RIO TINTO COPPER PTY LTD

WINU Access Road H2 Assessment

H2 Report

Document no. Rev 0: REP-HG-042

4 July 2025

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Synopsis

Rio Tinto Copper Pty Limited (RTC) is planning to develop a copper-gold mine approximately 320 km east of Port Hedland in the Pilbara region of Western Australia. The proposed mine complex would be connected to the Great Northern Highway via an access road following the Nyangumarta Highway, Wirlkirr Wirlkirr Road and Copperhead Road.

Groundwater is intended to serve as the primary water supply for construction of the new access road and for dust suppression/maintenance. RTC is seeking a temporary 5C groundwater abstraction license for 1.0 GL per annum (approximately 32 L/s) over a two-year period.

To meet the project demand, a total of five production bores - WINU1320, WINU1322, WINU1323, WINU1324 and WINU1328 - have been installed along the access road alignment.

Water abstraction would be along this series of bores as the road construction progress. Each bore will be utilised for an approximate duration of 6 months, resulting in a total operational period of 24 months across all bores.

The proposed abstraction bores would utilise water from two aquifers:

- 0.4 GL/a from the Broome Aquifer and Lower Callawa Formation.
    - WINU1324 and WINU1328 (at the western end of the access road) target the unconfined Broome/Lower Callawa aquifer above the Jarlemai Siltstone
- 0.6 GL/a from the Lower Callawa and Unconfined Wallal aquifer where the Jarlemai Siltstone is absent
    - WINU1320, WINU1322 and WINU1323 (at the eastern end of the access road) target the unconfined lower Callawa/Wallal sandstone aquifer, where the Jarlemai Siltstone is absent

Assuming peak abstraction rate of 15 L/s over a 6-month period, drawdown is estimated to remain stabilised below 35 m at WINU1328, and below 4 m at the remaining bores.

Groundwater levels are projected to approach steady-state conditions within the first few days of pumping, and to fully recover (within 1 day) after pumping ceases. Given that drawdown is minimal, over-abstraction is unlikely, and the risk of long-term aquifer depletion is considered low.

Due to the absence of any nearby third-party mining, agricultural or environmental receptors and the shallow and localised nature of the drawdown cones around the proposed production bores, the risk of impacts on other groundwater users is considered negligible.

Disclaimer

PROJECT 311012-01475 - REP-HG-042: WINU Access Road H2 Assessment - H2 Report

Rev	Description	Originator	Reviewer	Worley Approver	Revision Date	Customer Approver	Approval Date
Rev A	Internal review	A Claassen / H Foster	G Jacobs	C Kraut	6 June 2025		
Rev B	Client Review	A Claassen / H Foster	G Jacobs	C Kraut	9 June 2025		
Rev 0	For Client Use	A Claassen / H Foster	G Jacobs	C Kraut	4 July 2025		

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Acronyms and abbreviations

Acronym/abbreviation	Definition
BOM	Bureau of Meteorology
m BGL	Metre below ground level
CRT	Constant Rate Test
DEM	Digital Elevation Model
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EC	Electrical Conductivity
Fm	Formation
GIS	Geographical Information System
GL	Gigalitre
H2	Basic hydrogeological assessment including drilling and test pumping
HSU	Hydrostratigraphic units
HDPE	High-Density Polyethylene
ID/OD	Inside/Outside Diameter
m AHD	Metres Australian Height Datum
m BGL	Metres Below Ground Level
MB/PB	Monitoring/Production Bore
NB	Nominal Bore
NMR	Nuclear Magnetic Resonance
PCD	Polycrystalline Diamond
PEC	Priority Ecological Community
PSM	Pells Sullivan Meynink
PVC	Polyvinyl Chloride
RC	Reverse circulation
RTC	Rio Tinto Copper
SG	Specific Gravity
SILO	Scientific Information for Landowner
SRT	Step Rate Test
SRTM	Shuttle Radar Topography Mission
SWI	Seawater interface
WCB	West Canning Basin
WIR	Water Information Reporting

1. Introduction

1.1 Overview

Rio Tinto Copper Pty Limited (RTC) is planning to develop a copper-gold mine and associated infrastructure targeting 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.

Connecting the Winu mining complex to the Great Northern Highway will be the access road following the Nyangumarta Highway, Wirlkirr Wirlkirr Road and Copperhead Road.

Groundwater is intended to be the primary water supply for construction of the new access road (earthworks, subgrade works, paving) and for dust suppression. A temporary water abstraction license for 1 GL/a is needed; 0.7 GL/a for road construction and 0.3 GL/a for dust suppression.

1.2 Key objectives and scope of assessment

The key objectives of this assessment were:

- Refine the hydrogeological conceptualisation along the mine access road
- Support the application of a 5C abstraction license, for up to 1.0 GL/a for the duration of construction (24 months)

To meet the objectives outlines above the following scope of works has been completed:

- Review historical geological, hydrogeological and hydrological assessments of the project area
- A field hydrogeological investigation program including drilling, installation and pumping tests of production and monitoring bores
- Analysis of pumping test results and water chemistry
- Identification of groundwater management strategies and monitoring requirements

This report has been prepared according to the requirements of the Department of Water and Environmental Regulation (DWER) Policy 5.12 for a basic hydrogeological assessment (H2).

1.3 Study area

From west to east, the access road will include parts of the Nyangumarta Highway, Wirlkirr Wirlkirr Road and Copperhead Road (Figure 1-1).

The study area occurs within the Canning-Kimberley Groundwater Management area.

The main groundwater resources within the area are the Broome Aquifer and the Wallal Aquifer, which contain fresh to brackish groundwater resources within their onshore extents (Pells Sullivan Meynink, (PSM), 2017).

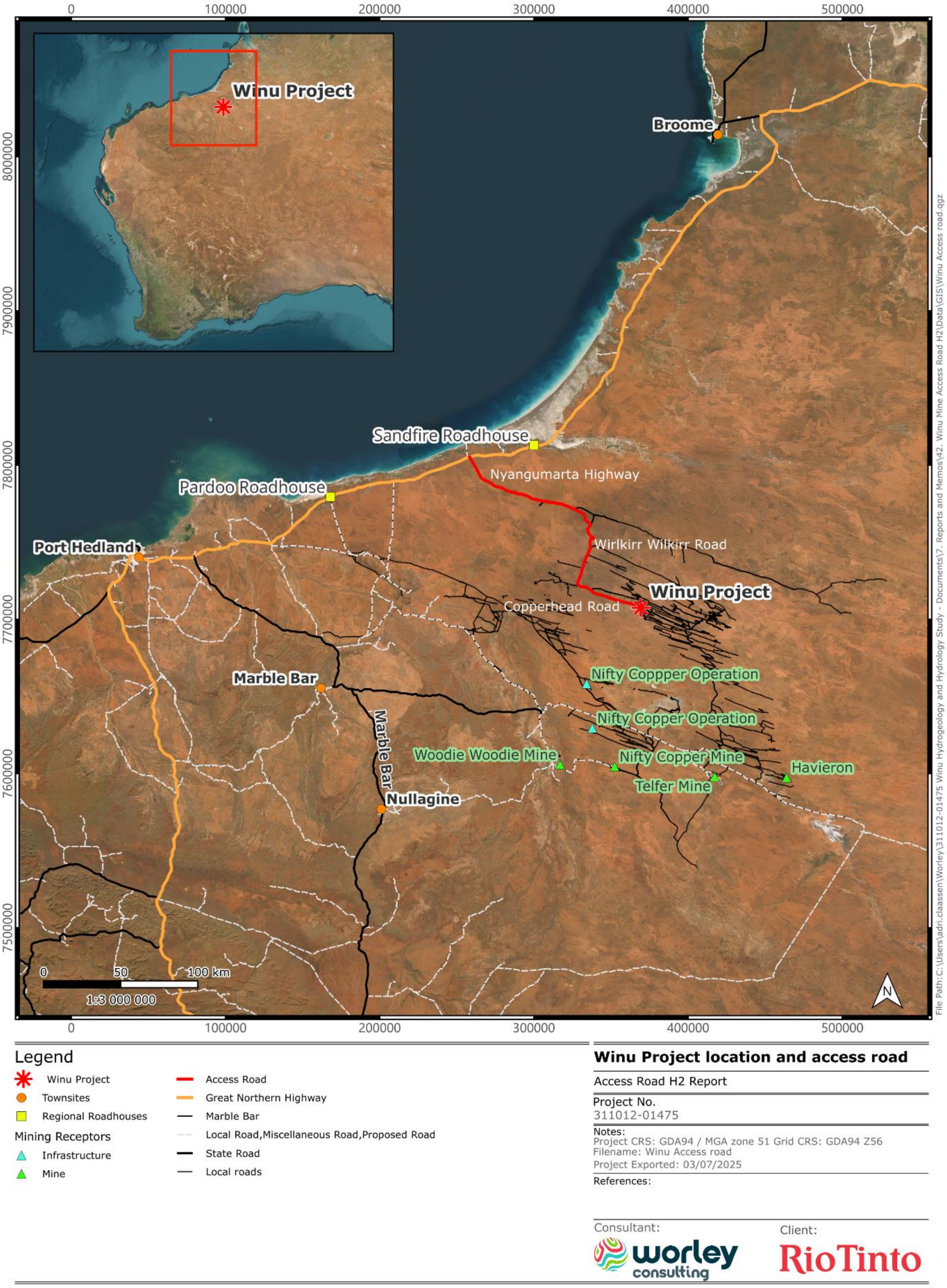


Figure 1-1 Project area and access road alignment

1.4 Topography

A Digital Elevation Model (DEM) was developed for the study area, Winu Mine Access Road Surface Water Management Plan Update 2024, Report 311012-01475 REP-HY-027, using provided topographic survey data. The DEM presented in Figure 1-2 shows natural surface elevations varying from 15 mAHD to 315 mAHD (Worley, 2024).

The topography within the study area is characterised by northwest-southeast orientated longitudinal aeolian sand dunes separated by interdunal corridors and endorheic basins. The dunes are typically 10 to 15 m high, with a width of 30 to 50 metres.

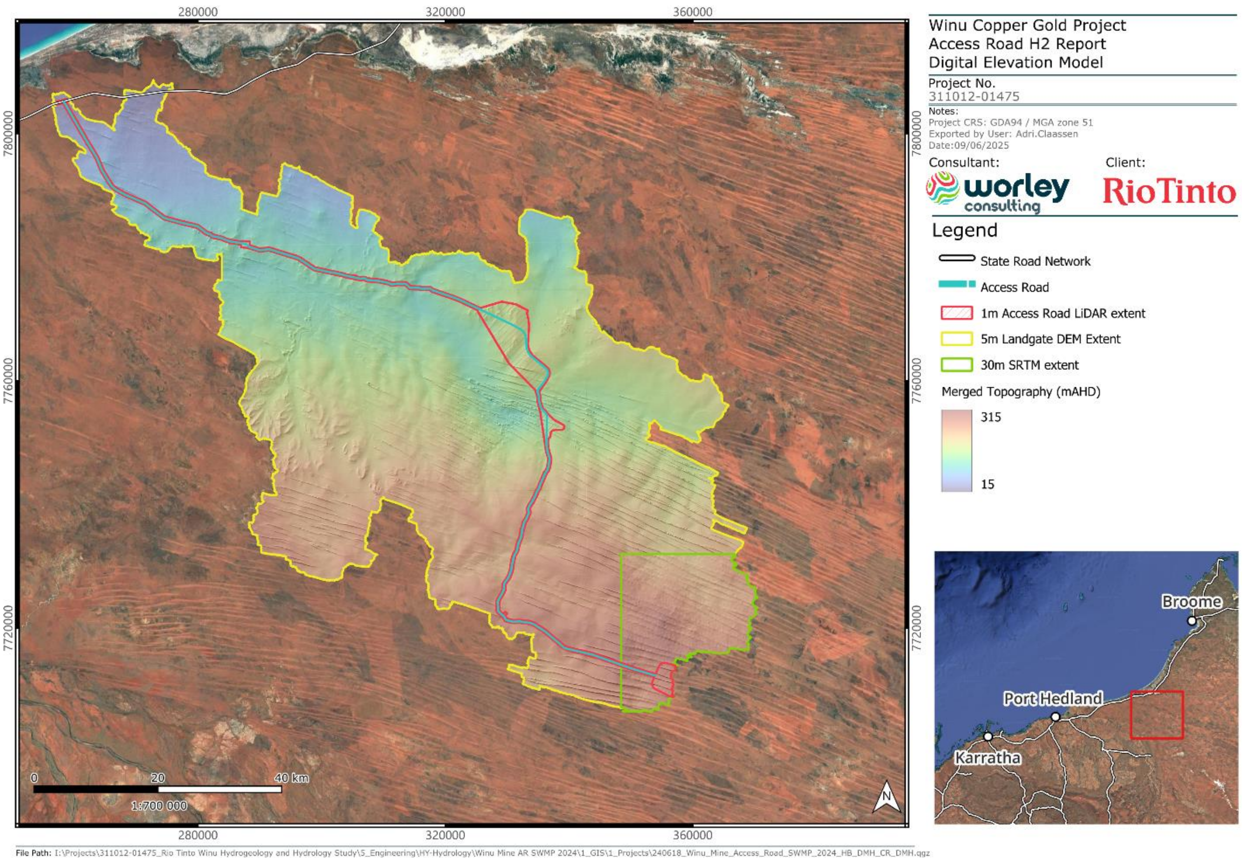


Figure 1-2: Digital elevation model for the access road

1.5 Proposed groundwater use

RTC intend to source water for construction of the access road from bores along the road alignment. The daily water demand estimated by RTC is approximately 2,740 kL/d (1.0 GL/a), as summarised in Table 1-1. Water abstraction would be along a series of bores as the road construction progress. Each bore will be utilised for an approximate duration of 6 months, resulting in a total operational period of 24 months across all bores.

The water demand equates to a constant supply of 32 L/s pumped into turkey's nests which is then distributed along the access road with pumps and High-Density Polyethylene pipelines (HDPE).

Table 1-1 Estimated daily construction water demand (RTC, 2025)

Activity	Required water supply (Gl/a)	Required water supply (L/s)
Permanent road construction	0.7	22.2
Road maintenance	0.3	9.5
Total	**1.0**	**31.7**

2. Climate

2.1 Rainfall, temperature and evaporation

The Project is 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 Bureau of Meteorology (BoM) rainfall station Telfer Aero (ID: 13030) is located 100 km south of Winu, where daily rainfall data has been recorded from January 1974 to 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 370 mm. Considering the most recent period of record since the year 2000, this average has increased to 404 mm, suggesting a wetter period in the overall gauge record.

Variability in annual rainfall experienced in the region is substantial, with some years annual totals occurring practically in one or two months. The current 2025 water year (as of April) has already accumulated 545 mm of rainfall.

Table 2-1 BoM Telfer Aero Climate statistics 1974 – April 2025, *(BoM, 2025)*

Parameter	Value
Mean annual rainfall	370 mm/y
Average evaporation	4,125 mm/y
Average maximum and minimum temperature in January	40.3 °C and 26.1 °C
Average maximum and minimum temperature in July	25.6 °C and 10.8 °C

The average maximum and minimum temperatures in January are 40.3 °C and 26.1 °C respectively, and the average maximum and minimum temperature in July are 25.6 °C and 10.8 °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.

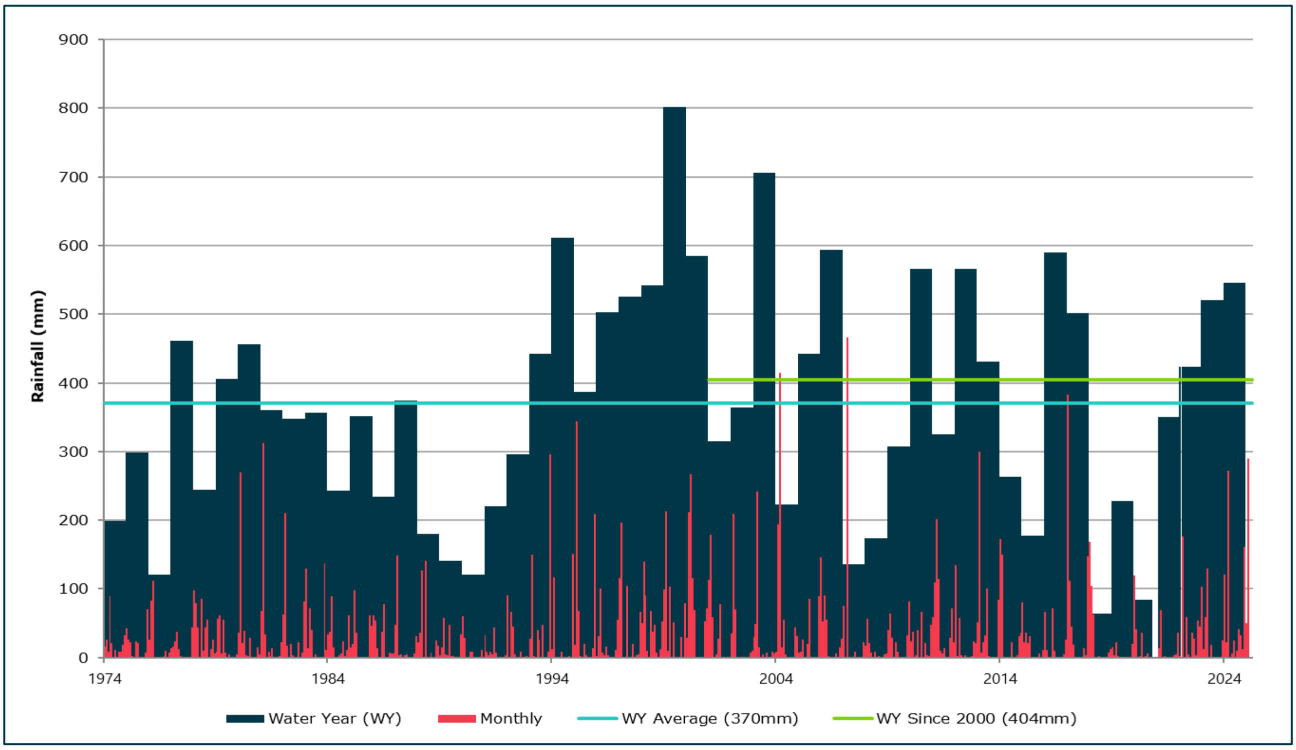


Figure 2-1 Average monthly and annual rainfall (by water year) recorded at Telfer Aero (Bureau of Meteorology identification no. 13030) (1974 – April 2025)

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 below ground level (BGL), there are no clearly defined surface water courses. However, internal drainage systems have resulted in the formation of several claypans in the larger area, which are likely associated with localised areas of ephemeral, perched water tables which express at surface after high rainfall events.

No surface water features are present within 20 km from the road alignment proposed abstraction locations (Figure 2-2).

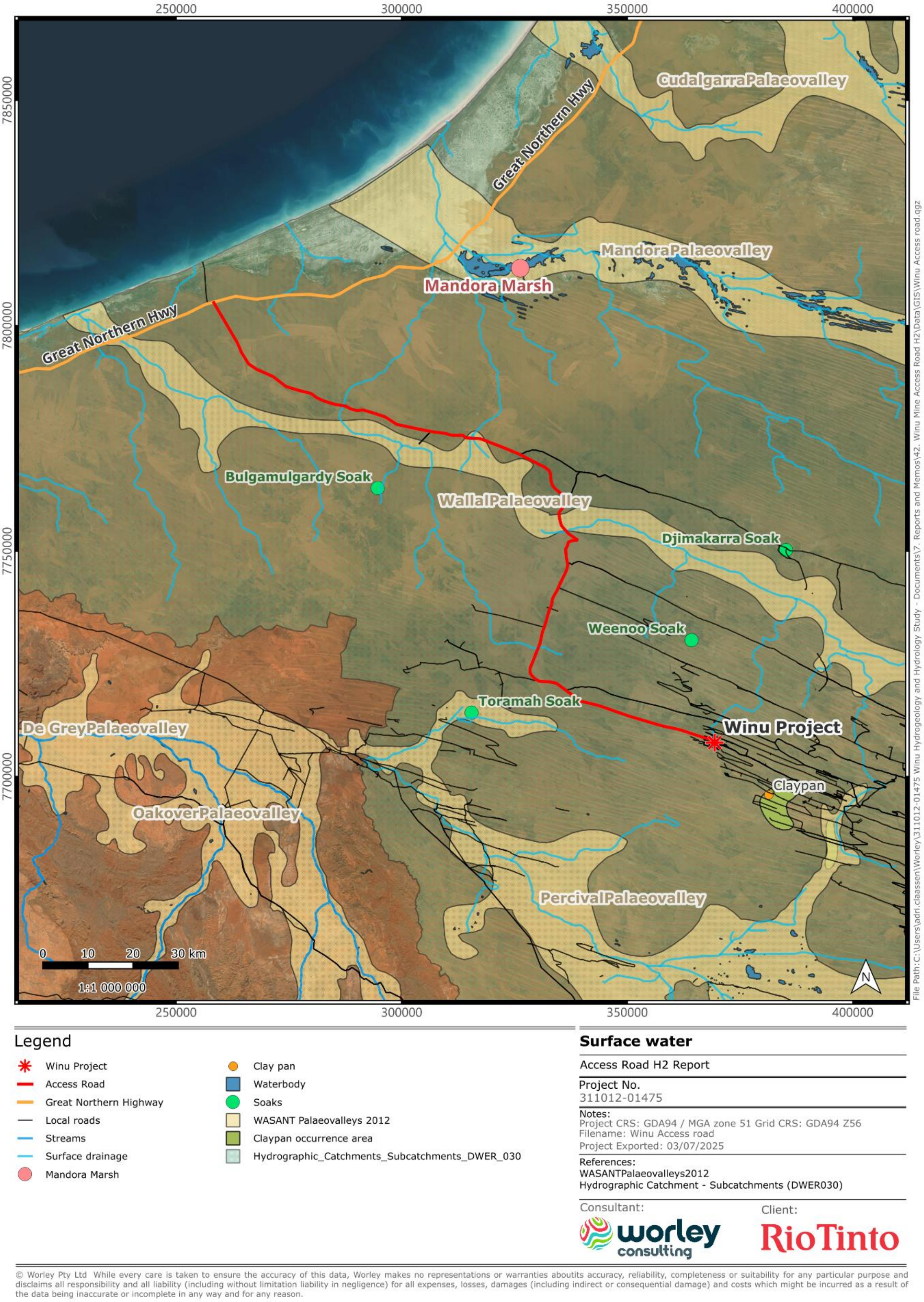


Figure 2-2 Surface water features in relation to access road alignment

2.2.2 Surface water quality

No surface water quality has been collected in the proximity of the access road alignment.

In May 2021 Golder (Golder, 2022) undertook water sampling at the Toramah Soak (30 km southwest of the WINU1320). The soak was dry during the time of sampling, however shallow groundwater was collected from a hand-augered hole at a depth of 0.72 m.

The appearance of the soaks and their physical setting is analogous to those of the claypans which occur to the west and south of the study area and may provide an indication of surface/shallow groundwater quality data for the study area, although with the large distances between Soaks, there may also be significant differences in various water quality parameters.

Consistent with the previous conceptualisation reported in Golder (2022), these surface water features are interpreted as localised features formed by surface water runoff, separate from the much deeper regional water table.

In summary, the results show:

- Relatively high salinity (saline to highly saline) likely as a result of evapoconcentration of the surface water and shallow groundwater
- Sodium-chloride/carbonate hydrochemical type, with negligible calcium/magnesium content
- High alkalinity/bicarbonate concentrations
- Basic pH value (9.4 pH) compared to groundwater at Winu (which typically ranges between pH 7 and 8)
- Elevated concentrations of aluminium and iron (total dissolved metals)

3. Hydrogeology

3.1 Geological overview

3.1.1 Regional geology

The road alignment proposed abstraction bores are located in the Canning Basin. The Canning Basin is the largest sedimentary basin in Western Australia (Middleton, 1990), originating in the Early Palaeozoic and comprises a total area of 640,000 km^2, with 530,000 km^2 located onshore, and 110,000 km^2 located offshore.

The Canning Basin is a deep, multi-phase, pericratonic basin which has undergone a complex structural evolution. During its 500-million-year sedimentary history, the basin and its depositional history has been controlled by several major basin-wide tectonic events that have resulted in the development of several stratal (unconformity) surfaces (Parra-Garcia, Sanchez, Dentith, & George, 2014). The most significant events impacting the Canning Basin area are the Samphire Marsh Extension, La Grange Extension/Bedout movement, and the Fitzroy Transpression.

The sedimentary deposits along the road alignment range from Ordovician to Quaternary/Recent in age, with Triassic-aged deposits being limited to offshore extents (Leech, 1979). These deposits overlie a Precambrian/Archaean aged basement, comprising crystalline igneous and metamorphic rocks (Pells Sullivan Meynink, (PSM), 2017).

3.2 Hydrostratigraphic units

With the results from drilling programs between 2022-2025 and public available data, the study area has been divided into four (4) hydrostratigraphic units (HSU) based on lithology and their hydrogeological function (Table 3-1).

This study focuses on the Broome, Lower Callawa Formation and Unconfined Wallal aquifers for potential water sources.

A short description of each HSU is given below and a summary of their thickness, and hydrogeological function is shown in Table 3-1.

3.2.1 Broome Aquifer

The early Cretaceous Broome Sandstone comprises nearshore marine sandstone and mudstone layers deposited during the same period as the fluvial Upper Callawa Formation (Leech, 1979).

The unconfined Broome Sandstone aquifer consist of poorly consolidated interbedded and cross-bedded sequences of fine to coarse grained, sub-angular to rounded quartz grains with weak ferruginous cement (Aquaterra, 2010). It has a thickness of up to 120 m on the western end of the access road alignment.

Interfingered with the Broome Sandstone is the Cretaceous Upper Callawa Formation, which is comprised of fluvial sediments ranging from a very fine to coarse grained sandstone.

Together, these units are overlain by recent surficial sediments, generally alluvium and aeolian deposits. The Broome aquifer is recharged directly by percolation of rainfall or indirectly through the overlying sediments (Aquaterra, 2010).

3.2.2 Lower Callawa Formation

Underlying the Broome Aquifer is the Lower Cretaceous Lower Callawa Formation, which comprises a lightly coloured sandy, clayey, siltstone, deposited within a lacustrine or near-shore marine to littoral environment. Depending on the degree of sand and clay, the Lower Callawa Formation is thought to potentially act as a leaky aquitard with a low to moderate hydraulic conductivity compared with the Broome Aquifer.

Recent drilling along the access road and analysis of publicly available data suggest that the Lower Callawa Formation should be distinguished from the Jarlemai Formation. Pump testing yielded over 15 L/s, while airlift yields of up to 5 L/s were recorded in monitoring bores WCS12B, NSO Bore 1, and WINU0937, all screened within the Lower Callawa Formation.

3.2.3 Jarlemai Siltstone

The main confining layer separating the Broome Aquifer from the Wallal Aquifer is the Jarlemai Siltstone, which is thought to act as an aquiclude where present. The layer is characterised by a dark grey to black bioturbated, clayey, siltstone unit, with occasional lenses of coal.

The Jarlemai Siltstone non-conformably overlies the Wallal Aquifer and pinches out to the east in the West Canning Basin (WCB), resulting in a partial to direct hydraulic connection between the saturated Lower Callawa Formation and the Wallal aquifer.

Where it pinches out, the Wallal Aquifer becomes unconfined by the overlying Lower Callawa Formation.

3.2.4 Wallal Aquifer

The Jurassic Wallal Sandstone is a sequence of continental to near shore marine sandstone (Hanna 2014). It comprises poorly consolidated fine to very coarse sandstone, beige to light grey in colour, with a regional thickness of up to 425 m onshore, and up to 750 m offshore. Some sources indicate potential for lignite within the Wallal Sandstone (Towner & Gibson, 1983). Laterally continuous gravel to pebble sized conglomerates have been reported towards the base of the formation (Aquaterra, 2010).

Depending on the thickness and extent of the overlying Jarlemai Siltstone, the Wallal Aquifer varies from unconfined to confined; artesian conditions have been observed close to the coastline, where several springs are believed to be sourced from the Wallal aquifer (Aquaterra 2010).

Artesian bores (ex. WCS02A and WCS06P) indicate an artesian pressure of approximately 50 m above mean sea level in the area of 80-Mile Beach.

Table 3-1 Summary of hydrostratigraphic units along road alignment

Hydro stratigraphic unit (HSU)	Lithology	Thickness	Hydrogeological function	Hydrogeological function and yield
Broome Sandstone	Very fine to coarse grained sandstone, with occasional interbedded shale and conglomerate (pebble to boulder sized)	Up to 120 m	Aquifer	Situated within the coastal region of the study area. Fully saturated in proximity to the coastline and becomes unsaturated with increasing distance from the coast, and with increasing elevation of the top of the Lower Callawa Formation/Jarlemai Siltstone. Groundwater flow within the aquifer is toward the coast. Unconfined aquifer. Bore yields of up to 11.5 L/s recorded (Leech, 1979)
Lower Callawa Formation	Sandy, clayey, siltstone	Between 50 to 70 m in the	Aquifer	Moderately yielding aquifer (depending on the degree of sand and clay). With a low to moderate hydraulic conductivity compared with the Broome and Wallal Sandstones. Historical yields of up to 5 L/s (Advisian, 2023c).
Jarlemai Siltstone	Puggy, silty clay, interbedded with silt and fine sand	Between 20 to 30 m in the	Aquiclude	The Jarlemai Siltstone is the main confining layer (aquiclude) separating the Broome and Lower Callawa from the Wallal Sandstone.
Wallal Sandstone	Fine to medium grained quartzose sandstone with minor siltstone, conglomerate, and minor coal fragments	Up to 425 m onshore, increasing to 750 m offshore	Aquifer	Confined to unconfined aquifer that underlies majority of the road alignment. Artesian pressures occur along the coast and can reach up to 60 m above ground level. Yields in the confined Wallal aquifer have tested above 50 L/s (Advisian, 2023c).

3.2.6 Hydrogeological cross-sections

Cross sections along Nyangumarta Highway (Figure 3-1) and Wirlkirr Wirlkirr Road (Figure 3-2) were constructed using leapfrog software and amended from the conceptual hydrogeological 3D model developed by PSM, 2017. The cross sections were developed for the along the proposed access road and the proposed locations for groundwater abstraction.

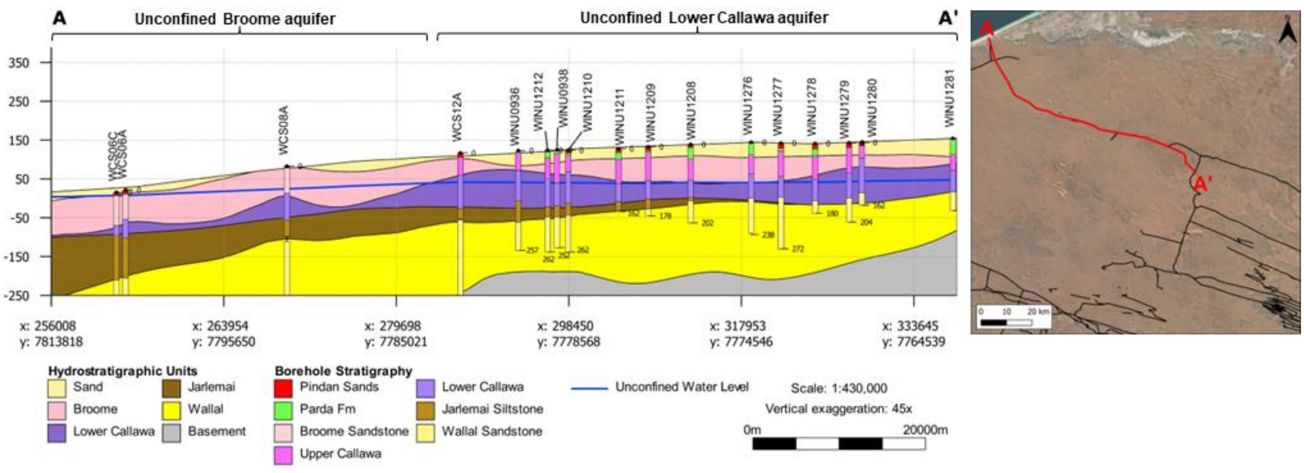


Figure 3-1 Conceptual cross section along Nyangumarta Highway

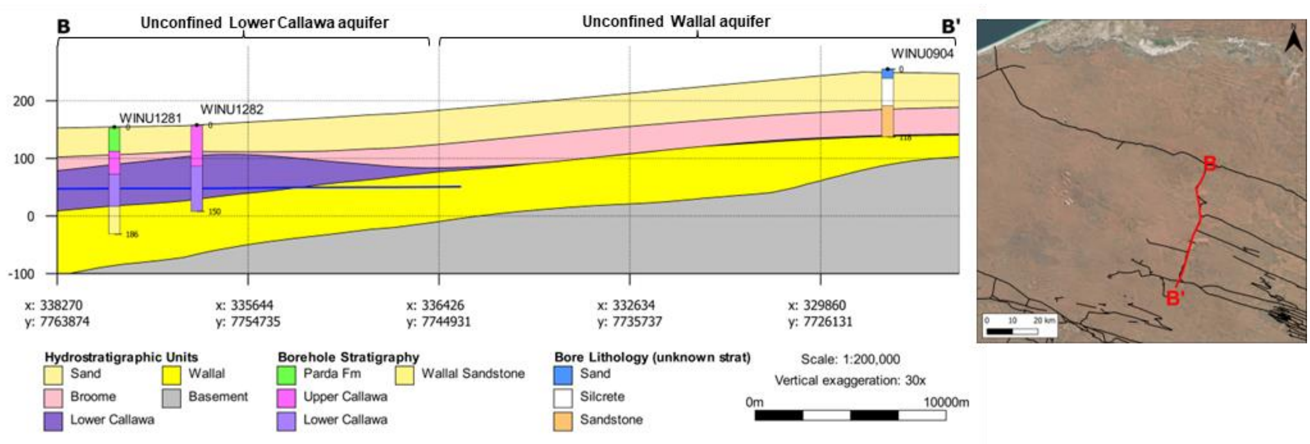


Figure 3-2 Conceptual cross section through along Wirlkirr Wirlkirr Road

3.3 Groundwater recharge

Groundwater recharge to the Broome Aquifer is generally unrestricted and occurs by direct infiltration of rainfall through overlying sediment, or through concentrated infiltration in streams and floodways.

Recharge to the deeper Wallal Aquifer occurs through vertical leakage from the upper units, however it is restricted to areas where the Lower Callawa Formation and Jarlemai Siltstone are absent (PSM, 2017). Groundwater recharge to the Wallal aquifer also takes place in areas where hydraulic heads within the Wallal Aquifer are lower than those within the Broome Aquifer.

Several hydrogeological studies relating to recharge estimation for the area have been documented in the West Canning Basin–Sandfire Hydrogeological Conceptual Report (DWER, 2016). These studies utilised chloride balance, water balance, and radioactive isotope methods to estimate rainfall recharge:

- Estimates of recharge range between 2 to 19.5 mm/y, with most studies reporting values around 7 mm/y
- As a percentage, the recharge rates range between 0.6 to 6% of the mean annual rainfall (with 7 mm/y equating to 2.1%)
- These recharge rates have been calculated assuming a mean annual rainfall of 326 mm (taken from Pardoo weather station)

The most likely source of recharge to the Lower Callawa aquifer is a combination of vertical infiltration through the overlying units, which are mostly permeable sands, and lateral throughflow from outcrop/subcrop(s) in the southeast towards Wallal.

Given the hydraulic characteristics of the Lower Callawa Formation, recharge to the unconfined Wallal aquifer may occur in areas where the Jarlemai Siltstone is absent and therefore extending the effective zone of recharge to the Wallal Sandstone Aquifer.

3.4 Groundwater levels and flow

Groundwater level data in the study area was sourced primarily from the Water Information Reporting (WIR) website and from recent field investigations undertaken along the access road alignment. These have been split into the Broome and Wallal aquifers based on bore construction and lithological logs. Where this data was not available, 3D geological surfaces extracted from the PSM (2017) groundwater model were used to designate potential aquifers using screened intervals and drilled depths.

A total of 387 unique measurement points with water level data occur within the study area, with 296 points in the Broome aquifer and 91 points in the Wallal aquifer.

The key features of groundwater flow directions and levels are:

3.4.1 Broome Aquifer

- Groundwater flow in the Broome aquifer is from east to west, from the hinterlands toward the coast, with isopotentials occurring sub-parallel to the coastline
- Groundwater levels in the eastern-most extent of the study area (~160 km from the coast) are at an elevation of 87.5 m AHD, and gradually decrease toward the coast (a flow gradient of 0.0005)

3.4.2 Wallal Aquifer

- Groundwater flow in the Wallal aquifer is from the east-southeast to west-northwest
- The groundwater potentiometric level is at an elevation of between 50 to 75 m AHD across most of the study area, with potentiometric levels decreasing toward the coast (flow gradient of approximately 0.00017).

4. Existing groundwater use

4.1 Groundwater allocation

RTC have a current groundwater allocation entitlement of 0.3 GL/a (300,000 kL/a) under groundwater licence GWL201165(8) that include tenements along the access road. The licensed groundwater allocation along the proposed access road is for pre-development activities.

Groundwater in the general area has been used since the early 1950s (DWER, 2016) and has primarily supported agricultural and mining operations in the area, as well as provided water for town water supply.

A summary of the groundwater allocation limits for the various groundwater resources is provided in Table 4-1. The data contained in Table 4-1 has been sourced from the documents listed below, as well as from spatial data provided by DWER.

Groundwater allocation limits for the various groundwater resources are defined by the following documents:

- Department of Water and Environmental Regulation (DWER), 2010. La Grange Groundwater Allocation Plan
- Department of Water and Environmental Regulation (DWER), 2013. Pilbara Groundwater Allocation Plan
- Department of Water and Environmental Regulation (DWER), 2018. West Canning Basin, Allocation Statement

Table 4-1 Groundwater allocation limits for the various groundwater resources within the study area

Groundwater area	Groundwater subarea	Groundwater resource	Total allocation limit (GL/y)	Water licenced and committed (GL/y)	Additional requested volumes (GL/y)
Canning-Kimberley	West Canning	Canning - Broome	10	0.126	9.2
		Canning - Wallal	50	50.73	10

4.2 Other groundwater users

4.2.1 Pastoral

Pastoral stations generally utilise the shallow Broome and Wallal aquifers for stock and domestic water supply, however since 2010, large scale abstraction from the artesian Wallal aquifer has been used for centre pivot irrigation of fodder crops at Pardoo Station, with similar operations at Wallal Downs station following soon after. Abstraction from the Wallal aquifer is expected to continue increasing over the next few years as development at Pardoo and Wallal Downs continue (PSM, 2017).

Within the WCB, groundwater allocation limits within the Broome aquifer are not fully utilised and are smaller in comparison to the Wallal aquifer, with DWER indicating that a volume of 0.126 GL/y had been allocated (DWER, 2018). The Wallal aquifer on the other hand is nominally over-allocated at 50.73 GL/y (based on assessments approved by DWER), with additional allocations being requested from the currently unused 10 GL/y public water supply reserve (DWER, 2018).

4.2.2 Mining

Groundwater abstraction in support of mining operations in the area is generally low, with the highest groundwater allocation for groundwater resource in the area being FMG at 10 GL/a, with a further 10 GL/a pending. Other users are BHP Minerals Pty Ltd with 1.245 GL/y and Rio Tinto Exploration Pty Ltd with 0.3 GL/y from the Wallal aquifer.

4.2.3 Environmental receptors

The study area does not include any environmental receptors directly; however, the regional area contains several potential environmental receptors that include internationally significant Ramsar listed wetlands along Eighty-Mile Beach and Mandora Marsh, artesian mound springs, and flora and plant communities. Key characteristics of each of these potential receptors are listed below. The location of the receptors is shown in below.

4.2.3.1 Wetlands

Eighty-Mile Beach

- Characterised by extensive intertidal mudflats that are 1 to 4 km wide
- Supports high richness of macroinvertebrates which provide food for a large number of shorebirds
- Macro tides and tidal flows across the beach are the critical hydrological component supporting the site
- Broome aquifer groundwater inputs into the intertidal mudflats are considered likely to be important for the ecological character of the wetlands (Hale and Butcher, 2009)
- Groundwater from the Broome and Wallal aquifers may also support several freshwater springs that flow along the coast

Mandora Marsh

- Extends from the coastal dunes at Eighty-Mile Beach to approximately 60 km inland
- It is partly included within the Eighty-Mile Beach Ramsar site and lies at the western edge of the Great Sandy Desert bioregion
- Mandora Marsh is located on the palaeo-estuary for this system (Storey et al., 2011)
- Mandora Marsh can be divided into three wetland types:
- Inland temporary lakes and claypans (Walyarta and East Lake)
- Permanent creeks (Salt Creek)
- Mound springs (various)

4.2.3.2 Flora and plant communities

- Four groups of vegetation are considered critical components of the ecological character of the Eighty-Mile Beach Ramsar site. These are paperbark (*Melaleuca leucadendra*), Dragon Tree (*Sesbania Formosa*), mangrove fern (*Acrostichum speciosum*), and Cumbingi (*Typha domingensis*).
- The mangroves associated with Salt Creek, and freshwater aquatic vegetation associated with mound springs are groundwater dependent
- The Grey Mangrove community lining Salt Creek is the most inland occurrence of mangroves in WA (Beard, 1967) and the community is listed as a Priority Ecological Community (PEC)
- Along Eighty-Mile Beach, the vegetation generally runs tangential to the coast, about 5 km inland
- The distribution of vegetation follows the inland edge of the seawater interface (SWI), suggesting fresh groundwater flow from the Broome aquifer may be impeded by the SWI, forcing fresh groundwater to flow to the surface.
- If that is the case, then maintenance of the SWI would be necessary to support this vegetation
- No threatened plant communities have been identified in the study area
- No priority flora has been identified in the study area that are groundwater dependent

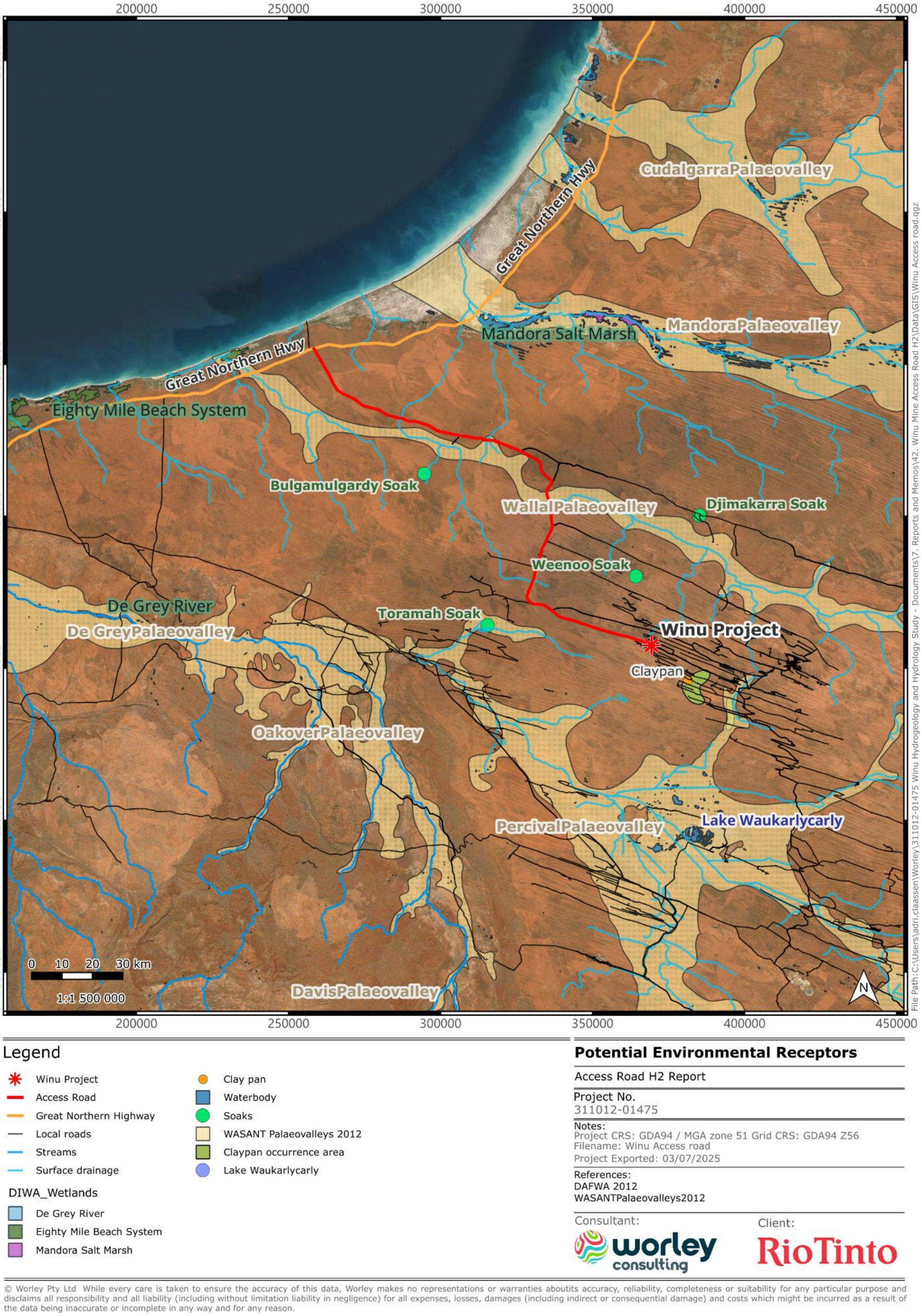


Figure 4-1 Environmental receptors surrounding the proposed access road alignment

5. Groundwater investigations

5.1 Data sources

Hydrogeological investigations for the road alignment study area were previously completed between 2022 and 2025 and the hydrogeological conceptualisation drew on these sources:

- 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 data sources utilised are summarised on Table 5-1.

Table 5-1 Summary of data sources

Data description	Source	Reference
Historic bore details and lithology for bores west of the Wallal borefield.	Water Information Reporting System (WIR) database	(DWER, 2023)
Wallal East RC drilling program summary and proposed bore network	Wallal East target identification based on RC drilling results	(Advisian, 2023b)
Wallal RC and Rotary Drilling results	Wallal RC and Rotary Drilling results	(Advisian, 2023c)
Aquifer system conceptual model, Wallal borefield details and aquifer parameterization	Wallal H3 Assessment, Conceptual and Numerical Model Update	(Advisian, 2023d)
Winu project RC drillhole details	RC Collar and Lithology datasets supplied by Rio Tinto Copper	Winu database
Winu Groundwater Model	Winu project area, H3 Hydrogeological Assessment	(Worley, 2025)

6. Drilling

6.1 Intrusive investigations

Drilling investigations completed along the proposed access road are summarised on Table 6-1, with drillhole locations presented in Figure 6-1.

All bore logs are shown in Appendix A.

Table 6-1 Summary of drilling investigations completed along the proposed access road

Year	No. of Bores and drilling method	Purpose
2022	6 RC	Exploration and conceptualisation
	3 Monitoring bores	RTC groundwater investigation
	1 Production bores	RTC groundwater investigation (Confined Wallal Aquifer)
2023	7 RC	Exploration and conceptualisation
2024-2025	5 Production bores	RTC groundwater investigation (Broome/Lower Callawa and unconfined Wallal Aquifers)

6.1.1 Reported airlift yields during drilling

Bore construction details are provided in Table 6-2 for all bores along the proposed access road, 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.

Airlift yields within the study area varied between 1 L/s (WINU1211) and 50 L/s (WINU0936), with an average of 5 L/s. Airlift volumes are restricted during RC drilling and is not a true reflection of aquifer properties.

A summary of the drilling investigations including the drilling methods used are given in Table 6-2. All bore logs are shown in Appendix A.

Table 6-2: Summary of drilling investigations completed within the access road project area

BH_ID	Easting	Northing	TOC (m AHD)	Date Completed	Bore Depth (m)	Drill Method	Design Screen Size and Type	Screen from (mbgl)	Screen to (mbgl)	Screened Length (m)	Screened Aquifer	Airlift (L/s)	Final pH	EC (uS/cm)
WINU0935	2929892	7780576	125.83	27/11/2022	251	Mud Rotary	100mm Stainless steel wire wound 1mm screens	218.5	242.5	24	Wallal Sandstones	8	8.31	661
WINU0936	293016	7780647	126.67	30/04/2023	245	Mud Rotary	10" Stainless steel wire wound 3mm screens	179	245	66	Wallal Sandstones	50	7.81	576
WINU0937	293046	7780720	126.82	1/11/2022	162	Mud Rotary	100mm Stainless steel wire wound 0.5mm screens	124	148	24	Lower Callawa above Jarlemai Siltstone	4	8.43	617
WINU0938	297191	7779091	131.89	14/12/2022	252	Mud Rotary	100mm Stainless steel wire wound 3mm screens	224	246	22	Wallal Sandstones	7	8.13	532
WINU1208	312197	7775726	142.64	23/07/2022	202	Reverse circulation		N/A	N/A	N/A		3.81	7.7	558
WINU1209	307277	7776343	146.32	19/07/2022	178	Reverse circulation		N/A	N/A	N/A		4.2	7.88	380.4
WINU1210	298312	7778473	125.16	29/07/2022	262	Reverse circulation		N/A	N/A	N/A		NR	NR	NR
WINU1211	303904	7777000	137.07	3/08/2022	162	Reverse circulation		N/A	N/A	N/A		0.9	8.3	339
WINU1212	296345	7779819	130.72	31/07/2022	262	Reverse circulation		N/A	N/A	N/A		NR	7.5	622
WINU1213	289976	7781165	128.18	1/08/2022	204	Reverse circulation		N/A	N/A	N/A		NR	7.7	870
WINU1276	319039	7774241	142.89	3/06/2023	238	Reverse circulation		N/A	N/A	N/A		2.8	7.7	365
WINU1277	322302	7773066	147.68	13/06/2023	272	Reverse circulation		N/A	N/A	N/A		3.5	7.7	315
WINU1278	325937	7771509	161.21	18/06/2023	180	Reverse circulation		N/A	N/A	N/A		1.9	7.9	347
WINU1279	331206	7772059	179.48	20/06/2023	204	Reverse circulation		N/A	N/A	N/A		2.6	7.2	333
WINU1280	332725	7771277	168.71	25/06/2023	162	Reverse circulation		N/A	N/A	N/A		1.92	7.6	412
WINU1281	336778	7761280	166.12	25/06/2023	186	Reverse circulation		N/A	N/A	N/A		NR	NR	NR
WINU1282	335065	7757398	148.54	27/06/2023	150	Reverse circulation		N/A	N/A	N/A		NR	NR	NR
WINU1320	333497	7738301	251.29	12/03/2025	303	Mud Rotary	10" Stainless steel wire wound 1mm screens	168.1	228.1	60	Lower Callawa/Unconfined Wallal Sandstone	6.7	8.28	1273
WINU1322	336417	7760913	164.089	8/04/2025	234	Mud Rotary	10" Stainless steel wire wound 1mm screens	178.2	220.2	42	Lower Callawa/Unconfined Wallal Sandstone	5	7.54	722
WINU1323	325172	7771453	159.438	4/03/2025	204	Mud Rotary	10" Stainless steel wire wound 1mm screens	167.5	197.5	30	Lower Callawa/Unconfined Wallal Sandstone	20	7.61	430.7
WINU1324	292977	7780476	126.001	21/10/2024	158	Mud Rotary	10" Stainless steel wire wound 1mm screens	119	149	30	Lower Callawa above Jarlemai Siltstone	7	7.79	562
WINU1328	268789	7789941	79.884	21/03/2025	152	Mud Rotary	10" Stainless steel wire wound 1mm screens	113.5	143.5	30	Broome	9	7.86	1861

Eastings and northings in GDA94 Z51
NR – Not recorded

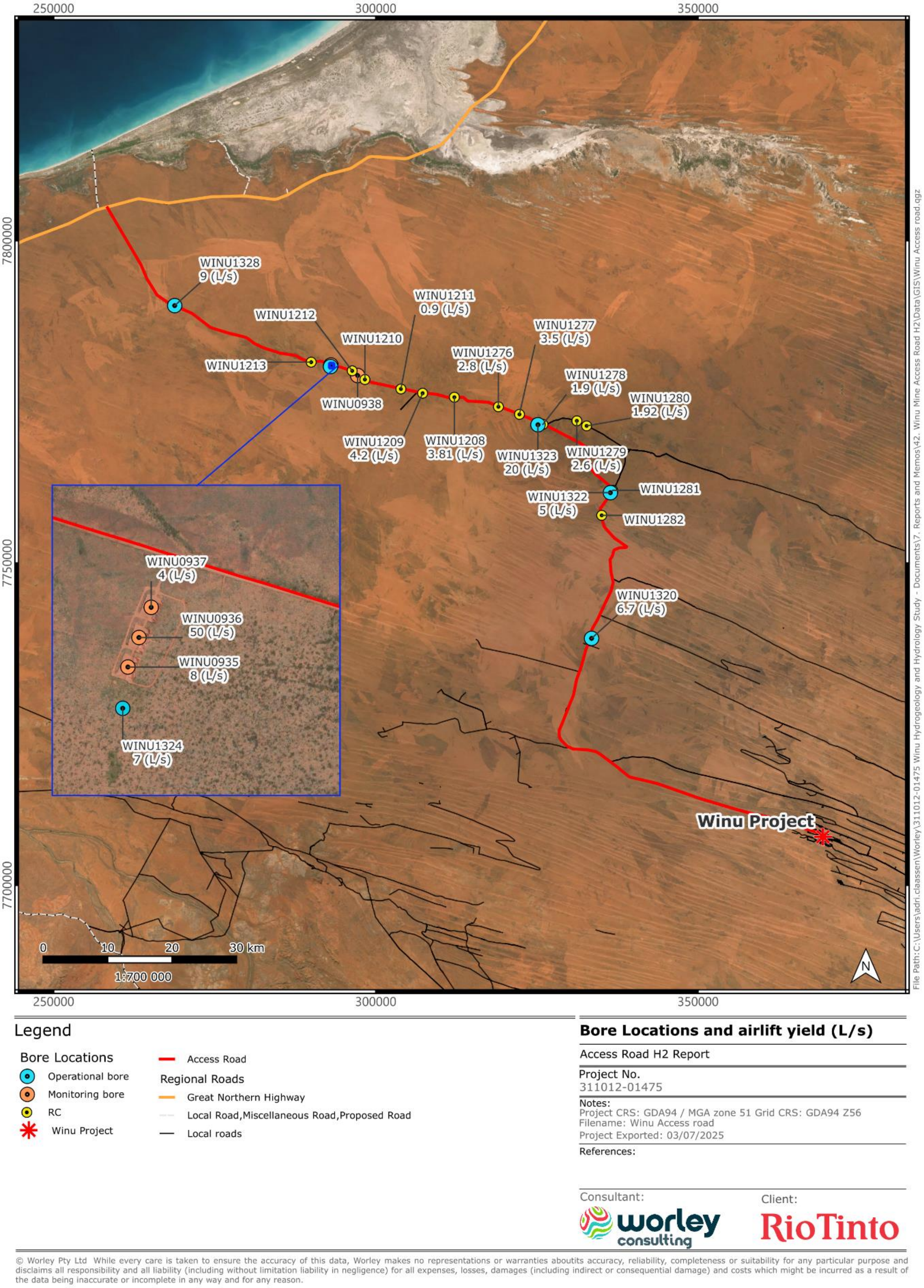


Figure 6-1: Borehole locations within the access road area

7. Test pumping

7.1 Pumping test details

Upon completion of the production bores, a stepped rate test (SRT) was carried out using five (5) progressively increasing pumping steps (rates), with a duration of up to 100 minutes Table 7-1.

The results from the SRT were used to decide if a constant rate test (CRT) was necessary and if yes, to select an initial pumping rate for those bores (Table 7-2).

To assess the performance of the bores during the pumping tests, drawdown was measured using pressure transducers and validated with manual measurements regularly throughout the pumping period. The pumping rate was monitored using calibrated flow meters.

Table 7-1: Summary of SRTs

Bore	No. of tests	No. of obs. bores	SRT date	Step pumping rates (L/s)	Total duration (minutes)
WINU1320	1	1	19/05/2025	5, 8, 11, 13, 14, 15.15	670
WINU1322	2	1	25/04/2025	3, 5, 7, 10, 14	570
			27/04/2025	16, 20, 24, 25.3	560
WINU1323	1	1	16/05/2025	14, 17, 20, 23, 26.3	670
WINU1324	1	1	04/05/2025	10, 12, 14, 16, 16.69	640
WINU1328	1	1	12/05/2025	7, 10, 13, 15.5, 16.7	590

Table 7-2: Summary of CRTs

Bore	No. of observation bores	CRT start date	CRT end date	CRT duration (days)	CRT Rate (L/s)
WINU1320	1	20/05/2025	21/05/2025	1	15.3 (pump max)
WINU1324	4	05/05/2025	07/05/2025	2	17 (pump max)
WINU1328	1	13/05/2025	14/05/2025	1	16.6 (pump max)

7.2 Step-rate tests (SRT)

The step rate test (SRT) consisted of four to five progressively increasing pumping steps (rates). Each step lasts for 60 - 100 minutes except for final step which may be shortened.

The first SRT at WINU1322a did not sufficiently stress the production bore and therefore a second SRT was conducted at higher flow rates.

The flow rates and drawdown measurements for each step (including recovery) are detailed in Figure 7-1 and Table 7-3 and represented in Appendix B.

Table 7-3: Step-rate test pumping rates and drawdown observations

Pumping bore	SWL (m BRL)	Pump inlet depth (m BRL)	Step	Pumping rate (L/s)	Duration of step (mins)	PWL at end of step	Total drawdown (m)	Step drawdown (m)
WINU1320	177.45	204	1	5	100	178.36	0.91	0.91
			2	8	100	179.08	1.63	0.72
			3	11	100	179.83	2.38	0.75
			4	14	100	180.59	3.14	0.76
			5	15.15	100	180.91	3.46	0.32
WINU1322	96.57	177.4	1a	3	100	96.71	0.14	0.14
			2a	5	100	96.81	0.24	0.10
			3a	7	100	96.90	0.33	0.09
			4a	10	100	97.06	0.49	0.16
			5a	14	50	97.31	0.74	0.25
	96.18	117	1b	16	60	97.17	0.99	0.99
			2b	20	60	97.39	1.21	0.22
			3b	24	60	97.66	1.48	0.27
			4b	25.3	80	97.72	1.54	0.06
WINU1323	95.99	127.4	1	14	100	96.80	0.81	0.81
			2	17	100	96.98	0.99	0.18
			3	20	100	97.16	1.17	0.18
			4	23	100	97.345	1.355	0.185
			5	26.3	90	97.52	1.53	0.175
WINU1324	80.48	120	1	10	100	82.78	2.30	2.30
			2	12	100	83.23	2.75	0.45
			3	14	100	83.77	3.29	0.54
			4	16	100	84.33	3.85	0.56

			5	16.69	70	84.52	4.04	0.19
WINU1328	50.66	122	1	7	90	66.37	15.71	15.71
			2	10	90	73.13	22.47	6.76
			3	13	90	80.26	29.60	7.13
			4	15.5	80	86.07	35.41	5.81
			5	16.7	90	89.10	38.44	3.03

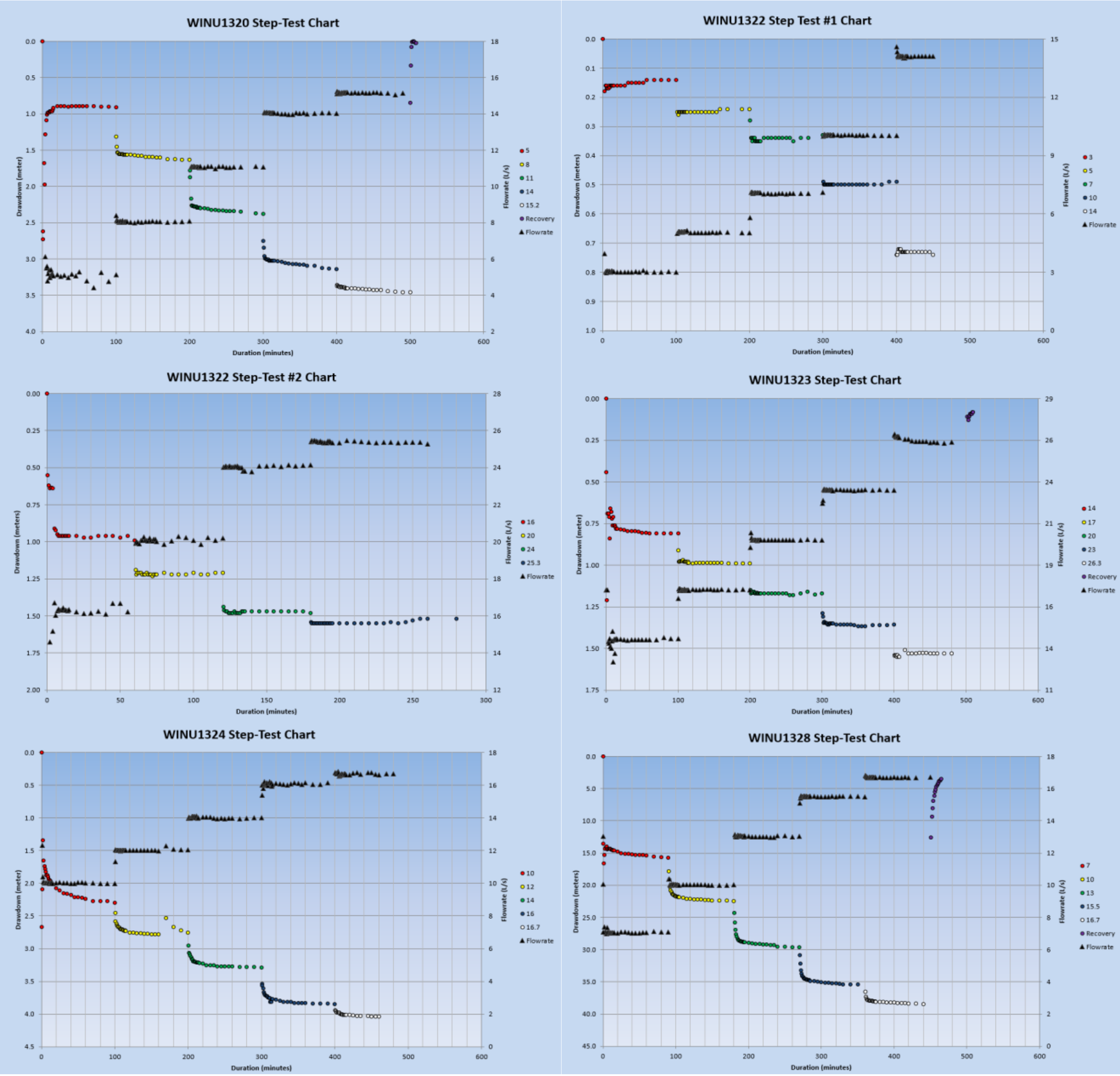


Figure 7-1: Step rate test data for bores along the proposed mine access road alignment

7.3 Constant-rate tests (CRT)

Since the SRT at WINU1322 and WINU1323 demonstrated that max pumping rates of up to 25 L/s could be sustained with minimal operational drawdown (<1.6 m) without stressing the aquifer, the decision was made to omit the CRT at these locations.

The aim of the CRT was to evaluate the performance of the bore over a longer pumping period and to stress the surrounding aquifer. Full 24- or 72-hour CRTs were conducted at WINU1320, WINU1324 and WINU1328.

The adopted pumping rates and the maximum drawdown are summarised in Table 7-4. Drawdown plots for WINU1320, WINU1324 and WINU1328 are presented in Figure 7-2, respectively.

Table 7-4: CRT flow rates, drawdown and recovery

Pumping bore	Flow rate (L/s)	CRT duration (hrs)	Observation bore	Max drawdown (m)	Time taken for 95% recovery (minutes)
WINU1320	14	24	N/A	3.11	2
WINU1324	17	72	WINU1324	4.1	40
			WINU0936	No drawdown response	N/A
			WINU0937	0.23	190
WINU1328	17	24	N/A	39.28	200

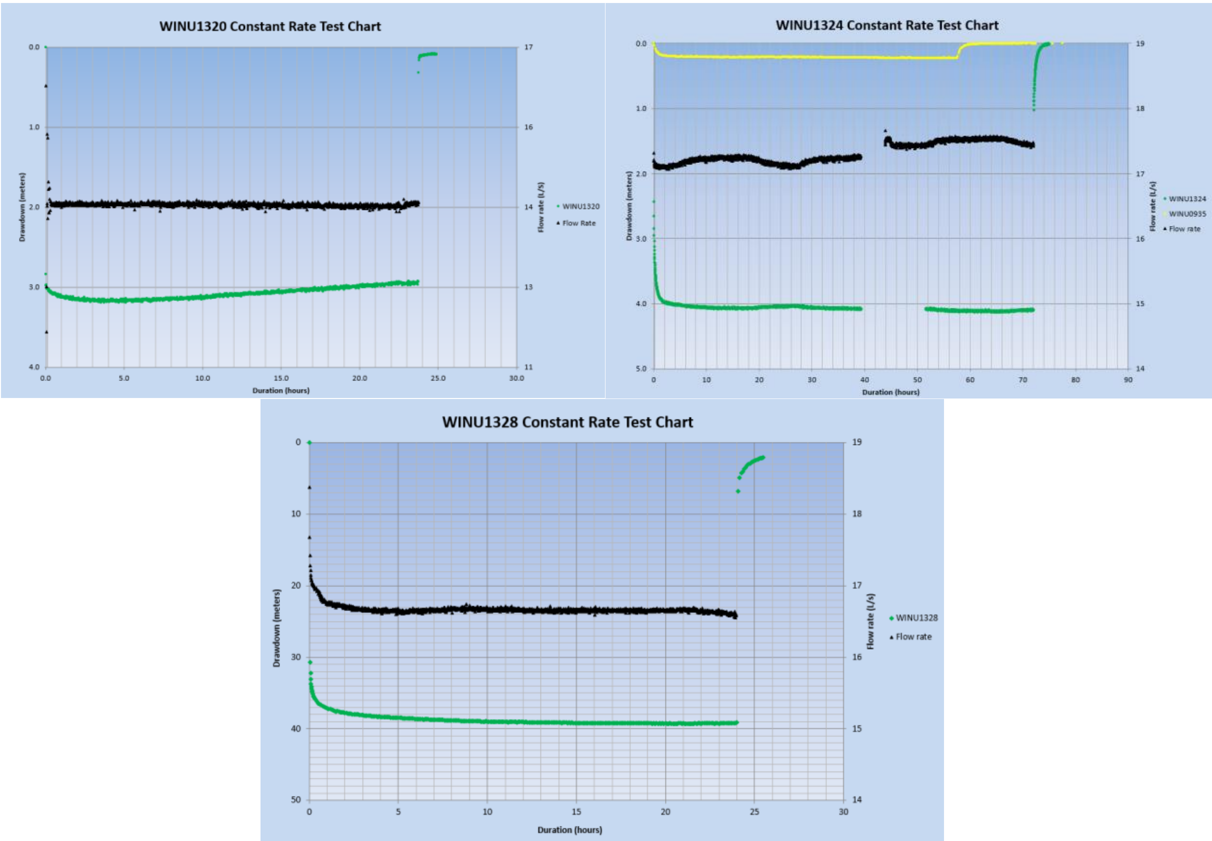


Figure 7-2: CRT data for bores along the proposed access road alignment

7.4 Test interpretation

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

Data along the proposed access road alignment was analysed using a range of analytic solutions which are summarised in Table 7-5 and shown in Appendix B.

Key observations from the analyses are as follows:

7.4.1 Broome/Lower Callawa

These bores (WINU1324 and WINU1328) are located to the west and lies above the Jarlemai Siltstone, meaning they are not connected to the Wallal Aquifer.

- Transmissivity of the Broome (WINU1328) and the Lower Callawa (WINU1324) aquifer is variable but generally high in magnitude and suitable for production supply.
- Transmissivity is estimated to be mostly in the order of 150 - 970 m^2/d
- The storage coefficient estimated during the WINU1324 test for the Lower Callawa aquifer is $4x10^{-4}$ and the estimated specific yield is 0.15 (15%).
- Due to the absence of monitoring bores during the other pumping tests, the corresponding storage parameters (presented in Table 7-5) is not calculable.

7.4.2 Lower Callawa and Unconfined Wallal

These bores (WINU1320, WINU322 and WINU1323) are located to the east and lies in the area where the Jarlemai Siltstone is absent, with direct connection between the Lower Callawa Formation and the Wallal Aquifer.

- Transmissivity of the bores tested in these formations were similar to those tested to the west and would be considered adequate for production supply.
  - Transmissivity ranges between 600 - 950 m^2/d.
  - No storage calculations have been done due to the lack of monitoring bores.

Table 7-5: Summary of estimated aquifer parameters

BH ID	Screened Lithology	Test Premise	Method	T (m^2/d)	Storage	Specific yield (Sy)
WINU1320	Lower Callawa/ Unconfined Wallal	CRT	Moench unconfined (1997)	667	N/A	N/A
WINU1322	Lower Callawa/ Unconfined Wallal	SRT	Moench unconfined (1997)	872	N/A	N/A
WINU1323	Lower Callawa/ Unconfined Wallal	SRT	Hantush-Jacob leaky (1995)	1057	N/A	N/A
WINU1324	Lower Callawa	CRT	Moench unconfined (1997)	967	4E-4	0.15
WINU1328	Broome	CRT	Moench unconfined (1997)	150	N/A	N/A

8. Groundwater chemistry

8.1 Groundwater chemistry

Chemistry data (field parameters) have been obtained from the five production bores and two monitoring bores that were installed as part of this scope of works. Recurring samples have been collected and analysed from the two monitoring bores (WINU0935 and WINU1937) while one-off samples have been collected from the pumping bores at the end of airlift testing.

A Piper plot characterising the groundwater chemistry is shown in Figure 8-1. The laboratory analysis results are presented in Appendix C, collected during routine baseline groundwater sampling. Lab results for WINU1320, WINU1323 and WINU1328 collected during pumping tests are also included. Lab analysis for WINU1322 and WINU1324 was not finalised at the time of reporting.

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

- Groundwater samples from the target aquifers (Broome, Lower Callawa and unconfined Wallal) along the road alignment are generally fresh, with an Electrical Conductivity between 419 µS/cm (WINU1323) to 1,750 µS/cm (WINU1328) (Figure 8-2)
- pH is generally neutral to slightly basic, between 7.0 and 8.0 pH
- Groundwater EC and pH do not appear to have an obvious spatial or vertical trend, or lithological association
- Piper plot analysis shows that groundwater has a sodium chloride signature
- 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
- Concentrations of dissolved metals are generally below detection limits

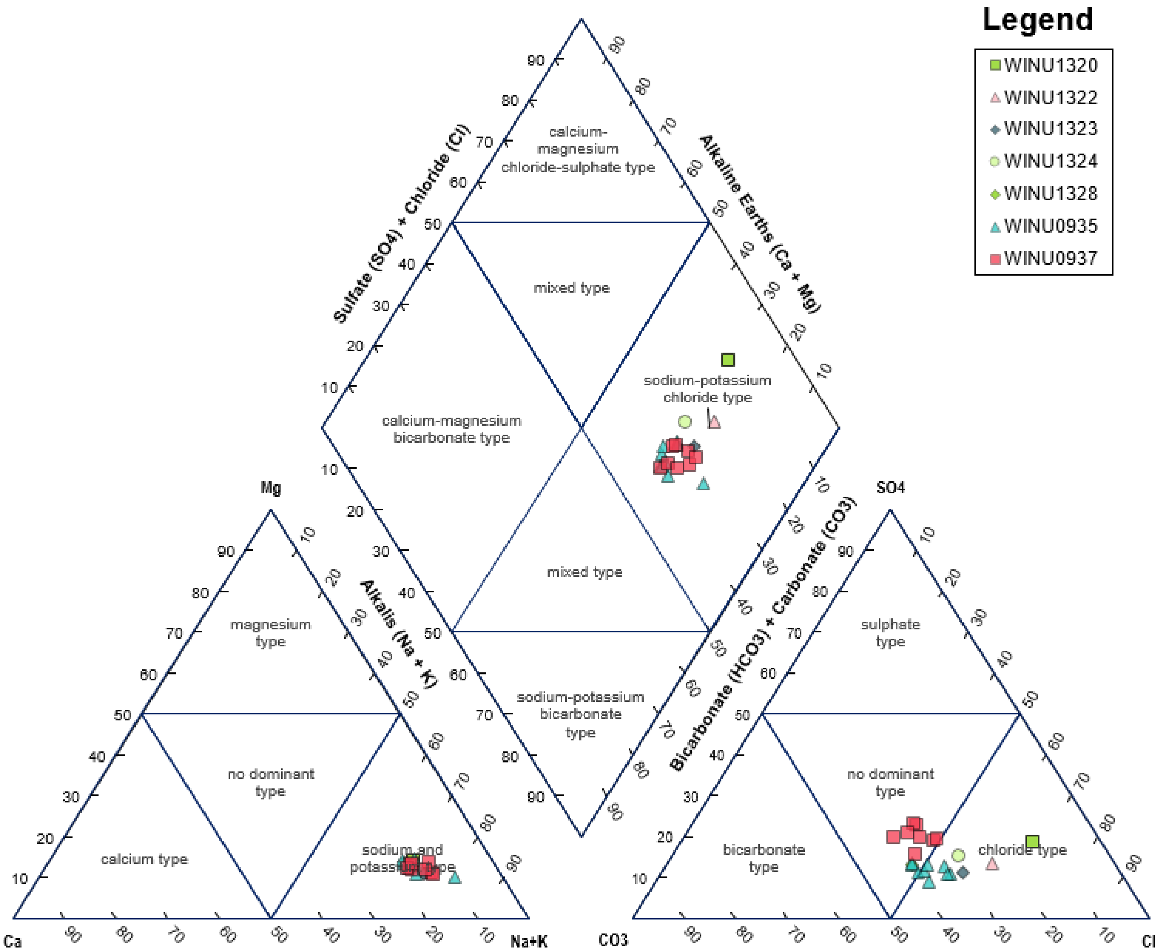
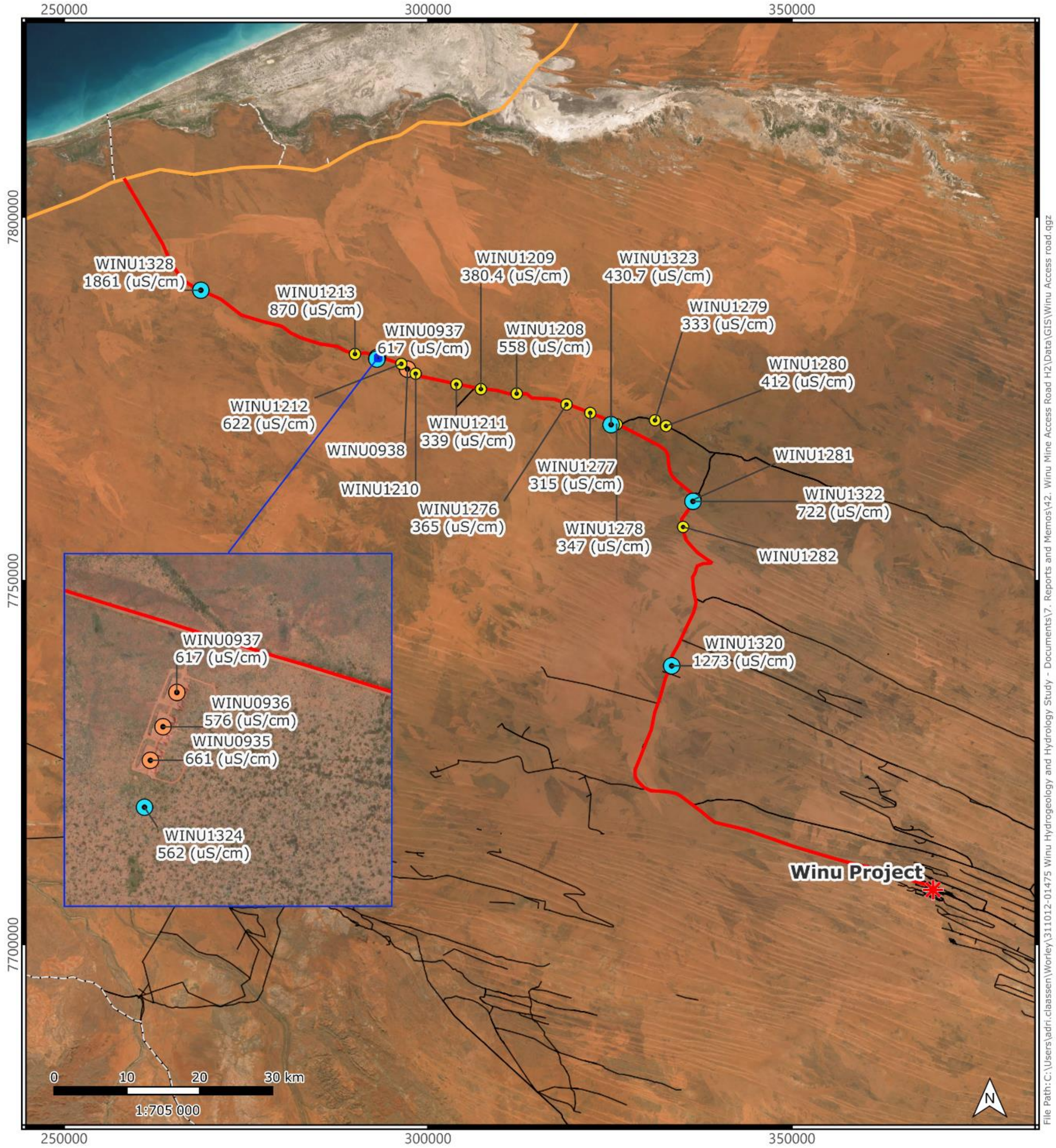


Figure 8-1: Piper diagram of groundwater chemistry of samples taken during pumping testing



Legend

- Winu Project

Regional roads

- Great Northern Highway
- Local Road,Miscellaneous Road,Proposed Road
- State Road
- RTX paterson tracks

Field water quality - EC (uS/cm)

Access Road H2 Report

Project No.
311012-01475

Notes:
Project CRS: GDA94 / MGA zone 51 Grid CRS: GDA94 Z56
Filename: Winu Access road
Project Exported: 03/07/2025

References:

Consultant: worley consulting

Client: RioTinto

Figure 8-2: Field Water quality measurements

9. Analytic groundwater response and prediction

A forward prediction of groundwater levels for each proposed production bore was performed based on the proposed construction schedule and water usage rates (Table 9-1), using the estimated hydraulic properties from the Aqtesolv analyses.

The results obtained from the Aqtesolv analysis (Table 9-1) indicate:

- Peak pumping rate (~15 L/s) at each bore can likely be maintained for the duration of road construction with negligible drawdown in surrounding aquifers.
- Bore WINU1328 screened in the Broome aquifer indicates the biggest drawdown predicted at ~34 m bgl
- All other bores indicate a predicted drawdown of less than 4 m

Table 9-1 Forward prediction of proposed abstraction rates

Bore id	Planned Usage Schedule		Op. Time (month)	Water Demand (GL/a)	Peak Rate (L/s)	Max predicted ddn (m)	Recovery time 95%(days)	Aquifer
	Start	Finish						
WINU1320	Jun-28	Nov-28	6	0.09	15	3.3	<1	Unconfined Wallal
WINU1322	Mar-28	Aug-28	6	0.21	15	1.6	<1	Unconfined Wallal
WINU1323	Nov-28	Apr-29	6	0.12	15	1.4	<1	Unconfined Wallal
Maintenance	Mar-28	Mar-30	24	0.17	15	N/A	N/A	Unconfined Wallal
Total Unconfined Wallal				**0.6**				
WINU1324	Nov-28	Apr-29	6	0.22	15	3.8	<1	Broome
WINU1328	Nov-28	Apr-29	6	0.15	15	34.5	<1	Broome
Maintenance	Mar-28	Mar-30	24	0.03	15	N/A	N/A	Broome
Total Broome				**0.4**				

10. Assessment of potential impacts

Based on the drawdown estimation results obtained from the analytic analysis and forward predictions of groundwater abstraction:

- 0.4 GL/a from the Broome Aquifer and Lower Callawa Formation above the Jarlemai Siltstone can be sustained with negligible impacts on any receptors
- 0.6 GL/a from the Lower Callawa and Unconfined Wallal aquifer where the Jarlemai Siltstone is absent can be sustained with negligible impacts on any receptors

The following assessment is provided:

- The third-party receptors outlined in Section 4.2.1 and 4.2.2 will not be affected by any water level drawdowns induced by pumping from proposed production bores for road construction
- Water levels and water pressure at the environmental receptors mentioned in Section 4.2.3 will not be affected by any water level drawdowns induced by pumping from proposed production bores for road construction.

11. Groundwater monitoring

Given the low volume of water abstraction proposed for each individual bore, and the minimal predicted drawdown, the associated risk does not justify a detailed groundwater monitoring program. However, it would be prudent to implement a basic operational monitoring strategy to address potential risks.

12. Conclusion

A total of five production bores - **WINU1320**, **WINU1322**, **WINU1323**, **WINU1324** and **WINU1328** - have been installed along the alignment of the proposed access road. These bores are proposed to collectively supply 1.0 GL/a of groundwater, which equates to a constant supply of ~32 L/s, for construction.

A groundwater temporary abstraction license (24-months) allowing 1.0 GL/a for construction is needed:

- 0.4 GL/a from the Broome Aquifer and Lower Callawa Formation above the Jarlemai Siltstone
- 0.6 GL/a from the Lower Callawa and Unconfined Wallal aquifer where the Jarlemai Siltstone is absent

Two production bores (WINU1324 and WINU1328) are screened above the Jarlemai Siltstone in the Broome and Lower Callawa formations, while the three bores (WINU1320, WINU1322 and WINU1323) to the east are screened where the Jarlemai Siltstone is absent and penetrates the Lower Callawa Formation and the Unconfined Wallal aquifer.

Assuming a peak demand, each bore would operate at a maximum pumping rate of approximately 15 L/s over a 6-month period, resulting in a total operational period of 24 months across all bores. Under this pumping regime, the expected maximum drawdowns are:

- Bore WINU1328 screened in the Broome aquifer indicates the biggest drawdown predicted at ~34.5 m.
- All other bores indicate a predicted drawdown of less than 4 m.

Aquifer response data shows that drawdown is minimal, stabilised, and recovers to within 95% of static levels within one day after pumping ceases. This suggests a low risk of long-term aquifer depletion. Even though WINU1328 experiences comparably more drawdown than the other bores, the steady-state nature of groundwater flow indicates that over-abstraction is unlikely.

Due to the absence of any nearby third-party mining, agricultural or environmental receptors and the shallow and localised nature of the drawdown cones around the proposed production bores, the risk of impacts on other groundwater users is considered negligible.

13. References

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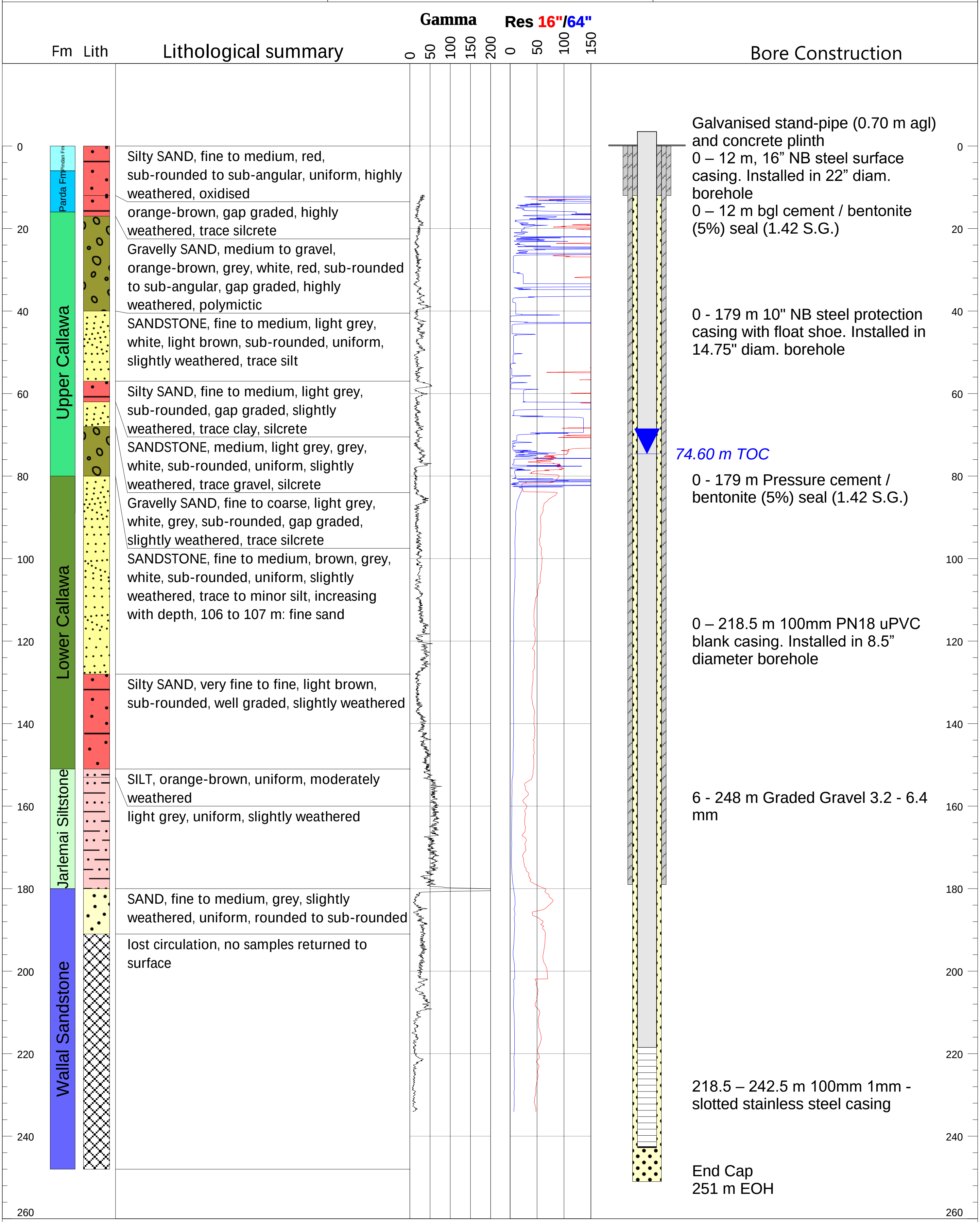
Appendix A. Bore and Drilling Logs

WINU0935 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 292989.33 mE / 7780575.50 mN Elevation: 125.83 m AHD (RL = TOC)	Construction start date: 22/10/2022 Construction end date: 27/11/2022 Inclination: -90° Depth drilled: 248 m BGL	Final airlift yield: 8 L/s EC: 661 µS/cm pH: 8.3 Temp: 31.4 °C Static Water Level: 74.60 m TOC



Additional notes:

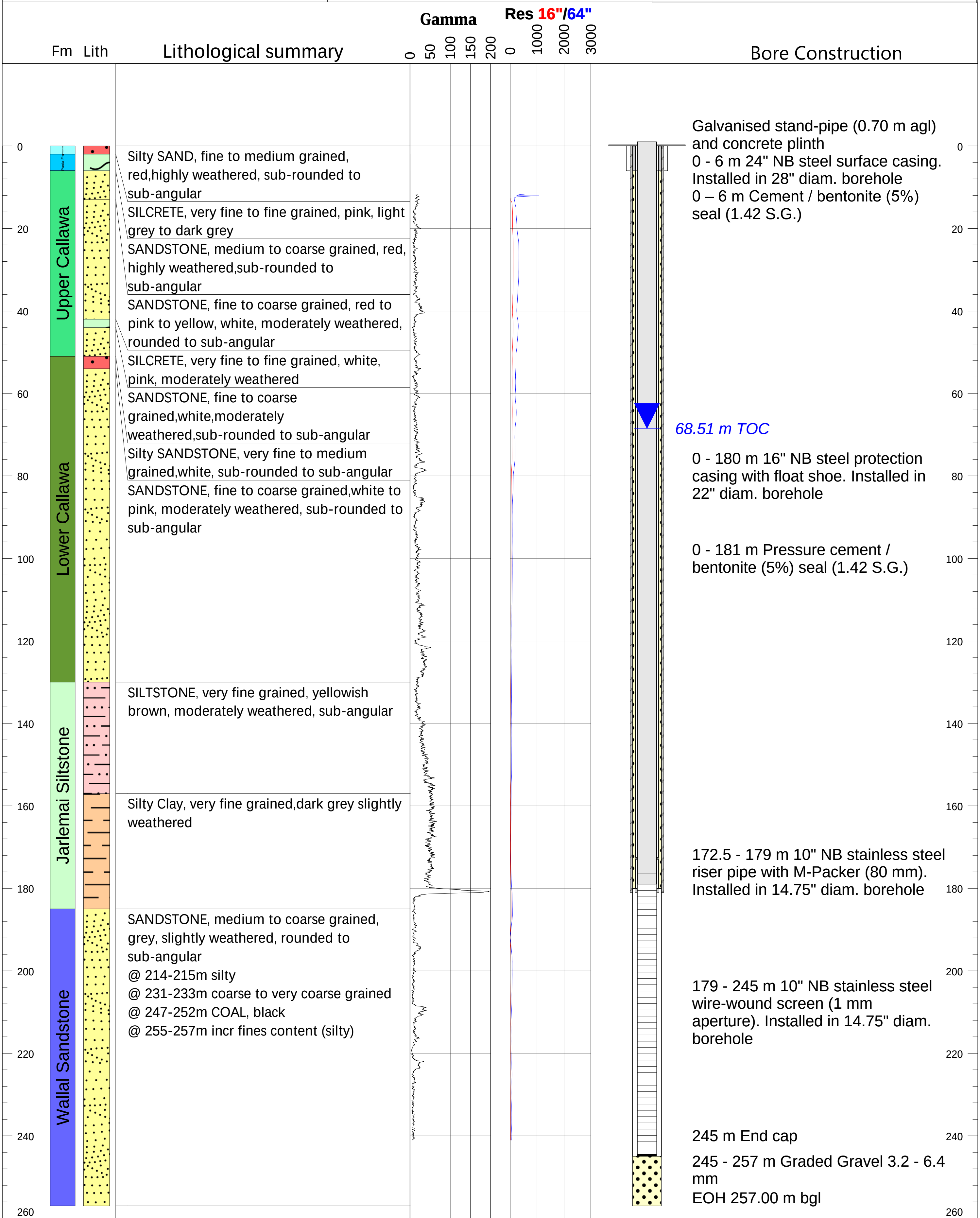
Advisian
Worley Group

WINU0936 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 293016.09 mE / 7780646.76 mN
Elevation: 126.67 m AHD (RL = TOC)

Construction start date: 22/10/2022
Construction end date: 30/04/2023
Inclination: -90°
Depth drilled: 257 m BGL

Final airlift yield: 50.0 L/s
EC: 576 µS/cm
pH: 7.8
Temp: 23.3 °C
Static Water Level: 68.51 m TOC



Additional notes:

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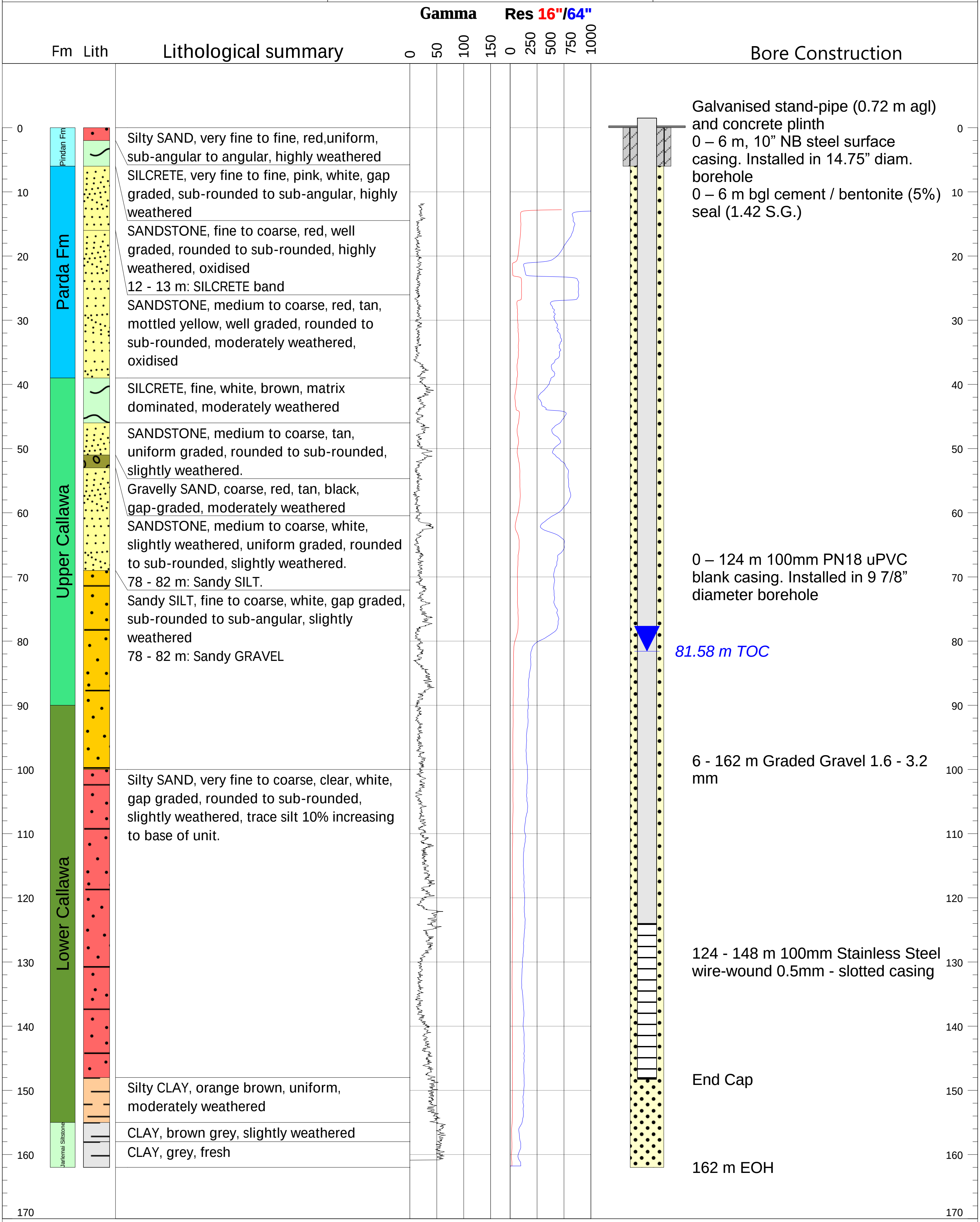
Worley Group

WINU0937 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program	Construction start date: 18/10/2022	Final airlift yield: 4 L/s
Client: Rio Tinto	Construction end date: 11/01/2022	EC: 617 µS/cm
CRS: GDA94 MGA51	Inclination: -90°	pH: 8.4
Coordinates: 293047 mE / 7780716 mN	Depth drilled: 162 m BGL	Temp: 30.4 °C
Elevation: 150 m AHD (RL = TOC)		Static Water Level: 81.58 m bgl



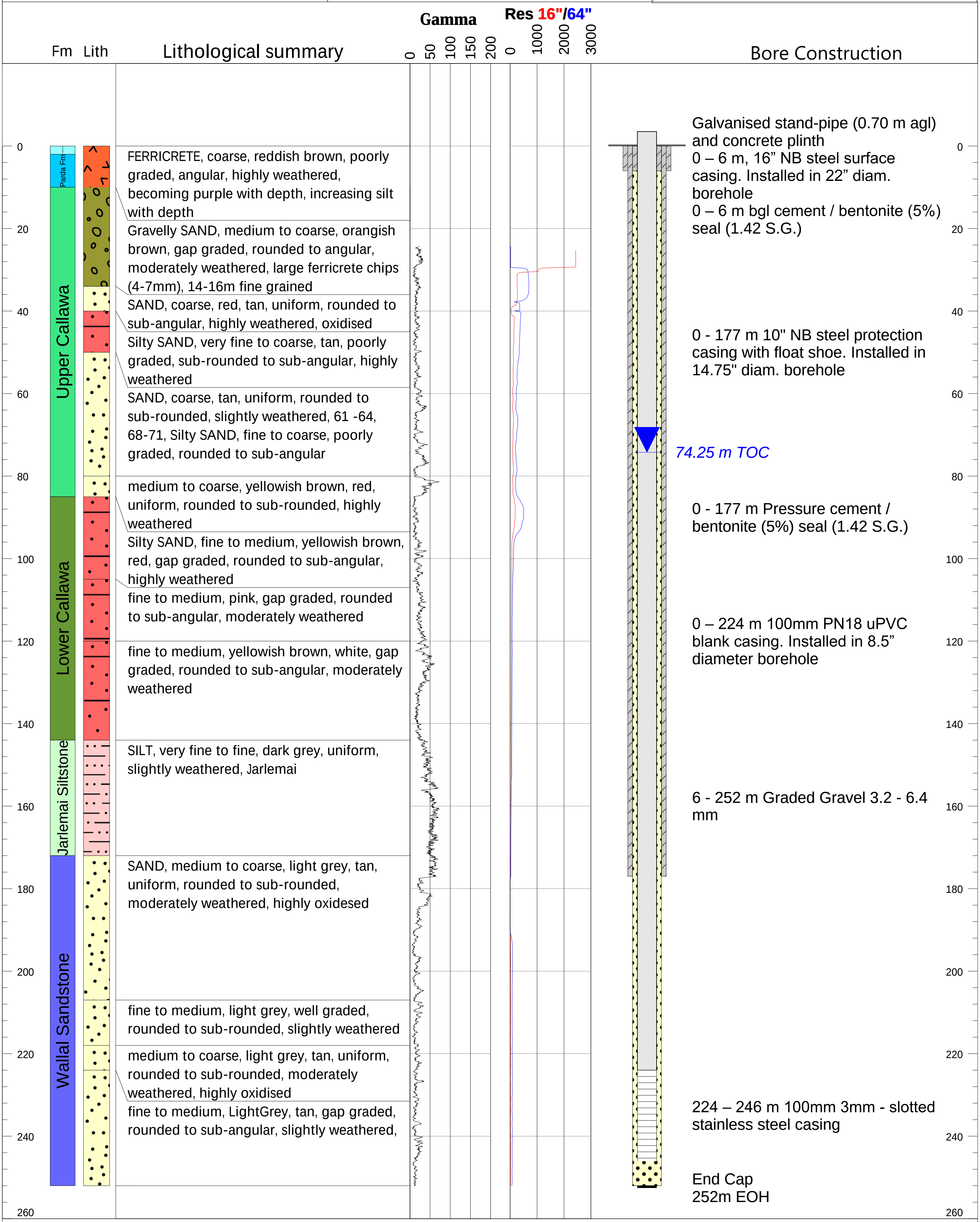
Additional notes:

WINU0938 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 297191.24 mE / 7779091.05 mN
Elevation: 131.89 m AHD (RL = TOC)

Construction start date: 05/11/2022
Construction end date: 14/12/2022
Inclination: -90°
Depth drilled: 252 m BGL

Final airlift yield: 7.0 L/s
EC: 532 µS/cm
pH: 8.1
Temp: 21.3 °C
Static Water Level: 73.13 m TOC

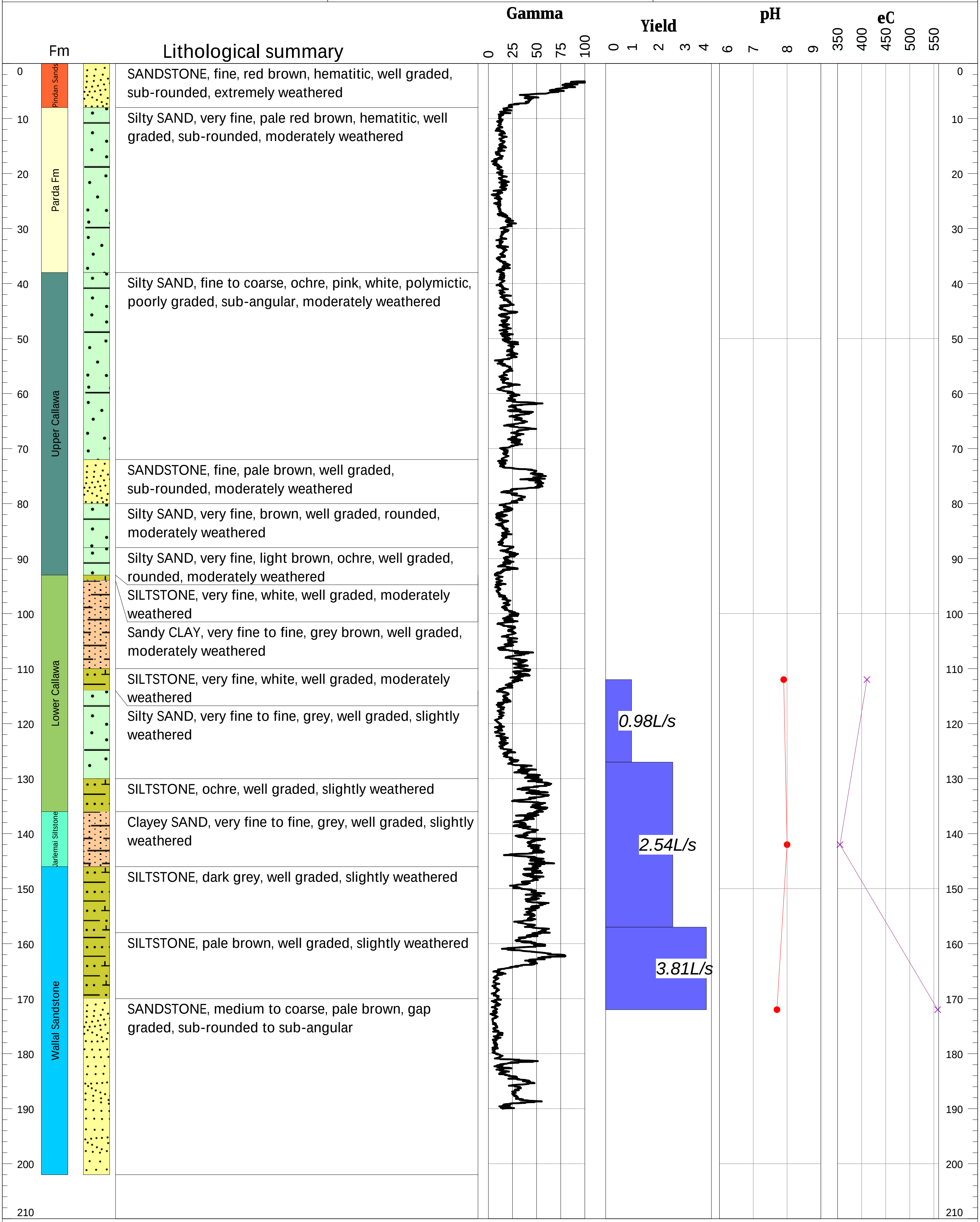


Additional notes:

Advisian
Worley Group

WINU1208 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 312200 mE / 7775735 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 12/07/2022 Construction end date: 23/07/2022 Inclination: -90° Depth drilled: 202 m BGL	Final airlift yield: 4 L/s EC: 558 µS/cm pH: 8 Static Water Level: m bgl Temp: °C



Additional notes:

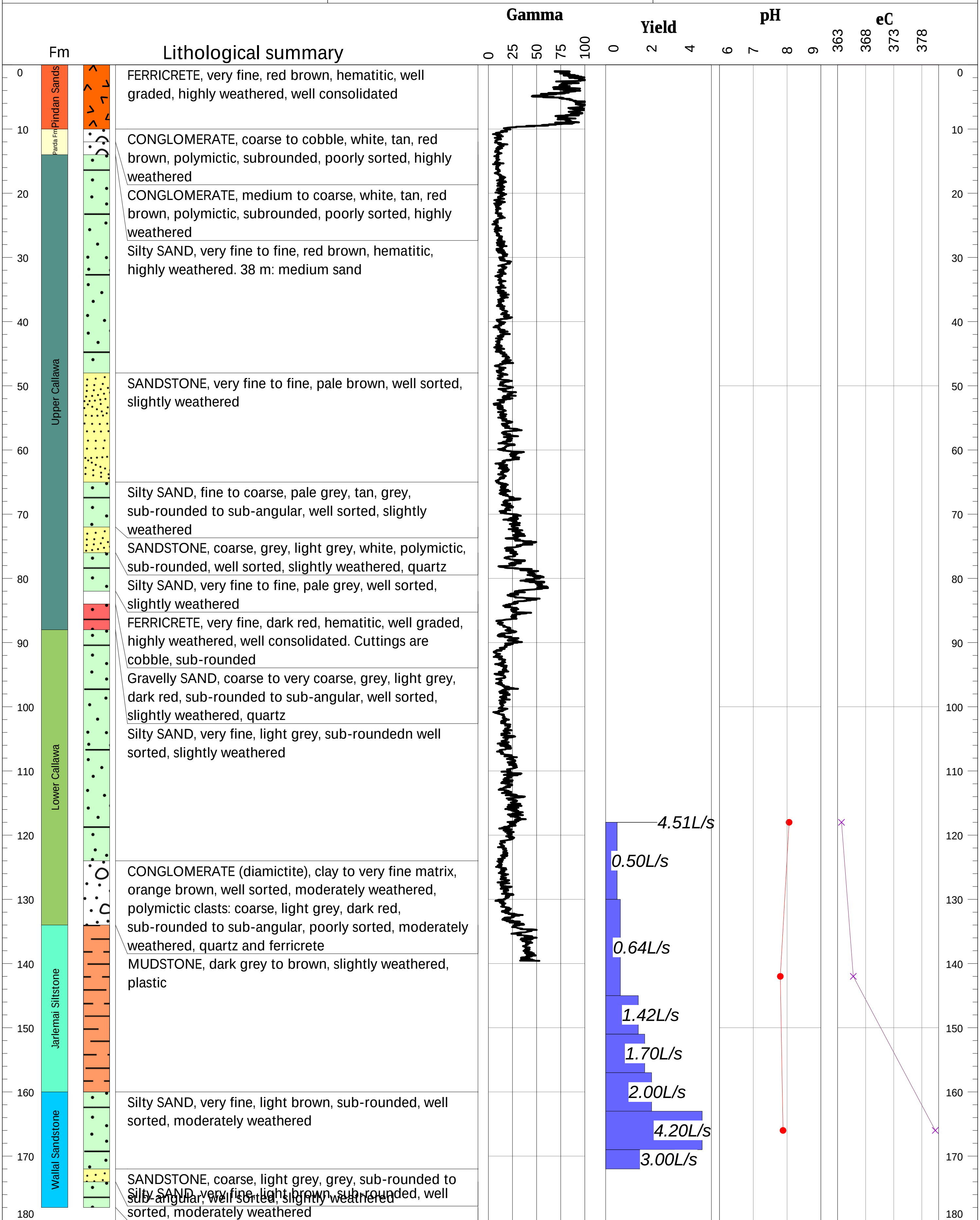
Advisian
Worley Group

WINU1209 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 307280 mE / 7776351 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 16/07/2022
Construction end date: 19/07/2022
Inclination: -90°
Depth drilled: 178 m BGL

Final airlift yield: 4 L/s
EC: 380 µS/cm
pH: 8
Static Water Level: m bgl
Temp: 30 °C

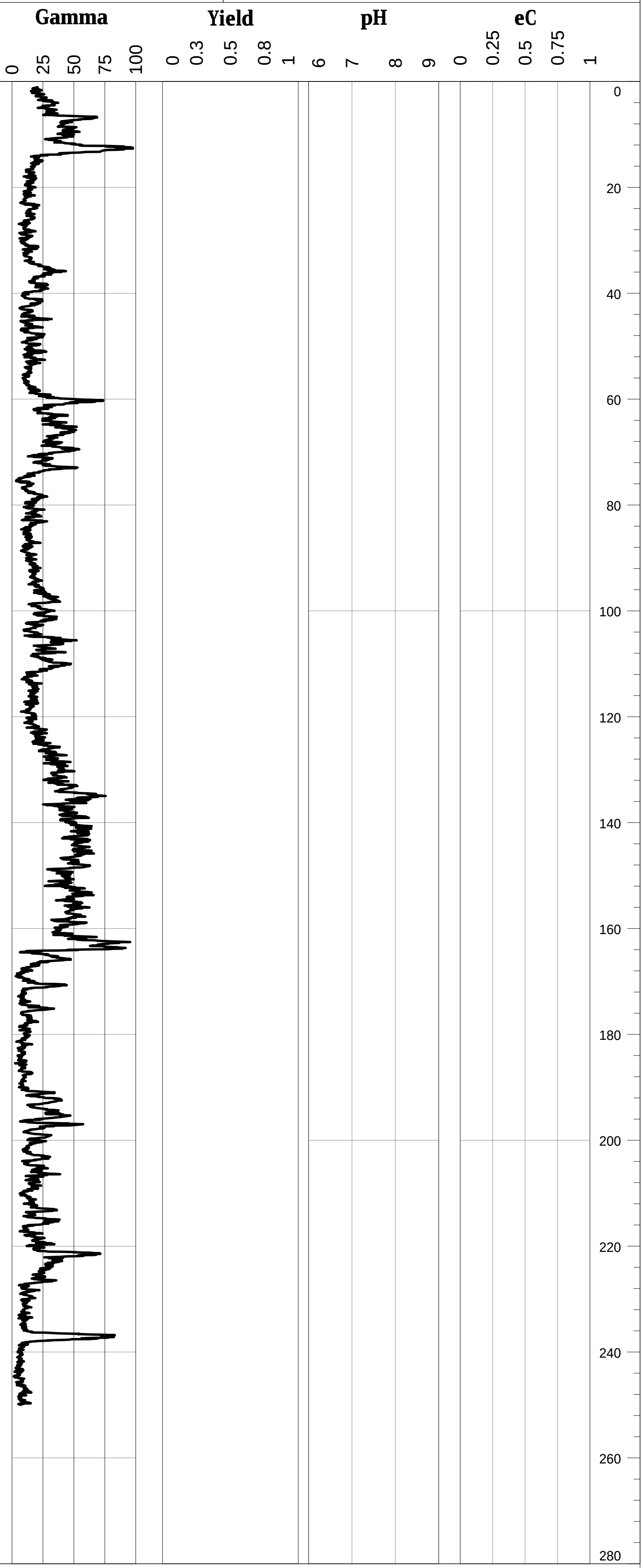


Additional notes:

WINU1210 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program	Construction start date: 19/07/2022	Final airlift yield: L/s
Client: Rio Tinto	Construction end date: 29/07/2022	EC: µS/cm
CRS: GDA94 MGA51	Inclination: -90°	pH:
Coordinates: 298319 mE / 7778473 mN	Depth drilled: 262 m BGL	Static Water Level: m bgl
Elevation: 0 m AHD (RL = TOC)		Temp: °C

Fm	Lithological summary
Pindan Sands	SANDSTONE, fine to medium, red brown, aeolian sand, well graded, sub-rounded, extremely weathered
Parda Fm	Sandy SILT, very fine to fine, orange brown, hematitic, poorly graded, sub-rounded, extremely weathered
Upper Callawa	SANDSTONE, fine to coarse, tan, light grey, grey, polymictic, moderately graded, sub-rounded to sub-angular, moderately weathered
Upper Callawa	SANDSTONE, fine to coarse, white, light grey, polymictic, poorly graded, sub-rounded to sub-angular, moderately weathered, minor silcrete, ochre, very fine
Lower Callawa	Silty SAND, very fine to fine, pale grey, , well graded, sub-rounded, moderately weathered, trace coarse sand, light grey, sub-rounded
Lower Callawa	Silty SAND, very fine to fine, orange brown, well graded, sub-rounded, moderately weathered, 90 m: minor coarse sand, light grey
Lower Callawa	Clayey SAND, fine, brown, well graded, rounded, slightly weathered
Lower Callawa	Clayey SAND, orange brown, well graded, rounded, moderately weathered
Jarlemai Siltstone	MUDSTONE, dark grey, well graded, fresh rock, massive, plastic. 156 - 160 m: trace silt. 164 - 166 m: minor silt, grey
Wallal Sandstone	SANDSTONE, medium, grey, light grey, brown, well graded, sub-rounded, fresh rock, 192 - 202 m: minor clay and silt, brown. 220 - 224 m: minor clay and silt, brown. 228 m: coarse sand, grey. 244 - 248 m: coarse sand, grey. 252 - 258 m: coarse sand, grey



Additional notes:

Advisian
Worley Group

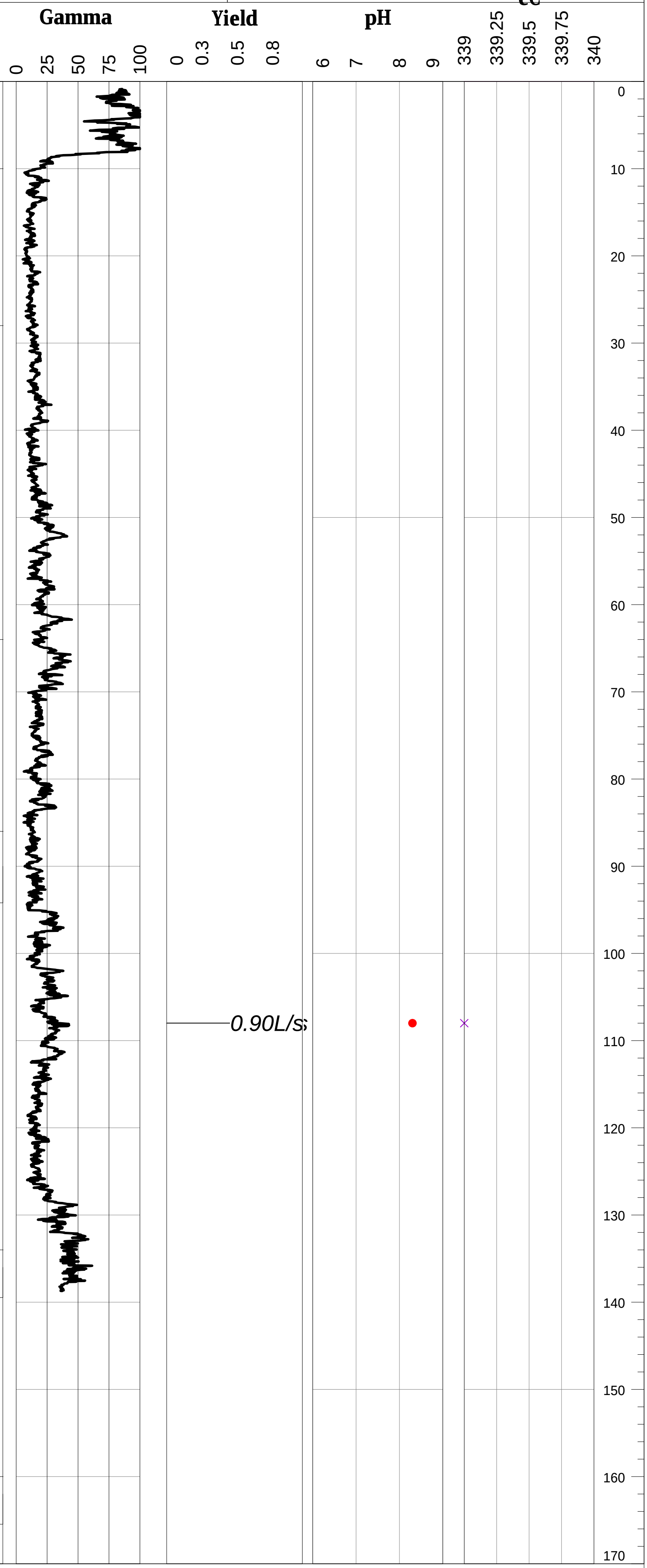
WINU1211 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 303904 mE / 7777012 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 02/07/2022
Construction end date: 03/08/2022
Inclination: -90°
Depth drilled: 162 m BGL

Final airlift yield: 0.9 L/s
EC: 339 µS/cm
pH: 8
Static Water Level: m bgl
Temp: °C

Fm	Lithological summary
Pindan Sands	FERRICRETE, very fine, red brown, hematitic, well graded, extremely weathered,
Parda Fm	SANDSTONE, medium to coarse, red brown, hematitic, well graded, sub-rounded to sub-angular, extremely weathered,
Upper Callawa	Silty SAND, very fine to fine, brown, gap graded, sub-rounded, moderately weathered, 44 - 58 m: minor coarse sand, light grey, sub-rounded to sub-angular.
	SANDSTONE, coarse to very coarse, light grey, grey, well graded, sub-rounded, slightly weathered, trace silt, white. 78 - 80 m: trace cobble, rounded, polymictic
	SANDSTONE, coarse, orange brown, light grey, grey, well graded, sub-rounded, slightly weathered, trace cobble
Lower Callawa	Silty SAND, coarse, grey,orange brown,dark grey, polymictic, poorly graded, sub-rounded, moderately weathered, decreasing coarse sand content with depth
	FERRICRETE, very fine, red brown, hematitic, well graded, rounded, highly weathered
Jarlemai Siltstone	MUDSTONE, dark grey, well graded, fresh rock, 156 - 160 m: minor silt
	Sandy SILT, very fine to fine, tan, well graded, sub-rounded, moderately weathered,



Additional notes:

Advisian
Worley Group

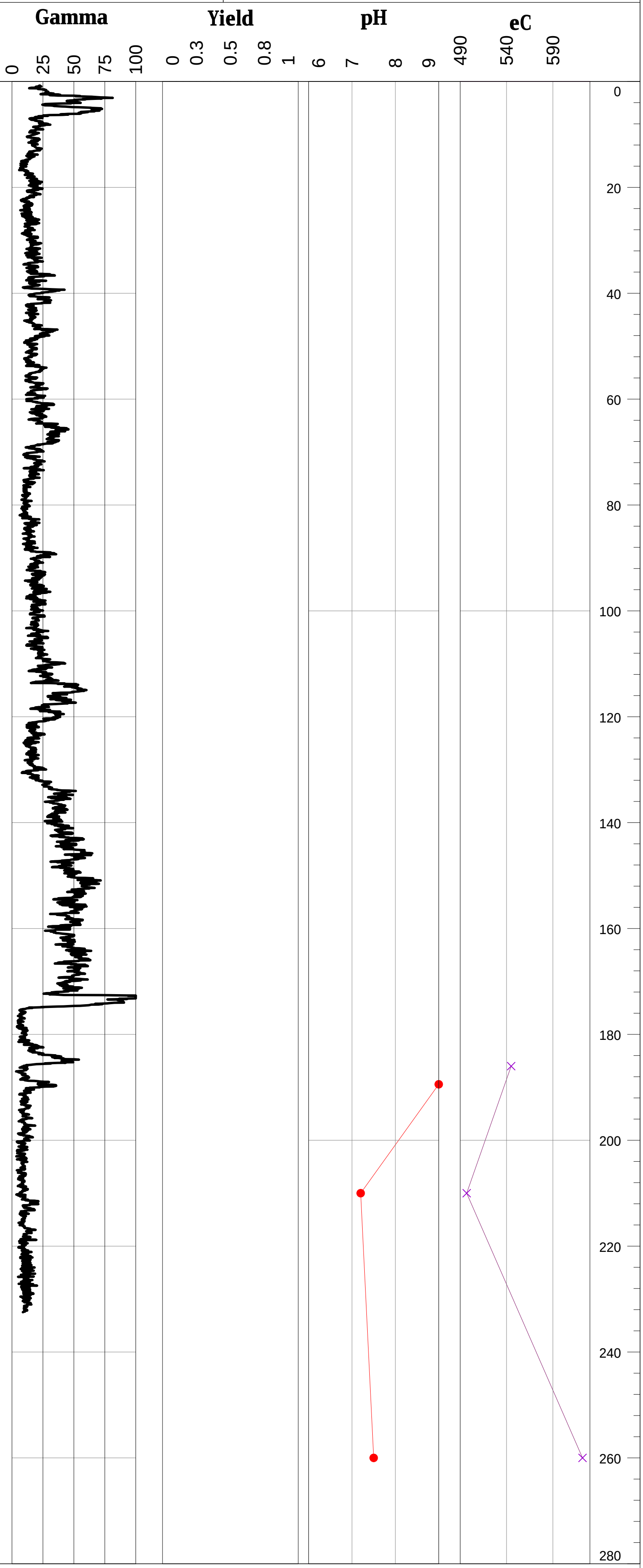
WINU1212 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 296338 mE / 7779813 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 27/07/2022
Construction end date: 31/07/2022
Inclination: -90°
Depth drilled: 262 m BGL

Final airlift yield: L/s
EC: 622 µS/cm
pH: 8
Static Water Level: m bgl
Temp: °C

Fm	Lithological summary
Parda Fm	SANDSTONE, very fine to fine, red brown, aeolian sand, hematitic, well graded, sub-rounded, extremely weathered
Parda Fm	Silty SAND, silt to fine, red brown, well graded, sub-rounded, highly weathered
Upper Callawa	Silty SAND, silt to very fine, pink brown, poorly graded, sub-rounded, moderately weathered, minor coarse sand
Upper Callawa	CONGLOMERATE, coarse to very coarse, light grey, white, dark grey, red, polymictic, gap graded, sub-rounded to sub-angular, slightly weathered
Upper Callawa	FERRICRETE, very fine, dark red, hematitic, well graded, sub-rounded, highly weathered, well consolidated
Upper Callawa	SANDSTONE, medium to coarse, light grey, well graded, rounded to sub-rounded, slightly weathered, trace silt, white, poorly consolidated 50 m: minor silt, white 66 - 68 m: silt, white andpale grey, massive, moderately weathered.
Lower Callawa	Silty SAND, very fine, pale brown, well graded, slightly weathered, trace coarse, light grey, quartzose, sub-rounded to sub-angular
Lower Callawa	SANDSTONE, fine to medium, pale brown, brown, light grey, well graded, sub-rounded to sub-angular, slightly weathered 82 m: SANDSTONE, light grey, medium 122 m: SANDSTONE, light grey, medium
Lower Callawa	Clayey SAND, very fine, brown, orange brown, well graded, moderately weathered,
Jarlemai Siltstone	MUDSTONE, dark grey, well graded, slightly weathered, massive, plastic
Wallal Sandstone	Gravelly SANDSTONE, coarse to very coarse, light grey, well graded, sub-rounded, fresh rock, quartz, trace cobble. 194 - 198 m: SANDSTONE, grey brown, fine to medium 202 - 204 m: SANDSTONE, grey brown, fine to medium 212 - 216 m: SANDSTONE, grey brown, fine to medium 224 - 228 m: SANDSTONE, grey brown, fine to medium
Wallal Sandstone	CONGLOMERATE, coarse to pebble, dark grey, light grey, goethitic, poorly graded, sub-rounded to sub-angular, moderately weathered
Wallal Sandstone	SANDSTONE, fine to medium, grey brown, well graded, sub-rounded to sub-angular, fresh rock
Wallal Sandstone	Gravelly SANDSTONE, coarse to very coarse, light grey, well graded, sub-rounded to sub-angular, fresh rock 248 - 254 m: SANDSTONE, grey brown, fine to medium 256 - 258 m: SANDSTONE, grey brown, fine to medium



Additional notes:

Advisian
Worley Group

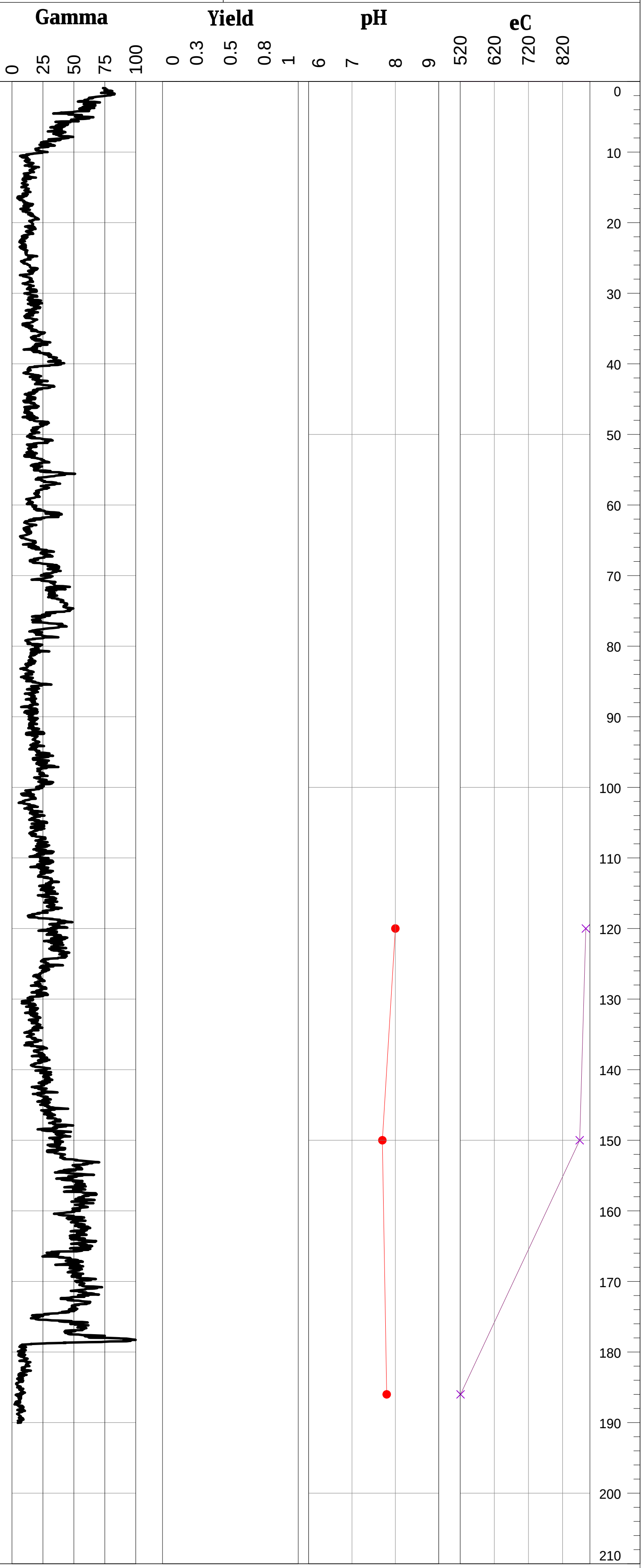
WINU1213 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 289976 mE / 7781168 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 30/07/2022
Construction end date: 03/08/2022
Inclination: -90°
Depth drilled: 204 m BGL

Final airlift yield: L/s
EC: 521 µS/cm
pH: 8
Static Water Level: m bgl
Temp: °C

Fm	Lithological summary
Pindan Sands	SANDSTONE, fine, red brown, aeolian sand, well graded, sub-rounded to sub-angular, extremely weathered
Parda Fm	SILCRETE, very fine, ochre, hematitic, uniform, rounded, highly weathered
Parda Fm	SANDSTONE, coarse, orange brown, hematitic, gap graded, sub-rounded, extremely weathered, trace silcrete
Upper Callawa	coarse to very coarse, red brown, grey, white, pink, hematitic, poorly graded, sub-rounded, highly weathered, polymictic, trace fine to medium grains
Upper Callawa	coarse, light grey, white, moderately sorted, sub-rounded, fresh rock, 48 m: trace fine sand. 54-56 m: gravel sized clasts of quartz
Upper Callawa	coarse to very coarse, light grey, orange brown, darky grey, hematitic, well graded, sub-rounded, moderately weathered
Upper Callawa	coarse, light grey, grey, white, well graded, sub-rounded, fresh rock, minor silty SAND, white, very fine, well graded, fresh
Upper Callawa	very fine to fine, light grey, well graded, sub-rounded, fresh rock
Upper Callawa	coarse, light grey, grey, white, well graded, sub-rounded, fresh rock, trace silty SAND, white, very fine, well sorted, fresh
Upper Callawa	very fine to fine, light grey, well graded, sub-rounded, fresh rock
Upper Callawa	coarse, light grey, grey, white, well graded, sub-rounded, fresh rock, minor silty SAND, white, very fine, well graded, fresh
Lower Callawa	coarse, light grey, orange brown, hematitic, well graded, sub-rounded, slightly weathered
Lower Callawa	Silty SAND, very fine, white, well graded, fresh rock, trace SAND, light grey, grey, coarse, subrounded, well graded
Lower Callawa	CONGLOMERATE, fine to coarse, orange brown,white, red brown, polymictic, poorly graded, sub-rounded to sub-angular, moderately weathered,
Jarlemai Siltstone	MUDSTONE, dark grey, black, well graded, slightly weathered, moderately plastic
Wallal Sandstone	SANDSTONE, coarse, grey, well graded, sub-rounded, fresh rock

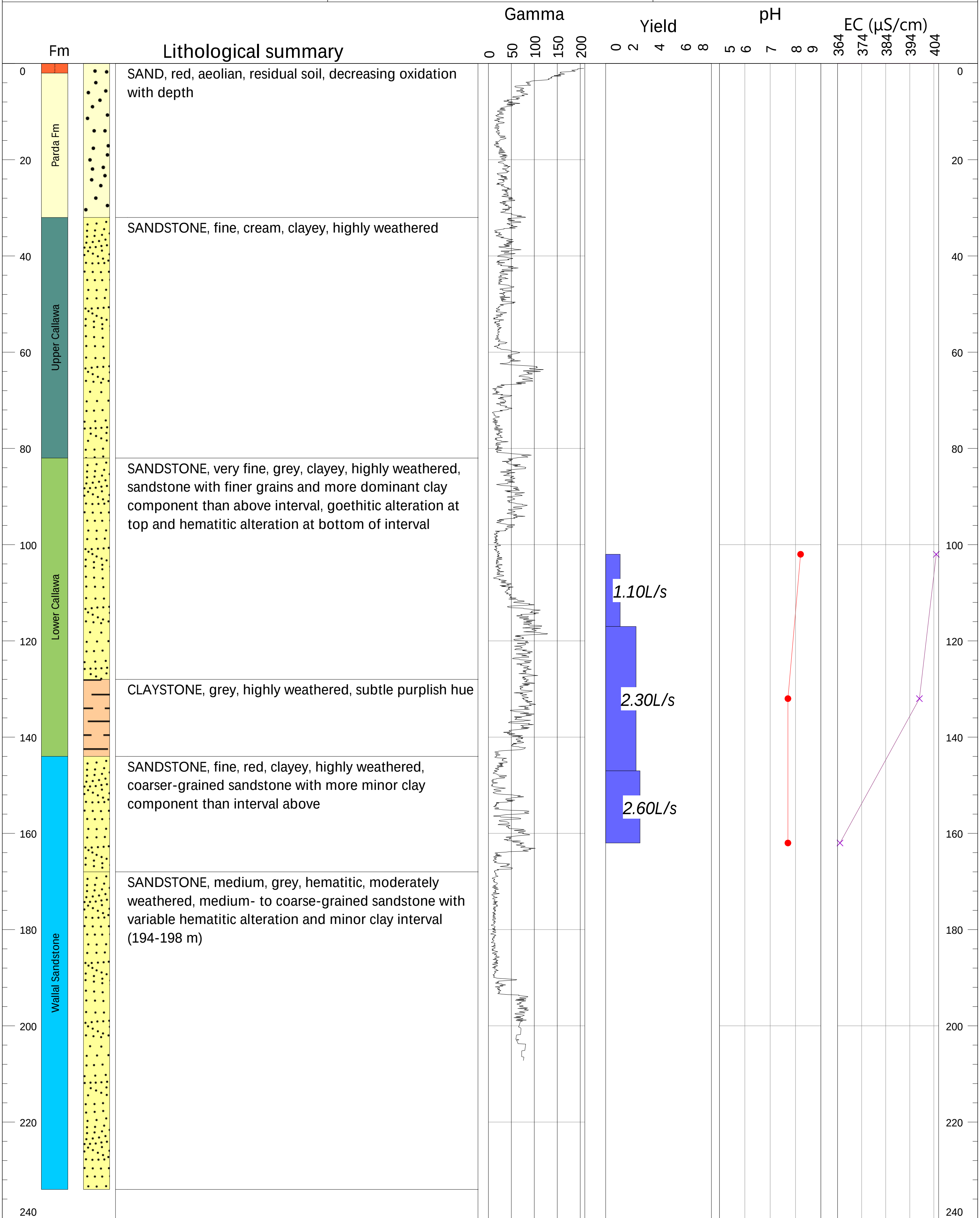


Additional notes:

Advisian
Worley Group

WINU1276 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 319039 mE / 7774243 mN Elevation: 0 m AHD (RL = TOC)	Construction start date: 23/05/2023 Construction end date: 13/06/2023 Inclination: -90° Depth drilled: 238 m BGL	Final airlift yield: 2.8 L/s EC: 365 µS/cm pH: 7.7 Static Water Level: m bgl



Additional notes:

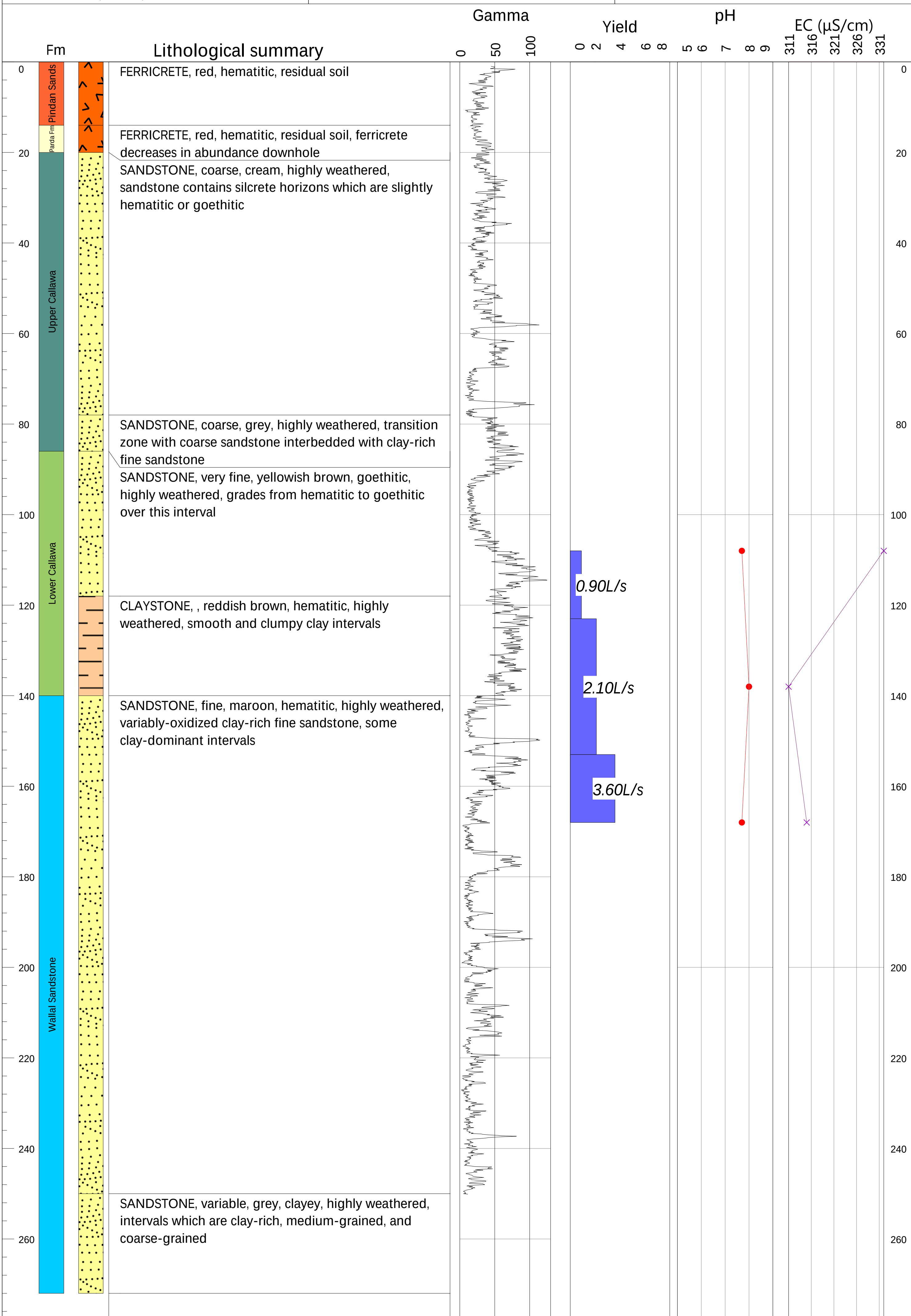
Advisian
Worley Group

WINU1277 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 322302 mE / 7773065 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 24/05/2023
Construction end date: 13/06/2023
Inclination: -90°
Depth drilled: 272 m BGL

Final airlift yield: 3.5 L/s
EC: 315 µS/cm
pH: 7.7
Static Water Level: m bgl

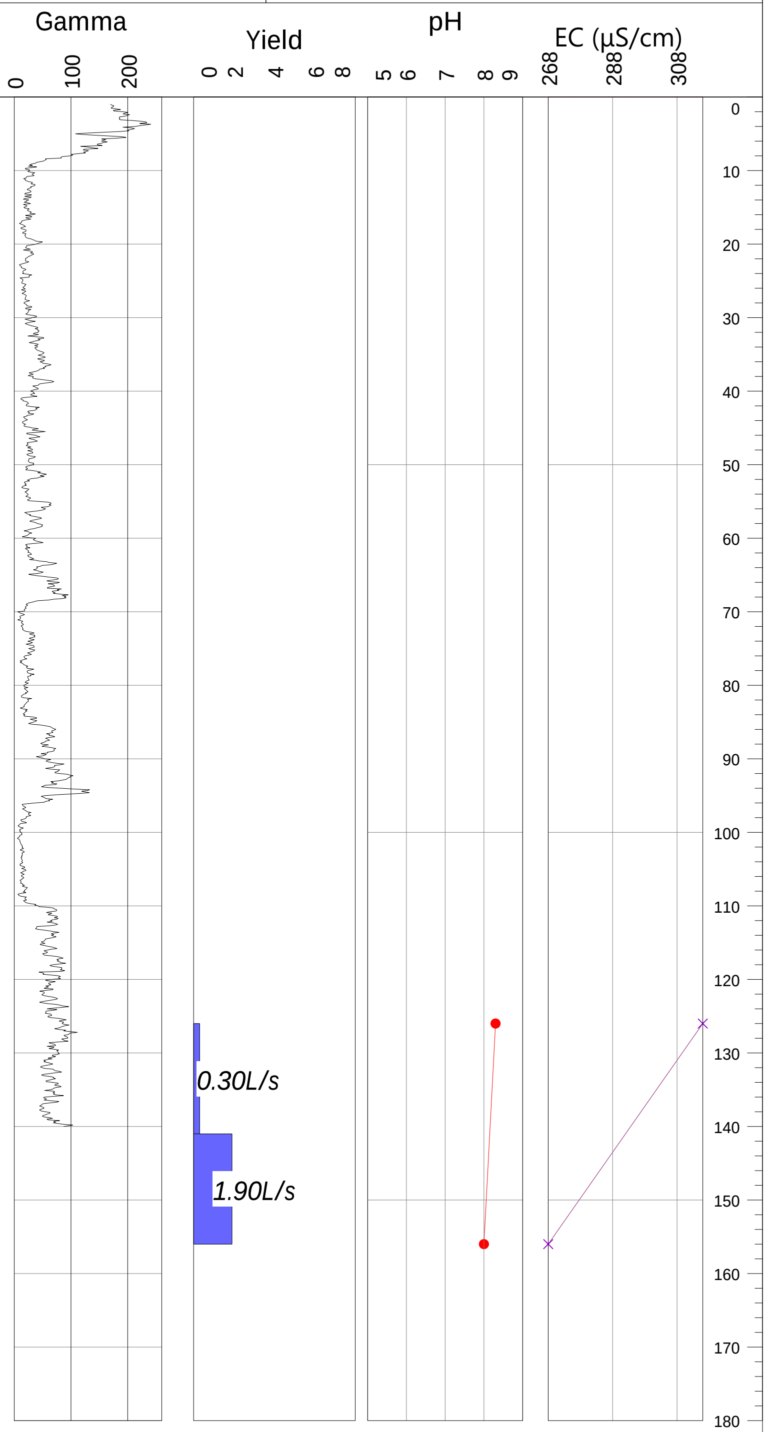


Additional notes:

WINU1278 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program	Construction start date: 28/05/2023	Final airlift yield: 1.9 L/s
Client: Rio Tinto	Construction end date: 18/06/2023	EC: 347 µS/cm
CRS: GDA94 MGA51	Inclination: -90°	pH: 7.9
Coordinates: 325938 mE / 7771508 mN	Depth drilled: 180 m BGL	Static Water Level: m bgl
Elevation: 0 m AHD (RL = TOC)		

Depth (m)	Fm	Lithological summary
0–14	Pindan Sands	FERRICRETE, red, residual soil
14–32	Parda Fm	SANDSTONE, variable, red, completely weathered, medium sand, clay-rich, hematitic alteration decreasing with depth
32–92	Upper Callawa	SANDSTONE, fine, cream, highly weathered, fine-grained sandstone with a clay component, intervals of coarse sand and intervals of minor hematitic ferricrete alteration
92–148	Lower Callawa	CLAYSTONE, brown, moderately weathered, small interval of hematitic alteration followed by large interval of goethitic alteration followed by hematitic alteration which becomes more muted downhole
148–166	Lower Callawa	SANDSTONE, variable, red, moderately weathered, increasing sand content and decreasing clay content downhole
166–180	Wallal Sandstone	SANDSTONE, variable, grey, moderately weathered, Wallal Sandstone



Additional notes:

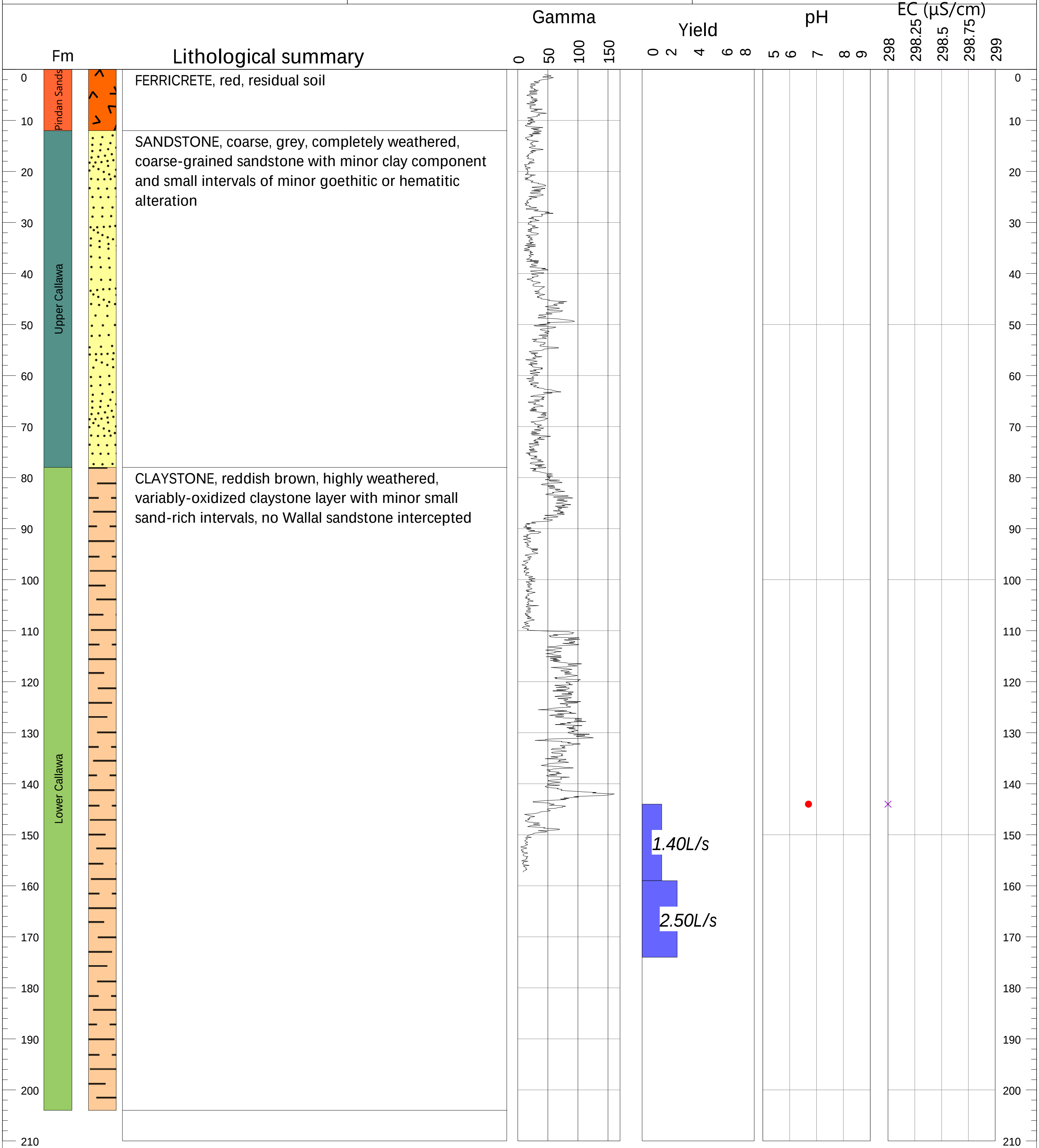
Advisian
Worley Group

WINU1279 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 331206 mE / 7772063 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 20/06/2023
Construction end date: 21/06/2023
Inclination: -90°
Depth drilled: 204 m BGL

Final airlift yield: L/s
EC: µS/cm
pH:
Static Water Level: m bgl



Additional notes:

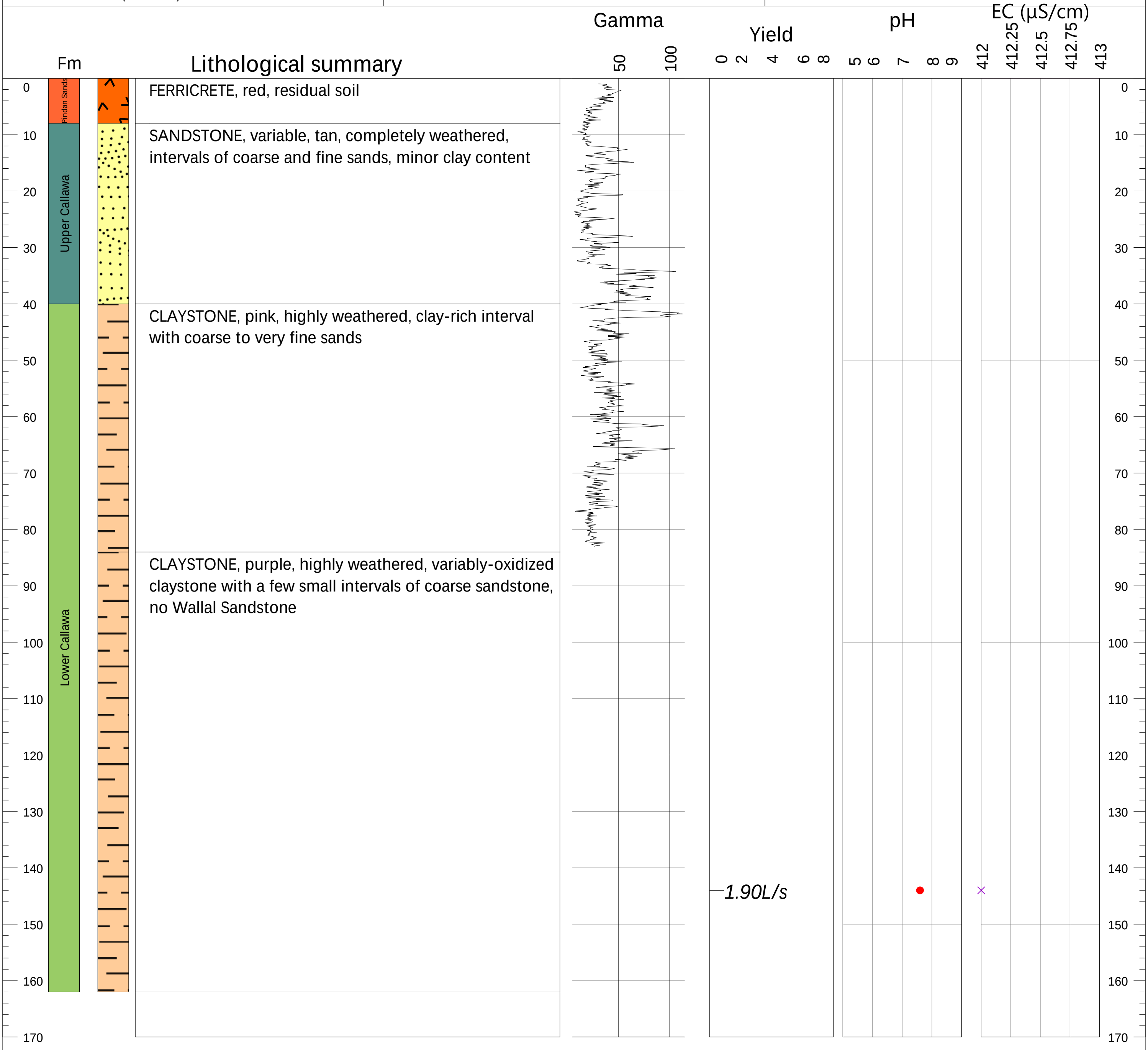
Advisian
Worley Group

WINU1280 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program
Client: Rio Tinto
CRS: GDA94 MGA51
Coordinates: 332725 mE / 7771277 mN
Elevation: 0 m AHD (RL = TOC)

Construction start date: 21/06/2023
Construction end date: 25/06/2023
Inclination: -90°
Depth drilled: 162 m BGL

Final airlift yield: L/s
EC: µS/cm
pH:
Static Water Level: m bgl



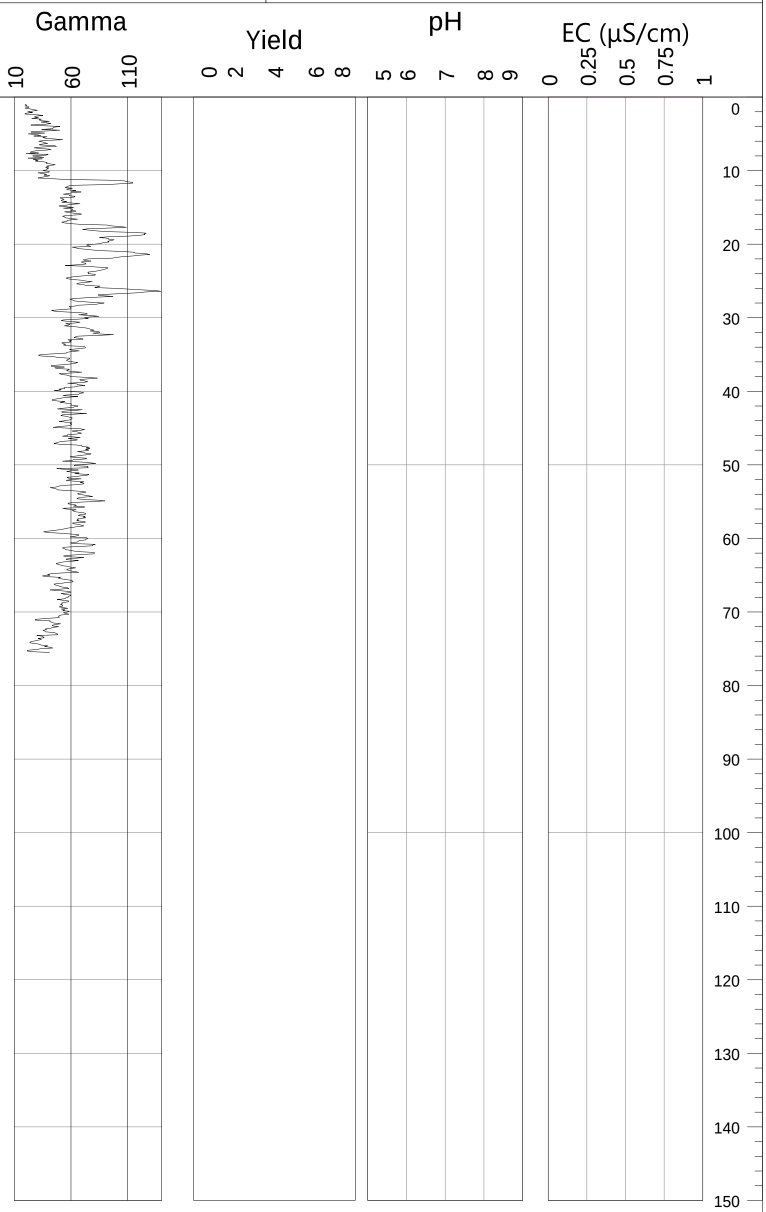
Additional notes:

Advisian
Worley Group

WINU1282 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program	Construction start date:	Final airlift yield: L/s
Client: Rio Tinto	Construction end date: 27/06/2023	EC: µS/cm
CRS: GDA94 MGA51	Inclination: -90°	pH:
Coordinates: 335065 mE / 7757397 mN	Depth drilled: 150 m BGL	Static Water Level: m bgl
Elevation: 0 m AHD (RL = TOC)		

Depth (m)	Fm	Lithological summary
0–72	Upper Callawa	SANDSTONE, medium, red, completely weathered, decreasing hematitic alteration with depth and minor clay component
72–150	Lower Callawa	SANDSTONE, variable, grey, highly weathered, clay-rich sandstone with coarse to fine sand grains, no Wallal Sandstone



Additional notes:

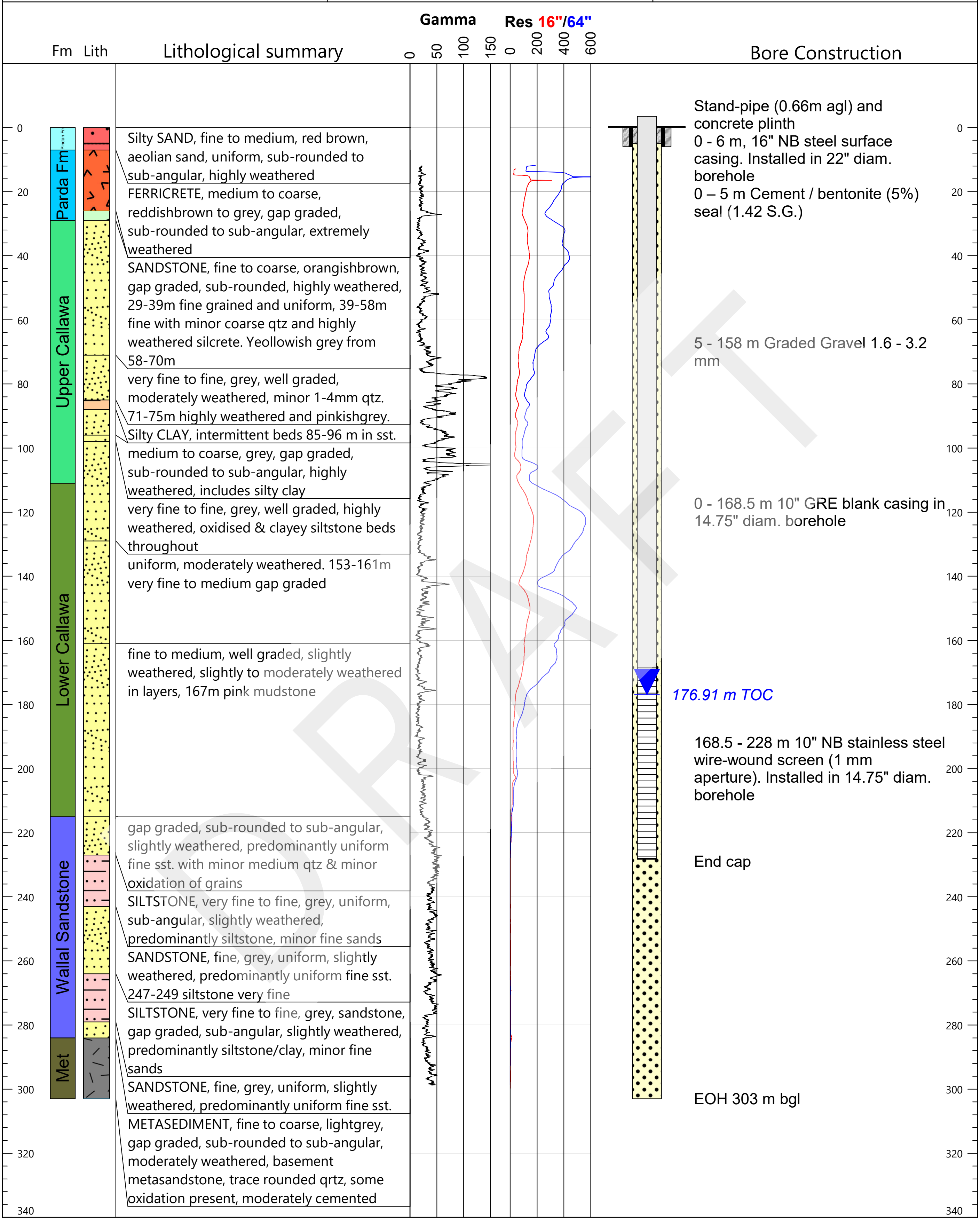
Advisian
Worley Group

WINU1320 - Composite Bore Log

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

Construction start date: 11/11/2024
Construction end date: 12/03/2025
Inclination: -90°
Depth drilled: 303 m BGL

Final airlift yield: 6.7 L/s
EC: 1273 µS/cm
pH: 8.3
Temp: 30.0 °C
Static Water Level: 176.91 m TOC



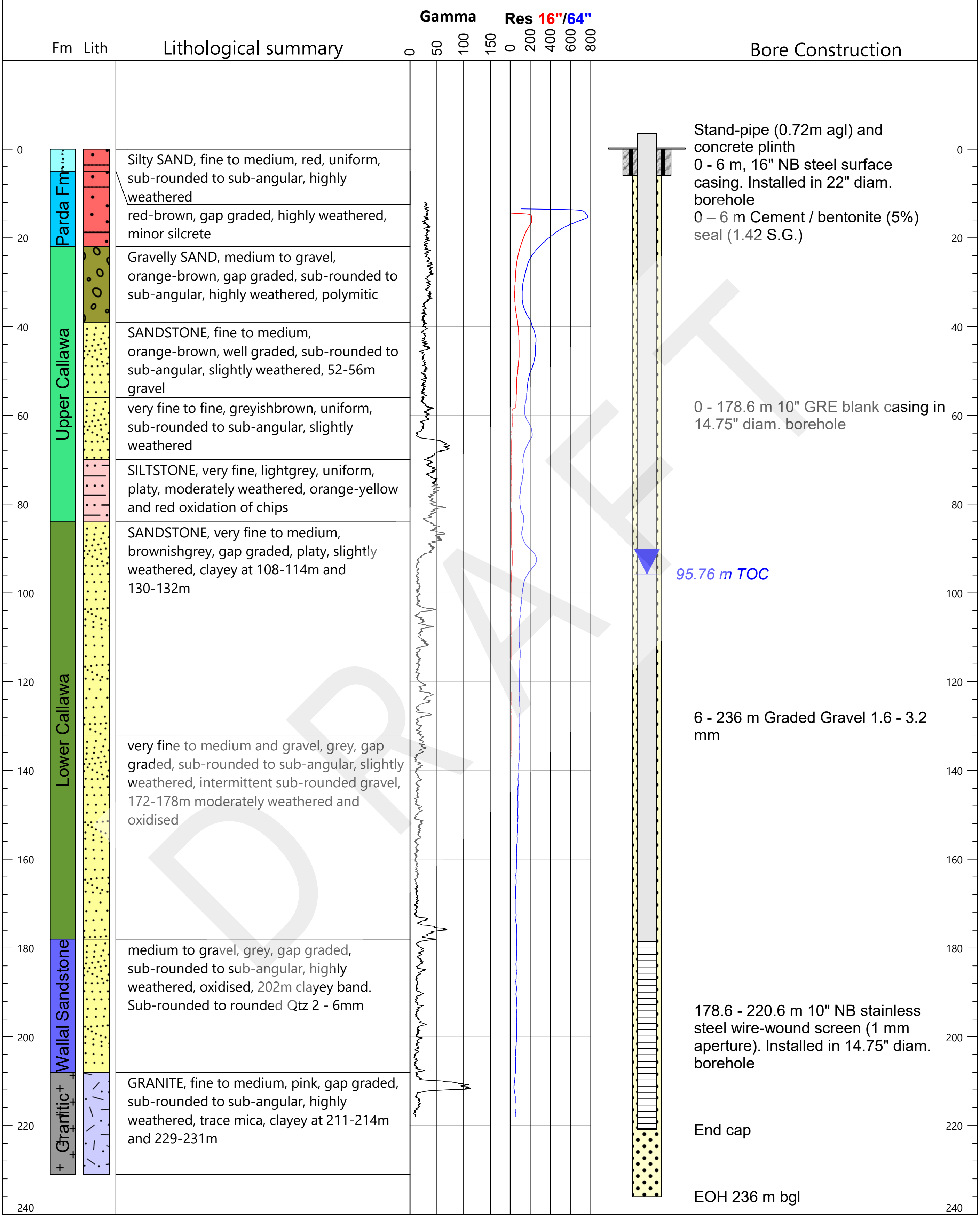
Additional notes:

WINU1322 - Composite Bore Log

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

Construction start date: 16/03/2025
Construction end date: 08/04/2025
Inclination: -90°
Depth drilled: 234 m BGL

Final airlift yield: 5.0 L/s
EC: 650 µS/cm
pH: 7.9
Temp: 24.4 °C
Static Water Level: 95.76 m TOC

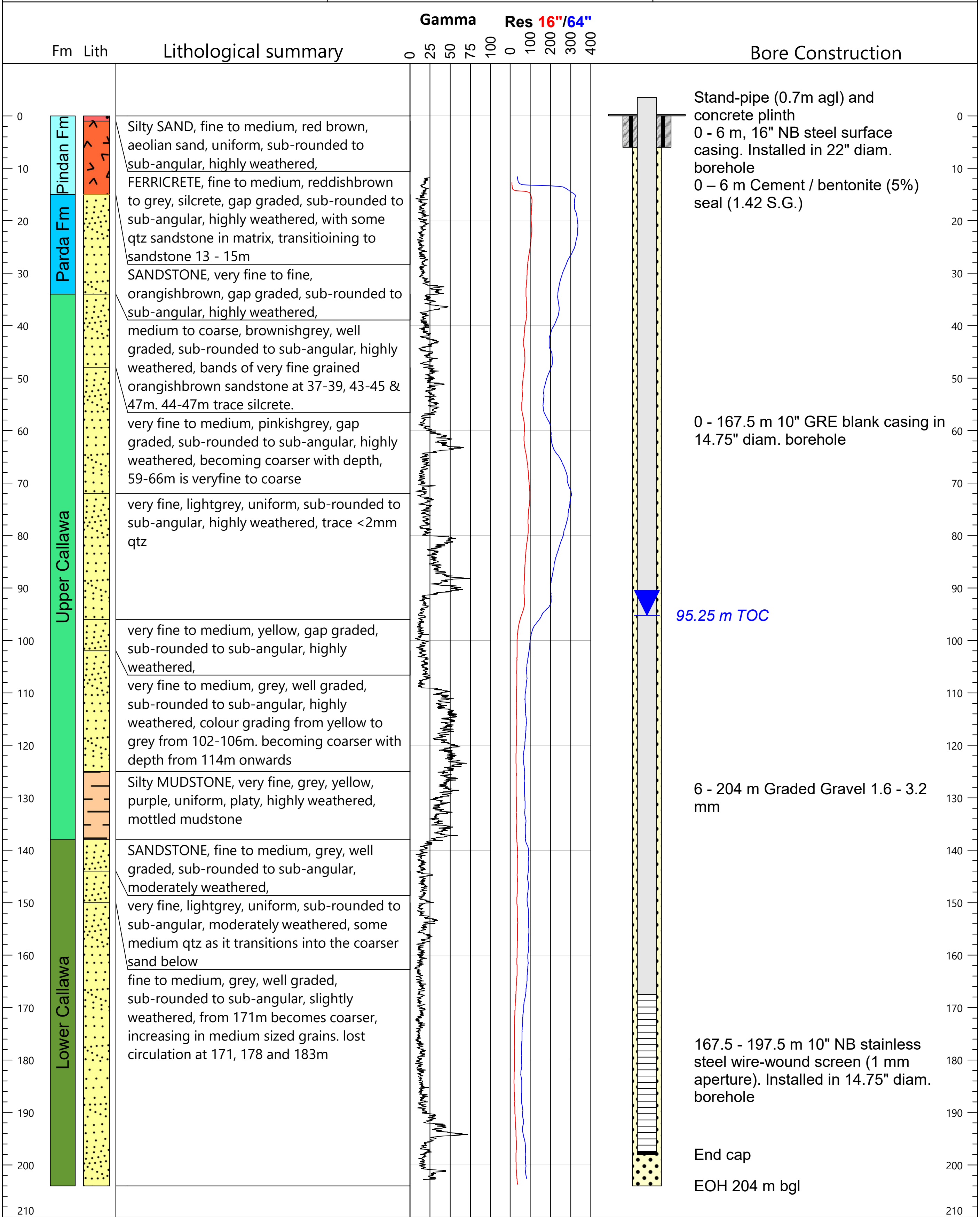


Additional notes:

worley consulting

WINU1323 - Composite Bore Log

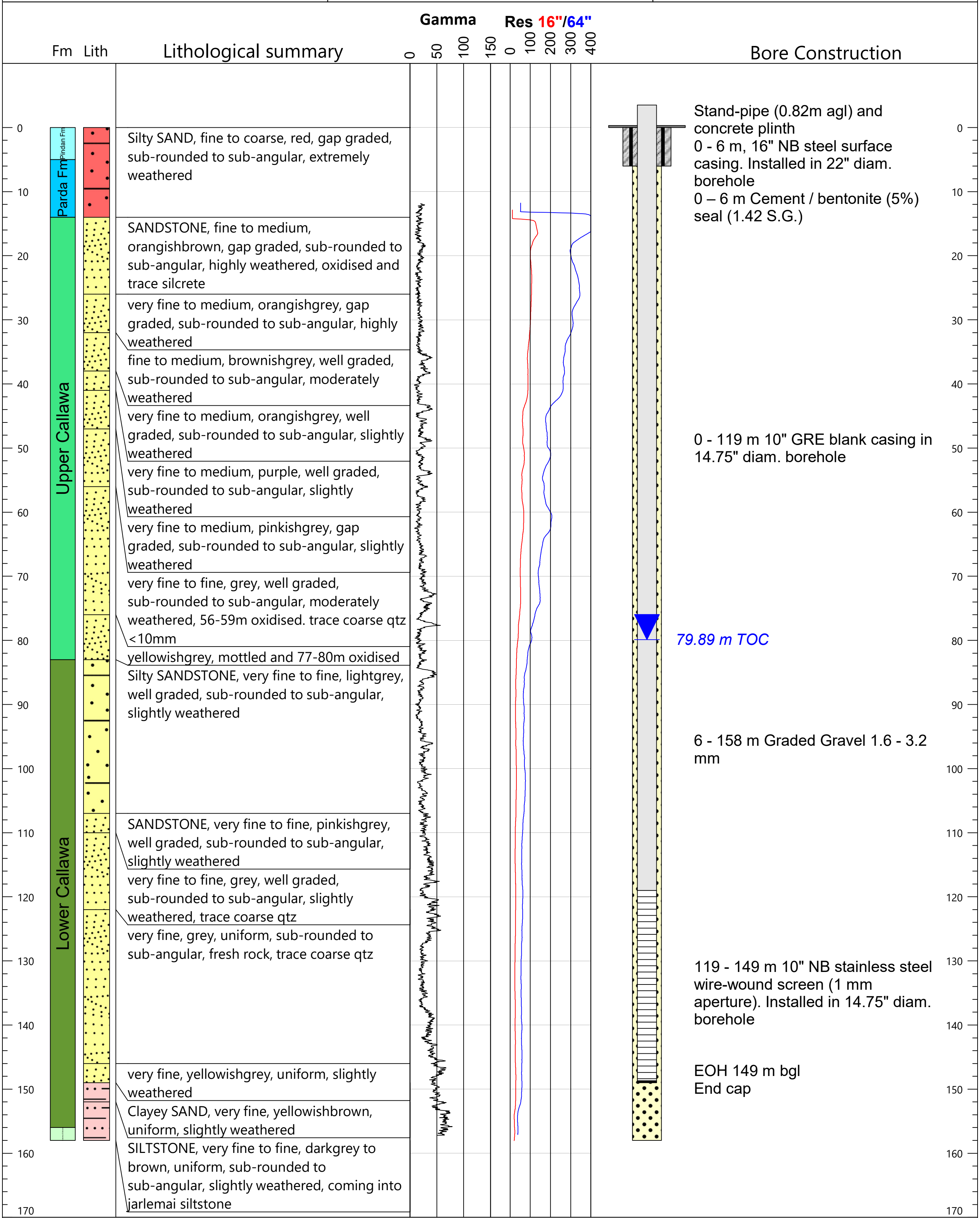
Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: TBC mE / TBC mN Elevation: TBC m AHD (RL = TOC)	Construction start date: 24/10/2024 Construction end date: 04/03/2025 Inclination: -90° Depth drilled: 204 m BGL	Final airlift yield: 20.0 L/s EC: 431 µS/cm pH: 7.6 Temp: 30.2 °C Static Water Level: 95.25 m TOC



Additional notes:

WINU1324 - Composite Bore Log

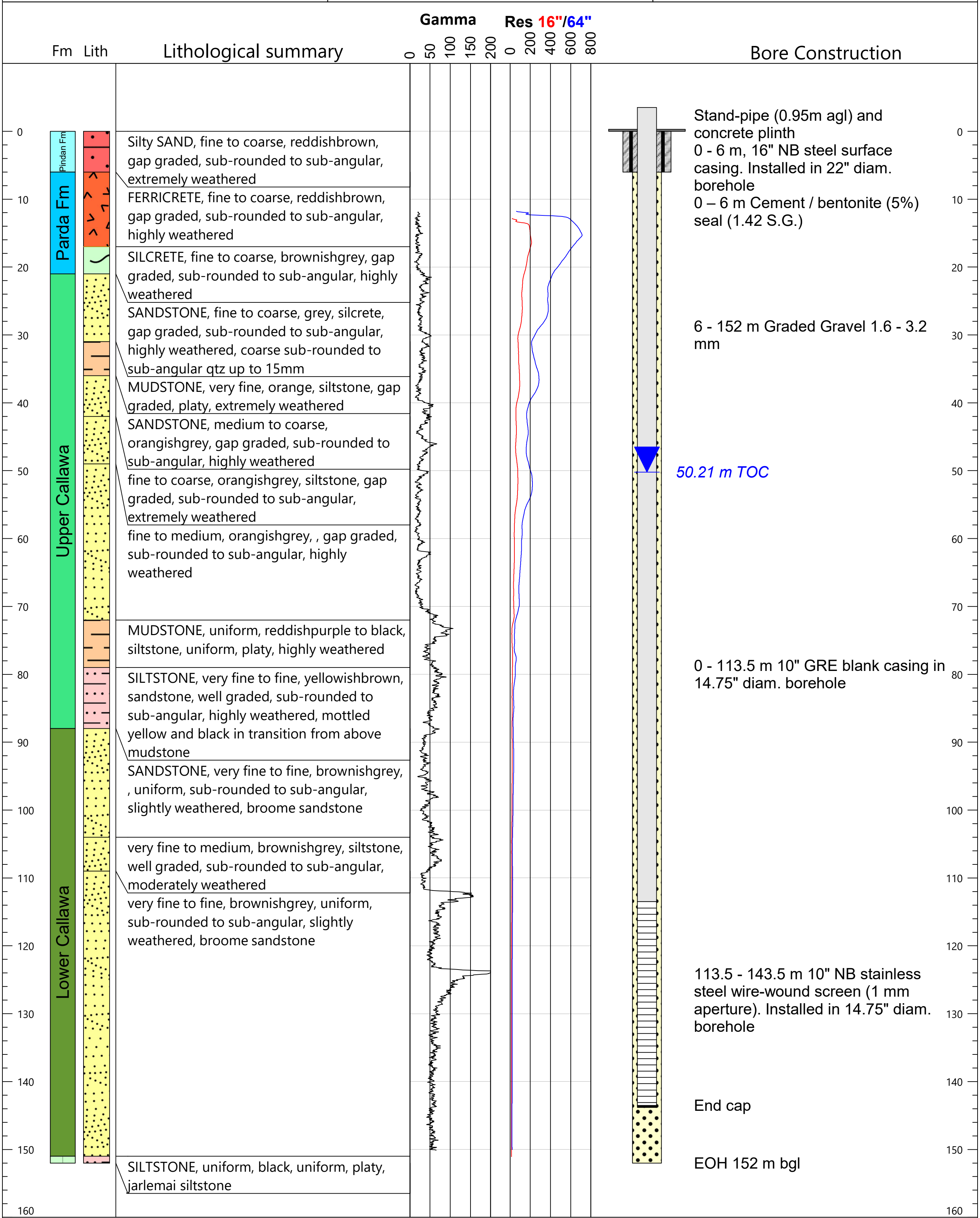
Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: 292976.89 mE / 7780475.87 mN Elevation: 126.00 m AHD (RL = TOC)	Construction start date: 28/09/2024 Construction end date: 21/10/2024 Inclination: -90° Depth drilled: 158 m BGL	Final airlift yield: 7.0 L/s EC: 568 µS/cm pH: 7.8 Temp: 35.9 °C Static Water Level: 79.89 m TOC



Additional notes:

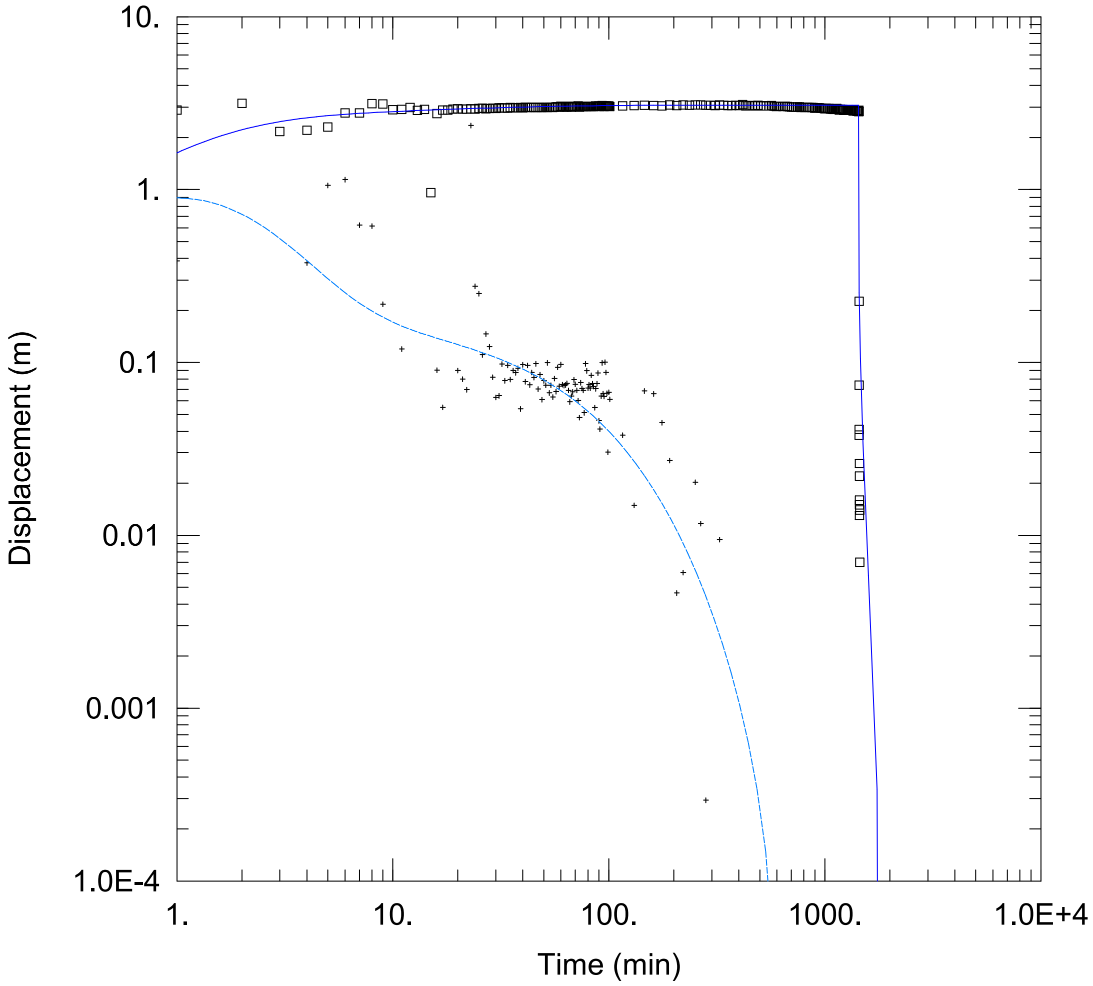
WINU1328 - Composite Bore Log

Project: Winu Hydrogeological Investigation Program Client: Rio Tinto CRS: GDA94 MGA51 Coordinates: TBC mE / TBC mN Elevation: TBC m AHD (RL = TOC)	Construction start date: 26/11/2024 Construction end date: 21/03/2025 Inclination: -90° Depth drilled: 152 m BGL	Final airlift yield: 8.0 L/s EC: 1593 µS/cm pH: 7.7 Temp: 27.9 °C Static Water Level: 50.21 m TOC



Additional notes:

Appendix B. Aqtesolve Analysis Plots



WELL TEST ANALYSIS

Data Set: C:\...\WINU1320 Moench Unconfined_GJ.aqt
Date: 06/09/25 Time: 17:56:36

PROJECT INFORMATION

Company: Worley
Client: Rio Tinto
Project: 311012-01475
Location: Winu
Test Well: WINU1320
Test Date: 5/5/2025

AQUIFER DATA

Saturated Thickness: 51. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1320	0	0

Observation Wells

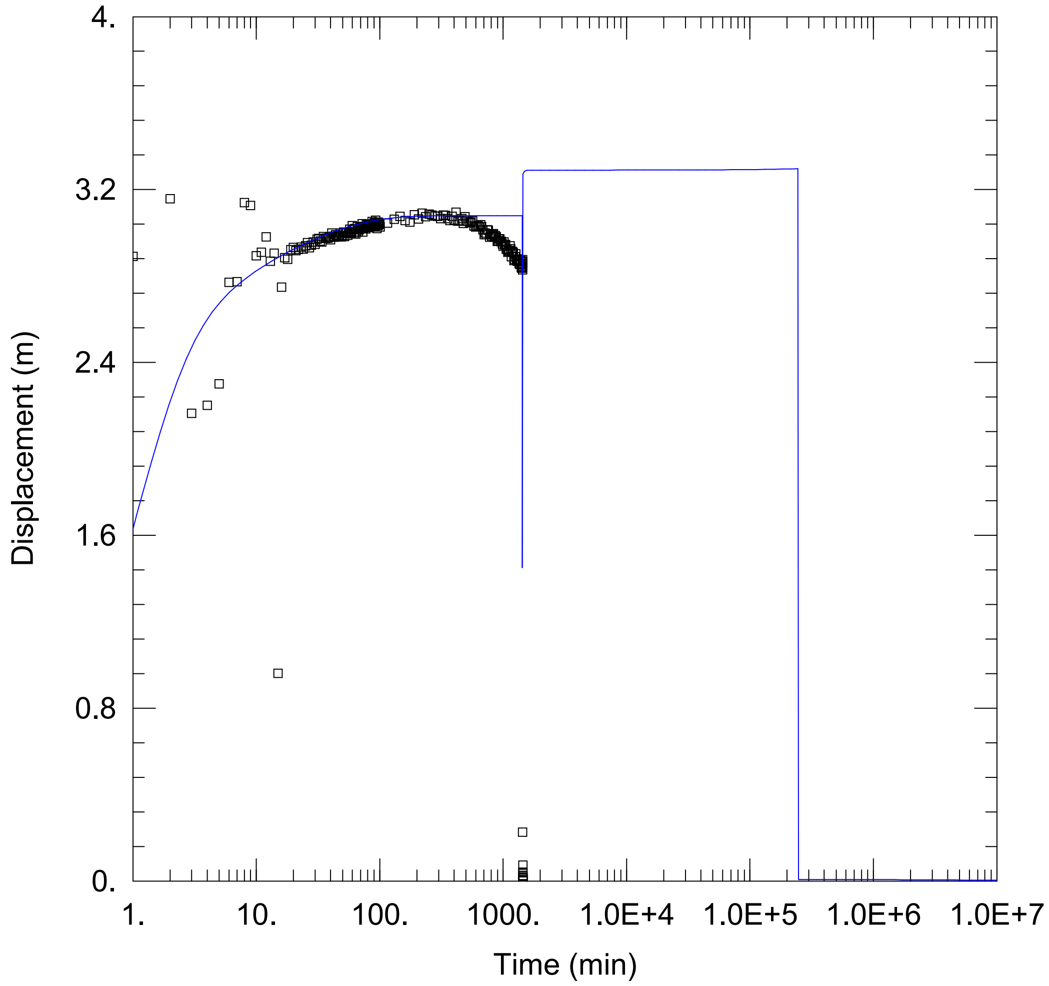
Well Name	X (m)	Y (m)
□ WINU1320	0	0

SOLUTION

Aquifer Model: Unconfined Solution Method: Moench

T = 666.6 m^2/day
Sy = 0.2222
Sw = 0.75
r(c) = 0.3117 m

S = 2.951E-6
ß = 1.462E-5
r(w) = 0.195 m
alpha = 1.803E-7 min^{-1}



WELL TEST ANALYSIS

Data Set: C:\...\WINU1320 Moench Unconfined_GJ - Copy.aqt
Date: 07/04/25 Time: 13:42:46

PROJECT INFORMATION

Company: Worley
Client: Rio Tinto
Project: 311012-01475
Location: Winu
Test Well: WINU1320
Test Date: 5/5/2025

AQUIFER DATA

Saturated Thickness: 51. m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1320	0	0

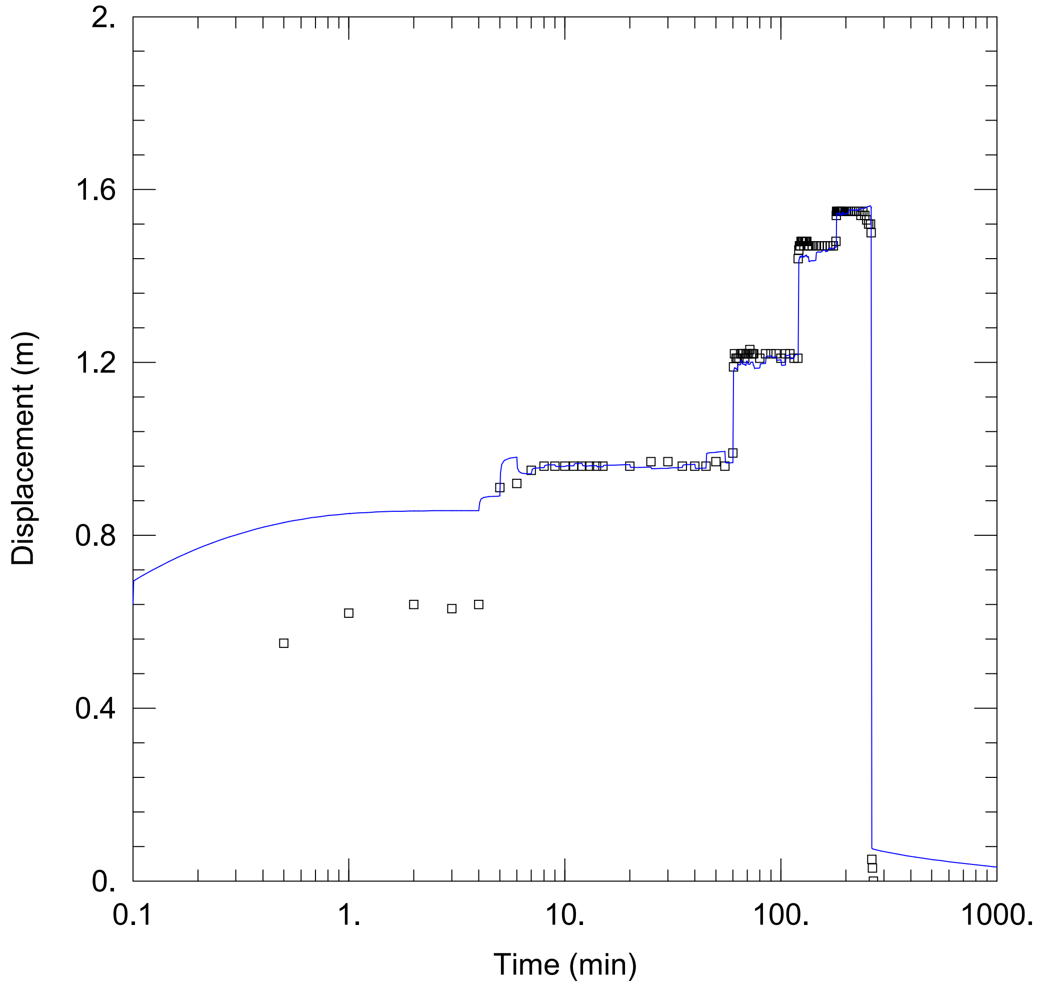
Observation Wells

Well Name	X (m)	Y (m)
□ WINU1320	0	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Moench

T = 666.6 m^2/day
S = 2.951E-6
Sy = 0.2222
ß = 1.462E-5
Sw = 0.75
r(w) = 0.195 m
r(c) = 0.3117 m
alpha = 1.803E-7 min^{-1}



WINU1322 SRT

Data Set: C:\...\WINU1322_T2_SRT_Moench_GJ.aqt
Date: 06/09/25 Time: 18:02:10

PROJECT INFORMATION

Company: Worley Consulting
Client: RTC WINU
Project: 311012-01475
Location: Road Access
Test Well: WINU1322
Test Date: 27/04/2024

AQUIFER DATA

Saturated Thickness: 125. m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1322	336414	7760909

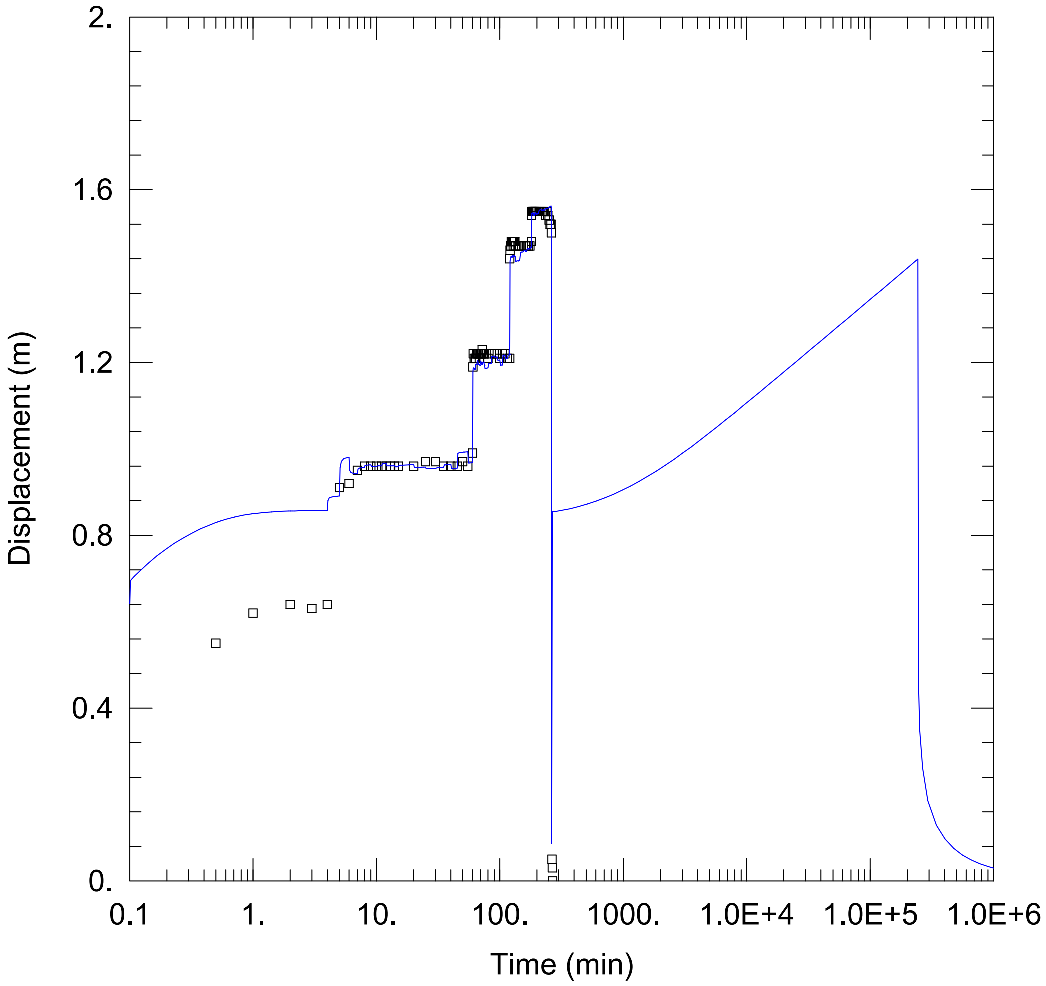
Observation Wells

Well Name	X (m)	Y (m)
□ WINU1322	336414	7760909

SOLUTION

Aquifer Model: Unconfined
Solution Method: Moench

T = 872. m^2/day
Sy = 0.1443
Sw = -2.525
r(c) = 0.1143 m
S = 5.137E-5
ß = 1.032E-6
r(w) = 0.127 m
alpha = 1.0E+30 min^{-1}



WINU1322 SRT

Data Set: C:\...\WINU1322_T2_SRT_Moench_GJ - Copy.aqt
Date: 07/04/25 Time: 13:43:16

PROJECT INFORMATION

Company: Worley Consulting
Client: RTC WINU
Project: 311012-01475
Location: Road Access
Test Well: WINU1322
Test Date: 27/04/2024

AQUIFER DATA

Saturated Thickness: 125. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1322	336414	7760909

Observation Wells

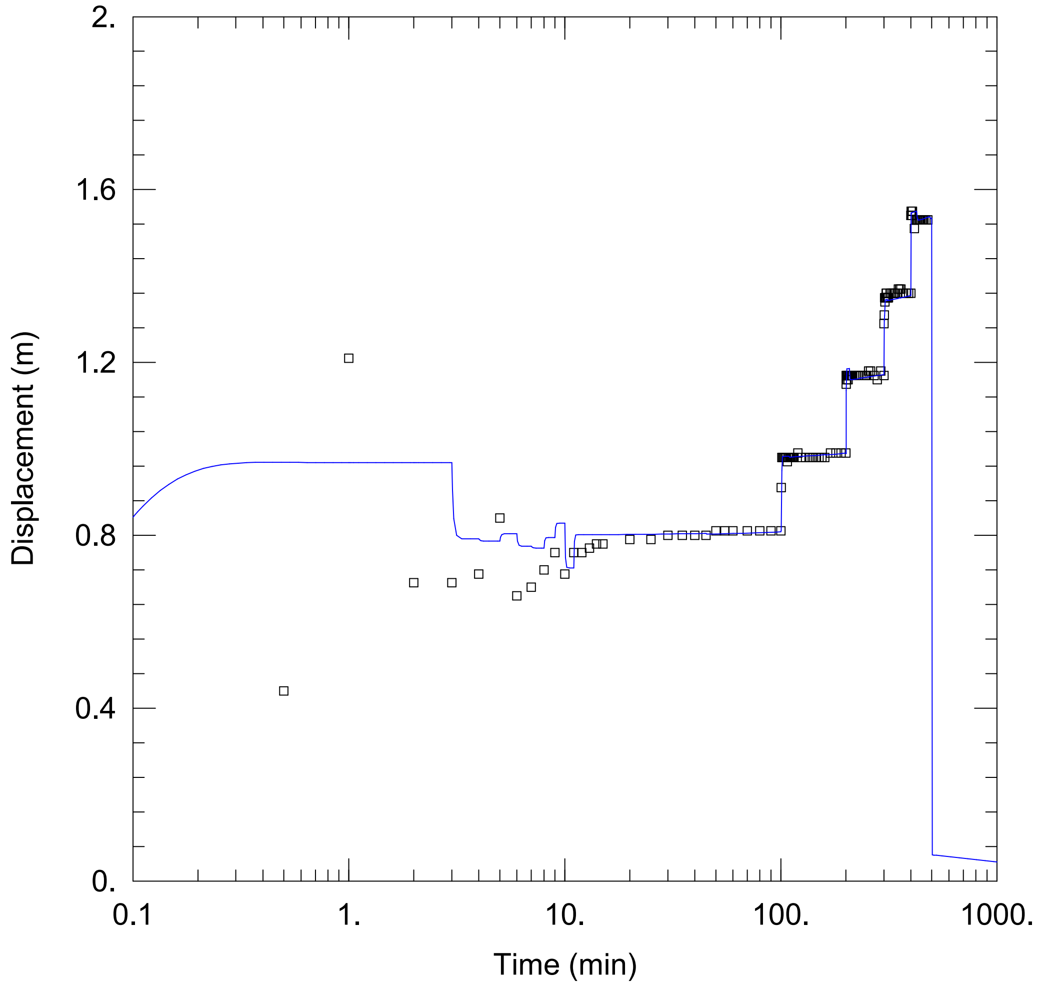
Well Name	X (m)	Y (m)
□ WINU1322	336414	7760909

SOLUTION

Aquifer Model: Unconfined Solution Method: Moench

T = 872. m^2/day
Sy = 0.1443
Sw = -2.525
r(c) = 0.1143 m

S = 5.137E-5
ß = 1.032E-6
r(w) = 0.127 m
alpha = 1.0E+30 min^{-1}



WELL TEST ANALYSIS

Data Set: C:\...\WINU1323_SRT_Moench_GJ.aqt
Date: 06/09/25 Time: 18:04:56

PROJECT INFORMATION

Company: Worley
Client: Rio Tinto
Project: 311012-01475
Location: Winu
Test Well: WINU1323
Test Date: 5/5/2025

AQUIFER DATA

Saturated Thickness: 102. m Anisotropy Ratio (Kz/Kr): 1.86

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1323	0	0

Observation Wells

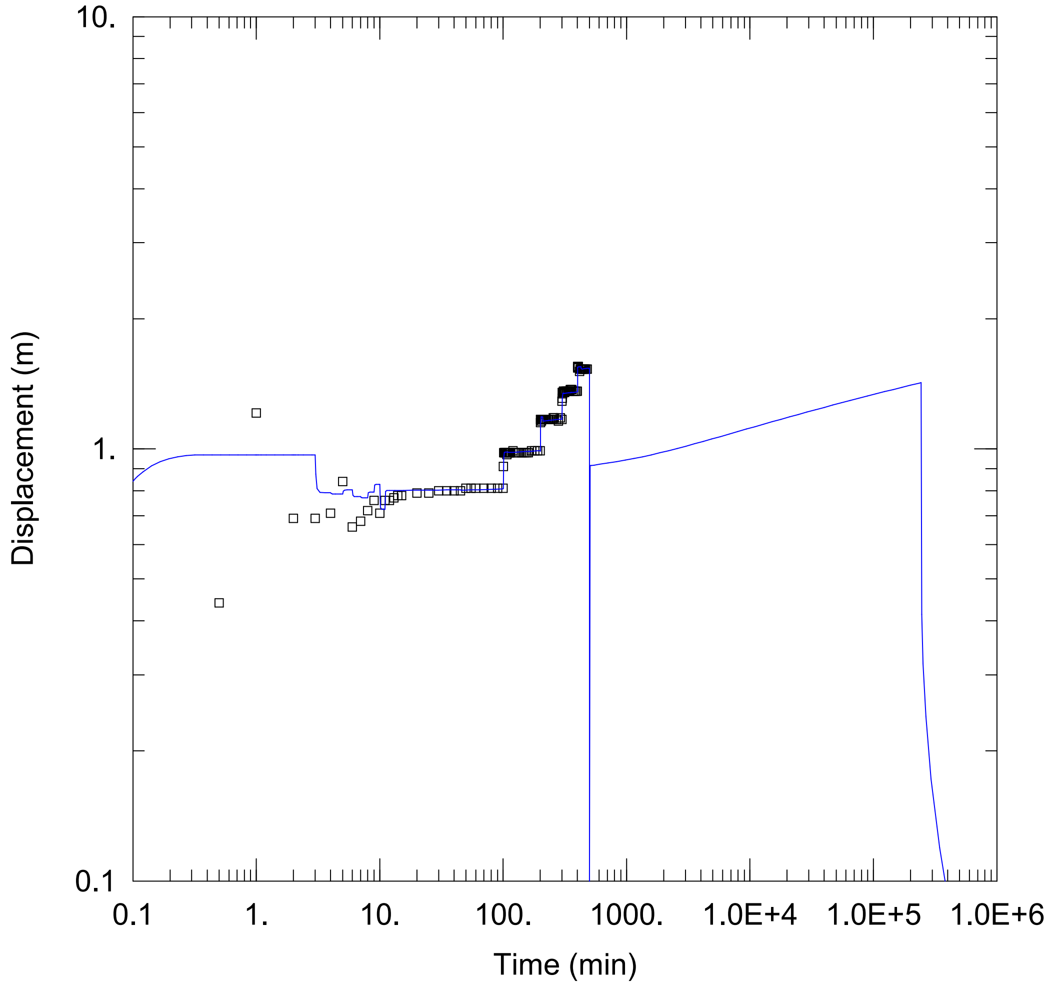
Well Name	X (m)	Y (m)
□ WINU1323	0	0

SOLUTION

Aquifer Model: Unconfined Solution Method: Moench

T = 1056.8 m^2/day
Sy = 0.1545
Sw = -3.75
r(c) = 0.127 m

S = 1.149E-6
ß = 1.148E-5
r(w) = 0.2534 m
alpha = 0.02512 min^{-1}



WELL TEST ANALYSIS

Data Set: C:\...\WINU1323_SRT_Moench_GJ - Copy.aqt
Date: 07/04/25 Time: 13:43:40

PROJECT INFORMATION

Company: Worley
Client: Rio Tinto
Project: 311012-01475
Location: Winu
Test Well: WINU1323
Test Date: 5/5/2025

AQUIFER DATA

Saturated Thickness: 102. m Anisotropy Ratio (Kz/Kr): 1.86

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1323	0	0

Observation Wells

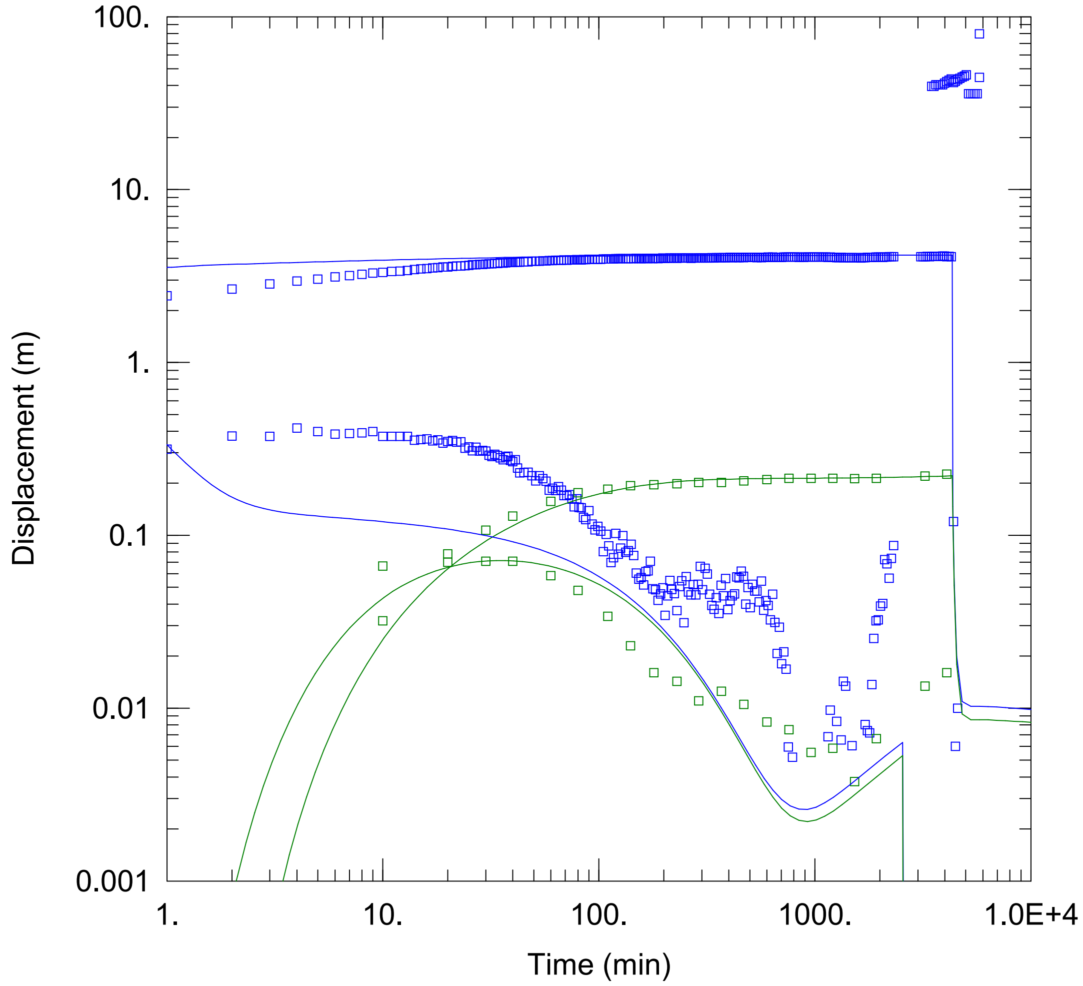
Well Name	X (m)	Y (m)
□ WINU1323	0	0

SOLUTION

Aquifer Model: Unconfined Solution Method: Moench

T = 1056.8 m^2/day
Sy = 0.1545
Sw = -3.75
r(c) = 0.127 m

S = 1.149E-6
ß = 1.148E-5
r(w) = 0.2534 m
alpha = 0.02512 min^{-1}



WINU1324_CRT

Data Set: C:\...\WINU1324_CRT_Unconfined_Moench_GJ.aqt
Date: 06/09/25 Time: 18:06:40

PROJECT INFORMATION

Company: Worley
Client: Rio Tinto
Project: 311012-01475
Location: Winu
Test Well: WINU1324
Test Date: 5/5/2025

AQUIFER DATA

Saturated Thickness: 79. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1324	292976.89	7780475.87

Observation Wells

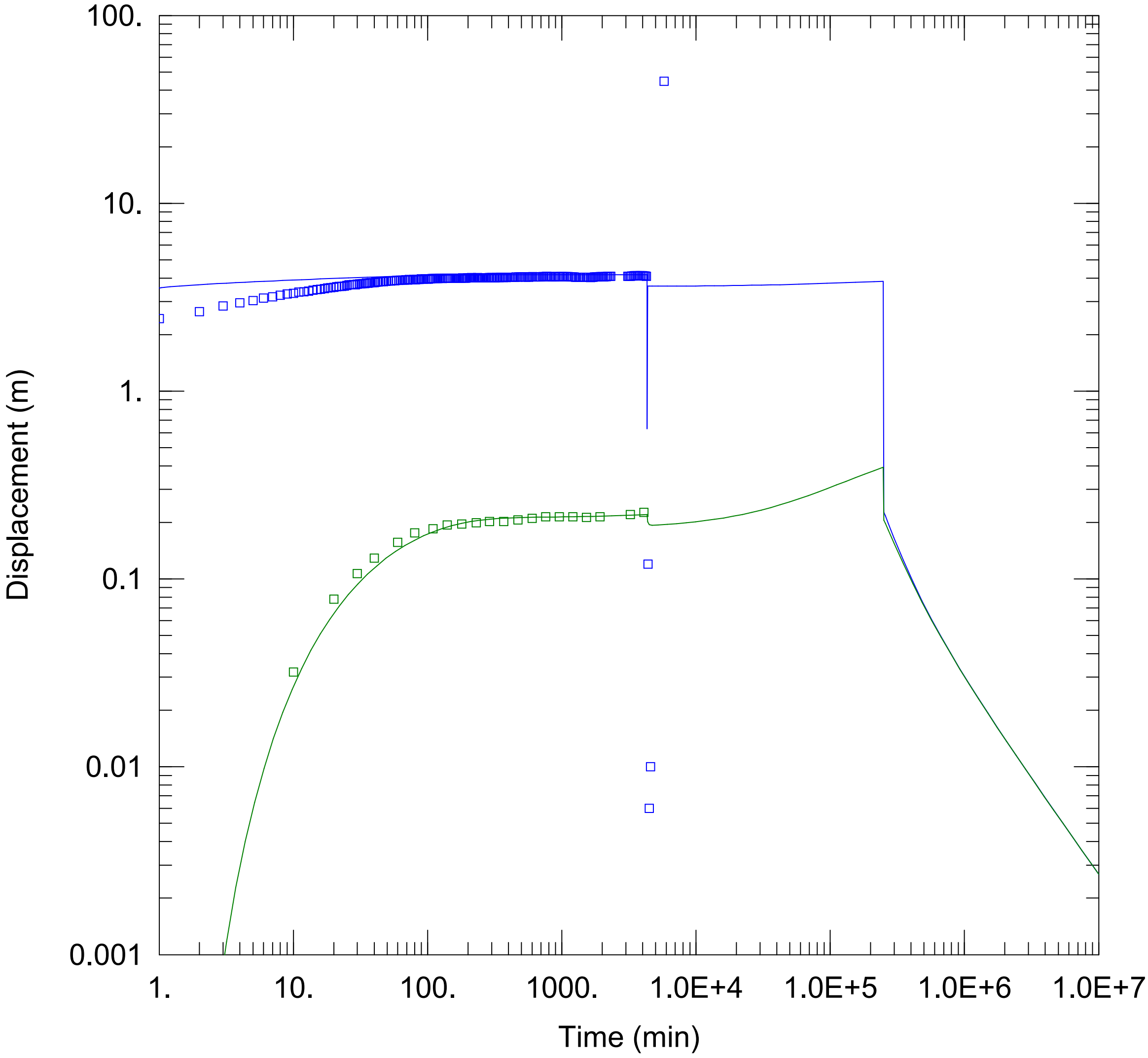
Well Name	X (m)	Y (m)
▫ WINU1324	292976.89	7780475.87
▫ WINU0937	293045.57	7780719.57

SOLUTION

Aquifer Model: Unconfined Solution Method: Moench

T = 967.3 m^2/day
Sy = 0.1484
Sw = 0.075

S = 0.0004024
Kz/Kr = 1.
r(w) = 0.1185 m



WINU1324_CRT

Data Set: C:\...\WINU1324_CRT_Unconfined_Moench_GJ - Copy.aqt
Date: 07/04/25 Time: 13:47:53

PROJECT INFORMATION

Company: Worley
Client: Rio Tinto
Project: 311012-01475
Location: Winu
Test Well: WINU1324
Test Date: 5/5/2025

AQUIFER DATA

Saturated Thickness: 79. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1324	292976.89	7780475.87

Observation Wells

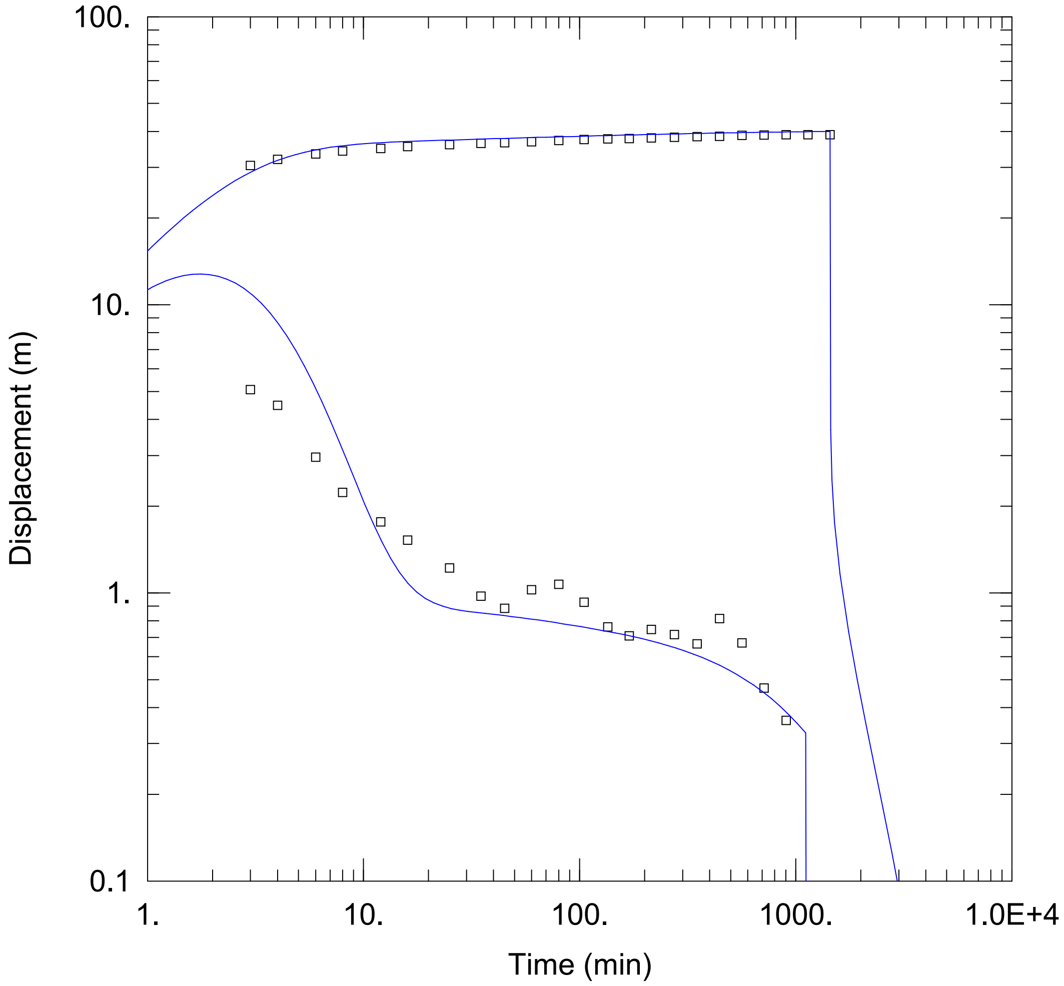
Well Name	X (m)	Y (m)
□ WINU1324	292976.89	7780475.87
□ WINU0937	293045.57	7780719.57

SOLUTION

Aquifer Model: Unconfined Solution Method: Moench

T = 967.3 m^2/day
Sy = 0.1484
Sw = 0.075
r(c) = 0.127 m

S = 0.0004024
Kz/Kr = 1.
r(w) = 0.1185 m
alpha = 2.089E-5 min^{-1}



WELL TEST ANALYSIS

Data Set: C:\...\WINU1328_CRT_Moench_unconfined_GJ.aqt
Date: 06/09/25 Time: 18:07:33

PROJECT INFORMATION

Company: Worley
Client: Rio Tinto
Project: 311012-01475
Location: Winu
Test Well: WINU1324
Test Date: 5/5/2025

AQUIFER DATA

Saturated Thickness: 64. m Anisotropy Ratio (Kz/Kr): 21.61

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1328	0	0

Observation Wells

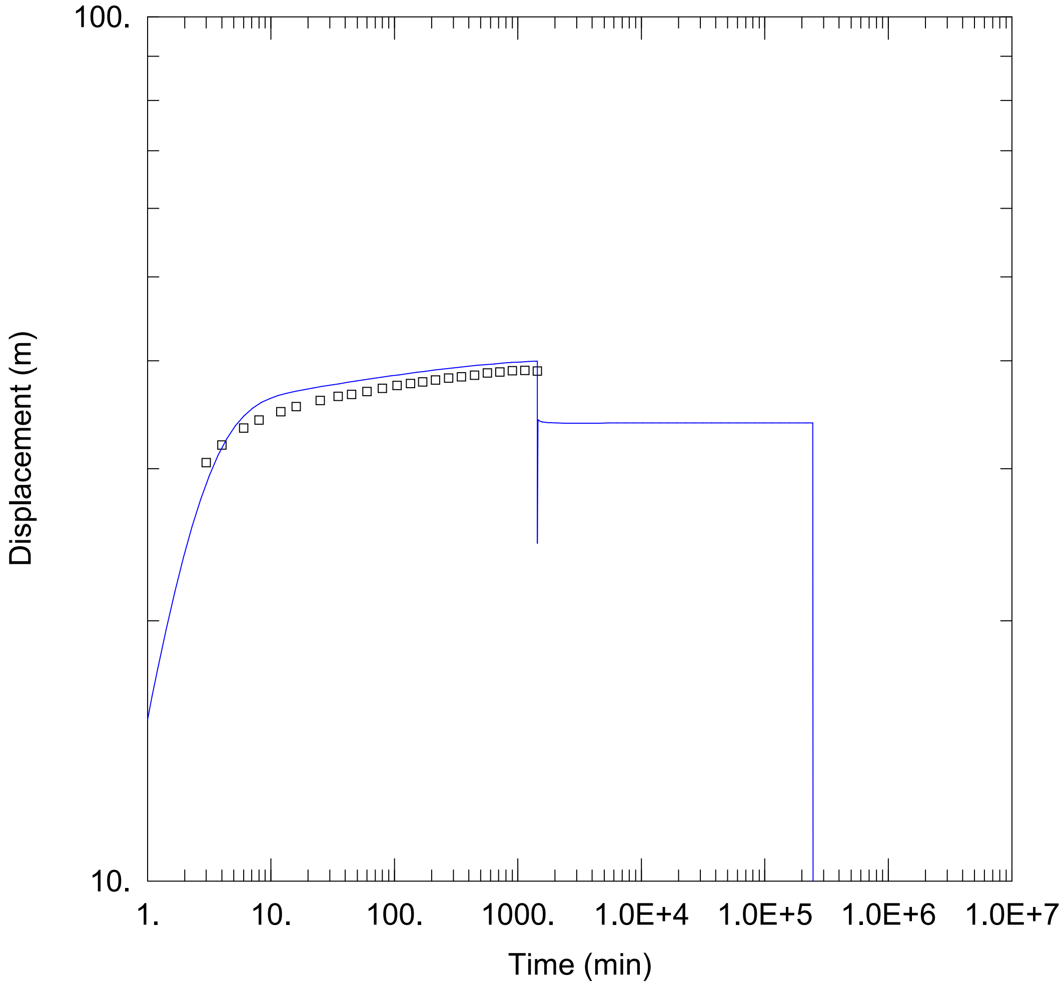
Well Name	X (m)	Y (m)
□ WINU1328	0	0

SOLUTION

Aquifer Model: Unconfined Solution Method: Moench

T = 150. m^2/day
Sy = 0.1399
Sw = 5.325
r(c) = 0.127 m

S = 4.385E-6
ß = 8.511E-5
r(w) = 0.127 m
alpha = 2.512E-8 min^{-1}



WELL TEST ANALYSIS

Data Set: C:\...\WINU1328_CRT_Moench_unconfined_GJ - Copy.aqt
Date: 07/04/25 Time: 13:48:30

PROJECT INFORMATION

Company: Worley
Client: Rio Tinto
Project: 311012-01475
Location: Winu
Test Well: WINU1324
Test Date: 5/5/2025

AQUIFER DATA

Saturated Thickness: 64. m
Anisotropy Ratio (Kz/Kr): 21.61

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
WINU1328	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ WINU1328	0	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Moench

T = 150. m^2/day
Sy = 0.1399
Sw = 5.325
r(c) = 0.127 m

S = 4.385E-6
ß = 8.511E-5
r(w) = 0.127 m
alpha = 2.512E-8 min^{-1}

Appendix C. Groundwater Chemistry

Sample Date	Hole_ID	Description	Status	Fluoride (mg/L)	Ionic Balance (%) (%)	Total Anions (meq/L) (meq/L)	Total Cations (meq/L) (meq/L)	Total Kjeldahl Nitrogen as N (mg/L)	Ammonia as N (mg/L)	Nitrate as N (mg/L)	Nitrite + Nitrate as N (mg/L)	Nitrite as N (mg/L)	Total Phosphate (mg/L)	Total Phosphorus as P (mg/L)	Silicon as SiO2 (mg/L)	Dissolved Oxygen - % Saturation (Field) (%sat)	Electrical Conductivity (Field) (uS/cm)	Redox Potential (Field) (mV)	Oxygen - Dissolved (Field) (mg/L)	pH (Field) (pH units)	Specific Conductance (Field) (uS/cm)	Temp (Field) (deg C)	Total Dissolved Solids (Field) (mg/L)
5/05/2023	WINU0935	BASELINE	Valid													28.6	581	115.6	2.04	7.03	502	33.3	326.2
5/05/2023	WINU0935	BASELINE	Valid	0.3	5.37	4.51	5.03	0.4	< 0.01	4.98		< 0.01	0.78	0.25	33.4								
6/06/2023	WINU0935	BASELINE	Valid													44	674	123.9	3.1	6.99	574	34.1	373.2
6/06/2023	WINU0935	BASELINE	Valid													45.1	548	125.1	3.45	7.12	507	29.1	329.5
30/07/2023	WINU0935	BASELINE	Valid	0.2	2.57	4.99	5.25	0.8	< 0.01	5.16	5.16	< 0.01	0.8	0.26	34.2								
30/07/2023	WINU0935	BASELINE	Valid													34.5	636	187.2	2.65	7.05	590	29.1	383.2
26/09/2023	WINU0935	BASELINE	Valid	0.3	6.17	4.39	4.86	0.5	< 0.01	5.06	5.06	< 0.01	0.17	0.05	31.2								
16/12/2023	WINU0935	BASELINE	Valid													42	669	105.5	3.03	8.03	583	32.7	378
16/12/2023	WINU0935	BASELINE	Valid	0.3	3.27	5.54	5.19	0.9	0.02	4.99	4.99	< 0.01	0.29	0.1	29.5								
6/06/2023	WINU0937	BASELINE	Valid													0.1	762	97.3	0	6.98	665	32.6	432.2
6/06/2023	WINU0937	BASELINE	Valid	0.2	4	4.74	5.13	0.3	0.01	2.81		< 0.01	0.17	0.06	23.3								
30/07/2023	WINU0937	BASELINE	Valid													23.4	658	145.1	1.74	6.99	591	31	384
30/07/2023	WINU0937	BASELINE	Valid													36	592	120	2.79	7.29	554	28.5	360.3
26/09/2023	WINU0937	BASELINE	Valid	0.1	0.52	5.65	5.71	0.5	0.02	3.2	3.2	< 0.01	0.3	0.1	25								
16/12/2023	WINU0937	BASELINE	Valid													71.3	347.2	166.5	5.54	7.36	326	28.4	211.9
16/12/2023	WINU0937	BASELINE	Valid	0.2	4.87	4.8	5.29	0.5	0.02	3.52	3.52	< 0.01	< 0.1	0.03	22.5								
11/02/2024	WINU0935	BASELINE	Valid	0.2	1.09	4.96	4.85	0.7	< 0.01	5.12	5.12	< 0.01	0.66	0.22	34.7								
11/02/2024	WINU0935	BASELINE	Valid													17.7	681	75.9	1.21	7.12	561	36.3	364.3
11/02/2024	WINU0937	BASELINE	Valid	0.2	2.65	5.1	4.83	0.7	< 0.01	2.67	2.67	< 0.01	0.14	0.05	22.7								
5/05/2024	WINU0935	BASELINE	Valid	0.3	4.14	4.75	5.16	0.7	0.01	5.29	5.29	< 0.01	1.87	0.61	33.2								
5/05/2024	WINU0935	BASELINE	Valid													16	461	71.3	1.13	7.1	393.3	34.2	255.7
5/05/2024	WINU0937	BASELINE	Valid	0.2	0.94	4.9	5	0.8	< 0.01	2.02	2.09	0.07	1.13	0.37	19.9								
5/05/2024	WINU0937	BASELINE	Valid													10.3	734	-20.7	0.74	6.65	637	32.9	414.4
28/07/2024	WINU0937	BASELINE	Valid	0.3	1.98	5.03	4.84	0.4	< 0.01	2.38	2.38	< 0.01	0.56	0.18	19.6								
28/07/2024	WINU0937	BASELINE	Valid													7.7	588	85.8	0.56	6.6	516	32.2	335.3
28/07/2024	WINU0935	BASELINE	Valid													11.1	600	72.5	0.8	6.82	523	32.8	339.9
28/07/2024	WINU0935	BASELINE	Valid	0.3	2.04	5.26	5.05	0.3	< 0.01	5.11	5.11	< 0.01	3.5	1.14	33.4								
21/09/2024	WINU0935	BASELINE	Valid	0.2	4	5.39	4.98	0.6	< 0.01	5.37		< 0.01	1.52	0.5	34.8								
21/09/2024	WINU0937	BASELINE	Valid	0.2	6.19	5.22	4.61	0.8	0.01	2.57		< 0.01	0.37	0.12	20								
21/09/2024	WINU0935	BASELINE	Valid													9.8	664	82.2	0.71	6.95	579	32.7	376
23/09/2024	WINU0937	BASELINE	Valid													7.3	635	68.9	0.54	6.7	567	31.2	683.7
13/11/2024	WINU0937	BASELINE	Valid	0.2	2.91	4.66	4.94	0.5	< 0.01	3.04	3.04	< 0.01	0.13	0.04	24								
13/11/2024	WINU0935	BASELINE	Valid	0.2	4.52	4.63	5.07	0.6	< 0.02	5.22	5.22	< 0.01	1.26	0.41	34.2								
13/11/2024	WINU0937	BASELINE	Valid													4.5	570	68.5	0.31	6.88	478	35.2	311.1
13/11/2024	WINU0935	BASELINE	Valid													6.4	579	72.2	0.44	7.04	483	35.5	313.7

Sample Date	Hole_ID	Aluminium (Dissolved) (mg/L)	Arsenic (Dissolved) (mg/L)	Cadmium (Dissolved) (mg/L)	Caesium (Dissolved) (mg/L)	Calcium (Dissolved) (mg/L)	Chromium (Dissolved) (mg/L)	Cobalt (Dissolved) (mg/L)	Copper (Dissolved) (mg/L)	Iron (Dissolved) (mg/L)	Lead (Dissolved) (mg/L)	Magnesium (Dissolved) (mg/L)	Manganese (Dissolved) (mg/L)	Mercury (Dissolved) (mg/L)	Molybdenum (Dissolved) (mg/L)	Nickel (Dissolved) (mg/L)	Potassium (Dissolved) (mg/L)	Selenium (Dissolved) (mg/L)	Silver (Dissolved) (mg/L)	Sodium (Dissolved) (mg/L)	Zinc (Dissolved) (mg/L)
5/05/2023	WINU0935																				
5/05/2023	WINU0935	< 0.01	< 0.001	< 0.0001		17	0.008		< 0.001	0.15	< 0.001	8	0.032	< 0.00004	0.02	0.335	5	< 0.01	< 0.00001	78	< 0.005
6/06/2023	WINU0935																				
6/06/2023	WINU0935																				
30/07/2023	WINU0935	0.02	< 0.001	< 0.0001		18	0.004		< 0.001	0.22	< 0.001	8	0.044	< 0.00004	0.015	0.394	5	< 0.01	< 0.00001	82	< 0.005
30/07/2023	WINU0935																				
26/09/2023	WINU0935	0.02	< 0.001	< 0.0001		9	0.003		< 0.001	0.14	< 0.001	6	0.063	< 0.00004	0.011	0.419	5	< 0.01	< 0.00001	87	0.007
16/12/2023	WINU0935																				
16/12/2023	WINU0935					17						7		< 0.00004			6			83	
6/06/2023	WINU0937																				
6/06/2023	WINU0937	< 0.01	< 0.001	< 0.0001		17	< 0.001		< 0.001	< 0.05	< 0.001	8	0.051	< 0.00004	0.015	0.363	4	< 0.01	< 0.00001	81	< 0.005
30/07/2023	WINU0937																				
30/07/2023	WINU0937																				
26/09/2023	WINU0937	< 0.01	< 0.001	< 0.0001		19	< 0.001		< 0.001	< 0.05	< 0.001	8	0.02	< 0.00004	0.009	0.369	4	< 0.01	< 0.00001	92	< 0.005
16/12/2023	WINU0937																				
16/12/2023	WINU0937	0.02	< 0.001	< 0.0001		14	< 0.001		< 0.001	< 0.05	< 0.001	7	< 0.001	< 0.00004	0.002	0.032	4	< 0.01	< 0.00001	90	< 0.005
11/02/2024	WINU0935	0.02	< 0.001	< 0.0001		17	0.004		< 0.001	0.15	< 0.001	8	0.035	< 0.00004	0.016	0.384	5	< 0.01	< 0.00001	74	< 0.005
11/02/2024	WINU0935																				
11/02/2024	WINU0937	< 0.01	< 0.001	< 0.0001		17	< 0.001		< 0.001	< 0.05	< 0.001	7	0.055	< 0.00004	0.017	0.287	4	< 0.01	< 0.00001	76	< 0.005
5/05/2024	WINU0935	0.01	< 0.001	< 0.0001		18	0.007		< 0.001	0.22	< 0.001	9	0.033	< 0.00004	0.012	0.383	5	< 0.01	< 0.00001	78	< 0.005
5/05/2024	WINU0935																				
5/05/2024	WINU0937	< 0.01	< 0.001	< 0.0001		16	0.003		0.001	0.3	< 0.001	8	0.124	< 0.00004	0.016	0.346	4	< 0.01	< 0.00001	79	0.009
5/05/2024	WINU0937																				
28/07/2024	WINU0937	< 0.01	< 0.001	< 0.0001		12	< 0.001		< 0.001	< 0.05	< 0.001	8	0.074	< 0.00004	0.021	0.237	4	< 0.01	< 0.00001	80	< 0.005
28/07/2024	WINU0937																				
28/07/2024	WINU0935																				
28/07/2024	WINU0935	0.04	< 0.001	< 0.0001		15	0.01		< 0.001	0.22	< 0.001	9	0.042	< 0.00004	0.021	0.454	5	< 0.01	< 0.00001	79	< 0.005
21/09/2024	WINU0935	0.06	< 0.001	< 0.0001		16	0.01		< 0.001	0.27	< 0.001	8	0.035	< 0.00004	0.021	0.43	5	< 0.01	< 0.00001	78	< 0.005
21/09/2024	WINU0937	< 0.01	< 0.001	0.0001		12	0.002		0.003	< 0.05	< 0.001	6	0.068	< 0.00004	0.019	0.214	5	< 0.01	< 0.00001	78	0.04
21/09/2024	WINU0935																				
23/09/2024	WINU0937																				
13/11/2024	WINU0937	< 0.01	< 0.001	< 0.0001		14	0.002		0.001	< 0.05	< 0.001	7	0.058	< 0.00004	0.02	0.301	4	< 0.01	< 0.00001	82	0.007
13/11/2024	WINU0935	< 0.01	< 0.001	< 0.0001		17	0.002		< 0.001	0.1	< 0.001	8	0.032	< 0.00004	0.019	0.43	5	< 0.01	< 0.00001	79	0.005
13/11/2024	WINU0937																				
13/11/2024	WINU0935																				

Sample Date	Hole_ID	Bicarbonate Alkalinity as CaCO3 (mg/L)	Carbonate Alkalinity as CaCO3 (mg/L)	Chloride (mg/L)	Electrical Conductivity @ 25°C	Hydroxide Alkalinity as CaCO3 (mg/L)	pH value (pH units)	Total Hardness as CaCO3 (mg/L)	Sulfate as SO4 - Turbidimetric (mg/L)	Suspended Solids (SS) (mg/L)	Total Alkalinity as CaCO3 (mg/L)	Total Dissolved Solids (Calc.) (mg/L)	Alkalinity (mg/L)
5/05/2023	WINU0935												165
5/05/2023	WINU0935	99	< 1	70	521	< 1	7.47	75	27	69	99	339	
6/06/2023	WINU0935												90
6/06/2023	WINU0935												105
30/07/2023	WINU0935	106	< 1	87	549	< 1	7.85	78	20	59	106	357	
30/07/2023	WINU0935												120
26/09/2023	WINU0935	80	< 1	77	536	< 1	7.71	47	25	46	80	348	
16/12/2023	WINU0935												100
16/12/2023	WINU0935	121	< 1	90	527	< 1	7.49	71	28	72	121	342	
6/06/2023	WINU0937												132
6/06/2023	WINU0937	103	< 1	64	536	< 1	7.4	75	42	52	103	348	
30/07/2023	WINU0937												114
30/07/2023	WINU0937												102
26/09/2023	WINU0937	118	< 1	88	588	< 1	8.04	80	39	56	118	382	
16/12/2023	WINU0937												105
16/12/2023	WINU0937	84	< 1	67	578	< 1	7.69	64	47	67	84	376	
11/02/2024	WINU0935	104	< 1	83	516	< 1	7.58	75	26	45	104	335	
11/02/2024	WINU0935												120
11/02/2024	WINU0937	98	< 1	78	518	< 1	7.39	71	45	81	98	337	
5/05/2024	WINU0935	97	< 1	79	520	< 1	7.47	82	28	96	97	338	
5/05/2024	WINU0935												150
5/05/2024	WINU0937	92	< 1	71	508	< 1	7.4	73	51	510	92	330	
5/05/2024	WINU0937												132
28/07/2024	WINU0937	90	< 1	83	479	< 1	7.18	63	43	142	90	311	
28/07/2024	WINU0937												90
28/07/2024	WINU0935												120
28/07/2024	WINU0935	98	< 1	98	494	< 1	7.37	74	26	279	98	321	
21/09/2024	WINU0935	102	< 1	99	524	< 1	7.35	73	27	74	102	341	
21/09/2024	WINU0937	92	< 1	86	488	< 1	7.18	55	46	120	92	317	
21/09/2024	WINU0935												132
23/09/2024	WINU0937												96
13/11/2024	WINU0937	93	< 1	67	510	< 1	7.13	64	44	10	93	332	
13/11/2024	WINU0935	101	< 1	72	512	< 1	7.22	75	28	72	101	333	
13/11/2024	WINU0937												93
13/11/2024	WINU0935												93

CERTIFICATE OF ANALYSIS

Work Order	: **EP2508251**	Page	: 1 of 5
Client	: **RIO TINTO WINU PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: Lily Deveroux	Contact	: Rhiannon Steere
Address	: LEVEL 18 CENTRAL PARK 152-158 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: 08 9406 1306
Project	: Baseline groundwater monitoring	Date Samples Received	: 27-May-2025 09:55
Order number	: 3106299420	Date Analysis Commenced	: 27-May-2025
C-O-C number	: 83241	Issue Date	: 05-Jun-2025 18:18
Sampler	: Lily Deveroux		
Site	: Baseline		
Quote number	: EP23RIOTINWIN0001_V6		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA

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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)			Sample ID	WINU1320	----	----	----	----
			Sampling date / time	19-May-2025 12:53	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2508251-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.47**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1080**	----	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	**702**	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	<5	----	----	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**138**	----	----	----	----
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	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**72**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**72**	----	----	----	----
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	**57.3**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**81**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**222**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**29**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**16**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**148**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**9**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.002**	----	----	----	----

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)			Sample ID	WINU1320	----	----	----	----
			Sampling date / time	19-May-2025 12:53	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2508251-001	--------	--------	--------	--------
				Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	**0.001**	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.002**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.006**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.014**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.033**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	----	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Silver	7440-22-4	0.00001	mg/L	<0.00001	----	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.4**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.02**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**6.43**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**6.43**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.8**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.02**	----	----	----	----

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)			Sample ID	WINU1320	----	----	----	----
			Sampling date / time	19-May-2025 12:53	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2508251-001	--------	--------	--------	--------
				Result	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser - Continued								
Total Phosphate	----	0.10	mg/L	<0.10	----	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**9.39**	----	----	----	----
ø Total Cations	----	0.01	meq/L	**9.43**	----	----	----	----
ø Ionic Balance	----	0.01	%	**0.24**	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EP2507949**	Page	: 1 of 5
Client	: **RIO TINTO WINU PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: Lily Deveroux	Contact	: Rhiannon Steere
Address	: LEVEL 18 CENTRAL PARK 152-158 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: 08 9406 1306
Project	: Baseline groundwater monitoring	Date Samples Received	: 20-May-2025 14:30
Order number	: 3106299420	Date Analysis Commenced	: 20-May-2025
C-O-C number	: ----	Issue Date	: 28-May-2025 16:38
Sampler	: Luke Cowley		
Site	: Winu		
Quote number	: EP23RIOTINWIN0001_V6		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Daniel Fisher	Inorganics Analyst	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA

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.

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

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WINU1328 Groundwater	WINU1323 Groundwater	----	----	----
			Sampling date / time	15-May-2025 16:00	17-May-2025 16:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	EP2507949-001	EP2507949-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.03**	**7.43**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1750**	**419**	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	**1140**	**272**	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	<5	<5	----	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**347**	**48**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**49**	**57**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**49**	**57**	----	----	----
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	**18.1**	**52.0**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**86**	**17**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**499**	**65**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**73**	**11**	----	----	----
Magnesium	7439-95-4	1	mg/L	**40**	**5**	----	----	----
Sodium	7440-23-5	1	mg/L	**173**	**61**	----	----	----
Potassium	7440-09-7	1	mg/L	**22**	**4**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WINU1328 Groundwater	WINU1323 Groundwater	----	----	----
			Sampling date / time	15-May-2025 16:00	17-May-2025 16:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2507949-001	EP2507949-002	--------	--------	--------
				Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.002**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0002**	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	**0.005**	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.002**	**0.001**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.014**	**0.003**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Iron	7439-89-6	0.05	mg/L	**0.14**	<0.05	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Silver	7440-22-4	0.00001	mg/L	<0.00001	<0.00001	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.3**	**0.4**	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.06**	**0.01**	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.05**	**5.82**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.05**	**5.82**	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.1**	**0.8**	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WINU1328 Groundwater	WINU1323 Groundwater	----	----	----
			Sampling date / time	15-May-2025 16:00	17-May-2025 16:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2507949-001	EP2507949-002	--------	--------	--------
				Result	Result	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	**0.02**	----	----	----
Total Phosphate	----	0.10	mg/L	<0.10	<0.10	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**16.8**	**3.33**	----	----	----
ø Total Cations	----	0.01	meq/L	**15.0**	**3.72**	----	----	----
ø Ionic Balance	----	0.01	%	**5.72**	**5.53**	----	----	----