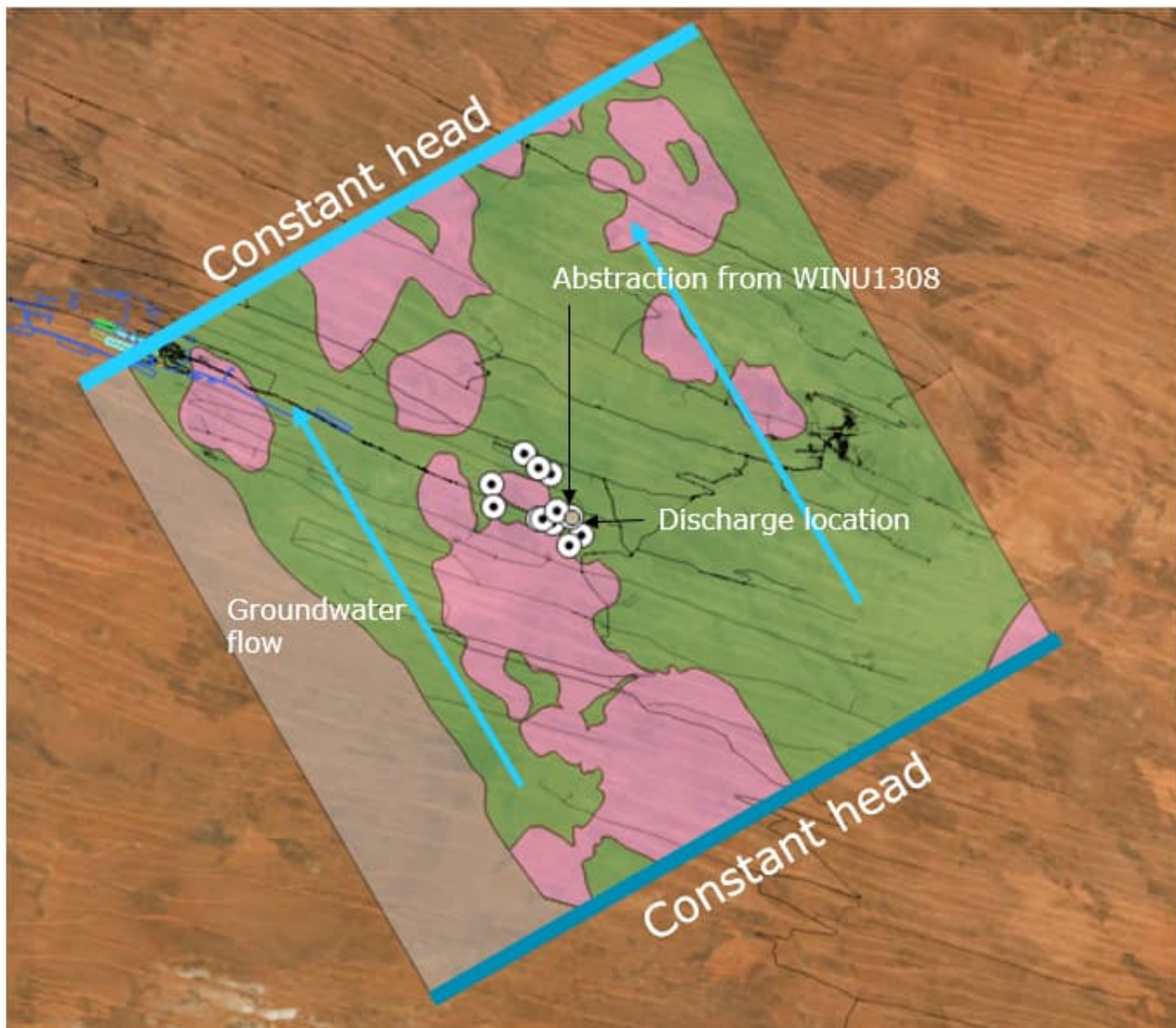


Figure 9-5 Constant head boundaries applied in model

9.3.6 Temporal discretisation

The groundwater model simulation starts with a steady state stress period to simulate the average groundwater flow regime and its representative water levels, reflective of applied parameterisation and boundary conditions, before progressing to a transient (calibration) model.

The transient model simulations are divided into 12 stress periods for historical matching (calibration) and prediction periods.

- History-matching:
 - 3 stress periods from start to end of pumping test. Two SPs represent two applied pumping rates, with SP lengths are 9 and 21 days respectively. The following SP represents recovery (20 days)
- Predictive simulation:
 - Water supply
 - 4 stress periods (10 year each) to include 32 years of continuous pumping
 - 5 stress periods (100 year each) simulate post-pumping aquifer recovery

9.4 History matching (calibration)

9.4.1 Calibration approach

History-matching in this study refers to the process of comparing observed groundwater level data vs modelled/predicted groundwater levels. The purpose of history-matching in this context is to constrain model parameters and allowable ranges, based on what is known from field testing, conceptual understanding and observed system behaviour (ideally of direct relevance to the model predictions of interest), using a range of observation data.

The combined steady-state and history-matching model are used to develop a suitable match between the observed and simulated water levels by adjusting aquifer parameters.

9.4.2 Calibration targets

Calibration targets are selected from available (and reliable) bore water level records, including monitoring and drawdowns induced by pumping tests.

The pumping bores and observation bores are assigned to their respective layers corresponding with the screened section of the bore.

Steady state groundwater levels are used to provide initial water levels for the transient calibration. The match between the observed and modelled water levels during pumping and recovery/mounding is used for evaluation of calibration performance.

9.4.3 Calibration results

Steady-state water levels are shown in Figure 9-6. The water level contours align with the regional groundwater flow, which predominantly follows a north-western direction. This alignment is in accordance with the flow along both regional and local geological structures.

A good match between simulated and measured water levels for drawdown and mounding (in case of WINU1379) during the pumping test was achieved and is shown in Figure 9-7. This indicates that the numerical block model replicates trends and responds adequately to the stresses applied from the pumping test.

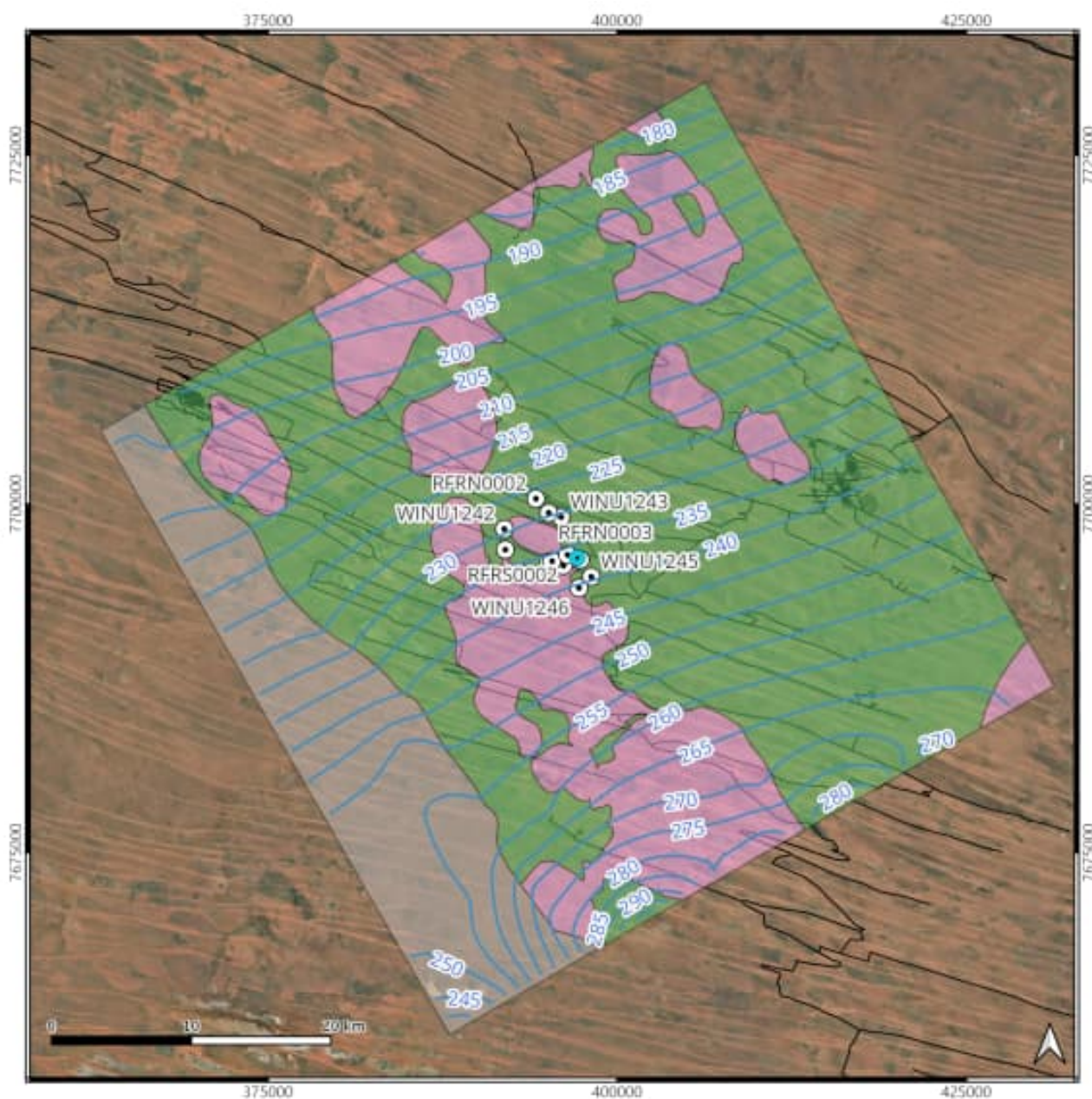


Figure 9-6 Steady-state water levels (m AHD)

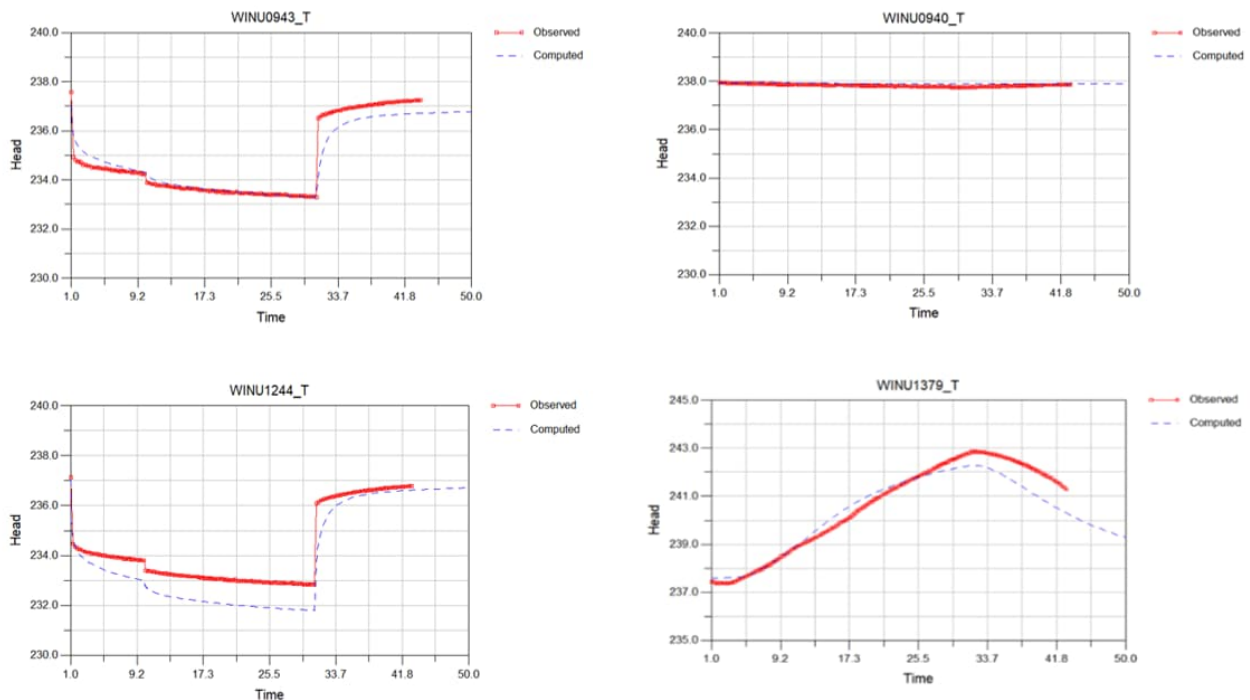


Figure 9-7 Observed vs modelled groundwater levels in monitoring bores

Multiple parameter ranges were tested during calibration. The model remains the most sensitive the hydraulic conductivity of the weathered zones with the presented values indicating the best fit for pumping test data. Higher hydraulic conductivities of the fresh layers resulted in a lower overall steady state water level, however, did not change the shape of the drawdown curves.

9.4.4 Calibrated parameters

Calibrated hydraulic properties are presented in Table 9-3.

Table 9-3 Calibrated hydraulic properties

Formation	Kh (m / d)	Kv (m / d)	Ss (1 / m)	Sy
Aeolian sand, silcrete / ferricrete, sandstone	1	0.1	1.00E-05	0.05
Permian mudstone, layer 3-10	0.001	0.001	1.00E-05	0.001
Weathered granite, layer 3-4	3	1.5	5.00E-06	0.01
Weathered metasediment, layer 3-4	2	0.2	1.00E-05	0.01
Fresh granite layer 5-10	0.005	0.005	1.00E-05	0.005
Fresh metasediment layer 5-10	0.001	0.001	2.00E-06	0.005

9.4.5 Water balance

Water balance during testing indicates changes in groundwater storage during testing and recovery. Groundwater throughflow or other components such as EVT are not affected.

The main components of groundwater balance during testing and recovery are presented in Figure 9-8:

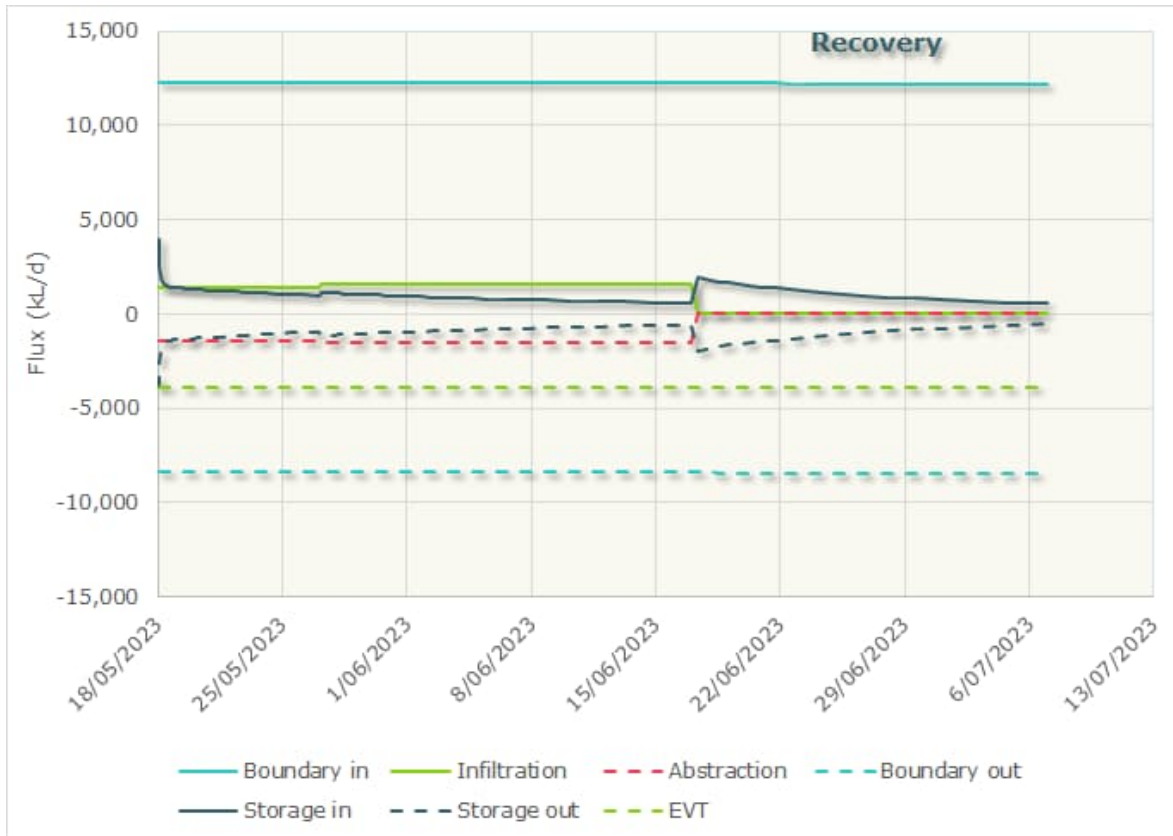


Figure 9-8 Transient water balance during testing and recovery (calibration period)

9.5 Predictive modelling

9.5.1 Predictive model setup

The numerical block model is used for predictive modelling of the regional groundwater level drawdown and potential yields. This involves simulating the impact of groundwater pumping from a nominal borefield at nine (9) abstraction locations. The locations were selected based on potential drilling areas/targets identified during the Rimfire target identification for the Phase 2 study. The Phase 2 study has not been completed to date and therefore these locations are nominal and would only be confirmed after drilling and testing of more bores.

The pumping spans over 32 years, representing life of mine (LoM); with subsequent recovery, following cessation of pumping, in total for 230 years.

The nominal borefield has been simulated by using the WEL package. Production bores were assigned a nominal depth of 100 m BGL, with dominant flow input coming from the weathered units, consistent with the current conceptualisation.

9.5.2 Predictive results

Forward projections of groundwater abstraction from the nine selected locations indicate that the nominal borefield has the potential to produce 2.8 GL/a, with individual bores operating with rates between 8 L/s and 11 L/s.

The numerical block model estimates that, after 32 years of continuous abstraction, the 2 m drawdown contour, as a measure of groundwater impact from pumping, will extend radially up to approximately 16 km from the nominal borefield.

The overall capacity of the borefield is not expected to be limited by the performance of individual bores. However, in practice, a greater number of production bores than suggested by the nominal design may be required to address potential construction challenges and to provide operational redundancy during peak times.

After 32 years of abstraction at a constant rate of 2.8 GL/a, the model water balance is expressed through the following volumes:

- 90 GL abstracted by the borefield
- 45 GL lost to evapotranspiration (this is a tentative estimate, reflecting uncertainty in the head distribution along the southern model boundary)
- 47 GL derived from net throughflow (serving as a proxy for recharge, which is not explicitly represented in the model)
- 87 GL sourced from aquifer storage.

A more detailed water balance component breakdown over time is presented in Figure 9-9. The groundwater change demonstrated through drawdown contours at the end of 32-year abstraction is shown in Figure 9-10.

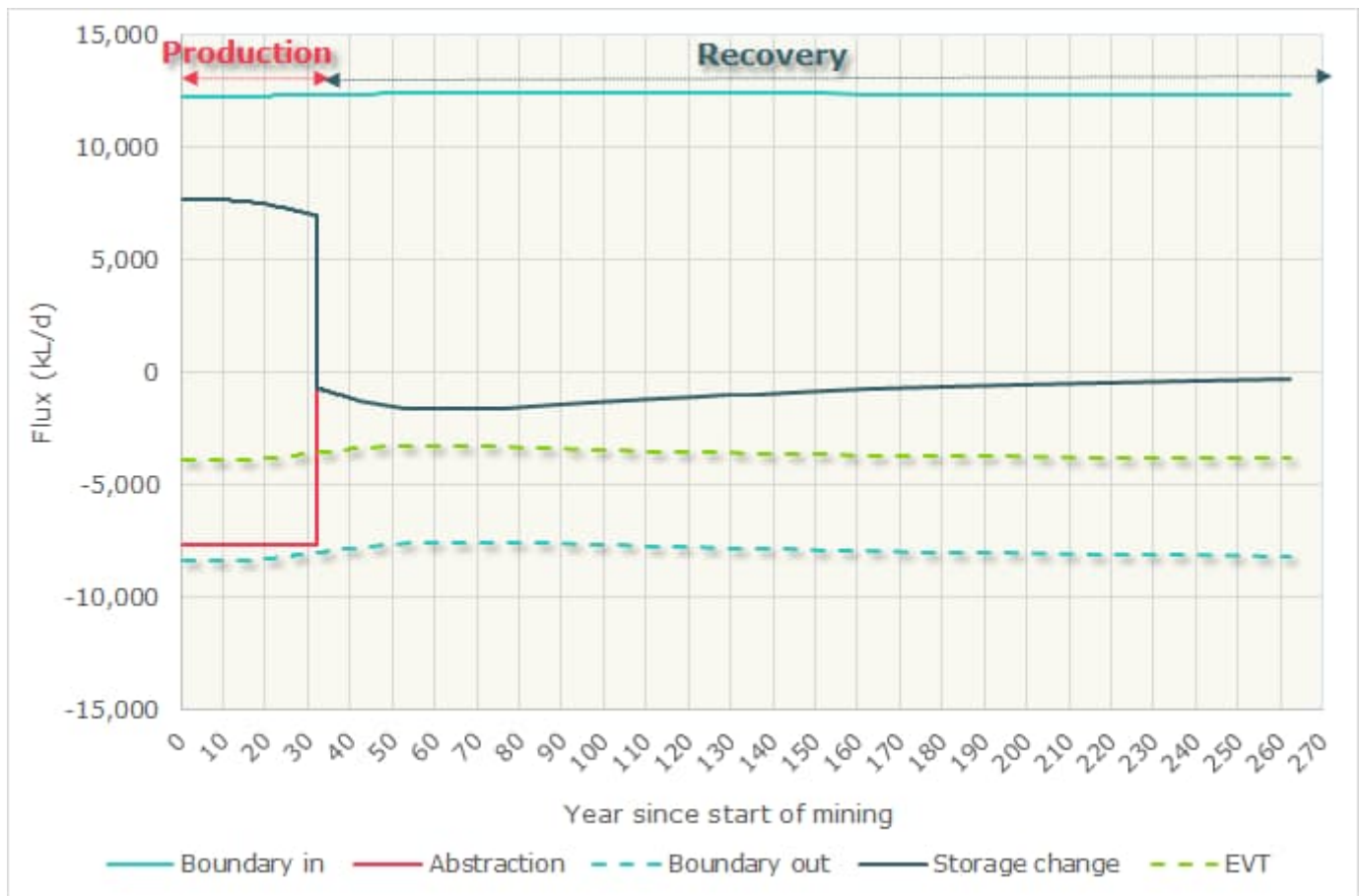


Figure 9-9 Water balance components during prediction period (production and recovery), 2.8 GL/a

The model makes use of the EVT package to simulate evapotranspirative and evaporative processes where groundwater is relatively shallow. This may be relevant to the relative rare cases of local depressions or surface drainages.

The model currently predicts small areas where EVT occurs being in regional valley structure (that overlies the palaeochannel) as shown in Figure 9-11. These may be indeed areas of shallow groundwater or the result of incorrectly set constant head levels along the south boundary. The effect of evaporation on borefield performance – or vice versa, is negligible.

Table

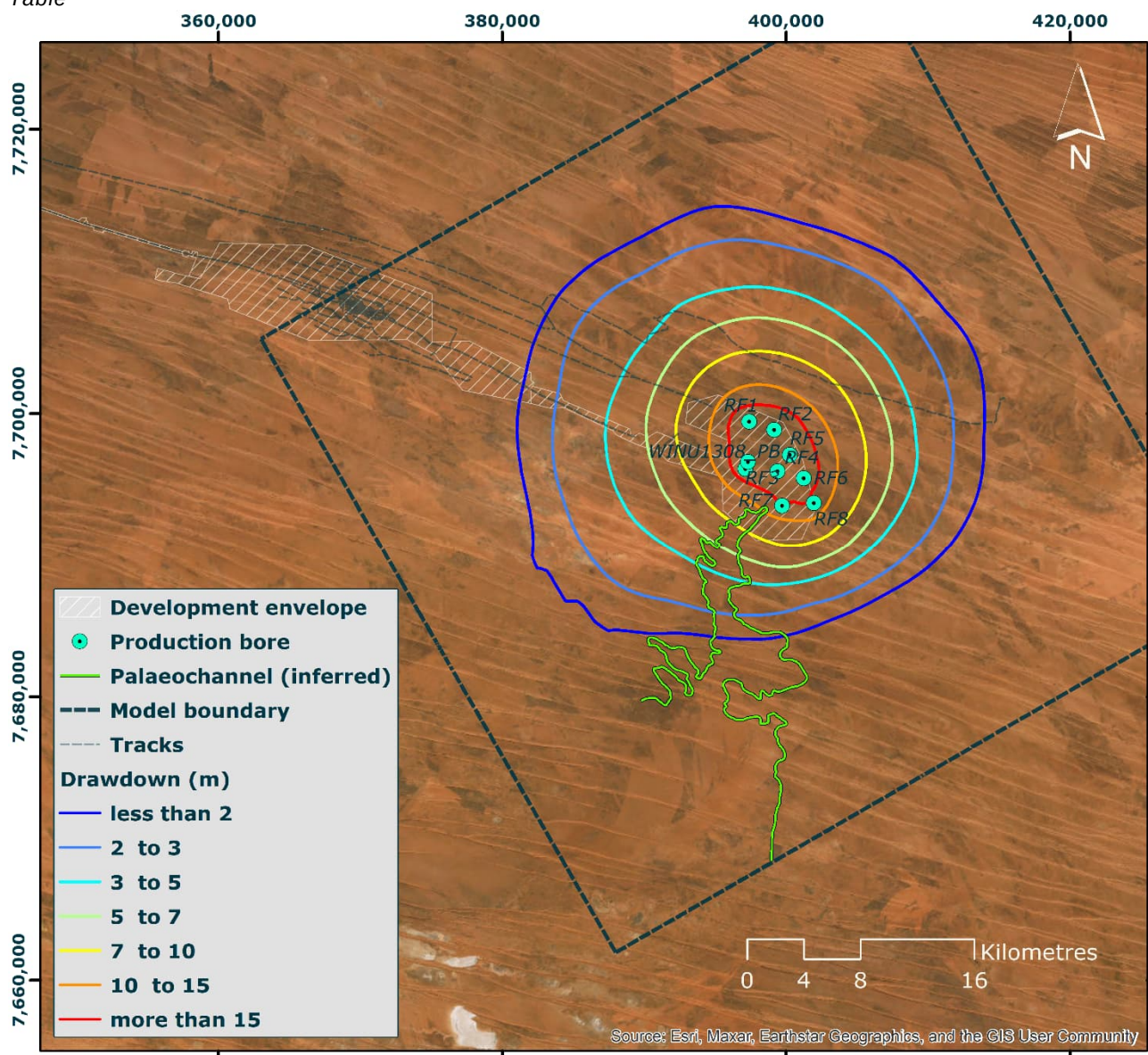


Figure 9-10 Drawdown at the end of 32-year simulated abstraction at 2.8 GL/a

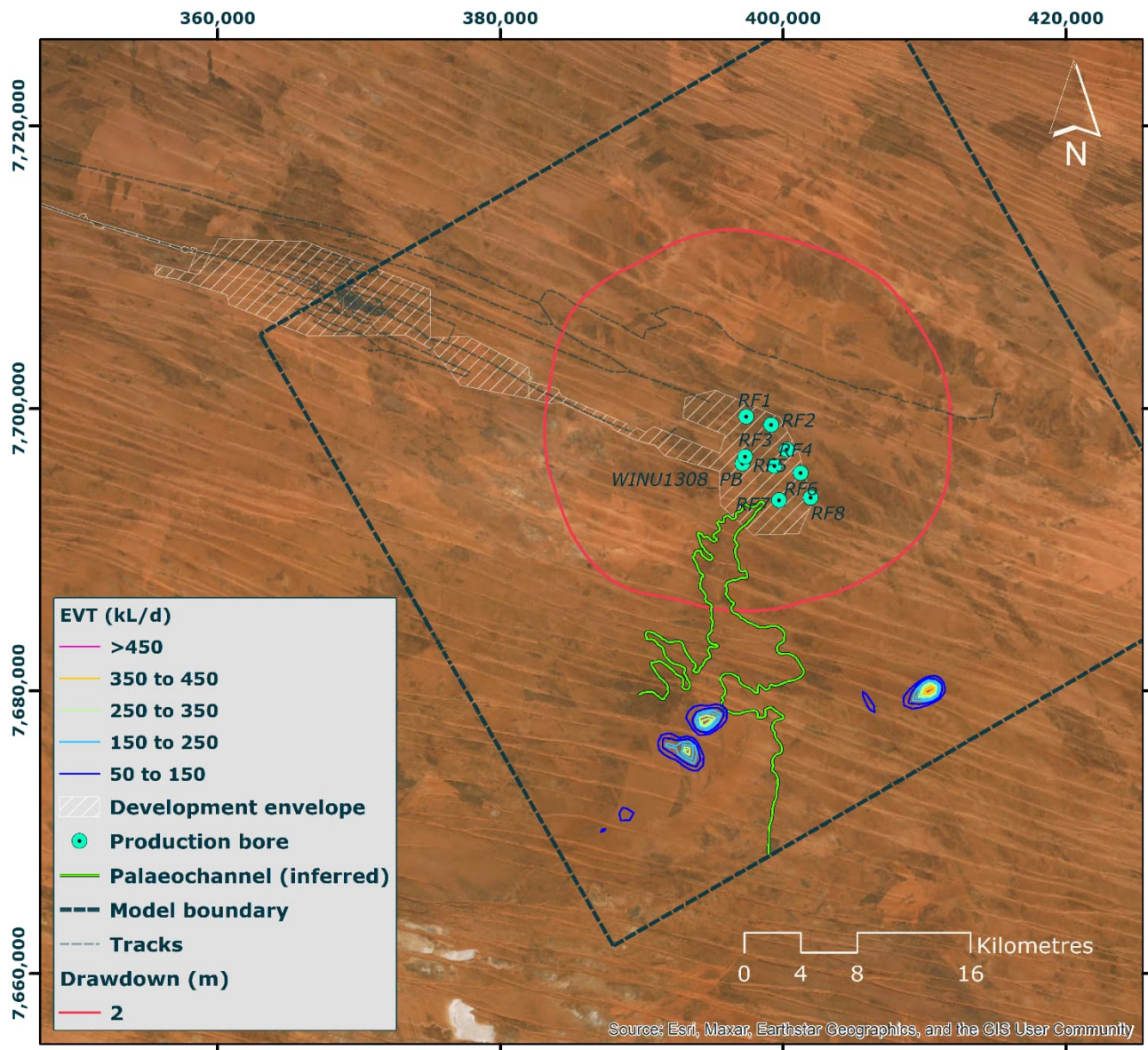


Figure 9-11 Small areas of possible active EVT as indicated by the model

9.5.3 Sensitivity analysis

The model sensitivity has been tested by adjusting selected aquifer parameters while maintaining a good calibration. The outcome of the model sensitivity analysis is:

- The potential yield values exhibit the highest sensitivity to hydraulic conductivity in layers 3 and 4 (weathered metasediment and weathered granite)
 - This aligns with observation of higher groundwater flows intersected at shallower depths within the moderately to highly weathered formations
- Decreasing hydraulic conductivity in the fresh metasediment and fresh granite does not lead to a significant decrease in the overall production rates.
- The sensitivity examined hydraulic conductivity only, with the storage parameters considered appropriate for this level of assessment. However, specific yield for weathered bedrock HSUs was reduced from the original value of 0.02 to 0.01.

Uncertainty in provided estimates remains, mainly about the validity of assumptions beyond the tested area. The model currently assumes similar conditions for granite and metasediment bedrock weathering within the entire model domain. The sustainability of simulated pumping rates relies on this assumption, which cannot be reliably confirmed at this stage, due to the limited testing available for the area.

The potential effects of variations in key aquifer parameters are evaluated as part of the uncertainty analysis (Section 9.6).

9.5.4 Regional groundwater recovery

Simulated groundwater recovery, represented as residual drawdown is shown in Figure 9-12 for the 2.8 GL/a scenario.

The results indicated that groundwater levels recover to within two metres after 50 years and to within a metre in approximately 100 years post closure.

In the closure scenario, no diffuse (“vertical”) recharge is assigned to the model. As a result, the current recovery projections only consider water contributions from groundwater throughflow. In practice though, the recovery process might be accelerated if vertical recharge were factored into the model.

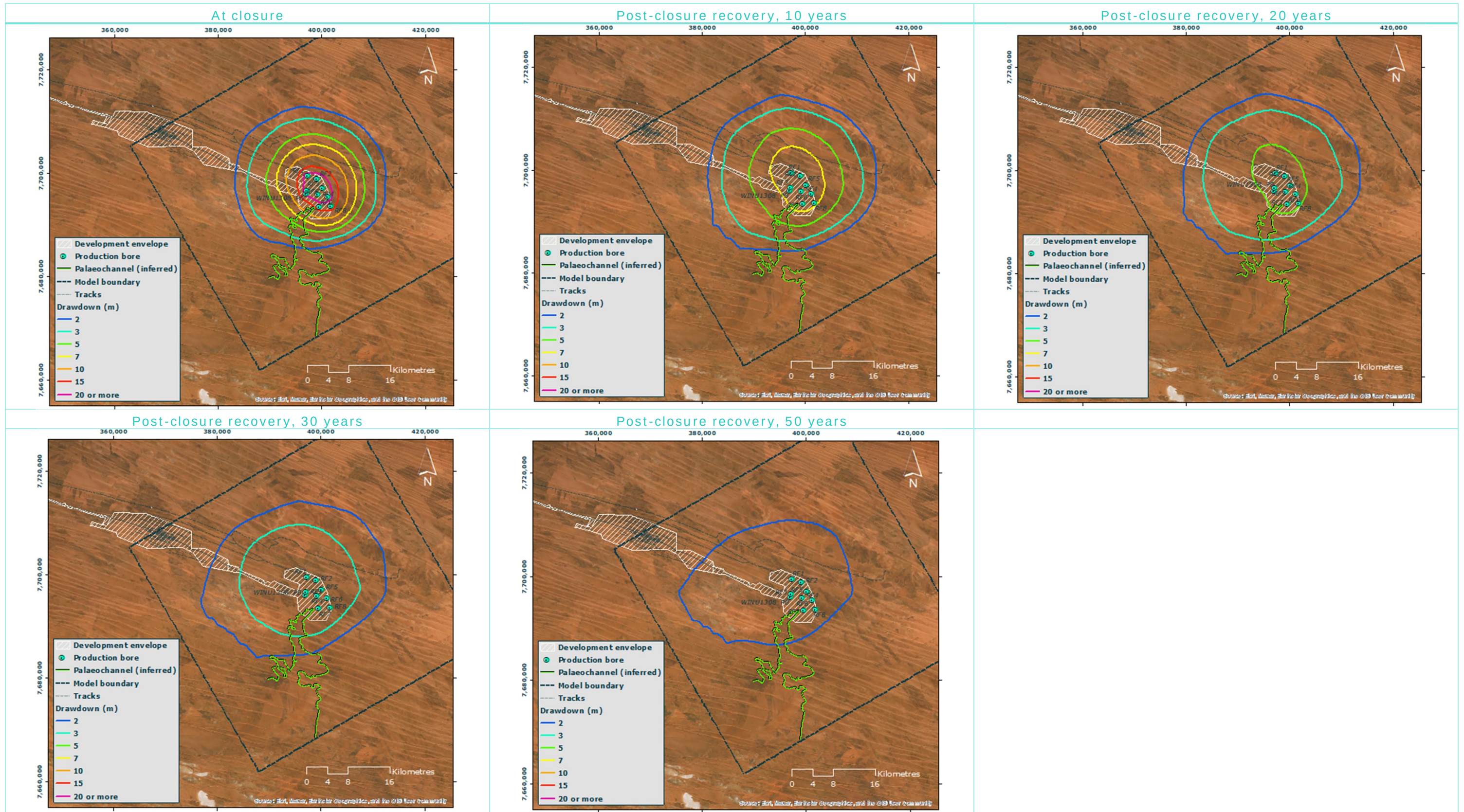


Figure 9-12 Simulated post-pumping recovery (as residual drawdown) for the 2.8 GL/a scenario

9.6 Uncertainty analysis

9.6.1 Approach

This numerical model, as with any model, is a simplification of a complex natural system with most of its properties and their spatial distribution being uncertain. The aquifer parameters have been tested for a relatively small part of the model domain.

Given the model is calibrated to the observed responses of a single pumping test, there remains the uncertainty around the distribution of hydraulic conductivity (K) and storage values (Sy in particular) at a regional scale.

To explore the effects of some of these uncertainties on predicted outcomes, a standard Monte Carlo (SMC) simulation is incorporated into the simulation run.

The standard Monte Carlo simulation run completed for this study is based on 200 parameter realisations.

9.6.2 Setup

The realisations run on combinations of hydraulic properties (of zones representing the weather aquifer) within prescribed plausible ranges, following lognormal distribution. The ranges used to populate the individual realisations are tabulated in Table 9-4.

Table 9-4 Monte Carlo run, parameter ranges

Parameter / Zone	Calibrated value	Minimum value	Maximum value
Kx 1 (m/d) (surficial sediments)	1	0.5	5
Kx 3 (m/d) (weathered metasediments)	2	1	4
Kx 5 (m/d) (weathered granitoids)	3	1	5
Sy 1 (surficial sediments)	0.05	0.03	0.15
Sy 3 (metasediments)	0.01	0.008	0.03
Sy 5 (granitoids)	0.01	0.008	0.03
Ss 1 (1/m) (surficial sediments)	1×10^{-5}	8×10^{-6}	5×10^{-5}
Ss 3 (1/m) (metasediments)	1×10^{-5}	5×10^{-6}	5×10^{-5}
Ss 5 (1/m) (granitoids)	5×10^{-6}	1×10^{-6}	5×10^{-5}

9.6.3 Results - groundwater level and drawdown

An evaluation of the full allocation scenario at 2.8 GL/yr yielded 192 successfully completed realisations, representing 96% of the total simulations runs. These realisations form the basis for the probabilistic analysis and discussion.

Rejected realisations are attributed to numerical non-convergence, which arises when the assigned pumping rates—under certain combinations of hydraulic properties—exceed the available drawdown in at least one borehole. Further analysis indicates that these non-convergent cases are primarily associated with bore WINU1308PB, likely due to its limited depth and close proximity to adjacent production bores.

Applied pumping rates are spatially variable but remain fixed at each individual site for the duration of the pumping period. These rates are assigned based on the relative distances between bores and the depth to the base of the weathered zone at each location. Bores situated farther from others, located upgradient, or intersecting a thicker weathered zone are allocated higher production rates. They are specified in Table 9-5:

Table 9-5 Production rates assigned in predictive simulations

Production bore	Nominal rate (kL/d)	Nominal rate (L/s)
WINU1308PB	720	8.3
RF1	750	8.7
RF2	750	8.7
RF3	800	9.3
RF4	980	11.3
RF5	960	11.1
RF6	928	10.7
RF7	960	11.1
RF8	820	9.5
Total	7,668	88.8

The SMC realisation outputs for the calibration period, presented as hydrographs of observation bores in Figure 9-13, indicate a satisfactory correspondence between simulated and observed groundwater levels.

Comparison between the observed values and the SMC-simulated ranges shows that, in all cases, the observed data fall within the interquartile range (P25 to P75) of evaluated simulations.

The interquartile range is relatively narrow, generally within four metres, indicating a low spread and consistent model performance. At three of the four observation locations, the median (P50) simulation slightly overestimates observed groundwater levels.

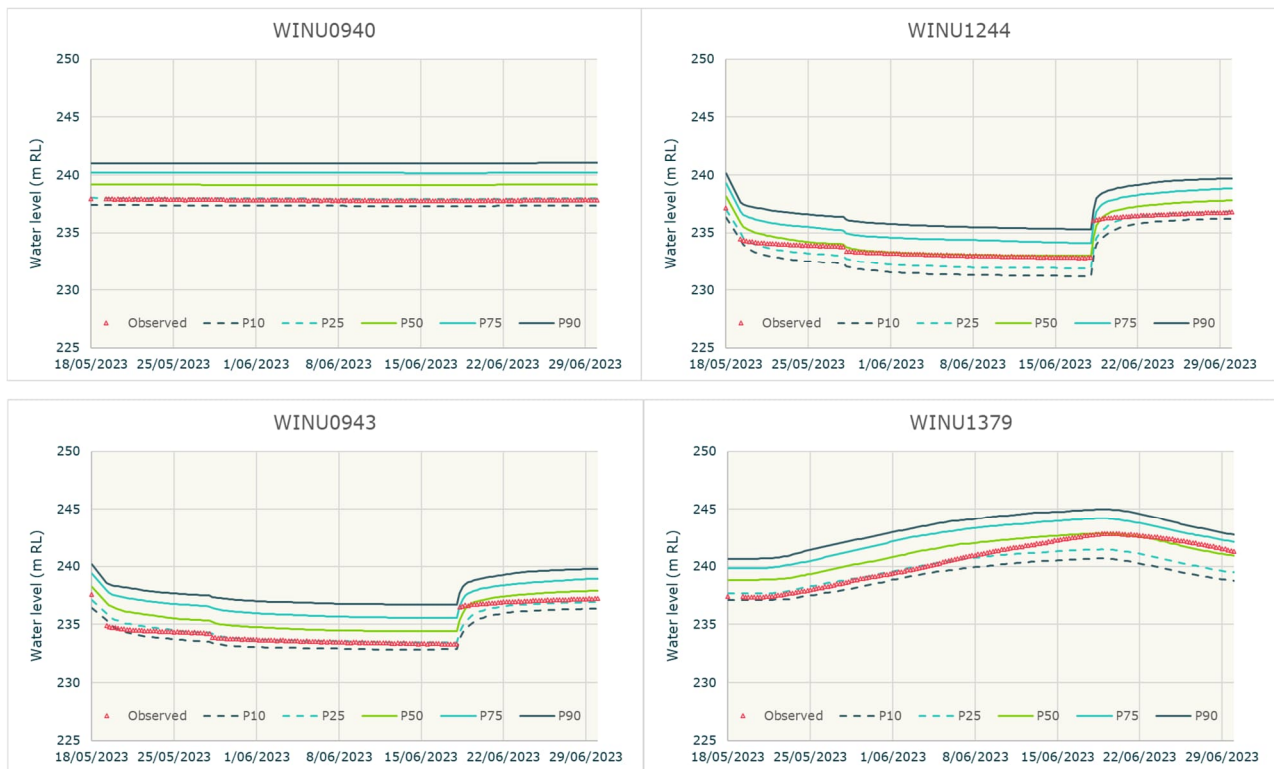


Figure 9-13 Probabilistic (SMC) water level ranges for observation bores, calibration period

The Monte Carlo run is calibration-unconstrained, which leads to some realisations exhibiting larger deviations from the observed data. The root mean square (RMS) statistic is an appropriate measure of such deviations. In this case, 77% of realizations achieve an RMS value of less than two metres, while only three realisations exceeding an RMS value of four metres

Based on hydrograph evaluation and RMS values, it is concluded that the applied perturbations of hydraulic parameters in the Monte Carlo run produce results that, in the majority of cases, conform well to the observed data.

Predictive simulations, represented as hydrographs, are presented within similar probabilistic band ranges (Figure 9-14) as those computed for the calibration stage, including the interquartile ranges. The range of probabilistic results increases in time during 32 years of simulated pumping. During the recovery phase the increase in the absolute range with time is comparatively smaller in relation to the pumping phase.

The hydrographs indicate that a return to pre-pumping levels within the nominal borefield area will take more than 150 years, based on a two-metre difference from the original levels. However, the difference is projected to be less than five metres in approximately 50 years for the median case (P50), and somewhat greater—by a few metres—for the P25 and P10 cases.

Drawdown at the end of borefield groundwater abstraction for P50 case (Figure 9-15) is very similar to the base case prediction (Figure 9-10). The P10 and P90 cases (Figure 9-15) suggest marginally smaller and larger drawdown footprints, respectively, suggesting that applied parameter perturbation ranges do not result in large deviations from predicted drawdown extents.

During recovery, following the cessation of pumping, the residual drawdown within the affected groundwater system reduces to less than 5 m relatively quickly, eg. in 50 years for P50 and P90 cases (Figure 9-16). At 75 years post-pumping, P90 drawdown extent will be similar to P50 extent at 50 years.

This suggests that within the range of hydraulic parameter combinations applied to the model prediction, the groundwater system will be close to recovery, within 2 m, to pre-pumping conditions in less than 100 to 150 years.

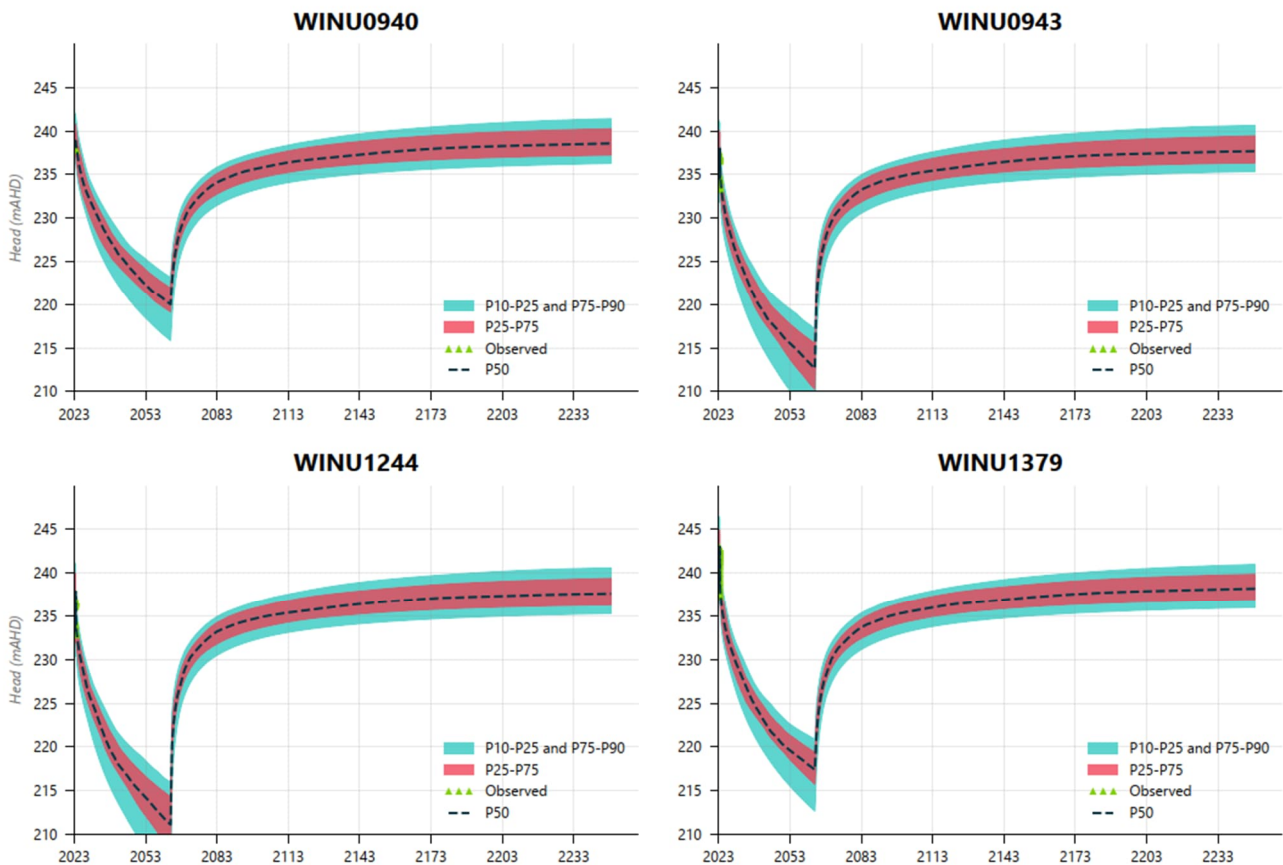
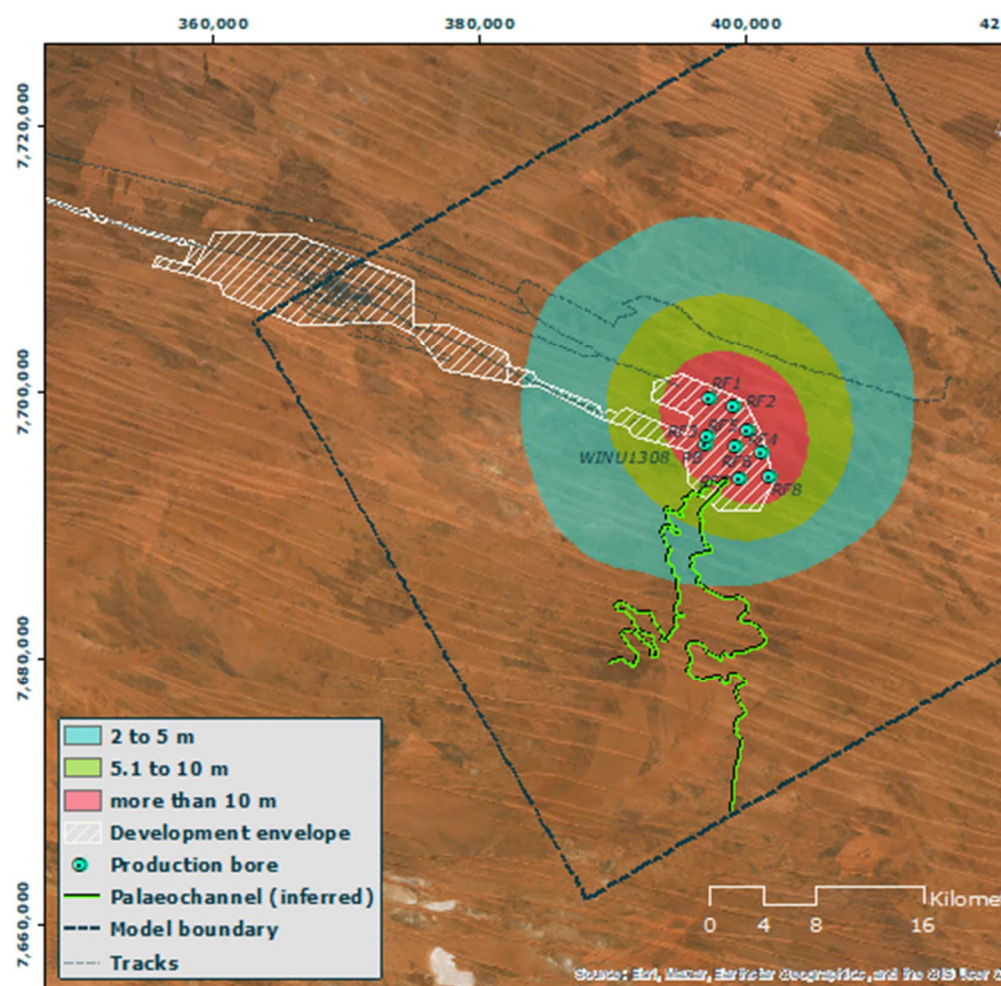
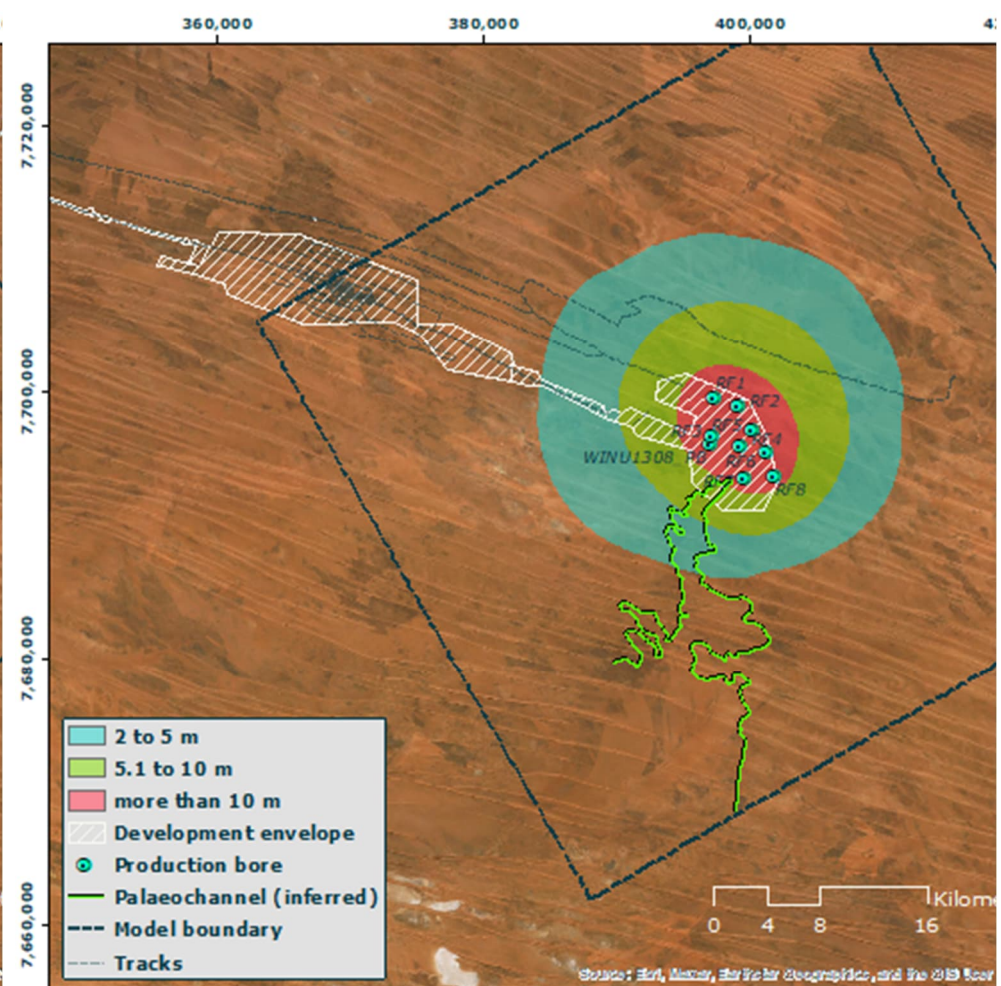


Figure 9-14 Probabilistic (SMC) head outputs for observation bores, prediction period

Drawdown, end of mining, P50 case



Drawdown, end of mining, P10 case



Drawdown, end of mining, P90 case

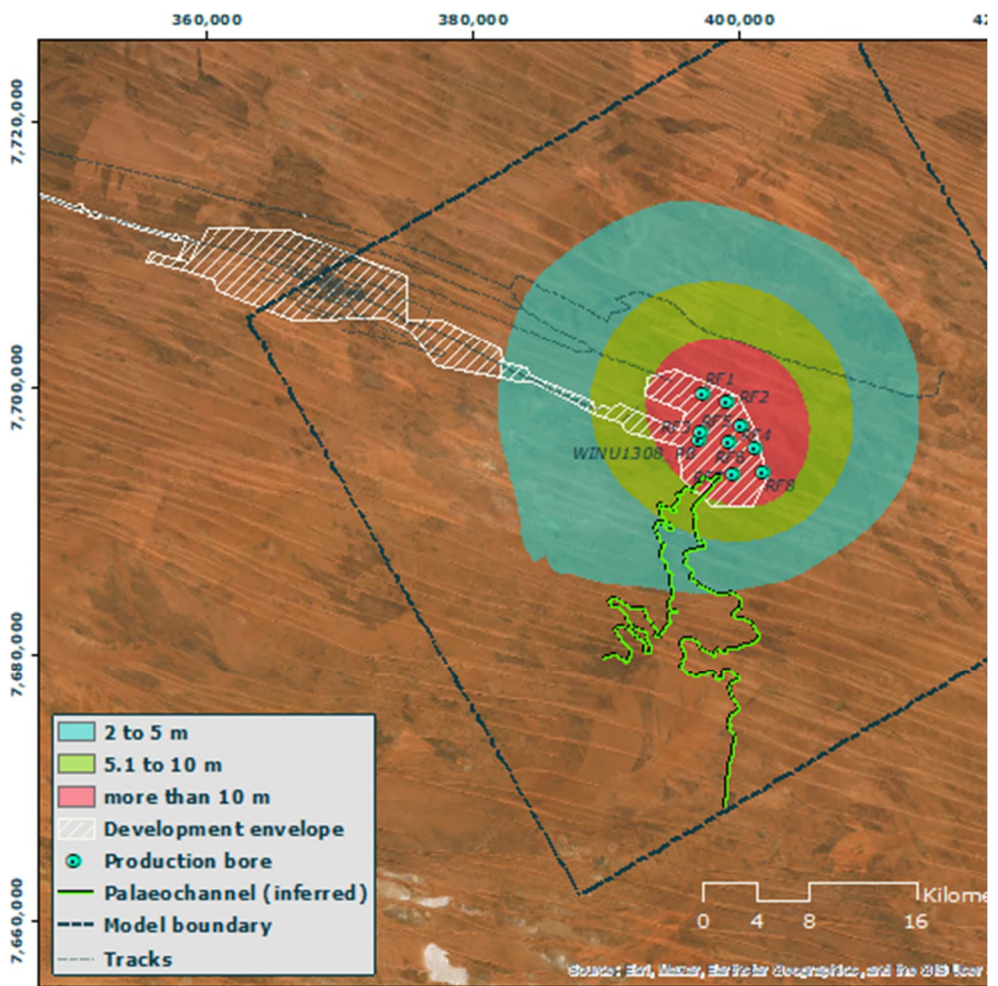
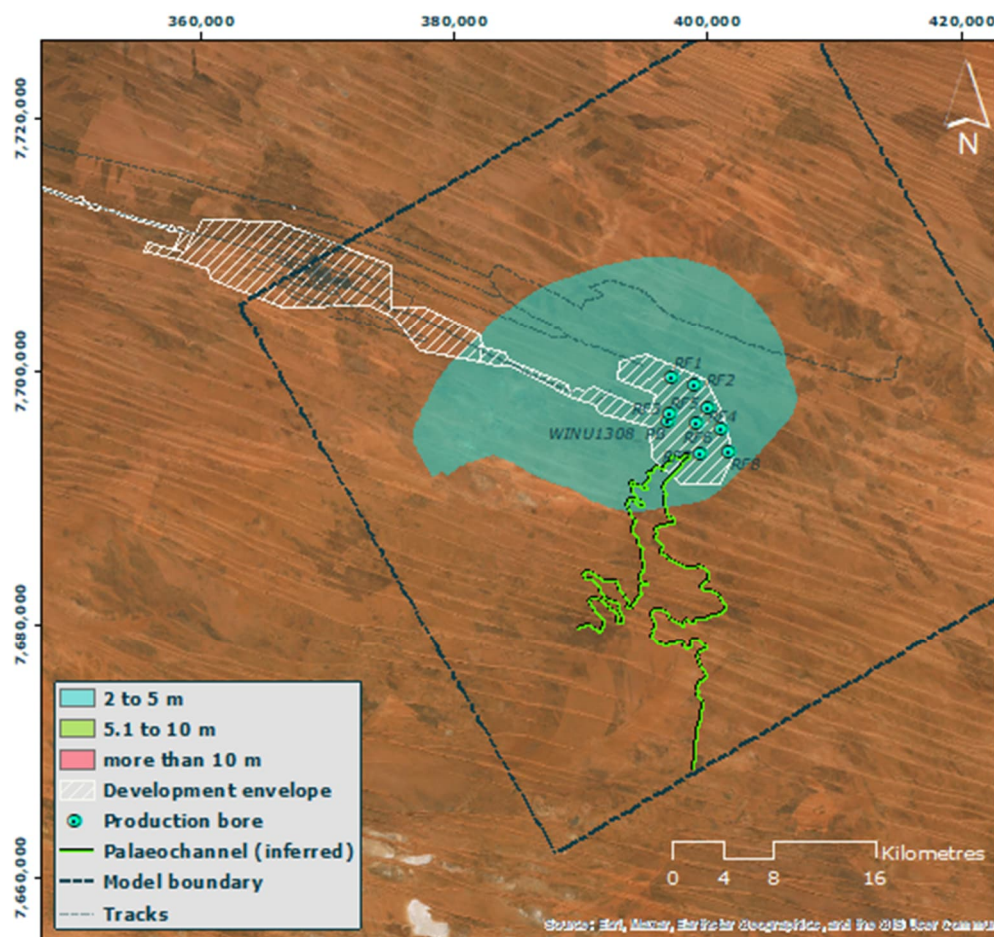
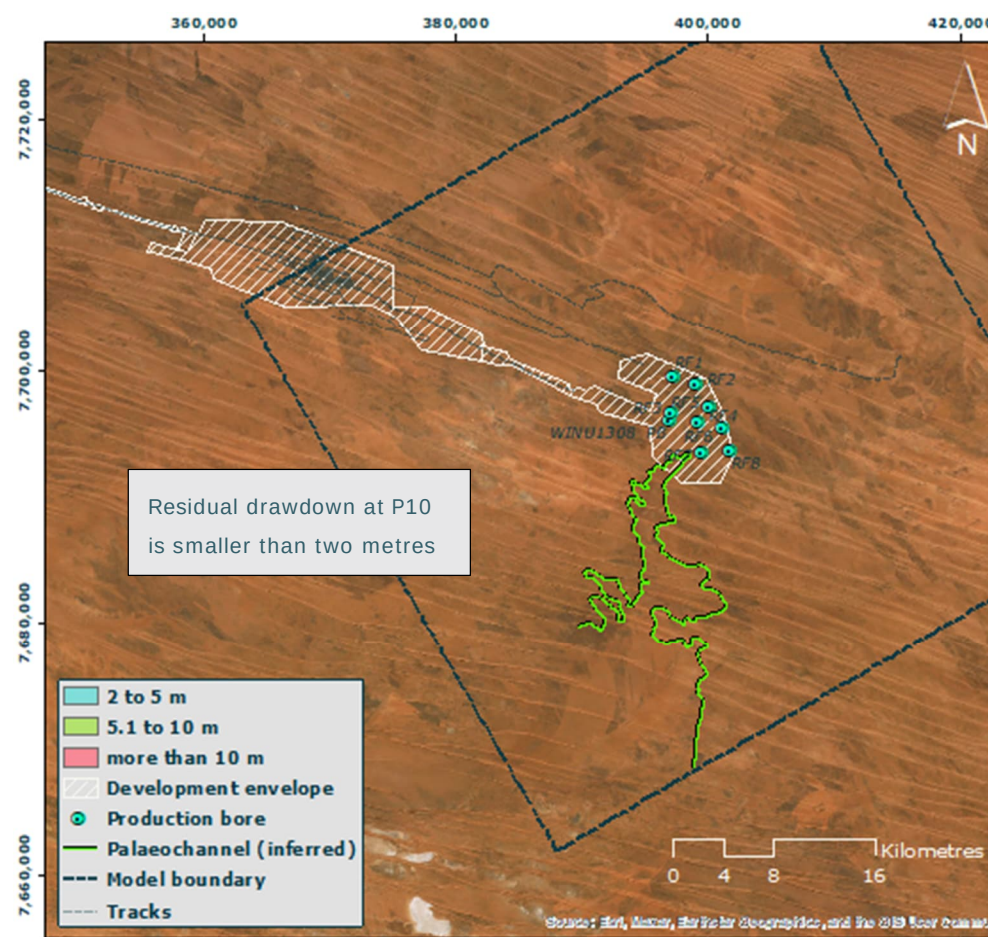


Figure 9-15 Probabilistic drawdown representation, end of mining

Residual drawdown, recovery at 50 years, P50 case



Residual drawdown, recovery at 50 years, P10 case



Residual drawdown during recovery at 50 years, P90 case

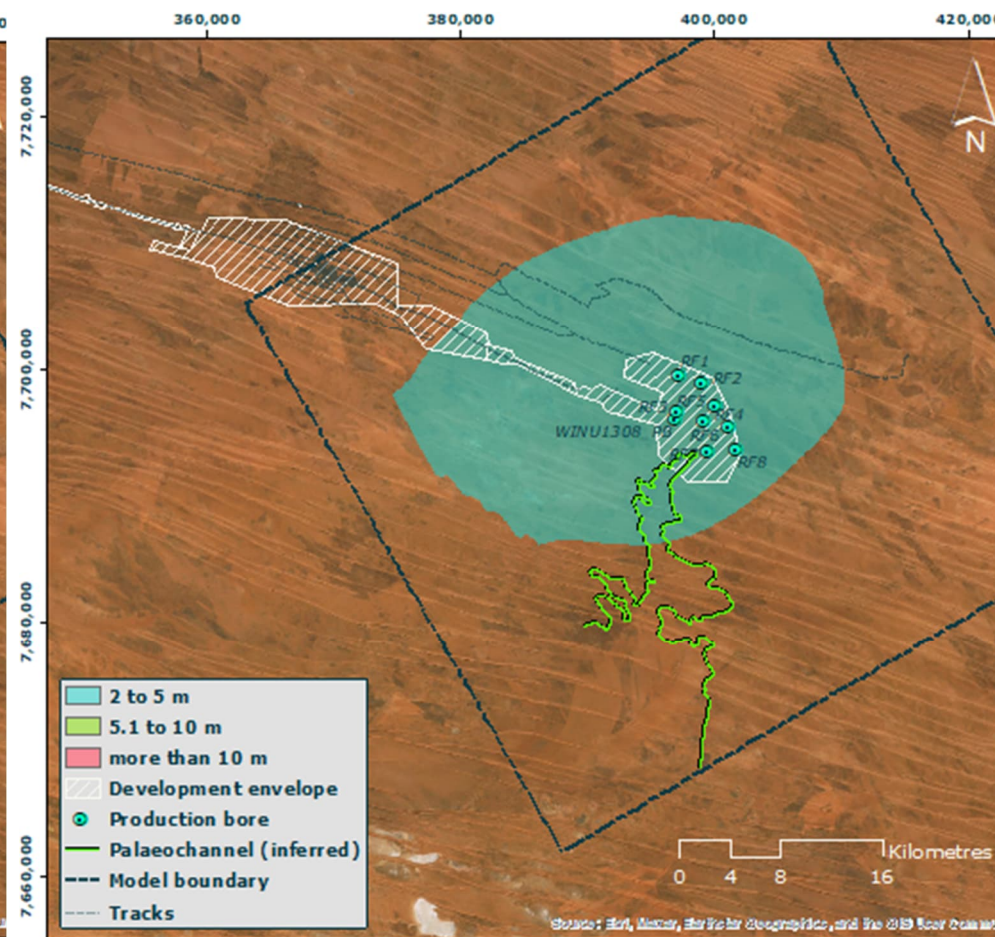


Figure 9-16 Probabilistic drawdown predictions, 50 years (P10, P50, P90) of recovery after cessation of abstraction

9.6.4 Results - abstraction rate

The probabilistic model suggests that for the 96% of the simulations completed a nominal borefield will be able to achieve a continuous abstraction rate of 2.8 GL/a over 32 years of operation.

The actual demand will be notably less than this, and in fact, the 2.8GL/a demand is a worst case prediction of peak demand that might only occur in a small number of years. The median forecast demand is for a borefield demand commencing in Year 16, peaking at 1.5 GL/a in Year 26 and declining to 1.2 GL/a after this.

9.6.5 Probabilistic groundwater change summary

The results of the uncertainty analysis regarding the groundwater change assessment are summarised using the risk-based terminology outlined in Middlemis and Peeters (2018), in Table 9-6:

Table 9-6 Uncertainty analysis, probabilistic terminology (after Middlemis and Peeters, 2018)

Percentile	Probability	Description
<10	>90%	It is very likely that the outcome is larger than this value
10 to 33	67 to 90%	It is likely that the outcome is larger than this value
33-67	33 to 67%	It is as likely as not that the outcome is larger than this value
67-90	10 to 33%	It is unlikely that the outcome is larger than this value
>90	<10%	It is very unlikely that the outcome is larger than this value

The uncertainty analysis using aggregated standard Monte Carlo realisations indicates that it is very unlikely that:

- Drawdown greater than 2 m will cover an area larger than approximately 800 km² at the end of borefield abstraction.
- The largest distance from the centrepoint of the nominal borefield to the 2 m drawdown contour at the end of mining in a NW direction will be more than 17 km.
- Drawdown larger than 2 m at recovery 50 years post cessation of pumping will cover an area greater than approximately 680 km².
- Drawdown anywhere at recovery 50 years post cessation of pumping is more than 5 m.
- The largest distance from the centrepoint of the nominal borefield to the 2 m drawdown contour, which is in the westerly direction, will be more than 22 km.

9.7 Modelling assumptions and limitations:

Numerical groundwater models are a simplified representation of what is potentially a complex hydrogeological system. This is due to the sparse and irregular distribution of information on geological structure, distribution and variation of hydraulic properties, and variations due to seasonal and climatic changes.

In addition, this model was developed to provide extended functionality to what would otherwise be represented by an analytical model.

The modelling assumptions and limitations identified are listed below:

- Delineation of study boundaries: Block model boundaries are set 25 km from the production bore and do not account for geological structures.
- Hydraulic (aquifer) parameterisation: Although some hydraulic testing has been conducted, no long-term water level monitoring is available and therefore numerical modelling relies on short-term stresses limited to the tested area.
 - The aquifer potential in the regional area is charged with uncertainty due to the dataset limitations
 - Hydraulic properties are obtained through calibration to a single pumping test
- Groundwater recharge rate: No diffuse (vertical) rainfall recharge is currently assigned to the numerical predictions. Disposal of pumping discharge is simulated as a small, discrete recharge zone.
- Groundwater levels: The regional water levels to the north and east of the Rimfire study area are assumed and designed to invoke the known groundwater gradient within the Rimfire area.
- Hydrostratigraphic units: The current model simulates HSUs with a zonal approach, however hydraulic property parameters outside of the tested zone might, in reality, vary and differ from the adopted values.
- Inferred palaeochannel: An inferred palaeochannel is shown on the figures, however, the presence of a palaeochannel has not been confirmed. Therefore, the inferred palaeochannel is not currently represented in the numerical model.
- Abstraction: Nine (9) wells are simulated around the Rimfire area, to represent a nominal borefield arrangement.

9.8 Summary of results

Based on the drawdown estimation results obtained from the long term (32 year) forward predictions of groundwater abstraction at 2.8 GL/a m³/d (on average 10 L/s per bore) from the Rimfire area, the following conclusions are drawn:

- The third-party mining receptors outlined in Section 4.2.2 will not be affected by any long-term pumping from Rimfire, given that the closest operation is located 90 km to the south.
- Water levels at the Winu project (30 km west of Rimfire) area are unlikely to be significantly affected by any long-term pumping. The 2 m drawdown indicate an area of potential influence extending up to 15 km radially around a nominal borefield (at the end of pumping).
- The two GDE zones, identified using the GDE Atlas tool, are unlikely to be affected by groundwater abstraction at Rimfire, given the closest GDE is situated approximately 30 km from the nominal Rimfire borefield.
- Water levels in the Weenoo and Djimaracka soaks will not be affected by pumping at Rimfire as these are located at least 45 km away, and are considered not groundwater dependent or groundwater connected (Golder, 2022).

10. Assessment of potential impacts

A high-level strategy for managing potential impacts to the environment, water resources, and other users is outlined in Table 10-1.

Table 10-1 Management strategies for potential impacts to water resources and environmental receptors

Receptor	Potential impacts	Consequence	Likelihood	Risk	Control
Water levels in the Percival Palaeovalley Percival Palaeovalley has a shallow water table which may support GDEs in the area	Reduction in water levels in the Percival Palaeovalley causing impact to groundwater dependent vegetation	Moderate	Unlikely	Low	Develop targeted groundwater monitoring points within both the palaeovalley system and deeper fractured rock aquifer system to assess and monitor differences in water levels Carry out regular groundwater level monitoring
Existing/potential users Maintain water quality and water levels Maintain groundwater resource for water supply	Reduction in groundwater levels within predicted drawdown area Water quality impacts	Moderate	Unlikely	Low	Further data collection and testing of the Rimfire aquifer system (and possibly Percival Palaeovalley aquifer system) Numerical model with updated testing results if/when available

The operational strategy should be developed fully when a borefield is established and should include:

- Contingency water supply options from other regional aquifers to meet site operational water demands.
- Groundwater management strategy and triggers (monitoring and sampling) at Rimfire to allow assessment of impacts to groundwater levels, other groundwater users and environmental receptors, from water abstraction.

11. Conclusion

The assessments presented in this report are based on the hydrogeological conceptual model of the Rimfire borefield area, which has been developed using data collected during field hydrogeological investigations conducted between 2020-2024.

WINU0942 bore drilled and tested in 2023 had construction flaws and poor connectivity between the observed and pumping bore. WINU1308 bore is a redrill of WINU0942 and was tested in June 2024. The redrill provided a greatly increased yield (4 L/s to 18 L/s) and a good hydraulic connection between the pumping and monitoring bores.

Testing results of WINU1308 were analysed in Aqtesolv and used as a basis of design for a numerical block model.

Mounding was observed in the pumping discharge area during the pumping, indicating infiltration effects. Mounding responses were modelled with the numerical block model.

A relatively simple block model was developed into a numerical groundwater flow model to aid the interpretation of the pumping test and use for predictive purposes considering a nominal borefield. The model allows to examine the groundwater response to abstraction from the current production bore, including drawdown and mounding from pumping discharge.

The numerical block model was used to simulate a nominal nine-bore borefield intersecting the highly weathered fractured rock aquifer incorporating the granite and metasediments.

Forward predictions of groundwater abstraction from these nine locations show the nominal borefield is potentially capable of sustaining the estimated worst-case peak demand of 2.8 GL/a (8 to 11 L/s per bore). Groundwater abstraction will create a cone of depression radially extending from the borefield.

The 2 m drawdown contour, as a measure of pumping effect, after simulation of 32 years of continuous abstraction from nine bores (which far exceeds what is forecast to be actually required) is predicted to extend in the order of 15 km from the borefield.

Based on the nominal borefield model predictions:

- It is considered unlikely for drawdown to have any impact on third-party receptors (other mining operations) in the area (90 km due south), or GDEs or soaks located 50 km northwest to northeast
- Water levels at the Winu project area (30 km due west-northwest) are unlikely to be affected by any long-term pumping from Rimfire.

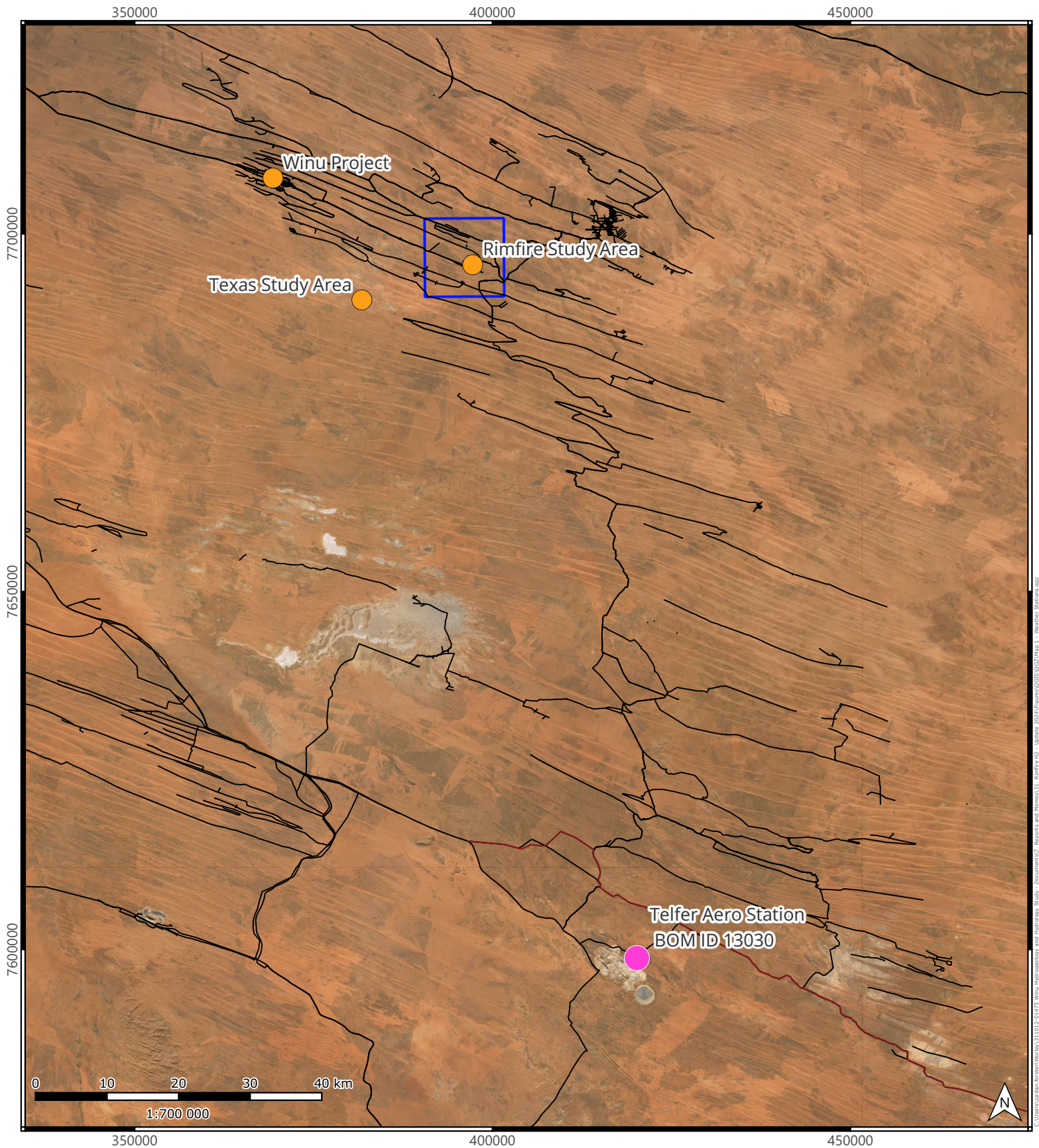
These predictive results assume that aquifer properties tested at Rimfire will be similar elsewhere within the model domain and the main water contributor is the weathered part of the fractured rock basement.

The model is reasonably conservative (it uses more conservative values than Aqtesolv results) and neglects the diffuse vertical recharge which may occur after large rainfall events and contribute to aquifer storage.

12. References

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- Worley. (2024a). *Winu Operational Surface Water Management Plan Update 2023*. Ref:311012-01475-REP-HY-018-Rev0.
- Worley. (2024c). *Winu Operational Surface Water Management Plan Update 2023*. Ref: 311012-01475-REP-HY-018-Rev0 .

Appendix A. Mapbook



Legend

- Site locations
- Telfer Aero Station
- Local Road
- Winu tracks
- Study Area

Weather Stations

Rimfire H3 Hydrogeological Assessment

Project No.
311012-01475

Client
Rio Tinto Copper

Figure No.
Map 1

Notes:

Project CRS: GDA94 / MGA zone 51
Last Saved: 12/08/2024, 16:14

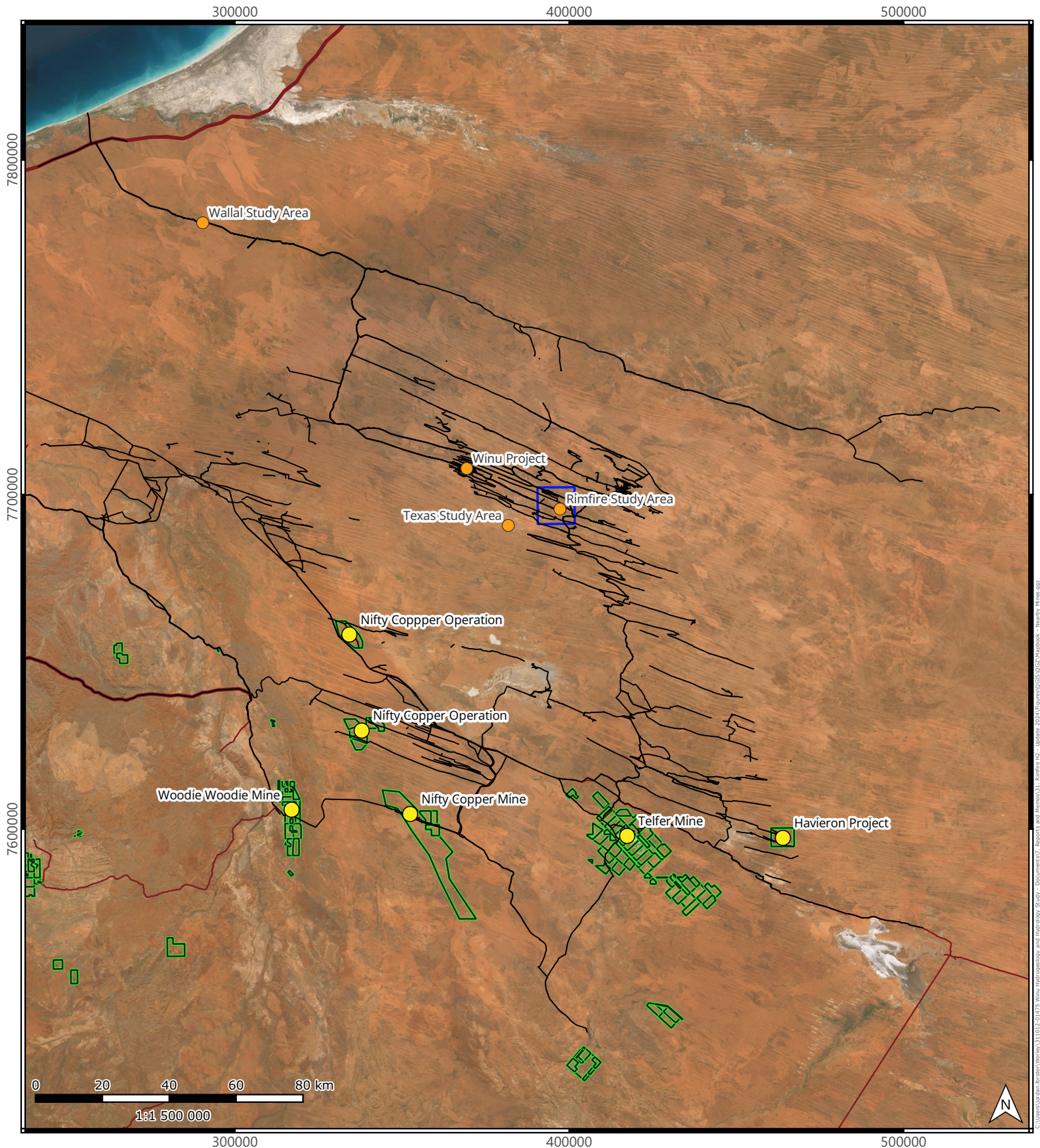
References

Consultant



Client





Legend

- Site locations
- Third party mining operations
- Winu tracks
- Local road
- State road
- Study area
- Mining leases

Third Party Mining Operations

Rimfire H3 Hydrogeological

Assessment

Project No.
311012-01475

Figure No.
Client Map 2

Notes:

Project CRS: GDA94 / MGA zone 51
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References

RTX, 2022

Consultant



Client



Appendix B. Surface Water Chemistry Analytical Results

CERTIFICATE OF ANALYSIS

Work Order	: EP2106108	Page	: 1 of 5
Client	: GOLDER ASSOCIATES	Laboratory	: Environmental Division Perth
Contact	: ROCHELLE IRWIN	Contact	: Lauren Biagioni
Address	: PO BOX 1914	Address	: 26 Rigali Way Wangara WA Australia 6065
	WEST PERTH WA 6872		
Telephone	: ----	Telephone	: 08 9406 1307
Project	: EP/882/20	Date Samples Received	: 31-May-2021 15:15
Order number	: P030891	Date Analysis Commenced	: 31-May-2021
C-O-C number	: ----	Issue Date	: 10-Jun-2021 17:08
Sampler	: Gerhard Jacobs		
Site	: ----		
Quote number	: EP/882/20_V3		
No. of samples received	: 1		
No. of samples analysed	: 1		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Metals conducted by ALS Brisbane, NATA Site No. 818.
- ED037-P (Alkalinity): Sample EP2106108-1 was centrifuged before analysis to reduce possible interference from sediment which may consume the alkalinity titrant.
- TDS by method EA-015 may bias high for sample #1 due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- EG020-T (Total Metals by ICP-MS): Limit of reporting raised for sample Toromah (EP2106108-001) due to matrix interference.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- It is recognised that ED040T (Major Anions - Total) is less than ED040F (Major Anions - Dissolved by ICP-AES) for Sample Toromah (EP2106108-001). However, the difference is within experimental variation of the methods.
- EG035T-LL (Total Mercury by FIMS – Low Level): Limit of reporting raised for sample Toromah(EP2106108-001) due to matrix interference.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Sub-Matrix: WATER (Matrix: WATER)		Sample ID		Toromah	----	----	----	----
		Sampling date / time		25-May-2021 13:01	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2106108-001	-----	-----	-----	-----
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	9.42	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	11800	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	8370	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	94700	----	----	----	----
EA041: Colour (True)								
Colour (True)	----	1	PCU	3000	----	----	----	----
pH Colour	----	0.01	pH Unit	9.52	----	----	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	46800	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	968	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	2380	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	3350	----	----	----	----
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	348	----	----	----	----
Silicon	7440-21-3	0.05	mg/L	16.5	----	----	----	----
ED040T: Total Major Anions								
Sulfur as S	63705-05-5	1	mg/L	326	----	----	----	----
Silicon	7440-21-3	0.05	mg/L	476	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	977	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	1930	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	2	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	2450	----	----	----	----
Potassium	7440-09-7	1	mg/L	431	----	----	----	----
ED093F: SAR and Hardness Calculations								



Analytical Results

Sub-Matrix: **WATER**
 (Matrix: **WATER**)

Sample ID

				Toromah	----	----	----	----
Sampling date / time				25-May-2021 13:01	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2106108-001	-----	-----	-----	-----
Result				----	----	----	----	----

ED093F: SAR and Hardness Calculations - Continued

Total Hardness as CaCO3	----	1	mg/L	5	----	----	----	----
-------------------------	------	---	------	----------	------	------	------	------

EG020T: Total Metals by ICP-MS

Niobium	7440-03-1	0.001	mg/L	0.014	----	----	----	----
Caesium	7440-46-2	0.001	mg/L	0.012	----	----	----	----
Rubidium	7440-17-7	0.001	mg/L	2.62	----	----	----	----
Bromine	7726-95-6	0.1	mg/L	5.3	----	----	----	----
Tungsten	7440-33-7	0.001	mg/L	<0.005	----	----	----	----
Tantalum	7440-25-7	0.001	mg/L	<0.005	----	----	----	----

EG035T: Total Mercury by FIMS

Mercury	7439-97-6	0.00004	mg/L	<0.00200	----	----	----	----
---------	-----------	---------	------	----------	------	------	------	------

EG094T: Total metals in Fresh water by ORC-ICPMS

Aluminium	7429-90-5	5	µg/L	488000	----	----	----	----
Antimony	7440-36-0	0.2	µg/L	7.2	----	----	----	----
Arsenic	7440-38-2	0.2	µg/L	832	----	----	----	----
Barium	7440-39-3	0.5	µg/L	15300	----	----	----	----
Beryllium	7440-41-7	0.1	µg/L	15.9	----	----	----	----
Boron	7440-42-8	5	µg/L	5850	----	----	----	----
Bismuth	7440-69-9	0.05	µg/L	6.01	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L	1.58	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	1940	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	452	----	----	----	----
Copper	7440-50-8	0.5	µg/L	1110	----	----	----	----
Iron	7439-89-6	2	µg/L	1010000	----	----	----	----
Lead	7439-92-1	0.1	µg/L	525	----	----	----	----
Lithium	7439-93-2	0.5	µg/L	140	----	----	----	----
Manganese	7439-96-5	0.5	µg/L	21300	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L	32.0	----	----	----	----
Selenium	7782-49-2	0.2	µg/L	37.6	----	----	----	----
Nickel	7440-02-0	0.5	µg/L	650	----	----	----	----
Silver	7440-22-4	0.1	µg/L	6.5	----	----	----	----
Strontium	7440-24-6	1	µg/L	28700	----	----	----	----
Thallium	7440-28-0	0.02	µg/L	10.2	----	----	----	----
Thorium	7440-29-1	0.1	µg/L	336	----	----	----	----
Tin	7440-31-5	0.2	µg/L	5.1	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Toromah	----	----	----	----
Sampling date / time					25-May-2021 13:01	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2106108-001	-----	-----	-----	-----
Result						----	----	----	----
EG094T: Total metals in Fresh water by ORC-ICPMS - Continued									
Titanium	7440-32-6	1	µg/L		4130	----	----	----	----
Uranium	7440-61-1	0.05	µg/L		23.3	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L		2960	----	----	----	----
Zinc	7440-66-6	1	µg/L		2690	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		4.2	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		5.89	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		1.24	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		7.13	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		5.96	----	----	----	----
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		142	----	----	----	----
∅ Total Cations	----	0.01	meq/L		118	----	----	----	----
∅ Ionic Balance	----	0.01	%		9.26	----	----	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(WATER) EG094T: Total metals in Fresh water by ORC-ICPMS

(WATER) EG020T: Total Metals by ICP-MS

(WATER) EG035T: Total Mercury by FIMS

(WATER) ED040T: Total Major Anions

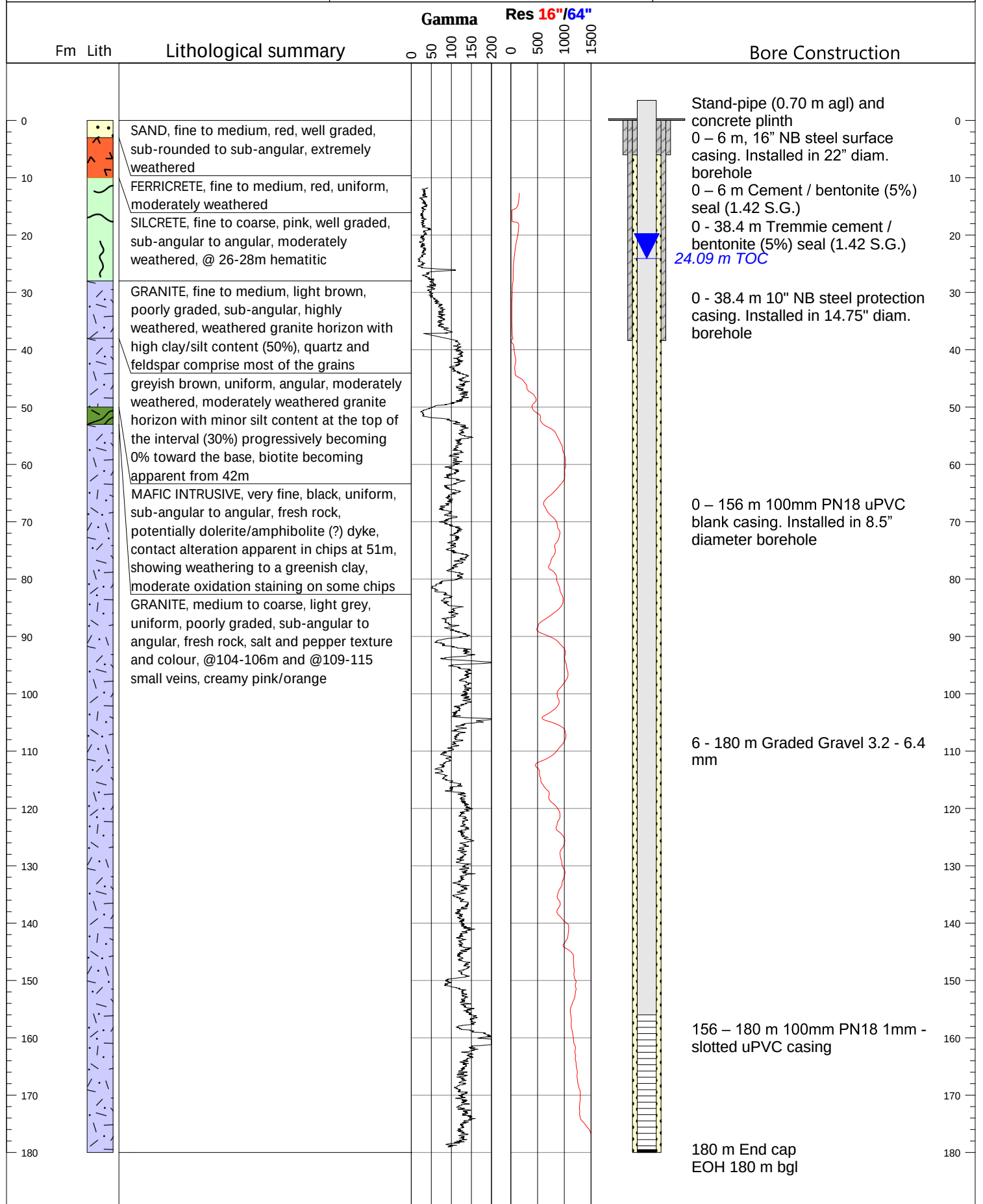
Appendix C. Borehole and Drilling Logs

WINU0940 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 397045.00 mE / 7695444.00 mN
Elevation: 150.00 m AHD (RL = TOC)

Construction start date: 20/03/2023
Construction end date: 13/05/2023
Inclination: -90°
Depth drilled: 180 m BGL

Final airlift yield: 2 L/s
EC: 1254 µS/cm
pH: 8
Temp: 20.6 °C
Static Water Level: 24.09 m TOC



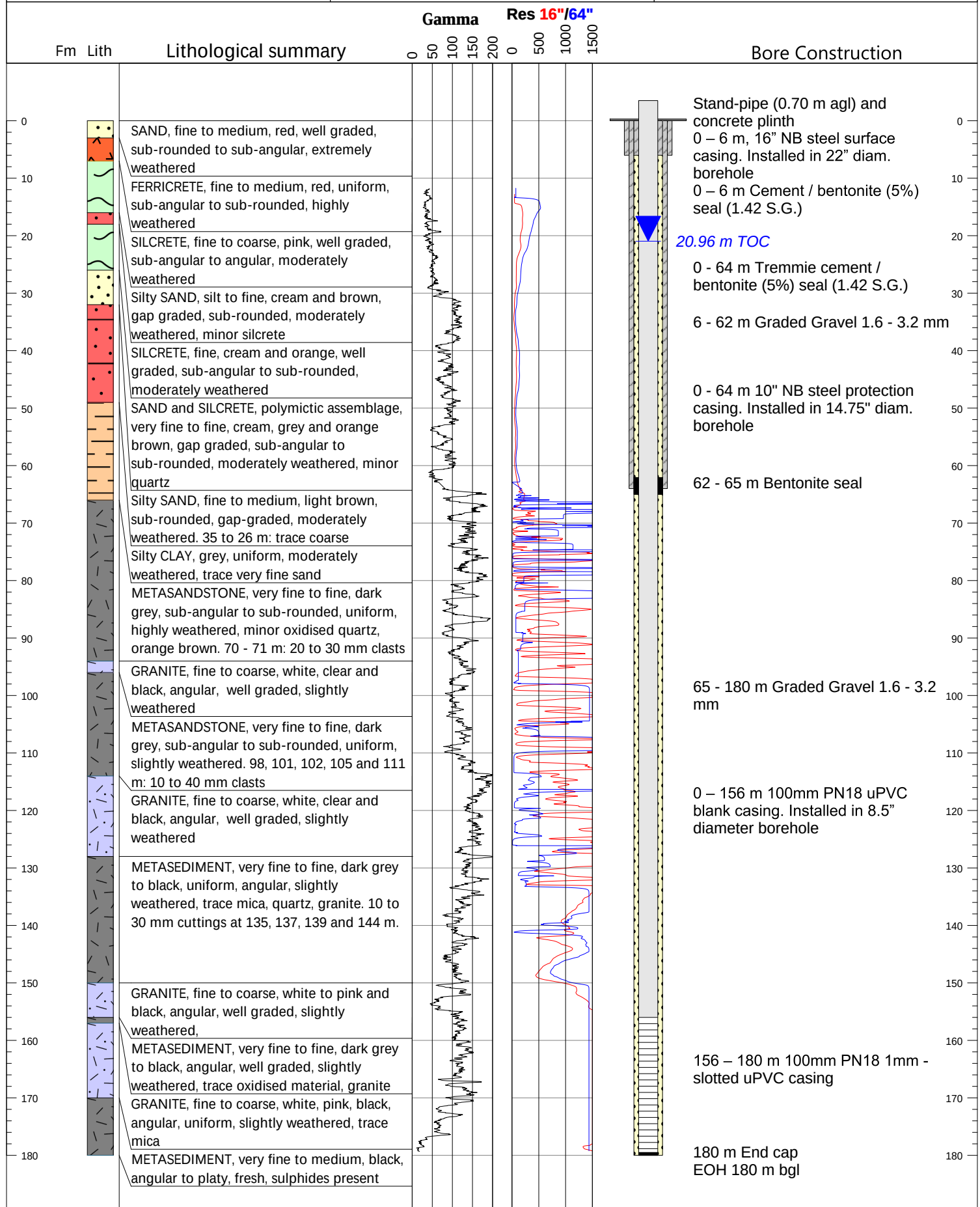
Additional notes:

WINU0941 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 397554.00 mE / 7695467.00 mN
Elevation: 150.00 m AHD (RL = TOC)

Construction start date: 16/05/2023
Construction end date: 24/06/2023
Inclination: -90°
Depth drilled: 180 m BGL

Final airlift yield: 0 L/s
EC: 674 µS/cm
pH: 8.3
Temp: 27.7 °C
Static Water Level: 20.96 m TOC



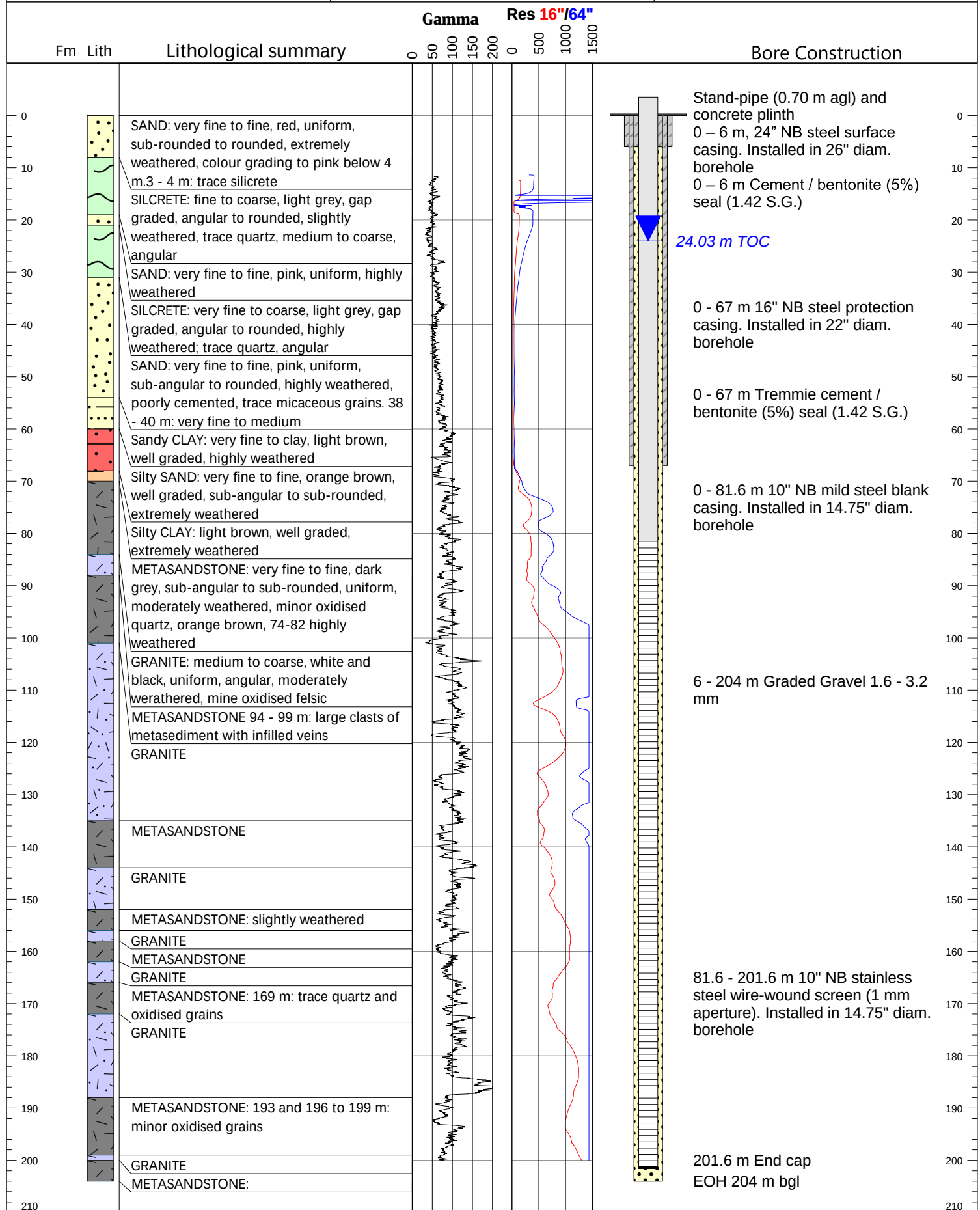
Additional notes:

WINU0942 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 397148.00 mE / 7696105.00 mN
Elevation: m AHD (RL = TOC)

Construction start date: 13/05/2023
Construction end date: 24/06/2023
Inclination: -90°
Depth drilled: 204 m BGL

Final airlift yield: 5 L/s
EC: 814 µS/cm
pH: 8.2
Temp: 31.1 °C
Static Water Level: 24.03 m TOC



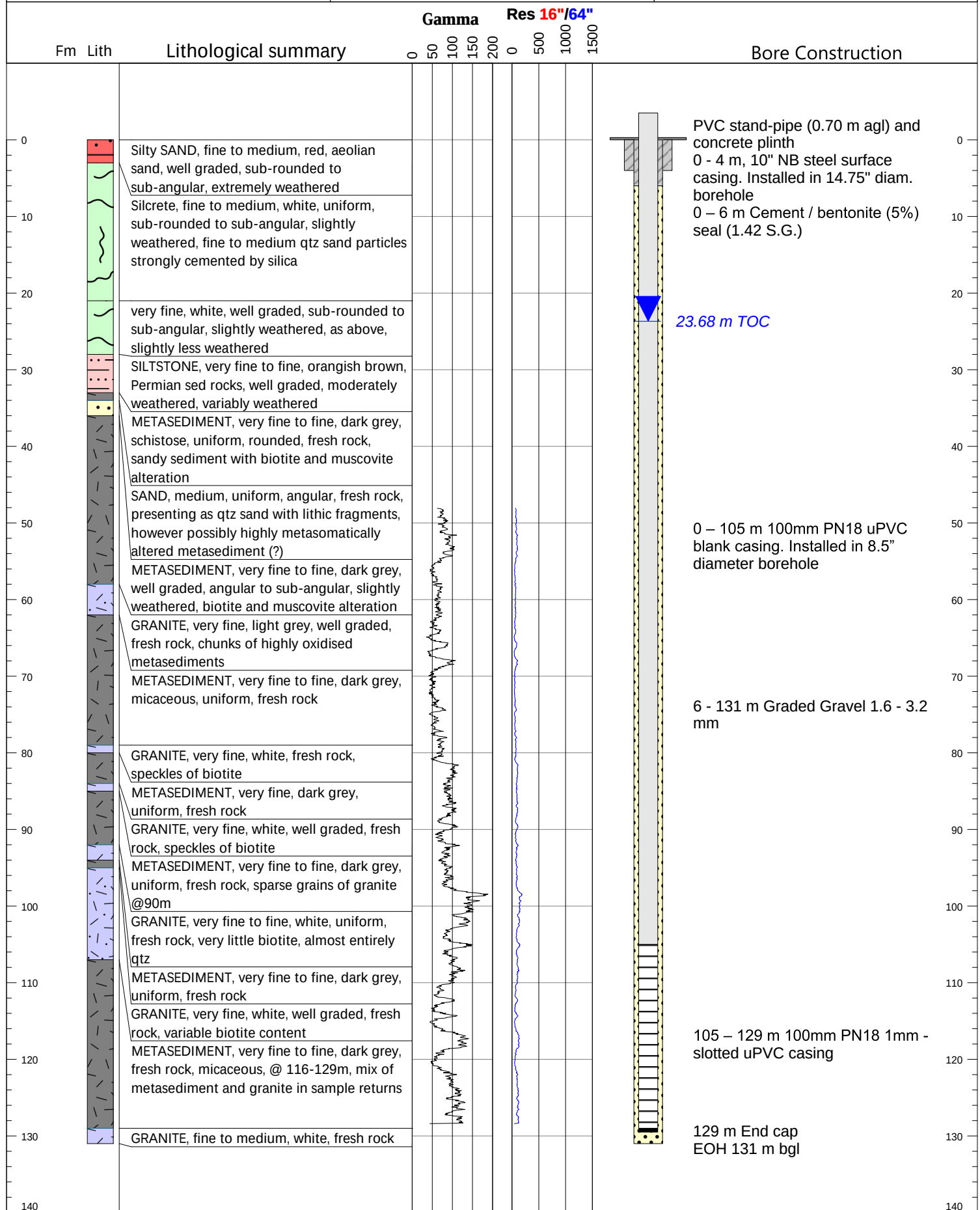
Additional notes:

WINU0943 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 397152.00 mE / 7696072.00 mN
Elevation: m AHD (RL = TOC)

Construction start date: 21/02/2023
Construction end date: 02/07/2023
Inclination: -90°
Depth drilled: 131 m BGL

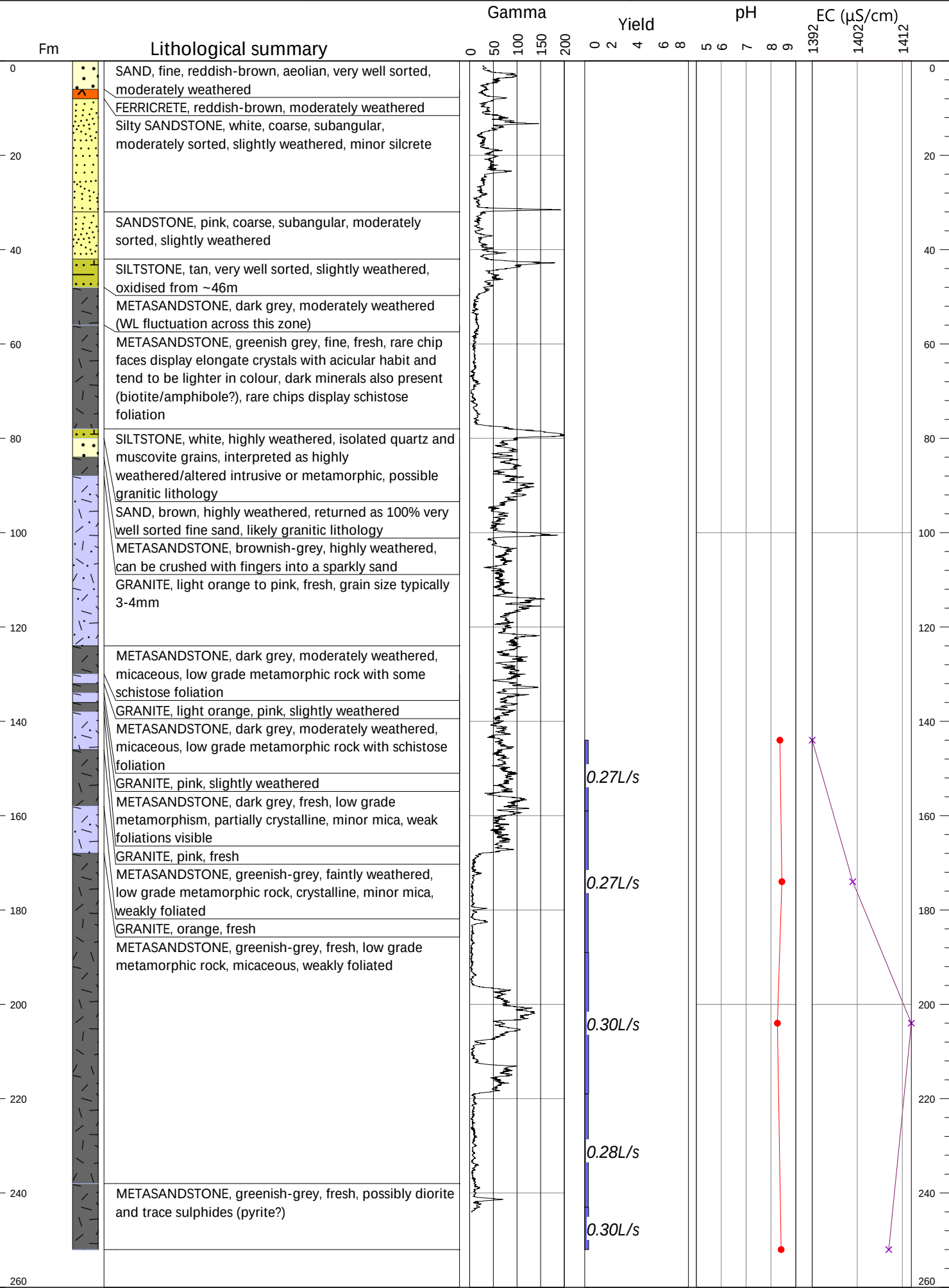
Final airlift yield: 1 L/s
EC: 899 µS/cm
pH: 8.1
Temp: 30.8 °C
Static Water Level: 23.68 m TOC



Additional notes:

WINU1242 - Composite Bore Log

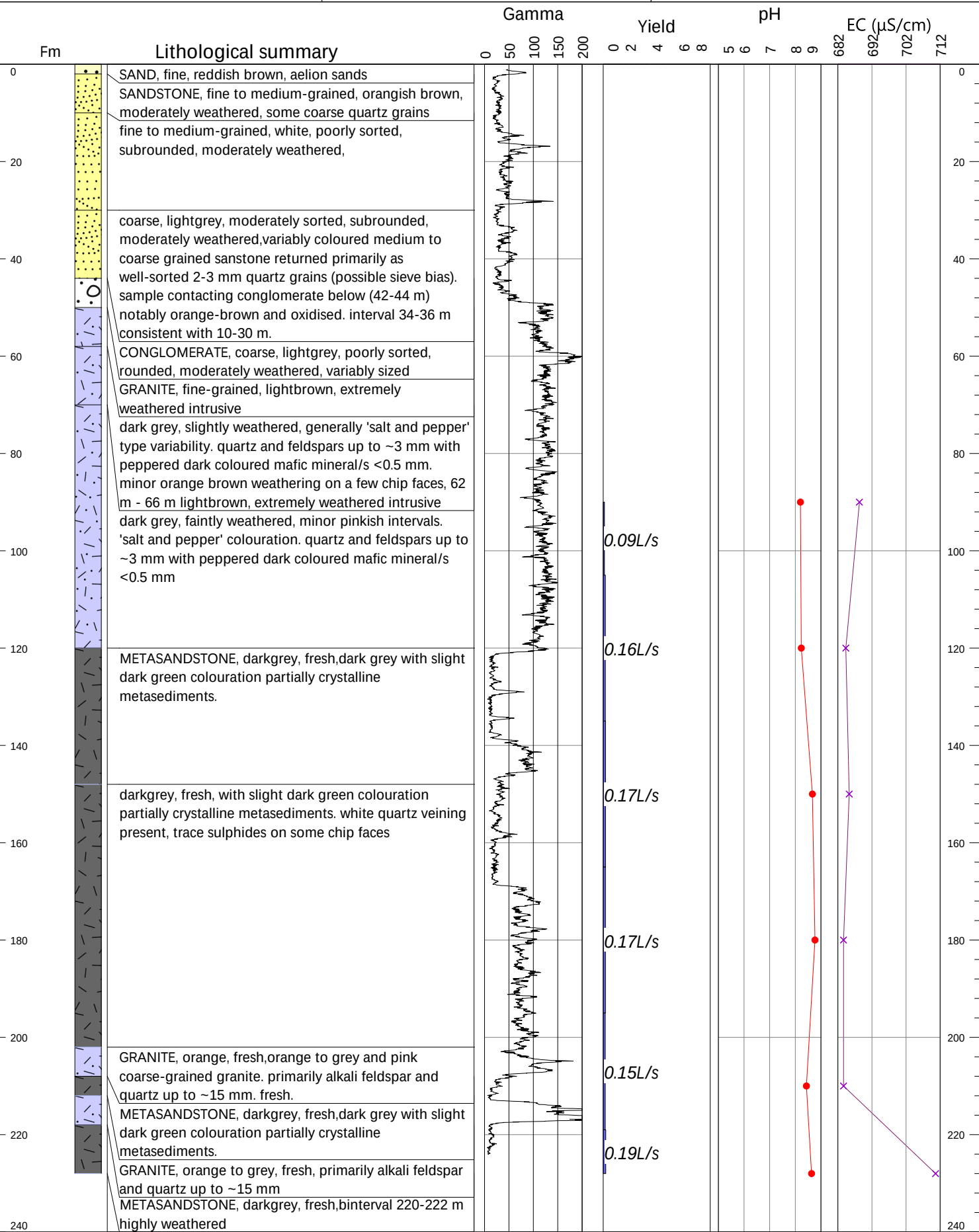
Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 391913 mE / 7698204 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 31/10/2022 Construction end date: 11/11/2022 Inclination: -90° Depth drilled: 252 m BGL	Final airlift yield: 0.3 L/s EC: 1409 µS/cm pH: 8 Static Water Level: 38.48 m bgl Temp: °C
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Additional notes:

WINU1243 - Composite Bore Log

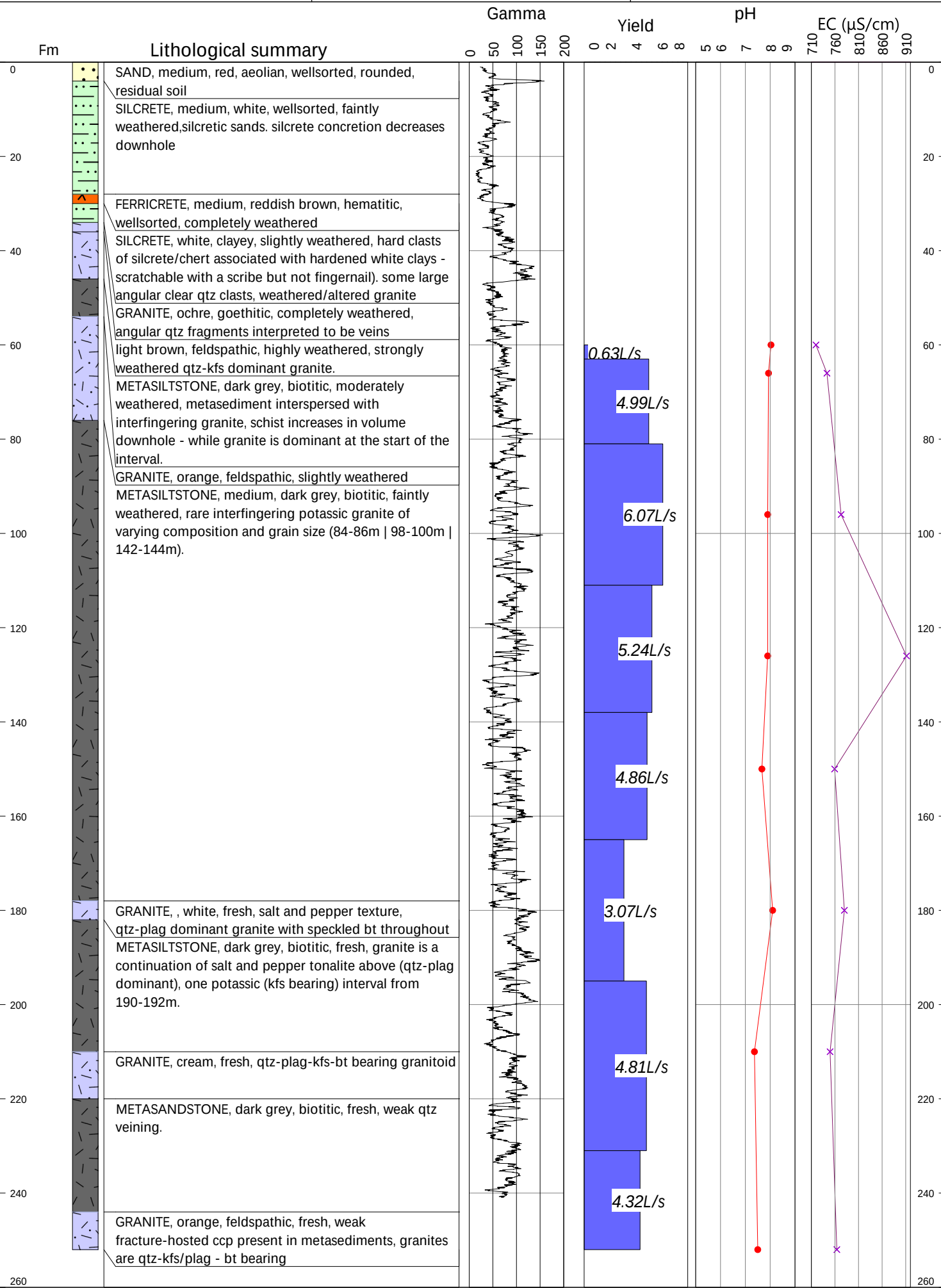
Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 395983 mE / 7699050 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 27/11/2022 Construction end date: 30/11/2022 Inclination: -90° Depth drilled: 228 m BGL	Final airlift yield: 0.2 L/s EC: 710 µS/cm pH: 9 Static Water Level: 42.20 m bgl Temp: °C
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Additional notes:

WINU1244 - Composite Bore Log

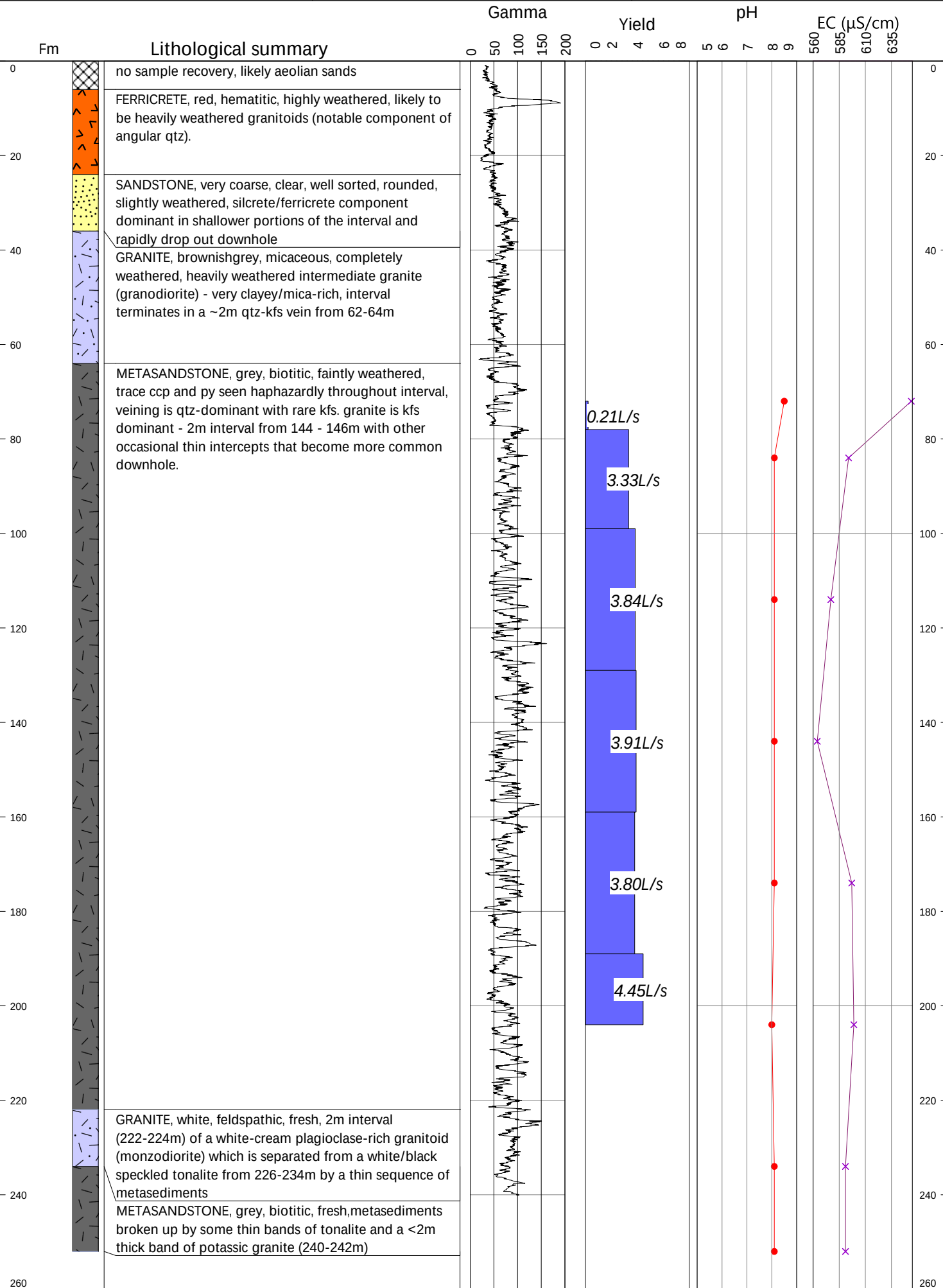
Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 397148 mE / 7696087 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 23/11/2022 Construction end date: 26/11/2022 Inclination: -90° Depth drilled: 252 m BGL	Final airlift yield: 4 L/s EC: 764 µS/cm pH: 8 Static Water Level: 23.20 m bgl Temp: °C
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Additional notes:

WINU1245 - Composite Bore Log

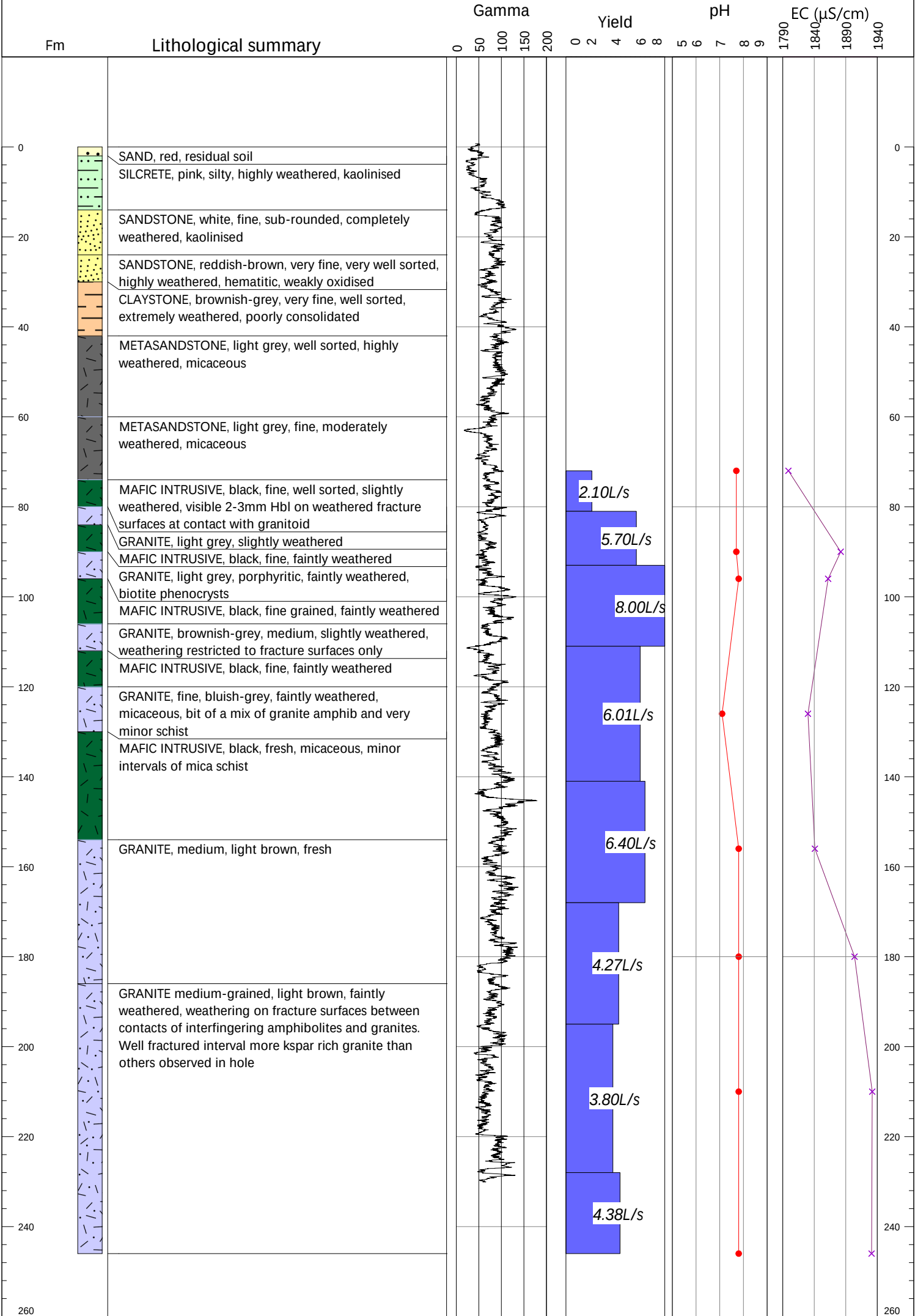
Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 398145 mE / 7694770 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 20/11/2022 Construction end date: 22/11/2022 Inclination: -90° Depth drilled: 252 m BGL	Final airlift yield: 4 L/s EC: 591 µS/cm pH: 8 Static Water Level: 19.27 m bgl Temp: °C
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Additional notes:

WINU1246 - Composite Bore Log

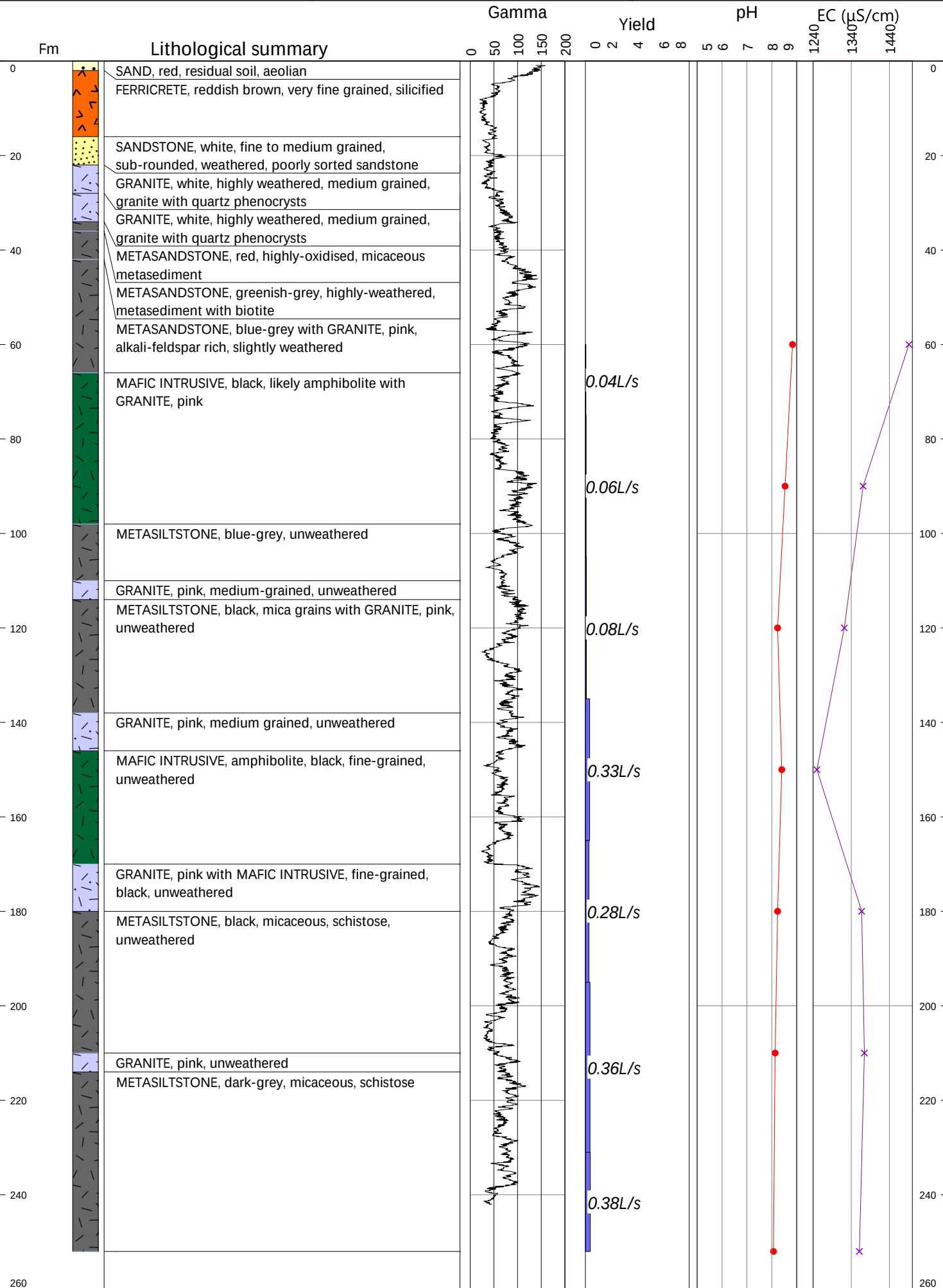
Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 397257 mE / 7693969 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 14/11/2022 Construction end date: 15/11/2022 Inclination: -90° Depth drilled: 246 m BGL	Final airlift yield: 4 L/s EC: 1931 µS/cm pH: 8 Static Water Level: 17.62 m bgl Temp: °C
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Additional notes:

WINU1247 - Composite Bore Log

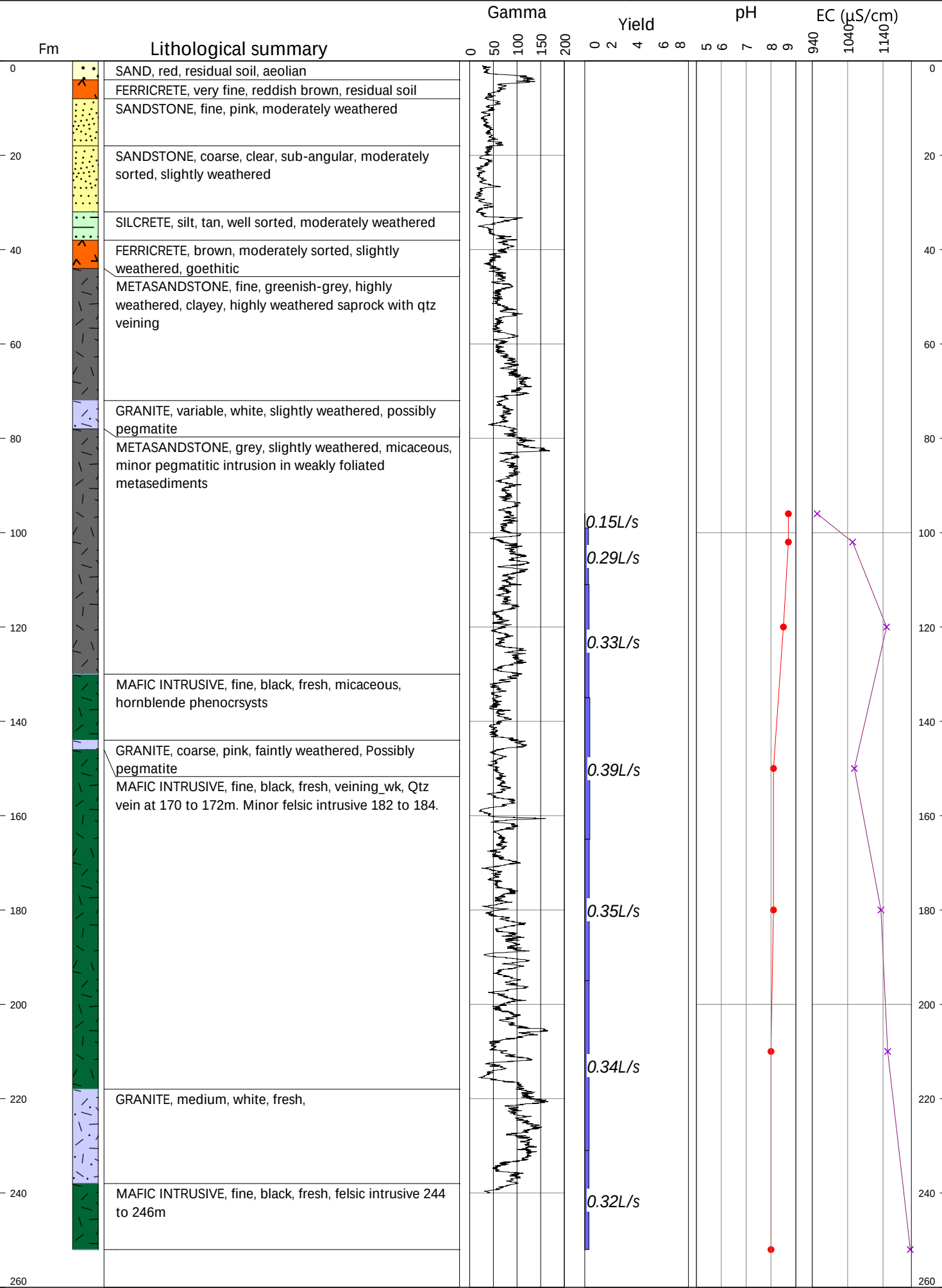
Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 396146 mE / 7695577 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 18/11/2022 Construction end date: 19/11/2022 Inclination: -90° Depth drilled: 252 m BGL	Final airlift yield: 0.3 L/s EC: 1346 µS/cm pH: 8 Static Water Level: 26.11 m bgl Temp: °C
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Additional notes:

WINU1248 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 391988 mE / 7696720 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 12/11/2022 Construction end date: 13/11/2022 Inclination: -90° Depth drilled: 252 m BGL	Final airlift yield: 0.3 L/s EC: 1153 µS/cm pH: 8 Static Water Level: 38.17 m bgl Temp: °C
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Additional notes:

Appendix D. Rimfire RC Drilling and Target Identification

Memorandum

Subject	Rimfire target identification based on RC drilling results		
Date	20 January 2023	Pages	8
To	Emma McGivern	From	Gerhard Jacobs
CC	Phil Denby Ravi Bhat		
Project no.	311012-01475	Doc no.	Rev 1
Project	Winu Hydrology & Hydrogeology 2023		

1 Introduction

Advisian was contracted by Rio Tinto Copper (RTC) to assist with a hydrogeological field program to aid the understanding and characterisation of regional groundwater resources around the Winu Project area.

Rimfire is situated approximately 25 km east southeast of the main Project area (Figure 1-1) and is one of the targets for the project water supply. Preliminary groundwater exploration at Rimfire, conducted in 2021 and November 2022, included reverse-circulation (RC) drilling to provide indicative hydrogeological, lithological, and drilling condition information.

This document describes the methodology and outcomes of the completed RC drilling program and recommends locations for further water investigation.

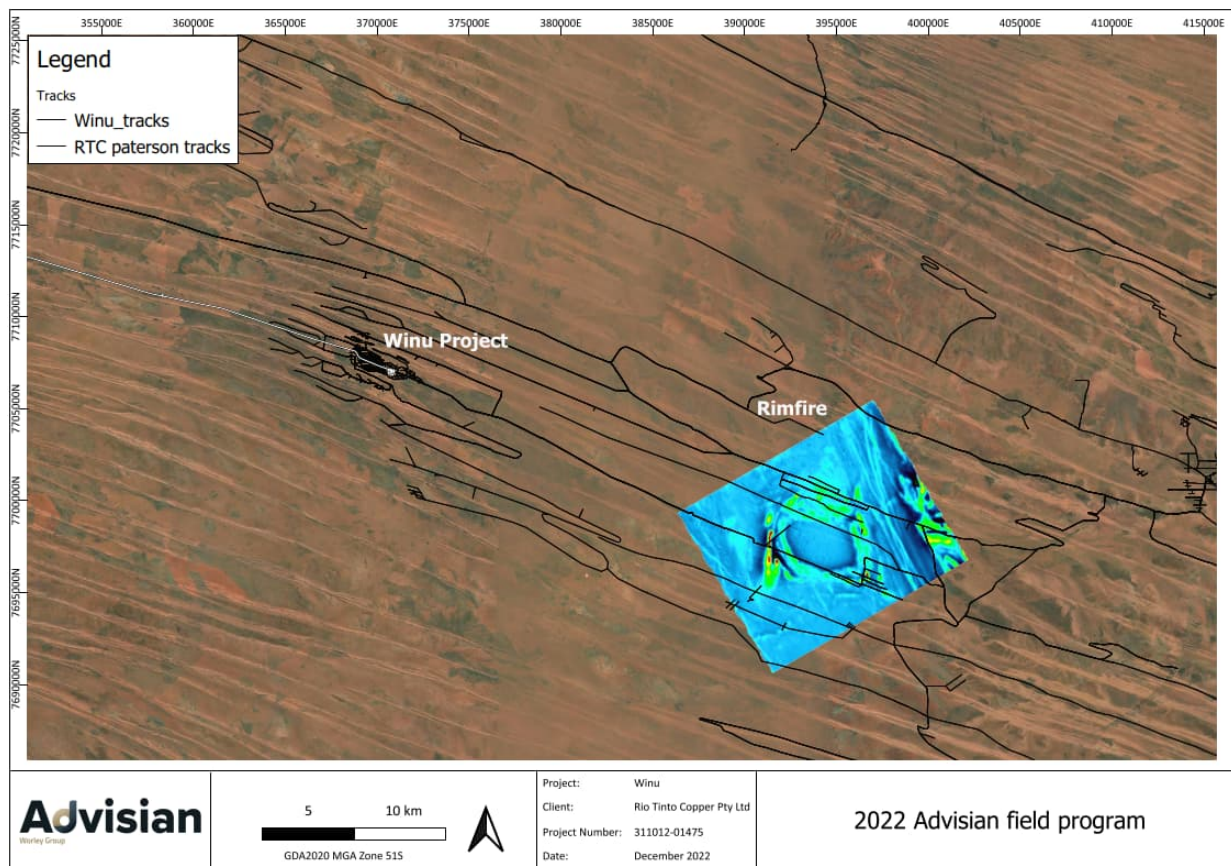


Figure 1-1 Rimfire location in relation to the project area

2 Reverse Circulation Program

2.1 Drilling methodology

RTC engaged drilling contractors Ranger Drilling (Ranger) to undertake the exploratory drilling at Rimfire in 2022. The approach involved drilling and installing PVC collars (for hole stability) to approximately 60 m before continuing with RC drilling to end of hole.

Lithology was logged by a RTC geologist and downhole geophysical surveys (Gamma) were completed by the drilling contractor after hole completion. Additional information from RC drilling during mineral exploration in 2021 was used, lithology and airlift data was collected by a RTX geologist, however, no other information was available for those holes.

2.2 Progressive water yield methodology

Once water was encountered during drilling, progressive water yield was estimated every 30 metres by airlift bucket testing. The test procedure is presented in Appendix A and involved:

- Drill rods were pulled back 1 metre from bottom and airlifting was performed with a constant pressure through the main drill string;
- Constant airflow was maintained for 15 minutes, and the produced water flow measured. Airlifting was continued for an additional 10 minutes, with produced water flow measured at 20 and 25 minutes;
- For flows below 0.5 L/s a 20 L bucket was used, and for flows above 0.5 L/s a 50 L bucket was used;
- Water quality (pH, EC) was recorded at each test; and
- A final airlift flow test was performed at the bottom of hole, with 4 measurements 15 minutes apart

3 Results

At Rimfire, six RC holes were drilled by RTX during mineral exploration in 2021 and seven RC bores were drilled in November 2022. The results are summarised on Table 3-1 and in Figure 3-1. Final bore logs are presented in Appendix B (lithology logs for WINU1243, 1244 and 1245 were not available at the time of reporting).

Table 3-1 Summary of RC drilling results

BH_ID	Easting	Northing	Dip	Bore Depth (m)	Final Airlift (L/s)	Final pH	EC (uS/cm)	Water Level (m bgl)
RMFR0006*	395102	7695834	-	240	good yield	-	-	-
RMFR0007*	395340	7695893	-	252	good yield	-	-	-
RFRN0002*	394180	7700373	-	210	6.6	-	-	-
RFRS0001*	397368	7696006	-	120	5	-	-	-
RFRS0002*	396438	7696350	-	102	5	-	-	-
RFRN0003*	395096	7699356	-	216	0.4	-	-	-
WINU1242	391913	7698204	-90	252	0.3	8.4	1409	38.44
WINU1243	395983	7699050	-90	228	0.2	8.63	710	-
WINU1244	397148	7696087	-90	252	4.2	7.4	756	-
WINU1245	398145	7694770	-90	252	3.8	8.1	591	19.27
WINU1246	397257	7693969	-90	246	4.4	7.8	1931	17.62
WINU1247	396146	7695577	-90	252	0	0	0	26.11
WINU1248	391988	7696720	-90	252	0.3	8	1153	38.17

**Low reliability as yields were estimated only and no proper airlift results are available*

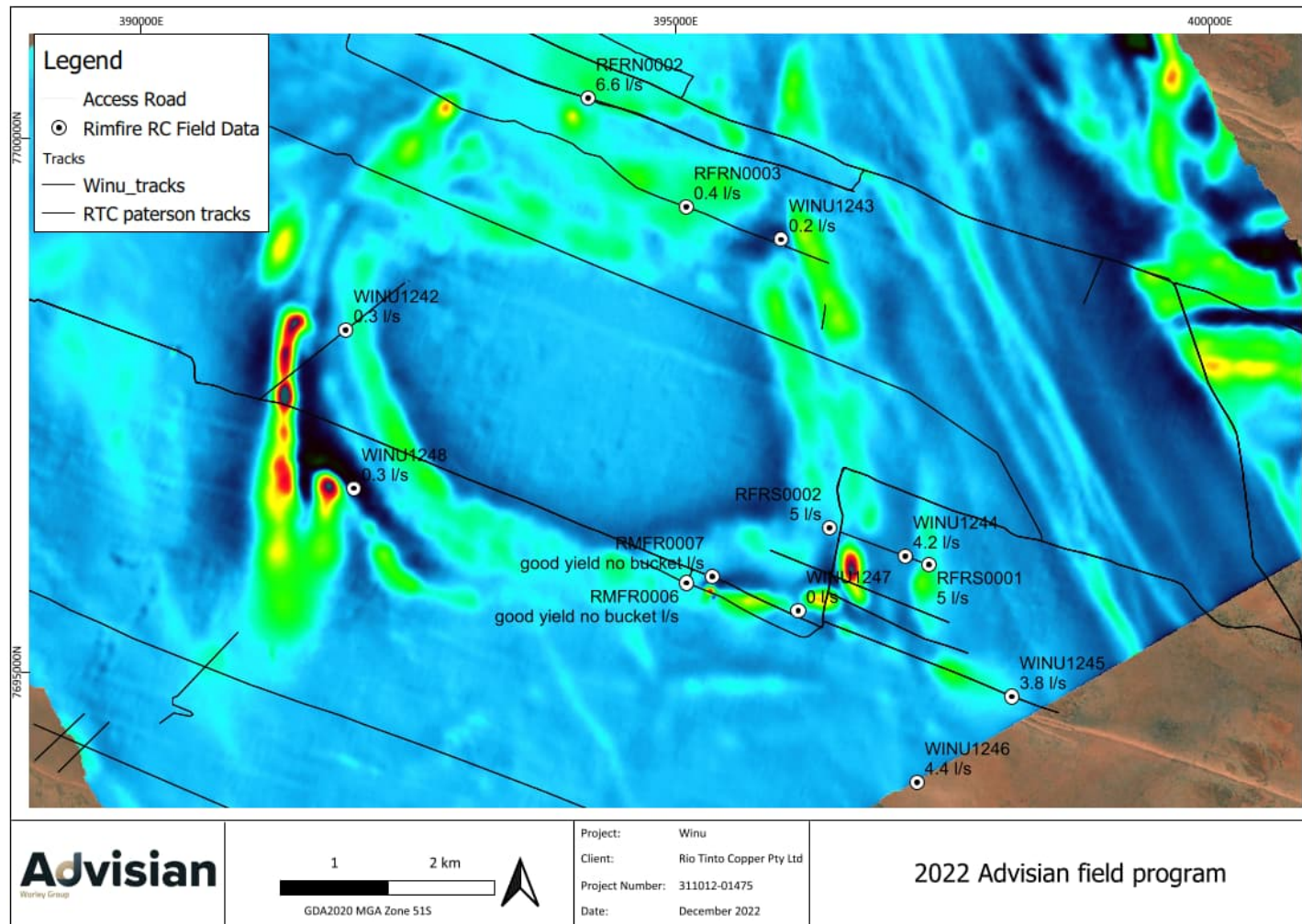


Figure 3-1 Rimfire RC drilling results

3.1 Discussion

RC holes which produced water or water bearing sections appear to be structurally controlled and associated with magnetic anomalies/lineaments in the vicinity of the granitic intrusive, particularly the longer lineaments interpreted in the magnetic survey area. Of the thirteen holes drilled, 8 produced airlift yields between 3.8 and 6.6 L/s.

3.2 Proposed Locations

To further evaluate the Rimfire groundwater resource, one production bore, and four monitoring bores are proposed on locations.

The proposed bore locations are located on existing RC drill pads, or preselected placeholder targets provided by RTC in 2022 and as presented on Table 3-2 and in Figure 3-2.

Table 3-2 Proposed bore locations for Rimfire

Proposed BH_ID	Placeholder/pad	Easting	Northing	Proposed Depth (m)	Purpose
Rimfire_PB01	WINU1244/Rimfire_RC5	397148	7696087	250	Pump Test
Rimfire_MB01	WINU1244/Rimfire_RC5	397148	7696092	250	Close monitoring location
Rimfire_MB02	Rimfire_PB11_Placeholder	397045	7695444	250	North-south lineament
Rimfire_MB03	Rimfire_PB2_Placeholder	397554	7695467	250	Regional north-south lineament
Contingency					
Rimfire_MB04	WINU1245/Rimfire_RC6	398146	7694770	250	Regional north-south lineament, far monitoring location

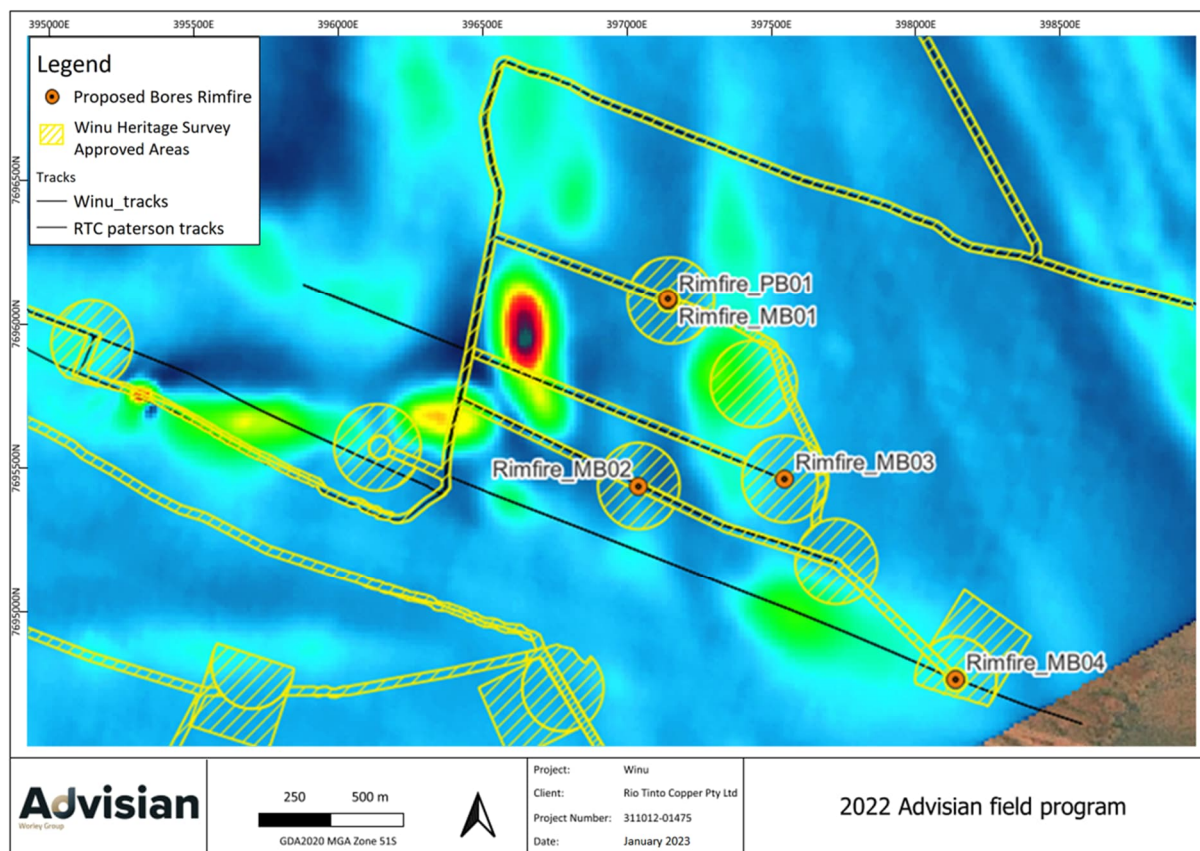


Figure 3-2 Proposed bore locations for Rimfire

4 Conclusion

The proposed bore locations based on the RC drilling at Rimfire is summarised below:

- Results from six previously drilled and seven recently drilled (November 2022) RC bores were used to identify higher yielding areas around Rimfire;
- A total of four bores are proposed, with 1 contingency monitoring bore location in the event any of the primary locations are inaccessible;
- Existing open RC holes should be used opportunistically as monitoring location during pumping test to broaden the monitoring network; and
- All bores should be constructed in accordance with RTC 26D license CAW207403(1) dated 23 May 2022 issued for tenement E45/4822 – Winu Project



Appendix A

Bucket Testing Methodology

This document has been revised from Golder 2020, 1. Hydrogeology data for RC pilot hole program –reinjection area

1.0 Hydrogeology data for RC pilot hole program

The pilot holes are being drilled to gather hydrogeological information including geology, groundwater observations, and undertake geophysical logging of holes. The following information is provided as a guide, please ask the RTC supervisor or Advisian Hydrogeologist if you have any questions.

The following data collection forms are available for use:

- RC Pilot Drilling Cover Sheet - For recording general hole data
- RC Drillers Log – for recording depths, lithology, groundwater observations, and other drilling information
- RC Pilot Drilling Groundwater Log – for recording water quality readings, and flow rate observations

1.1 Logging the RC drill cuttings

Using the RC Drillers log, record the depth interval, name of formation if known (e.g., surface sand, Permian sandstone, Permian mudstone, metasediments), name (e.g., SANDSTONE, CLAYSTONE, SANDY CLAY, METASEDIMENT etc.), note the colour, grain size, weathering, and any other relevant information.

Composite samples are to be collected in the following way:

- Drill cutting to be collected in chip trays at 2m intervals following the RTC procedure
- Bagged samples for chemical assay (one composite sample every 2m drilled), also following the RTC procedure.

1.2 Groundwater observations

Several observations for groundwater can be made during the RC drilling, which are:

- First water strike(s) - can be more than one if multiple aquifers are present
 - Note depth on the RC driller log
 - Conduct an airlift bucket test (Instructions below)
 - Record water quality of sample (see instructions below)
 - Record any changes in yield whilst drilling
 - Where yield increases/decreases, a note on the RC drillers log in comments.
- Note on RC drillers log whether water is present (or not) at the base of the Permian sandstone/ contact with mudstone, or in any other locations above mudstone.
- Water quality measurements and airlift yields
 - Through water bearing formations, undertake an airlift yield bucket test at the end of every 30m-drilled (see instructions below)

- Also record the water quality of the airlift yield sample. Complete a bucket test and record water quality if any sudden changes in yield are noted during drilling and note on the PLOD
 - E.g. – 200m hit fracture and water yield doubled
 - Intermittent airlift results recorded after 5 minutes of airlifting at a constant pressure
- At the designed hole depth (or final hole depth), conduct a final, airlift yield of at least 1 hour with a bucket test conducted every 15 minutes and record this data in the “final yield test” section on the *RC Drillers Log*
- Measure the groundwater level in the morning after drilling is completed, recording the following information:
 - Date / time
 - Depth to water (metres below ground level)

2.0 INSTRUCTIONS: Airlift yield bucket test

A general methodology for the driller is outlined below:

2.2 Continuous airlift yield bucket test methodology (every 30m)

1. Pull the bit back slightly from the bottom of the hole
2. Reduce the air compressor pressure/flow so more air is used to lift water rather than get blown into the formation. Pressure can be adjusted to the conditions, the rig and observation of flow rate, however 300 psi has reportedly worked well.
3. Record the pressure used and try to keep it consistent (so it is comparable between holes)
4. Three tests to be done at each depth.
5. Lift water from the hole for 15 minutes before the first test, and 5 minutes between subsequent tests.
6. Collect a groundwater sample for quality testing – pH and eC
7. Use a 50L bucket and record (in seconds) how long it takes to fill to the top
 - To calculate the rate in Litres / second – divide 50L/seconds
 - E.g. – 50L bucket filled in 25 seconds = 2L/s
8. Record the flow rate and groundwater quality data in the Water Data Log

Please note any observations related to groundwater flow on the RC driller log

2.3 End of hole bucket test methodology

1. Pull the bit back slightly from the bottom of the hole
2. Reduce the air compressor pressure/flow so more air is used to lift water rather than get blown into the formation. Pressure can be adjusted to the conditions, the rig and observation of flow rate, however 300 psi has reportedly worked well.
3. Record the pressure used and try to keep it consistent (so it is comparable between holes)
4. Four tests to be done at end of hole.
5. Lift water from the hole for 15 minutes before the first test, and 15 minutes between subsequent tests.
6. Collect a groundwater sample for quality testing – pH and eC
7. Use a 50L bucket and record (in seconds) how long it takes to fill to the top
 - To calculate the rate in Litres / second – divide 50L/seconds
 - E.g. – 50L bucket filled in 25 seconds = 2L/s
8. Record the flow rate and groundwater quality data in the Water Data Log
9. Total time 1 hour

Please note any observations related to groundwater flow on the RC driller log

3.0 INSTRUCTIONS: Record water quality parameters

Water quality parameters temperature, pH, EC (and TDS derived) are to be recorded for each airlift observation. The following information is required:

- The pH / EC meter should be calibrated in the morning each day (if possible) by the Advisian hydrogeologist
- A date and time recorded for each observation.
- Measure and record field water quality using the pH / EC meter provided. Write units for EC, which may be micro-Siemens per centimetre ($\mu\text{S}/\text{cm}$), milli-Siemens per metre (mS/m)
- Other observations on clarity, odour, suspended solids etc. can be recorded.

Appendix B

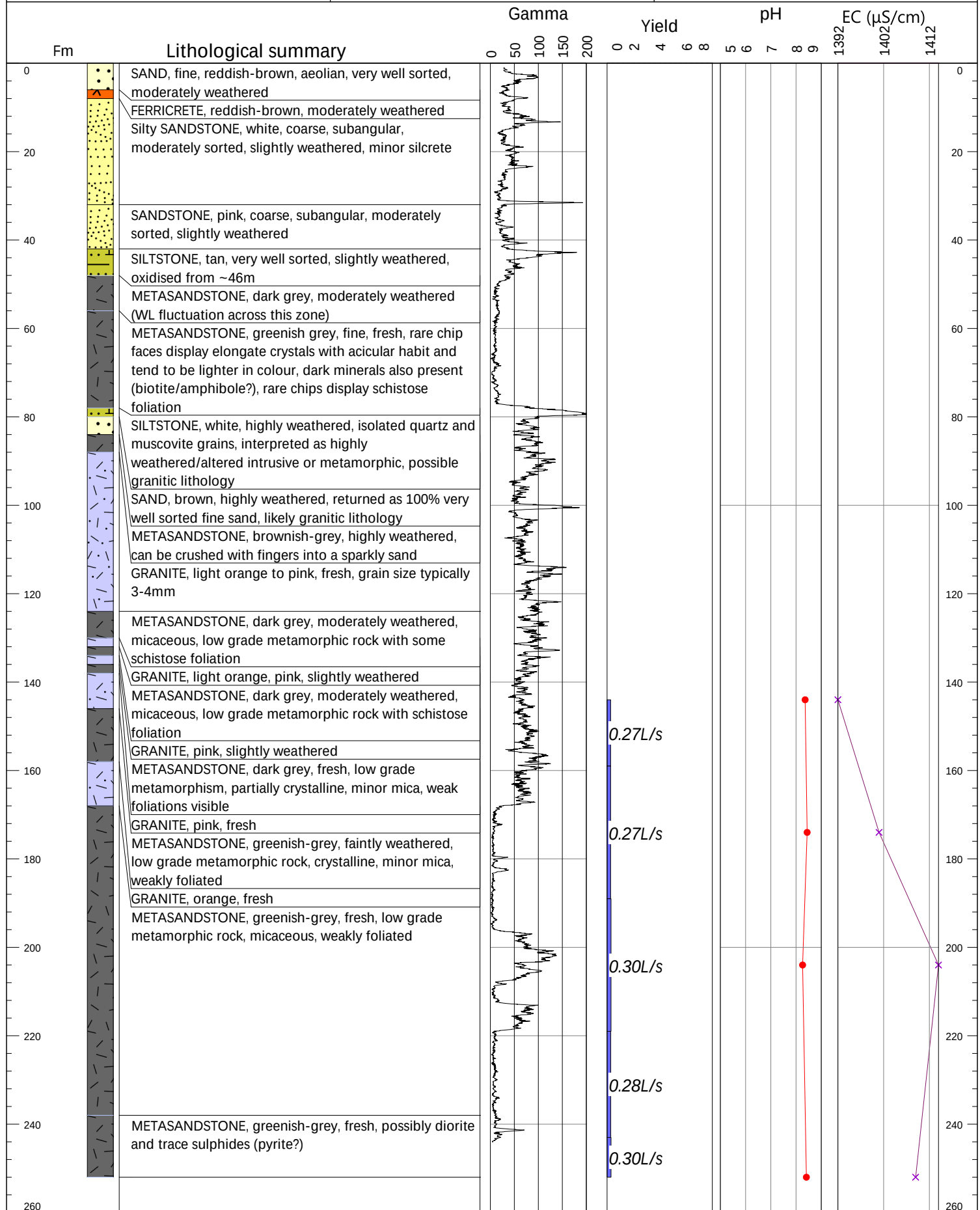
RC bore logs

WINU1242 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 391913 mE / 7698204 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 31/10/2022
Construction end date: 11/11/2022
Inclination: -90°
Depth drilled: 252 m BGL

Final airlift yield: 0.3 L/s
EC: 1409 µS/cm
pH: 8
Static Water Level: 38.48 m bgl
Temp: °C



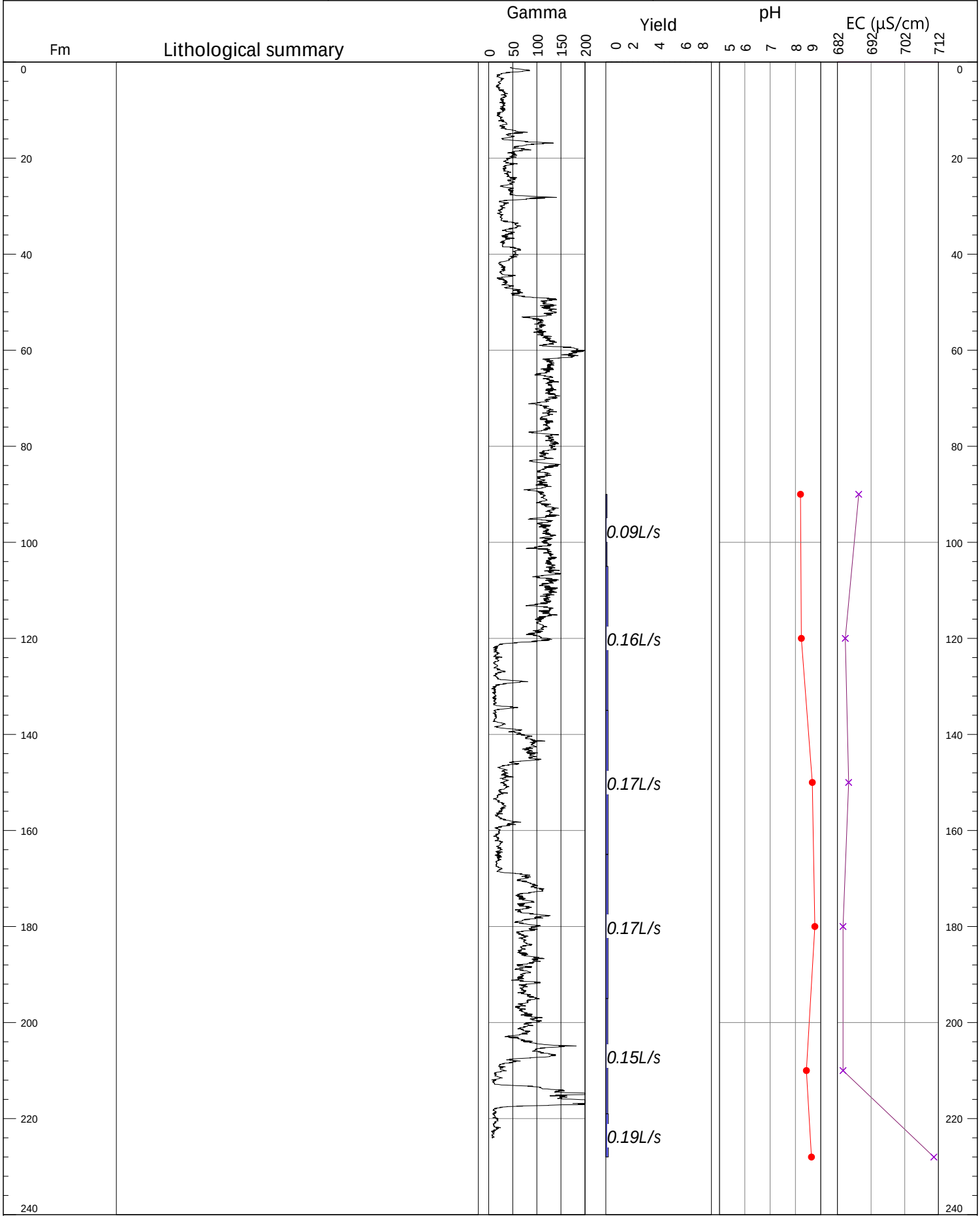
Additional notes:

WINU1243 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 395983 mE / 7699050 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 27/11/2022
Construction end date: 30/11/2022
Inclination: -90°
Depth drilled: 228 m BGL

Final airlift yield: 0.2 L/s
EC: 710 μ S/cm
pH: 9
Static Water Level: m bgl
Temp: °C



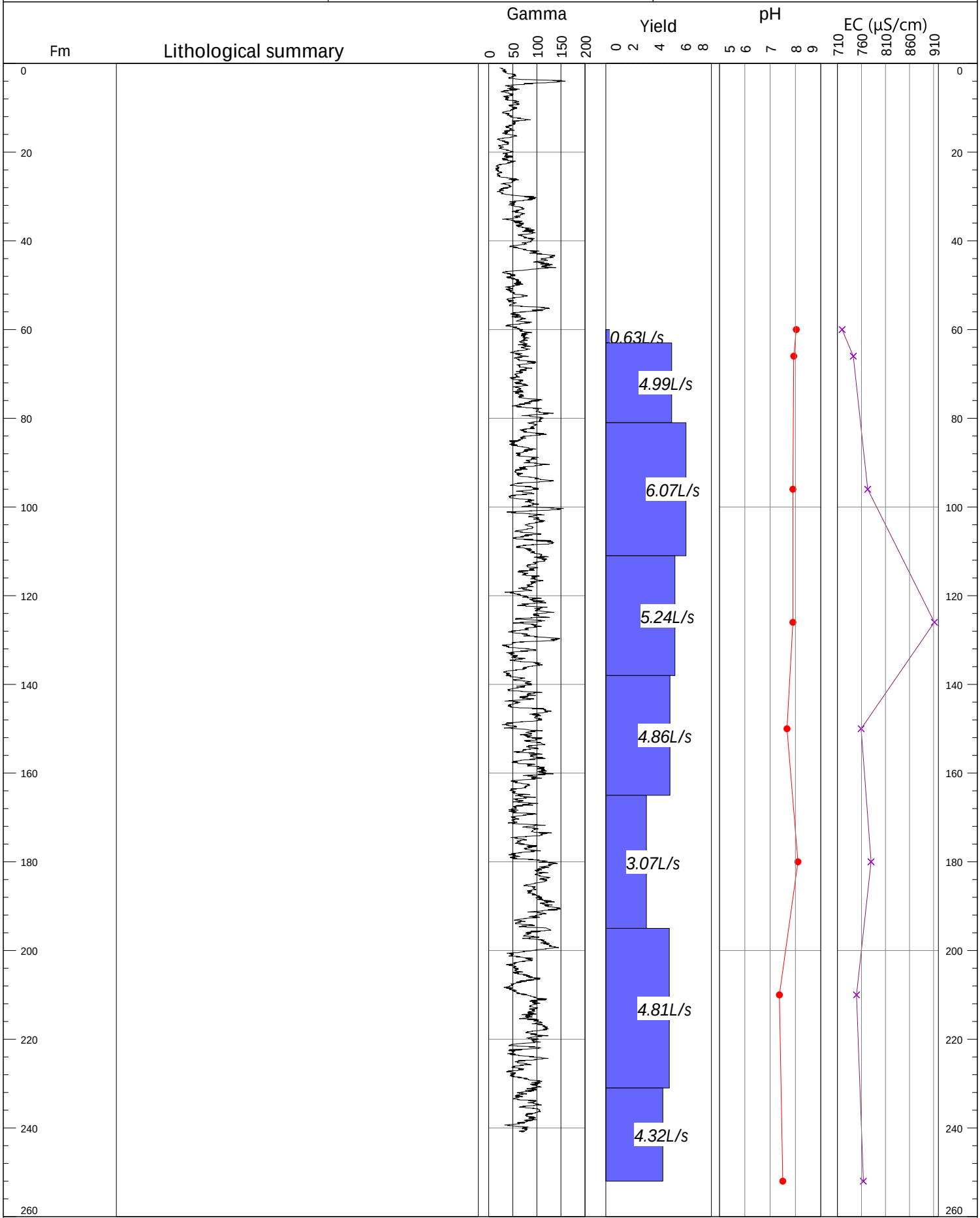
Additional notes:

WINU1244 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 397148 mE / 7696087 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 23/11/2022
Construction end date: 26/11/2022
Inclination: -90°
Depth drilled: 252 m BGL

Final airlift yield: 4 L/s
EC: 764 µS/cm
pH: 8
Static Water Level: m bgl
Temp: °C



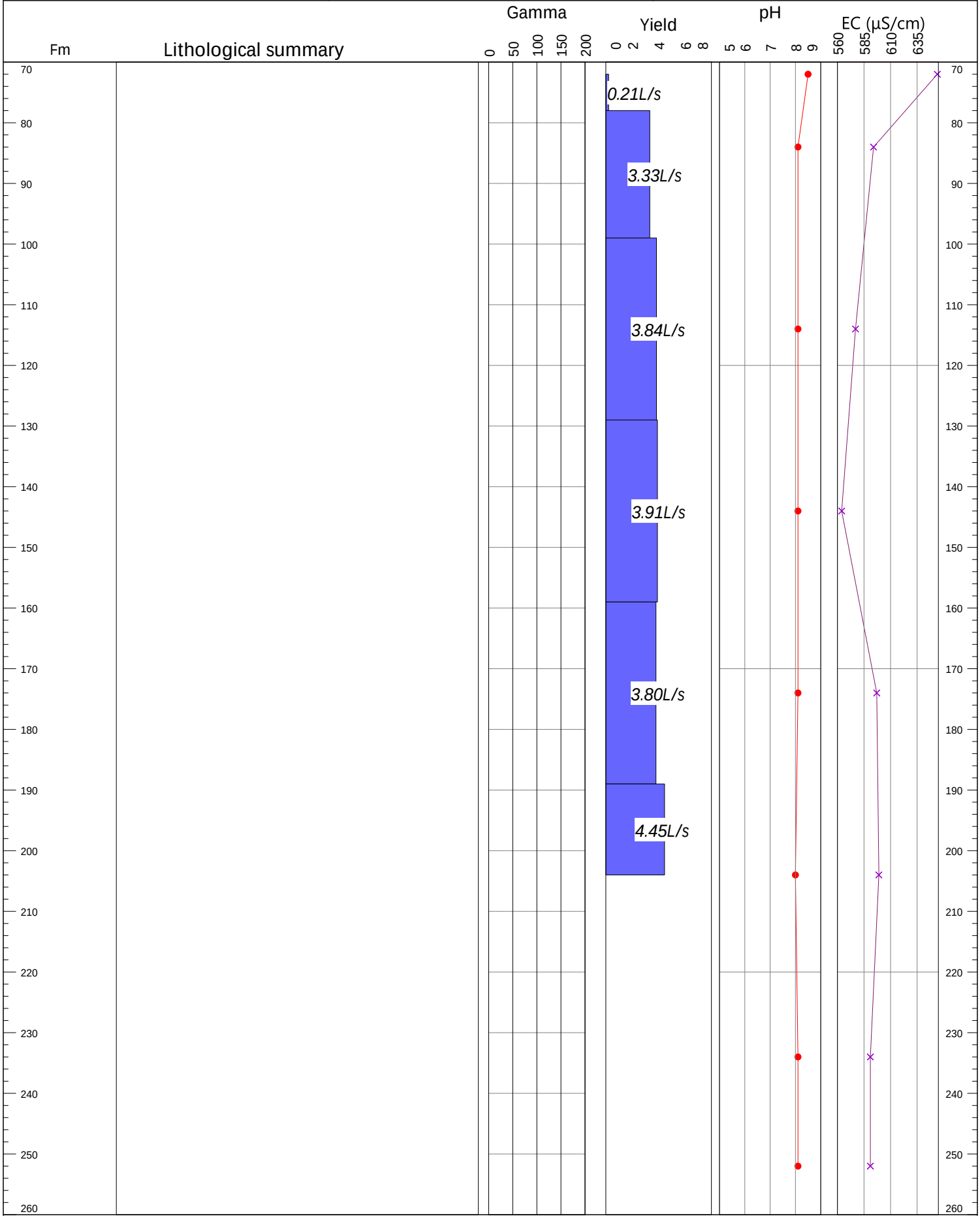
Additional notes:

WINU1245 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 398145 mE / 7694770 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 20/11/2022
Construction end date: 22/11/2022
Inclination: -90°
Depth drilled: 252 m BGL

Final airlift yield: 4 L/s
EC: 591 $\mu\text{S}/\text{cm}$
pH: 8
Static Water Level: 19.27 m bgl
Temp: °C



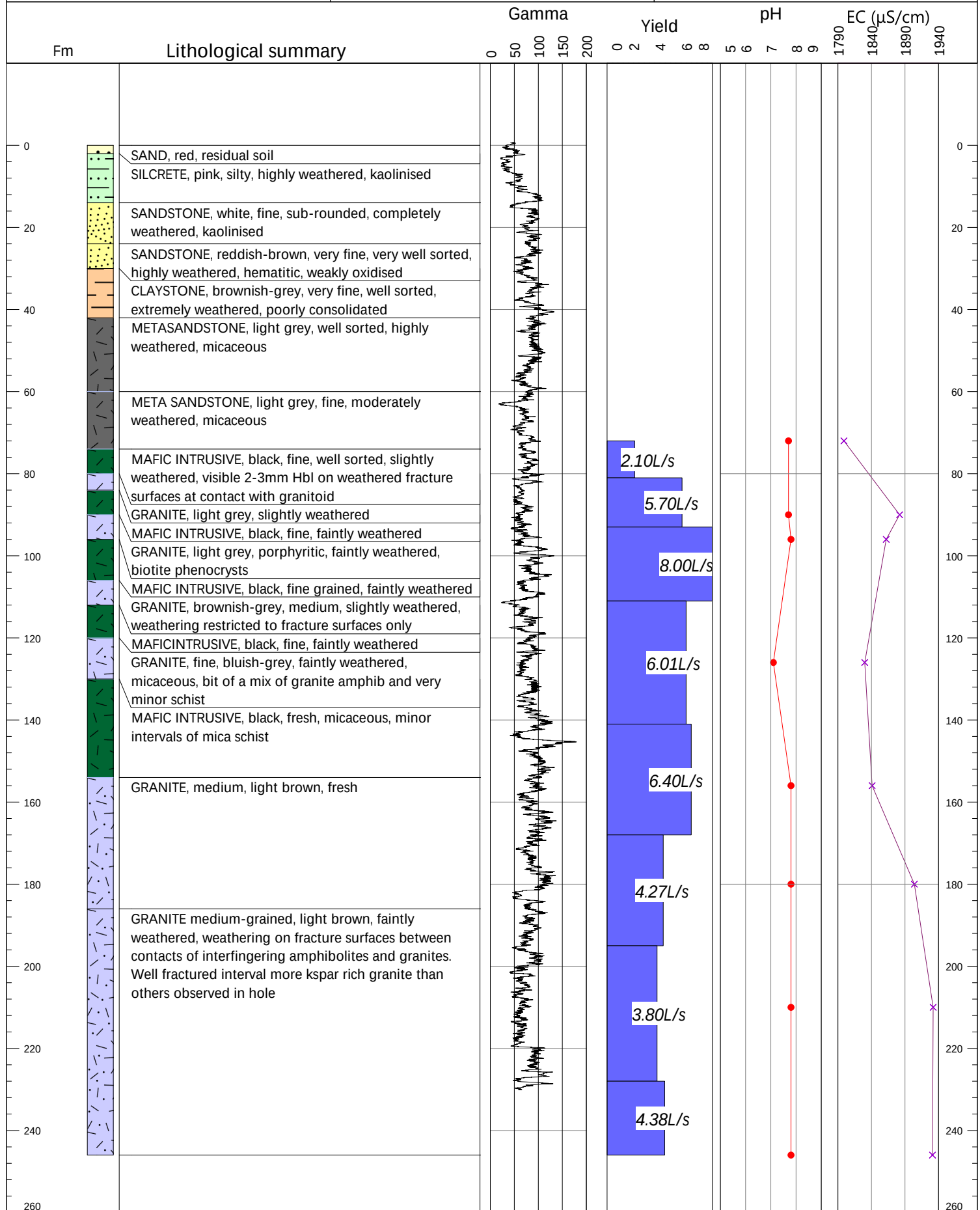
Additional notes:

WINU1246 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 397257 mE / 7693969 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 14/11/2022
Construction end date: 15/11/2022
Inclination: -90°
Depth drilled: 246 m BGL

Final airlift yield: 4 L/s
EC: 1931 µS/cm
pH: 8
Static Water Level: 17.62 m bgl
Temp: °C



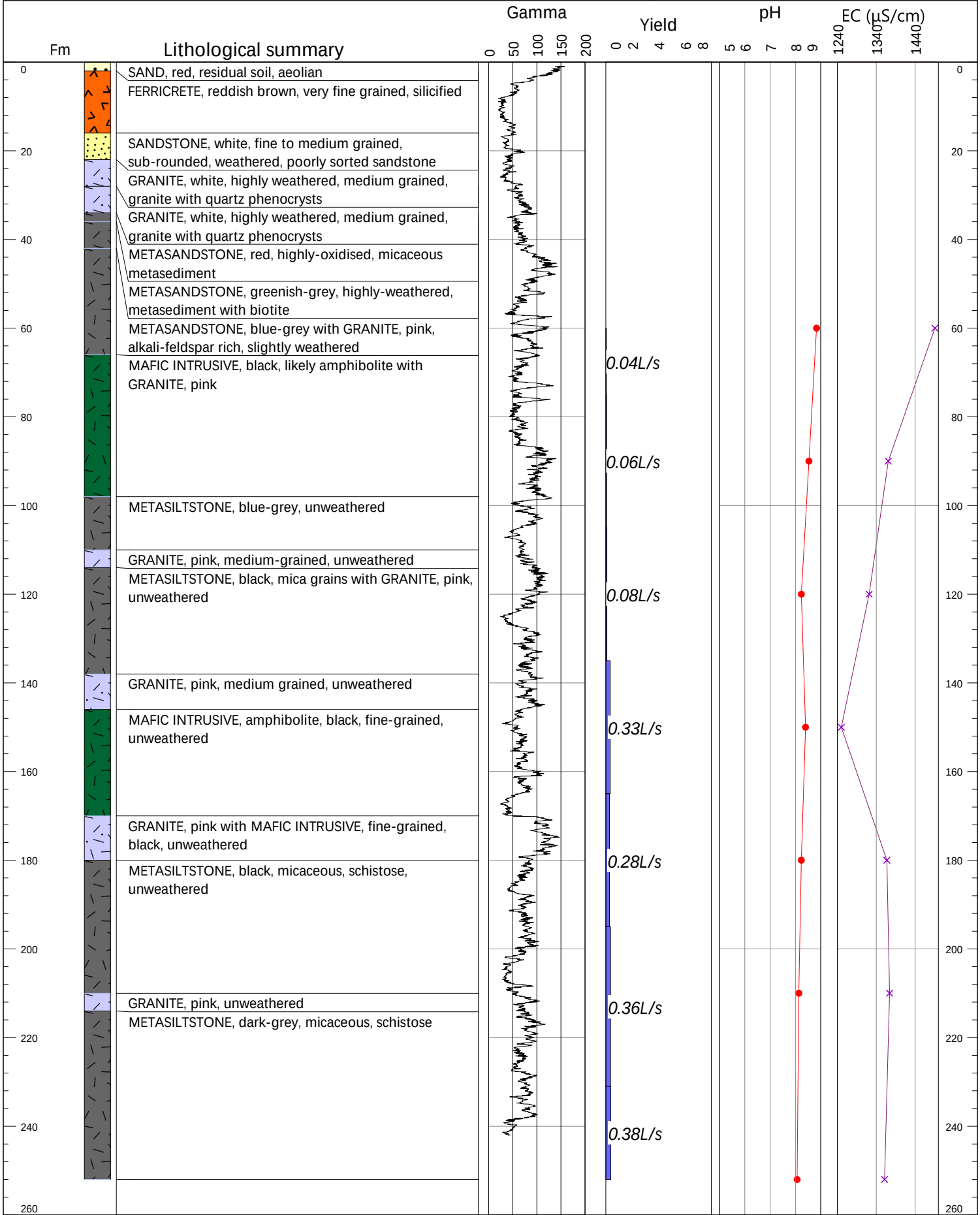
Additional notes:

WINU1247 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 396146 mE / 7695577 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 18/11/2022
Construction end date: 19/11/2022
Inclination: -90°
Depth drilled: 252 m BGL

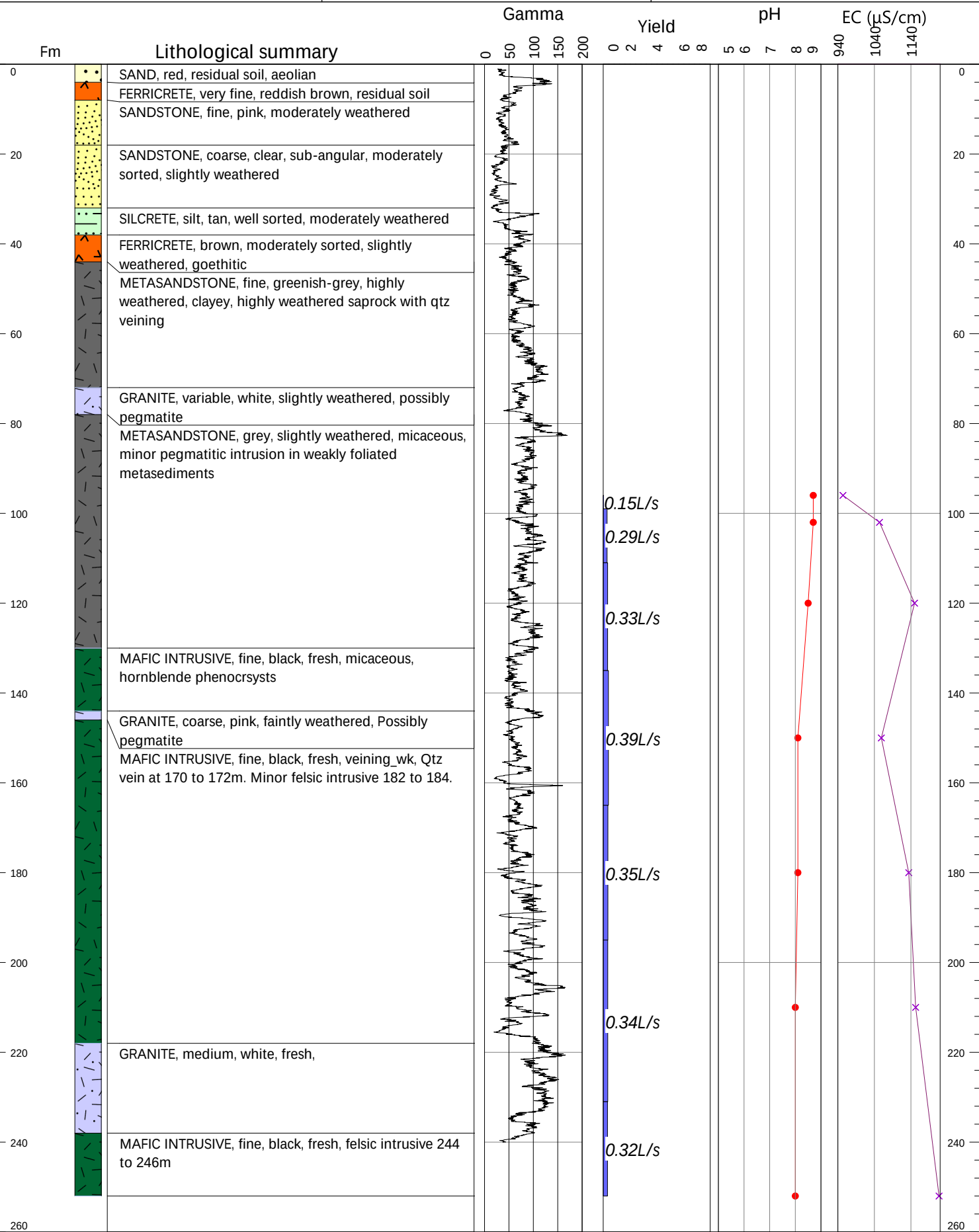
Final airlift yield: 0.3 L/s
EC: 1346 µS/cm
pH: 8
Static Water Level: 26.11 m bgl
Temp: °C



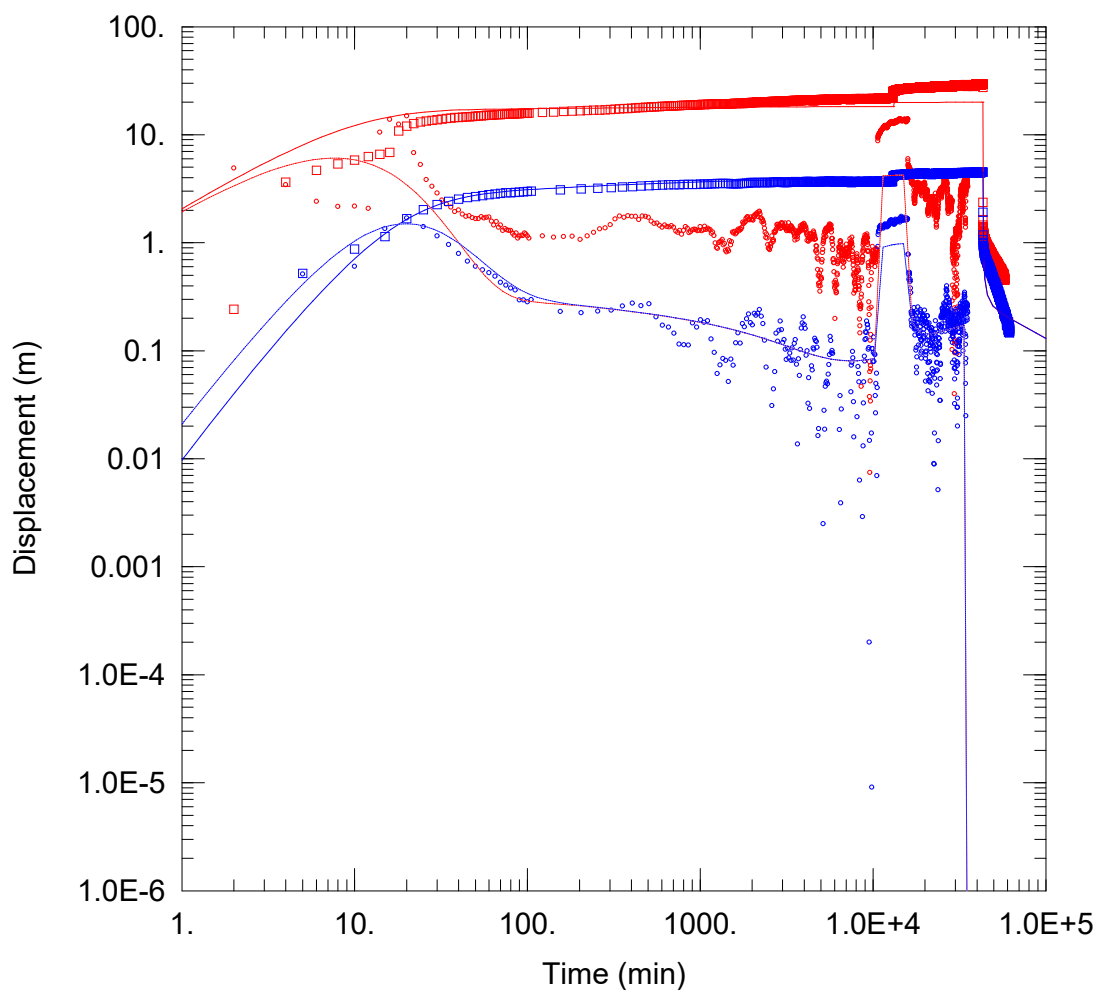
Additional notes:

WINU1248 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 391988 mE / 7696720 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 12/11/2022 Construction end date: 13/11/2022 Inclination: -90° Depth drilled: 252 m BGL	Final airlift yield: 0.3 L/s EC: 1153 µS/cm pH: 8 Static Water Level: 38.17 m bgl Temp: °C
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Appendix E. Aqtesolv Analysis Plots



WINU1308 CRT

Data Set: C:\...\WINU1308 CRT_gj_3.aqt

Date: 08/07/24

Time: 08:44:38

PROJECT INFORMATION

Company: Worley

Client: Rio Tinto

Project: 3111012-01475

Location: Winu

Test Well: WINU1308

Test Date: 18/05/2024

AQUIFER DATA

Saturated Thickness: 115. m

Anisotropy Ratio (Kz/Kr): 0.001025

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1308	397140	7696125

Observation Wells

Well Name	X (m)	Y (m)
□ WINU1308	397140	7696125
□ WINU0942	397140.0897	7696127.521

SOLUTION

Aquifer Model: Unconfined

Solution Method: Moench

T = 389.4 m²/day

Sy = 0.004308

Sw = 21.9

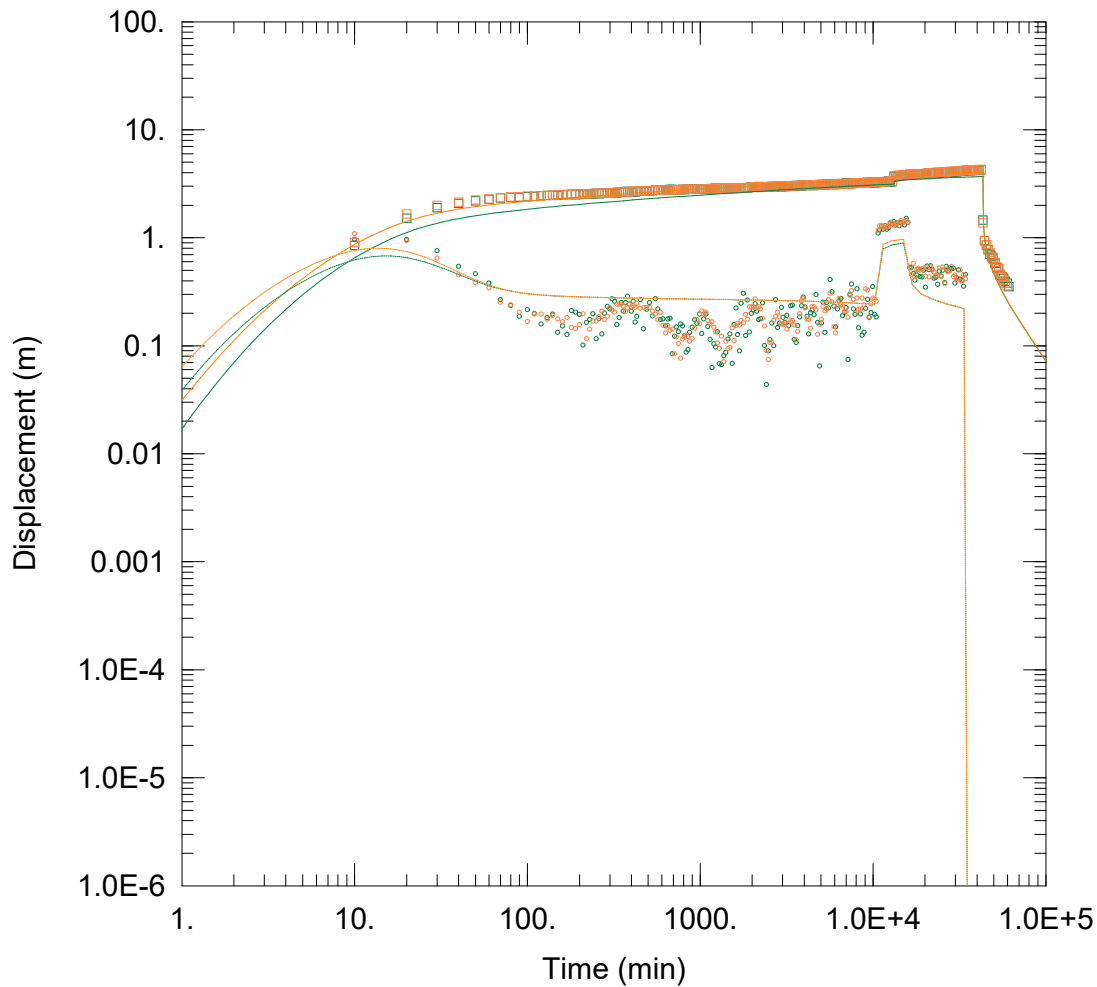
r(c) = 0.2375 m

S = 0.0001478

Kz/Kr = 0.001025

r(w) = 0.182 m

alpha = 158.5 min⁻¹



WINU1308 CRT

Data Set: C:\...\WINU1308 CRT_gj_4.aqt

Date: 08/02/24

Time: 13:35:15

PROJECT INFORMATION

Company: Worley

Client: Rio Tinto

Project: 3111012-01475

Location: Winu

Test Well: WINU1308

Test Date: 18/05/2024

AQUIFER DATA

Saturated Thickness: 80. m

Anisotropy Ratio (Kz/Kr): 0.3311

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1308	397140	7696125

Observation Wells

Well Name	X (m)	Y (m)
□ WINU0943	397148.5877	7696059.788
□ WINU01244	397128.52	7696092.19

SOLUTION

Aquifer Model: Unconfined

Solution Method: Moench

T = 419.9 m²/day

S = 1.523E-5

Sy = 0.004176

Kz/Kr = 1.

Sw = 19.5

r(w) = 0.1288 m

r(c) = 0.125 m

alpha = 2.004E-8 min⁻¹

Appendix F. Groundwater Chemistry Analytical Results

Figure 12-1 Final field water quality parameters from Rimfire RC drilling and boreholes taken during airlifting at end of hole

BH ID	Easting (GDA94z51)	Northing (GDA94z51)	Date/Time	Airlift Depth (m BGL)	Screened Lithology	pH	EC (µS/cm)	Temperature (°C)
WINU0940	397045	7695444	13/05/2023 10:15	174	Granite	8.3	1488	NR
WINU0941	397554	7695467	23/06/2023 15:00	178	Granite / Metasediment	8.3	674	27.7
WINU0942	397148.2	7696105.8	24/06/2023 13:00	198	Granite / Metasediment	8.2	802	28
WINU0943	397152	7696072	01/07/2023 16:10	127	Granite / Metasediment	8.1	899	30.8
WINU1242	391913.15	7698203.49	03/11/2022 09:50	252	Full sequence	8.4	1409	31.2
WINU1243	395983.15	7699049.42	30/11/2022 10:00	228	Full sequence	8.6	720	NR
WINU1244	397128.52	7696092.19	26/11/2022 16:25	252	Full sequence	7.4	756	NR
WINU1245	398144.27	7694771.1	22/11/2022 14:35	252	Full sequence	8.1	591	NR
WINU1246	397254.12	7693967.33	15/11/2022 14:25	246	Full sequence	7.8	1931	NR
WINU1247	396146.15	7695575.91	19/11/2022 15:58	252	Full sequence	8.1	1346	NR
WINU1248	391988.32	7696722.51	13/11/2022 14:30	252	Full sequence	8.0	1217	NR
WINU1308	397140	7696125	05/05/2024 12:00	136	Granite / Metasediment	8.1	846	28.5

NR = Not recorded

Figure 12-2 Final field water quality parameters from Rimfire RC drilling and boreholes taken during airlifting at end of hole

Sample ID	Sample Date	CRT	pH	EC @ 25°C	TDS (Calc)	Susp. Solids	Total Hardness as CaCO3	Hydroxide Alk as CaCO3	Carbonate Alk as CaCO3	Bicarb. Alk as CaCO3	Total Alk as CaCO3	Si as SiO2	Sulfate as SO4 – Turbidi-metric	Cl	Ca	Mg	Na	K	Al	As	Cd
			pH Unit	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L
WINU0942 CRT1	16/07/2023	WINU0942	7.66	736	478	<5	113	<1	<1	110	110	64.9	53	137	24	13	110	11	<10	<1	<0.1
WINU0942 CRT2	30/07/2023		7.98	820	533	<5	83	<1	<1	113	113	65.9	38	147	15	11	102	13	-	-	-
WINU0942 CRT3	8/08/2023		7.9	758	493	<5	115	<1	<1	106	106	67.4	37	151	23	14	104	13	<10	<1	<0.1
WINU0940	23/08/2023		7.6	1330	864	<5	232	<1	<1	127	127	49	81	329	55	23	178	19	20	<1	<0.1
WINU0941	23/08/2023		7.64	581	378	<5	71	<1	<1	130	130	38.9	38	92	17	7	92	9	20	<1	<0.1
WINU0943	23/08/2023		7.36	736	478	15	113	<1	<1	100	100	66.6	32	154	24	13	95	11	20	<1	<0.1
WINU1308 CRT1	18/05/2024	WINU1308	7.97	803	522	<5	104	112	<1	<1	112	73	43	160	22	12	10	99	0.02	<0.001	<0.0001
WINU1308 CRT2	16/06/2024		7.66	729	474	29	113	92	<1	<1	92	76	33	154	24	13	11	97	<0.01	<0.001	<0.0001
Sample ID	Sample Date	CRT	Cr	Cu	Pb	Mn	Mo	Ni	Se	Zn	Fe	Hg	Ag	F	NH3 as N	NO2 as N	NO3 as N	NO2 + NO3 as N	Total Kjeldahl Nitrogen as N	Total Phosphorus as P	Total Phosphate
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
WINU0942 CRT1	16/07/2023	WINU0942	<1	<1	<1	<1	2	<1	<10	<5	<50	<0.04	<0.01	0.5	<0.01	0.01	6.32	6.33	0.6	0.04	0.12
WINU0942 CRT2	30/07/2023		-	-	-	-	-	-	-	-	-	-	-	0.4	<0.01	<0.01	6.68	6.68	0.6	0.02	<0.1
WINU0942 CRT3	8/08/2023		<1	<1	<1	2	2	6	<10	8	<50	<0.04	<0.01	0.5	<0.01	<0.01	6.69	6.69	0.8	0.04	0.13
WINU0940	23/08/2023		<1	<1	<1	<1	6	1	<10	6	<50	<0.04	<0.01	0.5	0.09	<0.01	7.54	7.54	0.7	0.05	0.16
WINU0941	23/08/2023		<1	<1	<1	9	5	<1	<10	5	<50	<0.04	<0.01	0.4	<0.01	<0.01	4.72	4.72	0.6	0.06	0.17
WINU0943	23/08/2023		<1	<1	<1	<1	2	<1	<10	9	<50	<0.04	<0.01	0.4	<0.01	<0.01	6.97	6.97	0.6	0.04	0.13
WINU1308 CRT1	18/05/2024	WINU1308	<0.001	<0.001	<0.05	<0.001	0.001	0.002	<0.001	<0.01	<0.005	<0.00004	<0.00001	0.6	<0.01	<0.01	6.9	6.9	0.6	<0.01	<0.10
WINU1308 CRT2	16/06/2024		<0.001	<0.001	<0.05	<0.001	<0.001	0.001	<0.001	<0.01	<0.005	<0.00004	<0.00001	0.5	0.02	<0.01	7.15	7.15	0.9	<0.01	<0.10

Appendix G. Groundwater Levels

Figure 12-3 Groundwater level observations from Rimfire, Winu aerodrome, and Texas areas

BH ID	Easting	Northing	Reference Elevation (m AHD)	Water Level (m BRL)	Water Level (m AHD)	Date
AKD10	395380	7690092	251.16	4.10	247.06	9/09/2023 12:30
WIDI0016	380724	7702789	268.15	56.72	211.43	11/09/2023 11:55
WINU0940	397045	7695444	262.05	24.06	237.99	9/09/2023 8:15
WINU0941	397554	7695467	259.02	20.98	238.04	10/09/2023 14:00
WINU0942	397148	7696105.8	261.35	24.15	237.20	10/09/2023 13:50
WINU0943	397152	7696072	261.32	23.7	237.62	10/09/2023 13:55
WINU0945	381619	7690844	292.38	40.79	251.59	12/09/2023 8:40
WINU0946	381975	7690375	293.21	41.96	251.25	9/09/2023 10:05
WINU0947	380586	7693101	291.01	45.63	245.38	9/09/2023 11:35
WINU1242	391913	7698203	268.17	38.44	229.73	9/09/2023 7:40
WINU1243	395983	7699049	269.56	42.25	227.31	12/07/2023 10:20
WINU1244	397128	7696092	260.94	23.59	237.35	12/07/2023 15:20
WINU1245	398144	7694771	258.60	19.28	239.32	12/07/2023 12:50
WINU1246	397254	7693967	260.86	17.37	243.49	12/07/2023 8:35
WINU1247	396146	7695575	272.27	34.50	237.77	12/07/2023 9:05
WINU1248	391988	7696722	265.24	32.94	232.30	9/09/2023 8:00
WINU1249	387062	7688811	284.43	30.66	253.77	9/09/2023 11:00
WINU1250	383930	7689704	288.56	38.67	249.89	9/09/2023 10:40
WINU1251	382663	7690152	292.51	41.73	250.78	9/09/2023 10:20
WINU1253	380659	7695093	285.99	45.27	240.72	9/09/2023 11:55
WINU1308	397140	7696125	261*	24.97	236.03	18/05/2024 10:00

*Inferred reference level – WINU1308 is pending survey