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HYDRO ALUMINIUM SMELTER CAPPED WASTE STOCKPILE, 2021 ANNUAL GROUNDWATER MONITORING REPORT

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HYDRO ALUMINIUM SMELTER
2021 ANNUAL GROUNDWATER MONITORING REPORT

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Description	**2021 Annual Groundwater Monitoring Report for the leachate plume associated with the Capped Waste Stockpile at the former Hydro Aluminium Kurri Kurri Smelter, Loxford, NSW.**

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ABBREVIATIONS

Abbreviation	Description
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines (Water Quality)
CoC	Chain of Custody
DQI	Data Quality Indicator
DQO	Data Quality Objective
EPA	Environmental Protection Authority
GME	Groundwater Monitoring Event
ha	hectare
km	kilometre
L	litre
LOR	Limit of Reporting
m	metre
µg/L	micrograms per litre
mg/L	milligrams per litre
NATA	National Association of Testing Authorities
NC	Not calculated
ND	Not detected
n	Number of samples
pH	Measure of acidity, hydrogen ion activity
PQL	Practical Quantitation Limit
RPD	Relative Percentage Difference
QA/QC	quality assurance/quality control

EXECUTIVE SUMMARY

Thirty-three groundwater monitoring events have been completed between July 2013 and December 2021 to monitor a leachate impacted groundwater plume associated with the Capped Waste Stockpile (CWS) at the former Hydro Aluminium Kurri Kurri Smelter, located off Hart Road, Loxford, NSW. Monitoring of the groundwater down gradient of the CWS was initiated to assess the impacts to groundwater from leachate and to provide a temporal and spatial evaluation of the plume behaviour. Leachate from the CWS has high pH and elevated dissolved fluoride characteristics.

Each GME included the sampling and analysis of groundwater from a network of 25 shallow and deep wells located on five sections along the length of the leachate plume down-gradient of the CWS. In 2016, an additional two pairs of shallow and deep wells were added to the network. These wells are located adjacent to Swamp Creek, the nearest surface water receptor. Physico-chemical parameters were recorded, and groundwater samples analysed for soluble fluoride, total and free cyanide as well as total and dissolved aluminium.

Groundwater downgradient of the CWS is shallow and within a former sand filled river channel. Geological constraints limit the movement of groundwater and cause groundwater discharge to the surface following rainfall events. Groundwater wells target the upper phreatic surface, or shallow part of the aquifer, and a deeper part of the aquifer. The monitoring depth of the deeper well is variable and depending on geological stratum.

Evaluation of 2021 GME data has identified the following:

- The leachate plume in shallow groundwater is delineated to the north, with a decreasing trend in soluble fluoride concentrations in well N9 at the leading edge of the plume
- There are no changes in trend analysis for pH or soluble fluoride in the shallow aquifer compared to 2020 results that are indicative of the plume expanding. An increasing trend in soluble fluoride concentrations has been reported at well E4 on the eastern boundary of the leachate plume, which is constrained from further eastern migration at this location due to the geological constraints. In addition, soluble fluoride concentrations in leachate at this location on the eastern edge of the leachate plume have not increased significantly since monitoring commenced in 2013
- Consistent with previous monitoring, the leachate plume has impacted the deeper sand aquifer in a localised area close to the plume source, the CWS, as shown by elevated soluble fluoride concentrations and a high pH in well W2D. Concentrations at this well have been elevated over the monitoring period and there is no increasing trend observed, however there may be some expansion of impact to the east, towards W1D, with dark yellow to brown coloured groundwater observed and an increasing trend identified for both pH and soluble fluoride concentrations, although pH still remains below levels indicative of leachate impact.
- Consistent with previous monitoring, the leachate plume is not reaching the nearest surface water receptor of Swamp Creek, as indicated by continued low pH and low soluble fluoride concentrations in sentinel wells
- Leachate is currently only generated in limited quantities following heavy rainfall and removal of leachate from the northern interception trench is completed as required. Pumping of leachate from the active interception trench has not been required since 2016 due to the lack of leachate generation. Monitoring of groundwater and occasional pump out of passive leachate interception trenches is proposed to continue until remediation of the Capped Waste Stockpile is completed in 2023.

1. INTRODUCTION

Ramboll Australia Pty Ltd (Ramboll) was commissioned by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to undertake quarterly Groundwater Monitoring Events (GMEs) on a portion of the Hydro Aluminium Kurri Kurri Smelter, located off Hart Road, Loxford, New South Wales (NSW), Australia.

The portion of the Smelter subject to the quarterly groundwater monitoring comprises the former smelter waste storage area known as the 'Capped Waste Stockpile' (CWS) and an associated area of leachate impacted groundwater (the leachate plume). The CWS and associated leachate impacted groundwater were identified as Area of Concern 1 (AEC 1) in the Phase 2 Environmental Site Assessment completed by Ramboll in 2012. The location of AEC 1 is shown in **Figure 1, Appendix 1**.

Results of previous GMEs completed between July 2013 and December 2020 have been reported in the following reports:

- 'Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 12 Month Groundwater Monitoring Report', by Environ (now Ramboll), dated February 2015
- 'Hydro Aluminium Smelter, Capped Waste Stockpile, 2015 Annual Groundwater Monitoring Report' by Ramboll Environ (now Ramboll), dated April 2016
- 'Hydro Aluminium Smelter, Capped Waste Stockpile, 2016-2017 Annual Groundwater Monitoring Report', by Ramboll, dated February 2018
- 'Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 2018 Annual Groundwater Monitoring Report', by Ramboll, dated February 2019
- 'Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 2019 Annual Groundwater Monitoring Report', by Ramboll, dated February 2020
- 'Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 2020 Annual Groundwater Monitoring Report', by Ramboll, dated February 2021

This report presents the results of four quarterly GMEs, completed in March, June, September, and December of 2021, as well as a trend analysis of the results from the 33 monitoring events completed between 2013 and 2021.

1.1 Objective and Scope of Work

The objective of each quarterly GME was to:

- Assess the current status of leachate impacts to groundwater occurring from the CWS
- Compare the current status of leachate impacts to historical data to assess changes in groundwater quality.

The objective of this 2021 Groundwater Monitoring Report is to:

- Tabulate results for depth to groundwater, physico-chemical parameters and analytical data collected in 2021
- Complete trend analysis of monitored parameters in key wells incorporating data collected since July 2013
- Complete trend analysis with rainfall data
- Contour contaminant concentrations in the shallow and deep aquifers
- Assess the impact of the leachate interception trench on groundwater quality
- Assess plume migration
- Provide conclusions and recommendations

The scope of work for each quarterly GME included:

- Gauging, purging and sampling of 29 groundwater monitoring wells on five sections through the plume, including two shallow wells and two deep wells located adjacent to Swamp Creek

- Measurement of groundwater physico-chemical properties during purging, including pH, temperature, electrical conductivity (EC), redox (mV), total dissolved solids (TDS) and dissolved oxygen
- Laboratory analysis of groundwater samples for soluble fluoride, total and dissolved aluminium and total and free cyanide

1.2 Limitations

Ramboll Australia Pty Ltd (Ramboll) prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Kurri Kurri Pty Ltd dated 4 December 2020 and in accordance with our understanding and interpretation of current regulatory standards.

A representative program of sampling and laboratory analyses was undertaken as part of this investigation, based on past and present known uses of the site. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous. Site conditions may change over time. This report is based on conditions encountered at the Site at the time of the report and Ramboll disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent Ramboll's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment.

Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

1.3 User Reliance

This report has been prepared exclusively for Hydro Aluminium Kurri Kurri Pty Ltd and may not be relied upon by any other person or entity without Ramboll's express written permission.

2. BACKGROUND

2.1 Site Background

The Hydro Aluminium Kurri Kurri Smelter is located approximately 30 kilometres (km) west of the city of Newcastle and 150 km north of Sydney, in NSW, Australia. The smelter includes a 60-hectare (ha) plant area and a 2,000-ha buffer zone.

The CWS is a repository of waste arising during the operations of the aluminium smelter and includes spent pot lining, anodes, scrubber bags, concrete, brick, bulky waste, fines and other smelter wastes. The CWS is located near the eastern boundary of the smelter footprint and adjacent to the surrounding Hydro owned buffer land.

The CWS was maintained as an uncapped bunded waste repository prior to being capped with clay under development consent in the mid-1990s. At this time, impacts to vegetation in the buffer zone downgradient of the CWS were observed. Leachate from the CWS, caused by rainwater and groundwater coming in to contact with the CWS contents, was also known to have impacted on groundwater and investigations commenced to explore the extent of groundwater impact. These investigations identified that leachate impacted groundwater likely originated from the north east corner of the CWS and extended approximately 250 meters (m) north east. The CWS and associated leachate impacted groundwater were identified as AEC 1 in the Phase 2 Environmental Site Assessment completed by Environ (now Ramboll) in 2012. The location of AEC 1 is shown in **Figure 1, Appendix 1**. Ramboll assessed AEC 1 as part of the following investigations:

- 'Phase 2 Environmental Site Assessment, Kurri Kurri Aluminium Smelter', dated 1 November 2012
- 'Environmental Site Assessment, Capped Waste Stockpile, Kurri Kurri Aluminium Smelter', dated 13 December 2012
- 'Plume Delineation Report, Capped Waste Stockpile', dated 6 November 2013.

Following these investigations, a Groundwater Monitoring Programme was developed that included monitoring 25 wells on five cross sections along the length of the plume. A summary of the Plume Delineation Report was included in Section 2.2 of the 12 Month Groundwater Monitoring Report (ENVIRON June 2016) and further information regarding the development of the Program is presented in Section 2.4 of that report.

Interim mitigation measures were taken in 2013, 2016 and 2017 to intercept the shallow movement and daylighting of leachate impacted groundwater. Measures involved the installation of passive or active shallow trenches, extending approximately 2 m below the ground surface perpendicular to the plume migration and providing pipe conveyance of the leachate impacted groundwater to the surface.

Planning approval has been sought for the remediation of the CWS. The proposal for remediation is the consolidation of all contaminated materials within one centralised containment cell located approximately 1 km west of the current CWS site and within residual clay soils. It is anticipated that remediation will be completed in 2023. Remediation of the CWS will result in the removal of the source of leachate to the groundwater system. Remediation involves some removal of leachate impacted groundwater with the remaining groundwater remediation occurring through natural processes following subsequent rainfall.

2.2 Characterisation of the Leachate Plume

A conceptual site model was developed following Stage 1 and Stage 2 of the investigations and was included in 12 Month Groundwater Summary Report, 2014 (Environ 2015).

The Hydro aluminium smelter and surrounding land generally comprises flat, low lying swampy ground that is at an elevation of between 12 m AHD and 15 m AHD. The CWS is located within the smelter portion of the site and is approximately 170 m in length by 130 m in width and is up to 11 m high and currently comprises a grassed clay cap. The eastern portion of the site within

the buffer zone retains natural bushland vegetation with minor surface filling using refractory bricks along the buffer zone fence line. Two areas of vegetation impact, known as the northern and southern vegetation impact areas are located in the north eastern portion of the site.

The CWS comprises stockpiled spent pot lining wastes and other wastes including cryolite, alumina, floor sweepings, shot blast dust, cement and pot lining mix. The waste is not leachate generating of itself (i.e., not putrescible) however, the uncapped storage of waste and subsequent infiltration of rainwater through the waste stockpile led to the generation of leachate over a period of approximately 25 years. Prior to capping, the leachate was collected behind bund walls surrounding the spent pot lining stockpile. During capping, leachate was suspected to have been entrapped within the fill in the north eastern corner of the CWS.

The CWS was capped in 1995 to prevent further infiltration. The suspected burial of leachate during capping and the ongoing contact between waste material and shallow groundwater beneath the CWS is considered to result in the ongoing leachate generation.

Major contaminants in the leachate are sodium (4,800 mg/L to 15,300 mg/L), fluoride (1,100 mg/L to 3,420 mg/L), sulphate (4,000 mg/L to 6,740 mg/L) and cyanide (70 mg/L to 200 mg/L) based on data obtained from leachate ponded within the bunded area of the CWS prior to capping (Reference: Dames & Moore (1992) 'Environmental Impact Statement, Upgrades to Waste Storage Facilities at the Alcan Australia Limited Kurri Kurri Smelter'). Leachate impacted groundwater is observed to be brown in colour.

The leachate plume originates from beneath the eastern side of the CWS where seepage into shallow groundwater within a semi-continuous sand aquifer has occurred. The shallow sand aquifer has been delineated as an elongate and sinuous sand lens approximately 50 m wide and 250 m in length extending to the north east of the CWS. The shallow sand aquifer is surrounded vertically and horizontally by a discontinuous clay aquitard that has been less impacted by leachate in close proximity to the plume and not been impacted by leachate at a distance from the plume. The configuration of the aquifer is a result of the nature of the deposition of sediments within a former estuary during periods of sea level rise and fall. A schematic cross section of the site is included as **Attachment 1**, **Appendix 2**.

The location of the plume within the semi-continuous shallow sand aquifer constrained by the surrounding discontinuous clay aquitard suggests that the movement of the leachate groundwater plume is limited by the geology. The complex interbedded Quaternary sediments comprise estuarine muds (high plasticity clay), fluvial channel sands (fine grained and coarse-grained sands), sandy levee deposits (clayey sand/sandy clay) and high energy flood deposits (coarse grained quartz sand).

Delineation investigations show that the groundwater plume remains confined within one main sand filled channel which directs flow to the north east. This finding is consistent with observations of a heavily vegetated area evident in the 1961 historical aerial photograph (**Attachment 2**, **Appendix 2**). The heavy vegetation is a reflection of surface and subsurface drainage lines and likely represents the shallow groundwater table present in the sand filled channel. The 1961 aerial photograph depicts the vegetation extending further to the north east and connecting with Swamp Creek. Given the correlation between the plume extent and the vegetation, it is reasonable to conclude that the groundwater flow path will continue along the vegetation alignment toward Swamp Creek and that, should the plume migration reach the surface water receptor, the discharge point will occur approximately 750 m to 1,000 m north-east of the plume, as shown in **Attachment 2**, **Appendix 2**. Fate and transport modelling to predict the migration of the plume along this channel has been undertaken, as summarised in **Section 2.5**.

The shallow nature of the semi-continuous sand aquifer results in the exfiltration of leachate impacted groundwater within topographically low areas of the site and following high rainfall events. The impacts of exfiltration are observed on the eastern edge of the plume where dieback

of vegetation has occurred (southern and northern vegetation impact areas). Brown coloured seepage is observed and evaporation of exfiltrated groundwater has left a white salt crust on surface soils in this area. The high electrical conductivity of the exfiltrated groundwater (up to 15,000 µs/cm) exceeds the limit (12,200 µs/cm) at which conditions are generally too saline for plant growth (ANZECC, 2000).

The semi-continuous shallow sand aquifer that is impacted with leachate is characterised by high pH (pH >9), electrical conductivity (>5,000 µS/cm), fluoride (>200 mg/L) and total cyanide (>6 mg/L) concentrations and is brown in colour. Historical data indicates fluoride concentrations within the leachate plume decreased after the CWS was capped in 1995. Fluoride concentrations near the CWS, the source of the plume, peaked in 1997. Mid-way along the plume, fluoride concentrations peaked around 2000 and at the leading edge, fluoride concentrations peaked between 2004 and 2006, as shown in **Figure 2-1**.

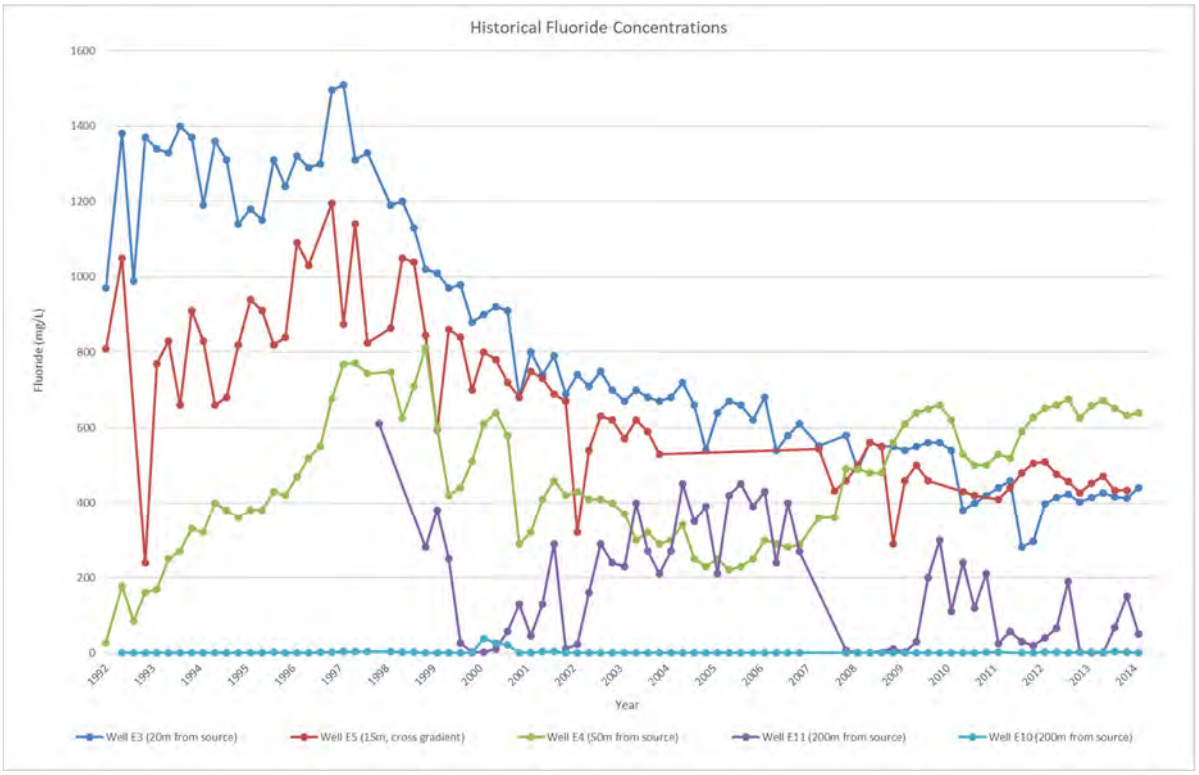


Figure 2-1: Historical Fluoride Concentrations Along the Plume 1992 - 2014

Ex-filtrated leachate impacted groundwater is observed to become overland flow discharging along a surface water flow path to a small dam. During periods of high rainfall, surface water within this dam is able to flow through a culvert structure to a larger dam which discharges to Swamp Creek. The overland flow path is shown in **Attachment 3**, **Appendix 2**.

Fluoride concentrations at the semi-permanent dam, located between the leachate impacted groundwater plume and Swamp Creek, typically vary between 15 mg/L and 25 mg/L. It is considered that the elevated fluoride concentrations in the semi-permanent dam are due to overland flow of exfiltrated groundwater from their source at the southern and northern vegetation impact areas. Sampling found the fluoride concentrations in Swamp Creek vary between 0.49 mg/L upstream of the smelter and 1.2 mg/L downstream. Adjacent to the semi-permanent dam discharge to Swamp Creek, fluoride concentrations were 1.6 mg/L. The Stage 2 Aquatic Assessment - Ecological Risk Assessment completed by ENVIRON in June 2013 indicated there is no discernible impact to the aquatic ecology within the semi-permanent dam as a result of elevated concentrations of fluoride in surface water and sediment.

2.3 Aquifer Characterisation

A sand aquifer within the buffer zone of the Hydro Aluminium Smelter has been impacted by leachate from the CWS. An underlying deep aquifer has also been impacted in close proximity to the contamination source. The characteristics of this sand aquifer and the underlying deep aquifer are critical to the understanding of the site CSM. Aquifer characteristics have been identified as outlined in **Table 2-1**.

Table 2-1: Aquifer Characteristics

Characteristic	Comment
Aquifer Type	Unconsolidated sediment (estuarine)
Aquifer Depth	Shallow: Approximately 0.3 m bgs to 2.5 m bgs Deep: Approximately 3.5 m bgs to 7 m bgs
Confined/Unconfined	Shallow: Unconfined Deep: Confined by high plasticity clays in some areas
Groundwater Flow Direction	Shallow: North to north east Deep: North east
Recharge Mechanism	Shallow: Infiltration Deep: Infiltration
Porosity	Shallow: Variable due to variable nature of the sediments. High porosity quartz gravels identified at northeast corner of the Capped Waste Stockpile. Mid to low porosity tightly packed sands identified along plume length. Deep: Mid to low porosity poorly sorted, tightly packed fine-grained sand.

The most important characteristic for the movement of leachate through the shallow aquifer is the nature of the materials, in particular the complex and variable nature of the unconsolidated sediments. The nature of the sediments impacts the porosity, with high porosity quartz gravels, mid to low porosity tightly packed sands and high plasticity clays with very low porosity, all identified within the unconsolidated estuarine sediments. The leachate from the CWS moves through the sediments with mid to high porosity but is retarded by high plasticity clays. Where these barriers to flow coincide with changes in topography, discharge of groundwater to the surface can occur.

2.4 Leachate Interception Trenches

The following leachate interception trenches were installed down gradient of the source of the leachate plume to capture leachate prior to daylighting to surface near the two vegetation impact areas:

- A passive interception trench was installed in early 2013 to the north of Section 2 to intercept leachate flowing into the southern vegetation impact area
- An active interception trench was installed at the toe of the CWS immediately upgradient of the wells on Section 1 in April 2014
- A second passive interception trench was installed north of Section 4 in October 2017 to capture leachate daylighting along the western edge of the northern vegetation impact area

The location of these interception trenches are shown in **Attachment 4**, **Appendix 2.** A conceptual cross section of the active interception trench on Section 1 is included in **Attachment 5**, **Appendix 2**.

These trenches were installed as an interim remedial measure to reduce daylighting and overland flow of leachate downgradient of the CWS. The active trench was in operation from May 2014 to March 2016 when the discharge rate dropped to 0 L/ minute. Operation of the active trench since

March 2016 has not been required as leachate is no longer collecting in the trench. The passive trenches are occasionally pumped out following heavy rainfall. The trenches have been effective as an interim remedial measure, with water quality improvements and regeneration of vegetation observed in the two vegetation impact areas.

2.5 Fate and transport modelling

ENVIRON (February 2015) conducted a hydrogeological review and analytical groundwater contaminant transport modelling to assess the fate and transport of the leachate plume within the shallow aquifer. The assessment and modelling included a review of site investigation data and the construction of a conceptual hydrogeological model of AEC 1 and its surrounds.

A one-dimensional model (UK EA Remedial Targets Worksheet) was used to simulate the groundwater flow and contaminant transport conditions to predict contaminant (fluoride) concentrations from the source to the nearest down-gradient receptor (Swamp Creek).

The model was calibrated against observed fluoride concentrations from the existing groundwater monitoring well network to the east and north-east of the capped waste stockpile. The groundwater fluoride concentration at the receptor impact point was then evaluated under the simulated model and compared with the guideline criteria.

The following conclusions were drawn from the results of the modelling:

- Based on the existing hydrogeological conditions and the presence of an ongoing source from the CWS, the model estimated a fluoride concentration of 4.3 mg/L at the receptor distance (1,000 m), compared to the guideline criteria of 1.5 mg/L
- This value is considered a conservative estimate given the model assumes a continuous source, however, historical, more recent and proposed works are considered to have mitigated the source contribution. Future remedial works are proposed to ultimately remove the source (spent Pot Liner, anodes, scrubber bags, concrete, brick, bulky waste, fines and other smelter wastes stockpiled within the CWS)
- The model demonstrates sensitivity to a number of input parameters including the soil partition coefficient, (Kd). Future studies may include site specific determination of the soil partition coefficient in order to improve model calibration.

2.6 Conceptual Site Model

A Conceptual Site Model (CSM) is a site-specific qualitative description of the source(s) of contamination, the pathway(s) by which a contaminant may migrate through environmental media and the populations (human and/or ecological) that may potentially be exposed. This relationship is commonly known as a Source-Pathway-Receptor (SPR) linkage. Where one or more elements of the SPR linkage are missing, the exposure pathway is considered to be incomplete, and no further assessment is required.

A CSM was developed for the CWS leachate plume based on details provided in the sections above. The CSM has been updated based on field observations and data to 2021.

2.6.1 Contaminant Sources

The contaminant sources at the CWS leachate plume is the aluminium smelter wastes disposed in the CWS, primarily spent pot lining and cryolite.

2.6.2 Contaminants of Concern

Contaminants of Concern associated with spent pot lining and cryolite include fluoride, cyanide, aluminium, sodium, sulphate and a high pH.

2.6.3 Potential Human and Ecological Receptors

Identified potential receptors of contaminants of concern, should a complete exposure pathway be present, include:

- Maintenance personnel (brush cutting is completed in this area)
- Hydro employees who access the buffer zone

- Vegetation growing in the area of the leachate plume
- Transitory fauna that traverse through the area of the leachate plume
- The ecology of the semi-permanent dam located adjacent to Swamp Creek, the nearest down gradient receptor
- The ecology of Swamp Creek

Limited human receptors were identified as the site is located in a portion of the buffer zone that is fenced and not accessible to the general public or Hydro employees aside from those who work in the buffer zone.

2.6.4 Potential Transport Mechanisms

Identified potential transport mechanisms by which contaminants of concern may migrate from the source include:

- Migration through groundwater
- Daylighting of groundwater and overland surface water flow

Infiltration as a transport mechanism was stopped by the capping of the CWS with low permeability clay in the mid-1990s.

2.6.5 Exposure Pathways

For a receptor to be exposed to a chemical contaminant derived from a site, there must be an exposure pathway linking the source of contamination and the exposed receptor. An exposure pathway described the course a chemical or physical agent takes from the source to the exposed receptor and generally includes the following elements (US EPA 1989):

- A source and mechanism of chemical release
- A retention or transport medium (or media where chemicals are transferred between media)
- A point of potential human contact with the contaminated media
- An exposure route (e.g., ingestion, inhalation) at the point of exposure

An evaluation of exposure pathways at the site is outlined in **Table 2-2**.

Table 2-2: Source-Pathway-Receptor Linkages

	Source-Pathway-Receptor Link? (Yes/No/Potential (P), Not Relevant (NR))						
	Maintenance Personnel	**Hydro Employees**	**Vegetation**	**Transitory fauna**	**Ecology of dam down gradient**	**Ecology of Swamp Creek**	**Justification**
Soil							
Dermal contact with impacted soil	No	No	NR	No	NR	NR	The contents of the CWS and underlying 0.5 m of soil are impacted by elevated concentrations of fluoride, asbestos, PAHs and petroleum hydrocarbons (Ramboll 2016). Natural soils more than 0.5 m below the waste are not impacted. The contamination is no longer accessible following capping of the CSW with low plasticity clay in the mid-1990s.
Incidental ingestion of impacted soil	No	No	NR	No	NR	NR	
Outdoor dust inhalation	No	No	NR	No	NR	NR	
Surface Water							
Dermal contact with impacted surface water	No	No	NR	No	No	No	Groundwater within the leachate plume can daylight and flow across overland flow paths, providing a pathway between contaminated groundwater and human and ecological receptors. Following the installation of the interception trenches, the daylighting of groundwater has reduced in frequency and impacted surface water has been observed on few occasions during heavy rainfall since 2014.
Incidental ingestion of impacted surface water	No	No	NR	No	No	No	
Uptake of impacted surface water	NR	NR	No	NR	NR	NR	
Groundwater							
Dermal contact with impacted groundwater	No	No	No	No	No	No	Groundwater within the leachate plume is not accessible aside from uptake of impacted water by vegetation, as evidenced by the two vegetation impact areas in the down gradient portion of the plume. High plasticity clays located east of the leachate plume prevent groundwater migration east towards Swamp Creek.
Incidental Ingestion of impacted groundwater	No	No	No	No	No	No	
Uptake of impacted groundwater	NR	NR	**Yes**	NR	NR	NR	

3. SAMPLING AND ANALYSIS QUALITY PLAN

3.1 Objective

The objective of each quarterly GME is to collect water quality data from the groundwater monitoring network to inform the behaviour of the leachate plume over time and provide data for annual reporting.

The groundwater monitoring network comprises groundwater wells located on five sections along the length of the leachate plume, as follows:

- Section 1: Wells E5, E5D, W7S, W7M, PUMP, W2S, W2D
- Section 2: Wells E5, E5D, E4, W1S, W1D
- Section 3: Wells A7, W3S, ~~W3D~~[1], ~~W3SA~~[2], W4S, ~~W4D~~[3]
- Section 4: Wells E11, W5S, W5D, N2
- Section 5: Wells G2, N8, N9, W6S, W6D

Two pairs of shallow and deep wells adjacent to Swamp Creek (F5/G5 and F6/G6) were added to the groundwater monitoring network in 2016. These are sentinel wells that are unimpacted by leachate. The presence of leachate in these wells would indicate potential impact to Swamp Creek, the nearest surface water receptor. The groundwater monitoring network is shown in **Figure 2, Appendix 1**.

3.2 Scope of Works

The scope of works included the following:

- The collection of groundwater samples and measurement of water levels and physico-chemical parameters (including pH temperature, EC, redox, TDS and dissolved oxygen) from 29 groundwater wells in the groundwater monitoring network
- Laboratory analysis of groundwater samples for soluble fluoride, total and dissolved aluminium, and total and free cyanide. Dissolved aluminium was included as part of laboratory analysis from June 2018.

3.3 Fieldwork Methodology

The fieldwork methodology for the collection of groundwater samples is outlined in **Table 3-1**.

Table 3-1: Field Methodology for Quarterly Groundwater Monitoring

Activity	Details
Well Gauging	Monitoring wells were gauged using a water interface probe.
Well Purging	Monitoring wells were purged prior to sampling by pumping water from the wells until the physico-chemical parameters stabilised.
Decontamination	The majority of the sampling equipment used during low flow sampling was dedicated and disposable, such as the dedicated and disposable sampling tube. Non-disposable sampling equipment, including the interface probe, water quality meter and flexible pump tubing was decontaminated by washing in a Decon®90 solution and rinsing with potable water between sampling locations.
Sample Collection and Storage	Groundwater samples were collected into laboratory-supplied bottles with the appropriate preservative for the analysis undertaken. The bottles were stored in an ice-filled cooler in the field and in transit to the laboratory.
Chain of Custody	Groundwater samples were dispatched to the laboratory under chain of custody conditions.

[1] This well has been unable to be sampled since December 2020 due to an obstruction in the well casing and is suspected to be damaged, it has not been replaced.

[2] This well was damaged in the April 2015 storm. As this well was dry for the majority of the 2013 and 2014 sampling events, it has not been replaced.

[3] This well was damaged in the April 2015 storm. It was able to be sampled until October 2016 but is now damaged beyond repair and has not been replaced.

3.4 Groundwater Well Maintenance

During the December 2021 GME, the well monument at G6 was replaced as the existing monument was heavily corroded. The well casing remains at the same depth within the new monument.

3.5 Data Quality Objectives

Data quality objectives (DQOs) are outlined in **Table 3-2**.

Table 3-2: Data Quality Objectives

DQO	Outcome
State the Purpose	To collect on-going monitoring data from a network of wells to understand the temporal and spatial behaviour of the aquifer in the area of leachate impacted groundwater.
Identify the Decision	• Is the data collected from the monitoring well network of sufficient quality to meet the project objectives? • Is the data collected from the monitoring well network of sufficient quality to be comparable between events?
Identify Inputs to the Decision	• Record physico-chemical parameters and collect samples from the groundwater monitoring well network (see **Figure 2, Appendix 1**) over four quarterly GMEs. • Complete analysis of collected groundwater samples for soluble fluoride, total and free cyanide, total and dissolved aluminium; and • Analyse the data and compare with historical results.
Define the Study Boundaries	AEC 1 identified in **Figure 1**, **Appendix 1** plus the surface water receptors identified down gradient of AEC 1, including a semi-permanent dam and Swamp Creek. The investigation relates to groundwater.
Develop a Decision Rule	The statistical parameters of interest are the concentrations of fluoride, cyanide, aluminium, pH and EC identified historically and in the current investigations. The Assessment Criteria outlined in **Section 5** and the historical groundwater concentrations where available for the monitoring wells. The Decision Rules for groundwater are: • Groundwater concentrations were assessed against the acceptance criteria outlined in **Section 5** in combination with a comparison against background criteria where applicable. An evaluation of significance was also undertaken; and • Recommendations were made for further evaluation for concentrations above criteria or background concentrations.
Specify Limits on Decision Errors	As this investigation involves a series of GMEs to monitor the state of a groundwater leachate plume, decision errors relate to the comparability of data between monitoring events. During the 2021 GMEs, 29 wells will be sampled unless found to be dry. This number takes into consideration three damaged wells (W3SA, W4D and W3D). Standard operating procedures, including consistent use of low flow techniques, should be implemented to ensure comparability of data between events. The same primary and secondary laboratories should be used for analysis and laboratory QA/QC should be assessed to ensure comparability between events.
Optimise the Design for Obtaining Data	Low flow sampling techniques will be used to collect groundwater samples to optimise the quality of the samples. Field samples for each round will be collected using the same sampling procedures to ensure comparability between GMEs.

3.6 Data Quality Indicators

Project data quality indicators (DQI) have been established to set acceptance limits on field and laboratory data collected as part of the quarterly groundwater monitoring program. The data quality indicators are outlined in **Table 3-3.**

Table 3-3: Data Quality Indicators

DQI	Field	Laboratory
Completeness – a measure of the amount of useable data from a data collection activity	All critical locations sampled. All samples collected, aside from dry wells. Experienced sampler. Documentation correct.	All critical samples analysed. All analysis completed according to standard operating procedures. Appropriate methods Appropriate Practical Quantitation Limits (PQLs).
Comparability – the confidence that data may be considered to be equivalent for each sampling and analytical event	Experienced sampler. Climatic conditions appropriate for the type of analyte. Climatic conditions noted during sampling. Same types of samples collected using same sampling methods.	Same analytical methods used. Same sample PQLs. Same NATA accredited laboratories used. Same units.
Representativeness – the confidence that data are representative of each medium present on site.	Appropriate media sampled. Groundwater sampled following stabilisation of physico-chemical parameters	All samples analysed according to standard operating procedures.
Precision – a quantitative measure of the variability of the data.	Collection of intra-laboratory duplicates at a rate of 1 in 10 primary samples. Collection of inter-laboratory duplicate samples at a rate of 1 in 20 primary samples.	Analysis of field duplicate samples, relative percent difference (RPDs) to be less than 30%. Laboratory duplicates analysed, RPDs to be less than 30%.
Accuracy – a quantitative measure of the closeness of the reported data to the “true” value.	Sampling methodologies appropriate and complied with. Collection of rinsate samples from non-disposable sampling equipment.	Analysis of: Rinsate blanks Method blanks Matrix spikes Surrogate spikes Laboratory control samples Reagent blanks. Results for blank samples to be non-detect. Results for spike samples to be between 70% and 130%.

4. QUALITY ASSURANCE / QUALITY CONTROL

Four quarterly GMEs were completed in March 2021, June 2021, September 2021, and December 2021. A quality assurance/quality control assessment is provided in **Table 4-1** and **Table 4-2**.

Table 4-1: QA/QC Sampling and Analysis Methodology Assessment

Sampling Methodology	Ramboll Assessment
Sampling Pattern and Locations	Prior to the commencement of the GMEs, the leachate plume originating from the CWS was delineated through staged fieldwork and reporting in ENVIRON (2013) 'Plume Delineation Report, Alcan Mound'. From the delineation work, 19 new groundwater wells were installed along the length of the plume to assist with groundwater monitoring. The five sections are approximately 60 m apart and extend from the toe of the CWS to the leading edge of the leachate plume. Groundwater wells target both the shallow and deep aquifer. Groundwater wells located on five sections were selected for the 2021 GMEs. Each section provides a cross section at different lengths along the known location of the leachate plume. One of the wells, W3SA, was destroyed in the April 2015 storm and has not been replaced. Another well, W4D, was also damaged in this storm but was able to be sampled until the October 2016 GME. This well can no longer be sampled and has not been replaced. A third well, W3D, has been unable to be sampled since December 2020 due to an obstruction within the well casing and is suspected to be damaged. This well has also not been replaced. In 2016, an additional two shallow and deep pairs of wells (F5/G5 and G6/F6) were added to the monitoring network. These wells are sentinel wells located adjacent to Swamp Creek, the nearest surface water receptor.
Sampling Density	Twenty-nine groundwater wells were selected for sampling for the 2021 quarterly GMEs on five sections along the length of the leachate plume and adjacent to the nearest surface water receptor. As the leachate plume is approximately 300 m in length, there is one section per 60 m. One primary groundwater sample was collected from each well (unless dry or damaged).
Sample Depths	Both shallow groundwater (the leachate plume) and the deep aquifer were sampled as part of the 2021 quarterly GMEs.
Sample Collection Method	For the 2021 quarterly GMEs, groundwater samples were collected using low flow methods (peristaltic pump and dedicated LDPE tubing). Groundwater samples were collected directly into laboratory-supplied bottles with field filtration for dissolved aluminium (0.45 µm). Disposable gloves were worn during sample collection.
Decontamination Procedures	Dedicated disposable tubing was used to collect the groundwater samples. A short piece of silicone tubing was retained in the peristaltic pump and used for all wells. This tubing along with all non-disposable sampling equipment (i.e., interface probe, water quality meter) was decontaminated between sampling locations by washing with a solution of Decon®90 and potable water.
Sample Handling and Containers	Samples were placed into laboratory supplied sampling containers, dosed with the correct preservative (where relevant) and immediately placed into a cooler chilled with ice and/or ice bricks while in the field and during transportation to the laboratory.
Detailed Description of Field Screening Protocols	A water quality meter was used to collect field data, including temperature, pH, electrical conductivity, reduction/oxidation potential, total dissolved solids, dissolved oxygen, and turbidity. These parameters were recorded during purging until they stabilised.

Chain of Custody	Samples were transported to the laboratory under chain of custody conditions. The chain of custody forms were signed by the laboratory on receipt of the samples.

Table 4-2: QA/Q Assessment

Data Quality Indicator	Ramboll Comments
Field Quality Control Samples	In general, intra-laboratory duplicate samples were collected at a rate of approximately 10% and inter-laboratory duplicate samples were analysed at a rate of approximately 5% during the 2021 GMEs. At least one rinsate sample was collected per GME. Inter-laboratory duplicates collected during the March and June 2021 GME's were inadvertently analysed by the primary laboratory, making them intra-laboratory duplicates. A summary of the field quality control samples collected during the 2021 GMEs is outlined below: • March 2021: three intra-laboratory duplicates (D01_20210317, T01_20210317, D02_20210325) and one rinsate (R01_20210325) • June 2021: three intra-laboratory duplicates (D01_20210615, T01_20210615, D02_20210616) and one rinsate (R01_20210616) • September 2021: two intra-laboratory duplicates (D01_20210920, D02_20210921), one inter-laboratory duplicate (T01_20210920) and one rinsate (R01_20210921) • December 2021: two intra-laboratory duplicates (D01_20211201, D02_20211202), one inter-laboratory duplicate (T01_20211201) and one rinsate (R01_20211202).
Field Quality Control Results	Intra-laboratory and inter-laboratory duplicate results for each GME are presented in **Table M**, **Appendix 3**. Relative percentage differences (RPDs) were calculated for intra-laboratory and inter-laboratory duplicate pairs of samples. RPDs for most analytes were below the criterion (30%) except for: • March 2021: intra-laboratory duplicate pair W2D/T01_20210317 RPD for total aluminium 37% • June 2021: intra-laboratory duplicate pair G2/D01_20210615 RPD for total aluminium 89%, intra-laboratory duplicate pair F6/D02_20210616 RPD for fluoride 67% and total aluminium 199%, and intra-laboratory duplicate pair G2/T01_20210615 RPD for total aluminium 56% • September 2021: intra-laboratory duplicate pair E5D/D01_20210920 RPD for dissolved aluminium 67%, intra-laboratory duplicate pair W5D/D02_20210921 RPD for total aluminium 39% and intra-laboratory duplicate pair E5D/T01_20210920 RPD for total cyanide 197%, dissolved aluminium 67%, total aluminium 47% • December 2021: intra-laboratory duplicate pair G5/D02_20211202 RPD for total aluminium 40% and inter-laboratory duplicate pair W5D/T01_20211201 RPD for fluoride 50%, total aluminium 117% Higher RPDs were generally the result of low-level detections close to the laboratory limit of reporting (LOR) with the exception of total aluminium in intra-/inter-laboratory duplicate pairs. There is no criterion for total aluminium. Therefore, these higher RPDs are not considered to affect the outcomes of this report. Rinsate sample results were all reported at less than the limit of reporting (<LOR) for the four 2021 GMEs.
Equipment Calibration	The water quality meter was calibrated prior to use. Standard practice is to rely on pre-calibration for short sampling periods. Calibration certificates are included in **Appendix 6**.
NATA registered laboratory and NATA endorsed methods	Envirolab was the primary analytical laboratory and ALS was used as the secondary laboratory. The laboratory certificates are NATA stamped.
Analytical methods	Summary analytical methods were included in the laboratory test certificates.
Holding times	Review of the CoCs and laboratory certificates indicate that holding times were met for all analytes for all samples during the 2021 GME's.
Practical Quantitation Limits (PQLs)	PQLs for all groundwater analytes were below the assessment criteria.
Laboratory quality control samples	Laboratory quality control samples were undertaken by the laboratories at appropriate frequencies.
Laboratory quality control results	The results for laboratory duplicates and laboratory control samples were within the limit of reporting.

	The results for laboratory duplicates, laboratory control samples, matrix spikes and surrogates were acceptable, noting that reporting of percentage recovery was not possible in some samples over the four quarters due to high concentrations of elements in the samples however, an acceptable recovery was obtained for the Laboratory Control Sample (LCS).

Ramboll makes the following conclusions regarding the DQIs:

- Completeness: The data for the 2021 GMEs is complete as the selected 29 groundwater wells were located and dipped for depth to groundwater during each GME and groundwater samples were collected from wells containing sufficient water to sample.
- Comparability: The groundwater data collected during the four 2021 GMEs is comparable to previous results as the sampling protocols, analysis methods, quality control methods and monitoring well locations are generally consistent between sampling events and with prior events. The four 2021 GMEs were completed by a single sampler, Jake Bourke, a Ramboll environmental scientist.
- Representativeness: The selection of shallow and deep wells on sections along the length of the leachate plume is considered to provide data that is representative of the leachate plume in shallow groundwater and representative of the underlying deep aquifer. Groundwater was sampled following purging to ensure groundwater samples are representative of the aquifer sampled.
- Precision: In the field, Ramboll achieved precision by using standard operating procedures for the collection of groundwater samples and by collecting duplicate and triplicate samples for analysis. Relative Percent Difference (RPD) results for duplicate samples were acceptable. Laboratory quality control results indicate precision was achieved at the primary and secondary laboratories.
- Accuracy: In the field, Ramboll achieved accuracy by using Ramboll's standard operating procedures for the collection of groundwater samples. Laboratory quality control results indicate accuracy was achieved at the primary and secondary laboratories.

In general, the DQIs outlined above have been met and Ramboll considers that the data is of suitable quality to meet the project objectives.

5. ASSESSMENT CRITERIA

5.1 Groundwater Assessment Criteria

The assessment criteria adopted for the assessment of groundwater contamination were sourced from the following references:

- NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination
- ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
- ANZG (2018) Guidelines for Fresh and Marine Water Quality
- ENVIRON (March 2013) Tier 2 Ecological Risk Assessment, Kurri Kurri Aluminium Smelter

5.2 Potential Beneficial Uses

NSW DEC (2007) indicates that for assessing groundwater quality, it is first necessary to assess the beneficial uses of groundwater and surface water down gradient of the site.

The closest surface water receptor to the site is a dam and then Swamp Creek located approximately 1.5 km to the north-east of the site within an area of the buffer zone used for farming. This drainage area discharges into Wentworth Swamp, which in turn discharges to the Hunter River approximately 15 km north-east of the site near Maitland.

Surface water acidity/alkalinity within the Swamp Creek is described as generally neutral with pH ranging between 7.0 and 7.8 and conductivity is generally fresh, ranging from 626 µS/cm to 1,520 µS/cm. This surface water body is considered to be a freshwater receptor.

Groundwater is expected to follow a subsurface drainage line through a sand filled channel and flow north east towards Swamp Creek. Water level gauging completed during previous investigations confirmed the groundwater flow direction to the north east.

According to the Office of Industry and Investment, NSW, there are 17 licensed groundwater abstractions (bores) located within the site, which are known to be associated with monitoring of groundwater impact. There are no other licensed groundwater bores within 2 km of the site.

Potential beneficial uses of groundwater down gradient of the site include:

- Discharge into Swamp Creek, which supports aquatic ecosystems, is used for recreational fishing and flows into Wentworth Swamp, which potentially flows into the Hunter River
- Extraction of water from Swamp Creek may also be used for stock watering and/or irrigation.

Drinking water has not been included as a potential beneficial use of water from Swamp Creek for the following reasons:

- Drinking water supply to the local communities is reticulated and originates from Chichester Dam on the Chichester River
- The Kurri Wastewater Treatment Works is located up gradient of the site. The works has a licensed discharge point into Swamp Creek.

5.3 Appropriate Criteria for Groundwater

Based on the review of potential beneficial uses of groundwater and surface water within the closest receptor, the criteria for protection of aquatic ecosystems, irrigation, stock watering and recreational use will be used.

The investigation levels presented in ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality are considered applicable for the protection of aquatic ecosystems of receiving waters. ANZG (2018) advocates a site-specific approach to developing guideline trigger values based on such factors as local biological affects data and the current levels of disturbance of the ecosystem. The guidelines present ‘low risk trigger values’ which are defined as concentrations of

key performance parameters below which there is a low risk of adverse biological effects. If these trigger values are exceeded, then further action is required which may include further site-specific investigations to assess potential contamination or management and remedial actions.

Low risk trigger values are presented in ANZG (2018) for the protection of 80-99% of species in fresh and marine waters, with trigger values depending on the health of the receiving waters.

Groundwater results will be compared against trigger values for the protection of 95% of freshwater species. A 95% protection of freshwater species was selected due to the indication from the Hunter Catchment Management Trust that declining stream water quality and a reduction in diversity of native plants and animals has occurred in the last ten years.

A guideline for fluoride that is protective of the environment has not been developed in Australia.

A summary of the assessment criteria for groundwater is presented in **Table 5-1**.

Table 5-1: Groundwater Assessment Criteria

Contaminant	95% Protection for Aquatic Ecosystems	Irrigation	Stock Watering	Recreational
Aluminium (mg/L)	0.055	5	5	9
Fluoride (mg/L)	No guideline	1	2	1.5
Free Cyanide (mg/L)	0.007	No guideline	No guideline	0.1
pH (pH Units)	6.5 – 8[a]	No guideline	No guideline	5 - 9
Electrical Conductivity (µS/cm)	No guideline	4,500 – 7,700[b] >12,200[c]	No guideline	No guideline

[a] *Values for lowland rivers from Table 3.3.2 in ANZECC (2000).*
[b] *Values for tolerant crops from Table 4.2.4 in ANZECC (2000).*
[c] *Value from Table 4.2.4 in ANZECC (2000) for where electrical conductivity is 'generally too saline' for plant growth.*

6. RESULTS AND TREND ANALYSIS

A summary of groundwater elevation, pH and laboratory results for the past 33 GMEs, including the four quarterly GMEs from 2021 are included in **Appendix 3**. Groundwater field parameter forms are included in **Appendix 4**, laboratory reports are included in **Appendix 5** and calibration certificates for the groundwater quality meter are included in **Appendix 6**.

The identified contaminants of concern associated with the leachate are fluoride, cyanide and aluminium. Fluoride has been selected as the primary contaminant of concern as a result of its persistence observed in groundwater and its concentration range in comparison with the adopted guideline criteria. Aluminium was not selected due to its ubiquity in the environment generally.

The following parameters have been assessed in the following sections:

- Section 6.1: Shallow Aquifer
    - Section 6.1.1: Groundwater Elevation and Flow Direction
    - Section 6.1.2: Groundwater pH
    - Section 6.1.3: Soluble Fluoride
    - Section 6.1.4: Free Cyanide
- Section 6.2: Deep Aquifer
    - Section 6.2.1: Groundwater Elevation and Flow Direction
    - Section 6.2.2: Groundwater pH
    - Section 6.2.3: Soluble Fluoride
    - Section 6.2.4: Free Cyanide

6.1 Shallow Aquifer

6.1.1 Groundwater Elevation and Flow Direction

Figure 6-1 shows groundwater elevation within the shallow aquifer across the 33 monitoring events completed between July 2013 and December 2021. Monthly rainfall is presented for the same period.

Historical groundwater elevation within the shallow aquifer generally shows an increase in response to heavy rainfall and a downward trend in groundwater elevation during extended periods of low rainfall.

Overall, groundwater elevation in the shallow aquifer shows minimal change between the start of monitoring in July 2013 and the most recent GME in December 2021. Decreasing groundwater elevations are consistent with a period of drought from 2017 to 2019, with groundwater elevations recovering following increased rainfall during 2020 and 2021.

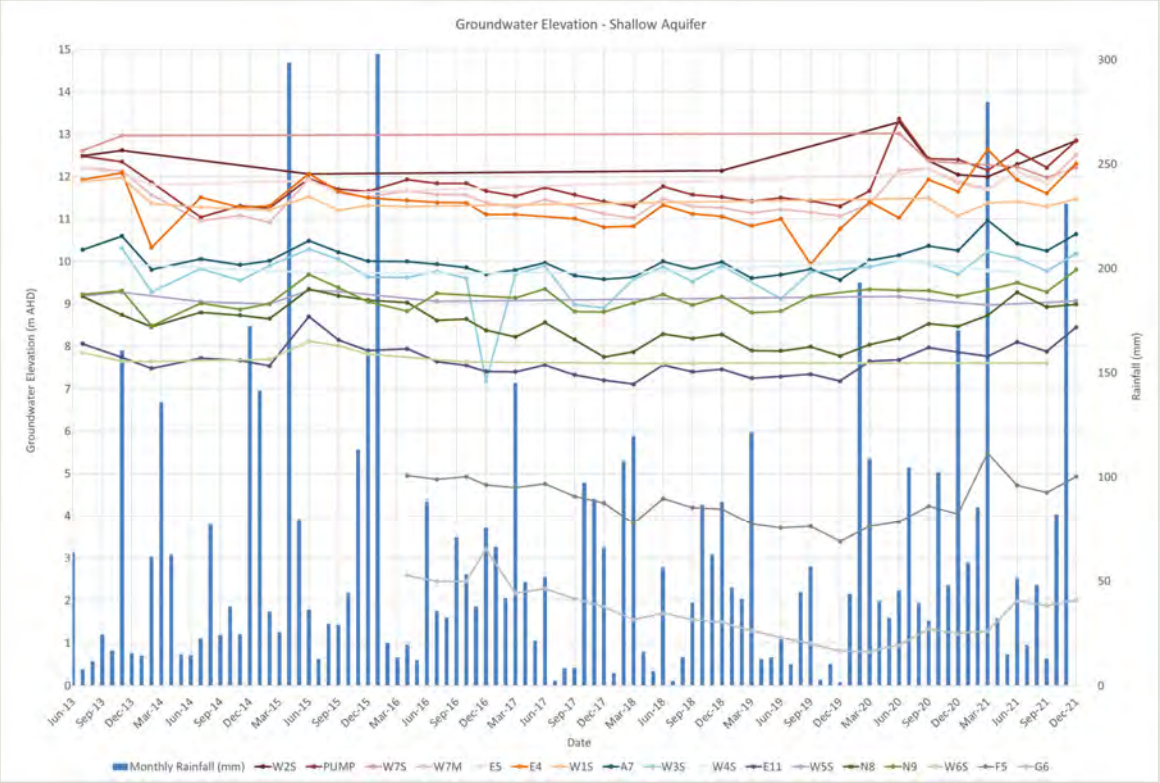


Figure 6-1: Groundwater Elevation – Shallow Aquifer, 2013 to 2021

Interpreted groundwater flow directions within the shallow aquifer for the four GMEs completed during 2021 is presented in **Figure 6-2**.

Between March 2021 and December 2021, groundwater flow within the shallow aquifer was generally to the north and northeast with a centralised low area at E11. These observations are largely consistent with historical observations. Historical elevations and flow directions are attached in **Appendix 7**.

RAMBOLL AUSTRALIA - GIS MAP file : 318001103 AnnualGroundwaterMonitoring2021 | F001_WL_Shallow_V01 | 31/01/2022

Figure 6-2 | Interpolated Groundwater Elevation and Flow Direction – Shallow Aquifer 2021

6.1.2 Groundwater pH

Table 6-1 summarises field pH values reported within the shallow aquifer during 2021. Complete results are included in **Appendix 3.**

Table 6-1: Field pH Values - Shallow Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Value (pH Units)	Maximum Value (pH Units)	No. Results Exceeding Criteria
Field pH	March 2021	15	4.22	9.56	**3 (Recreational) 6 (95% Protection)**
	June 2021	15	4.55	9.91	**5 (Recreational) 6 (95% Protection)**
	September 2021	12	4.68	10.10	**5 (Recreational) 7 (95% Protection)**
	December 2021	15	4.20	9.89	**4 (Recreational) 5 (95% Protection)**

A pH greater than 9 exceeds both the ANZECC (2000) 95% protection for aquatic species criteria and the recreational criteria. Wells with a pH greater than 9, which is also characteristic of leachate impacted groundwater, include the following:

- Section 1: E5, W7M
- Section 2: E4
- Section 3: A7
- Section 4: E11
- Section 5: None

Shallow wells along the length of the leachate plume reported pH values ranging between 6.89 and 9.89 during 2021.

The pH in shallow sentinel wells F5 and G6 near Swamp Creek were less than 5, which may be indicative of the natural pH of groundwater in this part of the Buffer Zone. Although this pH is outside the range for ANZECC (2000) 95% protection criteria, it is not considered to require further analysis as it is not indicative of leachate impact.

The lateral extent of high pH impacted groundwater in the shallow aquifer throughout 2021 is presented in **Figure 6-3**.

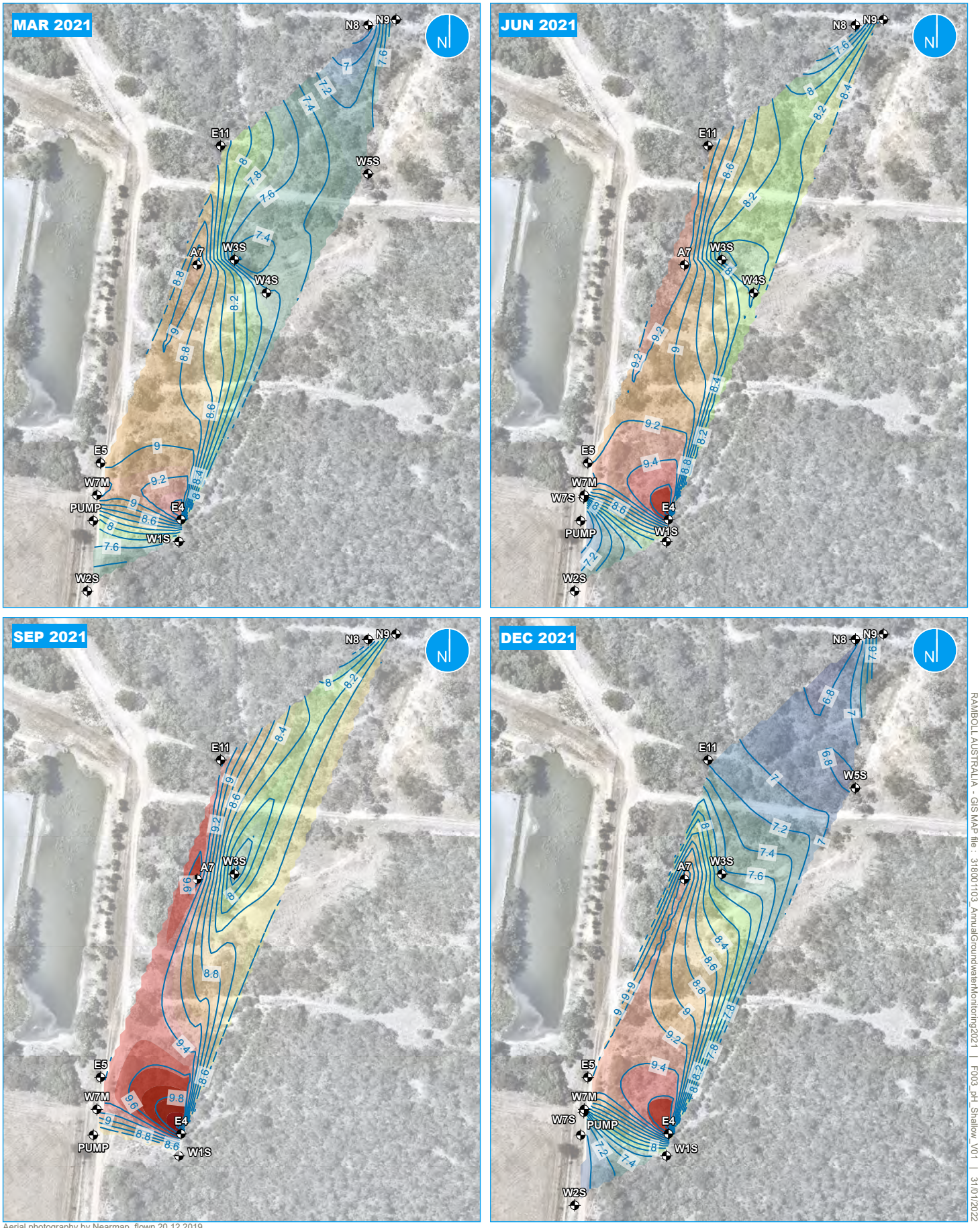


Figure 6-3 | Interpolated Field pH – Shallow Aquifer 2021

6.1.2.1 Time Series Trends

Comparison of pH values for the 33 GMEs completed between July 2013 and December 2021 are shown in **Figure 6-4** to **Figure 6-6**. The blue dotted line shows pH 9, where pH above this is characteristic of leachate impact. The time series trends show the following:

- The consistent presence of groundwater with elevated pH at shallow wells E4, E5, W7M, A7 and E11 along the length of the plume
- Overall decreasing pH in groundwater at PUMP on Section 1
- Low pH of groundwater in sentinel wells F5 and G6.

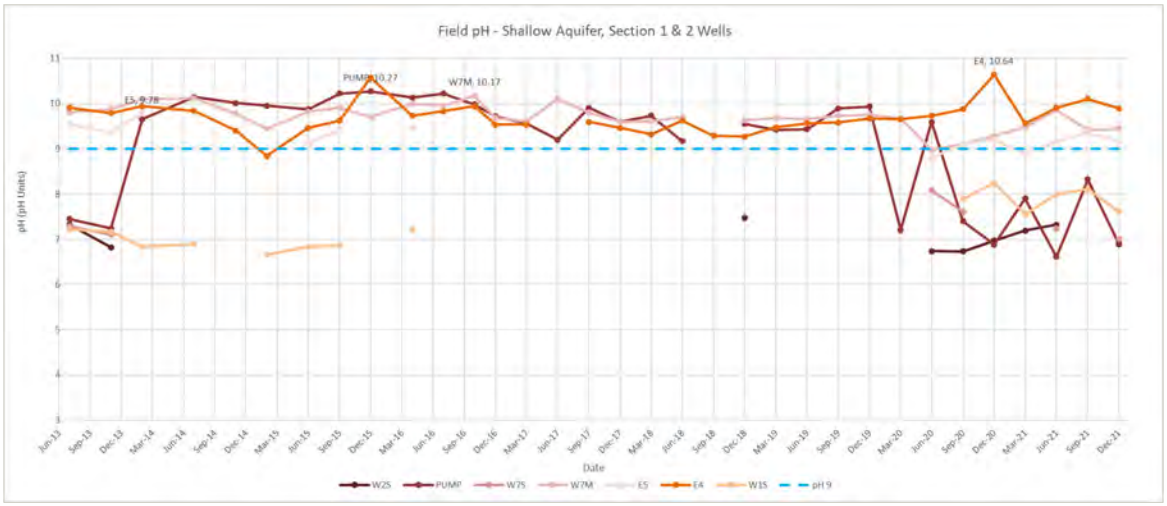


Figure 6-4: Field pH Values – Shallow Aquifer, Section 1 & 2 Wells

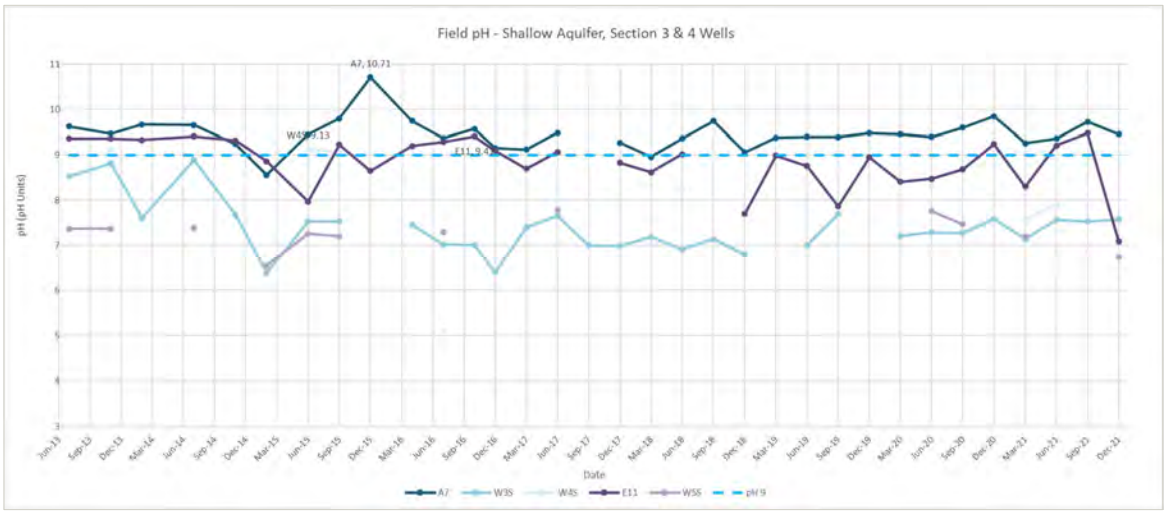


Figure 6-5: Field pH Values – Shallow Aquifer, Section 3 & 4 Wells

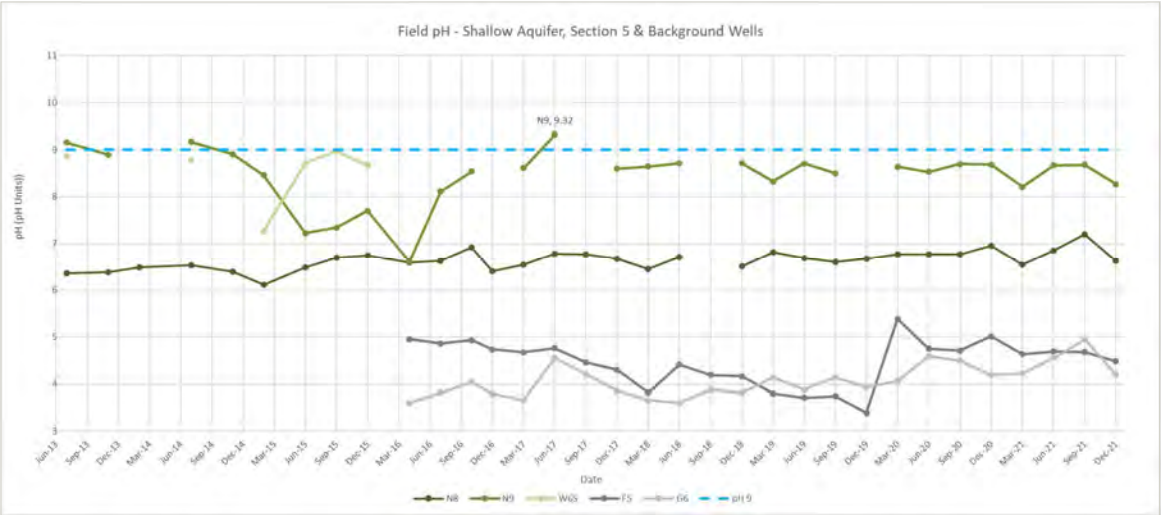


Figure 6-6: Field pH Values – Shallow Aquifer, Section 5 & Sentinel Wells

6.1.2.2 Mann-Kendall Trend Analysis

Mann-Kendall trend analysis was used to statistically assess each of the shallow monitoring locations to identify trends in pH. Trend analysis was carried out using the GSI Environmental Mann-Kendall Toolkit (GSI 2012). The outputs from the Mann-Kendall Toolkit are provided in **Appendix 8**. Data from July 2013 to December 2021 (33 sampling events) were included for the purpose of Mann-Kendall trend analysis of pH, a summary is provided in **Table 6-2**.

Mann-Kendall trend analysis of pH within the shallow aquifer indicates an increasing trend at three locations, W1S (located on Section 2), N8 (located on Section 5) and sentinel well G6. Since the first GME in July 2013, pH values at W1S and N8 have increased from pH 7.22 to pH 7.61 and pH 6.36 to pH 6.63, respectively (see **Figure 6-4** and **Figure 6 6**). These increases are not indicative of leachate impact, nor are they considered a significant change. Groundwater pH values at G6 also remain low and not indicative of leachate impact, increasing from pH 3.6 in April 2016 to pH 4.20 in December 2021 (see **Figure 6-6**). There are no increasing trends in pH for wells impacted by leachate.

Table 6-2: Mann-Kendall pH Trends - Shallow Aquifer

Well	Previous Trend 2013 to 2020	Current Trend 2013 to 2021	pH >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
PUMP	**Decreasing**	**Decreasing**	**Yes**	No
W2S	Stable	Stable	No	No
W7M	**Decreasing**	**Decreasing**	**Yes**	**Yes**
W7S	No Trend	Stable	No	No
E5	Prob. Decreasing	Prob. Decreasing	**Yes**	**Yes**
Section 2				
E4	Stable	No Trend	**Yes**	**Yes**
W1S	No Trend	**Increasing**	**Yes**	No
Section 3				
W3S	**Decreasing**	Stable	No	No
W4S	Stable	**Decreasing**	No	No

Well	Previous Trend 2013 to 2020	Current Trend 2013 to 2021	pH >Assessment Criteria[1]	Leachate Impacted[2]
A7	Stable	Stable	**Yes**	**Yes**
Section 4				
E11	**Decreasing**	**Decreasing**	**Yes**	**Yes**
W5S	No Trend	Stable	No	No
Section 5				
N8	**Increasing**	**Increasing**	No	No
N9	No Trend	Stable	**Yes**	No
W6S	-	-	No	No
Sentinel				
F5	Stable	Stable	No	No
G6	**Increasing**	**Increasing**	No	No

- Indicates no 2021 data available

I.D Insufficient data to perform trend analysis

[1]Field pH exceeded the assessment criteria for 95% Protection for Aquatic Ecosystems or Recreational criteria during any GME completed in 2021

[2]Groundwater generally characteristic of leachate impact i.e., pH >9, brown in colour

6.1.3 Soluble Fluoride

Table 6-3 summarises the laboratory results for soluble fluoride within the shallow aquifer during 2021. Complete results are included in **Appendix 3**.

Table 6-3: Soluble Fluoride Concentrations - Shallow Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	No. Results Exceeding Criteria
Soluble Fluoride	March 2021	15	0.20	630	**12 (Irrigation, Stock Watering and Recreational)**
	June 2021	15	0.30	760	**12 (Irrigation, Stock Watering and Recreational)**
	September 2021	12	0.20	570	**9 (Irrigation, Stock Watering and Recreational)**
	December 2021	15	0.20	680	**12 (Irrigation, Stock Watering and Recreational)**

During the four GMEs completed in 2021, soluble fluoride concentrations in shallow groundwater exceeded the site assessment criteria for Irrigation, Stock Watering and Recreational use at 13 wells as follows:

- Section 1: Pump, W2S, W7M, W7S, E5
- Section 2: E4, W1S
- Section 3: W3S, W4S, A7
- Section 4: E11, W5S
- Section 5: N9

The lower number of results exceeding site criteria during September 2021 were the result of a number of wells being dry at the time of sampling.

All Section 1, Section 2, Section 3, and Section 4 shallow wells exceeded the site assessment criteria for soluble fluoride during 2021, with concentrations generally decreasing to the northeast away from the CWS. The highest concentrations were generally reported at Section 2 well E4 (maximum concentration of 760 mg/L during June 2021) located hydraulically downgradient of Section 1. The sentinel wells F5 and G6, located adjacent to the nearest surface water receptor (Swamp Creek), have consistently reported fluoride concentrations below 1 mg/L, indicating no impact from the leachate plume. The lateral extent of soluble fluoride in the shallow aquifer throughout 2021 is presented in **Figure 6-7**.

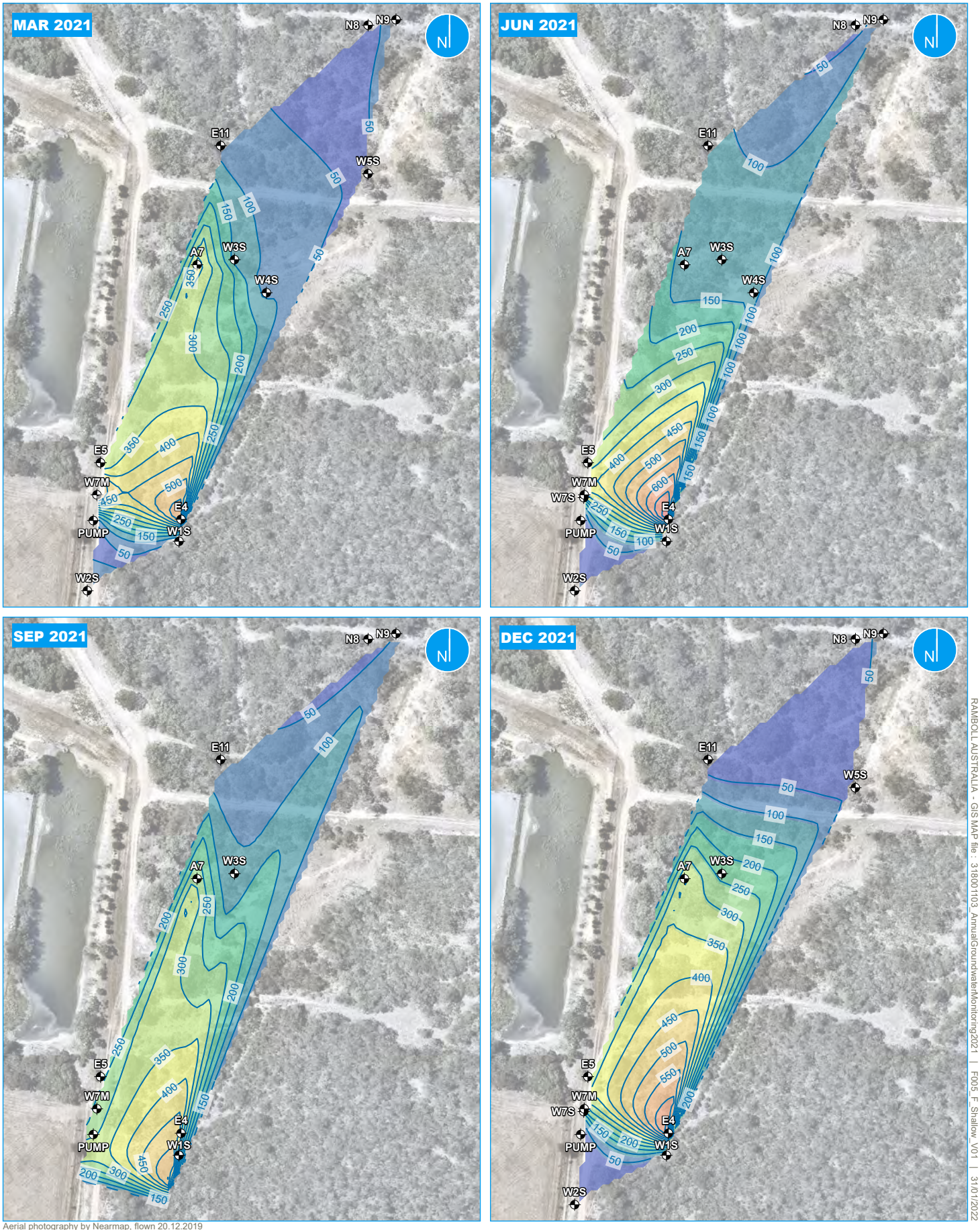


Figure 6-7 | Interpolated Soluble Fluoride - Shallow Aquifer 2021

6.1.3.1 Time Series Trends

Comparison of soluble fluoride concentrations for the 33 GMEs completed between July 2013 and December 2021 are shown in **Figure 6-8** to **Figure 6-10**. The time series trends show the following:

- Fluctuating soluble fluoride concentrations in wells on Section 1 and Section 2, closest to the source of the leachate
- Increasing soluble fluoride concentrations at E4 since September 2017
- Consistently elevated soluble fluoride concentrations indicating leachate impact at Section 3 and Section 4 wells despite overall decreasing concentrations at W4S
- Generally stable soluble fluoride concentrations at well N9 on Section 5, the leading edge of the plume
- Consistently low soluble fluoride concentrations at the sentinel wells F5 and G6.

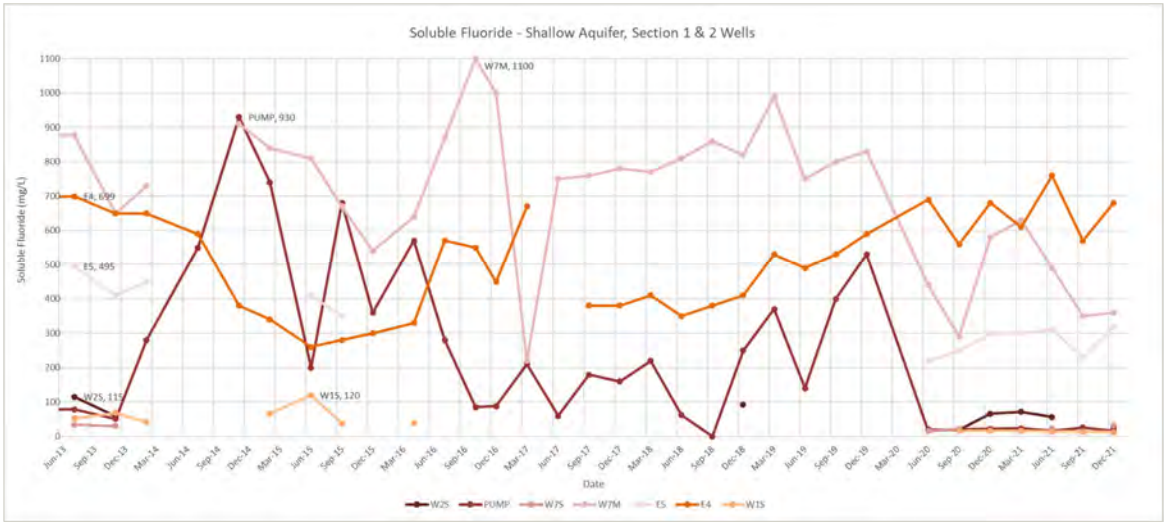


Figure 6-8: Soluble Fluoride Concentrations – Shallow Aquifer, Section 1 & 2 Wells

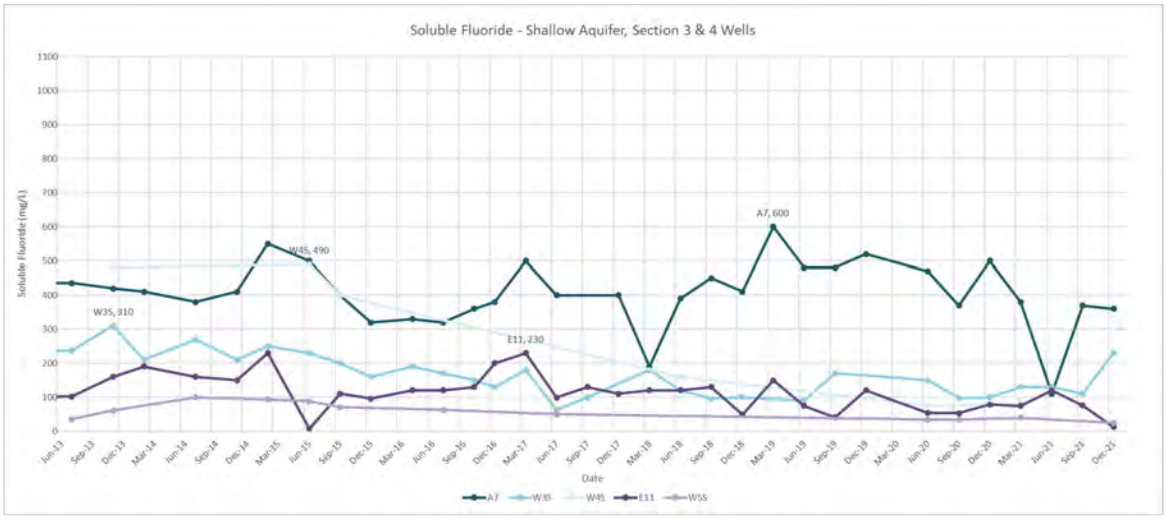


Figure 6-9: Soluble Fluoride Concentrations – Shallow Aquifer, Section 3 & 4 Wells

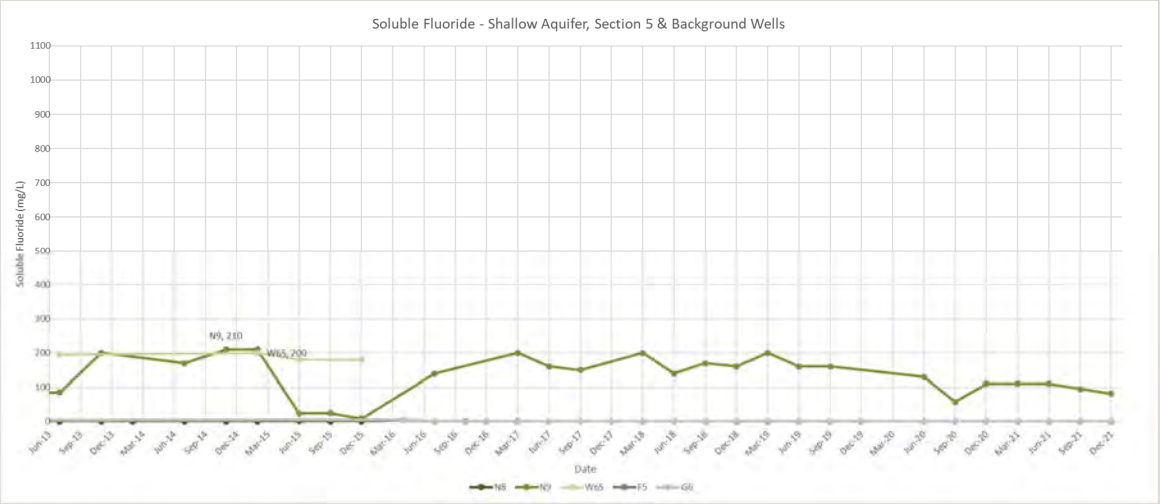


Figure 6-10: Soluble Fluoride Concentrations – Shallow Aquifer, Section 5 & Sentinel Wells

6.1.3.2 Mann-Kendall Trend Analysis

Data from July 2013 to December 2021 (33 sampling events) were included for the purpose of Mann-Kendall trend analysis of soluble fluoride, a summary is provided in **Table 6-4**.

Mann-Kendall trend analysis of soluble fluoride within the shallow aquifer indicates an increasing trend at 2 wells, E4 (located on Section 2) and N8 (located on Section 4). Further review of soluble fluoride concentrations at E4 reveal the increase to be minor, from 699 mg/L in July 2013 to 760 mg/L in June 2021 before decreasing again to 680 mg/L in December 2021. Soluble fluoride concentrations at N8 are within natural fluctuations and pH is not characteristic of leachate impacted groundwater at this location.

Mann-Kendall trend analysis of soluble fluoride at N9, the well at the leading edge of the plume, shows a decreasing trend indicating the plume is not expanding to the north.

Table 6-4: Mann-Kendall Trend Analysis of Soluble Fluoride – Shallow Aquifer

Well	Previous Trend 2013 to 2020	Current Trend 2013 to 2021	Soluble Fluoride >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
PUMP	**Decreasing**	**Decreasing**	**Yes**	No
W2S	Stable	Stable	**Yes**	No
W7M	Stable	**Decreasing**	**Yes**	**Yes**
W7S	Stable	Stable	**Yes**	No
E5	**Decreasing**	**Decreasing**	**Yes**	**Yes**
Section 2				
E4	No Trend	**Increasing**	**Yes**	**Yes**
W1S	**Decreasing**	**Decreasing**	**Yes**	No
Section 3				
W3S	**Decreasing**	**Decreasing**	**Yes**	No
W4S	**Decreasing**	**Decreasing**	**Yes**	No
A7	No Trend	Stable	**Yes**	**Yes**

Well	Previous Trend 2013 to 2020	Current Trend 2013 to 2021	Soluble Fluoride >Assessment Criteria[1]	Leachate Impacted[2]
Section 4				
E11	**Decreasing**	**Decreasing**	**Yes**	**Yes**
W5S	I.D	Stable	**Yes**	No
Section 4				
N8	**Increasing**	**Increasing**	No	No
N9	Stable	**Decreasing**	**Yes**	No
W6S	-	Stable	**-**	No
Sentinel				
F5	No Trend	Prob. Increasing	No	No
G6	No Trend	No Trend	No	No

- Indicates no 2021 data available
I.D Insufficient data to perform trend analysis
[1]Soluble fluoride exceeded the assessment criteria of either Irrigation, Stock Watering or Recreational during any GME completed in 2021
[2]Groundwater generally characteristic of leachate impact i.e., pH >9, brown in colour

6.1.4 Free Cyanide Shallow Wells

Both total and free cyanide were included for analysis in the 2021 GMEs. Free cyanide was introduced for analysis in 2015, as there are no Australian guidelines for total cyanide.

Laboratory results for free cyanide in shallow groundwater reported during 2021 are summarised in **Table 6-5**.

Table 6-5: Free Cyanide Concentrations - Shallow Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	No. Results Exceeding Criteria
Free Cyanide	March 2021	15	<0.004	0.03	**2 (95% Protection for Aquatic Ecosystems)**
	June 2021	15	<0.004	0.02	**2 (95% Protection for Aquatic Ecosystems)**
	September 2021	12	<0.004	0.01	**3 (95% Protection for Aquatic Ecosystems)**
	December 2021	15	<0.004	0.03	**4 (95% Protection for Aquatic Ecosystems)**

Free cyanide concentrations were below the laboratory limit of reporting in most wells along the leachate plume, aside from the following:

- Section 1: W2S, E5, W7M
- Section 2: E4
- Section 3: A7, W3S

Free cyanide concentrations exceeded the ANZECC (2000) 95% protection for aquatic ecosystems criterion in the following wells:

- Section 1: E5, W7M
- Section 2: E4
- Section 3: W3S

Sentinel wells F5 and G6 have consistently reported free cyanide concentrations below the laboratory limit of reporting (<0.004 mg/L) since regular monitoring began in 2016.

6.1.4.1 Time Series Trends

Comparison of free cyanide concentrations for the 28 GMEs completed between February 2015 and December 2021 are shown in **Figure 6-11** to **Figure 6-13**. Overall, concentrations of free cyanide in groundwater have decreased between 2015 and 2021 with no detections above the human health recreational guideline value of 0.1 mg/L since December 2015.

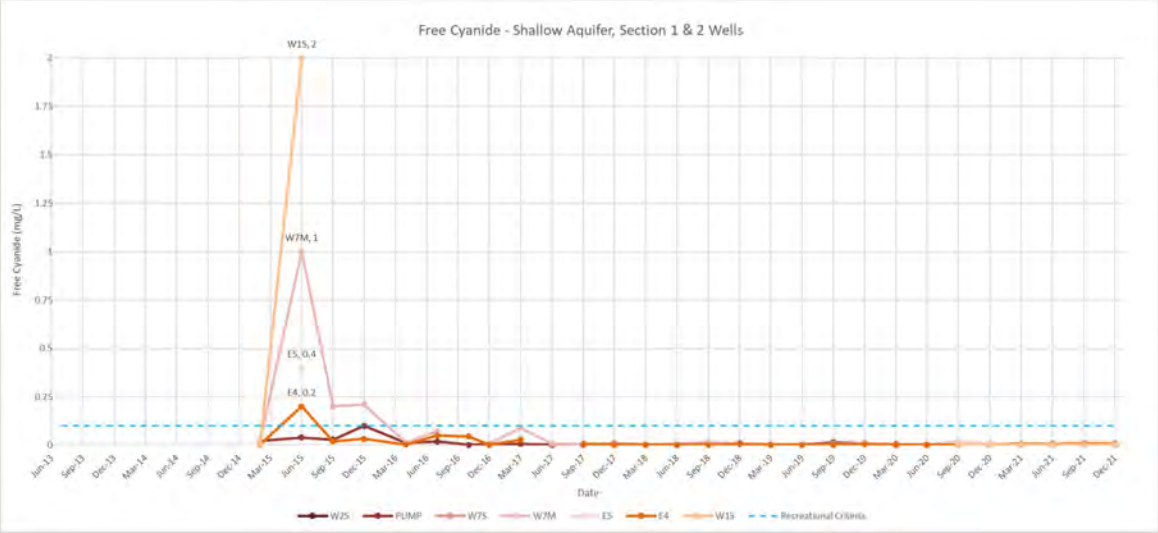


Figure 6-11: Free Cyanide Concentrations – Shallow Aquifer, Section 1 & 2 Wells

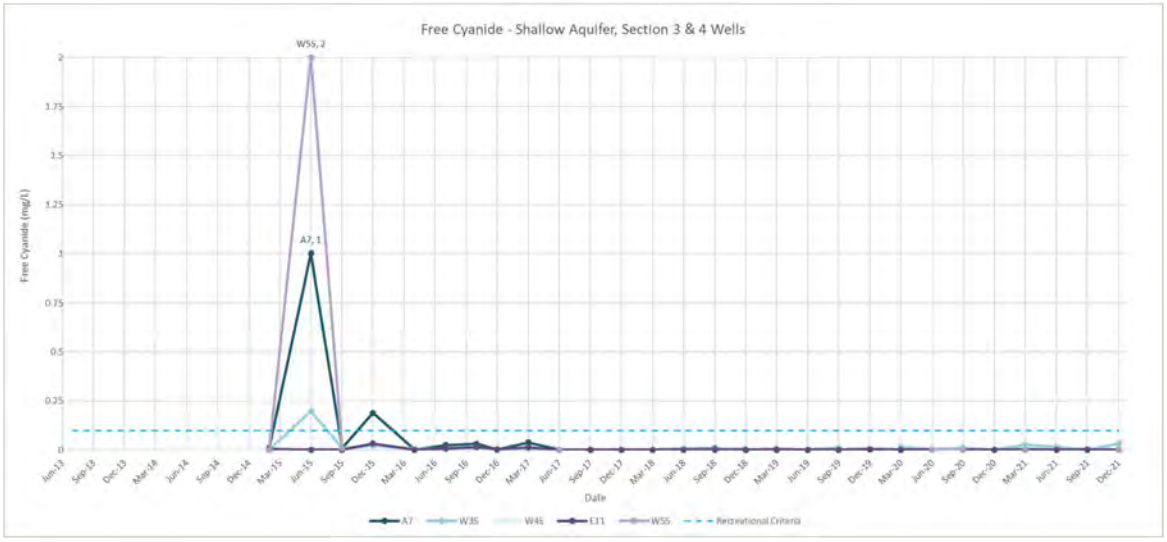


Figure 6-12: Free Cyanide Concentrations – Shallow Aquifer, Section 3 & 4 Shallow Wells

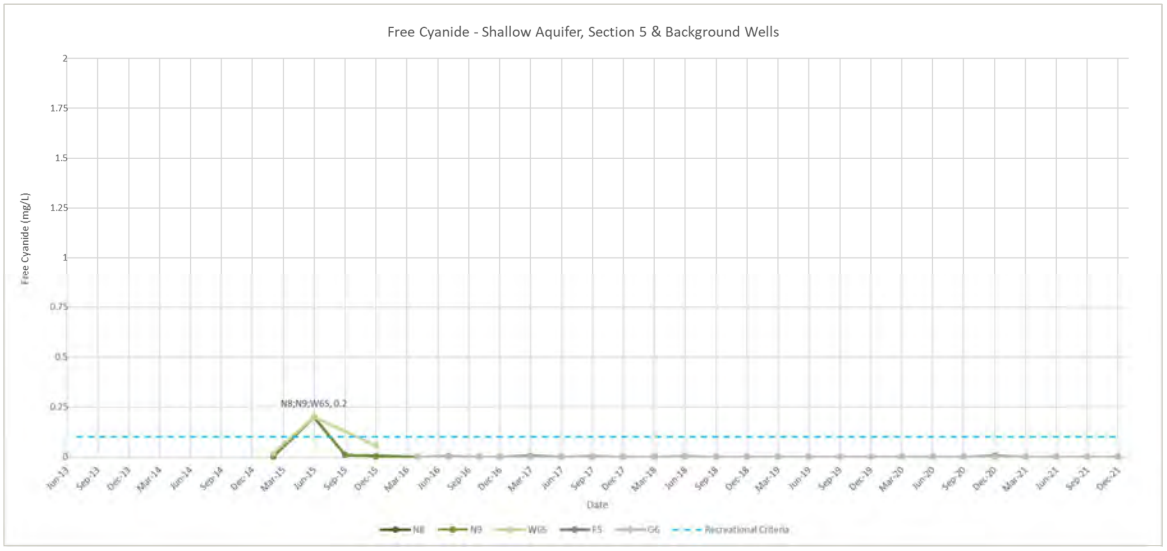


Figure 6-13: Free Cyanide Concentrations - Shallow Aquifer, Section 5 & Sentinel Shallow Wells

6.1.4.2 Mann-Kendall Trend Analysis

Data from February 2015 to December 2021 (28 sampling events) were included for the purpose of Mann-Kendall trend analysis of free cyanide in the shallow aquifer, a summary is provided in **Table 6-6**.

Mann-Kendall trend analysis of free cyanide in shallow groundwater indicates no increasing trends.

Table 6-6: Mann-Kendall Trend Analysis of Free Cyanide Trends - Shallow Aquifer

Well	Previous Trend 2013 to 2020	Current Trend 2013 to 2021	Free Cyanide >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
PUMP	**Decreasing**	**Decreasing**	No	No
W2S	Stable	Stable	No	No
W7M	**Decreasing**	Prob. Decreasing	**Yes**	**Yes**
W7S	I.D	Stable	No	No
E5	No Trend	No Trend	**Yes**	**Yes**
Section 2			No	
E4	**Decreasing**	No Trend	**Yes**	**Yes**
W1S	No Trend	No Trend	No	No
Section 3			No	
W3S	No Trend	No Trend	**Yes**	No
W4S	No Trend	No Trend	No	No
A7	**Decreasing**	**Decreasing**	No	**Yes**
Section 4			No	
E11	Prob. Decreasing	**Decreasing**	No	**Yes**
W5S	No Trend	No Trend	No	No
Section 5			No	
N8	Stable	Stable	No	No
N9	No Trend	No Trend	No	No
W6S	I.D	I.D	No	No
Sentinel			No	
F5	Stable	Stable	No	No
G6	Stable	Stable	No	No

I.D Insufficient data to perform trend analysis

[1] Free cyanide exceeded the assessment criteria of either 95% Protection of Aquatic Ecosystems or Recreational during any GME completed in 2021

[2]Groundwater generally characteristic of leachate impact i.e., pH >9, brown in colour

6.2 Deep Aquifer

6.2.1 Groundwater Elevation and Flow Direction

Figure 6-14 shows groundwater elevation within the deep aquifer across the 33 monitoring events completed between July 2013 and December 2021. Monthly rainfall is presented for the same period.

Groundwater levels within the deep aquifer decreased over the period of low rainfall between 2017 and 2019 and have since increased in response to increased rainfall in 2020 and 2021, with groundwater levels in the deep aquifer now similar to those observed during the first monitoring event in July 2013.

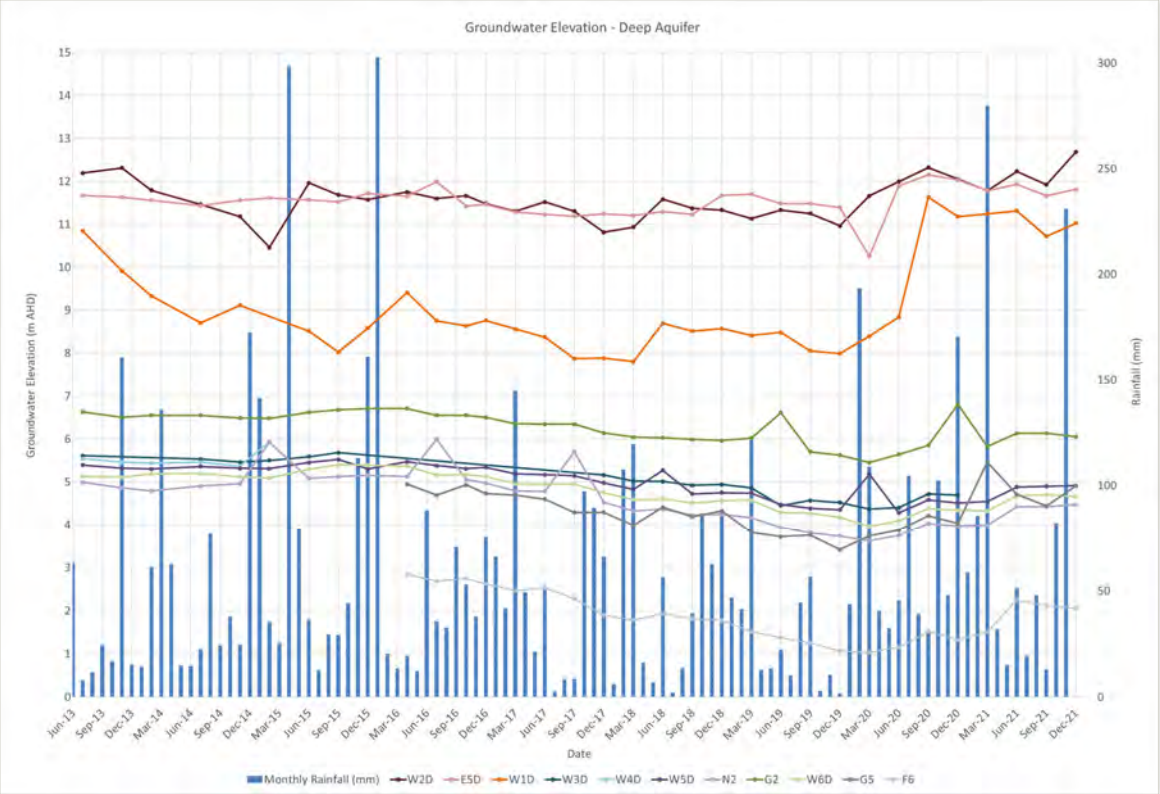
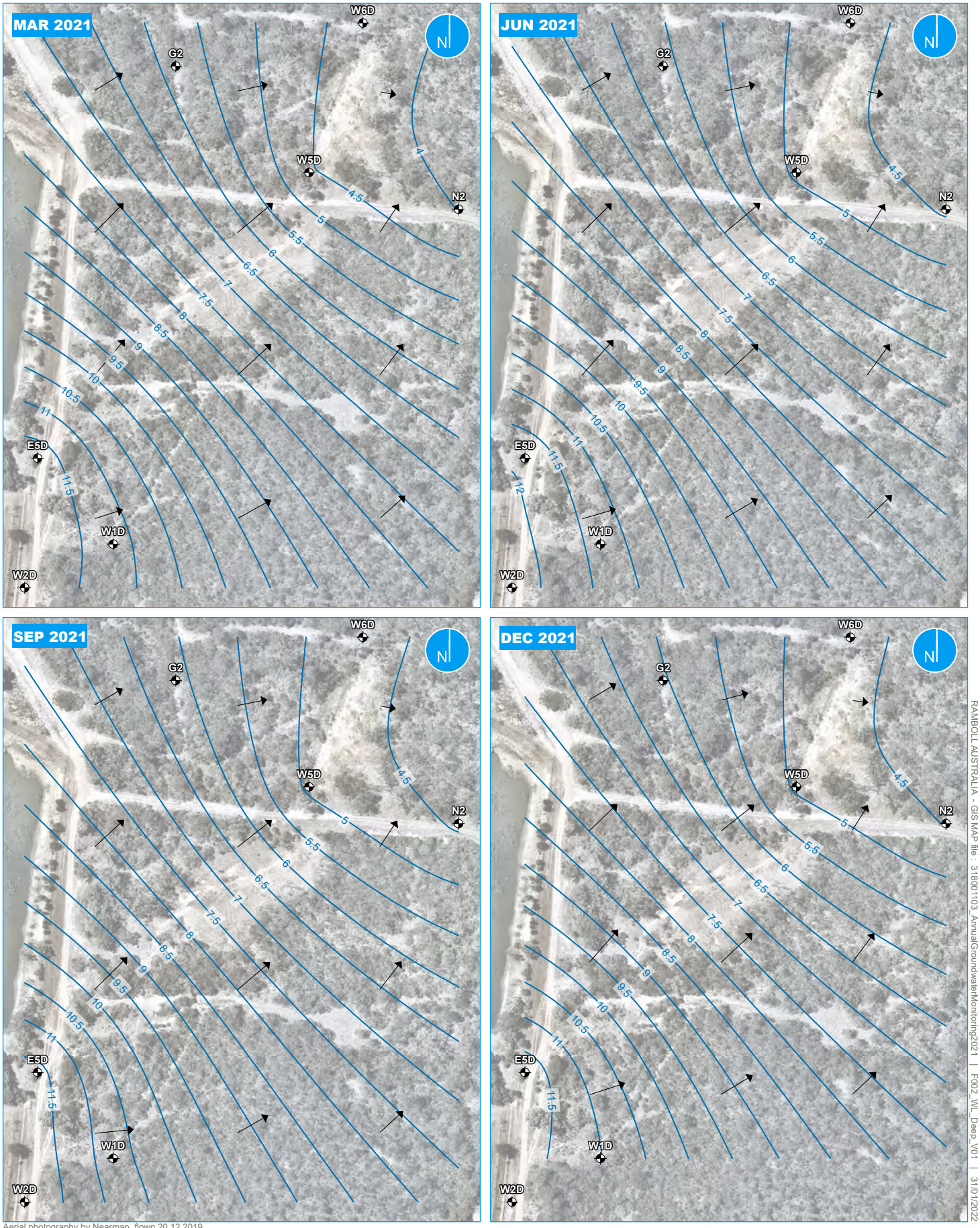


Figure 6-14: Groundwater Elevation – Deep Aquifer, 2013 to 2021

Interpreted groundwater flow directions within the deep aquifer for the four GMEs completed during 2021 is presented in **Figure 6-15**. Historical elevations and flow directions are attached in **Appendix 7**.

Groundwater flow direction in the deep aquifer is to the northeast. The deep aquifer shows little variation in flow direction between June 2013 and December 2021. There is a consistent gradient from approximately 11 m AHD near E5D to approximately 5 m AHD near W5D, then the gradient shallows through the northern vegetation impact area.



Aerial photography by Nearmap, flown 20.12.2019

Legend

- Monitoring location
- Flow direction
- 0.5 m water level contour

0 25 50m

A4
1:2,500

RAMBOLL AUSTRALIA - GIS MAP file : 31801103_AnnualGroundwaterMonitoring2021 | F002_WL_Deep_V01 | 31/01/2022

Figure 6-15 | Interpolated Groundwater Elevation and Flow Direction – Deep Aquifer 2021

6.2.2 Groundwater pH

Table 6-7 summarises field pH values reported within the deep aquifer during 2021. Complete results are included in **Appendix 3.**

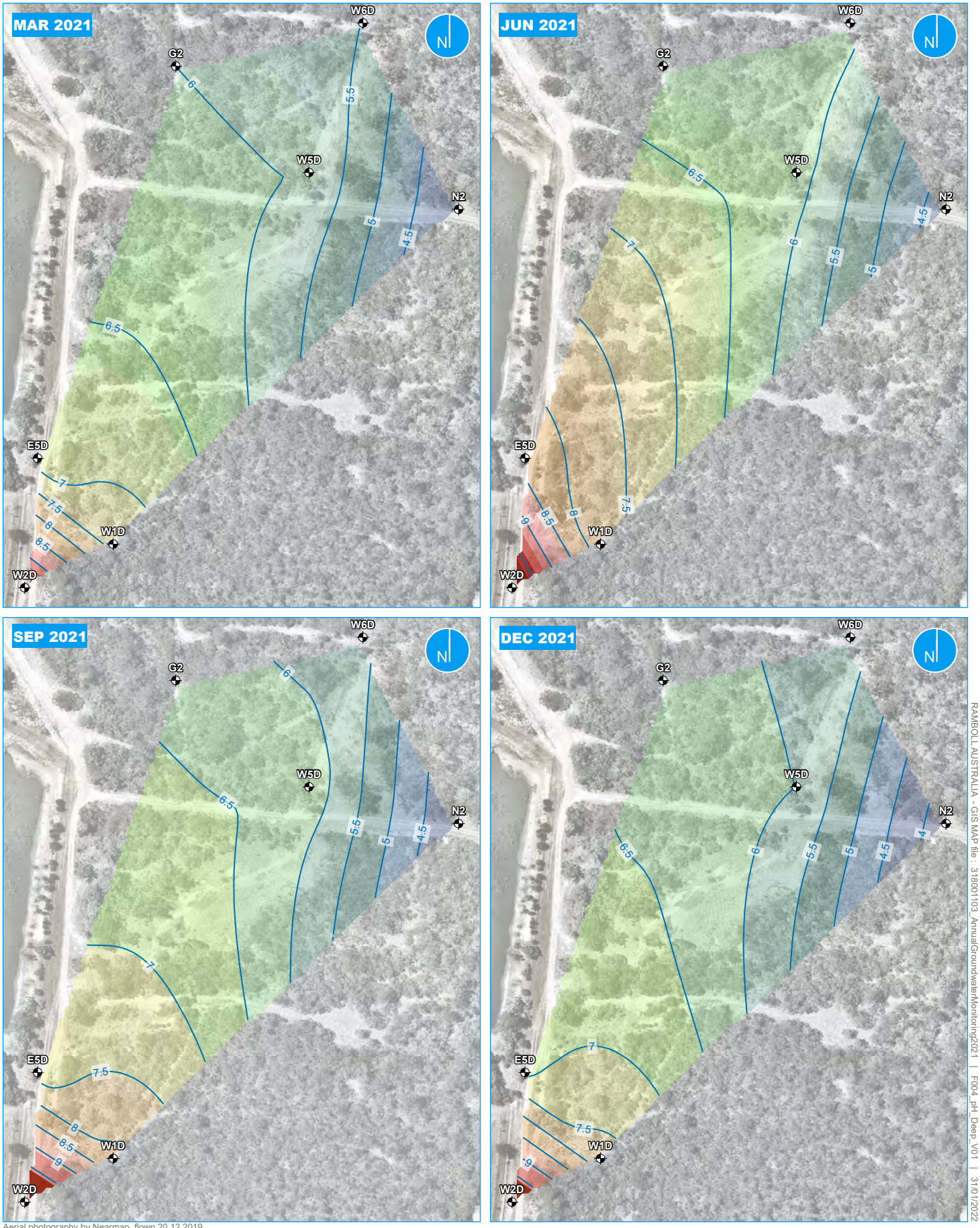
Table 6-7: Field pH Values – Deep Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Value (pH Units)	Maximum Value (pH Units)	No. Results Exceeding Criteria
Field pH	March 2021	9	3.94	9.72	**1 (95% Protection and Recreational)**
	June 2021	9	4.22	10.11	**2 (95% Protection) 1 (Recreational)**
	September 2021	9	3.98	10.37	**2 (95% Protection) 1 (Recreational)**
	December 2021	9	3.68	10.19	**1 (95% Protection and Recreational)**

The deep aquifer has generally not been impacted by leachate with pH levels largely below pH 8, except for W2D located on Section 1. The pH at W2D has consistently been greater than 9 indicating leachate impacted groundwater at this well.

The natural pH conditions in the deep aquifer are slightly acidic to neutral, with pH conditions generally within or below the trigger values for lowland rivers of 6.5 to 8 (ANZECC 2000).

The lateral extent of high pH impacted groundwater in the deep aquifer throughout 2021 is presented in **Figure 6-16**.



RAMBOLL AUSTRALIA - GIS MAP file : 318001103_AnnualGroundwaterMonitoring2021 | F004_pH_Deep_V01 | 31/01/2022

Figure 6-16 | Interpolated Field pH – Deep Aquifer 2021

6.2.2.1 Time Series Trends

Comparison of pH values reported within the deep aquifer for the 33 GMEs completed between July 2013 and December 2021 are shown in **Figure 6-17** to **Figure 6-19**. The blue dotted line shows pH 9 which is indicative of leachate impact.

The time series trends show the following:

- Consistently elevated pH above 9 at well W2D on Section 1
- Some fluctuations in pH in wells on Section 3 and Section 4
- pH consistently below 8 in down gradient and sentinel wells.

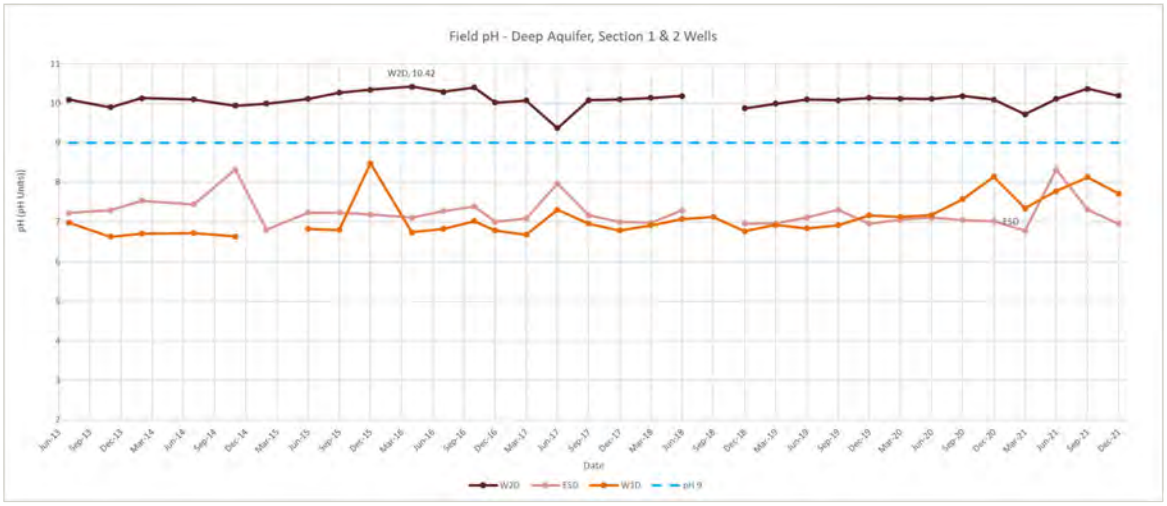


Figure 6-17: Field pH Values – Deep Aquifer, Section 1 & 2 Wells

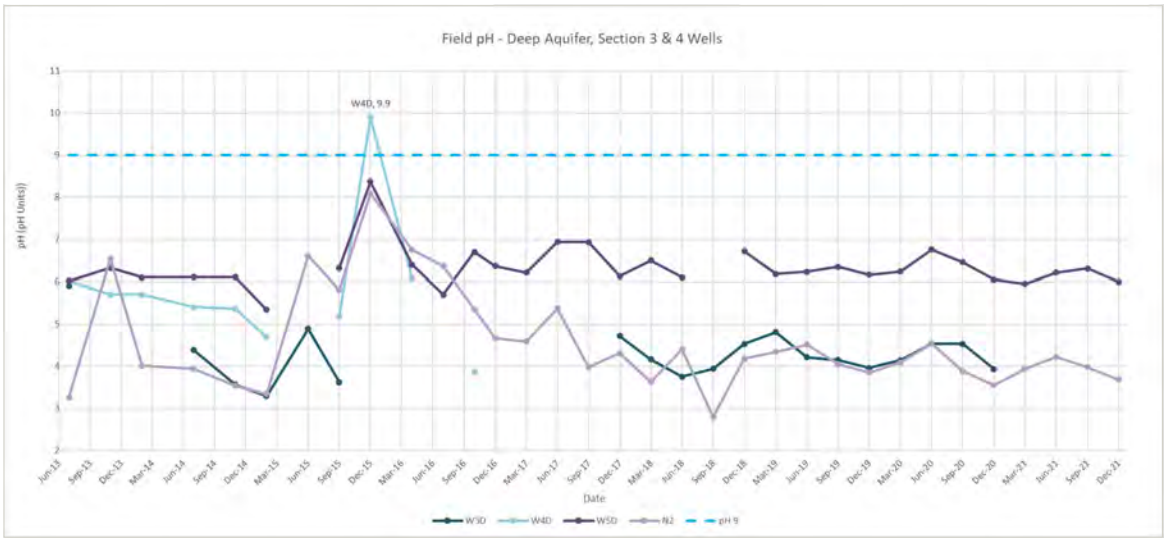


Figure 6-18: Field pH Values – Deep Aquifer, Section 3 & 4 Wells

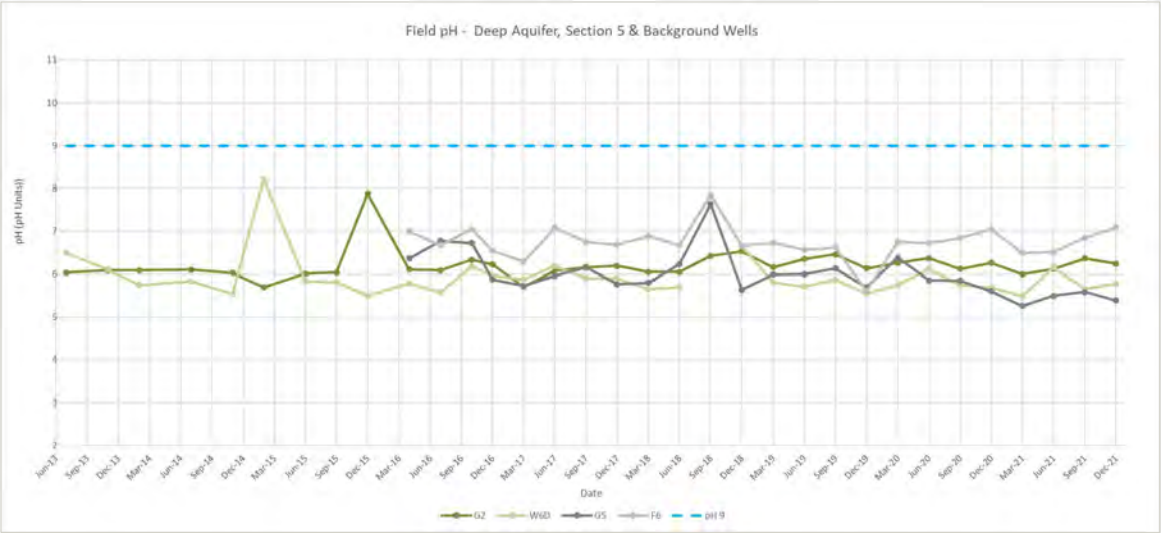


Figure 6-19: Field pH Values, Section 5 & Sentinel Deep Wells (pH Units)

6.2.2.2 Mann-Kendall Trend Analysis

Data from July 2013 to December 2021 (33 sampling events) were included for the purpose of Mann-Kendall trend analysis of pH, a summary is provided in **Table 6-8**.

Mann-Kendall trend analysis of pH within the deep aquifer indicates increasing trends at W1D, located on Section 2 and G2, located on Section 5. Further review of W1D indicates an increase from pH 6.98 in July 2013 to pH 7.71 in December 2021. While pH values at W1D are not characteristic of leachate impact the groundwater has been described as clear to dark yellow/brown and the overall increasing pH trend may be indicative of the leachate plume expanding to the east of well W2D, the most leachate-impacted well.

The increase in pH at Section 5 well G2 is minor, from pH 6.04 in July 2013 to pH 6.24 in December 2021, and not characteristic of leachate impacted groundwater.

Table 6-8: Mann-Kendall pH Trends - Deep Aquifer

Well	Previous Trend 2013 to 2020	Current Trend 2013 to 2021	pH >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
W2D	No Trend	No Trend	**Yes**	**Yes**
E5D	**Decreasing**	**Decreasing**	**Yes**	No
Section 2				
W1D	**Increasing**	**Increasing**	**Yes**	No
Section 3				
~~W3D~~	Stable	*Damaged*	*Damaged*	*Damaged*
~~W4D~~	*Destroyed*	*Destroyed*	*Destroyed*	*Destroyed*
Section 4				
W5D	Prob. Increasing	No Trend	No	No
N2	Prob. Decreasing	**Decreasing**	No	No
Section 5				
G2	**Increasing**	**Increasing**	No	No

Well	Previous Trend 2013 to 2020	Current Trend 2013 to 2021	pH >Assessment Criteria[1]	Leachate Impacted[2]
W6D	Stable	Prob. Decreasing	No	No
Sentinel				
G5	**Decreasing**	**Decreasing**	No	No
F6	No Trend	No Trend	No	No

I.D Insufficient data to perform trend analysis
[1] Free cyanide exceeded the assessment criteria of either 95% Protection of Aquatic Ecosystems or Recreational during any GME completed in 2021
[2]Groundwater generally characteristic of leachate impact i.e., pH >9, brown in colour

6.2.3 Soluble Fluoride

Laboratory results for soluble fluoride in the deep aquifer reported during 2021 are summarised in **Table 6-9**.

Table 6-9: Soluble Fluoride Concentrations – Deep Aquifer

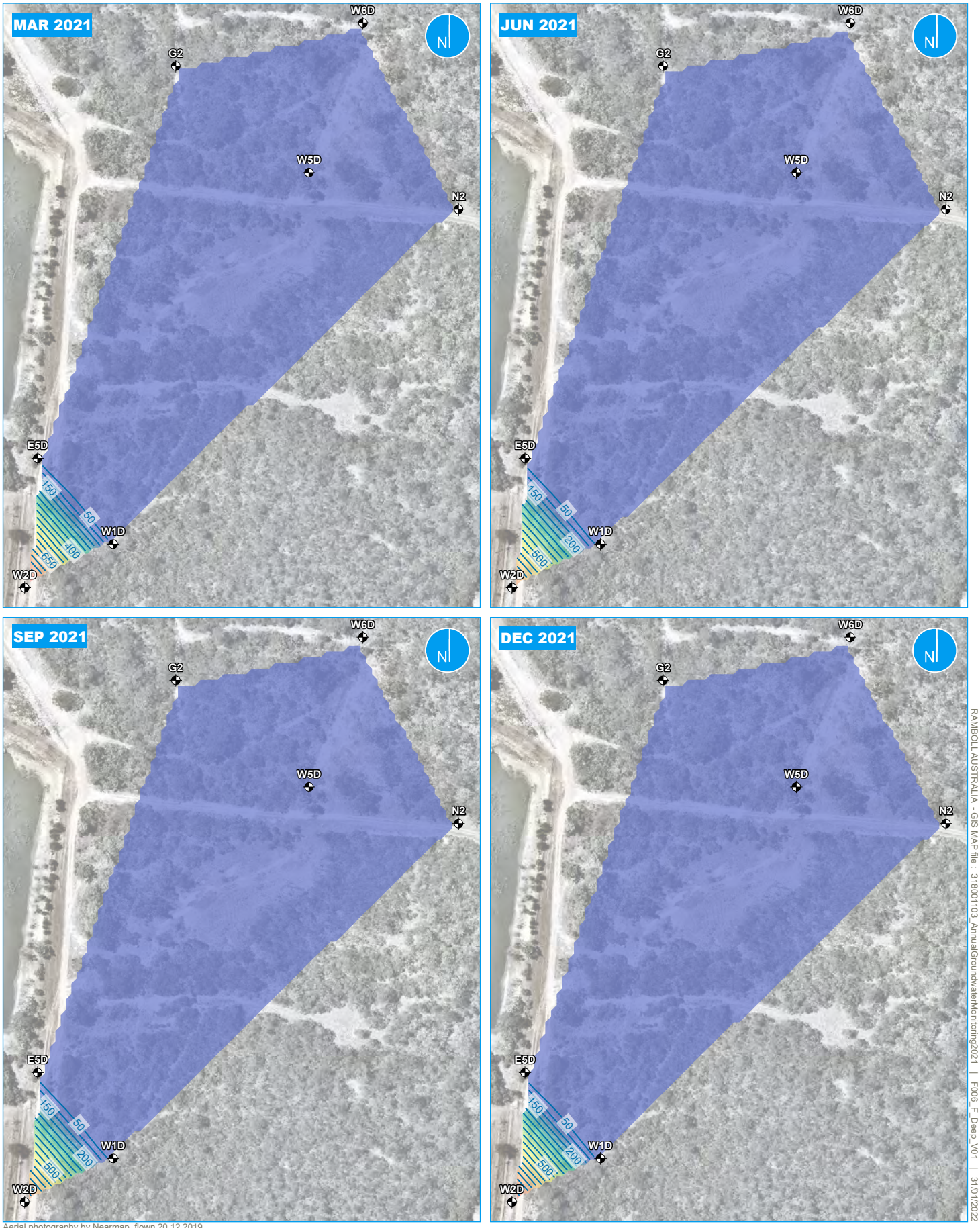
Contaminant of Concern	Date	No. of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	No. Results Exceeding Criteria
Soluble Fluoride	March 2021	9	<0.1	1000	**3 (Irrigation, Stock Watering & Recreational)**
	June 2021	9	<0.1	860	**4 (Irrigation)** **3 (Stock Watering & Recreational)**
	September 2021	9	<0.1	880	**3 (Irrigation, Stock Watering & Recreational)**
	December 2021	9	0.1	1000	**3 (Irrigation, Stock Watering & Recreational)**

During the GMEs completed throughout 2021 soluble fluoride exceeded site assessment criteria at three wells as follows:

- Section 1: W2D and E5D
- Section 2: W1D
- Section 4: N2

The highest soluble fluoride concentrations were consistently reported at Section 1 deep well W2D. W2D is located directly adjacent to the CWS and reports the highest soluble fluoride concentrations of all the wells.

The lateral extent of soluble fluoride in the deep aquifer throughout 2021 is presented in **Figure 6-20**.



Aerial photography by Nearmap, flown 20.12.2019

Legend

Monitoring location

Fluoride (mg/L)

0 1000

0 25 50m

A4 1:2,500

RAMBOLL AUSTRALIA - GIS MAP file : 318001103_AnnualGroundwaterMonitoring2021 | F006_F_Deep_V01 | 31/01/2022

Figure 6-20 | Interpolated Soluble Fluoride - Deep Aquifer 2021

6.2.3.1 Time Series Trends

Comparison of soluble fluoride concentrations within the deep aquifer for the 33 GMEs completed between July 2013 and December 2021 are shown in **Figure 6-21** to **Figure 6-24** with concentrations for W2D only, shown in **Figure 6-21**.

The time series trends show the following:

- Consistently elevated soluble fluoride concentrations at well W2D on Section 1
- Some initial fluctuations in concentrations on Section 1 to Section 5 followed by consistently lower soluble fluoride concentrations from 2017 to 2021, aside from an increase at W1D from 2020 to 2021
- Consistently low soluble fluoride concentrations in the sentinel wells.

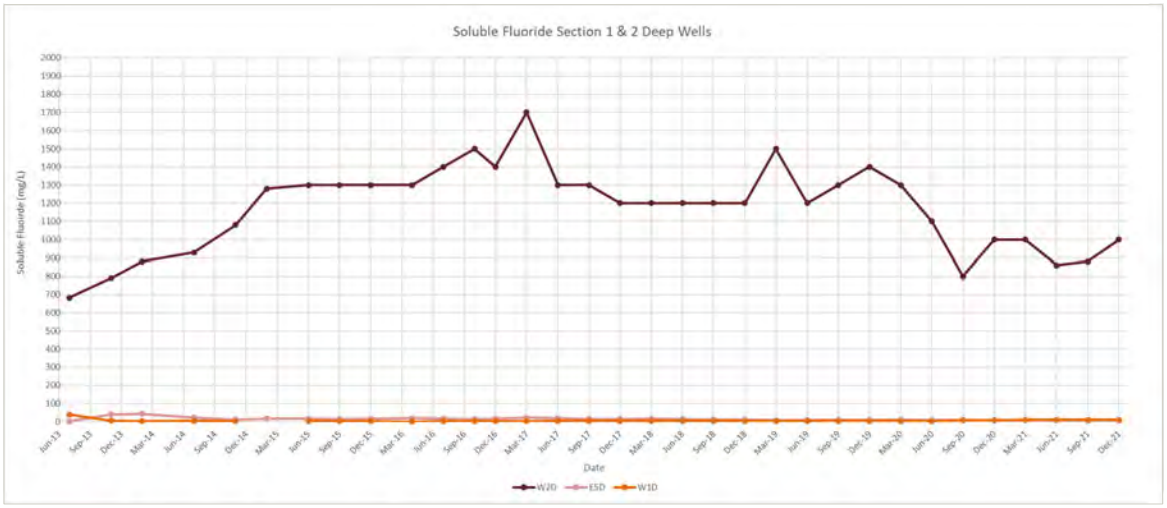


Figure 6-21: Soluble Fluoride Concentrations – Deep Aquifer, W2D

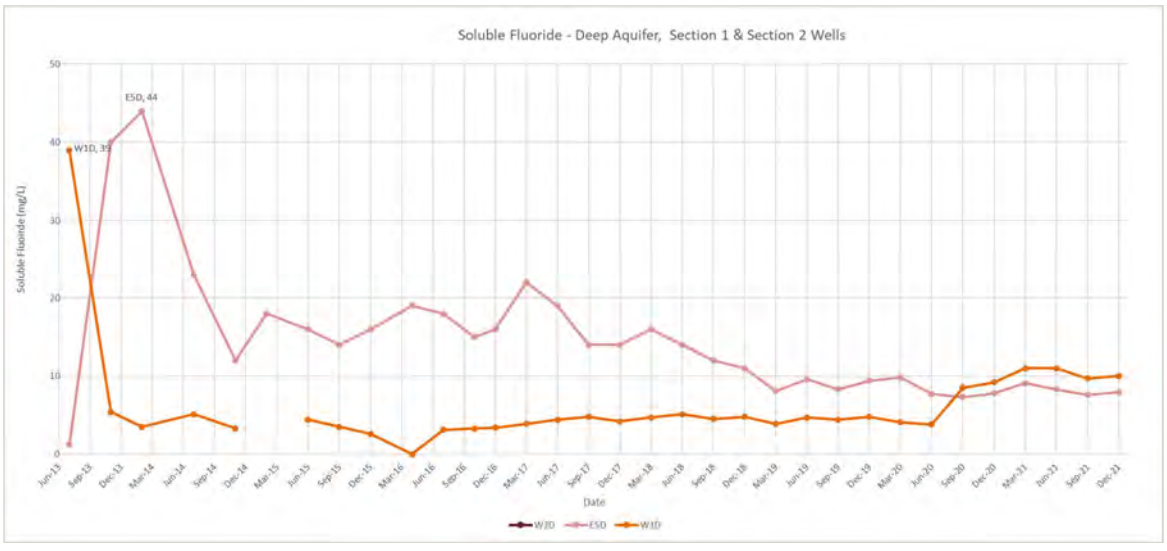


Figure 6-22: Soluble Fluoride Concentrations – Deep Aquifer, Section 1 & 2 Wells

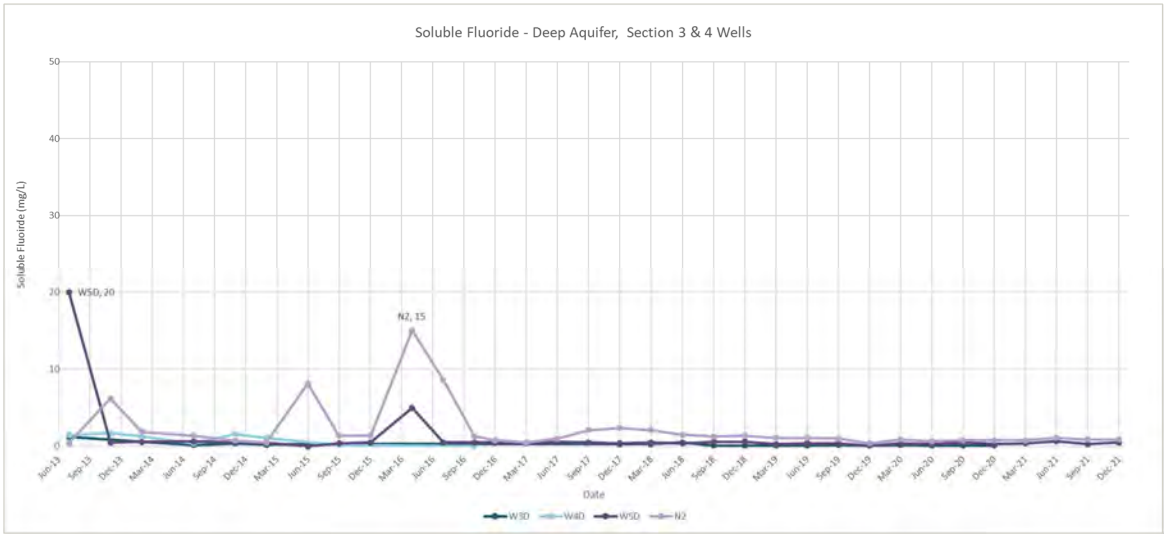


Figure 6-23: Soluble Fluoride Concentrations – Deep Aquifer, Section 3 & 4 Wells

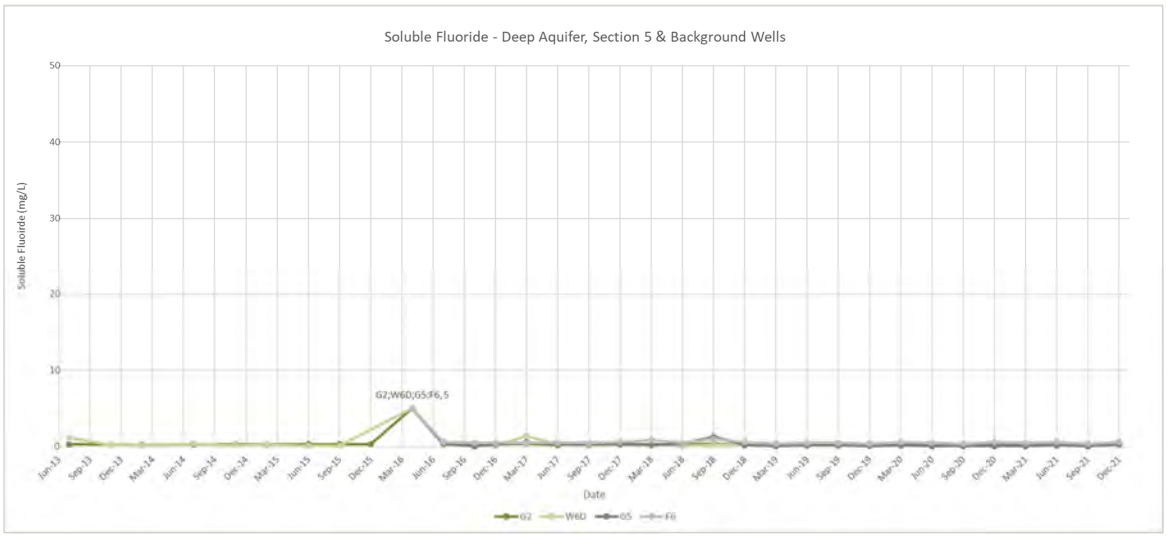


Figure 6-24: Soluble Fluoride Concentrations – Deep Aquifer, Section 5 & Sentinel Wells

6.2.3.2 Mann-Kendall Trend Analysis

Data from July 2013 to December 2021 (33 sampling events) were included for the purpose of Mann-Kendall trend analysis of soluble fluoride, a summary is provided in **Table 6-10**. Mann-Kendall trend analysis of soluble fluoride indicates an increasing trend in well W1D located on Section 2. Further review indicates fluoride concentrations have increased from 2.6 mg/L in December 2015 to 10 mg/L in December 2021, although pH at W1D is not characteristic of leachate impacted groundwater, field observations have reported groundwater discolouration indicating the plume may be expanding to the east of highly impacted well W2D.

Table 6-10: Mann-Kendall Soluble Fluoride Trends - Deep Aquifer

Well	Previous Trend 2013 to 2020	Current Trend 2013 to 2021	Soluble Fluoride >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
W2D	No Trend	Stable	**Yes**	**Yes**
E5D	**Decreasing**	**Decreasing**	**Yes**	No
Section 2				
W1D	No Trend	**Increasing**	**Yes**	No
Section 3				
W3D	**Decreasing**	*Damaged*	*Damaged*	*Damaged*
~~W4D~~	*Destroyed*	*Destroyed*	*Destroyed*	*Destroyed*
Section 4				
W5D	**Decreasing**	**Decreasing**	No	No
N2	**Decreasing**	**Decreasing**	No	No
Section 5				
G2	No Trend	Prob. Increasing	No	No
W6D	**Decreasing**	**Decreasing**	No	No
Sentinel				
G5	**Decreasing**	**Decreasing**	No	No
F6	No Trend	No Trend	No	No

I.D Insufficient data to perform trend analysis

[1]Soluble Fluoride exceeded the assessment criteria of either 95% Protection of Aquatic Ecosystems or Recreational during any GME completed in 2021

[2]Groundwater generally characteristic of leachate impact i.e., pH >9, brown in colour

6.2.4 Free Cyanide

Laboratory results for free cyanide in deep groundwater reported during 2021 are summarised in **Table 6-11***Table 6-5*. Free cyanide concentrations exceeded the site ecological assessment criteria for 95% protection for aquatic ecosystems at W2D during June 2021, September 2021 and December 2021. All other wells targeting the deep aquifer reported free cyanide concentrations below the laboratory limit of reporting.

Table 6-11: Free Cyanide Concentrations – Deep Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	No. Results Exceeding Criteria
Free Cyanide	March 2021	9	<0.004	0.005	0
	June 2021	9	<0.004	0.008	**1 (95% Protection)**
	September 2021	9	<0.004	0.011	**1 (95% Protection)**
	December 2021	9	<0.004	0.009	**1 (95% Protection)**

6.2.4.1 Time Series Trends

Comparison of free cyanide concentrations at W2D for twenty-eight GMEs completed between February 2015 and December 2021 are shown in **Figure 6-25**. Only concentrations at W2D have been graphed because all other concentrations have historically fallen below the laboratory limit of reporting. Free cyanide concentrations at W2D increased marginally from 0.005 mg/L in March 2021 to 0.009 mg/L in December 2021 but have remained consistently low overall since 2017.

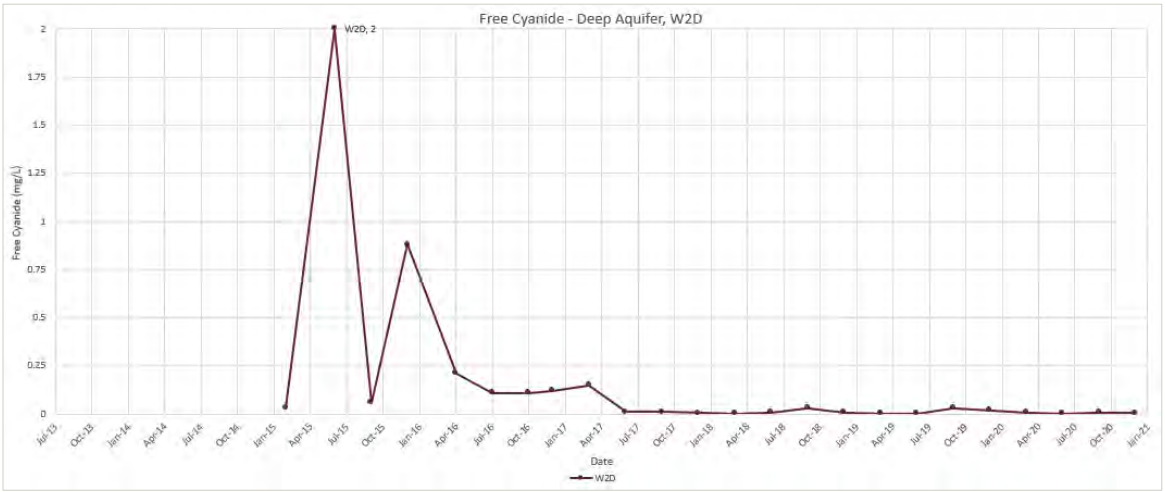


Figure 6-25: Free Cyanide Concentration – Deep Aquifer, W2D

6.2.4.2 Mann-Kendall Trend Analysis

Data from February 2015 to December 2021 (28 sampling events) were included for the purpose of Mann-Kendall trend analysis of free cyanide, a summary is provided in **Table 6-12**.

Mann-Kendall trend analysis of free cyanide in the deep aquifer shows a ‘stable’ trend at all wells aside from the leachate impacted well W2D, which shows a ‘decreasing’ trend.

Table 6-12: Mann-Kendall Trend Analysis of Free Cyanide – Deep Aquifer

Well	Previous Trend 2013 to 2020	Current Trend 2013 to 2021	Free Cyanide >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
W2D	**Decreasing**	**Decreasing**	**Yes**	**Yes**
E5D	Stable	Stable	No	No
Section 2				
W1D	Stable	Stable	No	No
Section 3				
W3D	Stable	*Damaged*	*Damaged*	*Damaged*
~~W4D~~	*Destroyed*	*Destroyed*	*Destroyed*	*Destroyed*
Section 4				
W5D	Stable	Stable	No	No
N2	Stable	Stable	No	No
Section 5				
G2	Stable	Stable	No	No
W6D	Stable	Stable	No	No
Sentinel				
G5	Stable	Stable	No	No
F6	Stable	Stable	No	No

I.D Insufficient data to perform trend analysis

[1]Free cyanide exceeded the assessment criteria of either 95% Protection of Aquatic Ecosystems or Recreational during any GME completed in 2021

[2]Groundwater generally characteristic of leachate impact i.e., pH >9, brown in colour

7. HYDRO DATA

Hydro collect groundwater samples for analysis from the monitoring well network in between the Ramboll quarterly GMEs. Thirty-three (33) sampling events have been completed by Hydro between May 2014 and December 2021. Hydro personnel gauged the depth to water and collected groundwater samples for pH, conductivity, fluoride, and total cyanide.

Fluoride concentrations for wells sampled by Hydro are included in **Table 7-1** with a graphic representation provided in **Figure 7-1**.

Wells W2S and W7M have been dry for all sampling rounds. Wells W1S, W7S, W4S, W5S and W6S have been dry for the majority of sampling rounds. Fluoride concentrations have been most elevated in W2D. Elevated fluoride concentrations in wells W1S, W2D, W3S, W4S, W5S and W6S show impact from the leachate plume. Fluoride concentrations in wells W1D and E5D are also elevated but to a lesser extent. Fluoride concentrations in W6D were marginally above site assessment criteria (irrigation and recreation) during December 2017. The results from the Hydro sampling are similar to the results of the quarterly GMEs completed by Ramboll.

Table 7-1: Fluoride Concentrations in Wells Sampled by Hydro (mg/L)

Date	W1S	W1D	W2D	W7S	E5D	W3S	W4S	W5S	W6S	W6D
May 2014	70	8.9	840	39	39	410	610	180	-	-
June 2014	75	5.7	660	-	36	310	400	87	-	1.1
September 2014	79	3	1,200	-	15	270	460	110	-	0.7
December 2014	58	2	1,200	-	10	230	-	89	-	0.7
March 2014	-	2	1,200	-	10	230	-	-	-	<0.5
June 2014	-	3.4	1,300	-	14	240	500	95	150	0.7
September 2015	-	2	1,300	-	7	220	-	77	-	<0.5
December 2015	-	<5	1,100	-	9	180	-	8.3	-	<0.5
March 2016	-	8.3	1,200	-	14	230	-	-	-	0.9
June 2016	-	3.7	1,600	-	<0.5	160	-	-	-	<0.5
September 2016	-	4.1	1,100	-	12	130	-	-	-	<0.5
December 2016	-	7.5	1,400	-	15	-	-	-	-	<0.5
March 2017	-	5.3	1,200	-	14	220	-	-	-	<0.5
June 2017	-	4.5	1,300	-	18	140	-	-	-	<0.5
September 2017	-	4.2	1,200	-	20	90	-	-	-	<0.5
December 2017	-	6.7	1,600	-	200	1,100	-	-	-	1.7
March 2018	-	15.0	1,700	-	25	1,700	-	-	-	-
June 2018	-	6.4	2,200	-	30	120	-	-	-	-
September 2018	-	4.5	860	-	12	96	-	-	-	-
December 2018	-	4.3	1,100	-	10	87	-	-	-	-
March 2019	-	5.5	1,100	-	20	-	-	-	-	-
June 2019	-	5.2	1,500	-	10	120	-	-	-	-
September 2019	-	7.7	1,200	-	12	140	-	-	-	-
December 2019	-	4.8	1,200	-	7.3	-	-	-	-	-
March 2020	-	5.6	1,100	-	8.4	180	-	-	-	-

Date	W1S	W1D	W2D	W7S	E5D	W3S	W4S	W5S	W6S	W6D
June 2020	-	6.8	650	-	8.0	130	-	-	-	-
September 2020	-	12	910	-	17	33	-	-	-	-
December 2020	-	9.6	770	-	11	<0.5	-	-	-	-
March 2021	-	11	780	-	15	28	-	-	-	-
June 2021	-	11	1100	-	11	270	-	-	-	-
September 2021	-	13	1100	-	15	150	-	-	-	-
December 2021	-	46	270*	-	8.5	220	-	-	-	-

- *Not sampled*

* *Anomalous data, not included in graph*

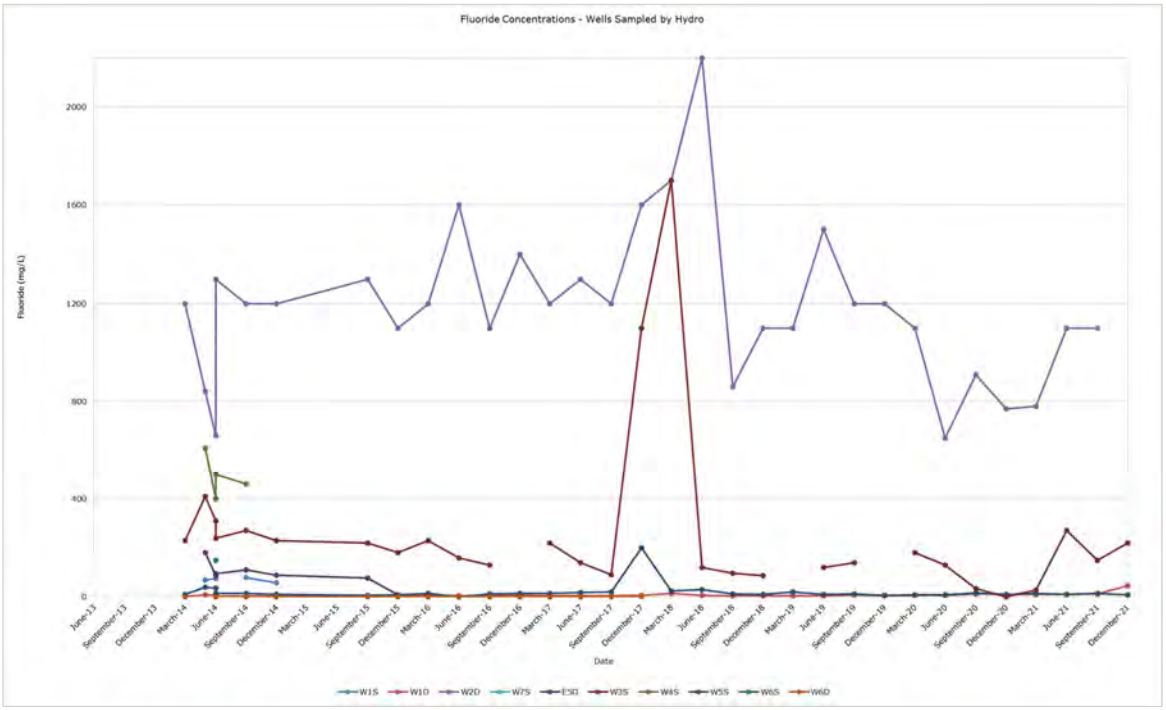


Figure 7-1: Fluoride Concentrations in Wells Sampled by Hydro

8. CONCLUSIONS AND RECOMMENDATIONS

Thirty-three GMEs have been completed within a leachate impacted groundwater plume associated with the CWS (AEC 1) at the former Hydro Aluminium Kurri Kurri Smelter. The four most recent events were completed in March, June, September, and December 2021.

Each GME included the sampling and analysis of groundwater from a network of 27 shallow and deep wells located on five sections along the length of the leachate plume down-gradient of the CWS. An additional pair of two shallow and deep wells were added to the network in 2016. These wells are located adjacent to Swamp Creek, the nearest surface water receptor. Physico-chemical parameters were recorded, and groundwater samples were collected and analysed for soluble fluoride, total and free cyanide as well as total and dissolved aluminium.

Evaluation of 2021 GME data has identified the following:

- The leachate plume in shallow groundwater is delineated to the north, with a decreasing trend in soluble fluoride concentrations in well N9 at the leading edge of the plume
- There are no changes in trend analysis for pH or soluble fluoride in the shallow aquifer compared to 2020 results that are indicative of the plume expanding. An increasing trend in soluble fluoride concentrations has been reported at well E4 on the eastern boundary of the leachate plume, which is constrained from further eastern migration at this location due to the geological constraints. In addition, soluble fluoride concentrations in leachate at this location on the eastern edge of the leachate plume have not increased significantly since monitoring commenced in 2013
- Consistent with previous monitoring, the leachate plume has impacted the deeper sand aquifer in a localised area close to the plume source, the CWS, as shown by elevated soluble fluoride concentrations and a high pH in well W2D. Concentrations at this well have been elevated over the monitoring period and there is no increasing trend observed, however there may be some expansion of impact to the east, towards W1D, with dark yellow to brown coloured groundwater observed and an increasing trend identified for both pH and soluble fluoride concentrations, although pH still remains below levels indicative of leachate impact.
- Consistent with previous monitoring, the leachate plume is not reaching the nearest surface water receptor of Swamp Creek, as indicated by continued low pH and low soluble fluoride concentrations in sentinel wells
- Leachate is currently only generated in limited quantities following heavy rainfall and removal of leachate from the northern interception trench is completed as required. Pumping of leachate from the active interception trench has not been required since 2016 due to the lack of leachate generation. Monitoring of groundwater and occasional pump out of passive leachate interception trenches is proposed to continue until remediation of the Capped Waste Stockpile is completed in 2023.

9. REFERENCES

ANZG (2018) Guidelines for Fresh and Marine Water Quality

ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality

ENVIRON (March 2013) Tier 2 Ecological Risk Assessment, Kurri Kurri Aluminium Smelter

ENVIRON (February 2015) Groundwater Fate and Transport Modelling, Leachate Plume – Capped Waste Stockpile, Hydro Aluminium Smelter Kurri Kurri, NSW

ENVIRON (June 2016) Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 12 Month Groundwater Monitoring Report

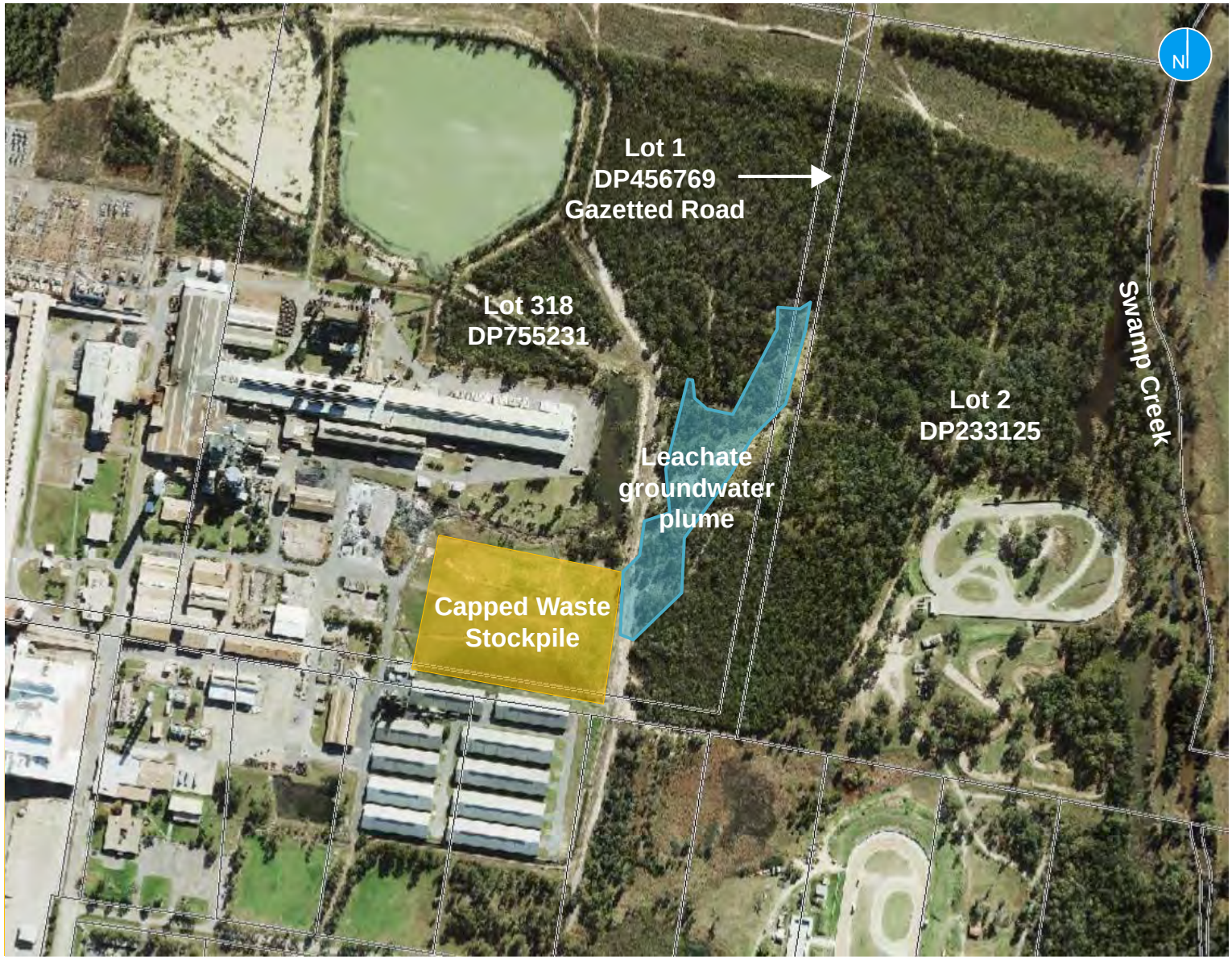
ENVIRON (September 2016) Plume Delineation Report, Capped Waste Stockpile

GSI (2012) Groundwater Services Inc., GSI Man-Kendall Toolkit for Constituent Trend Analysis, Version 1.0, November 2012

NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination

Ramboll (April 2016) Hydro Aluminium Smelter, Capped Waste Stockpile, 2015 Annual Groundwater Monitoring Report

APPENDIX 1
FIGURES



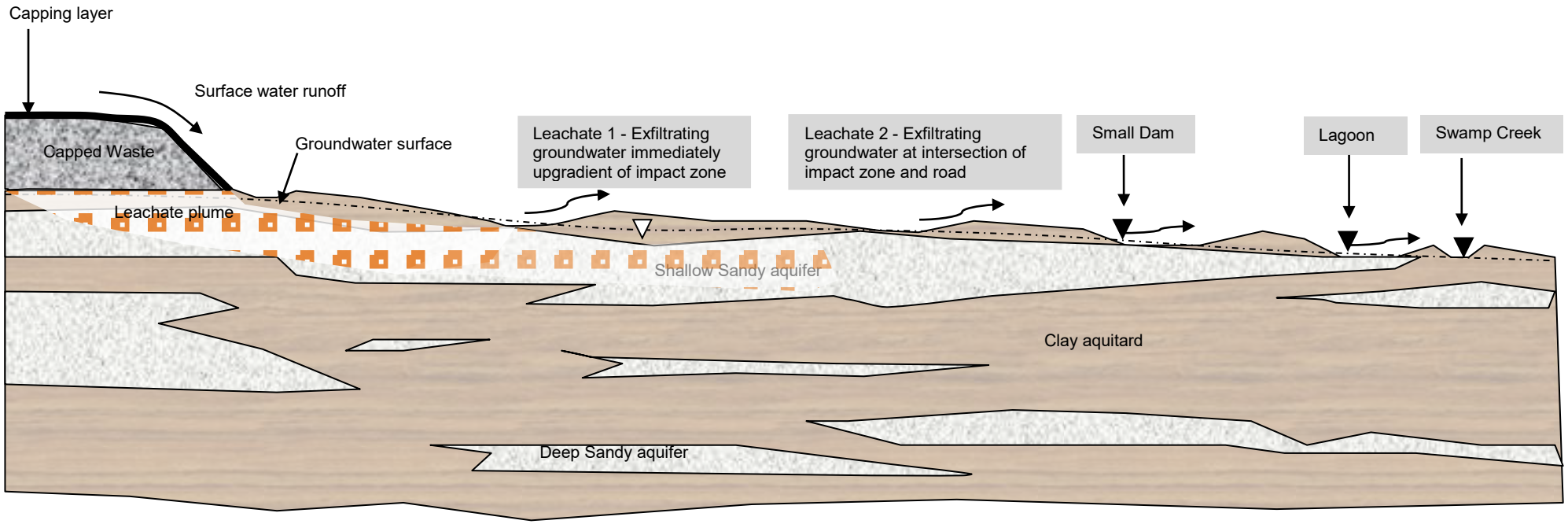
RAMBOLL/AUSTRALIA - GIS MAP file : 318000664 - 2019 Annual Groundwater Monitoring Report - Figure 1

Figure 1 | AEC 1: Site Location Plan, 2021 Annual Groundwater Monitoring Report

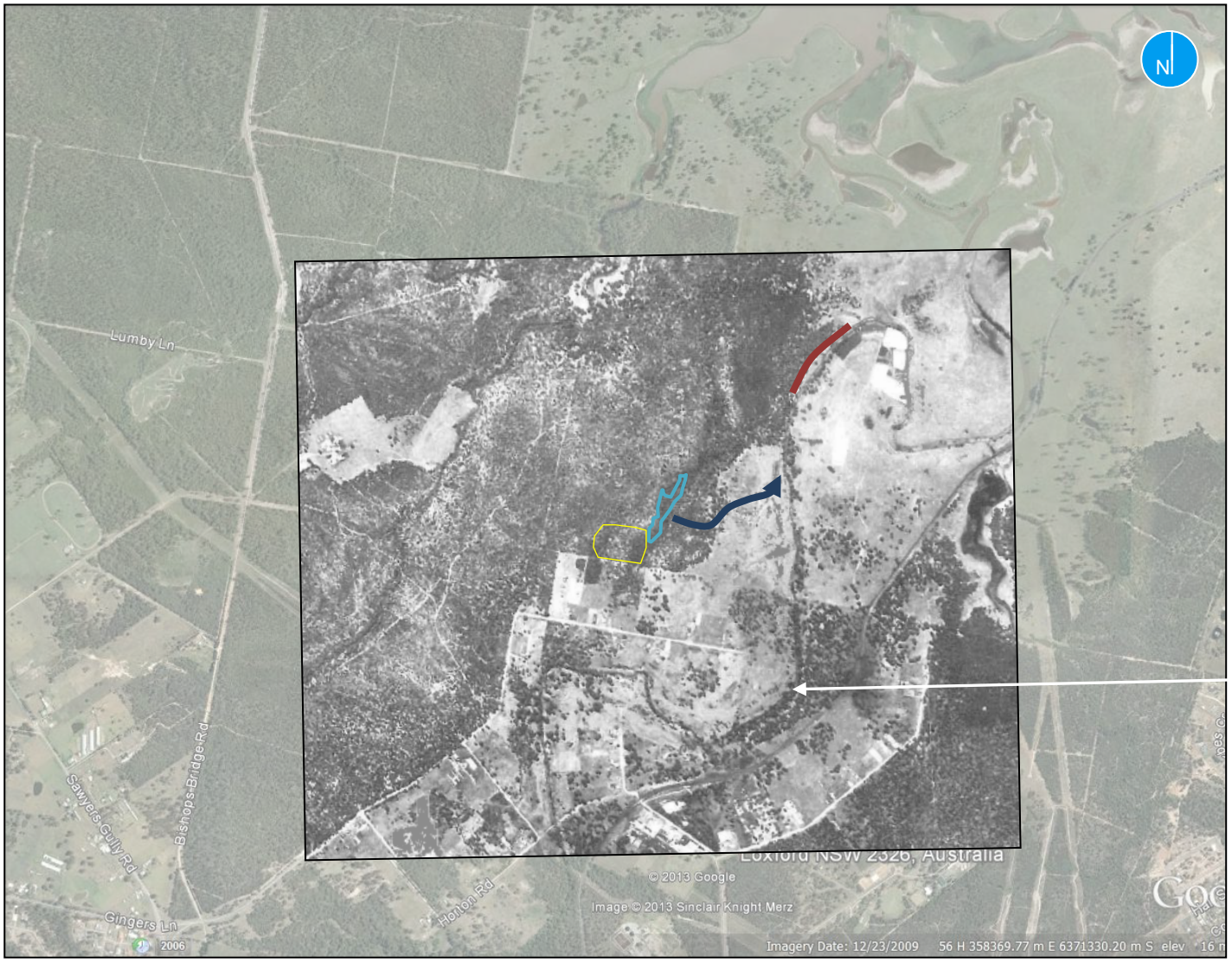
RAMBOLL AUSTRALIA - GIS MAP file : 318000664 - 2019 Annual Groundwater Monitoring Report - Figure 2

Figure 2 | Groundwater Monitoring Well Network, 2021 Annual Groundwater Monitoring Report

APPENDIX 2
ATTACHMENTS



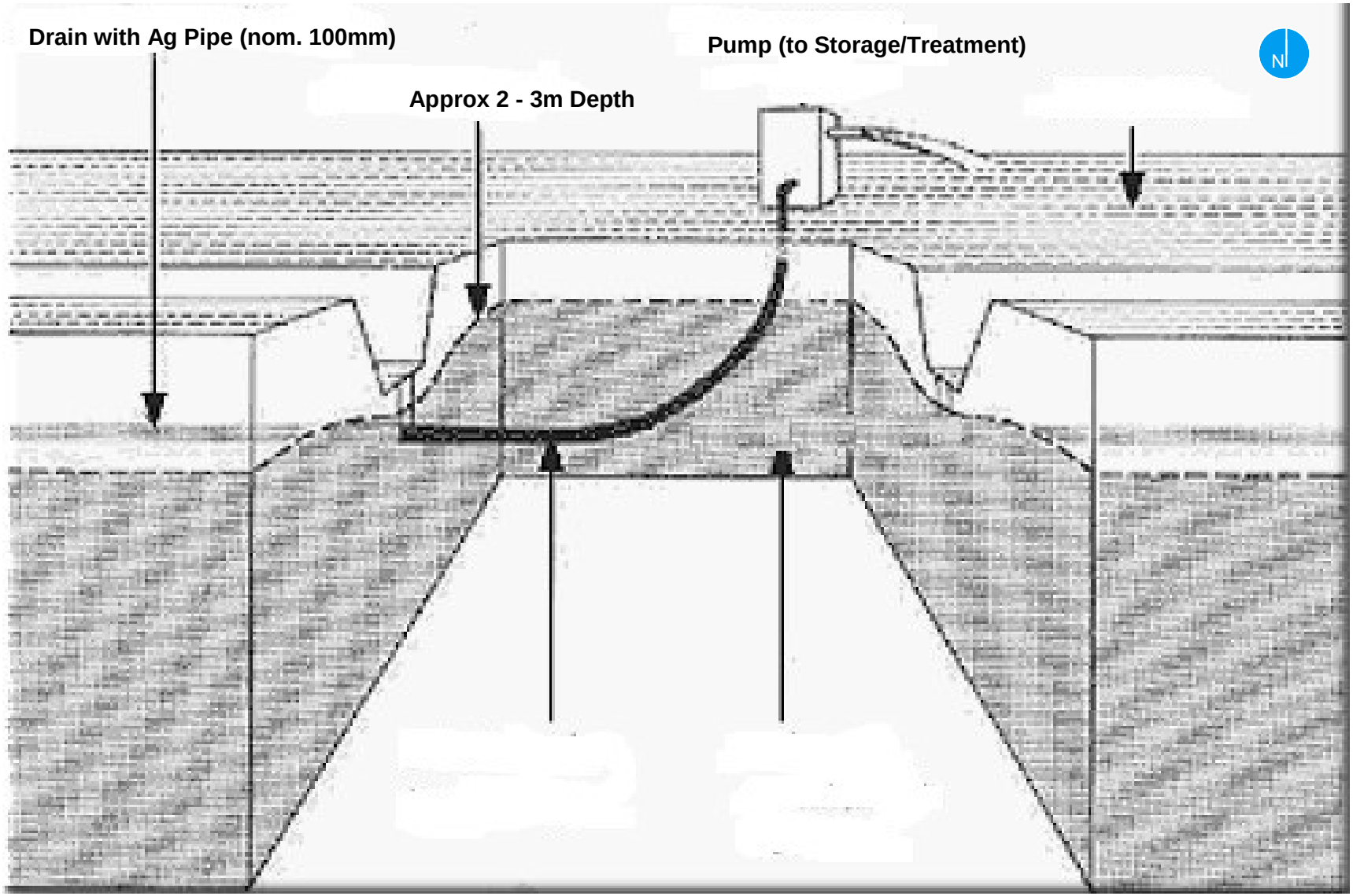
RAMBOLL AUSTRALIA - GIS MAP file : 318000664 - 2019 Annual Groundwater Monitoring Report - Attachment 1



RAMBOLL AUSTRALIA - GIS MAP file : 318000664 - 2019 Annual Groundwater Monitoring Report - Attachment 2

Attachment 2 | 1961 Aerial Photograph showing Plume Location, 2021 Annual Groundwater Monitoring Report

Topographic Contours mAHD (based on 1m Lidar)



APPENDIX 3
2013-2021 GME HISTORICAL DATA

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
					Sample ID:		W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		12.489	12.619	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
					Sample Description:		Light brown	Clear	Dry	Dry	Dry	Dry	Turbid, brown, purged dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	7.33	6.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***115***	***58***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***91.5***	***33***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13
					Sample ID:		W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	E5
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		-			12.139						13.289	12.379	12.049	11.999	12.289	-	12.849	12.214
					Sample Description:		Dry	Dry	Dry	Clear, no odour	Dry	Dry	Dry	Dry	Dry	Clear, turbid	Turbid, pale yellow, no odour	Turbid, light brown, no odour	Turbid, light brown, no odour	Slightly turbid, pale yellow/grey, no odour	Insufficient water to sample	Turbid, pale yellow brown, no odour	Brown
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	-	-	-	7.47	-	-	-	-	-	6.74	6.73	6.97	7.19	7.32	-		*9.54*
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	***92***	-	-	-	-	-	***20***	***20***	***66***	***72***	***57***	-	***24***	***495***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	0.01	-	-	-	-	-	<0.004	<0.004	0.008	<0.004	0.005	-	<0.004	-
Total Cyanide						mg/L	0.004	-	-	-	3.9	-	-	-	-	-	0.17	0.48	1.8	1.5	0.44	-	0.061	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	-	-	-	***37***	-	-	-	-	-	***18***	***19***	***31***	***43***	**6.9**	-	***9.6***	0.33
Aluminium (dissolved)						mg/L	0.01	-	-	-	***11***	-	-	-	-	-	***9.6***	**7.2**	**5.2**	**5.20**	4.50	-	4.20	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	14-April-2017	Jun-17	Sep-17	Dec-17	Mar-18
					Sample ID:		E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		12.054	11.804	-	-	-	11.904	11.614	-	11.724	-	-	-	-	-	-	-	-
					Sample Description:		Brown	Brown	Dry	Dry	Dry	Brown	Brown	Dry	Brown	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	*9.37*	*9.78*	-	-	-	*9.14*	*9.42*	-	*9.48*	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***410***	***450***	-	-	-	***410***	***350***	-	***330***	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	*<0.8*	-	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.52	2.5	-	-	-	3	-	-	-	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
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01-02-22

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Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13	Nov-13
Sample ID:							E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	PUMP	PUMP
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							-	-	-	-	-	-	-	-	12.054	12.184	11.914	11.714	12.134	11.864	12.304	12.487	12.352
Sample Description:							Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Slightly red/brown	Clear, yellow/brown, no odour	Clear to slightly turbid, brown, no odour	Slightly turbid, pale brown, no odour	Clear, dark brown, no odour	Clear, yellow brown, no odour	Clear, dark brown, no odour	Light brown	Light brown, cloudy
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	-	-	-	-	-	-	-	-	8.79	*9.11*	*9.2*	8.89	*9.15*	*9.36*	*9.16*	7.45	7.24
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	-	-	-	-	-	***220***	***250***	***300***	***300***	***310***	***230***	***320***	***79***	***51***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	-	-	-	0.007	0.011	0.01	<0.004	0.011	0.011	0.013	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	62	57	79	54	50	18	19	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	-	-	-	-	-	-	-	-	0.9	1	3.6	**9**	0.49	0.75	1.6	***58.1***	***60***
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	0.08	0.07	0.12	0.13	0.08	0.10	0.09	-	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18
					Sample ID:		PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		11.862	11.042	11.312	11.262	11.952	11.702	11.652	11.932	11.842	11.842	11.662	11.542	11.742	11.572	11.412	11.302	11.772
					Sample Description:		Brown, murky, light brown	Brown, no odour	Brown, turbid, some odour	Light brown, no odour	Light brown	Very turbid, brown	-	Brown, turbid	Very turbid, brown	-	Milky	Brown	Brown	Milky brown	Brown	Turbid, brown	Light brown, no odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	*9.65*	*10.14*	*10.01*	*9.95*	*9.87*	*10.22*	*10.27*	*10.13*	*10.22*	*9.98*	*9.72*	*9.56*	*9.2*	*9.9*	*9.6*	*9.73*	*9.17*
Soluble Fluoride		1	2	1.5		mg/L	0.1	***280***	***550***	***930***	***740***	***200***	***680***	***360***	***570***	***280***	***85***	***88***	***210***	***60***	***180***	***160***	***220***	***62***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	0.021	<0.08	0.029	0.1	0.01	0.018	<0.004	0.006	0.006	<0.004	<0.005	0.009	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	4.1
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***17***	-	***310***	***370***	***120***	***610***	***97***	***280***	***93***	***90***	***120***	***740***	***39***	***160***	***45***	***82***	***46***
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.09

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13	Nov-13	Feb-14
					Sample ID:	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	W7S	W7S	W7S
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):	11.572	11.522	11.422	11.502	11.432	11.302	11.662	13.362	12.422	12.402	12.152	12.602	12.212	12.852	12.614	12.969	-
					Sample Description:	Light brown/grey, hydrogen sulfide odour	Clear to slightly brown, no odour	Slightly brown, slight sulphidic odour	Slightly turbid, clear, no odour	Brown/grey, sulphidic odour	Turbid, slightly brown	Yellow/brown, turbid	Clear, no odour	Turbid, yellow, no odour	Slightly turbid, light brown, no odour	Turbid, pale black/grey/brown, strong odour	Slightly turbid, some flocculants, pale grey, no odour	Slightly turbid, pale grey, no odour	Clear, colourless, no odour	Cloudy/turbid	Light brown, cloudy sediment	Dry
Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9	pH units	-	*13.68*	*9.55*	*9.42*	*9.43*	*9.89*	*9.93*	7.2	*9.59*	7.4	6.88	7.9	6.61	8.32	6.91	7.29	7.1	-
Soluble Fluoride		1	2	1.5	mg/L	0.1		***250***	***370***	***140***	***400***	***530***	***30***	***17***	***21***	***22***	***24***	***17***	***26***	***17***	***34***	***31***	-
Free Cyanide	0.007			0.1	mg/L	0.004	0.01	0.009	<0.004	<0.004	0.014	0.007	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-
Total Cyanide					mg/L	0.004	44	14	21	9.8	35	57	0.31	0.009	0.077	0.23	0.23	0.056	0.068	0.012	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	***23***	**5.4**	***9.3***	***38***	***93***	***77***	***49***	3.2	**6.1**	***12***	***23***	***12***	***18***	4.1	***415***	***42***	-
Aluminium (dissolved)					mg/L	0.01	0.46	1.9	1.3	4.3	0.86	2.9	***17***	0.44	0.76	1.9	***15.00***	**6.40**	***11.00***	2.10	-	-	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18
					Sample ID:		W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
					Sample Description:		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Purge dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***210***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13	Nov-13	Feb-14	Jul-14
Sample ID:							W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7M	W7M	W7M	W7M
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							-	-	-	-	-	-	13.019	12.369	-	-	12.229	11.979	12.219	12.218	12.138	11.568	10.958
Sample Description:							Dry	Dry	Dry	Dry	Dry	Dry	Clear, no odour	Turbid, yellow/brown, no odour	Dry	Dry	Very turbid, pale brown, no odour	Dry	Very turbid, pale brown, no odour	Light brown	Brown	Brown, dark, sulphur smell	Brown, no odour
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[a]			5 - 9	pH units	-	-	-	-	-	-	-	-	8.08	7.61	-	-	7.24	-	7.01	*9.81*	*9.87*	*10.1*	*10.12*
Soluble Fluoride		1	2	1.5	mg/L	0.1	-	-	-	-	-	-	-	***17***	***22***	-	-	***24***	-	***33***	***878***	***650***	***730***	-
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	-	-	<0.004	<0.004	-	-	<0.004	-	<0.004	-	-	-	-
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	0.08	1.1	-	-	1.2	-	1	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	-	-	-	-	-	-	-	**5.9**	***65***	-	-	***410***	-	***86***	***11.4***	2.3	***45***	
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	2.1	0.55	-	-	***20***	-	***9.1***	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18
					Sample ID:		W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		11.088	10.918	11.938	11.608	11.518	11.668	11.578	11.568	11.388	11.278	11.458	11.298	11.128	11.018	11.478	11.298	11.268
					Sample Description:		Brown, turbid, some odour	Brown/copper, strong odour	Brown	Brown	-	Brown	-	Brown	-	Brown	Brown	Brown	Tea brown	Tea brown	Turbid, light brown, no odour	Turbid, brown, no odour	Slightly brown, slight odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	*9.78*	*9.44*	*9.82*	*9.91*	*9.7*	*9.99*	*9.95*	*10.17*	*9.68*	*9.61*	*10.1*	*9.8*	*9.6*	*9.61*	*9.7*	*13.24*	*9.63*
Soluble Fluoride		1	2	1.5		mg/L	0.1	***910***	***840***	***810***	***670***	***540***	***640***	***870***	***1100***	***1000***	***220***	***750***	***760***	***780***	***770***	***810***	***860***	***820***
Free Cyanide	0.007			0.1		mg/L	0.004		0.02	***<2***	***<0.4***	*0.21*	0.013	0.072	-	0.007	0.09	0.007	0.005	0.006	<0.004	0.008	0.017	0.007
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	140	190	160	130
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***21***	0.99	***32***	**8.7**	**7.8**	4.4	0.08	**6.2**	***11***	3.4	1.3	1.2	3.6	***10***	0.76	**6.6**	0.31
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16	0.14	0.22

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational														
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:		W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		11.138	11.228	11.158	11.068	11.348	12.148	12.188	11.858	11.698	12.128	11.848	12.518
					Sample Description:		Slightly brown	Brown, no odour	Brown/red, slightly sulphidic odour	Slightly brown	Slightly red/brown, no odour	Clear, no odour	Clear to slightly turbid, brown, no odour	Slightly turbid, brown, no odour	Slightly turbid, dark brown, strong odour	Slightly turbid, dark brown, no odour	Clear, dark yellow, no odour	Slightly turbid, pale yellow brown, no odour
Analyte grouping / Analyte						**Units**	**LOR**												
pH (field)	6.5-8[¤]			5 - 9		pH units	-	*9.68*	*9.65*	*9.73*	*9.75*	*9.67*	*8.97*	*9.1*	*9.28*	*9.47*	*9.86*	*9.42*	*9.44*
Soluble Fluoride		1	2	1.5		mg/L	0.1	***990***	***750***	***800***	***830***	***810***	***440***	***290***	***580***	***630***	***490***	***350***	***360***
Free Cyanide	0.007			0.1		mg/L	0.004	0.006	<0.004	0.006	0.009	0.006	<0.004	0.019	0.009	0.005	0.006	0.013	0.008
Total Cyanide						mg/L	0.004	150	130	160	160	130	34	28	30	75	48	25	16
Aluminium (total)	0.055	5	5	9		mg/L	0.01	**7.5**	1.5	2	***10***	0.74	2.8	***11***	***11***	2.1	**8.1**	2.3	**6.8**
Aluminium (dissolved)						mg/L	0.01	0.28	0.30	0.30	0.27	0.39	0.83	2.60	0.76	0.35	0.51	0.36	0.37

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							11.887	11.977	11.367	11.277	-	11.217	11.527	11.207	11.317	11.297	-	-	-	-	-	-	-
Sample Description:							Brown	Brown	Brown, cloudy, sulphur odour	Dark brown	Dry	Brown, no odour	Dark brown, turbid	Brown		Brown	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	7.22	7.17	6.84	6.9	-	6.66	6.83	6.86	-	7.21	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***53***	***69***	***42***	-	-	***66***	***120***	***38***	-	***39***	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	0.004	<4	-	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***121***	***130***	***27***	-	-	***120***	***1200***	-	-	***15***	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

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For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13
Sample ID:							W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	E4
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							-	-	-	-	-	-	-	-	-	10.857	11.487	11.077	11.377	11.417	11.297	11.477	11.93
Sample Description:							Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Turbid, yellow, no odour	Red/brown, sulphidic odour	Turbid, yellow brown, no odour	Turbid, dark yellow, no odour	Turbid, yellow brown, no odour	Turbid, yellow brown, no odour	Brown
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[a]			5 - 9	pH units	-	-	-	-	-	-	-	-	-	-	-	7.89	8.24	7.55	7.99	8.11	7.61	*9.91*
Soluble Fluoride		1	2	1.5	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	***17***	***17***	***17***	***14***	***14***	***13***	***699***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	0.71	0.7	0.44	0.45	0.18	0.35	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	3.2	**7**	**7.6**	***56***	4.7	2.1	0.379
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	0.3	0.14	0.12	0.22	0.11	0.07	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18
					Sample ID:	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
					Aquifer:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):	12.09	10.33	11.51	11.28	11.31	12.07	11.65	11.5	11.44	11.39	11.38	11.11	11.11	-	11.01	10.81	10.83
					Sample Description:	Brown, sulphur smell	Brown	Dark brown, no odour	Strong sulphur odour, dark brown	Brown/orange , no odour	Brown	Dark brown, turbid		Brown	Brown	Turbid, brown	Tea colour	Tea brown	Dry	Milky brown	Dark brown	Brown
Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9	pH units	-	*9.79*	*9.94*	*9.84*	*9.4*	8.84	*9.46*	*9.62*	*10.57*	*9.73*	*9.83*	*9.94*	*9.53*	*9.53*	-	*9.59*	*9.46*	*9.32*
Soluble Fluoride		1	2	1.5	mg/L	0.1	***650***	***650***	***590***	***380***	***340***	***260***	***280***	***300***	***330***	***570***	***550***	***450***	***670***	-	***380***	***380***	***410***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	<0.004	<0.4	<0.04	0.032	0.004	0.049	0.045	<0.004	0.029	-	0.008	<0.004	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.89	0.4	3.2	***35***	***46***	***49***	***53***	***18***	***14***	***9.9***	2.6	***36***	***12***	-	***32***	***37***	***37***
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:		E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		11.33	11.12	11.06	10.84	11	9.94	10.77	11.4	11.03	11.93	11.65	12.64	11.92	11.61	12.31
					Sample Description:		Brown/orange, strong hydrogen sulfide odour	Turbid, slightly brown/yellow	Slightly brown, no odour	Slightly brown, slight sulphidic odour	Slightly yellow, sulphidic odour	Brown, sulphidic odour	Clear to slightly grey	Yellow/brown	Red/brown, no odour	Clear to slightly turbid, orange/brown, slight unknown	Brown/red, easy to filter	Clear, brown, slight odour	Turbid, brown, no odour	Very turbid, dark brown, no odour	Slightly turbid, yellow brown, sulphidic odour
Analyte grouping / Analyte						**Units**	**LOR**														
pH (field)	6.5-8[a]			5 - 9		pH units	-	*9.62*	*9.29*	*9.27*	*9.47*	*9.56*	*9.58*	*9.67*	*9.65*	*9.73*	*9.87*	*10.64*	*9.56*	*9.91*	*10.1*	*9.89*
Soluble Fluoride		1	2	1.5		mg/L	0.1	***350***	***380***	***410***	***530***	***490***	***530***	***590***	***560***	***690***	***560***	***680***	***610***	***760***	***570***	***680***
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	0.006	<0.004	<0.004	<0.004	0.006	0.004	<0.004	<0.004	<0.004	0.008	0.006	0.008	0.008
Total Cyanide						mg/L	0.004	69	41	48	57	74	130	130	110	160	190	1.8	89	120	47	81
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***13***	***22***	1.7	***5.2***	1.3	0.98	1.8	***14***	0.5	0.55	0.44	0.65	***9.4***	***70***	0.49
Aluminium (dissolved)						mg/L	0.01	1	0.42	0.8	1.1	0.25	0.83	0.45	0.79	0.36	0.46	0.28	0.38	0.45	0.53	0.29

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
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Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:						Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:						Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:						Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:						A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7
Project Name:						Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:						Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:						Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:						Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):						10.279	10.599	9.809	10.059	9.919	10.019	10.489	10.219	10.009	9.999	9.939	9.859	9.699	9.799	9.969	9.669	9.579
Sample Description:						Brown	Brown	Brown	Brown, strong organic material odour	Brown/orange, slightly turbid, slight odour	Dark orange/brown, no odour	Brown	Brown	-	Brown	Brown	Turbid, brown	Brown	Tea brown	Tea brown	Tea brown, foul smell	Tea brown, smelly
Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9	pH units	-	*9.63*	*9.47*	*9.67*	*9.66*	*9.24*	8.56	*9.45*	*9.8*	*10.71*	*9.75*	*9.37*	*9.57*	*9.15*	*9.12*	*9.49*	2.65	*9.27*
Soluble Fluoride		1	2	1.5	mg/L	0.1	***436***	***420***	***410***	***380***	***410***	***550***	***500***	***400***	***320***	***330***	***320***	***360***	***380***	***500***	***400***	***390***	***400***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	*11*	*<2*	<0.020	*0.19*	<0.004	0.026	0.032	<0.004	0.039	<0.004	<0.005	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.208	4.7	0.7	0.26	0.71	1.7	2.7	0.61	0.72	***14***	2.9	2.1	3	***25***	3.7	**5.9**	4.1
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13	
					Sample ID:	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	W3S	
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	
					Section:	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	
					Aquifer:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	
					SWL (m AHD):	9.629	9.999	9.819	9.989	9.609	9.689	9.819	9.569	10.029	10.149	10.369	10.259	10.969	10.419	10.249	10.649	-	
					Sample Description:	Tea brown	Dark brown/orange, very strong hydrogen sulfide odour	Slightly brown/yellow, 'rotten egg' odour	Brown, sulphidic odour	Slightly brown, sulphidic odour	Slightly brown, sulphidic odour	Brown sulphidic odour	Slightly red/brown, sulphidic odour	Slightly red/brown, sulphidic odour	Slightly brown, sulphidic odour	Clear, brow, strong 'rotten eggs' odour	Red/brown, strong odour	Clear, brown, strong odour	Clear to slightly turbid, dark yellow/brown, slight odour	Slightly turbid, dark brown, strong odour	Clear to slightly turbid, dark brown, sulphidic odour	Light brown	
Analyte grouping / Analyte						**Units**	**LOR**															
pH (field)	6.5-8[a]			5 - 9		pH units	-	8.96	*9.36*	*9.75*	*9.06*	*9.38*	*9.4*	*9.39*	*9.48*	*9.46*	*9.4*	*9.6*	*9.85*	*9.26*	*9.36*	*9.73*	*9.46*	8.53
Soluble Fluoride		1	2	1.5		mg/L	0.1	***190***	***390***	***450***	***410***	***600***	***480***	***480***	***520***	***410***	***470***	***370***	***500***	***380***	***110***	***370***	***360***	***237***
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	0.007	0.009	<0.004	<0.004	<0.004	<0.004	0.004	<0.004	<0.004	<0.004	<0.004	0.005	<0.004	0.005	<0.004	-
Total Cyanide						mg/L	0.004	15	87	80	54	100	82	88	90	64	86	81	1.8	43	9.2	20	18	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	**8.9**	***24***	4.4	1	0.44	0.5	0.4	0.33	0.46	0.37	0.4	0.87	0.31	0.16	1	0.28	***11.7***
Aluminium (dissolved)						mg/L	0.01	-	0.37	0.2	0.25	0.19	0.16	0.21	0.28	0.25	0.21	0.22	0.23	0.21	0.11	0.23	0.15	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18
Sample ID:							W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							10.312	9.282	9.832	9.552	9.902	10.292	10.052	9.632	9.622	9.762	9.602	7.182	9.702	9.902	8.982	8.912	9.582
Sample Description:							Brown	Light brown	Clear to brown, no odour	Brown/orange, no odour	Brown/orange, no odour	Brown	Light brown, slightly turbid	-	Brown	Turbid, brown	Turbid, brown	Brown	-	Tea brown	Brown	Purge dry	Milky brown
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	8.82	7.61	8.89	7.68	6.38	7.53	7.53		7.46	7.02	7.01	6.4	7.4	7.66	7	6.99	7.19
Soluble Fluoride		1	2	1.5		mg/L	0.1	***310***	***210***	***270***	***210***	***250***	***230***	***200***	***160***	***190***	***170***	***150***	***110***	***180***	***62***	***99***	-	***180***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	<0.004	*<0.4*	<0.02	0.023	0.007	0.005	0.014	<0.004	0.007	<0.004	<0.005	-	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
Aluminium (total)	0.055	5	5	9		mg/L	0.01	2.6	**7.1**	***9.2***	**5.3**	***34***	4.4	***24***	***92***	***15***	**6.9**	***21***	***90***	***48***	***15***	***110***	-	***80***
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13	Nov-13
Sample ID:							W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W4S	W4S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							9.872	9.522	9.902	-	9.122	9.752	-	9.872	10.022	9.952	9.702	10.242	10.082	9.772	10.182	-	9.934
Sample Description:							Turbid, brown	Turbid, brown, no odour	Slightly brown, no odour	Turbid, pale brown, silty	Clear to yellow, slightly turbid, cloudy	Slightly brown	Insufficient water for sampling	Slightly brown/red	Clear, slightly red/brown	Clear to slightly turbid, brown, no odour	Red/brown, no odour	Turbid, yellow/brown, no odour	Clear to slightly turbid, yellow brown, no odour	Slightly turbid, dark yellow brown, slight odour	Clear, dark yellow brown, no odour	Dry	Brown
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.91	7.14	6.8	-	7.01	7.7	-	7.21	7.29	7.28	7.59	7.14	7.57	7.53	7.58	-	***9.13***
Soluble Fluoride		1	2	1.5		mg/L	0.1	***120***	***96***	***100***	-	***90***	***170***	-	***150***	***150***	***97***	***100***	***130***	***130***	***110***	***230***	-	***480***
Free Cyanide	0.007			0.1		mg/L	0.004	0.007	0.004	0.008	-	<0.004	0.013	-	0.016	0.005	0.011	<0.004	0.028	0.016	<0.004	0.033	-	-
Total Cyanide						mg/L	0.004	24	14	15	-	15	20	-	26	18	9.3	14	13	17	12	14	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***16***	***23***	***21***	-	***33***	3.8	-	***26***	3.1	**8.2**	***29***	**8.7**	4	3.1	0.73	-	3.6
Aluminium (dissolved)						mg/L	0.01	1.3	1.1	3.2	-	3.3	0.79	-	4.1	1.2	4.4	3.5	2.5	0.58	0.62	0.3	-	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
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Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18
Sample ID:							W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							-	-	-	-	9.739	9.729	-	-	9.719	-	-	-	-	-	-	-	9.759
Sample Description:							Dry	Dry	Dry	Dry	Brown	Dark brown	Dry	Dry	Slightly turbid, brown	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dark brown, orange odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	-	-	-	-	*9.13*	*9.07*	-	-	5.11	-	-	-	-	-	-	-	8.26
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	-	***490***	***400***	-	-	-	-	-	-	-	-	-	-	***160***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	*<4*	*<40*	-	-	-	-	-	-	-	-	-	-	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
Aluminium (total)	0.055	5	5	9		mg/L	0.01	-	-	-	-	2.3	***13***	-	-	-	-	-	-	-	-	-	-	***71***
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.38

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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
					Aquifer:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):	-	-	-	-	-	-	9.599	10.029		10.629	9.789	9.739	-	-
					Sample Description:	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Slightly red/brown	Purge dry	Dry, mud at base of well	Very turbid, brown, organic odour	Very turbid, grey/black/brown, organic odour	Insufficient water to sample	Insufficient water to sample
Analyte grouping / Analyte						**Units**	**LOR**												
pH (field)	6.5-8[a]			5 - 9		pH units	-	-	-	-	-	-	-	-	8.32	-	-	7.58	7.91	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	-	-	-	-	***76***	-	-	***81***	***120***	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	-	-	<0.004	-	-	<0.004	<0.004	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	2.1	-	-	2.2	1.7	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	-	-	-	-	-	-	-	***19***	-	-	***63***	***170***	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	5.4	-	-	***24***	2.3	-	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							8.06	7.735	7.48	7.72	7.67	7.54	8.7	8.15	7.9	7.94	7.64	7.55	7.41	7.4	7.56	7.33	7.2
Sample Description:							Clear/light brown	Cloudy, brown	Light brown	Brown, slightly turbid, sulphidic odour	Dark grey, turbid, no odour	Brown/orange, slight sulphidic odour	Brown	-	-	Clear to light brown, turbid	Turbid, brown	Turbid, brown	Grey	Brown	Brown	Milky	Brown
Analyte grouping/Analyte						**Units**	**LOR**																
pH (field)	6.5-8[o]			5 - 9		pH units	-	*9.36*	*9.36*	*9.33*	*9.41*	*9.32*	8.86	7.97	*9.23*	8.65	*9.2*	*9.29*	*9.41*	*9.1*	8.7	*9.07*	3.51	8.83
Soluble Fluoride		1	2	1.5		mg/L	0.1	***102***	***160***	***190***	***160***	***150***	***230***	***7.4***	***110***	***96***	***120***	***120***	***130***	***200***	***230***	***99***	***130***	***110***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	0.005	<0.004	<0.004	0.033	<0.004	0.009	0.016	0.004	0.015	<0.004	<0.005	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***23***	***23***	4	**7.8**	3.6	5	2.5	***11***	2.7	**7.6**	***23***	***22***	***15***	***89***	**5.6**	***120***	***49***
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[o] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13
Sample ID:							E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	W5S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							7.11	7.56	7.4	7.46	7.25	7.29	7.34	7.18	7.65	7.68	7.97	7.86	7.76	8.1	7.88	8.45	9.188
Sample Description:							Yellow	Light brown, hydrogen sulfide odour	Slightly brown	Clear, no odour	-	Clear, sulphidic odour	Clear, slightly turbid	Clear, sulphidic odour	-	Clear, slight sulphidic odour	Clear, yellow/brown, no odour	Clear to slightly turbid, light brown, no odour	Low turbid, pale yellow, strong odour	Very turbid	Turbid, pale yellow brown, slight odour	Turbid, pale brown, no odour	Light brown
Analyte grouping/Analyte						**Units**	**LOR**																
pH (field)	6.5-8[o]			5 - 9		pH units	-	8.62	*9.02*	*10.45*	7.7	8.99	8.76	7.87	8.95	8.41	8.48	8.69	*9.24*	8.3	*9.21*	*9.48*	7.09	7.37
Soluble Fluoride		1	2	1.5		mg/L	0.1	***120***	***120***	***130***	***49***	***150***	***74***	***41***	***120***	***41***	***54***	***53***	***78***	74	120	76	12	***35***
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	0.004	<0.004	<0.004	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
Total Cyanide						mg/L	0.004	7.4	10	8	0.65	18	3.8	0.3	20	0.79	1.9	3.5	5.1	1.9	3.1	1.4	0.17	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	4.4	4.9	***9.3***	***6.4***	***11***	1.8	3.9	1.5	3.3	2.4	2.6	**5.3**	1.1	***50***	5	4.8	***13***
Aluminium (dissolved)						mg/L	0.01	-	0.03	0.02	0.1	0.06	0.04	0.03	0.03	0.07	0.06	0.12	0.08	0.05	0.23	0.09	2	-

Blank Cell indicates no criterion available

[o] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18
Sample ID:							W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							9.273	-	9.053	-	8.993	9.323	9.293	-	-	9.063	-	-	-	-	-	-	-
Sample Description:							Light brown, cloudy	Dry	Brown, turbid, no odour	Dry	Brown/orange , no odour	Brown	Brown	Dry	Dry	-	Dry	Dry	Dry	Brown	Dry	Dry	Dry
Analyte grouping/Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	7.37	-	7.39	-	6.55	7.26	7.2	-	-	7.29	-	-	-	7.79	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***61***	-	***100***	-	***93***	***88***	***70***	-	-	***62***	-	-	-	***50***	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	<0.004	<4	<0.02	-	-	-	-	-	-	<0.004	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***13***	-	***15***	-	***22***	**7**	***31***	-	-	***10***	-	-	-	**6.2**	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

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For Limit of Reporting (LOR) refer to laboratory certificates of analysis

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:		W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		-	-	-	-	-	-	-	8.843	9.173	9.093	-	8.973	-	-	9.073
					Sample Description:		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Clear, yellow, no odour	Slightly turbid, yellow/orange / brown, no odour	Dry	Very turbid, brown, no odour	Dry	Dry	Very turbid, grey brown, no odour
Analyte grouping / Analyte					**Units**	**LOR**														
pH (field)	6.5-8[α]			5 - 9	pH units	-	-	-	-	-	-	-	-	-	7.76	7.47	-	7.2	-	-	6.74
Soluble Fluoride		1	2	1.5	mg/L	0.1	-	-	-	-	-	-	-	-	***34***	***34***	-	39	-	-	24
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	-	-	-	<0.004	<0.004	-	<0.004	-	-	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	2.6	2.2	-	2.5	-	-	0.34
Aluminium (total)	0.055	5	5	9	mg/L	0.01	-	-	-	-	-	-	-	-	**11**	**23**	-	***42***	-	-	***32***
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	**6.6**	2.6	-	5	-	-	***14***

Blank Cell indicates no criterion available

[α] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							9.18	8.74	8.46	8.8	8.73	8.65	9.35	9.19	9.09	9.03	8.61	8.64	8.38	8.22	8.56	8.16	7.75
Sample Description:							Yellow	Clear, slightly cloudy	Light brown, sulphur odour	Clear/dark yellow, no odour	Dark grey, turbid, no odour	Orange/yellow, no odour	Brown	Slightly turbid, light brown	-	Brown, turbid	-	Turbid, brown	-	Light brown	Brown	Faint yellow	Faint brown
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	6.36	6.38	6.48	6.53	6.39	6.11	6.49	6.69	6.74	6.59	6.63	6.92	6.4	6.54	6.78	6.76	6.67
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.27	0.17	0.26	0.27	0.29	0.35	0.9	0.3	0.4	***<10***	0.4	0.6	0.4	1	0.4	0.4	0.4
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	<0.004	*<0.4*	<0.02	0.005	<0.004	0.004	<0.004	<0.004	0.006	<0.004	<0.005	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.102	***12***	0.11	0.3	***91***	1.8	***29***	**5.3**	3.4	***34***	0.47	1.6	1	***34***	3.9	***25***	4
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13
Sample ID:							N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N9
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							7.87	8.29	8.18	8.28	7.9	7.89	7.99	7.77	8.04	8.19	8.53	8.47	8.73	9.27	8.93	8.99	9.222
Sample Description:							Brown	Light brown, some odour	Brown/yellow	Slightly brown, very slight sulphidic odour	Slightly brown/yellow, no odour	Clear to yellow	Turbid, brown/yellow, no odour	Slightly yellow, sulphidic odour	Clear, bright yellow, sulphidic odour	Slightly yellow/red, no odour	Turbid, yellow, no odour	Slightly turbid, brown, slight odour	Turbid, yellow/orange /brown, slight odour	Slightly turbid, yellow/brown, no odour	Turbid, yellow/orange brown, slight odour	Turbid, pale yellow brown, no odour	Light brown
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.45	6.71	*10.53*	6.51	6.81	6.68	6.6	6.67	6.76	6.77	6.77	6.95	6.54	6.85	7.19	6.63	*9.16*
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.2	0.4	0.4	0.4	0.4	0.5	0.6	0.5	0.5	***85***
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
Total Cyanide						mg/L	0.004	0.54	0.67	0.56	0.6	0.61	0.55	0.47	0.63	0.35	0.49	0.66	0.44	0.1	0.2	0.1	0.041	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	**5.1**	4.3	0.22	0.35	0.9	0.76	1.1	1.7	0.3	0.63	4.5	1	0.7	**5.1**	**6.5**	0.2	***14.7***
Aluminium (dissolved)						mg/L	0.01	-	0.02	0.03	0.06	0.04	0.06	0.06	0.06	0.07	0.05	0.06	0.05	0.06	0.05	0.04	0.04	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18
Sample ID:							N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							9.312	8.482	9.012	8.872	9.002	9.692	9.382	9.052	8.832	9.252	-	-	9.142	9.352	8.822	8.812	9.022
Sample Description:							Cloudy brown	Dry	Dark yellow, slightly turbid, no odour	Dark grey, becoming yellow, turbid, no odour	Brown/orange, sulphidic odour	Turbid, grey	Clear, strong sulphidic odour	-	Brown	Slightly brown	Brown	Dry	Brown	Light brown, smelly	-	Tea brown	Tea brown
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	8.9	-	*9.17*	8.91	8.46	7.22	7.34	7.7	6.61	8.11	8.54	-	8.61	*9.32*	-	8.6	8.65
Soluble Fluoride		1	2	1.5		mg/L	0.1	***200***	-	***170***	***210***	***210***	***24***	***25***	***9***	-	***140***	-	-	***200***	***160***	***150***		***200***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	<0.004	*<0.4*	<0.02	<0.004	-	<0.004	-	-	<0.004	<0.004	<0.005	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***62***	-	***9***	***130***	**8**	***14***	***22***	0.89	-	**5.5**	-	-		1.6	-	-	0.54
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13	Nov-13
Sample ID:							N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	W6S	W6S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							9.222	8.972	9.172	8.792	8.832	9.182	-	9.342	9.322	9.312	9.182	9.332	9.502	9.282	9.802	7.85	7.65
Sample Description:							Light brown, some odour	Brown, sediment, strong hydrogen sulfide odour	Clear, slightly brown, sulphidic odour	Light brown, sediments, strong sulphidic odour	Clear, sediments	Clear to slightly brown, sulphidic odour	Insufficient water for sampling	Clear, sulphidic odour	Clear, sulphidic odour	Clear to slightly turbid, yellow, sulphidic odour	Turbid, light brown, slight odour	Low turbid, pale brown/yellow, strong odour	Turbid, pale yellow, strong odour	Turbid, pale yellow brown, no odour	Turbid, pale yellow brown, no odour	Light brown	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	8.72	*12.9*	8.72	8.33	8.71	8.5	-	8.64	8.53	8.7	8.69	8.21	8.67	8.68	8.27	8.87	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***140***	***170***	***160***	***200***	***160***	***160***	-	***140***	***130***	***57***	***110***	***110***	***110***	***95***	***82***	***195***	-
Free Cyanide	0.007			0.1		mg/L	0.004	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	<0.004	<0.004	<0.004	0.008	<0.004	<0.004	<0.004	<0.004	-	-
Total Cyanide						mg/L	0.004	6.7	7.2	7.4	6.6	9.2	8	-	5.4	3.7	2.9	5.3	2.3	1.1	0.83	0.18	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***17***	0.95	0.28	1.5	2	0.64	-	4.9	1.6	1.3	1.6	0.52	***15***	3.7	0.71	***60.1***	-
Aluminium (dissolved)						mg/L	0.01	0.1	0.1	0.08	0.27	0.46	0.08	-	1.1	0.7	0.6	0.28	0.06	0.84	0.6	0.06	-	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18
Sample ID:							W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							7.64	-	-	7.69	8.12	8.01	7.82	-	-	7.63	-	-	-	-	-	-	7.59
Sample Description:							Dry	Brown/yellow, turbid	Dry	Orange, no odour	Light brown, turbid	Light brown, slightly turbid	-	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	-	8.79	-	7.27	8.72	8.98	8.67	-	-	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	***200***	***180***	-	***180***	-	-	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	0.019	*<0.4*	-	0.058	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	-	-	-	3.5	**7.7**	-	***22***	-	-	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

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Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational															
					Sample Type:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
					Aquifer:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):	7.6	-	-	-	-	-	7.59	-	-	Dry	-	-	7.6	-
					Sample Description:	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry

Analyte grouping / Analyte					**Units**	**LOR**														
pH (field)	6.5-8[¤]			5 - 9	pH units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available
[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																			
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20
Sample ID:							F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							4.95	4.86	4.93	4.73	4.67	4.76	4.46	4.3	3.82	4.41	4.19	4.16	3.8	3.71	3.75	3.39	3.75	3.85
Sample Description:							Clear to light brown	Clear	Clear	Colourless	Colourless with particles	Faint yellow	Colourless	Colourless with particles	Colourless with particles	Clear, hydrogen sulfide odour	Clear	Clear, very slight sulphidic odour	Clear, no odour	Clear, slight sulphidic odour	Clear, no odour	Clear, sulphidic odour	Clear, organic odour	Clear, slight sulphidic odour
Analyte grouping / Analyte						**Units**	**LOR**																	
pH (field)	6.5-8[¤]			5 - 9		pH units	-	7.38	5.58	5.25	4.46	4.11	5.08	4.21	4.57	4.3	4.46	4.35	5.02	4.96	4.71	4.6	4.54	5.38	4.75
Soluble Fluoride		1	2	1.5		mg/L	0.1	***<10***	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	<0.1	<0.4	<0.4
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	<0.004	0.013	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9		mg/L	0.01	2.2	2.1	0.89	2.3	2.3	4.6	2.9	3.2	3	2.2	2.1	2	1.4	1.7	2.3	1.9	1.7	2.5
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	1.5	1.9	1.7	1.1	0.92	1.5	1.2	1.3	2.3

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																			
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18
Sample ID:							F5	F5	F5	F5	F5	F5	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							4.23	4.04	5.48	4.72	4.55	4.93	2.59	2.45	2.45	3.21	2.17	2.28	2.04	1.86	1.55	1.7	1.55	1.49
Sample Description:							Clear, no odour	Clear, sulphidic odour	Clear to slightly turbid, colourless/grey, slight	Clear, colourless, slight sulphidic odour, slight	Clear with some flocculants, colourless, strong odour	Clear, colourless, black flocculants, sulphidic	-	Clear	Clear	Colourless with particles	Colourless with particles	Colourless	Colourless with particles	Colourless with particles	Colourless with particles	Clear, no odour	Clear, no odour	Clear, no odour
Analyte grouping / Analyte						**Units**	**LOR**																	
pH (field)	6.5-8[a]			5 - 9		pH units	-	4.71	5.01	4.63	4.69	4.68	4.48	3.6	3.82	4.04	3.79	3.66	4.55	4.21	3.86	3.66	3.6	3.88	3.81
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.1	0.2	0.2	0.3	0.2	0.2	***<10***	<0.1	0.2	<0.1	<0.1	0.4	0.4	0.5	0.4	0.4	0.4	0.7
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-	-	-	-	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9		mg/L	0.01	3.2	2.2	2.6	2.7	2.7	2.4	***28***	0.78	0.13	***29***	***25***	***23***	***21***	***27***	***27***	***25***	***23***	***25***
Aluminium (dissolved)						mg/L	0.01	2.7	1.9	2.2	2	2.2	2	-	-	-	-	-	-	-	-	-	***26***	***22***	***23***

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational													
					Sample Type:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
					Aquifer:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):	1.29	1.13	0.99	0.81	0.8	0.96	1.33	1.23	1.28	1.99	1.88	2.01
					Sample Description:	Clear, slight sulphidic odour	Clear, sulphidic odour	Slightly brown, strong sulphidic odour	Clear, sulphidic odour	Clear, sulphidic odour	Clear, sulphidic odour, slightly turbid	Clear, no odour	Clear, sulphidic odour	Slightly turbid, black/grey, strong odour	Clear, colourless, strong sulphidic odour, slight	Clear with flocculants, colourless, slight odour	Clear, colourless, strong sulphidic odour
Analyte grouping / Analyte					**Units**	**LOR**											
pH (field)	6.5-8[¤]			5 - 9	pH units	-	4.14	3.88	4.14	3.93	4.06	4.59	4.49	4.19	4.22	4.55	4.94	4.2
Soluble Fluoride		1	2	1.5	mg/L	0.1	0.6	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.4	0.6	0.4	0.6
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	***16***	***17***	***9.8***	**9**	**6.9**	**7.3**	***9.3***	**6.9**	**8**	3.5	**6.6**	**7.4**
Aluminium (dissolved)					mg/L	0.01	***16***	***18***	***9.5***	**8.9**	**6.7**	**5.8**	**8.5**	**6.9**	**8**	2.8	**5.9**	**5.6**

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

RAMBOLL

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18
					Sample ID:	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	12.193	12.313	11.793	11.463	11.183	10.463	11.963	11.683	11.573	11.753	11.603	11.663	11.483	11.303	11.523	11.303	10.813	10.933
					Sample Description:	Brown	Brown	Brown	Dark brown, slight sulphidic odour	Brown, turbid, strong odour	Copper/brown, strong sulphidic odour	Brown	Brown	-	Brown	Brown	Brown	Brown	Dark brown	Dark brown	Tea brown	Tea brown	Reddish/tea brown
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[¤]			5 - 9	pH units	-	*10.09*	*9.9*	*10.13*	*10.1*	9.94	*9.99*	*10.11*	*10.27*	*10.34*	*10.42*	*10.29*	*10.4*	*10.02*	*10.07*	*9.37*	*10.08*	*10.1*	*10.14*
Soluble Fluoride		1	2	1.5	mg/L	0.1	***682***	***790***	***880***	***930***	***1080***	***1279***	***1300***	***1300***	***1300***	***1300***	***1400***	***1500***	***1400***	***1700***	***1300***	***1300***	***1200***	***1200***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	0.03	<4	*0.058*	*0.88*	*0.21*	*0.11*	*0.11*	*0.12*	*0.15*	0.012	0.01	0.006	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300
Aluminium (total)	0.055	5	5	9	mg/L	0.01	2.86	0.6	0.67	1.4	44	0.03	0.19	0.03	3.5	0.06	0.09	0.92	***31***	1	0.08	1.6	0.28	1.1
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13	Nov-13	Feb-14
					Sample ID:	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	E5D	E5D	E5D
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	11.583	11.373	11.333	11.133	11.333	11.253	10.963	11.663	8.842	12.323	12.053	11.783	12.233	11.923	12.683	11.672	11.632	11.562
					Sample Description:	Dark brown, odour	Dark brown	Brown, slight 'burnt' odour	Dark brown	Brown, very slight sulphidic odour	Brown/red, no odour	Slightly brown/red	Red/brown, sulphidic odour	Red/brown, sulphidic odour	Turbid, orange/brown, no odour	Clear to turbid, brown, slight odour	Slightly turbid, brown, strong odour	Clear to slightly turbid, dark chocolate brown, no	Clear to slightly turbid, dark brown, no odour	Clear, dark brown, sulphidic odour	Cloudy, brown	-	Light brown/clear
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9	pH units	-	*10.18*	*13.74*	*9.87*	*9.99*	*10.1*	*10.08*	*10.14*	*10.12*	*10.11*	*10.18*	*10.09*	*9.72*	*10.11*	*10.37*	*10.19*	7.22	7.29	7.53
Soluble Fluoride		1	2	1.5	mg/L	0.1	***1200***	***1200***	***1200***	***1500***	***1200***	***1300***	***1400***	***1300***	***1100***	***800***	***1000***	***1000***	***860***	***880***	***1000***	1.21	***40***	***44***
Free Cyanide	0.007			0.1	mg/L	0.004	0.007	0.029	0.009	0.004	0.004	0.03	0.018	0.009	<0.004	0.008	0.006	0.005	0.008	0.011	0.009	-	-	-
Total Cyanide					mg/L	0.004	330	280	330	300	230	240	270	250	210	190	1.8	120	100	46	82	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.71	0.39	1	0.61	0.72	0.83	1.2	0.97	0.76	0.76	0.71	1.6	2	1.6	0.68	1.697	1.5	***110***
Aluminium (dissolved)					mg/L	0.01	0.77	0.52	0.69	0.51	0.7	0.73	0.7	0.76	0.78	0.69	0.58	0.73	0.6	0.6	0.56	-	-	-

Blank Cell indicates no criterion available

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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

RAMBOLL

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18
					Sample ID:	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	11.432	11.562	11.612	11.572	11.522	11.722	11.652	11.992	11.422	11.462	11.282	11.232	11.192	11.242	11.202	11.292	11.232	11.672
					Sample Description:	Brown, no odour	Yellow/orange, no odour	Light brown/copper, no odour	-	Brown	-	Brown	Brown	Brown	Milky	Brown	Light brown	Milky brown	Light tea brown	Light yellow	Light brown, some odour	Brown	Slightly brown, no odour

Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9	pH units	-	7.44	8.32	6.8	7.23	7.23	7.18	7.1	7.27	7.39	7	7.08	7.97	7.16	7	6.97	7.29	*12.79*	6.95
Soluble Fluoride		1	2	1.5	mg/L	0.1	***23***	***12***	***18***	***16***	***14***	***16***	***19***	***18***	***15***	***16***	***22***	***19***	***14***	***14***	***16***	***14***	***12***	***11***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	<0.004	<0.4	<0.02	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.6	1.2	0.81
Aluminium (total)	0.055	5	5	9	mg/L	0.01	2.2	3.3	3.4	2.1	2.1	4.3	3.6	2.7	1.9	4.2	***64***	2.8	5	2.2	3.4	4.1	2.2	0.72
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	0.01	0.03

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational													
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:		E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		11.702	11.482	11.482	11.392	10.262	11.892	12.152	12.032	11.782	11.932	11.662	11.812
					Sample Description:		Clear to slightly yellow, no odour	Slighlty brown, no odour	Clear to slightly brown, no odour	Clear, no odour	Bright yellow, sulphidic odour	Clear, no odour	Clear to slightly turbid, yelow, no odour	Slightly turbid, light brown, no odour	Medium turbid, yellow brown, strong odour	Clear, yellow, no odour	Clear to slightly turbid, dark yellow, slight odour	Clear, pale brown, sulphidic odour
Analyte grouping / Analyte						**Units**	**LOR**											
pH (field)	6.5-8[a]			5 - 9	pH units	-	6.96	7.1	7.3	6.95	7.05	7.1	7.04	7.02	6.77	8.32	7.31	6.95
Soluble Fluoride		1	2	1.5	mg/L	0.1	***8.1***	***9.6***	***8.3***	***9.4***	***9.8***	***7.7***	***7.3***	***7.8***	***9.1***	***8.3***	***7.6***	***7.9***
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	1.1	0.92	0.68	1.1	2.3	0.84	0.7	0.63	0.38	0.61	0.17	0.27
Aluminium (total)	0.055	5	5	9	mg/L	0.01	1.3	1.2	1.2	2.5	1.2	1.3	1.6	1.3	1.6	0.33	0.42	0.27
Aluminium (dissolved)					mg/L	0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	0.02	0.01	0.03	0.01	0.02	0.02

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							10.852	9.912	9.332	8.702	9.112	-	8.512	8.022	8.582	9.412	8.752	8.632	8.762	8.562	8.372	7.872	7.882
Sample Description:							Brown	-	Light brown	Light brown, turbid	-	Dry	Light brown, turbid	Light brown, slightly turbid	-	Brown	Brown	Turbid, brown	Light brown	Tea brown	Tea brown	Tea brown	Tea brown
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.98	6.62	6.7	6.71	6.63	-	6.82	6.79	8.48	6.73	6.82	7.02	6.78	6.67	7.3	6.95	6.78
Soluble Fluoride		1	2	1.5		mg/L	0.1	***39***	***5.4***	***3.5***	***5.1***	***3.3***	-	***4.4***	***3.5***	***2.6***	***<10***	***3.1***	***3.3***	***3.4***	***3.9***	***4.4***	***4.8***	***4.2***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	-	<0.2	<0.02	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***21.2***	0.9	2.4	2.4	0.26	0.26	4	0.95	0.4	1.5	0.66	0.87	18	89	120	4.1	1.4
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:		W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		7.802	8.692	8.512	8.572	8.412	8.482	8.052	7.992	8.392	8.842	11.632	11.182	11.242	11.312	10.722	11.022
					Sample Description:		Brown	Yellow, hydrogen sulfide odour	Slight brown/yellow	Clear, slightly brown, slight sulphidic odour	Clear to slightly brown, slight sulphidic odour	Clear, slighly cloudy, sulphidic odour	Slightly brown/yellow, sulphidic odour	Slightly yellow, no odour	Bright yellow	Clear to slightly yellow	Clear, dark yellow no odour	Yellow, no odour	Clear, dark yellow, no odour	Clear, yellow/brown, no odour	Clear, dark yellow, no odour	Clear brown, no odour
Analyte grouping / Analyte						**Units**	**LOR**															
pH (field)	6.5-8[a]			5 - 9	pH units	-	6.91	7.07	7.12	6.76	6.92	6.83	6.91	7.16	7.12	7.17	7.57	8.14	7.34	7.78	8.13	7.71
Soluble Fluoride		1	2	1.5		mg/L	0.1	***4.7***	***5.1***	***4.5***	***4.8***	***3.9***	***4.7***	***4.4***	***4.8***	***4.1***	***3.8***	***8.5***	***9.2***	***11***	***11***	***9.7***	***10***
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	0.34	0.69	0.59	0.67	0.64	0.47	0.046	0.67	0.25	0.5	1	1.1	0.6	0.19	0.23	0.1
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.46	0.88	0.38	0.43	0.48	0.69	0.71	0.23	0.98	2.1	1.2	0.53	0.4	0.29	0.32	0.8
Aluminium (dissolved)						mg/L	0.01	-	0.14	0.14	0.25	0.15	0.21	0.19	0.1	0.15	0.22	0.13	0.09	0.14	0.05	0.05	0.08

Blank Cell indicates no criterion available

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Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							5.61	-	-	5.53	5.46	5.5	5.59	5.68	-	-	-	-	-	-	-	-	5.16
Sample Description:							Clear	Dry	Dry	Clear, no odour	Grey, slightly turbid, no odour	Clear, no odour	Clear	Sclear, sulphidic odour	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Turbid, suspended particles
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	5.91	-	-	4.38	3.56	3.29	4.89	3.62	-	-	-	-	-	-	-	-	4.72
Soluble Fluoride		1	2	1.5		mg/L	0.1	1.23	-	-	0.19	0.41	0.22	0.3	0.3	-	-	-	-	-	-	-	-	0.3
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	<0.004	<0.004	<0.004	-	-	-	-	-	-	-	-	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.7	-	-	0.58	0.72	0.76	0.81	0.04	-	-	-	-	-	-	-	-	1.4
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13
Sample ID:							W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W4D
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							5.02	5.01	4.92	4.94	4.86	4.45	4.57	4.52	4.37	4.4	4.72	4.69	-	-	-	-	5.539
Sample Description:							Slightly turbid, odourless	Clear, some odour	Light brown, some odour	Clear, no odour	Clear, no odour	Clear, slight sulphidic odour	-	Clear, no odour	Clear	Clear	Clear, no odour	Clear, no odour	Well damaged and unable to be sampled	Well damaged and unable to be sampled	Well damaged and unable to be sampled	Well damaged and unable to be sampled	Clear
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	4.16	3.75	3.94	4.53	4.81	4.21	4.15	3.96	4.14	4.54	4.53	3.93	-	-	-	-	6.02
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.3	0.5	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	-	-	-	-	1.48
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Total Cyanide						mg/L	0.004	<0.004	0.036	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	1.2	1.5	0.9	1	0.81	1	1	1.1	0.99	2.3	0.97	1.2	-	-	-	-	0.794
Aluminium (dissolved)						mg/L	0.01	-	1.3	0.91	1	0.74	0.87	0.94	0.94	0.89	0.69	0.72	1.1	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational													
					Sample Type:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	
					Sample ID:	W4D	W4D	W4D	W4D	W4D	W4D	W4D	W4D	W4D	W4D	W4D	
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	
					Section:	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	
					SWL (m AHD):	5.459	5.439	5.459	5.369	5.939	-	-	-	-	-	-	
					Sample Description:	Clear	Clear	Clear to pale yellow, no odour	Clear, no odour	Clear, no odour	Clear	Clear	-	Clear	-	-	
Analyte grouping / Analyte						**Units**	**LOR**										
pH (field)	6.5-8[a]			5 - 9		pH units	-	5.7	5.7	5.4	5.36	4.69	-	5.18	*9.9*	6.08	-	3.87
Soluble Fluoride		1	2	1.5		mg/L	0.1	*1.7*	1.3	0.41	*1.6*	1.1	-	0.2	-	-	-	<0.1
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	<0.004	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.48	0.19	0.27	0.5	0.35	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							5.396	5.321	5.301	5.361	5.321	5.311	5.451	5.521	5.301	5.471	5.381	5.311	5.341	5.191	5.171	5.141	4.981
Sample Description:							Clear	Clear	Clear	Clear, no odour	Light brown, slightly turbid, no odour	Clear, no odour	Dry	Clear	-	Clear	Clear	Slightly turbid	Colourless	Colourless	Clear, colourless	Colourless	Faint yellow with particles
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[α]			5 - 9		pH units	-	6.02	6.32	6.1	6.11	6.11	5.34	-	6.32	8.37	6.4	5.7	6.7	6.37	6.21	6.94	6.93	6.13
Soluble Fluoride		1	2	1.5		mg/L	0.1	***20***	0.51	0.59	0.65	0.53	0.44	-	0.4	0.5	***<10***	0.5	0.5	0.5	0.4	0.6	0.5	0.4
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.323	0.04	0.02	0.02	0.05	0.16	-	0.99	0.54	0.39	0.23	0.14	0.05	0.01	0.05	0.02	0.2
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[α] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

RAMBOLL

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13
					Sample ID:	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	N2
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	4.831	5.271	4.721	4.751	4.741	4.471	4.381	4.351	5.181	4.281	4.581	4.511	4.541	4.881	4.901	4.911	4.993
					Sample Description:	Clear with few particles	Clear some particles, no odour	Clear, slightly brown	Clear, no odour	-	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, sulphidic odour	Clear, no odour	Clear, no odour	Clear, colourless, slight odour	Slightly turbid, grey/brown, no odour	Clear to slightly turbid, colourless, no odour	Turbid, grey/brown, no odour	Clear
Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9	pH units	-	6.5	6.1	*10.2*	6.72	6.18	6.23	6.35	6.16	6.24	6.76	6.46	6.05	5.95	6.21	6.31	6	3.26
Soluble Fluoride		1	2	1.5	mg/L	0.1	0.5	0.4	0.6	0.6	0.3	0.4	0.4	0.1	0.4	0.3	0.5	0.3	0.4	0.7	0.3	0.5	0.43
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
Total Cyanide					mg/L	0.004	<0.004	0.004	0.01	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.03	0.16	0.09	0.04	0.44	0.04	0.24	0.28	0.04	0.52	0.24	0.09	0.33	0.33	0.27	0.38	**5.771**
Aluminium (dissolved)					mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	0.01	<0.01	0.02	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

RAMBOLL

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18
					Sample ID:	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	4.863	4.793	4.903	4.963	5.923	5.083	5.123	5.153	5.123	5.993	5.053	4.973	4.793	4.783	5.703	4.523	4.323
					Sample Description:	Clear	Clear	Pale yellow/brown, slightly turbid, no odour	Light grey, slightly turbid, no odour	Light brown, no odour	Brown/black	Clear, sulphidic odour	-	Turbid, black	Trubid, black	Turbid	Faint yellow	Brown	Brown	Milky	Faint yellow	-
Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[α]			5 - 9	pH units	-	6.54	4.01	3.94	3.54	3.34	6.61	5.81	8.09	6.75	6.37	5.35	4.67	4.59	5.37	3.98	4.31	3.63
Soluble Fluoride		1	2	1.5	mg/L	0.1	***6.2***	*1.9*	1.4	0.74	0.49	***8.1***	1.4	1.4	***15***	***8.6***	1.3	0.8	0.5	1	***2.1***	***2.4***	***2.1***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.054
Aluminium (total)	0.055	5	5	9	mg/L	0.01	3	4.6	4.5	**6.7**	***28***	3.4	2.4	***9.1***	***24***	3.2	3.7	**5.9**	***23***	***10***	***23***	5.7	5.2
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

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Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:		N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		4.363	4.223	4.243	4.163	3.933	3.813	3.733	3.623	3.753	4.023	3.973	3.983	4.423	4.423	4.473
					Sample Description:		Light brown, no odour	Clear, slightly brown	-	Clear, no odour	Clear to grey, no odour	Clear, no odour. Purged dry	Clear, no odour	Clear to turbid, slightly brown	Clear, sulphidic odour	Clear to slightly turbid, no odour	Clear, no odour	Very turbid, yellow/brown/ grey, no odour	Very turbid, pale brown, no odour	Turbid, pale yellow brown, no odour	Turbid, pale grey, no odour
Analyte grouping / Analyte						**Units**	**LOR**														
pH (field)	6.5-8[α]			5 - 9	pH units	-	4.41	2.8	4.18	4.34	4.51	4.05	3.85	4.09	4.54	3.88	3.55	3.94	4.22	3.98	3.68
Soluble Fluoride		1	2	1.5	mg/L	0.1	1.5	1.3	1.4	1.1	1.1	1	0.4	0.9	0.7	0.8	0.8	0.8	1.1	0.9	0.9
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	0.013	0.01	0.005	<0.004	0.005	0.007	<0.004	0.051	0.009	<0.004	<0.004	0.005	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	**6.9**	4.7	5	4.2	**6.2**	**8.4**	**7.7**	**8.5**	**6.7**	4.5	3.1	***12***	***12***	**6.5**	4.4
Aluminium (dissolved)					mg/L	0.01	3.1	3.8	3.9	4.2	3.2	3.2	3.5	2.6	2.6	3.1	2.8	2.4	2.1	3.4	3

Blank Cell indicates no criterion available

[α] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							6.632	6.502	6.552	6.552	6.492	6.482	6.622	6.682	6.712	6.712	6.552	6.552	6.502	6.352	6.342	6.342	6.142
Sample Description:							Clear	Clear	Clear	Pale brown, slightly turbid, no odour	Light brown/orange, slight odour, slightly turbid	Light brown, no odour	Clear, slightly cloudy	Turbid, brown	-	Light brown, turbid	Clear	Slightly turbid	Faint yellow	Faint yellow	Faint yellow	Faint yellow	Faint yellow
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.04	6.09	6.09	6.1	6.03	5.7	6.01	6.04	7.87	6.11	6.09	6.33	6.22	5.71	6.08	6.16	6.19
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.28	0.28	0.25	0.28	0.28	0.28	0.3	0.3	0.3	***<10***	0.3	0.3	0.3	0.4	0.2	0.3	0.4
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	<0.004	<0.004	<0.02	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.115	0.1	0.04	1.2	2.1	2.9	2	4.1	1.8	***9.6***	1.2	1.6	1.2	1.2	**6.6**	1.8	1.7
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Jul-13
					Sample ID:	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	W6D
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	6.042	6.032	5.992	5.962	6.022	6.612	5.702	5.622	5.452	5.642	5.852	6.802	5.822	6.132	6.132	6.052	5.129
					Sample Description:	Faint yellow	Clear, no odour	Light brown, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Slightly turbid, pale yellow, no odour	Slightly turbid, light brown, no odour	Slightly turbid, pale grey	Clear to slightly turbid, colourless to pale grey, no	Slightly turbid, colourless, no odour	Turbid, grey, strong sulphidic odour	Clear

Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9	pH units	-	6.05	6.05	6.42	6.53	6.16	6.35	6.46	6.13	6.26	6.37	6.12	6.26	6	6.12	6.36	6.24	6.49
Soluble Fluoride		1	2	1.5	mg/L	0.1	0.3	0.3	0.4	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.4	0.3	0.3	0.5	1.19
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
Total Cyanide					mg/L	0.004	<0.004	0.005	0.006	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.5	2.4	0.57	1.5	1	0.68	1.1	1.3	0.41	1	1.9	1.7	0.62	0.73	0.62	0.1	1.087
Aluminium (dissolved)					mg/L	0.01	-	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.01	<0.01	<0.01	0.03	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	
					Sample ID:	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	
					Section:	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	
					SWL (m AHD):	5.109	5.189	5.199	5.119	5.089	5.299	5.399	5.389	5.369	5.159	5.169	5.129	4.959	4.949	4.949	4.749	4.589	
					Sample Description:	Clear	Clear	Pale brown, slightly turbid, no odour	Clear, no odour	Clear, no odour	Clear	Clear	-	Clear	Clear	Colourless, clear	Faint yellow	Clear	Clear, colourless	Light yellow	Clear, colourless	Colourless with particles	
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[¤]			5 - 9	pH units	-	6.11	5.75	5.83	5.54	8.22	5.84	5.81	5.5	5.79	5.58	6.18	5.96	5.88	6.19	5.9	5.9	5.65
Soluble Fluoride		1	2	1.5	mg/L	0.1	0.25	0.21	0.4	0.19	0.3	0.1	0.1	-	***<10***	0.2	0.1	0.1	1.4	0.3	0.1	0.2	0.3
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.06	0.04	1.2	0.5	0.12	0.19	0.74	-	0.08	0.08	0.17	-	1.1	0.09	***25***	2.7	0.47
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:		W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		4.609	4.509	4.559	4.569	4.289	4.269	4.169	3.959	4.089	4.379	4.339	4.319	4.679	4.699	4.659
					Sample Description:		Turbid, light brown, no odour	Clear, slightly brown	Clear, no odour	Slightly yellow	Clear, slight odour	Turbid, slightly brown, no odour	Clear, slight sulphidic odour	Clear, no odour	Clear, no odour	-	Turbid, yellow/brown, no odour	Very turbid, pale brown/grey, no odour	Very turbid, pale brown, no odour	Turbid, pale yellow brown, slight odour	Turbid, pale brown, no odour
Analyte grouping / Analyte						**Units**	**LOR**														
pH (field)	6.5-8[a]			5 - 9	pH units	-	5.7	*10.47*	6.65	5.81	5.71	5.87	5.56	5.75	6.12	5.75	5.69	5.49	6.16	5.65	5.78
Soluble Fluoride		1	2	1.5	mg/L	0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	0.1
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	0.005	0.006	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.028	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	***19***	0.96	2.4	3.6	0.98	3.6	1.9	1.6	4.4	3.6	3.2	**7.1**	**8.4**	**5.4**	4.1
Aluminium (dissolved)					mg/L	0.01	<0.01	<0.01	0.02	0.02	0.02	0.02	0.02	0.04	0.03	0.04	0.02	0.98	0.05	0.05	0.04

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20
Sample ID:							G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							4.95	4.69	4.93	4.73	4.69	4.6	4.29	4.29	3.99	4.41	4.19	4.32	3.82	3.72	3.76	3.42	3.74
Sample Description:							Clear	-	Colourless, clear	Colourless	Colourless with suspended solids	Turbid	Light brown with particles		Colourless with few particles	Clear, some particles, no odour	Clear	Clear, very slight sulphidic odour	Clear, slight sulphidic odour	Clear, sulphidic odour	Clear, black particulates, very slight sulphidic odour	Clear, no odour	Clear, very strong sulphidic odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.36	6.77	6.72	5.88	5.73	5.96	6.15	5.77	5.8	6.23	7.63	5.64	5.99	6	6.13	5.7	6.38
Soluble Fluoride		1	2	1.5		mg/L	0.1	***<1.0***	0.4	<0.1	0.3	0.6	0.3	0.3	0.3	0.2	0.4	1.3	0.2	<0.1	0.2	0.2	0.1	0.2
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	0.006	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	<0.004	<0.004	0.01	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9		mg/L	0.01	1.8	***24***	0.14	0.17	**6.2**	3.6	4.9	0.26	0.19	0.9	0.04	0.21	0.29	0.12	0.29	0.41	0.11
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	<0.01	<0.01	0.03	0.03	<0.01	0.01	0.02	<0.01

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18
Sample ID:							G5	G5	G5	G5	G5	G5	G5	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							3.87	4.21	4.03	5.46	4.71	4.44	4.91	2.84	2.68	2.75	2.62	2.46	2.53	2.28	1.9	1.78	1.93
Sample Description:							Clear, sulphidic odour, black particulate	Clear, no odour	Clear, no odour	Clear, colourless, no odour	Clear, colourless, slight sulphidic odour, slight	Clear with flocculants, colourless, slight odour	Clear, colourless, sulphidic odour, black flocculants	-	Clear	-	Colourless	Colourless with particles	Colourless	Colourless with particles	Light grey with particles	Clear, colourless	Clear, no odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	5.86	5.85	5.61	5.26	5.5	5.59	5.39	6.99	6.67	7.05	6.54	6.29	7.08	6.75	6.68	6.88	6.67
Soluble Fluoride		1	2	1.5		mg/L	0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.3	***<10***	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.9	0.5
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-	-	-	-	0.024	<0.004
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.08	0.07	0.06	0.09	0.15	0.18	0.06	0.57	0.7	0.15	0.12	0.33	0.08	0.11	**7.6**	0.16	0.06
Aluminium (dissolved)						mg/L	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.03	-	-	-	-	-	-	-	-	-	<0.01

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
					Sample ID:		F6	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		1.82	1.77	1.52	1.38	1.25	1.07	1.03	1.16	1.52	1.32	1.51	2.25	2.12	2.06
					Sample Description:		Clear, no odour	Clear	Clear, slight sulphidic odour	Clear, sulphidic odour	Clear, black particulate, sulphidic odour	Clear, sulphidic odour	Clear, sulphidic odour	Clear, sulphidic odour	Clear, no odour	Clear, no odour	Clear, colourless, strong odour	Clear to slightly turbid, colourless, slight odour,	Clear to slightly turbid, colourless, no odour	Clear, colourless, sulphidic odour
Analyte grouping / Analyte						**Units**	**LOR**													
pH (field)	6.5-8[a]			5 - 9	pH units	-	7.85	6.66	6.73	6.57	6.62	5.61	6.75	6.72	6.83	7.05	6.49	6.51	6.84	7.08
Soluble Fluoride		1	2	1.5	mg/L	0.1	1	0.6	0.4	0.5	0.5	0.4	0.6	0.5	0.4	0.6	0.5	0.6	0.4	0.6
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	0.032	0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.008	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.03	0.05	0.06	0.05	0.12	0.07	0.03	0.04	0.27	0.03	0.05	0.08	0.03	<0.01
Aluminium (dissolved)					mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:		Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplciate	RPD%	Primary	Intra-laboratory	RPD%	Primary	Intra-laboratory	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary
	Sample Type:		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater
	Sample date:		Feb-15	Feb-15		Feb-15	Feb-15		Feb-15	Feb-15		Jun-15	Jun-15		Jun-15	Jun-15		Jun-15	Jun-15		Sep-15	Sep-15		Sep-15
	Sample ID:		G2	QA1		G2	QA2		E11	QA3		PUMP	QA1 (QA100)		W7M	QA2 (QA101)		W7M	QA3 (QC200)		PUMP	QA100		W7M
	Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow
Analyte grouping / Analyte	**Units**	**LOR**																						
Soluble Fluoride	mg/L	0.1	0.28	0.28	*0.0*	0.28	0.4	*35.3*	230	240	*4.3*	200	210	*4.9*	810	850	*4.8*	810	895	*10.0*	680	670	*1.5*	660
Free Cyanide	mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	0.005	0.005	*0.0*	<0.08	<0.08	*NC*	<2	<4	*NC*	<2	<0.040	*NC*	0.029	0.027	*7.1*	<0.04
Total Cyanide	mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	7.7	13	*51.2*	8.7	9.3	*6.7*	170	180	*5.7*	170	107	*45.5*	110	100	*9.5*	100
Aluminium (total)	mg/L	0.01	2.9	2.8	*3.5*	2.9	1.62	*56.6*	5	5.2	*3.9*	120	120	*0.0*	32	3.4	*161.6*	32	3.42	*161.4*	610	6,200	*164.2*	8700
Aluminium (dissolved)	mg/L	0.01	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR)
Shaded cells exceed RPD >30%
NC = not calculated as one or more results are below the LOR.

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:		Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-lboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate
	Sample Type:		Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater
	Sample date:		Sep-15		Sep-15	Sep-15		Dec-15	Dec-15		Dec-15	Dec-15		Apr-16	Apr-16		Apr-16	Apr-16		Apr-16	Apr-16		Jul-16	Jul-16
	Sample ID:		QA101		W7M	QA200		W2D	QA101		W2D	QA201		G2	QA101		G2	QA201		E11	QA102		G2	QC101
	Project Name:		Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow
Analyte grouping / Analyt	**Units**	**LOR**																					
Soluble Fluoride	mg/L	0.1	13	*192.3*	660	648	*1.8*	1300	1200	*8.0*	1300	1300	*0.0*	0.2	0.2	*0.0*	0.2	0.3	*40.0*	120	120	*0.0*	0.3	0.3
Free Cyanide	mg/L	0.004	<0.004	*NC*	<0.04	<0.04	*NC*	0.88	0.67	*27.1*	0.88	0.7	*22.8*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004
Total Cyanide	mg/L	0.004	1.9	*192.5*	100	56.9	*54.9*	290	300	*3.4*	290	290	*0.0*	0.046	0.038	*19.0*	0.046	<0.004	*NC*	15	15	*0.0*	<0.004	<0.004
Aluminium (total)	mg/L	0.01	2100	*122.2*	8700	2270	*117.2*	3.5	3	*15.4*	3.5	2.8	*22.2*	9.6	8.9	*7.6*	9.6	10	*4.1*	7.6	9.4	*21.2*	1.2	1.2
Aluminium (dissolved)	mg/L	0.01	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR)
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NC = not calculated as one or more results are below the LO

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:			RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%
	Sample Type:				Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater	
	Sample date:				Jul-16	Jul-16		Jul-16	Jul-16		Oct-16	Oct-16		Oct-16	Oct-16		Oct-16	Oct-16		Dec-16	Dec-16		Dec-16	Dec-16	
	Sample ID:				G2	QC102		W7M	QC100		W5D	QA100		W5D	QA200		A7	QA101		N2	2DUP		F5	5DUP	
	Project Name:				Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
	Sampling Method:				Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow	
Analyte grouping / Analyte		**Units**	**LOR**																						
Soluble Fluoride		mg/L	0.1	*0.0*	0.3	0.2	*40.0*	870	900	*3.4*	0.5	0.4	*22.2*	0.5	0.5	*0.0*	390	390	*0.0*	0.8	0.7	13.3	<0.1	<0.1	*NC*
Free Cyanide		mg/L	0.004	*NC*	<0.004	<0.004	*NC*	0.072	0.084	*15.4*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	0.03	0.03	*0.0*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*
Total Cyanide		mg/L	0.004	*NC*	<0.004	<0.004	*NC*	250	260	*3.9*	0.005	0.005	*0.0*	0.005	<0.003	*NC*	76	94	*21.2*	0.12	0.098	20.2	<0.004	<0.004	*NC*
Aluminium (total)		mg/L	0.01	*0.0*	1.2	0.79	*41.2*	0.08	0.08	*0.0*	0.14	0.1	*7.4*	0.14	0.14	*0.0*	2.1	2.2	*4.7*	5.9	5.6	5.2	2.3	2.2	4.4
Aluminium (dissolved)		mg/L	0.01	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR)
Shaded cells exceed RPD >30%
NC = not calculated as one or more results are below the LO

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:		Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary
	Sample Type:		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater
	Sample date:		Mar-17	Mar-17		Mar-17	Mar-17		Mar-17	Mar-17		Jun-17	Jun-17		Jun-17	Jun-17		Jun-17	Jun-17		Sep-17	Sep-17		Sep-17
	Sample ID:		E5D	DUP1		E5D	TRIP1		W6D	DUP2		N8	DUP1		G2	TRIP1		G2	DUP2		G2	DUP1		G2
	Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow
Analyte grouping / Analyte		**Units**	**LOR**																					
Soluble Fluoride		mg/L	0.1	22	19	14.6	22	21.9	0.5	1.4	0.5	94.7	0.4	0.4	0.0	0.2	0.3	40.0	0.2	0.3	40.0	0.3	0.3	0.0	0.3
Free Cyanide		mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
Total Cyanide		mg/L	0.004	5.5	2.3	82.1	5.5	3.04	57.6	0.043	0.043	0.0	<0.004	0.2	*NC*	<0.004	<0.004	*NC*	<0.004	0.004	*NC*	<0.004	<0.004	*NC*	<0.004
Aluminium (total)		mg/L	0.01	64	26	84.4	64	13.1	132.0	1.1	0.8	31.6	3.9	4.9	22.7	6.6	1.04	145.5	6.6	9.4	35.0	1.8	4.9	92.5	1.8
Aluminium (dissolved)		mg/L	0.01	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-

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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:		Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate
	Sample Type:		Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater
	Sample date:		Sep-17		Sep-17	Sep-17		Dec-17	Dec-17		Dec-17	Dec-17		Dec-17	Dec-17		Mar-18	Mar-18		Mar-18	Mar-18		Mar-18	Mar-18
	Sample ID:		TRIP1		N8	DUP2		W2D	DUP1		W2D	TRIP1		G2	DUP2		F6	DUP1		G5	TRIP1		G5	DUP2
	Project Name:		Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow
Analyte grouping / Analyte		**Units**	**LOR**																					
Soluble Fluoride		mg/L	0.1		0.4	28.6	0.4	0.4	0.0	1200	1200	0.0	1200	1430	17.5	0.4	0.4	0.0	0.9	1	10.5	0.2	0.2	0.0	0.2	0.2
Free Cyanide		mg/L	0.004		<0.004	*NC*	<0.004	<0.004	*NC*	0.006	0.012	66.7	0.006	<1	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004
Total Cyanide		mg/L	0.004		<0.004	*NC*	0.41	0.027	175.3	200	230	14.0	200	268	29.1	<0.004	<0.004	*NC*	0.024	0.023	4.3	<0.004	<0.004	*NC*	<0.004	<0.004
Aluminium (total)		mg/L	0.01		0.82	74.8	25	26.0	3.9	0.28	0.25	11.3	0.28	<100	*NC*	1.7	1.4	19.4	0.16	0.13	20.7	0.19	0.17	11.1	0.19	0.15
Aluminium (dissolved)		mg/L	0.01		-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR)
Shaded cells exceed RPD >30%
NC = not calculated as one or more results are below the LC

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:			Primary	Intra-laboratory Duplicate		Primary	Inter-laboratory Duplicate		Primary	Intra-laboratory Duplicate		Primary	Intra-laboratory Duplicate		Primary	Inter-laboratory Duplicate		Primary	Intra-laboratory Duplicate		Primary	Intra-laboratory Duplicate	
	Sample Type:			Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater	
	Sample date:		RPD%	Jun-18	Jun-18	RPD%	Jun-18	Jun-18	RPD%	Jun-18	Jun-18	RPD%	Sep-18	Sep-18	RPD%	Sep-18	Sep-18	RPD%	Sep-18	Sep-18	RPD%	Dec-18	Dec-18	RPD%
	Sample ID:			E5D	QA101		W1D	QA102		W1D	QA103		W3D	QA101		G2	QA102		G2	QA103		E5D	QA101	
	Project Name:			Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
	Sampling Method:			Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow	
Analyte grouping / Analyte	**Units**	**LOR**																					
Soluble Fluoride	mg/L	0.1	0.0	14	14	0.0	5.1	5.9	14.5	5.1	5.1	0.0	0.1	0.1	0.0	0.4	0.4	0.0	0.4	0.4	0.0	11	11	0.0
Free Cyanide	mg/L	0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.005	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*
Total Cyanide	mg/L	0.004	*NC*	1.6	1.7	6.1	0.69	0.532	25.9	0.7	0.7	4.3	<0.004	<0.004	*NC*	0.006	0.006	0.0	0.006	0.01	50.0	0.81	0.82	1.2
Aluminium (total)	mg/L	0.01	23.5	4.1	3.8	7.6	0.88	0.58	41.1	0.88	0.93	5.5	0.9	1.0	5.4	0.57	0.49	15.1	0.57	0.37	42.6	0.72	0.6	18.2
Aluminium (dissolved)	mg/L	0.01	*NC*	<0.01	<0.01	*NC*	0.14	0.1	33.3	0.1	0.1	0.0	0.9	1.0	9.4	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	0.03	0.02	40.0

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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:		Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary
	Sample Type:		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater
	Sample date:		Dec-18	Dec-18		Dec-18	Dec-18		Mar-19	Mar-19		Mar-19	Mar-19		Mar-19	Mar-19		Jun-19	Jun-19		Jun-19	Jun-19		Jun-19
	Sample ID:		W1D	QA103		W1D	QA102		W5D	QA101		G5	QA103		W5D	QA102		G2	QA101		F6	QA102		F6
	Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow
Analyte grouping / Analyte		**Units**	**LOR**																					
Soluble Fluoride		mg/L	0.1	4.8	5.7	17.1	4.8	4.8	0.0	0.3	0.3	0.0	<0.1	0.1	*NC*	0.3	0.5	50.0	0.3	0.3	0.0	0.5	0.5	0.0	0.5
Free Cyanide		mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
Total Cyanide		mg/L	0.004	0.67	0.171	118.7	0.67	0.45	39.3	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
Aluminium (total)		mg/L	0.01	0.43	0.76	55.5	0.43	0.51	17.0	0.44	0.38	14.6	0.3	0.3	12.9	0.44	0.36	20.0	0.7	0.7	0.0	0.05	0.04	22.2	0.05
Aluminium (dissolved)		mg/L	0.01	0.25	<0.01	*NC*	0.25	0.21	17.4	<0.01	<0.01	*NC*	30.0	30.0	0.0	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01

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Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

RAMBOLL

	Duplicate Type:		Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate
	Sample Type:		Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater
	Sample date:		Jun-19		Sep-19	Sep-19		Sep-19	Sep-19		Sep-19	Sep-19		Dec-19	Dec-19		Dec-19	Dec-19		Dec-19	Dec-19		Mar-20	Mar-20
	Sample ID:		QA103		F6	QA101		G5	QA102		G5	QA103		G2	QA101		G5	QA102		G5	QA103		F6	D01
	Project Name:		Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Groundwater M	Groundwater M		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow
Analyte grouping / Analyt	**Units**	**LOR**																						
Soluble Fluoride	mg/L	0.1	0.5	0.0	0.5	0.5	0.0	0.2	0.3	40.0	0.2	0.3	40.0	0.3	<0.1	*NC*	0.1	<0.1	*NC*	0.1	0.1	0.0	0.6	0.6
Free Cyanide	mg/L	0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004
Aluminium (total)	mg/L	0.01	0.08	46.2	0.12	0.18	40.0	0.29	0.32	9.8	0.29	0.48	49.4	1.3	1.2	8.0	0.41	0.37	10.3	0.41	0.29	34.3	0.03	0.02
Aluminium (dissolved)	mg/L	0.01	<0.01	*NC*	<0.01	<0.01	*NC*	*0.01*	<0.01	*NC*	0.01	<0.01	*NC*	<0.01	<0.01	*NC*	0.02	0.02	0.0	0.02	0.02	0	<0.01	<0.01

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Project No: 318001103
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Project Name: 2021 Annual Groundwater Monitoring Report
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01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:			Primary	Intra-laboratory Duplicate		Primary	Inter-laboratory Duplicate		Primary	Intra-laboratory Duplicate		Primary	Intra-laboratory Duplicate		Primary	Inter-laboratory Duplicate		Primary	Intra-laboratory Duplicate		Primary	Intra-laboratory Duplicate	
	Sample Type:			Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater	
	Sample date:		RPD%	Mar-20	Mar-20	RPD%	Mar-20	Mar-20	RPD%	Jun-20	Jun-20	RPD%	Jun-20	Jun-20	RPD%	Jun-20	Jun-20	RPD%	Sep-20	Sep-20	RPD%	Sep-20	Sep-20	RPD%
	Sample ID:			G5	D02		G5	T01		G2	D01_170620		F6	D02_180620		F6	T01_180620		G2	DUP1		G5	DUP2	
	Project Name:			Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
	Sampling Method:			Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow	
Analyte grouping / Analyte	**Units**	**LOR**																						
Soluble Fluoride	mg/L	0.1	0.0	0.2	0.3	40.0	0.2	0.3	40.0	0.3	0.3	0.0	0.5	0.5	0.0	0.5	0.6	18.2	0.2	0.3	40.0	<0.1	0.1	*NC*
Free Cyanide	mg/L	0.004	*NC*	<0.004	<0.04	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*
Total Cyanide	mg/L	0.004	*NC*	<0.004	<0.04	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.008	*NC*
Aluminium (total)	mg/L	0.01	40.0	0.11	0.08	31.6	0.11	0.12	8.7	1	1	0.0	0.04	0.05	22.2	0.04	0.06	40.0	1.9	1.7	11.1	0.07	0.08	13.3
Aluminium (dissolved)	mg/L	0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	0.03	0.03	0.0

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01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:		Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary
	Sample Type:		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater
	Sample date:		Sep-20	Sep-20		Dec-20	Dec-20		Dec-20	Dec-20		Dec-20	Dec-20		Mar-21	Mar-21		Mar-21	Mar-21		Mar-21	Mar-21		Jun-21
	Sample ID:		G5	TRIP1		W6D	D01_20201208		W6D	T01_20201208		F6	D02_091220		W2D	D01_20210317		F5	D02_20210325		W2D	T01_20210317		G2
	Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow
Analyte grouping / Analyt		**Units**	**LOR**																					
Soluble Fluoride		mg/L	0.1	<0.1	<0.1	*NC*	<0.1	<0.1	*NC*	<0.1	0.1	*NC*	0.6	0.7	*15.4*	1000	920	8.3	0.2	0.2	0.0	1000	930	7.3	0.3
Free Cyanide		mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	0.005	0.005	0.0	<0.004	<0.004	*NC*	0.005	0.006	18.2	<0.004
Total Cyanide		mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	0.008	0.007	*13.3*	120	120	0.0	<0.004	<0.004	*NC*	120	100	18.2	<0.004
Aluminium (total)		mg/L	0.01	0.07	0.07	0.0	3.2	2.6	20.7	3.2	1.46	74.7	0.03	0.03	0.0	1.6	1.4	13.3	2.6	2.6	0.0	1.6	1.1	**37.0**	0.73
Aluminium (dissolved)		mg/L	0.01	0.03	0.02	40.0	0.02	0.02	0.0	0.02	0.01	66.7	<0.01	<0.01	*NC*	0.73	0.69	5.6	2.2	2.2	0.0	0.73	0.72	1.4	<0.01

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Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:		Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary
	Sample Type:		Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater
	Sample date:		Jun-21		Jun-21	Jun-21		Jun-21	Jun-21		Sep-21	Sep-21		Sep-21	Sep-21		Sep-21	Sep-21		Dec-21	Dec-21		Dec-21
	Sample ID:		D01_20210615		F6	D02_20210616		G2	T01_20210615		E5D	D01_20210920		W5D	D02_20210921		E5D	T01_20210920		W5D	D01_20211202		G5
	Project Name:		Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow
Analyte grouping / Analyt	**Units**	**LOR**																					
Soluble Fluoride	mg/L	0.1	0.3	0.0	0.3	0.6	**66.7**	0.3	0.3	0.0	7.6	7.7	1.3	0.3	0.3	0.0	7.6	<0.0001	*NC*	0.5	0.5	0.0	0.3
Free Cyanide	mg/L	0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.00004	*NC*	<0.004	<0.004	*NC*	<0.004
Total Cyanide	mg/L	0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	0.17	0.2	16.2	<0.004	<0.004	*NC*	0.17	0.00126	**197.1**	<0.004	<0.004	*NC*	<0.004
Aluminium (total)	mg/L	0.01	1.9	**89.0**	2.7	0.008	**198.8**	0.73	1.3	**56.2**	0.42	0.37	12.7	0.27	0.4	**38.8**	0.42	0.26	**47.1**	0.38	0.28	**30.3**	0.06
Aluminium (dissolved)	mg/L	0.01	<0.01	*NC*	2	<0.01	*NC*	<0.01	<0.01	*NC*	0.02	0.01	**66.7**	<0.01	0.01	*NC*	0.02	0.01	**66.7**	0.02	0.02	0.0	0.03

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01-02-22

Table vi: Results
Shallow Aquifer, Background

	Duplicate Type:		Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%
	Sample Type:		Groundwater		Groundwater	Groundwater	
	Sample date:		Dec-21		Dec-21	Dec-21	
	Sample ID:		D02_20211202		W5D	101_20211201	
	Project Name:		Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
	Sampling Method:		Low-flow		Low-flow	Low-flow	
Analyte grouping / Analy	**Units**	**LOR**					
Soluble Fluoride	mg/L	0.1	0.3	0.0	0.5	0.3	**50.0**
Free Cyanide	mg/L	0.004	<0.004	*NC*	<0.004	<0.004	*NC*
Total Cyanide	mg/L	0.004	<0.004	*NC*	<0.004	<0.004	*NC*
Aluminium (total)	mg/L	0.01	0.04	**40.0**	0.38	0.1	**116.7**
Aluminium (dissolved)	mg/L	0.01	0.03	0.0	0.02	<0.01	*NC*

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR
Shaded cells exceed RPD >30%
NC = not calculated as one or more results are below the L

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

			Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17
	Sample Type:		Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank
	Sample date:		Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17
	Sample ID:		QB1	QA4 (QA300)	QA300	QA301	QA301	QA300	QA300	BLANK	BLANK	BLANK	BLANK
	Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Analyte grouping / Analy	**Units**	**LOR**											
Soluble Fluoride	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Free Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	mg/L	0.01	*0.05*	<0.01	<0.01	*0.02*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium (dissolved)	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-

			Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20
	Sample Type:		Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank
	Sample date:		Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20
	Sample ID:		BLANK	BLANK	QC101	QC101	QC101	QC101	R01	QC101	QC101	R01	R01_180320
	Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Analyte grouping / Analy	**Units**	**LOR**											
Soluble Fluoride	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Free Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	mg/L	0.01	0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium (dissolved)	mg/L	0.01	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

LOR = Limit of Reporting

<value = Less than the laboratory Limit of Reporting (LOR)

Shaded cells indicate when above the acceptance criteria for Trip Spikes/Blanks and Rinsates

Project No: 318001103
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2021 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
01-02-22

Table vi: Results
Shallow Aquifer, Background

	Sample Type:			Rinsate Blank	Rinsate Blank
	Sample date:			Sep-20	Dec-20
	Sample ID:			R01_20200923	R01_091220
	Project Name:			Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Analyte grouping / Analy	**Units**	**LOR**			
Soluble Fluoride	mg/L	0.1		<0.1	<0.1
Free Cyanide	mg/L	0.004		<0.004	<0.004
Total Cyanide	mg/L	0.004		<0.004	<0.004
Aluminium (total)	mg/L	0.01		<0.01	<0.01
Aluminium (dissolved)	mg/L	0.01		<0.01	<0.01

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR
Shaded cells indicate when above the acceptance criteria for Trip Spikes/Blanks and Rinsates

APPENDIX 4
FIELD PARAMETER FORMS

No.	Well ID	Well Depth (m)	Notes (March) 2021
1	A7	4.32	25/03/21
2	E11	4.82	17/03/21
3	E4	3.4	25/03/21
4	E5	2.57	17/03/21
5	E5D	5.44	17/03/21
6	F5	7.37	25/03/21
7	F6	15.48	18/03/21
8	G2	13.42	17/03/21
9	G5	11.31	25/03/21
10	G6	7.14	18/03/21
11	N2	5.62	17/03/21
12	N8	5.3	17/03/21
13	N9	2.83	17/03/21
14	PUMP	3.45	17/03/21
15	W1D	10.38	25/03/21
16	W1S	2.41	25/03/21
17	W2D	6.36	17/03/21
18	W2S	2.37	17/03/21
19	W3D	10.08	25/03/21 → unable to be sampled
20	W3S	2.55	25/03/21
21	W3SA	0.5	destroyed
22	W4D	10	destroyed
23	W4S	1.12	25/03/21
24	W5D	10.54	17/03/21
25	W5S	1.7	17/03/21
26	W6D	8.8	17/03/21
27	W6S	3.1	Dry
28	W7M	3.72	17/03/21
29	W7S	2.3	Dry

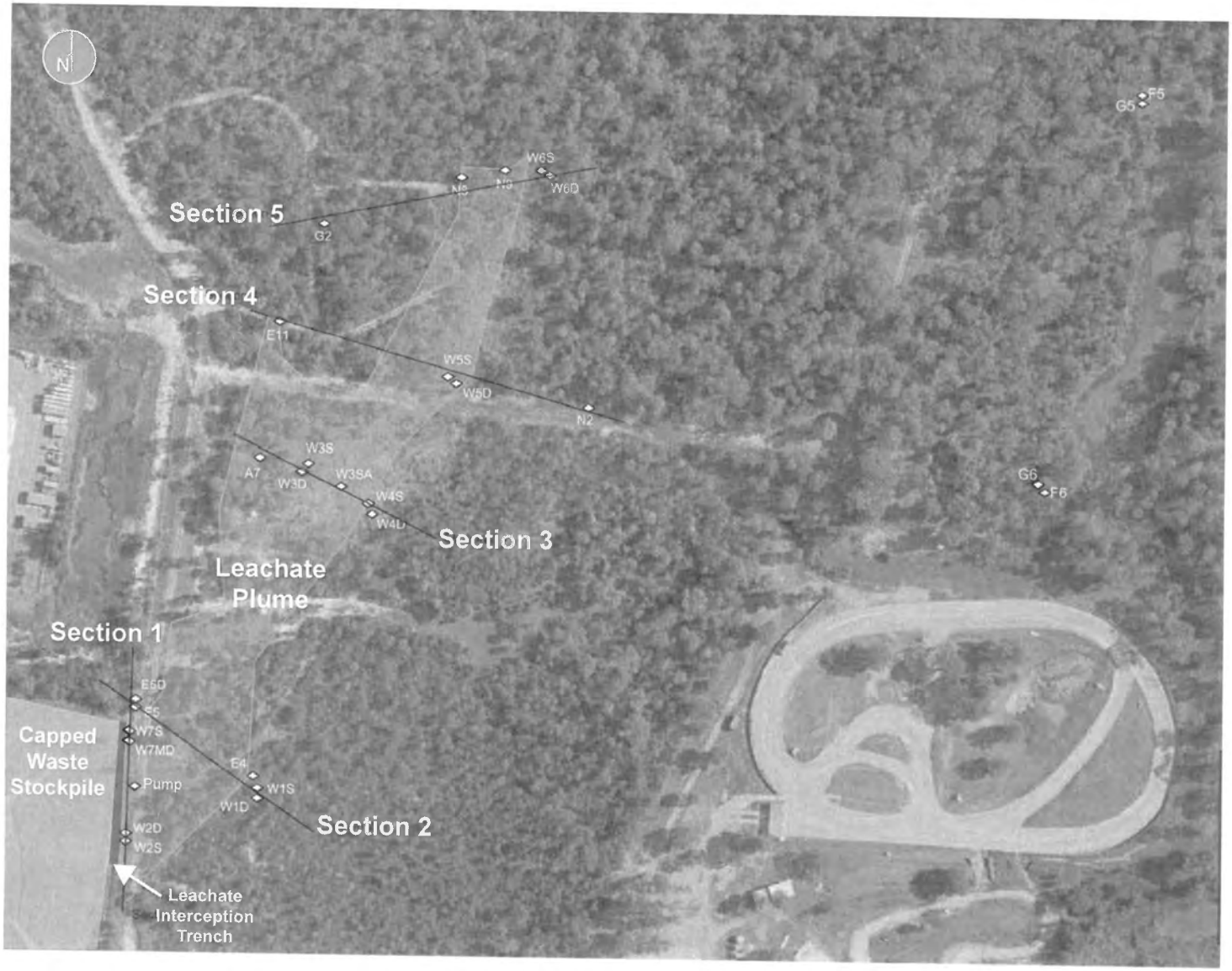

Figure 2 | Groundwater Monitoring Well Network, 2019 Annual Groundwater Monitoring Report

RAMBOLL

Daily Field Report

Project Name:	Quarterly GW Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/2021		
Start time:	7.00am	Subcontractors:	
Finish time:	2.10pm		
Weather:	overcast, raining - top of 22°C		

BoM

Field Report:

7.00am - JAB arrived onsite to meet Glenn and load gear into Glenn's work ute.

7.30am - JAB and Glenn commence sampling of GW wells on Section 1, Section 5 and most of Section 4.

1.30pm - JAB and Glenn call it a day on Section 4, well N2.

1.55pm - JAB and Glenn transfer gear off Glenn's ute

2.10pm - JAB leaves site for today.

Wells completed:

W2S, W2D, PUMP, W7S, W7M, E5, E5D, G2, N8, N9, W6D, W6S, E11, W5S, W5D, N2,

QA/QC

DO1 - 20210317 Primary sample W2D
TO1 - 20210317

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W25

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	7.30am	Subcontractors:	
Finish time:	7.50am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.23m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.38m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)
7.47	0.4		2.38	19.13	7.19	4170	4.48	-3	2.66	766	turbid, light brown, no odour

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Purge dry – only one lot of field parameters recorded and samples taken from flow cell

Well Head Integrity: Final water level 2.38 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W2D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021
Project No:	318001103
Date:	17/03/21
Start time:	7.50am
Finish time:	8.30am

Ramboll Personnel: J Bourke

Subcontractors:

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.25m	m	
Correction:		m	IP Probe
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.36m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)
7:58	0.75		2.51	19.19	9.75	29900	1.32	-266	18.3	145	Slightly turbid, brown, strong odour
8.02	0.75		2.72	19.45	9.73	30100	0.42	-262	18.59	230	〃 〃
8.06	0.75		3.02	19.01	9.72	30200	0.18	-370	18.4	221	
8.12	0.75		3.28	18.98	9.72	30200	0.06	-379	18.4	156	

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: DOL-20210317 and TOI-20210317 taken from this well

Well Head Integrity: Final water level 3.88mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: PUMP

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	8.30am	Subcontractors:	
Finish time:	9.05am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.15m	m	
Correction:		m	IP Probe
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.45m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.40	0.45		2.23	18.45	8.45	725	3.33	39	0.465	95.4	turbid, pale black/grey/brown, strong odour
8.45	0.45		2.28	18.54	7.55	774	0.57	-11	0.494	86.1	" "
8.48	0.45		2.31	18.59	7.54	737	0.48	-7	0.471	83.8	" "
8.52	0.45		2.36	18.69	7.84	628	0.39	2	0.387	84.7	" "
8.55	0.45		2.42	18.76	7.89	516	0.35	5	0.329	331	" "
8.58	0.45		2.46	18.88	7.90	483	0.40	5	0.313	274	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.56mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast/Rain

Other:

PERTH
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East Perth WA 6004
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: WTM

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	9.13am	Subcontractors:	
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.62m	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.72m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (~~mS/cm~~ g/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.23	0.95		2.97	20.51	9.55	23800	1.01	-239	15.0	28.3	slightly turbid, dark brown, strong odour
9.26	0.95		3.10	20.60	9.52	22100	0.77	-233	13.8	23.7	" "
9.28	0.95		3.19	20.67	9.48	20800	0.35	-298	12.9	17.6	" "
9.30	0.95		3.21	20.68	9.47	20800	0.17	-280	12.9	11.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.21 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W75

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	9.10am	Subcontractors:	
Finish time:	9.12am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.32m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.32m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Dry. Not sampled

Well Head Integrity:

Samples Filtered: N/A

Weather Conditions: Overcast

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	9.40am	Subcontractors:	
Finish time:	9.56am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.39m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.59m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.49	0.45		2.59	20.7	8.89	20100	1.26	196	12500	118	Slightly turbid brown, no odour

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Well purge dry - one set of field readings taken and sampled - from flow cell

Well Head Integrity: Final water level 2.59mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast/Raining

Other:

PERTH
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/3/21		
Start time:	9.57am	Subcontractors:	
Finish time:	10.14am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.40m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.44m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (~~mS/cm~~)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10:03	0.45		2.60	19.42	6.79	15200	2.29	-72	9.42	414	Medium turbid, yellow brown, strong odour
10:06	0.45		2.64	19.58	6.77	15300	1.12	-86	9.52	425	〃 〃
10:09	0.45		2.69	19.70	6.77	15400	0.69	-91	9.53	404	〃 〃

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.74 mbTOC

Samples Filtered: metals

Weather Conditions: overcast

Other:

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The Junction NSW 2291
Ph: 02 4962 5444

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: G2

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	10.20am	Subcontractors:	
Finish time:	10.48am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	8.52	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	13.37 m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:		End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS ~~(mS/cm)~~ g/L	Turbidity (NTU)	Comments (Appearance, colour and odour)
10:30	0.75		8.62	19.15	6.04	6120	1.19	-13	3.86	133	Slightly turbid, pale grey,
10:33	0.75		8.63	19.01	6.00	6100	0.61	-13	3.84	129	
10.36	0.75		8.63	18.95	6.00	6120	0.34	-6	3.85	144	

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 8.56 mbTOC
Samples Filtered: Metals
Weather Conditions: Overcast
Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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The Junction NSW 2291
Ph: 02 4962 5444

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N8

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	11:58am	Subcontractors:	
Finish time:	12:14am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.42m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.28m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS ~~(mS/cm)~~ g/L	Turbidity (NTU)	Comments (Appearance, colour and odour)
12:02	0.75		3.65	20.76	6.54	10600	6.01	-108	6.52	244	turbid, yellow/orange/brown, slight odour
12:05	0.75		3.80	21.24	6.53	10500	5.41	-107	6.52	261	" "
12:07	0.75		3.89	21.37	6.54	10500	4.20	-110	6.54	265	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 4.11mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N9

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	10:53am	Subcontractors:	
Finish time:	11.10am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.20m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.83m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (~~mS/cm~~ g/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.00	0.45		2.57	20.10	8.19	10400	0.45	-234	6.48	130	low turbid, pale brown/yellow chocolate, strong odour
11.02	0.45		2.68	20.12	8.20	10500	0.37	-232	6.51	63.4	" "
11.05	0.45		2.78	20.14	8.21	10700	0.56	-216	6.62	29.4	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Purged dry after samples taken

Well Head Integrity: Final water level 2.83 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

HUNTER
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The Junction NSW 2291
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: WGD

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	11:15am	Subcontractors:	
Finish time:	11:49am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.97m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	8.87m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (~~mS/cm~~ g/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11:37	0.75		5.30	20.09	5.79	1240	1.33	72	0.797	1000	very turbid, pale brown/grey, no odour
11:40	0.75		6.40	19.82	5.79	1240	0.77	73	0.795	1000	" "
11:43	0.75		6.75	19.83	5.79	1250	0.65	70	0.799	1000	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: NOTE: Turbidity maxed out at 1000 NTU for WQM. very turbid and hard to filter

Well Head Integrity: Final water level 6.45 mbTOC

Samples Filtered: Metals

Weather Conditions: Sunny/Overcast

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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The Junction NSW 2291
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W65

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	11:51 am	Subcontractors:	
Finish time:	11:52 am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.10m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.12m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Unable to be sampled – DRY

Well Head Integrity: Final water level - N/A

Samples Filtered: N/A

Weather Conditions: Sunny/Overcast

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E11

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	12:20am	Subcontractors:	
Finish time:	12:34am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.08m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.79m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12:25	0.75		3.12	20.82	8.38	12400	1.30	-124	7.67	73.4	low turbid, pale yellow, strong odour
12:27	0.75		3.12	20.88	8.37	12400	0.46	-151	7.70	67.1	〃 〃
12:29	0.75		3.12	20.80	8.34	12300	0.29	-152	7.63	61.3	〃 〃
12:31	0.75		3.12	20.77	8.30	12300	0.19	-151	7.58	59.9	〃 〃

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.12 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
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East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
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Ph: 02 9954 8100

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W5S

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/3/21		
Start time:	12:40pm	Subcontractors:	
Finish time:	12:56pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.52m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.71m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (~~mS/cm~~) g/L	Turbidity (NTU)	Comments (Appearance, colour and odour)
12:48	0.45		1.61	21.55	7.19	2750	6.08	170	1.77	892	very turbid, brown, no odour
12:48	0.2		1.70	21.47	7.20	2710	8.68	149	1.72	946	

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: very hard to filter well purged dry - samples collected from flow cell

Well Head Integrity: Final water level

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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The Junction NSW 2291
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W5D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	12:57pm	Subcontractors:	
Finish time:	1.23pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.03m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.65m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (~~mS/cm~~ g/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
13:04	0.45		6.59	20.44	6.02	6220	1.66	7	3.92	342	clear, colourless, slight odour
13:09	0.45		6.92	20.18	5.94	6500	0.48	12	4.10	335	" "
13:13	0.45		7.15	20.12	5.94	6540	0.47	12	4.12	328	" "
13.16	0.45		7.33	20.02	5.95	6530	0.19	10	4.12	329	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 7.45 mbTOC
Samples Filtered:	Metals
Weather Conditions:	Overcast
Other:	

PERTH
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East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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The Junction NSW 2291
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N2

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	17/03/21		
Start time:	1.25pm	Subcontractors:	
Finish time:	1.56pm		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.87m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.62m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)
13:33	0.45		5.14	19.45	4.13	7280	2.02	283	4.59 5.72	1000	very turbid, yellow/brown/grey, no odour
13:37	0.45		5.22	19.68	4.06	7320	0.71	292	4.62	1000	"
13:42	0.45		5.47	19.41	3.95	7180	0.39	311	4.52	1000	" "
13:45	0.45		5.55	19.29	3.94	6880	0.38	318	4.33	1000	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: NOTE: Turbidity maxed out meter at 1000NTU. Hard to filter. well purged dry - sampled from flow cell

Well Head Integrity: Final water level 5.62mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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The Junction NSW 2291
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RAMBOLL

Daily Field Report

Project Name:	Quarterly GW Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	18/03/21		
Start time:	6.30am	Subcontractors:	
Finish time:	8.45am		
Weather:	Raining - HEAVY & CONSTANT		

BoM

Field Report:

6.30am JAB arrives onsite and transfers gear into Glenn's ute

7.00am Commence sampling by completing F6 and G6

8.30am JAB and Glenn call it a day and postpone sampling remaining when weather is better. Gear transfered out of Glenn's ute

8.45am JAB leaves site.

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

HUNTER
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The Junction NSW 2291
Ph: 02 4962 5444

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: F6

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	18/03/21		
Start time:	6.54am	Subcontractors:	
Finish time:	7.46am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.17m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	15.48m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS ~~(mS/cm)~~	Turbidity (NTU)	Comments (Appearance, colour and odour)
7:27	0.45		5.78	18.40	6.52	9900	1.40	-62	6.24	21.3	clear, colourless, strong odour
7:30	0.45		5.95	18.45	6.55	9770	0.89	-64	6.16	15.0	" "
7:33	0.45		6.19	18.29	6.50	9980	0.69	-66	6.29	10.6	" "
7:36	0.45		6.39	18.28	6.49	1000	0.36	-73	6.20	7.5	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: final water level 6.68 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast / Raining

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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The Junction NSW 2291
Ph: 02 4962 5444

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: G6

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	18/03/21		
Start time:	7.55am	Subcontractors:	
Finish time:	8.15am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.27m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.08m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)
7:51	0.45		5.38	18.42	5.37	7680	3.95	-1	4.84	42.6	Slightly turbid, black/ grey, strong odour
7.54	0.45		5.38	18.33	4.92	7750	1.01	35	4.88	30.6	" "
7.57	0.45		5.39	18.25	4.63	7710	0.47	71	4.86	24.1	" "
7.59	0.45		5.41	18.22	4.35	7700	0.27	90	4.85	15.9	" "
8.01	0.45		5.42	18.23	4.26	7690	0.14	89	4.85	12.8	" "
8.03	0.45		5.43	18.17	4.22	7690	0.09	84	4.85	13.5	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 5.45mbTOC

Samples Filtered: Metals

Weather Conditions: Raining

Other:

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Daily Field Report

Project Name:	Quarterly GW Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/2021		
Start time:	7.00am	Subcontractors:	
Finish time:			
Weather:	Fine/Sunny - top of 26°C		

BoM

Field Report:

7.00am JAB arrives onsite and meets Glenn to transfer sampling gear into Glenn's ute

7.30am JAB and Glenn commence GW sampling

12.00pm JAB and Glenn complete sampling, and transfer gear off Glenn's ute

12.40pm JAB leaves site

Wells completed:

F5, G5, A7, W3S, W3D, W4S, E4, W1S, W1D

QA/QC

DO2_20210325 → primary sample F5

RO1_20210325 → Rinsate

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: F5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/21		
Start time:	7.43am	Subcontractors:	
Finish time:	8.23am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.15m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.37m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm) g/L	Turbidity (NTU)	Comments (Appearance, colour and odour)
7:50	0.45		2.36	18.18	7.80	12100	1.91	24	7.50	13.6	clear to slightly turbid, colourless/
7:53	0.45		2.41	18.32	7.73	12100	1.10	-20	7.51	12.6	grey, slight odour
7.57	0.45		2.45	18.30	7.62	12100	0.72	-26	7.50	11.8	" "
8.00	0.45		2.49	18.33	7.63	12100	0.50	-33	7.50	11.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: DO2_20210325 taken here

Well Head Integrity: Final water level 2.50mbTOC

Samples Filtered: Metals

Weather Conditions: Fine

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: G5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/21		
Start time:	8.26am	Subcontractors:	
Finish time:	8.52am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.13m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	11.31m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS ~~(mS/cm)~~ g/L	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.36	0.45		2.32	17.43	5.37	7190	1.85	3	4.52	12.6	Clear, colourless, no odour
8.39	0.45		2.83	17.93	5.32	7260	1.04	9	4.58	8.7	" "
8.43	0.45		2.59	17.84	5.28	7290	0.58	11	4.59	7.1	" "
8.47	0.45		2.68	18.00	5.26	7290	0.34	14	4.60	5.2	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.73 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W35

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/21		
Start time:	9.10am	Subcontractors:	
Finish time:	9.32am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.11m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.55m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (~~mS/cm~~) g/L	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.16	0.75		1.38	19.72	7.20	6830	2.52	263	4.40	28.5	turbid, yellow/brown, no odour
9.18	0.75		1.47	19.87	7.19	5500	2.97	278	3.44	22.4	" "
9.21	0.75		1.52	19.85	7.15	5770	2.58	281	3.68	56.4	" "
9.24	0.75		1.56	19.82	7.14	6590	1.83	275 ~~277~~	4.14	58.2	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 1.55mbTOC
Samples Filtered:	Metals
Weather Conditions:	Fine/Sunny
Other:	

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W3D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/21		
Start time:	9.32am	Subcontractors:	
Finish time:	9.46am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	Unknown	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth		m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Unable to be sampled. Unable to get IP Probe or tubing further than 4.62mbTOC

Well Head Integrity:

Samples Filtered:

Weather Conditions: Fine/Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: A7

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/21		
Start time:	10.00am	Subcontractors:	
Finish time:	10.22am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.35m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.30m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS ~~(mS/cm)~~ 572	Turbidity (NTU)	Comments (Appearance, colour and odour)
10:10	0.45		1.44	20.29	9.27	17700	0.71	-371	11.0	10.3	clear, brown, strong odour
10:12	0.45		1.48	20.22	9.27	17700	0.31	-368	11.0	8.1	" "
10.14	0.45		1.54	20.19	9.26	17600	0.05	-381	10.9	8.2	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 1.61 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W45

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/21		
Start time:	10.24am	Subcontractors:	
Finish time:	10.55am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	0.84m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.12m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10.41	0.45		0.92	22.94	7.66	6630	1.12	-94	4.21	381	very turbid, brown, organic odour
10.45	0.45		1.05	22.77	7.58	6570	1.10	-109	4.04	283	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Purged well dry. Sample taken from flow cell

Well Head Integrity: Final water level 1.12mbTOC

Samples Filtered:

Weather Conditions: Fine/Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W15

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/21		
Start time:	11.04am	Subcontractors:	
Finish time:	11.27am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.80m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.41m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS ~~(mS/cm)~~ g/L	Turbidity (NTU)	Comments (Appearance, colour and odour)
11:15	0.45		1.93	22.27	7.53	15000	1.21	-51	9.59	92.7	turbid, yellow brown, no odour
11:18	0.45		2.07	22.88	7.53	14900	0.27	-131	9.31	43.8	
11.21	0.45		2.35	21.53	7.55	15400	0.1	-80	9.52 ~~8.064~~	90.9	

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Sampled from flow cell

Well Head Integrity: Final water level 2.37mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W1D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/21		
Start time:	11.28am	Subcontractors:	
Finish time:	11:47am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.87m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.40m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (mS/cm)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.32	0.75		2.33	22.17	7.36	15400	0.83	-117	9.62	13.9	clear, dark yellow, no odour
11.39	0.75		2.48	21.85	7.35	15500	0.38	-136	9.64	13.7	" "
11.41	0.75		2.58	21.63	7.38	15600	0.24	-145	9.66	12.4	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.12 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E4

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	25/03/21		
Start time:	11.50am	Subcontractors:	
Finish time:	12.21pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.17m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.41m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm	DO (mg/L)	Redox (mV)	TDS (~~mS/cm~~)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11:59	0.75		1.26	22.17	9.58	27500	1.77	-329	17.1	0.0	clear, brown, slight odour
12:01	0.75		1.29	22.04	9.57	27600	0.69	-346	17.1	0.0	" "
12:03	0.75		1.33	21.99	9.56	27900	0.22	-357	17.1	0.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 1.42 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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No.	Well ID	Well Depth (m)	Notes (June) 2021
1	A7	4.32	16/06/21
2	E11	4.82	15/06/21
3	E4	3.4	16/06/21
4	E5	2.57	15/06/21
5	E5D	5.44	15/06/21
6	F5	7.37	16/06/21
7	F6	15.48	16/06/21
8	G2	13.42	15/06/21
9	G5	11.31	16/06/21
10	G6	7.14	16/06/21
11	N2	5.62	16/06/21
12	N8	5.3	15/06/21
13	N9	2.83	15/06/21
14	PUMP	3.45	15/06/21
15	W1D	10.38	16/06/21
16	W1S	2.41	16/06/21
17	W2D	6.36	15/06/21
18	W2S	2.37	15/06/21
19	W3D	10.08	Potentially damaged (unable to be sampled March 2021)
20	W3S	2.55	16/06/21
21	W3SA	0.5	destroyed
22	W4D	10	destroyed
23	W4S	1.12	16/06/21
24	W5D	10.54	16/06/21
25	W5S	1.7	Dry
26	W6D	8.8	15/06/21
27	W6S	3.1	Dry
28	W7M	3.72	15/06/21
29	W7S	2.3	15/06/21

Unable to be sampled again June 2021

RAMBOLL

Daily Field Report

Project Name:	Quarterly GW Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	7.00am	Subcontractors:	
Finish time:	2.15pm		
Weather:	Fine/Sunny – top of 17°C		

BoM

Field Report:

7.00am JAB arrives onsite and meets Glenn. Both transfer sampling gear into Glenn's ute.

7.25am Commence GW sampling of wells W2S, W2D, PUMP, W7S, W7M, E5, E5D, G2, N9, W6D, W6S, N8 and E11

2.00pm Completed GW sampling for today. Travel back to site office. Transfer gear off Glenn's ute.

2.15pm JAB leaves site

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W25

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	7.26am	Subcontractors:	
Finish time:	8.00am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.94	m	
Correction:		m	IP Probe
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.38	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: 7.34am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
7.43	0.5		2.17	9.01	7.09	3420	2.48	180	2170	121	Slightly turbid, pale yellow/grey, no odour
7.49	0.5		2.30	8.44	7.30	3830	9.06	55	2470	160	
7.55	0.3		238	823	7.32	4100	9.15	16	2690	177	11 11

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Well purged dry. Sampled from flow cell

Well Head Integrity: Final water level 2.38 mbTOC

Samples Filtered: Metals

Weather Conditions: Sunny / Fine

Other:

PERTH
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W2D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	8.01am	Subcontractors:	
Finish time:	8.30am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.80	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.37	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	8.08am	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.11	0.5		2.15	7.38	10.12	29900	0.0	-47	18600	30.4	clear to slightly turbid, dark chocolate
8.14	0.5		2.29	9.49	10.13	28200	0.0	-84	17600	37.4	brown, no odour
8.17	0.5		2.58	11.53	10.10	27300	0.0	-116	17100	38.3	" "
8.22	0.5		2.79	10.20	10.11	28500	0.0	-146	17600	37.5	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 3.05 mBTOC
Samples Filtered:	Metals
Weather Conditions:	Fine / Sunny
Other:	

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: PUMP

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	8.33am	Subcontractors:	
Finish time:	8.56am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.70	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.45	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.36am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.37	0.5		1.72	9.78	7.01	719	0.78	-33	458	1000*	Slightly turbid, some flocculants, pale
8.42	0.5		1.74	9.75	6.82	634	0.56	-12	412	1000*	grey, no odour
8.47	0.5		1.76	9.82	6.72	564	0.33	15	359	639	" "
8.52	0.5		1.79	9.99	6.63	523	0.48	41	336	341	" "
8.57	0.5		1.81	10.13	6.61	512	0.47	47	329	310	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: * 1000 NTU max reading for turbidity on WQM

Well Head Integrity: Final water level 1.83 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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East Perth WA 6004
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W7S

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	9.01am	Subcontractors:	
Finish time:	9.29am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.07	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.32	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.10am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.13	0.5		2.21	10.53	7.32	4850	7.95	-33	3130	1000*	Very turbid, pale brown, no odour
9.19	0.5		2.32	12.37	7.24	4840	6.51	-33	3080	1000*	n n

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments * 1000 NTU max reading for turbidity on WQM
Well purged dry. Sampled from flow cell

Well Head Integrity: final water level 2.32 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W7M

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	9.32am	Subcontractors:	
Finish time:	9.48am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.19	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.81	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.35am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.38	0.5		2.53	11.45	9.92	21200	0.0	-220	13100	223	slightly turbid, dark brown,
9.41	0.5		2.71	11.92	9.85	19200	0.0	-244	12000	219	no odour " "
9.44	0.5		2.83	12.40	9.86	17900	0.0	-252	11100	167	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.97 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	9.53 am	Subcontractors:	
Finish time:	10.13 am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.97	m	
Correction:		m	IP Probe
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.58	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.57am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10.00	0.5		2.06	13.81	9.23	18000	0.0	245	11200	0.1	clear dark brown, no odour
10.03	0.5		2.17	14.20	9.20	18200	0.0	246	11200	0.0	" "
10.06	0.5		2.23	14.58	9.15	18200	0.0	245	11300	0.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.32 mbtoc

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	10.15am	Subcontractors:	
Finish time:	11.02am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.25	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.43	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 10.18am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10.28	0.5		2.46	15.39	8.97	10400	0.04	65	6410	1000+	very turbid, yellow, no odour
10.25	0.5		2.49	15.57	8.58	9930	0.0	78	6220	1000+	"
10.28	0.5		2.60	16.11	8.20	9480	0.0	71	6000	921	" "
10.34	0.5		2.67	16.98	8.20	9250	0.0	53	5850	179	turbid, yellow, no odour
10.37	0.5		2.68	17.26	8.30	9200	0.0	45	5790	110	" "
10.37	0.5		2.71	17.82	7.09	14000	0.0	-55	8670	49	" "
10.42	0.5		2.73	17.90	7.08	14000	0.0	-66	8170	54.6	" "
10.46	0.5		2.72	18.09	8.07	9390	0.0	-71	5870	63.3	" "
10.49	0.5		2.75	18.30	8.32	9260	0.0	-79	7020	73.6	" "
10.51	0.5		2.77	18.17	8.23	9660	0.0	-87	5980	26.9	clear, yellow, no odour
10.55	0.5		2.82	18.72	8.20	9490	0.0	-75	5980	22.1	" "
10.58	0.5		2.84	18.95	8.32	9460	0.0	-66	5970	9.1	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: * 1000 NTU max reading for turbidity on WQM
* field readings noted to be going up and down on WQM for this well. Stabalised as well as possible

Well Head Integrity: Final water level 2.88 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

PERTH
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East Perth WA 6004
Ph: 08 9225 5199

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: G2

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	11.12am	Subcontractors:	
Finish time:	11.49am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	8.21	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	13.42	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method:' ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 11.18am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.24	0.5		8.28	19.05	6.63	8170	11.31	8	5150	24.7	clear to slightly turbid, colourless to pale grey,
11.27	0.5		8.28	17.98	6.15	8210	0.0	10	5170	18.1	no odour
11.30	0.5		8.27	18.03	6.13	8240	0.0	11	5190	20.5	" "
11.33	0.5		8.29	18.03	6.12	8270	0.0	12	5210	23.6	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

D01-20210615 and T01-20210615 taken here

Well Head Integrity: Final water level 8.32 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N9

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	11.54am	Subcontractors:	
Finish time:	12.14pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.03	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.86	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.02	0.5		2.34	16.22	8.65	9850	2.79	-164	6230	280	turbid, pale yellow, strong odour
12.05	0.5		2.48	16.42	8.66	9680	2.89	-155	6100	264	" "
12.08	0.5		2.50	16.48	8.67	9740	2.73	-140	6140	239	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.39 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W6D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	12.21pm	Subcontractors:	
Finish time:	12.59pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.61	m	iP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	8.80	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.25pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.28	0.5		5.88	16.24	9.27	894	2.38	3	580	346	turbid, pale brown no odour
12.34	0.5		5.92	16.79	5.96	1060	1.12	37	659	458	" "
12.37	0.5		5.96	16.93	6.03	793	0.0	-17	507	459	" "
12.40	0.5		5.99	17.18	5.66	1610	0.0	49	1030	1000*	VERY turbid, pale brown, no odour
12.43	0.5		6.05	17.23	6.15	1400	0.0	53	893	1000*	" "
12.48	0.5		6.12	17.36	6.02	1390	0.0	71	891	1000*	" "
12:49	0.5		6.18	17.43	6.16	1510	0.0	73	964	1000*	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments * 1000 NTU max reading for turbidity on WQM

Well Head Integrity: Final water level 6.26 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

PERTH
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SYDNEY
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: WGS

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	1.02pm	Subcontractors:	
Finish time:	1.03pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.09m	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.11m	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Well dry. Not sampled

Well Head Integrity:

Samples Filtered: Nil

Weather Conditions: Fine/Sunny

Other:

PERTH
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East Perth WA 6004
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North Sydney NSW 2060
Ph: 02 9954 8100

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: N8

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	1.07pm	Subcontractors:	
Finish time:	1.21pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.88	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.28	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 1.08pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
1.11	0.5		3.06	16.91	6.89	11100	0.0	-130	6870	66.6	slightly turbid, yellow/brown
1.14	0.5		3.18	16.92	6.89	11200	0.0	-130	6940	56.2	no odour " "
1.17	0.5		3.29	16.99	6.85	11300	0.0	-130	6990	109	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.51 mbTOC

Samples Filtered: Metals

Weather Conditions: Sunny / Fine

Other:

PERTH
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East Perth WA 6004
Ph: 08 9225 5199

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E11

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	15/06/21		
Start time:	1.35pm	Subcontractors:	
Finish time:	1.58pm		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.74	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.79	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: 1.38pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
1.42	0.5		2.76	19.00	9.11	12100	0.0	-143	7510	1000+	
1.45	0.5		2.77	19.02	9.17	11800	0.0	-194	7350	1000+	
1.48	0.5		2.76	19.09	9.19	11500	0.0	-195	7135	502	
1.51	0.5		2.76	19.12	9.21	11200	0.0	-194	6960	365	

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments + 1000 NTU max reading for turbidity on WQM

Well Head Integrity: final water level 2.75 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
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Daily Field Report

Project Name:	Quarterly GW Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	7.00am	Subcontractors:	
Finish time:			
Weather:	Fine, sunny - top of 19°C		

BoM

Field Report:

7.00am JAB arrives onsite to meet Glenn. Both transfer gear to Glenn's Ute.

7.35am Commence Gw sampling of wells - W55, W5D, N2, F6, G6, G5, F5, W3D, W35, A7, W15, W1D and E4.

[redacted] Rinsate R01_20210616 taken on flexi-tubing for peri-pump.

1.45pm Sampling complete and travel back to site office to transfer gear off Glenn's ute.

2.00pm JAB leaves site.

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W5S

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	7.35am	Subcontractors:	
Finish time:	7.38am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.64	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.70	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Dry / insufficient water to sample

Well Head Integrity:

Samples Filtered: Nil

Weather Conditions: Fine

Other:

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Ph: 08 9225 5199

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W5D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	7.39am	Subcontractors:	
Finish time:	8.13am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.69	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.53	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 7.49am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
7.54	0.5		5.96	7.35	6.17	10500	0.0	-24	6250	807	very turbid, grey brown, no odour
7.57	0.5		6.35	9.03	6.14	9050	0.0	-16	5830	592	" "
8.00	0.5		6.59	9.28	6.19	8540	0.0	-16	5270	376	" "
8.03	0.5		6.73	7.80	6.20	4170	0.0	-17	5170	175	Slightly turbid, grey brown, no odour
8.06	0.5		6.81	9.95	6.21	7900	0.0	-17	5160	98.4	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 7.06 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N2

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	8.15am	Subcontractors:	
Finish time:	8.36am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.43	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.61	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.20am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.23	0.5		4.77	6.21	4.33	11700	1.25	249	7240	1000*	very turbid, pale brown, no odour
8.28	0.5		4.86	6.61	4.21	11500	0.0	268	7110	874	" "
8.30	0.5		5.00	6.71	4.22	12100	0.0	267	7510	830	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: * 1000 NTU max reading for turbidity on WQM

Well Head Integrity: Final water level 5.29 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: F6

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	8.42am	Subcontractors:	
Finish time:	9.09am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.43	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	15.48	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.48am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.51	0.5		4.80	6.97	6.54	12500	0.91	-41	7750	15.1	clear to slightly turbid, colourless,
8.54	0.5		4.88	7.18	6.53	12500	0.04	-44	7770	9.7	odour slight, slight sheen
8.57	0.5		5.13	7.84	6.51	12400	0.0	-50	7690	2.8	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

DO2_20210616 taken here

Well Head Integrity: Final water level 5.60 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: G6

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	9.04am	Subcontractors:	
Finish time:	9.36am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.56	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.09	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.12am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.15	0.5		4.67	9.06	5.03	13300	0.0	-4	8230	9.7	clear, colourless, strong Sulphidic odour, slight sheen
9.17	0.5		4.68	10.83	5.00	13300	0.0	-7	8240	9.5	" "
9.19	0.5		4.67	12.30	4.84	12200	0.0	-10	7620	7.2	" "
9.20	0.5		4.67	11.97	4.74	12200	0.0	-18	7590	3.8	" "
9.21	0.5		4.67	11.72	4.69	12300	0.0	-20	7640	3.5	" "
9.22	0.5		4.68	12.05	4.61	12200	0.0	-35	7580	3.2	" "
9.23	0.5		4.68	11.87	4.58	12500	0.0	-40	7750	2.3	" "
9.25	0.5		4.70	13.62	4.55	12000	0.0	-53	7460	3.3	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Strong odour. Water from well changed from colourless to dark brown instantly upon contact with sodium hydroxide preservative in cyanide bottle. Possible reaction due to flocculants

Well Head Integrity: Final water level 4.60 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

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Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: G5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	9.40am	Subcontractors:	
Finish time:	10.00am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.88	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	11.34	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.47 End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.47	0.5		3.22	12.96	5.58	10100	0.49	-64	6290	6.4	clear, colourless, slight sulphide odour, slight sheen
9.50	0.5		3.33	12.76	5.53	10300	0.0	-64	6390	3.7	" "
9.53	0.5		3.45	13.03	5.51	10300	0.0	-67	6400	1.8	" "
9.56	0.5		3.54	13.43	5.50	10300	0.0	-69	6260	0.9	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: GW changed from colourless to pale black and still clear in cyanide bottle. Potentially due to reaction with Sodium hydroxide bottle.

Well Head Integrity: Final water level 3.63 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: F5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	10.03am	Subcontractors:	
Finish time:	10.25am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.91	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.37	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	10.07am	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10:10	0.5		3.18	15.11	4.63	12000	0.0	39	7590	11.6	Clear, colourless, slight sulphidic
10:13	0.5		3.22	14.63	4.67	12000	0.0	37	7410	10.7	odour, slight sheen
10:16	0.5		3.27	14.20	4.69	12400	0.0	33	7680	5.8	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.27 mbTOC
Samples Filtered: Metals
Weather Conditions: Fine / Sunny
Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W3D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	10.35am	Subcontractors:	
Finish time:	10.37am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	—	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	—	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Unable to be sampled. IP Probe would not reach > 4.64m. Assumed to be damaged. Unable to be sampled during previous GME in March 2021

Well Head Integrity:

Samples Filtered: Nil

Weather Conditions: Fine/Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W35

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	10.39am	Subcontractors:	
Finish time:	10.59am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.27	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.52	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10.45	0.5		1.47	13.44	7.60	12600	1.41	248	7820	67.5	clear to slightly turbid, yellow brown,
10.48	0.5		1.58	13.43	7.58	12600	1.08	265	7830	66.6	no odour " "
10.51	0.5		1.70	13.54	7.57	12600	0.69	282	7820	66.8	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: final water level 1.75 mBTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
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East Perth WA 6004
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: A7

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	11.06am	Subcontractors:	
Finish time:	11.36am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.90	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.32	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 11.08am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.11	0.5		1.99	14.96	9.53	14300	0.15	-291	8880	15.9	clear to slightly turbid, dark yellow/
11.14	0.5		2.03	15.15	9.52	13900	0.0	-383	8600	18.8	brown, slight odour
11.17	0.5		2.09	15.33	9.51	13100	0.0	-405	8060	19.6	" "
11.20	0.5		2.16	15.43	9.49	12200	0.0	-402	7400	20.4	" "
11.23	0.5		2.22	15.73	9.45	11300	0.0	-415	7020	20.4	" "
11.26	0.5		2.25	15.76	9.42	10800	0.0	-408	6710	19.7	" "
11.29	0.5		2.31	15.94	9.36	11300	0.0	-409	7110	21.3	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.39 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W15

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	11.46am	Subcontractors:	
Finish time:	12.06pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.76	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.42	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	11.50am	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11:53	0.5		1.86	16.34	8.03	13900	3.25	-117	8600	209	turbid, dark yellow, no odour
11:56	0.5		2.02	15.81	8.01	14100	1.43	-105	8150	89.9	" "
11:59	0.5			16.44	7.99	14000	0.60	-83	8620	154	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: well purged dry. Sampled from flow cell.

Well Head Integrity:	Final water level 2.42 mbTOC
Samples Filtered:	Metals
Weather Conditions:	Fine / Sunny
Other:	

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W1D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	12.08pm	Subcontractors:	
Finish time:	12.29pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.80	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.43	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.14pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.17	0.5		2.31	16.69	7.83	13900	1.32	-7	8610	6.9	clear, yellow/brown, no odour
12.19	0.5		2.89	16.87	7.80	14100	0.00	-23	8740	6.1	" "
12.21	0.5		2.66	17.06	7.79	14900	0.0	-28	9260	5.9	" "
12.23	0.5		2.98	17.25	7.78	14900	0.0	-37	9260	4.8	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 3.19mbTOC
Samples Filtered:	Metals
Weather Conditions:	Fine/Sunny
Other:	

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: E4

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	12.32pm	Subcontractors:	
Finish time:	12.53pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.89	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.41	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.35pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.38	0.5		1.99	16.56	9.91	26500	0.0	-353	16900	1000*	turbid, brown no odour
12.41	0.5		2.03	16.55	9.91	26600	0.0	-370	16500	642	" "
12.44	0.5		2.07	16.54	9.91	26800	0.0	-381	16600	511	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments * 1000 NTU max reading for turbidity on WQM

Well Head Integrity: final water level 2.10 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W45

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	16/06/21		
Start time:	1.26pm	Subcontractors:	
Finish time:	1.40pm		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	0.89	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.12	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 1.32pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
1.32	0.5		1.06	14.20	7.91	10600	4.85	-30.4	6570	94.1	very turbid, grey/black/ brown, organic odour

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: well purged dry. Sampled from flow cell

Well Head Integrity: final water level 1.12 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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No.	Well ID	Well Depth (m)	Notes (June) 2021
1	A7	4.32	21/09/21
2	E11	4.82	20/09/21
3	E4	3.4	21/09/21
4	E5	2.57	20/09/21
5	E5D	5.44	20/09/21
6	F5	7.37	21/09/21
7	F6	15.48	21/09/21
8	G2	13.42	20/09/21
9	G5	11.31	21/09/21
10	G6	7.14	21/09/21
11	N2	5.62	20/09/21
12	N8	5.3	20/09/21
13	N9	2.83	20/09/21
14	PUMP	3.45	20/09/21
15	W1D	10.38	21/09/21
16	W1S	2.41	21/09/21
17	W2D	6.36	20/09/21
18	W2S	2.37	DRY / Insufficient Water
19	W3D	10.08	Potentially damaged (unable to be sampled June 2021) Damaged
20	W3S	2.55	21/09/21
21	W3SA	0.5	destroyed
22	W4D	10	destroyed
23	W4S	1.12	Insufficient water/DRY
24	W5D	10.54	21/09/21
25	W5S	1.7	DRY
26	W6D	8.8	20/09/21
27	W6S	3.1	DRY
28	W7M	3.72	20/09/21
29	W7S	2.3	DRY

RAMBOLL

Daily Field Report

Project Name:	Quarterly GW Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	7.00am	Subcontractors:	
Finish time:			
Weather:	Fine/Sunny/Windy		

BoM

Field Report:

7.00am JAB arrives onsite and meets Glenn for escort

7.30am Commence sampling of GW wells W2D, W2S, PUMP, W7S, E3, W7M, E5D, G2, N9, W6S, W6D, E11 and N2.

1.45pm Finish sampling for the day and pack up gear.

2.00pm JAB leaves site and heads to office

QA/QC:

Primary: E5D
Duplicate: D01_20210920
Triplicate: T01_20210920

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	W25

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	7.27am	Subcontractors:	
Finish time:	7.29am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.27	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.37	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Insufficient water to sample

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: WZD

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	7.30am	Subcontractors:	
Finish time:	8.05am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.11	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.38	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 7.40 End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
7.44	0.5		2.26	12.64	10.37	28500	0.93	23	17700	30.9	clear to slightly turbid, dark brown,
7.48	0.5		2.57	13.55	10.37	28000	0.0	-31	17400	38.0	no odour " "
7.52	0.5		2.72	14.14	10.37	27700	0.0	-56	17200	37.6	" "
7.56	0.5		3.18	14.37	10.37	27600	0.0	-63	17100	35.8	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.32 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: PUMP

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	8.11am	Subcontractors:	
Finish time:	8.46am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.09	m	
Correction:		m	IP Probe
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.45	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.17 End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.21	0.5		2.18	13.42	9.22	273	0.0	119	176	70.6	Slightly turbid, pale grey, no odour
8.25	0.5		2.22	13.59	9.07	268	0.0	119	174	67.5	" "
8.29	0.5		2.27	13.83	8.84	263	0.0	124	171	62.8	" "
8.33	0.5		2.32	14.37	8.41	241	0.0	160	160	51.4	" "
8.37	0.5		2.37	14.43	8.37	234	0.0	162	150	49.6	" "
8.40	0.5		2.42	14.52	8.32	221	0.0	164	164	49.7	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.47 mBTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W7S

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	8.54am	Subcontractors:	
Finish time:	8.55am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.32	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.32	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Dry - unable to be sampled

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W7M

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	8.58am	Subcontractors:	
Finish time:	9.20am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.47	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.72	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.00am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.03	0.5		2.73	16.37	9.39	7510	0.0	237	4740	33.4	clear dark yellow, no odour
9.06	0.5		2.78	16.47	9.42	7540	0.0	240	4750	22.7	" "
9.09	0.5		2.82	16.75	9.42	7660	0.0	229	4820	21.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.81 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
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North Sydney NSW 2060
Ph: 02 9954 8100

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	9.23am	Subcontractors:	
Finish time:	9.43am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.29	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.57	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: 9.26am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.29	0.5		2.32	18.94	9.41	15600	1.40	222	9630	16.0	clear, yellow brown, no odour
9.32	0.5		2.35	18.95	9.40	15600	1.41	222	9620	15.6	" "
9.35	0.5		2.40	19.18	9.36	15000	1.91	215	9300	17.7	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: final water level 2.45 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	9.45am	Subcontractors:	
Finish time:	10.14am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.52	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.43	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.50am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.54	0.5		2.70	19.00	7.33	13000	4.96	-48	8120	52.6	clear to slightly turbid, dark
9.58	0.5		2.75	19.60	7.32	12700	5.59	-39	7940	38.2	yellow, slight odour
10.02	0.5		2.78	19.48	7.31	12900	4.90	-41	7990	36.5	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: DO1_20210920 and TO1_20210920 taken here.

Well Head Integrity: Final water level 2.82 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny / Windy

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: G2

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	10.25am	Subcontractors:	
Finish time:	10.52am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	8.21	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	13.93	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 10.32am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10.36	0.5		8.24	20.74	6.40	5120	0.0	14	3230	65.1	slightly turbid, colourless, no
10.40	0.5		8.26	20.52	6.39	5130	0.0	16	3230	62.1	odour " "
10.44	0.5		8.28	20.51	6.36	5120	0.0	19	3230	60.1	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 8.24 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny/Windy

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: N9

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	11.00am	Subcontractors:	
Finish time:	11.21am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.25	m	
Correction:		m	IP Probe
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.83	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: 11.05am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.09	0.5		2.40	23.26	8.64	7270	0.59	-222	4610	407	turbid, pale yellow brown, no odour
11.13	0.5		2.48	22.19	8.68	7100	0.24	-323	4470	198	" "
11.16	0.5		2.56	21.25	8.68	7250	0.85	-339	4560	182	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Sampled from flow cell as well ran almost dry with sediment at bottom

Well Head Integrity: Final water level 2.64 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W65

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	11.23am	Subcontractors:	
Finish time:	11.24am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.09	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.11	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Dry - unable to be sampled

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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Ph: 08 9225 5199

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North Sydney NSW 2060
Ph: 02 9954 8100

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W6D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	11.29am	Subcontractors:	
Finish time:	12.07pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.59	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	8.86	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 11.41am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.44	0.5			24.86	6.67	742	3.4	37	481	230	turbid, pale yellow brown,
11.47	0.5			24.64	6.07	701	5.1	63	447	226	slight odour
11.50	0.5			24.65	5.96	688	4.2	31	441	216	" "
11.53	0.5			24.79	5.81	670	5.6	16	431	206	" "
11.56	0.5			24.89	5.74	660	5.3	12	422	210	" "
11.59	0.5			25.04	5.69	659	5.6	9	420	206	" "
12.02	0.5			25.16	5.65	652	5.1	7	417	197	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 6.00 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: NB

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	12.23pm	Subcontractors:	
Finish time:	12.43pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.22	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.30	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.27pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.31	0.5		3.50	24.10	7.22	8630	6.46	34	5440	116	turbid yellow/ orange brown,
12.34	0.5		3.66	22.40	7.19	8860	6.45	58	5580	115	slight odour
12.37	0.5		3.74	22.17	7.19	8880	6.27	28	5600	116	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.83 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

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North Sydney NSW 2060
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: E11

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	12.50pm	Subcontractors:	
Finish time:	1.11pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.96	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.82	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.53pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.56	0.5		2.96	26.82	9.53	10500	0.9	-163	6450	226	turbidy pale yellow brown
12.59	0.5		2.97	23.89	9.57	11100	8.0	-208	6840	218	slight odour
1.02	0.5		2.97	23.09	9.56	10900	8.5	-203	6720	174	" "
1.05	0.5		2.98	22.33	9.48	9860	7.90	-195	6280	128	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: final water level 2.97 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N2

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	20/09/21		
Start time:	1.16pm	Subcontractors:	
Finish time:	1.45pm		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.43	m	
Correction:		m	IP Probe
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.61	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 1.20pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
1.24	0.5		4.64	22.60	5.11	5850	2.26	211	3710	117	turbid, pale yellow brown,
1.27	0.5		4.78	21.58	4.64	5980	4.74	263	3750	108	no odour
1.30	0.5		4.86	21.14	4.30	6000	3.28	351	3800	83.5	" "
1.33	0.5		4.95	20.80	4.08	6010	3.90	386	3800	72.5	" "
1.36	0.5		5.09	20.59	4.00	6040	3.25	407	3810	61.1	" "
1.39	0.5		5.18	20.61	3.98	6050	3.30	413	3810	56.5	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 5.3 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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RAMBOLL

Daily Field Report

Project Name:	Quarterly GW Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	6.30am	Subcontractors:	
Finish time:			
Weather:			

BoM

Field Report:

6.30am JAB arrives onsite to meet Glenn, transfer sampling gear to Glenn's ute and be escorted to sampling locations.

6.50am Commence sampling of remaining wells W55, W5D, F6, G6, F5, G5, W3D, W35, A7, W45, W15, W1D and E5.

Rinsate taken at end of sampling

1.30pm JAB leaves site to head to office

NOTE: W3D still unable to be sampled. Highly likely it is damaged as IP won't surpass 4.63 mbTOC

QA/QC:

Primary: W5D
Duplicate: D02-20210921

Rinsate collected on flexi-tubing: R01_20210921

RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W55

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	6.52am	Subcontractors:	
Finish time:	6.54am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.68	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.71	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Dry / insufficient water to sample

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

PERTH
Level 2, 200 Adelaide Terrace
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Ph: 08 9225 5199

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Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W5D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	6.54am	Subcontractors:	
Finish time:	7.20am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.67	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.53	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 7.01am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
7.04	0.5		6.19	14.07	6.56	5660	2.0	-56	3570	119	clear to slightly turbid, colourless,
7.08	0.5		6.42	14.80	6.36	5750	0.0	-31	3620	88.1	no odour " "
7.12	0.5		6.56	15.00	6.36	5750	0.0	-23	3610	41.5	" "
7.15	0.5		6.64	15.14	6.31	5770	0.0	-21	3630	46.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: DO2_20210921 taken here

Well Head Integrity: Final water level 7.04 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: F6

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	7.55am	Subcontractors:	
Finish time:	8.15am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.56	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	15.47	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 7.58am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.01	0.5		4.78	14.79	6.89	8680	0.70	-62	5460	15.9	clear to slightly turbid, colourless,
8.04	0.5		5.06	14.90	6.85	8740	0.0	-69	5500	21.0	no odour
8.07	0.5		5.23	14.96	6.84	8730	0.0	-71	5500	19.6	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 5.46mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny/Windy

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: G6

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/09/21		
Start time:	8.16am	Subcontractors:	
Finish time:	8.47am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.67	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.06	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	8.30am	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
4.34	0.5		4.76	14.52	5.03	6690	0.0	-75	4210	30.2	clear with flocculants, colourless, ~~no~~ odour slight
4.37	0.5		4.78	14.59	4.98	6800	0.0	38	4280	21.1	" "
4.40	0.5		4.74	14.63	4.94	6800	0.0	23	4280	21.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	final water level 4.74 mbTOC
Samples Filtered:	Metals
Weather Conditions:	Fine/Sunny/Windy
Other:	

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: F5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	8.56am	Subcontractors:	
Finish time:	9.26am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.08	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.38	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.03am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.07	0.5		3.32	14.85	4.67	10100	0.0	9	6260	14.2	clear with some flocculants,
9.10	0.5		3.36	14.71	4.67	10100	0.0	-20	6290	13.5	colourless, strong odour
9.13	0.5		3.40	14.78	4.68	10100	0.0	-25	6270	12.3	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.37mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Cloudy

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: G5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	9.27am	Subcontractors:	
Finish time:	10.00am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.15	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	11.34	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.34am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.38	0.5		3.19	14.21	5.87	6380	0.0	-7	4030	22.8	clear with flocculants,
9.42	0.5		3.28	14.22	5.87	6420	0.0	10	4060	21.0	colourless, slight odour
9.46	0.5		3.39	14.54	5.68	6470	0.0	41	4070	20.0	" "
9.50	0.5		3.44	14.88	5.63	6410	0.0	52	4040	20.2	" "
9.53	0.5		3.48	14.92	5.59	6390	0.0	56	4030	19.4	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 3.53 mbTOC
Samples Filtered:	Metals
Weather Conditions:	Fine/Cloudy
Other:	

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W35

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	10.21am	Subcontractors:	
Finish time:	10.45am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.58	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.52	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 10.31am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10.34	0.5		1.74	16.46	7.55	7790	1.87	283	4910	62.6	slightly turbid, dark yellow brown,
10.37	0.5		1.83	16.50	7.52	7770	0.25	300	4890	60.9	slight odour
10.40	0.5		1.98	16.22	7.53	7760	0.28	304	4890	60.3	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.10 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: A7

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	11.03am	Subcontractors:	
Finish time:	11.26am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.07	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.33	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	11.08am	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.13	0.5		2.14	19.20	9.75	16400	6.72	-401	10100	79.1	slightly turbid, dark brown,
11.16	0.5		2.16	19.34	9.73	16300	6.61	-431	10100	61.3	strong odour
11.18	0.5		2.19	19.31	9.73	16300	6.46	-437	10100	52.8	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 2.22mbTOC
Samples Filtered:	Metals
Weather Conditions:	fine/sunny
Other:	

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W45

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	11.31am	Subcontractors:	
Finish time:	11.32am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.06	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.12	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Insufficient water to sample

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W15

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	11.45am	Subcontractors:	
Finish time:	12.00pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.88	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.41	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: 11.48am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.50	0.5		2.07	18.02	8.08	12400	1.94	-160	7680	201	turbid yellow brown, no odour
11.53	0.5		2.20	17.31	8.08	12600	1.81	-161	7830	241	" "
11.56	0.5		2.30	16.37	8.11	13000	1.61	-93	8050	115	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 2.40 mbTOC
Samples Filtered:	Metals
Weather Conditions:	Fine/Sunny
Other:	

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: WID

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	12.05pm	Subcontractors:	
Finish time:	12.36pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.39	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.09 End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.19	0.5		2.54	19.80	8.12	13800	0.0	36	8580	15.4	clear, dark yellow, no odour
12.22	0.5		2.76	19.84	8.12	13900	0.0	43	8040	22.6	" "
12.25	0.5		2.97	20.25	8.13	13700	0.0	37	8500	22.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.22 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E4

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	21/09/21		
Start time:	12.38pm	Subcontractors:	
Finish time:	1.02pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.20	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.41	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: [illegible] 13.47 End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
13:50	0.5		2.29	22.33	10.09	22700	0.0	-336	14700	1000*	very turbid, dark brown, no odour
13:53	0.5		2.30	21.61	10.09	23000	0.0	-321	14300	333	" "
13:56	0.5		2.31	20.82	10.10	23700	0.0	-323	14290	366	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments *1000 NTU is maximum turbidity reading on WQM

Well Head Integrity: Final water level 2.31 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine / Sunny

Other:

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No.	Well ID	Well Depth (m)	Notes (December) 2021
1	A7	4.32	2/12/21
2	E11	4.82	1/12/21
3	E4	3.4	2/12/21
4	E5	2.57	1/12/21
5	E5D	5.44	1/12/21
6	F5	7.37	2/12/21
7	F6	15.48	2/12/21
8	G2	13.42	1/12/21
9	G5	11.31	2/12/21
10	G6	7.14	2/12/21
11	N2	5.62	1/12/21
12	N8	5.3	1/12/21
13	N9	2.83	1/12/21
14	PUMP	3.45	1/12/21
15	W1D	10.38	2/12/21
16	W1S	2.41	2/12/21
17	W2D	6.36	1/12/21
18	W2S	2.37	1/12/21
19	W3D	10.08	damaged (unable to be sampled since December 2020)
20	W3S	2.55	2/12/21
21	W3SA	0.5	destroyed
22	W4D	10	destroyed
23	W4S	1.12	Insufficient water to sample
24	W5D	10.54	1/12/21
25	W5S	1.7	1/12/21
26	W6D	8.8	1/12/21
27	W6S	3.1	dry
28	W7M	3.72	1/12/21
29	W7S	2.3	1/12/21

RAMBOLL AUSTRALIA - GIS MAP file : 318000864 - 2019 Annual Groundwater Monitoring Report - Figure 2

Figure 2 | Groundwater Monitoring Well Network, 2019 Annual Groundwater Monitoring Report

RAMBOLL

Daily Field Report

Project Name:	Quarterly GW Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	7.30am	Subcontractors:	
Finish time:	3.30pm		
Weather:			

BoM

Field Report:

7.30am JAB arrives onsite to commence December GME

Wells sampled: W2S, W2D, PUMP, W7S, W7M, E5, E5D, G2, N8, N9, W6S, E11, W5S, W5D and N2

3.30pm JAB leaves site to head to office

QA/QC

Primary: W5D
Dup trip:
DO1 - 20211201
TO1 - 20211201

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W25

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	7.20am	Subcontractors:	
Finish time:	8.01am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.38	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.38	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 7.37am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
7.40	0.5		1.45	20.14	6.99	1200	3.71	139	762	223	turbid, pale yellow brown, no odour
7.43	0.5		1.47	20.21	7.03	1070	3.58	143	671	194	" "
7.46	0.5		1.48	20.25	6.99	905	3.33	145	572	208	" "
7.49	0.5		1.48	20.25	6.97	804	3.10	148	510	233	" "
7.52	0.5		1.48	20.26	6.89	723	3.04	149	465	252	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 1.48 mBTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W2D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	8.02am	Subcontractors:	
Finish time:	8.27am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.35	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.36	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.07am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.10	0.5		1.65	19.84	10.24	31000	0.04	-263	19000	7.6	Clear, dark brown, sulphidic odour
8.13	0.5		1.92	19.94	10.21	31000	0.04	-261	19100	5.0	" "
8.15	0.5		2.03	20.20	10.19	30800	0.01	-259	18800	4.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.10mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: PUMP

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	8.28am	Subcontractors:	
Finish time:	8.52am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.45	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.45	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.29am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.32	0.5		1.51	21.37	7.44	443	2.55	81	284	38.3	Clear colourless, no odour
8.35	0.5		1.53	21.45	7.22	417	2.51	96	268	37.4	" "
8.38	0.5		1.54	21.65	7.10	379	2.42	115	246	30.9	" "
8.41	0.5		1.56	21.88	6.96	358	2.40	128	232	26.7	" "
8.44	0.5		1.58	22.03	6.92	352	2.41	132	229	25.1	" "
8.47	0.5		1.60	22.13	6.91	345	2.45	135	224	26.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 1.62mbTOC

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W7S

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	8.53am	Subcontractors:	
Finish time:	9.29am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.08	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.33	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.00am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.04	0.5		2.17	22.33	7.04	2280	2.55	97	1760	>1000*	Very turbid, pale brown, no odour
9.08	0.5		2.30	22.05	7.01	2290	5.74	100	1470	>1000*	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments * max reading for turbidity on WQM
Sampled from flow cell, well purged almost dry

Well Head Integrity: Final water level 2.31mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W7M

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	9.26am	Subcontractors:	
Finish time:	9.57am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.80	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.81	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.40am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.43	0.5		2.06	21.80	9.34	8570	0.57	131	5740	112	Slightly turbid, pale yellow brown, no odour
9.45	0.5		2.29	21.85	9.41	8820	0.53	134	5580	105	" "
9.49	0.5		2.33	21.83	9.47	9200	0.31	119	5790	75.5	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.30 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	10.02am	Subcontractors:	
Finish time:	10.30am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.80	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.57	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	10.11am	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10.14	0.5		1.92	21.54	9.16	19300	7.30	183	12000	6.5	Clear, dark brown, no odour
10.17	0.5		1.99	20.73	9.16	19700	7.22	190	12300	6.3	" "
10.20	0.5		2.06	20.60	9.16	19800	7.03	192	12300	6.0	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 2.10mbTOC
Samples Filtered:	Metals
Weather Conditions:	Overcast
Other:	

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	10.31am	Subcontractors:	
Finish time:	10.51am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.37	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.43	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	10.33am	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
10.36	0.5		2.58	22.36	7.05	13700	0.65	-93	8780	21.5	clear, pale brown, sulphidic odour
10.39	0.5		2.59	22.23	6.95	13800	0.11	-102	8590	39.6	" "
10.42	0.5		2.60	22.19	6.95	13800	0.12	-88	8560	43.4	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 2.63 mbTOC
Samples Filtered:	Metals
Weather Conditions:	Overcast
Other:	

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: G2

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	10.59am	Subcontractors:	
Finish time:	11.37am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	8.29	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	13.35	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 11.15am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.18	0.5		8.29	21.76	6.31	5810	1.51	-112	3660	261	turbid, grey, strong sulphidic odour
11.21	0.5		8.29	20.86	6.27	5750	0.38	-121	3640	166	" "
11.24	0.5		8.29	20.74	6.24	5770	0.27	-123	3636	140	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final Water level 8.29 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N9

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	11.40am	Subcontractors:	
Finish time:	12.12pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.73	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.83	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: 11.46am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.49	0.5		1.86	19.72	8.49	10400	3.32	95	6450	140	turbid, pale yellow brown, no odour
11.52	0.5		1.95	19.45	8.45	10500	2.47	122	6530	270	" "
11.55	0.5		1.99	18.84	8.31	10900	2.29	179	6760	295	" "
11.58	0.5		2.09	18.79	8.30	11000	2.34	195	6820	243	" "
12.01	0.5		2.10	18.72	8.27	11200	2.10	202	6930	212	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 1.85 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W65

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	12.24pm	Subcontractors:	
Finish time:	12.25pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.10	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.11	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Dry - unable to be sampled

Well Head Integrity: –

Samples Filtered: –

Weather Conditions: Sunny

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W6D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	12.26pm	Subcontractors:	
Finish time:	12.56pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.63	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	8.86	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.35pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.38	0.5			22.63	6.21	1280	2.85	30	814	588	Turbid, pale brown, no odour
12.41	0.5			22.60	5.97	1210	2.36	36	771	590	" "
12.44	0.5			22.53	5.76	1160	2.05	50	745	594	" "
12.47	0.5			22.47	5.76	1120	1.67	64	717	621	" "
12.50	0.5			22.48	5.78	1110	1.48	56	713	602	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 5.89 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast/Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: N8

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	1.03pm	Subcontractors:	
Finish time:	1.21pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.16	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.27	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 1.04pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
1.07	0.5		3.38	22.57	6.67	9030	6.56	-171	5680	168	Turbid, pale yellow brown, no odour
1.10	0.5		3.59	21.91	6.64	9270	4.95	-141	5840	172	" "
1.13	0.5		3.66	21.75	6.63	9410	3.93	-133	5930	173	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 3.76 mbTOC

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E11

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	1.27pm	Subcontractors:	
Finish time:	1.55pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.39	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.78	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
1.36	0.5		2.40	22.76	7.19	1590	1.00	-38	1010	151	Turbid, pale brown, no odour
1.39	0.5		2.42	22.64	7.12	1510	1.03	-40	979	139	" "
1.42	0.5		2.42	22.22	7.09	1510	0.73	-48	927	98.2	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 2.42 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W55

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	2.10pm	Subcontractors:	
Finish time:	2.25pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.42	m	iP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.70	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 2.12pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
2.15	0.5		1.48	22.15	6.83	1690	0.71	-131	1070	>1000*	Very turbid, grey brown, no odour
2.18	0.5		1.60	21.9	6.76	1450	0.27	-134	921	550	" "
2.21	0.5		1.64	21.61	6.74	1340	0.34	-131	860	859	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments * max turbidity reading for WQM
Sampled from flow cell - well purged dry

Well Head Integrity: Final water level 1.70 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W5D

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	2.27pm	Subcontractors:	
Finish time:	3.06pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.66	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.54	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 2.34 pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
2.41	0.5		6.28	19.94	6.00	6170	0.58	-11	3890	234	Turbid, grey brown no odour
2.44	0.5		6.42	19.76	6.00	6220	0.38	-12	3920	204	" "
2.47	0.5		6.64	19.65	6.00	6180	0.32	-13	3900	176	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: DOL-20211201 and TOL-20211201 taken here

Well Head Integrity: Final water level

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: NZ

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	3.08pm	Subcontractors:	
Finish time:	3.37pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.38	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.64	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 3.21pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
3.24	0.5		4.57	20.82	3.77	5790	1.34	422	3650	176	turbid, pale grey, no odour
3.27	0.5		4.84	20.86	3.7	5980	1.48	421	3690	144	" "
3.30	0.5		4.88	20.22	3.68	6340	1.46	421	3890	118	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: final water level 6.02 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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Daily Field Report

Project Name:	Quarterly GW Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/12/21		
Start time:	7.30am	Subcontractors:	
Finish time:	12.45pm		
Weather:	Sunny / Fine		

BoM

Field Report:

7.30am JAB arrives onsite to complete GW monitoring.

Wells sampled: F6, F5, G6, G5

9.30am Glenn assists JAB with replacing monument for G6 after it has been sampled as to not affect SWL for 2021. New monument, however sits at same stick up as old monument for TOC measurements.

10.15am Wells sampled: W45, W35, A7, E4, W1D and W15.

12.45pm JAB leaves site to head to office

QA/QC

Primary: G5

Dup: D02_20211202

Rinsate: R01_20211202

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	G5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/12/21		
Start time:	7.32am	Subcontractors:	
Finish time:	8.10am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.68	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	11.34	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	7.51	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
7.54	0.5		2.97	18.58	5.47	6860	0.92	73	4330	11.8	clear colourless, sulphidic odour
7.57	0.5		3.16	18.53	5.39	6790	0.56	55	4340	8.9	black flocculants
8.00	0.5		3.18	18.48	5.39	6890	0.73	54	4370	8.0	〃 〃

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: DOZ-20211202 taken here

Well Head Integrity: Final water level 1.40 mbTOC

Samples Filtered: Metals

Weather Conditions: Sunny/Fine

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: F5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	1/12/21		
Start time:	8.11am	Subcontractors:	
Finish time:	8.49am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.70	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.38	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.23am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
8.26	0.5		3.03	18.67	7.57	11000	0.86	71	6830	7.5	clear, colourless, black flocculants, sulphidic
8.29	0.5		3.17	18.86	7.50	11100	0.72	68	6850	16.2	odour " "
8.32	0.5		3.19	18.72	7.48	11100	0.33	65	6860	16.1	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 3.13mbTOC
Samples Filtered:	Metals
Weather Conditions:	Overcast
Other:	

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: G5

Project Name:	Hydro Quarterly Groundwater Monitoring 2021
Project No:	318001103
Date:	2/12/21
Start time:	8.55am
Finish time:	9.19am

Ramboll Personnel: J Bourke

Subcontractors:

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.54	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.79	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.05am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.08	0.5		4.63	18.90	4.20	7770	0.68	36	4900	36.3	clear, colourless, strong sulphidic odour
9.11	0.5		4.64	18.90	4.19	7780	0.50	31	4900	46.3	" "
9.14	0.5		4.65	18.97	4.20	7790	1.30	29	4910	43.2	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 4.58 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	F6

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/12/21		
Start time:	9.27am	Subcontractors:	
Finish time:	10.07am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.62	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	15.48	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	9.31am	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
9.34	0.5		4.67	20.88	7.10	9010	2.74	-82	5680	5.5	clear, colourless, sulphidic odour
9.37	0.5		4.73	20.59	7.09	9100	2.31	-63	5740	5.8	" "
9.40	0.5		4.84	20.53	7.08	9120	2.05	-54	5750	6.7	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 5.45mbTOC
Samples Filtered:	Metals
Weather Conditions:	Overcast
Other:	

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: WQS

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/12/21		
Start time:	10.16am	Subcontractors:	
Finish time:	10.17am		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	0.87	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.10	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Insufficient water to sample

Well Head Integrity: –

Samples Filtered: –

Weather Conditions: Overcast

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W35

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/12/21		
Start time:	10.17am	Subcontractors:	
Finish time:	10.52am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.17	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.52	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 1.23pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
1.28	0.5		1.35	21.60	7.71	6110	7.32	267	3850	9.0	clear, dark yellow brown, no odour
1.33	0.5		1.40	21.30	7.52	6920	7.31	257	4360	7.9	" "
1.38	0.5		1.45	21.68	7.58	6930	6.70	256	4370	7.8	" "
1.43	0.5		1.47	21.90	7.58	6530	6.52	256	4600	7.1	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 1.42 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

HUNTER
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The Junction NSW 2291
Ph: 02 4962 5444

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: A7

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/12/21		
Start time:	10.57am	Subcontractors:	
Finish time:	10.23am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.67	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.32	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	11.00am	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.03	0.5		1.73	24.00	9.47	15000	0.06	-384	9310	39.8	Clear to slightly turbid, dark brown, sulphidic odour
11.06	0.5		1.80	23.92	9.47	15000	0.00	-157	9310	19.9	" "
11.09	0.5		1.89	23.99	9.46	14700	0.0	-417	9140	20.2	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 1.96 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E4

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/12/21		
Start time:	11.31am	Subcontractors:	
Finish time:	11.50am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.50	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 11.35am End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
11.38	0.5		1.56	24.70	9.89	26100	0.01	-337	16200	32.7	Slightly turbid, yellow brown, Sulphidic Odour
11.41	0.5		1.60	24.07	9.89	26300	0.0	-358	16300	30.4	" "
11.44	0.5		1.65	23.16	9.89	26800	0.0	-362	16600	23.4	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: Final water level 1.68 mbTOC

Samples Filtered: Metals

Weather Conditions: Overcast/Sunny

Other:

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SYDNEY
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W15

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/12/21		
Start time:	11.55am	Subcontractors:	
Finish time:	12.16pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.70	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.41	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling			
Method:	☐ Micro-Purge	☑ Peristalic	☐ Bailer
Start Sampling:	1.57	End Sampling:	
Sample Appearance:			

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.00	0.5		1.97	24.90	7.57	14800	0.09	-46	9170	75.1	turbid, yellow brown, no odour
12.03	0.5		2.03	24.68	7.58	15000	0.38	-1	9320	58.6	" "
12.06	0.5		2.13	25.11	7.61	15100	0.56	23	9380	68.7	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 2.13 mbTOC
Samples Filtered:	Metals
Weather Conditions:	Sunny/Cloudy
Other:	

PERTH
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID:	WID

Project Name:	Hydro Quarterly Groundwater Monitoring 2021	Ramboll Personnel:	J Bourke
Project No:	318001103		
Date:	2/12/21		
Start time:	12.17pm	Subcontractors:	
Finish time:	12.43pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.09	m	IP Probe
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.33pm End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS (mg/L)	Turbidity (NTU)	Comments (Appearance, colour and odour)
12.26	0.5		2.44	27.66	7.72	14000	0.23	20	8680	9.9	cleary brown, no odours
12.29	0.5		2.58	26.87	7.71	14300	0.17	16	8880	10.7	" "
12.32	0.5		2.63	26.93	7.71	14500	0.13	-6	8970	13.4	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity:	Final water level 2.68 mbTOC
Samples Filtered:	Metals
Weather Conditions:	Sunny
Other:	

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APPENDIX 5
LABORATORY REPORTS

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 264673

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro Groundwater Plume Monitoring - 318001103**
Number of Samples	18 Water
Date samples received	19/03/2021
Date completed instructions received	19/03/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	26/03/2021
Date of Issue	26/03/2021

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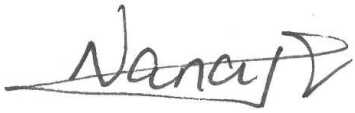
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Hannah Nguyen, Senior Chemist
Jaimie Loa-Kum-Cheung, Metals Supervisor
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		264673-1	264673-2	264673-3	264673-4	264673-5
Your Reference	UNITS	W2S	W2D	PUMP	W7M	E5
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Fluoride, F	mg/L	72	1,000	24	630	300
Total Cyanide	mg/L	1.5	120	0.23	75	54
Free Cyanide in Water	mg/L	<0.004	0.005	<0.004	0.005	<0.004

Miscellaneous Inorganics						
Our Reference		264673-6	264673-7	264673-8	264673-9	264673-10
Your Reference	UNITS	E5D	G2	N8	N9	W6D
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Fluoride, F	mg/L	9.1	0.4	0.5	110	0.1
Total Cyanide	mg/L	0.38	<0.004	0.10	2.3	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		264673-11	264673-12	264673-13	264673-14	264673-15
Your Reference	UNITS	E11	W5S	W5D	N2	D01_20210317
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Fluoride, F	mg/L	74	39	0.4	0.8	920
Total Cyanide	mg/L	1.9	2.5	<0.004	0.005	120
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	0.005

Miscellaneous Inorganics				
Our Reference		264673-16	264673-17	264673-18
Your Reference	UNITS	T01_20210317	F6	G6
Date Sampled		17/03/2021	18/03/2021	18/03/2021
Type of sample		Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021
Fluoride, F	mg/L	930	0.5	0.4
Total Cyanide	mg/L	100	<0.004	<0.004
Free Cyanide in Water	mg/L	0.006	<0.004	<0.004

HM in water - dissolved						
Our Reference		264673-1	264673-2	264673-3	264673-4	264673-5
Your Reference	UNITS	W2S	W2D	PUMP	W7M	E5
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Aluminium-Dissolved	µg/L	5,200	730	15,000	350	130

HM in water - dissolved						
Our Reference		264673-6	264673-7	264673-8	264673-9	264673-10
Your Reference	UNITS	E5D	G2	N8	N9	W6D
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Aluminium-Dissolved	µg/L	30	10	60	60	980

HM in water - dissolved						
Our Reference		264673-11	264673-12	264673-13	264673-14	264673-15
Your Reference	UNITS	E11	W5S	W5D	N2	D01_20210317
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Aluminium-Dissolved	µg/L	50	5,000	<10	2,400	690

HM in water - dissolved				
Our Reference		264673-16	264673-17	264673-18
Your Reference	UNITS	T01_20210317	F6	G6
Date Sampled		17/03/2021	18/03/2021	18/03/2021
Type of sample		Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	23/03/2021	23/03/2021	23/03/2021
Aluminium-Dissolved	µg/L	720	<10	8,000

HM in water - total						
Our Reference		264673-1	264673-2	264673-3	264673-4	264673-5
Your Reference	UNITS	W2S	W2D	PUMP	W7M	E5
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Aluminium-Total	µg/L	43,000	1,600	23,000	2,100	9,000

HM in water - total						
Our Reference		264673-6	264673-7	264673-8	264673-9	264673-10
Your Reference	UNITS	E5D	G2	N8	N9	W6D
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Aluminium-Total	µg/L	1,600	620	700	520	7,100

HM in water - total						
Our Reference		264673-11	264673-12	264673-13	264673-14	264673-15
Your Reference	UNITS	E11	W5S	W5D	N2	D01_20210317
Date Sampled		17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Aluminium-Total	µg/L	1,100	42,000	330	12,000	1,400

HM in water - total				
Our Reference		264673-16	264673-17	264673-18
Your Reference	UNITS	T01_20210317	F6	G6
Date Sampled		17/03/2021	18/03/2021	18/03/2021
Type of sample		Water	Water	Water
Date prepared	-	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021
Aluminium-Total	µg/L	1,100	50	8,000

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjusted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	264673-8
Date prepared	-			22/03/2021	1	22/03/2021	22/03/2021		22/03/2021	22/03/2021
Date analysed	-			22/03/2021	1	22/03/2021	22/03/2021		22/03/2021	22/03/2021
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	72	73	1	96	103
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	1.5	1.5	0	99	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	98	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	264673-13
Date prepared	-			[NT]	10	22/03/2021	22/03/2021		[NT]	22/03/2021
Date analysed	-			[NT]	10	22/03/2021	22/03/2021		[NT]	22/03/2021
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	10	0.1	[NT]		[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	10	<0.004	<0.004	0	[NT]	92
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	10	<0.004	<0.004	0	[NT]	98

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	22/03/2021	22/03/2021		[NT]	[NT]
Date analysed	-			[NT]	11	22/03/2021	22/03/2021		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	11	74	72	3	[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	11	1.9	[NT]		[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	11	<0.004	[NT]		[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	264673-2
Date prepared	-			22/03/2021	1	22/03/2021	22/03/2021		22/03/2021	22/03/2021
Date analysed	-			23/03/2021	1	23/03/2021	23/03/2021		23/03/2021	23/03/2021
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	5200	5200	0	102	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	22/03/2021	22/03/2021		[NT]	[NT]
Date analysed	-			[NT]	11	23/03/2021	23/03/2021		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	11	50	60	18	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	264673-2
Date prepared	-			22/03/2021	1	22/03/2021	22/03/2021		22/03/2021	22/03/2021
Date analysed	-			22/03/2021	1	22/03/2021	22/03/2021		22/03/2021	22/03/2021
Aluminium-Total	µg/L	10	Metals-022	<10	1	43000	43000	0	100	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	22/03/2021	22/03/2021		[NT]	[NT]
Date analysed	-			[NT]	11	22/03/2021	22/03/2021		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	11	1100	1100	0	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

8 HM in water - dissolved - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.
8 HM in water - total - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318001103	**Envirolab Services** 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie	
Contact person: JK	**PO No.:**		
Project Mgr: Jordyn Kirsch	**Envirolab Quote No. :**		
Sampler: JB + JK	**Date results required:**	**Envirolab Services WA t/a MPL** 16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au Contact: Joshua Lim	
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharge applies*		
Phone: (02) 49625444 **Mob:** 0467580473	**Lab comments:** Highly contaminated		
Fax:			
Email: jkirsch@ramboll.com; jbourke@ramboll.com			

Sample information					Tests Required												Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium								Provide as much information about the sample as you can
1	W2S		17/03/2021	WATER	X	X	X	X	X								
2	W2D		17/03/2021	WATER	X	X	X	X	X								
3	PUMP		17/03/2021	WATER	X	X	X	X	X								
4	W7M		17/03/2021	WATER	X	X	X	X	X								
5	E5		17/03/2021	WATER	X	X	X	X	X								
6	E5D		17/03/2021	WATER	X	X	X	X	X								
7	G2		17/03/2021	WATER	X	X	X	X	X								
8	N8		17/03/2021	WATER	X	X	X	X	X								
9	N9		17/03/2021	WATER	X	X	X	X	X								
10	W6D		17/03/2021	WATER	X	X	X	X	X								
11	E11		17/03/2021	WATER	X	X	X	X	X								
12	W5S		17/03/2021	WATER	X	X	X	X	X								
13	W5D		17/03/2021	WATER	X	X	X	X	X								
14	N2		17/03/2021	WATER	X	X	X	X	X								

ENVIROLAB GROUP
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 269673
Date Received: 19-03-2021
Time Received: 10:20
Received By: TSHAW
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company):	Ramboll	**Received by (company):** ELS SYD	***Lab use only:***
Print Name:	Jake Bourke	**Print Name:** TSHAW	**Samples Received:** Cool or Ambient (circle one)
Date & Time:	18/03/2021	**Date & Time:** 19.03.2021 1020	**Temperature Received at:** 4°C (if applicable)
Signature:		**Signature:**	**Transported by:** Hand delivered / courier

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318001103
Contact person: JK	**PO No.:**
Project Mgr: Jordyn Kirsch	**Envirolab Quote No. :**
Sampler: Jake Bourke	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0467580473	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; jbourke@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium										Provide as much information about the sample as you can
15	D01_20210317		17/03/2021	WATER	X	X	X	X	X										
16	T01_20210317		17/03/2021	WATER	X	X	X	X	X										
17	F6		18/03/2021	WATER	X	X	X	X	X										
18	G6		18/03/2021	WATER	X	X	X	X	X										

Relinquished by (company):	Ramboll	**Received by (company):**	ELS SYD
Print Name:	Jake Bourke	**Print Name:**	TJ HOW
Date & Time:	18/03/2021	**Date & Time:**	19.03.2021 1020
Signature:		**Signature:**	

Lab use only:
Samples Received: (Cool) or Ambient (circle one)
Temperature Received at: 7 (if applicable)
Transported by: Hand delivered / courier

* 264673

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch

Sample Login Details

Your reference	Hydro Groundwater Plume Monitoring - 318001103
Envirolab Reference	264673
Date Sample Received	19/03/2021
Date Instructions Received	19/03/2021
Date Results Expected to be Reported	26/03/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	18 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	4
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Fluoride, F	Total Cyanide	Free Cyanide in Water	HM in water - dissolved	HM in water - total
W2S	✓	✓	✓	✓	✓
W2D	✓	✓	✓	✓	✓
PUMP	✓	✓	✓	✓	✓
W7M	✓	✓	✓	✓	✓
E5	✓	✓	✓	✓	✓
E5D	✓	✓	✓	✓	✓
G2	✓	✓	✓	✓	✓
N8	✓	✓	✓	✓	✓
N9	✓	✓	✓	✓	✓
W6D	✓	✓	✓	✓	✓
E11	✓	✓	✓	✓	✓
W5S	✓	✓	✓	✓	✓
W5D	✓	✓	✓	✓	✓
N2	✓	✓	✓	✓	✓
D01_20210317	✓	✓	✓	✓	✓
T01_20210317	✓	✓	✓	✓	✓
F6	✓	✓	✓	✓	✓
G6	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

SCC0228

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318001103	**Envirolab Services** 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie	
Contact person: JK	**PO No.:**		
Project Mgr: Jordyn Kirsch	**Envirolab Quote No.:**		
Sampler: JB + JK	**Date results required:**	**Envirolab Services WA t/a MPL** 16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au Contact: Joshua Lim	
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharge applies*		
Phone: (02) 49625444 **Mob:** 0467580473	**Lab comments:** Highly contaminated		
Fax:			
Email: jkirsch@ramboll.com; jbourke@ramboll.com			

Sample information					Tests Required													Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium									Provide as much information about the sample as you can
1	A7		25/03/2021	WATER	X	X	X	X	X									
2	E4		25/03/2021	WATER	X	X	X	X	X									
3	F5		25/03/2021	WATER	X	X	X	X	X									
4	G5		25/03/2021	WATER	X	X	X	X	X									
5	W1D		25/03/2021	WATER	X	X	X	X	X									
6	W1S		25/03/2021	WATER	X	X	X	X	X									
7	W3S		25/03/2021	WATER	X	X	X	X	X									
8	W4S		25/03/2021	WATER	X	X	X	X	X									
9	D02_20210325		25/03/2021	WATER	X	X	X	X	X									
10	R01_20210325		25/03/2021	WATER	X	X	X	X	X									
			25/03/2021	WATER	X	X	X	X	X									

ENVIROLAB GROUP
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 265214
Date Received: 26/3/2021
Time Received: 1040
Received By: RP
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company):	Ramboll	**Received by (company):**	RP
Print Name:	Jake Bourke	**Print Name:**	Ping
Date & Time:	25/03/2021	**Date & Time:**	26/3/2021 1040
Signature:		**Signature:**	

Lab use only:
Samples Received Cool or Ambient (circle one)
Temperature Received at: 4.2 (if applicable)
Transported by: Hand delivered / courier

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Ramboll (Newcastle) Australia Pty Ltd
Attention	J Kirsch

Sample Login Details

Your reference	Hydro GW Plume Monitoring - 318001103
Envirolab Reference	265214
Date Sample Received	26/03/2021
Date Instructions Received	26/03/2021
Date Results Expected to be Reported	02/04/2021

Sample Condition

Samples received in appropriate condition for analysis	YES
No. of Samples Provided	10 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	4
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Fluoride, F	Total Cyanide	Free Cyanide in Water	All metals in water - total	All metals in water-dissolved
A7	✓	✓	✓	✓	✓
E4	✓	✓	✓	✓	✓
F5	✓	✓	✓	✓	✓
G5	✓	✓	✓	✓	✓
W1D	✓	✓	✓	✓	✓
W1S	✓	✓	✓	✓	✓
W3S	✓	✓	✓	✓	✓
W4S	✓	✓	✓	✓	✓
D02_20210325	✓	✓	✓	✓	✓
R01_20210325	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318001103
Contact person: Jake Bourke	
Project Mgr: Jordyn Kirsch	PO No.: 318001103
Sampler: Jake Bourke	Envirolab Quote No. :
Address: Level 2 Suite 18, 50 Glebe Road,	Date results required:
The Junction	
	Or choose: standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 Mob: 0467580473	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	Lab comments: Highly contaminated
Email: jkirsch@ramboll.com; jbourke@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium										Provide as much information about the sample as you can
1	W2S		15/06/2021	WATER	X	X	X	X	X										
2	W2D		15/06/2021	WATER	X	X	X	X	X										
3	PUMP		15/06/2021	WATER	X	X	X	X	X										
4	W7M		15/06/2021	WATER	X	X	X	X	X										
5	W7S		15/06/2021	WATER	X	X	X	X	X										
6	E5		15/06/2021	WATER	X	X	X	X	X										
7	E5D		15/06/2021	WATER	X	X	X	X	X										
8	N9		15/06/2021	WATER	X	X	X	X	X										
9	W6D		15/06/2021	WATER	X	X	X	X	X										
10	W6S		15/06/2021	WATER	X	X	X	X	X										
11	N8		15/06/2021	WATER	X	X	X	X	X										
12	G2		15/06/2021	WATER	X	X	X	X	X										
13	D01_20210615		15/06/2021	WATER	X	X	X	X	X										
14	T01_20210615		15/06/2021	WATER	X	X	X	X	X										

ENVIROLAB GROUP Chatswood NSW Ph: (02) 9910 6200

Job No: 271928
Date Received: 17/6/21
Time Received: 1116
Received By: SO
Temp: Cool/Ambient
Cooling: Ice/icepack
Security: Intact/Broken/none

Relinquished by (company):	Ramboll	Received by (company):	EGS SYD
Print Name:	Jake Bourke	Print Name:	Sasan Day
Date & Time:	16/06/2021	Date & Time:	17/6/21 1116
Signature:		Signature:	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 8°C (if applicable) ICE
Transported by: Hand delivered / courier

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318001103	Envirolab Services 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie
Contact person: Jake Bourke		
Project Mgr: Jordyn Kirsch	PO No.: 318001103	
Sampler: Jake Bourke	Envirolab Quote No. :	
Address: Level 2 Suite 18, 50 Glebe Road,	Date results required:	
The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day	Envirolab Services WA t/a MPL 16-18 Hayden Crt, Myaree WA 6154
Phone: (02) 49625444 Mob: 0467580473	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*	Phone: 08 9317 2505 Fax :08 9317 4163
Fax:	Lab comments: Highly contaminated	E-mail: lab@mpl.com.au
Email: jkirsch@ramboll.com; jbourke@ramboll.com		Contact: Joshua Lim

Sample information					Tests Required												Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium								Provide as much information about the sample as you can
1	W5D		16/06/2021	WATER	X	X	X	X	X								
2	N2		16/06/2021	WATER	X	X	X	X	X								
3	F6		16/06/2021	WATER	X	X	X	X	X								
4	G6		16/06/2021	WATER	X	X	X	X	X								
5	G5		16/06/2021	WATER	X	X	X	X	X								
6	F5		16/06/2021	WATER	X	X	X	X	X								
7	W3D		16/06/2021	WATER	X	X	X	X	X								
8	A7		16/06/2021	WATER	X	X	X	X	X								
9	W1S		16/06/2021	WATER	X	X	X	X	X								
10	W1D		16/06/2021	WATER	X	X	X	X	X								
11	E4		16/06/2021	WATER	X	X	X	X	X								
12	W4S		16/06/2021	WATER	X	X	X	X	X								
13	D02_20210616		16/06/2021	WATER	X	X	X	X	X								
14	R01_20210616		16/06/2021	WATER	X	X	X	X	X								

Envirolab Group STO
Chatswood NSW
Ph. (02) 9910 6200
Job No: 274929
Date Received: 17/6/21
Time Received: 1116
Received By: SD
Temp: Cool/Ambient
Cooling: Ice/Ice-pack
Security: Intact/Broken/None

Relinquished by (company):	Ramboll	Received by (company):	EGS STO
Print Name:	Jake Bourke	Print Name:	Susan Day
Date & Time:	16/06/2021	Date & Time:	17/6/21 1116
Signature:		Signature:	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 8°C (if applicable)
Transported by: Hand delivered / courier ICE

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch

Sample Login Details

Your reference	Hydro Groundwater Plume Monitoring - 318001103
Envirolab Reference	271928
Date Sample Received	17/06/2021
Date Instructions Received	17/06/2021
Date Results Expected to be Reported	24/06/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	14 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	8
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Fluoride, F	Total Cyanide	Free Cyanide in Water	HM in water - dissolved	HM in water - total
W2S	✓	✓	✓	✓	✓
W2D	✓	✓	✓	✓	✓
PUMP	✓	✓	✓	✓	✓
W7M	✓	✓	✓	✓	✓
W7S	✓	✓	✓	✓	✓
E5	✓	✓	✓	✓	✓
E5D	✓	✓	✓	✓	✓
N9	✓	✓	✓	✓	✓
W6D	✓	✓	✓	✓	✓
W6S	✓	✓	✓	✓	✓
N8	✓	✓	✓	✓	✓
G2	✓	✓	✓	✓	✓
D01_20210615	✓	✓	✓	✓	✓
T01_20210615	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

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SAMPLE RECEIPT ADVICE

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch

Sample Login Details

Your reference	Hydro Groundwater Plume Monitoring - 318001103
Envirolab Reference	271929
Date Sample Received	17/06/2021
Date Instructions Received	17/06/2021
Date Results Expected to be Reported	24/06/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	14 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	8
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Fluoride, F	Total Cyanide	Free Cyanide in Water	HM in water - dissolved	HM in water - total
W5D	✓	✓	✓	✓	✓
N2	✓	✓	✓	✓	✓
F6	✓	✓	✓	✓	✓
G6	✓	✓	✓	✓	✓
G5	✓	✓	✓	✓	✓
F5	✓	✓	✓	✓	✓
W3D	✓	✓	✓	✓	✓
A7	✓	✓	✓	✓	✓
W1S	✓	✓	✓	✓	✓
W1D	✓	✓	✓	✓	✓
E4	✓	✓	✓	✓	✓
W4S	✓	✓	✓	✓	✓
D02_20210616	✓	✓	✓	✓	✓
R01_20210616	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 271928

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro Groundwater Plume Monitoring - 318001103**
Number of Samples	14 Water
Date samples received	17/06/2021
Date completed instructions received	17/06/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	24/06/2021
Date of Issue	24/06/2021
Reissue Details	This report replaces R00 created on 23/06/2021 due to: Sample ID Amended (Client Request)

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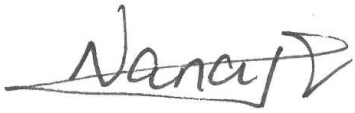
Results Approved By
Giovanni Agosti, Group Technical Manager
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		271928-1	271928-2	271928-3	271928-4	271928-5
Your Reference	UNITS	W2S	W2D	PUMP	W7M	W7S
Date Sampled		15/06/2021	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Fluoride, F	mg/L	57	860	17	490	24
Total Cyanide	mg/L	0.44	100	0.056	48	1.2
Free Cyanide in Water	mg/L	0.005	0.008	<0.004	0.006	<0.004

Miscellaneous Inorganics						
Our Reference		271928-6	271928-7	271928-8	271928-9	271928-10
Your Reference	UNITS	E5	E5D	N9	W6D	E11
Date Sampled		15/06/2021	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Fluoride, F	mg/L	310	8.3	110	<0.1	120
Total Cyanide	mg/L	50	0.61	1.1	0.028	3.1
Free Cyanide in Water	mg/L	0.011	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics					
Our Reference		271928-11	271928-12	271928-13	271928-14
Your Reference	UNITS	N8	G2	D01_20210615	T01_20210615
Date Sampled		15/06/2021	15/06/2021	15/06/2021	15/06/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Fluoride, F	mg/L	0.6	0.3	0.3	0.3
Total Cyanide	mg/L	0.20	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004

HM in water - dissolved						
Our Reference		271928-1	271928-2	271928-3	271928-4	271928-5
Your Reference	UNITS	W2S	W2D	PUMP	W7M	W7S
Date Sampled		15/06/2021	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Dissolved	µg/L	4,500	600	6,400	510	20,000

HM in water - dissolved						
Our Reference		271928-6	271928-7	271928-8	271928-9	271928-10
Your Reference	UNITS	E5	E5D	N9	W6D	E11
Date Sampled		15/06/2021	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Dissolved	µg/L	80	10	840	50	230

HM in water - dissolved					
Our Reference		271928-11	271928-12	271928-13	271928-14
Your Reference	UNITS	N8	G2	D01_20210615	T01_20210615
Date Sampled		15/06/2021	15/06/2021	15/06/2021	15/06/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Dissolved	µg/L	50	<10	<10	<10

HM in water - total						
Our Reference		271928-1	271928-2	271928-3	271928-4	271928-5
Your Reference	UNITS	W2S	W2D	PUMP	W7M	W7S
Date Sampled		15/06/2021	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Total	µg/L	6,900	2,000	12,000	8,100	410,000

HM in water - total						
Our Reference		271928-6	271928-7	271928-8	271928-9	271928-10
Your Reference	UNITS	E5	E5D	N9	W6D	E11
Date Sampled		15/06/2021	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Total	µg/L	490	330	15,000	8,400	50,000

HM in water - total					
Our Reference		271928-11	271928-12	271928-13	271928-14
Your Reference	UNITS	N8	G2	D01_20210615	T01_20210615
Date Sampled		15/06/2021	15/06/2021	15/06/2021	15/06/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Total	µg/L	5,100	730	1,900	1,300

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjusted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	271928-3
Date prepared	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Date analysed	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	57	58	2	103	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	0.44	0.44	0	111	99
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	0.005	0.005	0	99	95

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	271928-12
Date prepared	-			[NT]	11	18/06/2021	18/06/2021		[NT]	18/06/2021
Date analysed	-			[NT]	11	18/06/2021	18/06/2021		[NT]	18/06/2021
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	11	0.6	0.5	18	[NT]	89
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	11	0.20	[NT]		[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	11	<0.004	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	14	18/06/2021	18/06/2021		[NT]	[NT]
Date analysed	-			[NT]	14	18/06/2021	18/06/2021		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	14	0.3	[NT]		[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	14	<0.004	<0.004	0	[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	14	<0.004	<0.004	0	[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	271928-3
Date prepared	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Date analysed	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	4500	4100	9	100	#

QUALITY CONTROL: HM in water - dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	9	18/06/2021	18/06/2021		[NT]	[NT]
Date analysed	-			[NT]	9	18/06/2021	18/06/2021		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	9	50	50	0	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	271928-2
Date prepared	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Date analysed	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Aluminium-Total	µg/L	10	Metals-022	<10	1	6900	6600	4	97	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	18/06/2021	18/06/2021		[NT]	[NT]
Date analysed	-			[NT]	11	18/06/2021	18/06/2021		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	11	5100	4200	19	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

8 HM in water - dissolved - # Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

8 HM in water - total - # Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

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CERTIFICATE OF ANALYSIS 271929

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro Groundwater Plume Monitoring - 318001103**
Number of Samples	14 Water
Date samples received	17/06/2021
Date completed instructions received	17/06/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	24/06/2021
Date of Issue	24/06/2021
Reissue Details	This report replaces R00 created on 23/06/2021 due to: Sample ID Amended (Client Request)

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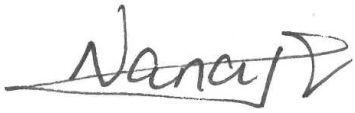
Results Approved By
Giovanni Agosti, Group Technical Manager
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		271929-1	271929-2	271929-3	271929-4	271929-5
Your Reference	UNITS	W5D	N2	F6	G6	G5
Date Sampled		16/06/2021	16/06/2021	16/06/2021	16/06/2021	16/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Fluoride, F	mg/L	0.7	1.1	0.6	0.6	0.2
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		271929-6	271929-7	271929-8	271929-9	271929-10
Your Reference	UNITS	F5	W3S	A7	W1S	W1D
Date Sampled		16/06/2021	16/06/2021	16/06/2021	16/06/2021	16/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Fluoride, F	mg/L	0.3	130	110	14	11
Total Cyanide	mg/L	<0.004	17	9.2	0.45	0.19
Free Cyanide in Water	mg/L	<0.004	0.016	<0.004	<0.004	<0.004

Miscellaneous Inorganics					
Our Reference		271929-11	271929-12	271929-13	271929-14
Your Reference	UNITS	E4	W4S	D02_20210616	R01_20210616
Date Sampled		16/06/2021	16/06/2021	16/06/2021	16/06/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Fluoride, F	mg/L	760	120	0.6	<0.1
Total Cyanide	mg/L	120	1.7	<0.004	<0.004
Free Cyanide in Water	mg/L	0.006	<0.004	<0.004	<0.004

HM in water - dissolved						
Our Reference		271929-1	271929-2	271929-3	271929-4	271929-5
Your Reference	UNITS	W5D	N2	F6	G6	G5
Date Sampled		16/06/2021	16/06/2021	16/06/2021	16/06/2021	16/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Dissolved	µg/L	10	2,100	<10	2,800	30

HM in water - dissolved						
Our Reference		271929-6	271929-7	271929-8	271929-9	271929-10
Your Reference	UNITS	F5	W3S	A7	W1S	W1D
Date Sampled		16/06/2021	16/06/2021	16/06/2021	16/06/2021	16/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Dissolved	µg/L	2,000	580	110	220	50

HM in water - dissolved					
Our Reference		271929-11	271929-12	271929-13	271929-14
Your Reference	UNITS	E4	W4S	D02_20210616	R01_20210616
Date Sampled		16/06/2021	16/06/2021	16/06/2021	16/06/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Dissolved	µg/L	450	2,300	<10	<10

HM in water - total						
Our Reference		271929-1	271929-2	271929-3	271929-4	271929-5
Your Reference	UNITS	W5D	N2	F6	G6	G5
Date Sampled		16/06/2021	16/06/2021	16/06/2021	16/06/2021	16/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Total	µg/L	330	12,000	80	3,500	150

HM in water - total						
Our Reference		271929-6	271929-7	271929-8	271929-9	271929-10
Your Reference	UNITS	F5	W3S	A7	W1S	W1D
Date Sampled		16/06/2021	16/06/2021	16/06/2021	16/06/2021	16/06/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Total	µg/L	2,700	4,000	160	56,000	290

HM in water - total					
Our Reference		271929-11	271929-12	271929-13	271929-14
Your Reference	UNITS	E4	W4S	D02_20210616	R01_20210616
Date Sampled		16/06/2021	16/06/2021	16/06/2021	16/06/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Date analysed	-	18/06/2021	18/06/2021	18/06/2021	18/06/2021
Aluminium-Total	µg/L	9,400	170,000	80	<10

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjusted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	271929-2
Date prepared	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Date analysed	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	0.7	0.6	15	112	108
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	104	89
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	98	95

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	18/06/2021	18/06/2021		[NT]	[NT]
Date analysed	-			[NT]	11	18/06/2021	18/06/2021		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	11	760	[NT]		[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	11	120	[NT]		[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	11	0.006	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	14	18/06/2021	18/06/2021		[NT]	[NT]
Date analysed	-			[NT]	14	18/06/2021	18/06/2021		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	14	<0.1	[NT]		[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	14	<0.004	<0.004	0	[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	14	<0.004	<0.004	0	[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	271929-5
Date prepared	-			18/06/2021	4	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Date analysed	-			18/06/2021	4	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Aluminium-Dissolved	µg/L	10	Metals-022	<10	4	2800	2800	0	100	92

QUALITY CONTROL: HM in water - dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	10	18/06/2021	18/06/2021		[NT]	[NT]
Date analysed	-			[NT]	10	18/06/2021	18/06/2021		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	10	50	40	22	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	271929-2
Date prepared	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Date analysed	-			18/06/2021	1	18/06/2021	18/06/2021		18/06/2021	18/06/2021
Aluminium-Total	µg/L	10	Metals-022	<10	1	330	260	24	102	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	18/06/2021	18/06/2021		[NT]	[NT]
Date analysed	-			[NT]	11	18/06/2021	18/06/2021		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	11	9400	8700	8	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

8 HM in water - total - # Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318001103	**Envirolab Services** 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie
Contact person: JAB	**PO No.:**	
Project Mgr: Jordyn Kirsch	**Envirolab Quote No. :**	
Sampler: JAB	**Date results required:**	**Envirolab Services WA t/a MPL** 16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au Contact: Joshua Lim
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharge applies*	
Phone: (02) 49625444 **Mob:** 0467580473	**Lab comments:** Highly contaminated	
Fax:		
Email: jkirsch@ramboll.com; jbourke@ramboll.com		

Sample information					Tests Required												Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium											Provide as much information about the sample as you can
1	W2D		20/09/2021		X	X	X	X	X											
2	PUMP		20/09/2021	WATER	X	X	X	X	X											
3	W7M		20/09/2021	WATER	X	X	X	X	X											
4	E5		20/09/2021	WATER	X	X	X	X	X											
5	E5D		20/09/2021	WATER	X	X	X	X	X											
6	G2		20/09/2021	WATER	X	X	X	X	X											
7	N8		20/09/2021	WATER	X	X	X	X	X											
8	N9		20/09/2021	WATER	X	X	X	X	X											
9	W6D		20/09/2021	WATER	X	X	X	X	X											
10	E11		20/09/2021	WATER	X	X	X	X	X											
11	N2		20/09/2021	WATER	X	X	X	X	X											
12	W5D		21/09/2021	WATER	X	X	X	X	X											
13	F6		21/09/2021	WATER	X	X	X	X	X											
~~13~~ 14	G6		21/09/2021	WATER	X	X	X	X	X											

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

~~Job No:~~ 279030

~~Date Received:~~ 24/9/21
~~Time Received:~~ 1040
~~Received By:~~ VV
~~Temp: Cool/Ambient~~
~~Cooling: Ice/Icepack~~
Security: Intact/Broken/None

Relinquished by (company):	Ramboll	**Received by (company):**	ELS - SYD
Print Name:	Jake Bourke	**Print Name:**	V. VEGA
Date & Time:	21/09/2021	**Date & Time:**	24/9/21 @ 1040
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 15°C (if applicable)
Transported by: Hand delivered / courier

VV ~~13 — 001 (EXTRA)~~
~~14 — 001~~

2nd esky received on 27/9/21 @ 1020

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318001103
Contact person: JAB	**PO No.:**
Project Mgr: Jordyn Kirsch	**Envirolab Quote No. :**
Sampler: JAB	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0467580473	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; jbourke@ramboll.com	

Envirolab Services
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E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required													Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium									Provide as much information about the sample as you can
15	F5		21/09/2021	WATER	X	X	X	X	X									
16	G5		21/09/2021	WATER	X	X	X	X	X									
17	W3S		21/09/2021	WATER	X	X	X	X	X									
18	A7		21/09/2021	WATER	X	X	X	X	X									
19	W1S		21/09/2021	WATER	X	X	X	X	X									
20	W1D		21/09/2021	WATER	X	X	X	X	X									
21	E4		21/09/2021	WATER	X	X	X	X	X									
22	D01_20210920		20/09/2021	WATER	X	X	X	X	X									
~~23~~	T01_20210920		20/09/2021	WATER	X	X	X	X	X									Please forward to ALS
23	D02_20210921		21/09/2021	WATER	X	X	X	X	X									
~~24~~ 24	R01_20210921		21/09/2021	WATER	X	X	X	X	X									

Relinquished by (company):	Ramboll	**Received by (company):**	ELS-SYD
Print Name:	Jake Bourke	**Print Name:**	Y. VEGA
Date & Time:	18/03/2021	**Date & Time:**	24/9/21 @ 1040
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 13°C (if applicable)
Transported by: Hand delivered / courier

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318001103
Contact person: JAB	**PO No.:**
Project Mgr: Jordyn Kirsch	**Envirolab Quote No. :**
Sampler: JAB	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
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16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Environmental Division Sydney
Work Order Reference
ES2134801

Telephone : – 61-2-8784 8555

Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium	Comments
15	F5		21/09/2021	WATER	X	X	X	X	X	
16	G5		21/09/2021	WATER	X	X	X	X	X	
17	W3S		21/09/2021	WATER	X	X	X	X	X	
18	A7		21/09/2021	WATER	X	X	X	X	X	
19	W1S		21/09/2021	WATER	X	X	X	X	X	
20	W1D		21/09/2021	WATER	X	X	X	X	X	
21	E4		21/09/2021	WATER	X	X	X	X	X	
22	D01_20210920		20/09/2021	WATER	X	X	X	X	X	
~~23~~ –	T01_20210920		20/09/2021	WATER	X	X	X	X	X	Please forward to ALS
23	D02_20210921		21/09/2021	WATER	X	X	X	X	X	
24	R01_20210921		21/09/2021	WATER	X	X	X	X	X	

Provide as much information about the sample as you can

Relinquished by (company):	Ramboll	ELS SYD	**Received by (company):** ELS - SYD
Print Name:	Jake Bourke	A BM	**Print Name:** Y. VEGA
Date & Time:	18/03/2021	27/9/21 1310	**Date & Time:** 24/9/21 @ 1040
Signature:			**Signature:**

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 13°C (if applicable)
Transported by: Hand delivered / courier

Rec - SOGH 27/9/21 1645 279030 W

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318001103
Contact person: JAB	**PO No.:**
Project Mgr: Jordyn Kirsch	**Envirolab Quote No. :**
Sampler: JAB	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0467580473	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
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Email: jkirsch@ramboll.com; jbourke@ramboll.com	

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16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information | **Tests Required** | **Comments**

Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium	Comments
15	F5		21/09/2021	WATER	X	X	X	X	X	
16	G5		21/09/2021	WATER	X	X	X	X	X	
17	W3S		21/09/2021	WATER	X	X	X	X	X	
18	A7		21/09/2021	WATER	X	X	X	X	X	
19	W1S		21/09/2021	WATER	X	X	X	X	X	
20	W1D		21/09/2021	WATER	X	X	X	X	X	
21	E4		21/09/2021	WATER	X	X	X	X	X	
22	D01_20210920		20/09/2021	WATER	X	X	X	X	X	
1 23	T01_20210920		20/09/2021	WATER	X	X	X	X	X	Please forward to ALS
23	D02_20210921		21/09/2021	WATER	X	X	X	X	X	
24	R01_20210921		21/09/2021	WATER	X	X	X	X	X	

Environmental Division Sydney
Work Order Reference
ES2134801

Telephone : +61-2-8784 8555

Provide as much information about the sample as you can

Relinquished by (company):	Ramboll	ELS SYD
Print Name:	Jake Bourke	A BM
Date & Time:	18/03/2021	27/9/21 1310
Signature:		

Received by (company):	ELS - SYD
Print Name:	Y. VEGA
Date & Time:	27/9/21 @ 1040
Signature:	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 13°C (if applicable)
Transported by: Hand delivered / courier

Rec-SOGfr 27/9/21 1645 279030 W 4.4c

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2134801**

Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JORDYN KIRSCH	Contact	: Olivia Barbato
Address	: 100 Pacific Hwy NORTH SYDNEY 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jkirsch@ramboll.com	E-mail	: olivia.barbato@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: Hydro Groundwater Plume Monitoring - 318001103	Page	: 1 of 2
Order number	: ----	Quote number	: EB2017ENVIAUS0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: JAB		

Dates

Date Samples Received	: 27-Sep-2021 16:45	Issue Date	: 28-Sep-2021
Client Requested Due Date	: 05-Oct-2021	Scheduled Reporting Date	: **05-Oct-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 4.4'C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EG020F Dissolved Metals by ICP/MS	WATER - EG020T Total Metals by ICP/MS (including digestion)	WATER - EK025SF Free CN By Segmented Flow Analyser	WATER - EK026SF Total Cyanide by Segmented Flow Analyser	WATER - EK040-P Fluoride (PCT)
ES2134801-001	20-Sep-2021 00:00	T01_20210920	✓	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE		
- A4 - AU Tax Invoice (INV)	Email	AsiaPac-Accounts@Ramboll.com
JAKE BOURKE		
- *AU Certificate of Analysis - NATA (COA)	Email	JBOURKE@ramboll.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	JBOURKE@ramboll.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	JBOURKE@ramboll.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	JBOURKE@ramboll.com
- Chain of Custody (CoC) (COC)	Email	JBOURKE@ramboll.com
- EDI Format - SRAENV (SRAENV)	Email	JBOURKE@ramboll.com
- EDI Format - XTab (XTAB)	Email	JBOURKE@ramboll.com
JORDYN KIRSCH		
- *AU Certificate of Analysis - NATA (COA)	Email	jkirsch@ramboll.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jkirsch@ramboll.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jkirsch@ramboll.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jkirsch@ramboll.com
- Chain of Custody (CoC) (COC)	Email	jkirsch@ramboll.com
- EDI Format - SRAENV (SRAENV)	Email	jkirsch@ramboll.com
- EDI Format - XTab (XTAB)	Email	jkirsch@ramboll.com

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 279030

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro Groundwater Plume Monitoring - 318001103**
Number of Samples	24 Water
Date samples received	24/09/2021
Date completed instructions received	24/09/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	01/10/2021
Date of Issue	01/10/2021

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Giovanni Agosti, Group Technical Manager
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		279030-1	279030-2	279030-3	279030-4	279030-5
Your Reference	UNITS	W2D	PUMP	W7M	E5	E5D
Date Sampled		20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Fluoride, F	mg/L	880	26	350	230	7.6
Total Cyanide	mg/L	46	0.068	25	18	0.17
Free Cyanide in Water	mg/L	0.011	<0.004	0.013	0.011	<0.004

Miscellaneous Inorganics						
Our Reference		279030-6	279030-7	279030-8	279030-9	279030-10
Your Reference	UNITS	G2	N8	N9	W6D	E11
Date Sampled		20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Fluoride, F	mg/L	0.3	0.5	95	<0.1	76
Total Cyanide	mg/L	<0.004	0.10	0.83	<0.004	1.4
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		279030-11	279030-12	279030-13	279030-14	279030-15
Your Reference	UNITS	N2	W5D	F6	G6	F5
Date Sampled		20/09/2021	21/09/2021	21/09/2021	21/09/2021	21/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Fluoride, F	mg/L	0.9	0.3	0.4	0.4	0.2
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		279030-16	279030-17	279030-18	279030-19	279030-20
Your Reference	UNITS	G5	W3S	A7	W1S	W1D
Date Sampled		21/09/2021	21/09/2021	21/09/2021	21/09/2021	21/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Fluoride, F	mg/L	<0.1	110	370	14	9.7
Total Cyanide	mg/L	<0.004	12	20	0.18	0.23
Free Cyanide in Water	mg/L	<0.004	<0.004	0.005	<0.004	<0.004

Miscellaneous Inorganics					
Our Reference		279030-21	279030-22	279030-23	279030-24
Your Reference	UNITS	E4	D01_20210920	D02_20210921	R01_20210921
Date Sampled		21/09/2021	20/09/2021	21/09/2021	21/09/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Fluoride, F	mg/L	570	7.7	0.3	<0.1
Total Cyanide	mg/L	47	0.20	<0.004	<0.004
Free Cyanide in Water	mg/L	0.008	<0.004	<0.004	<0.004

HM in water - dissolved						
Our Reference		279030-1	279030-2	279030-3	279030-4	279030-5
Your Reference	UNITS	W2D	PUMP	W7M	E5	E5D
Date Sampled		20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Dissolved	µg/L	600	11,000	360	100	20

HM in water - dissolved						
Our Reference		279030-6	279030-7	279030-8	279030-9	279030-10
Your Reference	UNITS	G2	N8	N9	W6D	E11
Date Sampled		20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Dissolved	µg/L	<10	40	600	50	90

HM in water - dissolved						
Our Reference		279030-11	279030-12	279030-13	279030-14	279030-15
Your Reference	UNITS	N2	W5D	F6	G6	F5
Date Sampled		20/09/2021	21/09/2021	21/09/2021	21/09/2021	21/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Dissolved	µg/L	3,400	<10	<10	5,900	2,200

HM in water - dissolved						
Our Reference		279030-16	279030-17	279030-18	279030-19	279030-20
Your Reference	UNITS	G5	W3S	A7	W1S	W1D
Date Sampled		21/09/2021	21/09/2021	21/09/2021	21/09/2021	21/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Dissolved	µg/L	30	620	230	110	50

HM in water - dissolved					
Our Reference		279030-21	279030-22	279030-23	279030-24
Your Reference	UNITS	E4	D01_20210920	D02_20210921	R01_20210921
Date Sampled		21/09/2021	20/09/2021	21/09/2021	21/09/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Dissolved	µg/L	530	10	10	<10

HM in water - total						
Our Reference		279030-1	279030-2	279030-3	279030-4	279030-5
Your Reference	UNITS	W2D	PUMP	W7M	E5	E5D
Date Sampled		20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Total	µg/L	1,600	18,000	2,300	750	420

HM in water - total						
Our Reference		279030-6	279030-7	279030-8	279030-9	279030-10
Your Reference	UNITS	G2	N8	N9	W6D	E11
Date Sampled		20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Total	µg/L	620	6,500	3,700	5,400	5,000

HM in water - total						
Our Reference		279030-11	279030-12	279030-13	279030-14	279030-15
Your Reference	UNITS	N2	W5D	F6	G6	F5
Date Sampled		20/09/2021	21/09/2021	21/09/2021	21/09/2021	21/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Total	µg/L	6,500	270	30	6,600	2,700

HM in water - total						
Our Reference		279030-16	279030-17	279030-18	279030-19	279030-20
Your Reference	UNITS	G5	W3S	A7	W1S	W1D
Date Sampled		21/09/2021	21/09/2021	21/09/2021	21/09/2021	21/09/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Total	µg/L	180	3,100	1,000	4,700	320

HM in water - total					
Our Reference		279030-21	279030-22	279030-23	279030-24
Your Reference	UNITS	E4	D01_20210920	D02_20210921	R01_20210921
Date Sampled		21/09/2021	20/09/2021	21/09/2021	21/09/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Date analysed	-	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Aluminium-Total	µg/L	70,000	370	400	<10

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjusted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hypochlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	279030-2
Date prepared	-			28/09/2021	1	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Date analysed	-			28/09/2021	1	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	880	830	6	88	99
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	46	50	8	96	114
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	0.011	0.01	10	101	87

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	279030-22
Date prepared	-			[NT]	11	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Date analysed	-			[NT]	11	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	11	0.9	0.8	12	95	108
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	11	<0.004	<0.004	0	91	#
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	11	<0.004	<0.004	0	92	#

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	20	28/09/2021	28/09/2021		[NT]	[NT]
Date analysed	-			[NT]	20	28/09/2021	28/09/2021		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	20	9.7	9.7	0	[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	20	0.23	[NT]		[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	20	<0.004	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	24	28/09/2021	28/09/2021		[NT]	[NT]
Date analysed	-			[NT]	24	28/09/2021	28/09/2021		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	24	<0.1	[NT]		[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	24	<0.004	<0.004	0	[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	24	<0.004	<0.004	0	[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	279030-2
Date prepared	-			28/09/2021	1	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Date analysed	-			28/09/2021	1	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	600	570	5	98	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	279030-22
Date prepared	-			[NT]	11	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Date analysed	-			[NT]	11	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	11	3400	3300	3	99	99

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	28/09/2021	28/09/2021		[NT]	[NT]
Date analysed	-			[NT]	21	28/09/2021	28/09/2021		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	21	530	500	6	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	279030-2
Date prepared	-			28/09/2021	1	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Date analysed	-			28/09/2021	1	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Aluminium-Total	µg/L	10	Metals-022	<10	1	1600	1300	21	91	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	279030-20
Date prepared	-			[NT]	10	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Date analysed	-			[NT]	10	28/09/2021	28/09/2021		28/09/2021	28/09/2021
Aluminium-Total	µg/L	10	Metals-022	[NT]	10	5000	5000	0	98	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	19	28/09/2021	28/09/2021		[NT]	[NT]
Date analysed	-			[NT]	19	28/09/2021	28/09/2021		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	19	4700	4600	2	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	28/09/2021	28/09/2021		[NT]	[NT]
Date analysed	-			[NT]	21	28/09/2021	28/09/2021		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	21	70000	74000	6	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Misc Inorg
Low spike recovery was obtained for this sample. Sample matrix interference is suspected. However, an acceptable recovery was obtained for the LCS

8 HM in water - dissolved - # Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

8 HM in water - total - # Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch

Sample Login Details

Your reference	Hydro Groundwater Plume Monitoring - 318001103
Envirolab Reference	279030
Date Sample Received	24/09/2021
Date Instructions Received	24/09/2021
Date Results Expected to be Reported	01/10/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	24 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	13
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Fluoride, F	Total Cyanide	Free Cyanide in Water	HM in water - dissolved	HM in water - total
W2D	✓	✓	✓	✓	✓
PUMP	✓	✓	✓	✓	✓
W7M	✓	✓	✓	✓	✓
E5	✓	✓	✓	✓	✓
E5D	✓	✓	✓	✓	✓
G2	✓	✓	✓	✓	✓
N8	✓	✓	✓	✓	✓
N9	✓	✓	✓	✓	✓
W6D	✓	✓	✓	✓	✓
E11	✓	✓	✓	✓	✓
N2	✓	✓	✓	✓	✓
W5D	✓	✓	✓	✓	✓
F6	✓	✓	✓	✓	✓
G6	✓	✓	✓	✓	✓
F5	✓	✓	✓	✓	✓
G5	✓	✓	✓	✓	✓
W3S	✓	✓	✓	✓	✓
A7	✓	✓	✓	✓	✓
W1S	✓	✓	✓	✓	✓
W1D	✓	✓	✓	✓	✓
E4	✓	✓	✓	✓	✓
D01_20210920	✓	✓	✓	✓	✓
D02_20210921	✓	✓	✓	✓	✓
R01_20210921	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2134801**	Page	: 1 of 2
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JORDYN KIRSCH	Contact	: Olivia Barbato
Address	: 100 Pacific Hwy NORTH SYDNEY 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318001103	Date Samples Received	: 27-Sep-2021 16:45
Order number	: ----	Date Analysis Commenced	: 29-Sep-2021
C-O-C number	: ----	Issue Date	: 05-Oct-2021 12:33
Sampler	: JAB		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

ilac-MRA NATA
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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EK025sf: LOR raised for Free CN sample 1 due to sample matrix.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Sample ID	**T01_20210920**	**----**	**----**	**----**	**----**
			Sampling date / time	20-Sep-2021 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2134801-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	10	µg/L	**10**	**----**	**----**	**----**	**----**
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	10	µg/L	**260**	**----**	**----**	**----**	**----**
EK025SF: Free CN by Segmented Flow Analyser								
Free Cyanide	----	0.004	mg/L	<0.040	**----**	**----**	**----**	**----**
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	**1.26**	**----**	**----**	**----**	**----**
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	**----**	**----**	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2134801**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JORDYN KIRSCH	Contact	: Olivia Barbato
Address	: 100 Pacific Hwy NORTH SYDNEY 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318001103	Date Samples Received	: 27-Sep-2021
Order number	: ----	Date Analysis Commenced	: 29-Sep-2021
C-O-C number	: ----	Issue Date	: 05-Oct-2021
Sampler	: JAB		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3928813)									
ES2134719-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.03	0.03	0.0	No Limit
ES2134719-011	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 3930590)									
ES2134503-021	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.01	<0.01	0.0	No Limit
ES2134941-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 3927936)									
ES2134801-001	T01_20210920	EK025SF: Free Cyanide	----	0.004	mg/L	<0.040	<0.040	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 3927935)									
ES2134801-001	T01_20210920	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	1.26	1.24	1.5	0% - 20%
EK040P: Fluoride by PC Titrator (QC Lot: 3928555)									
ES2134785-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
ES2134863-004	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3928813)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	95.2	80.0	116
EG020T: Total Metals by ICP-MS (QCLot: 3930590)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	95.7	82.0	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 3927936)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	113	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3927935)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	123	73.0	133
EK040P: Fluoride by PC Titrator (QCLot: 3928555)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	98.2	82.0	116

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 3927936)							
ES2134801-001	T01_20210920	EK025SF: Free Cyanide	----	4 mg/L	99.6	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3927935)							
ES2134801-001	T01_20210920	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	# Not Determined	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 3928555)							
ES2134785-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	80.0	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2134801**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JORDYN KIRSCH	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318001103	Date Samples Received	: 27-Sep-2021
Site	: ----	Issue Date	: 05-Oct-2021
Sampler	: JAB	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK026SF: Total CN by Segmented Flow Analyser	ES2134801--001	T01_20210920	**Total Cyanide**	57-12-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
Dissolved Metals by ICP-MS - Suite A	0	3	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	0	11	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
T01_20210920	**20-Sep-2021**	**----**	----	----	**30-Sep-2021**	19-Mar-2022	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
T01_20210920	**20-Sep-2021**	**30-Sep-2021**	19-Mar-2022	✓	**30-Sep-2021**	19-Mar-2022	✓
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
T01_20210920	**20-Sep-2021**	**----**	----	----	**29-Sep-2021**	04-Oct-2021	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
T01_20210920	**20-Sep-2021**	**----**	----	----	**29-Sep-2021**	04-Oct-2021	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
T01_20210920	**20-Sep-2021**	**----**	----	----	**29-Sep-2021**	18-Oct-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	3	**66.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	3	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	11	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237, APHA 4500-CN-C&O and ISO 14403: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C&O / ASTM D7511 / ISO 14403. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318001103	**Envirolab Services** 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie
Contact person: Jake Bourke	PO No.:	
Project Mgr: Jordyn Kirsch	Envirolab Quote No. :	
Sampler: Jake Bourke	Date results required:	
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharge applies*	**Envirolab Services WA t/a MPL** 16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au Contact: Joshua Lim
Phone: (02) 49625444 Mob: 0467580473	Lab comments: Highly contaminated	
Fax:		
Email: jkirsch@ramboll.com; jbourke@ramboll.com		

Sample information					Tests Required												Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium								Provide as much information about the sample as you can
1	W2S		1/12/2021	WATER	X	X	X	X	X								
2	W2D		1/12/2021	WATER	X	X	X	X	X								
3	PUMP		1/12/2021	WATER	X	X	X	X	X								
4	W7S		1/12/2021	WATER	X	X	X	X	X								
5	W7M		1/12/2021	WATER	X	X	X	X	X								
6	E5		1/12/2021	WATER	X	X	X	X	X								
7	E5D		1/12/2021	WATER	X	X	X	X	X								
8	G2		1/12/2021	WATER	X	X	X	X	X								
9	N9		1/12/2021	WATER	X	X	X	X	X								
10	W6D		1/12/2021	WATER	X	X	X	X	X								
11	N8		1/12/2021	WATER	X	X	X	X	X								
12	E11		1/12/2021	WATER	X	X	X	X	X								
13	W5S		1/12/2021	WATER	X	X	X	X	X								
14	W5D		1/12/2021	WATER	X	X	X	X	X								

Chatswood NSW
Ph: (02) 9910 6200

Job No: 284490
Date Received: 3/12/2021
Time Received: 1040
Received By: EJ
Temp: Cool/Ambient

Relinquished by (company):	Ramboll	Received by (company): EJ	*Lab use only:*
Print Name:	Jake Bourke	Print Name: Ray	Samples Received: Cool or Ambient (circle one)
Date & Time:	2/12/2021	Date & Time: 3/12/2021 1040	Temperature Received at: 4°C (if applicable)
Signature:		Signature:	Transported by: Hand delivered / courier

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318001103
Contact person: Jake Bourke	**PO No.:**
Project Mgr: Jordyn Kirsch	**Envirolab Quote No. :**
Sampler: Jake Bourke	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0467580473	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; jbourke@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium										Provide as much information about the sample as you can
15	N2		01/12/2021	WATER	X	X	X	X	X										
16	G5		02/12/2021	WATER	X	X	X	X	X										
17	F5		02/12/2021	WATER	X	X	X	X	X										
18	G6		02/12/2021	WATER	X	X	X	X	X										
19	F6		02/12/2021	WATER	X	X	X	X	X										
20	W3S		02/12/2021	WATER	X	X	X	X	X										
21	A7		02/12/2021	WATER	X	X	X	X	X										
22	E4		02/12/2021	WATER	X	X	X	X	X										
23	W1S		02/12/2021	WATER	X	X	X	X	X										
24	W1D		02/12/2021	WATER	X	X	X	X	X										
25	D01_20211202		01/12/2021	WATER	X	X	X	X	X										
-	T01_20211202		01/12/2021	WATER	X	X	X	X	X										Please forward to ALS
26	D02_20211202		02/12/2021	WATER	X	X	X	X	X										
27	R01_20211202		02/12/2021	WATER	X	X	X	X	X										

Relinquished by (company):	Ramboll	**Received by (company):**	ES
Print Name:	Jake Bourke	**Print Name:**	Phay
Date & Time:	02/12/2021	**Date & Time:**	3/12/2021 1040
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
Transported by: Hand delivered / courier

284490

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318001103
Contact person: Jake Bourke	PO No.:
Project Mgr: Jordyn Kirsch	Envirolab Quote No. :
Sampler: Jake Bourke	Date results required:
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 Mob: 0467580473	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	Lab comments: Highly contaminated
Email: jkirsch@ramboll.com; jbourke@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium	Comments
15	N2		01/12/2021	WATER	X	X	X	X	X	Provide as much information about the sample as you can
16	G5		02/12/2021	WATER	X	X	X	X	X	
17	F5		02/12/2021	WATER	X	X	X	X	X	
18	G6		02/12/2021	WATER	X	X	X	X	X	
19	F6		02/12/2021	WATER	X	X	X	X	X	
20	W3S		02/12/2021	WATER	X	X	X	X	X	
21	A7		02/12/2021	WATER	X	X	X	X	X	
22	E4		02/12/2021	WATER	X	X	X	X	X	
23	W1S		02/12/2021	WATER	X	X	X	X	X	
24	W1D		02/12/2021	WATER	X	X	X	X	X	
25	D01_20211202		01/12/2021	WATER	X	X	X	X	X	
-	T01_20211202		01/12/2021	WATER	X	X	X	X	X	
26	D02_20211202		02/12/2021	WATER	X	X	X	X	X	
27	R01_20211202		02/12/2021	WATER	X	X	X	X	X	Please forward to ALS

HT

Environmental Division
Sydney
Work Order Reference
ES2144330

Telephone : + 61-2-8784 8555

Relinquished by (company):	Ramboll	ELS Syd	Received by (company): ELS
Print Name:	Jake Bourke	K Lowe	Print Name: Phan
Date & Time:	02/12/2021	6/12/21, 1250	Date & Time: 3/12/2021 1040
Signature:			Signature:

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
Transported by: Hand delivered / courier

rec: TAs 6/12/21 3:50

284490

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2144330**

Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JORDYN KIRSCH	Contact	: Olivia Barbato
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jkirsch@ramboll.com	E-mail	: olivia.barbato@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: Hydro Groundwater Plume Monitoring - 318001103	Page	: 1 of 2
Order number	: ----	Quote number	: EB2017ENVIAUS0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Jake Bourke		

Dates

Date Samples Received	: 06-Dec-2021 15:50	Issue Date	: 06-Dec-2021
Client Requested Due Date	: 13-Dec-2021	Scheduled Reporting Date	: **13-Dec-2021**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 9.2'C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EG020F Dissolved Metals by ICP/MS	WATER - EG020T Total Metals by ICP/MS (including digestion)	WATER - EK025SF Free CN By Segmented Flow Analyser	WATER - EK026SF Total Cyanide by Segmented Flow Analyser	WATER - EK040-P Fluoride (PCT)
ES2144330-001	01-Dec-2021 00:00	T01_20211201	✓	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE		
- A4 - AU Tax Invoice (INV)	Email	AsiaPac-Accounts@Ramboll.com
JAKE BOURKE		
- *AU Certificate of Analysis - NATA (COA)	Email	JBOURKE@ramboll.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	JBOURKE@ramboll.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	JBOURKE@ramboll.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	JBOURKE@ramboll.com
- Chain of Custody (CoC) (COC)	Email	JBOURKE@ramboll.com
- EDI Format - EQUIS_ENVIRON (EQUIS_ENVIRON)	Email	JBOURKE@ramboll.com
- EDI Format - XTab (XTAB)	Email	JBOURKE@ramboll.com
JORDYN KIRSCH		
- *AU Certificate of Analysis - NATA (COA)	Email	jkirsch@ramboll.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jkirsch@ramboll.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jkirsch@ramboll.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jkirsch@ramboll.com
- Chain of Custody (CoC) (COC)	Email	jkirsch@ramboll.com
- EDI Format - EQUIS_ENVIRON (EQUIS_ENVIRON)	Email	jkirsch@ramboll.com
- EDI Format - XTab (XTAB)	Email	jkirsch@ramboll.com

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 284490

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Bourke, J Kirsch
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro Groundwater Plume Monitoring - 318001103**
Number of Samples	27 Water
Date samples received	03/12/2021
Date completed instructions received	03/12/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	10/12/2021
Date of Issue	31/01/2022
Reissue Details	This report replaces R01 created on 20/12/2021 due to: revised report with #22 Total Cyanide result amended.

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Inorganics Supervisor
Hannah Nguyen, Metals Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		284490-1	284490-2	284490-3	284490-4	284490-5
Your Reference	UNITS	W2S	W2D	PUMP	W7S	W7M
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Date analysed	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Fluoride, F	mg/L	24	1,000	17	33	360
Total Cyanide	mg/L	0.061	82	0.012	1.0	16
Free Cyanide in Water	mg/L	<0.004	0.009	<0.004	<0.004	0.008

Miscellaneous Inorganics						
Our Reference		284490-6	284490-7	284490-8	284490-9	284490-10
Your Reference	UNITS	E5	E5D	G2	N9	W6D
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Date analysed	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Fluoride, F	mg/L	320	7.9	0.5	82	0.1
Total Cyanide	mg/L	19	0.27	<0.004	0.18	<0.004
Free Cyanide in Water	mg/L	0.013	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		284490-11	284490-12	284490-13	284490-14	284490-15
Your Reference	UNITS	N8	E11	W5S	W5D	N2
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Date analysed	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Fluoride, F	mg/L	0.5	12	24	0.5	0.9
Total Cyanide	mg/L	0.041	0.17	0.34	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		284490-16	284490-17	284490-18	284490-19	284490-20
Your Reference	UNITS	G5	F5	G6	F6	W3S
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Date analysed	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Fluoride, F	mg/L	0.3	0.2	0.6	0.6	230
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004	14
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	0.033

Miscellaneous Inorganics						
Our Reference		284490-21	284490-22	284490-23	284490-24	284490-25
Your Reference	UNITS	A7	E4	W1S	W1D	D01_20211201
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Date analysed	-	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021
Fluoride, F	mg/L	360	680	13	10	0.5
Total Cyanide	mg/L	18	82	0.35	0.10	<0.004
Free Cyanide in Water	mg/L	<0.004	0.008	<0.004	<0.004	<0.004

Miscellaneous Inorganics			
Our Reference		284490-26	284490-27
Your Reference	UNITS	D02_20211202	R01_20211202
Date Sampled		1/12/2021	1/12/2021
Type of sample		Water	Water
Date prepared	-	06/12/2021	06/12/2021
Date analysed	-	06/12/2021	06/12/2021
Fluoride, F	mg/L	0.3	<0.1
Total Cyanide	mg/L	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004

HM in water - dissolved						
Our Reference		284490-1	284490-2	284490-3	284490-4	284490-5
Your Reference	UNITS	W2S	W2D	PUMP	W7S	W7M
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Date analysed	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Aluminium-Dissolved	µg/L	4,200	560	2,100	9,100	370

HM in water - dissolved						
Our Reference		284490-6	284490-7	284490-8	284490-9	284490-10
Your Reference	UNITS	E5	E5D	G2	N9	W6D
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Date analysed	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Aluminium-Dissolved	µg/L	90	20	30	60	40

HM in water - dissolved						
Our Reference		284490-11	284490-12	284490-13	284490-14	284490-15
Your Reference	UNITS	N8	E11	W5S	W5D	N2
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Date analysed	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Aluminium-Dissolved	µg/L	40	2,000	14,000	20	3,000

HM in water - dissolved						
Our Reference		284490-16	284490-17	284490-18	284490-19	284490-20
Your Reference	UNITS	G5	F5	G6	F6	W3S
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Date analysed	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Aluminium-Dissolved	µg/L	30	2,000	5,600	<10	300

HM in water - dissolved						
Our Reference		284490-21	284490-22	284490-23	284490-24	284490-25
Your Reference	UNITS	A7	E4	W1S	W1D	D01_20211201
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Date analysed	-	08/12/2021	08/12/2021	08/12/2021	08/12/2021	08/12/2021
Aluminium-Dissolved	µg/L	150	290	70	80	20

HM in water - dissolved			
Our Reference		284490-26	284490-27
Your Reference	UNITS	D02_20211202	R01_20211202
Date Sampled		1/12/2021	1/12/2021
Type of sample		Water	Water
Date prepared	-	08/12/2021	08/12/2021
Date analysed	-	08/12/2021	08/12/2021
Aluminium-Dissolved	µg/L	30	<10

HM in water - total						
Our Reference		284490-1	284490-2	284490-3	284490-4	284490-5
Your Reference	UNITS	W2S	W2D	PUMP	W7S	W7M
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Date analysed	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Aluminium-Total	µg/L	9,600	680	4,100	86,000	6,800

HM in water - total						
Our Reference		284490-6	284490-7	284490-8	284490-9	284490-10
Your Reference	UNITS	E5	E5D	G2	N9	W6D
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Date analysed	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Aluminium-Total	µg/L	1,600	270	100	710	4,100

HM in water - total						
Our Reference		284490-11	284490-12	284490-13	284490-14	284490-15
Your Reference	UNITS	N8	E11	W5S	W5D	N2
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Date analysed	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Aluminium-Total	µg/L	200	4,800	32,000	380	4,400

HM in water - total						
Our Reference		284490-16	284490-17	284490-18	284490-19	284490-20
Your Reference	UNITS	G5	F5	G6	F6	W3S
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Date analysed	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Aluminium-Total	µg/L	60	2,400	7,400	<10	730

HM in water - total						
Our Reference		284490-21	284490-22	284490-23	284490-24	284490-25
Your Reference	UNITS	A7	E4	W1S	W1D	D01_20211201
Date Sampled		1/12/2021	1/12/2021	1/12/2021	1/12/2021	1/12/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Date analysed	-	09/12/2021	09/12/2021	09/12/2021	09/12/2021	09/12/2021
Aluminium-Total	µg/L	280	490	2,100	800	280

HM in water - total			
Our Reference		284490-26	284490-27
Your Reference	UNITS	D02_20211202	R01_20211202
Date Sampled		1/12/2021	1/12/2021
Type of sample		Water	Water
Date prepared	-	09/12/2021	09/12/2021
Date analysed	-	09/12/2021	09/12/2021
Aluminium-Total	µg/L	40	<10

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjusted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hypochlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	284490-2
Date prepared	-			06/12/2021	1	06/12/2021	06/12/2021		06/12/2021	06/12/2021
Date analysed	-			06/12/2021	1	06/12/2021	06/12/2021		06/12/2021	06/12/2021
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	24	24	0	113	103
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	0.061	[NT]		99	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	[NT]		103	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	284490-14
Date prepared	-			[NT]	3	06/12/2021	06/12/2021		06/12/2021	06/12/2021
Date analysed	-			[NT]	3	06/12/2021	06/12/2021		06/12/2021	06/12/2021
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	3	17	18	6	109	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	3	0.012	0.011	9	99	89
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	3	<0.004	<0.004	0	93	88

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	284490-22
Date prepared	-			[NT]	11	06/12/2021	06/12/2021		[NT]	06/12/2021
Date analysed	-			[NT]	11	06/12/2021	06/12/2021		[NT]	06/12/2021
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	11	0.5	0.5	0	[NT]	121
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	11	0.041	[NT]		[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	11	<0.004	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	284490-27
Date prepared	-			[NT]	12	06/12/2021	06/12/2021		[NT]	06/12/2021
Date analysed	-			[NT]	12	06/12/2021	06/12/2021		[NT]	06/12/2021
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	12	12	12	0	[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	12	0.17	0.17	0	[NT]	101
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	12	<0.004	<0.004	0	[NT]	100

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	19	06/12/2021	06/12/2021		[NT]	[NT]
Date analysed	-			[NT]	19	06/12/2021	06/12/2021		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	19	0.6	[NT]		[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	19	<0.004	<0.004	0	[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	19	<0.004	<0.004	0	[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	06/12/2021	06/12/2021		[NT]	[NT]
Date analysed	-			[NT]	21	06/12/2021	06/12/2021		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	21	360	360	0	[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	21	18	[NT]		[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	21	<0.004	[NT]		[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	284490-9
Date prepared	-			08/12/2021	8	08/12/2021	08/12/2021		08/12/2021	08/12/2021
Date analysed	-			08/12/2021	8	08/12/2021	08/12/2021		08/12/2021	08/12/2021
Aluminium-Dissolved	µg/L	10	Metals-022	<10	8	30	30	0	87	76

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W6	284490-22
Date prepared	-			[NT]	17	08/12/2021	08/12/2021		08/12/2021	08/12/2021
Date analysed	-			[NT]	17	08/12/2021	08/12/2021		08/12/2021	08/12/2021
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	17	2000	2000	0	86	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	08/12/2021	08/12/2021		[NT]	[NT]
Date analysed	-			[NT]	21	08/12/2021	08/12/2021		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	21	150	150	0	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	284490-2
Date prepared	-			09/12/2021	1	09/12/2021	09/12/2021		09/12/2021	09/12/2021
Date analysed	-			09/12/2021	1	09/12/2021	09/12/2021		09/12/2021	09/12/2021
Aluminium-Total	µg/L	10	Metals-022	<10	1	9600	9700	1	91	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	284490-22
Date prepared	-			[NT]	11	09/12/2021	09/12/2021		09/12/2021	09/12/2021
Date analysed	-			[NT]	11	09/12/2021	09/12/2021		09/12/2021	09/12/2021
Aluminium-Total	µg/L	10	Metals-022	[NT]	11	200	210	5	88	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	09/12/2021	09/12/2021		[NT]	[NT]
Date analysed	-			[NT]	21	09/12/2021	09/12/2021		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	21	280	280	0	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

8 HM in water - dissolved - # Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

8 HM in water - total - # Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2144330**	Page	: 1 of 2
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JORDYN KIRSCH	Contact	: Olivia Barbato
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318001103	Date Samples Received	: 06-Dec-2021 15:50
Order number	: ----	Date Analysis Commenced	: 07-Dec-2021
C-O-C number	: ----	Issue Date	: 13-Dec-2021 13:24
Sampler	: Jake Bourke		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

ilac-MRA NATA
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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Sample ID	**T01_20211201**	**----**	**----**	**----**	**----**
				Sampling date / time	01-Dec-2021 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES2144330-001**	**--------**	**--------**	**--------**	**--------**
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	**----**	**----**	**----**	**----**
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.10**	**----**	**----**	**----**	**----**
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	**----**	**----**	**----**	**----**
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	**----**	**----**	**----**	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	**----**	**----**	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2144330**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JORDYN KIRSCH	Contact	: Olivia Barbato
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318001103	Date Samples Received	: 06-Dec-2021
Order number	: ----	Date Analysis Commenced	: 07-Dec-2021
C-O-C number	: ----	Issue Date	: 13-Dec-2021
Sampler	: Jake Bourke		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4067493)									
ES2145048-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2143904-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.03	0.03	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 4065227)									
ES2144286-033	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.03	0.03	0.0	No Limit
ES2144293-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	2.65	2.54	4.3	0% - 20%
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 4067452)									
ES2144267-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 4067449)									
ES2144463-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	0.089	0.089	0.0	0% - 20%
ES2144267-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 4060427)									
ES2144411-006	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
ES2144118-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.8	0.7	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4067493)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	98.0	80.0	116
EG020T: Total Metals by ICP-MS (QCLot: 4065227)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	91.4	82.0	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 4067452)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	93.9	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4067449)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	111	73.0	133
EK040P: Fluoride by PC Titrator (QCLot: 4060427)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	90.6	82.0	116

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 4067452)							
ES2144267-001	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	86.2	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 4067449)							
ES2144267-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	86.4	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 4060427)							
ES2144118-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	97.4	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2144330**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JORDYN KIRSCH	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318001103	Date Samples Received	: 06-Dec-2021
Site	: ----	Issue Date	: 13-Dec-2021
Sampler	: Jake Bourke	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
Dissolved Metals by ICP-MS - Suite A	0	8	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	0	9	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
T01_20211201	**01-Dec-2021**	**----**	----	----	**10-Dec-2021**	30-May-2022	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
T01_20211201	**01-Dec-2021**	**09-Dec-2021**	30-May-2022	✓	**09-Dec-2021**	30-May-2022	✓
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
T01_20211201	**01-Dec-2021**	**----**	----	----	**10-Dec-2021**	15-Dec-2021	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
T01_20211201	**01-Dec-2021**	**----**	----	----	**10-Dec-2021**	15-Dec-2021	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
T01_20211201	**01-Dec-2021**	**----**	----	----	**07-Dec-2021**	29-Dec-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	8	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	9	**22.22**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	8	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	9	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237, APHA 4500-CN-C&O and ISO 14403: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C&O / ASTM D7511 / ISO 14403. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

APPENDIX 6
CALIBRATION CERTIFICATES

Oil / Water Interface Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument **Geotech Interface Meter (60M)**
Serial No. **3953**

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Eloise Carroll**

Calibration date: **5/03/2021**

Next calibration due: **4/05/2021**

SERVICE & CALIBRATION REPORT
Water Quality Meter

Customer details:
Ramboll Australia Pty Ltd
The Junction NSW 2291
Attn: Jake Bourke

Job no. *210226*

Date: *17 Feb 2021*

Instrument model:
HORIBA U-52G/10m
Multi-parameter water quality meter

Instrument serial number: *4KV0033X 2020*

PRE-DELIVERY CALIBRATION

Calibration: (in accordance with manufacturer's specifications)

Parameter - unit	Calibration value	After calibration	Comment
pH (pH)	7.01	7.01	Pass
pH (pH)	4.00	4.00	Pass
ORP (mV)	240	240	Pass
Conductivity (mS/cm	0.000	0.000	Pass
Conductivity (mS/cm)	0.718	0.718	Pass
Conductivity (mS/cm)	6.67	6.67	Pass
Conductivity (mS/cm)	58.6	58.6	Pass
Turbidity (NTU)	0.0	0.0	Pass
Turbidity (NTU)	8.0	8.0	Pass
Turbidity (NTU)	80	80	Pass
Turbidity (NTU)	400	400	Pass
D.O. zero (mg/L)	0.00	0.00	Pass
D.O span (mg/L)	8.93mg/L @ 22.2°C	8.93mg/L @ 22.2°C	Pass
Temperature (°C)	23.1°C	23.1°C	Pass

Comments:
MAKE SURE pH reference electrode is refilled with soln #330 regularly. If the #330 soln solidifies inside the pH reference electrode, remove the liquid junction cap and rinse out the old soln with distilled water. Then refill with fresh soln # 330. ***Please read the notes on pH maintenance.***

Calibration carried out by:
Tim Adams

AUSTRALIAN SCIENTIFIC PTY LTD
(Exclusive HORIBA Agent for Australia)
11 McDougall Street, Kotara NSW 2289
TEL: 1800 021 083
E-mail: sales@austscientific.com.au **www.austscientific.com.au**

Multi-Parameter Water Quality Meter Calibration

pH Manual Calibration (two-points)

Instrument: Horiba U-52G/10m
Control Unit Serial No: TH06G239
Sensor Probe Unit Serial No: 4KV0033X

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Solution	Temperature	Calibration Point	Measurement Value
	pH 4 standard solution phthalate	22.57	4.01	4.01
	pH 7 standard solution Neutral phosphate	22.54	6.86	6.86

Calibrated by: **Jake Bourke**

Calibration date: **16/03/2021**

Table A: Change in pH with temperature (°C)

Temperature (°C)	pH 4 standard solution Phthalate	pH 7 standard solution Neutral phosphate	pH 9 standard solution Borate
0	4.01	6.98	9.46
5	4.01	6.95	9.39
10	4.00	6.92	9.33
15	4.00	6.90	9.27
20	4.00	6.88	9.22
25	4.01	6.86	9.18
30	4.01	6.85	9.14
35	4.02	6.84	9.10
40	4.03	6.84	9.07
45	4.04	6.84	9.04

Multi-Parameter Water Quality Meter Calibration

pH Manual Calibration (two-points)

Instrument: Horiba U-52G/10m
Control Unit Serial No: TH06G239
Sensor Probe Unit Serial No: 4KV0033X

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Solution	Temperature	Calibration Point	Measurement Value
pH	pH 4 standard solution phthalate	18.29	4.00	4.00
	pH 7 standard solution Neutral phosphate	18.36	6.88	6.88

Calibrated by: **Jake Bourke**

Calibration date: **25/03/2021**

Table A: Change in pH with temperature (°C)

Temperature (°C)	pH 4 standard solution Phthalate	pH 7 standard solution Neutral phosphate	pH 9 standard solution Borate
0	4.01	6.98	9.46
5	4.01	6.95	9.39
10	4.00	6.92	9.33
15	4.00	6.90	9.27
20	4.00	6.88	9.22
25	4.01	6.86	9.18
30	4.01	6.85	9.14
35	4.02	6.84	9.10
40	4.03	6.84	9.07
45	4.04	6.84	9.04

Oil / Water Interface Meter

Instrument **Geotech Interface Meter (60m)**
Serial No. **3955**

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors			
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Darcy Keogh**

Calibration date: **20-May-21**

Next calibration due: **20-Jul-21**

Multi-Parameter Water Quality Meter Calibration

Instrument: Horiba U-52G/10m
Control Unit Serial No: TH06G239
Sensor Probe Unit Serial No: 4KV0033X

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Parameter	Units	Temp. (°C)	Calibration Value	After Calibration	Comment
pH	pH	17.96	4.00	4.00	Pass
pH	pH	17.53	7.02	7.02	Pass
pH	pH	17.58	10.06	10.06	Pass
ORP	pH	-	240	240	Pass
Conductivity	mS/cm	-	0.00	0.00	Pass
Conductivity	mS/cm	14.76	0.581	0.581	Pass
Conductivity	mS/cm	14.8	5.39	5.39	Pass
Conductivity	mS/cm	16.28	48.50	48.50	Pass
D.O. Zero	mg/L	-	0.00	0.00	Pass
D.O. Span	mg/L	19.28	9.26	9.26	Pass

Calibrated by: **Jake Bourke**

Calibration date: **8/06/2021**

Table A: Change in pH with temperature (°C)

Temperature (°C)	pH 4 standard solution	pH 7 standard solution	pH 10 standard solution
5	4.00	7.09	10.24
10	4.00	7.06	10.19
15	4.00	7.04	10.12
20	4.00	7.02	10.06
30	4.01	7.00	9.96
35	4.02	6.99	9.92
40	4.03	6.97	9.90
50	4.06	6.95	9.82

Table B: Change in Conductivity with temperature (°C)

Temperature (°C)	Standard solution (0.718 mS/cm)	Standard solution (6.67 mS/cm)	Standard solution (58.6 mS/cm)
10	0.512	4.76	41.80
11	0.526	4.88	42.90
12	0.540	5.01	44.10
13	0.533	0.51	45.20
14	0.567	5.27	46.30
15	0.581	5.39	47.40
16	0.595	5.52	48.50
17	0.608	5.65	49.60
18	0.622	5.87	50.80
19	0.636	5.90	51.90
20	0.649	6.03	53.00
21	0.663	6.16	54.10
22	0.677	6.29	55.20
23	0.691	6.41	56.40
24	0.704	6.54	57.50
25	0.718	6.67	58.60
26	0.732	6.79	59.70
27	0.745	6.92	60.80
28	0.759	7.05	62.00
29	0.773	7.18	63.10
30	0.787	7.30	64.20
31	0.800	7.43	65.30

Table C: Change in Dissolved Oxygen with Temperature at 100% Relative Humidity (Altitude:sea level)

Temperature	DO (100% R.H.)
(Celsius)	(ppm, mg/L)
0.00	14.60
1.00	14.19
2.00	13.81
3.00	13.44
4.00	13.09
5.00	12.75
6.00	12.43
7.00	12.12
8.00	11.83
9.00	11.55
10.00	11.27
11.00	11.01
12.00	10.76
13.00	10.52
14.00	10.29
15.00	10.07
16.00	9.85
17.00	9.65
18.00	9.45
19.00	9.26
20.00	9.07
21.00	8.90
22.00	8.72
23.00	8.56
24.00	8.40
25.00	8.24
26.00	8.09
27.00	7.95
28.00	7.81
29.00	7.67
30.00	7.54
31.00	7.41
32.00	7.28

Values are for pressure = 760 mm Hg for measurements at sea level.
For a given temperature, the concentration of dissolved oxygen concentration decreases by 0.3 mg/L with every 500 ft (152.4 m) increase in altitude.

Multi-Parameter Water Quality Meter Calibration

pH Manual Calibration (two-points)

Instrument: Horiba U-52G/10m
Control Unit Serial No: TH06G239
Sensor Probe Unit Serial No: 4KV0033X

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Solution	Temperature	Calibration Point	Measurement Value
pH	pH 4 standard solution phthalate	12.71	7.04	7.04
	pH 7 standard solution Neutral phosphate	12.95	4.00	4.00

Calibrated by: **Jake Bourke**

Calibration date: **14/06/2021**

Table A: Change in pH with temperature (°C)

Temperature (°C)	pH 4 standard solution	pH 7 standard solution	pH 10 standard solution
5	4.00	7.09	10.24
10	4.00	7.06	10.19
15	4.00	7.04	10.12
20	4.00	7.02	10.06
30	4.01	7.00	9.96
35	4.02	6.99	9.92
40	4.03	6.97	9.90
50	4.06	6.95	9.82

Oil / Water Interface Meter

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Instrument **Geotech Interface Meter (30M)**
Serial No. **4019**

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Gary Needs**

Calibration date: **15-Sep-21**

Next calibration due: **14-Nov-21**

Multi-Parameter Water Quality Meter Calibration

Instrument: Horiba U-52G/10m
Control Unit Serial No: TH06G239
Sensor Probe Unit Serial No: 4KV0033X

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Parameter	Units	Temp. (°C)	Calibration Value	After Calibration	Comment
pH	pH	16.84	4.00	4.00	Pass
pH	pH	16.55	7.04	7.04	Pass
pH	pH	17.3	10.12	10.12	Pass
ORP	pH	-	240	240	Pass
Conductivity	mS/cm	-	0.00	0.00	Pass
Conductivity	mS/cm	17.41	0.608	0.608	Pass
Conductivity	mS/cm	17.45	5.65	5.65	Pass
Conductivity	mS/cm	17.63	50.80	50.80	Pass
D.O. Zero	mg/L	-	0.00	0.00	Pass
D.O. Span	mg/L	16.89	9.65	9.65	Pass
Turbidity	0	-	0.00	0.00	Pass
Turbidity	8	-	8.00	8.00	Pass
Turbidity	80	-	80.00	80.00	Pass
Turbidity	400	-	400.00	400.00	Pass

Calibrated by: **Jake Bourke**

Calibration date: **25/08/2021**

Table A: Change in pH with temperature (°C)

Temperature (°C)	pH 4 standard solution	pH 7 standard solution	pH 10 standard solution
5	4.00	7.09	10.24
10	4.00	7.06	10.19
15	4.00	7.04	10.12
20	4.00	7.02	10.06
30	4.01	7.00	9.96
35	4.02	6.99	9.92
40	4.03	6.97	9.90
50	4.06	6.95	9.82

Table B: Change in Conductivity with temperature (°C)

Temperature (°C)	Standard solution (0.718 mS/cm)	Standard solution (6.67 mS/cm)	Standard solution (58.6 mS/cm)
10	0.512	4.76	41.80
11	0.526	4.88	42.90
12	0.540	5.01	44.10
13	0.533	0.51	45.20
14	0.567	5.27	46.30
15	0.581	5.39	47.40
16	0.595	5.52	48.50
17	0.608	5.65	49.60
18	0.622	5.87	50.80
19	0.636	5.90	51.90
20	0.649	6.03	53.00
21	0.663	6.16	54.10
22	0.677	6.29	55.20
23	0.691	6.41	56.40
24	0.704	6.54	57.50
25	0.718	6.67	58.60
26	0.732	6.79	59.70
27	0.745	6.92	60.80
28	0.759	7.05	62.00
29	0.773	7.18	63.10
30	0.787	7.30	64.20
31	0.800	7.43	65.30

Table C: Change in Dissolved Oxygen with Temperature at 100% Relative Humidity (Altitude:sea level)

Temperature	DO (100% R.H.)
(Celsius)	(ppm, mg/L)
0.00	14.60
1.00	14.19
2.00	13.81
3.00	13.44
4.00	13.09
5.00	12.75
6.00	12.43
7.00	12.12
8.00	11.83
9.00	11.55
10.00	11.27
11.00	11.01
12.00	10.76
13.00	10.52
14.00	10.29
15.00	10.07
16.00	9.85
17.00	9.65
18.00	9.45
19.00	9.26
20.00	9.07
21.00	8.90
22.00	8.72
23.00	8.56
24.00	8.40
25.00	8.24
26.00	8.09
27.00	7.95
28.00	7.81
29.00	7.67
30.00	7.54
31.00	7.41
32.00	7.28

Values are for pressure = 760 mm Hg for measurements at sea level.
For a given temperature, the concentration of dissolved oxygen concentration decreases by 0.3 mg/L with every 500 ft (152.4 m) increase in altitude.

Multi-Parameter Water Quality Meter Calibration

pH Manual Calibration (two-points)

Instrument: Horiba U-52G/10m
Control Unit Serial No: TH06G239
Sensor Probe Unit Serial No: 4KV0033X

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Solution	Temperature	Calibration Point	Measurement Value
pH	pH 4 standard solution phthalate	17.98	4.00	4.00
	pH 7 standard solution Neutral phosphate	17.99	7.02	7.02

Calibrated by: **Jake Bourke**

Calibration date: **18/09/2021**

Table A: Change in pH with temperature (°C)

Temperature (°C)	pH 4 standard solution	pH 7 standard solution	pH 10 standard solution
5	4.00	7.09	10.24
10	4.00	7.06	10.19
15	4.00	7.04	10.12
20	4.00	7.02	10.06
30	4.01	7.00	9.96
35	4.02	6.99	9.92
40	4.03	6.97	9.90
50	4.06	6.95	9.82

Water Level Meter

Instrument Geotech Water150m
Serial No. 4252

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
	above 7.9v	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Darcy Keogh

Calibration date: 22-Oct-21

Next calibration due: 20-Apr-22

SERVICE & CALIBRATION REPORT
Water Quality Meter

Customer details:
Ramboll Australia Pty Ltd
Lvl2, Suite 19B, 50 Glebe Road
The Junction NSW 2291

Job no.
211136

Date:
26 November 2021

Instrument model:
HORIBA U-52G/10m
Multi-parameter water quality meter

Instrument serial number:
4KV0033X 2020

Fault report:
Check turbidity sensor.

Repairs carried out:
Replaced glass cell inside turbidity sensor (no charge).
Re-calibrated all sensors as follows:

Calibration: (in accordance with manufacturer's specifications)

Parameter - unit	Before Calibration	Calibration value	After calibration	Comment
pH (pH)	7.25	7.01	7.01	Pass
pH (pH)	4.09	4.00	4.00	Pass
ORP mV	229mV	225mV	225mV	Pass
Conductivity (mS/cm	0.000	0.000	0.000	Pass
Conductivity (mS/cm)	0.701	0.718	0.718	Pass
Conductivity (mS/cm)	6.48	6.67	6.67	Pass
Conductivity (mS/cm)	57.9	58.6	58.6	Pass
Turbidity (NTU)	0.0	0.0	0.0	Pass
Turbidity (NTU)	6.5	8.0	8.0	Pass
Turbidity (NTU)	77.3	80.0	80.0	Pass
Turbidity (NTU)	395	400	400	Pass
D.O. zero (mg/L)	0.00	0.00	0.00	Pass
D.O span (mg/L)	9.04mg/L@22^{0}C	8.96mg/L@22^{0}C	8.96mg/L@22^{0}C	Pass
Temperature (^{0}C)	21.12^{0}C	22.30^{0}C	22.30^{0}C	Pass

Comments:
MAKE SURE the pH reference electrode is refilled with soln #330 regularly. If the pH reference filling soln solidifies in the reference electrode, rinse out the pH reference electrode with distilled water. Then refill with fresh HORIBA soln # 330

Calibration carried out by:
Tony Fincher

AUSTRALIAN SCIENTIFIC PTY LTD
11 McDougall Street, Kotara NSW 2289
TEL: 1800 021 083
E-mail: sales@austscientific.com.au **www.austscientific.com.au**

Multi-Parameter Water Quality Meter Calibration

pH Manual Calibration (two-points)

Instrument: Horiba U-52G/10m
Control Unit Serial No: TH06G239
Sensor Probe Unit Serial No: 4KV0033X

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Solution	Temperature	Calibration Point	Measurement Value
pH	pH 4 standard solution phthalate	20.02	4.00	4.00
	pH 7 standard solution Neutral phosphate	19.83	7.02	7.02

Calibrated by: **Jake Bourke**

Calibration date: **1/12/2021**

Table A: Change in pH with temperature (°C)

Temperature (°C)	pH 4 standard solution	pH 7 standard solution	pH 10 standard solution
5	4.00	7.09	10.24
10	4.00	7.06	10.19
15	4.00	7.04	10.12
20	4.00	7.02	10.06
30	4.01	7.00	9.96
35	4.02	6.99	9.92
40	4.03	6.97	9.90
50	4.06	6.95	9.82

APPENDIX 7
HISTORICAL GROUNDWATER CONTOURS

Groundwater Contours - Shallow Aquifer 2013-2020

Shallow Aquifer July 2013

Shallow Aquifer November 2013

Shallow Aquifer February 2014

Shallow Aquifer June 2014

Shallow Aquifer November 2014

Shallow Aquifer February 2015

Shallow Aquifer June 2015

Shallow Aquifer September 2015

Shallow Aquifer December 2015

Shallow Aquifer April 2016

Shallow Aquifer July 2016

Shallow Aquifer October 2016

Shallow Aquifer December 2016

Shallow Aquifer March 2017

Shallow Aquifer June 2017

Shallow Aquifer September 2017

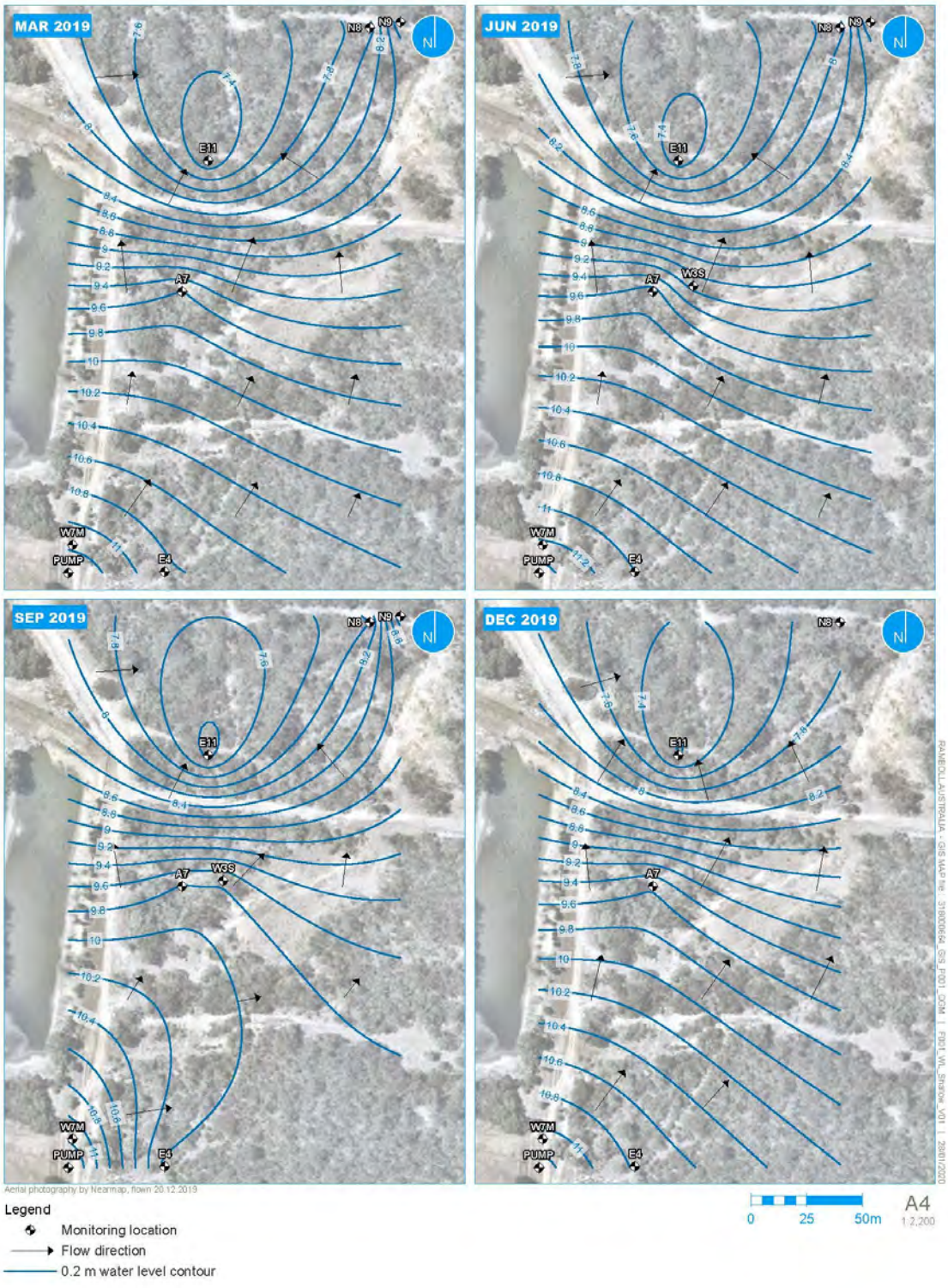
Shallow Aquifer December 2017

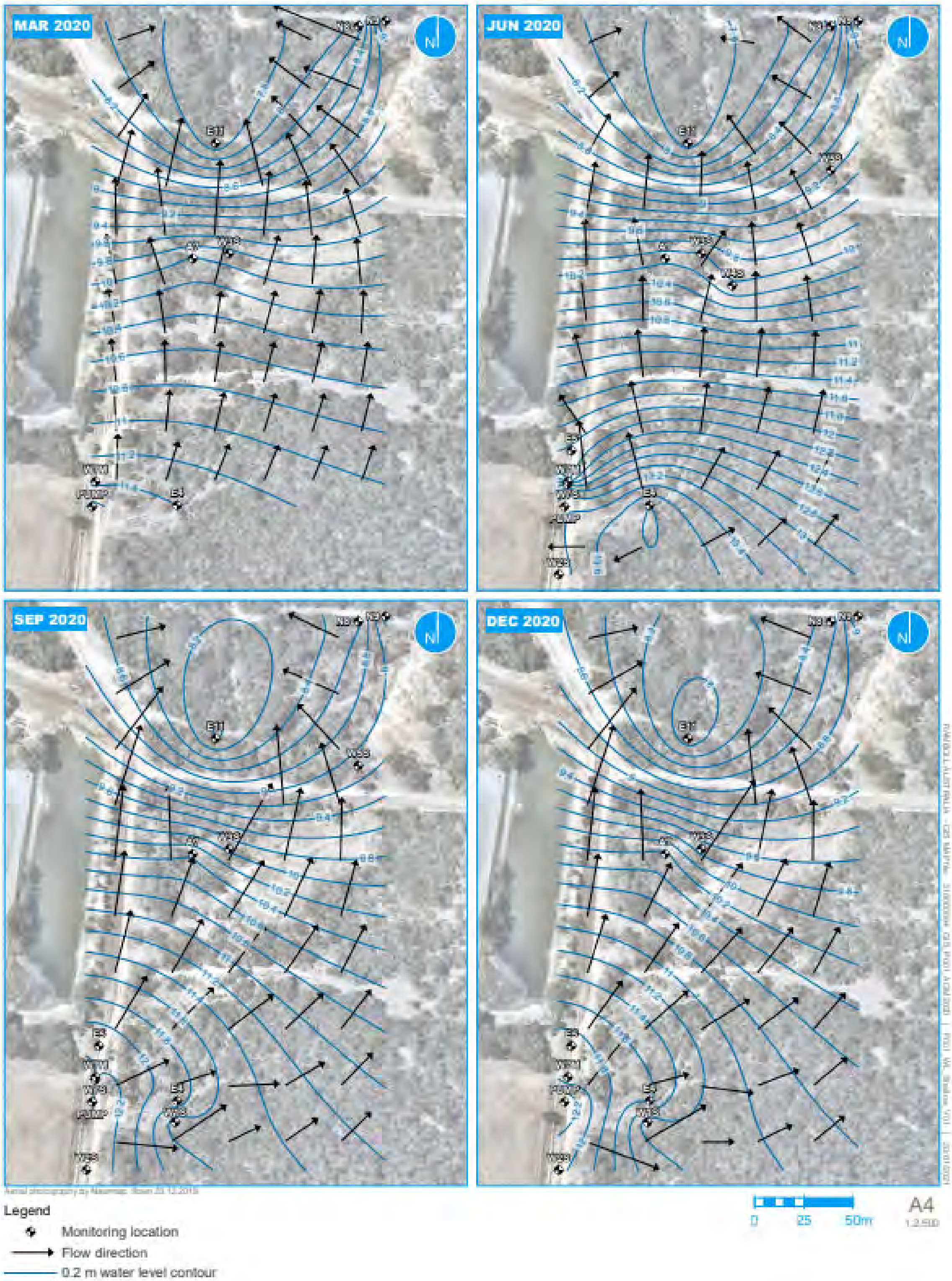
Shallow Aquifer March 2018

Shallow Aquifer June 2018

Shallow Aquifer September 2018

Shallow Aquifer December 2018


MAR 2019
JUN 2019
SEP 2019
DEC 2019
N8
N9
E11
A7
W3S
W7M
PUMP
E4
Aerial photography by Nearmap, flown 20.12.2019
Legend
Monitoring location
Flow direction
0.2 m water level contour
0
25
50m
A4
1:2,200


MAR 2020
JUN 2020
SEP 2020
DEC 2020
E11
A1
E4
PUMP
Legend
Monitoring location
Flow direction
0.2 m water level contour
0
25
50m
A4

Groundwater Contours – Deep Aquifer 2013-2020

Deep Aquifer February 2014

Deep Aquifer June 2014

Deep Aquifer November 2014

Deep Aquifer February 2015

Deep Aquifer June 2015

Deep Aquifer September 2015

Deep Aquifer December 2015


Deep Aquifer April 2016


Deep Aquifer July 2016


Deep Aquifer October 2016


Deep Aquifer December 2016

Deep Aquifer March 2017

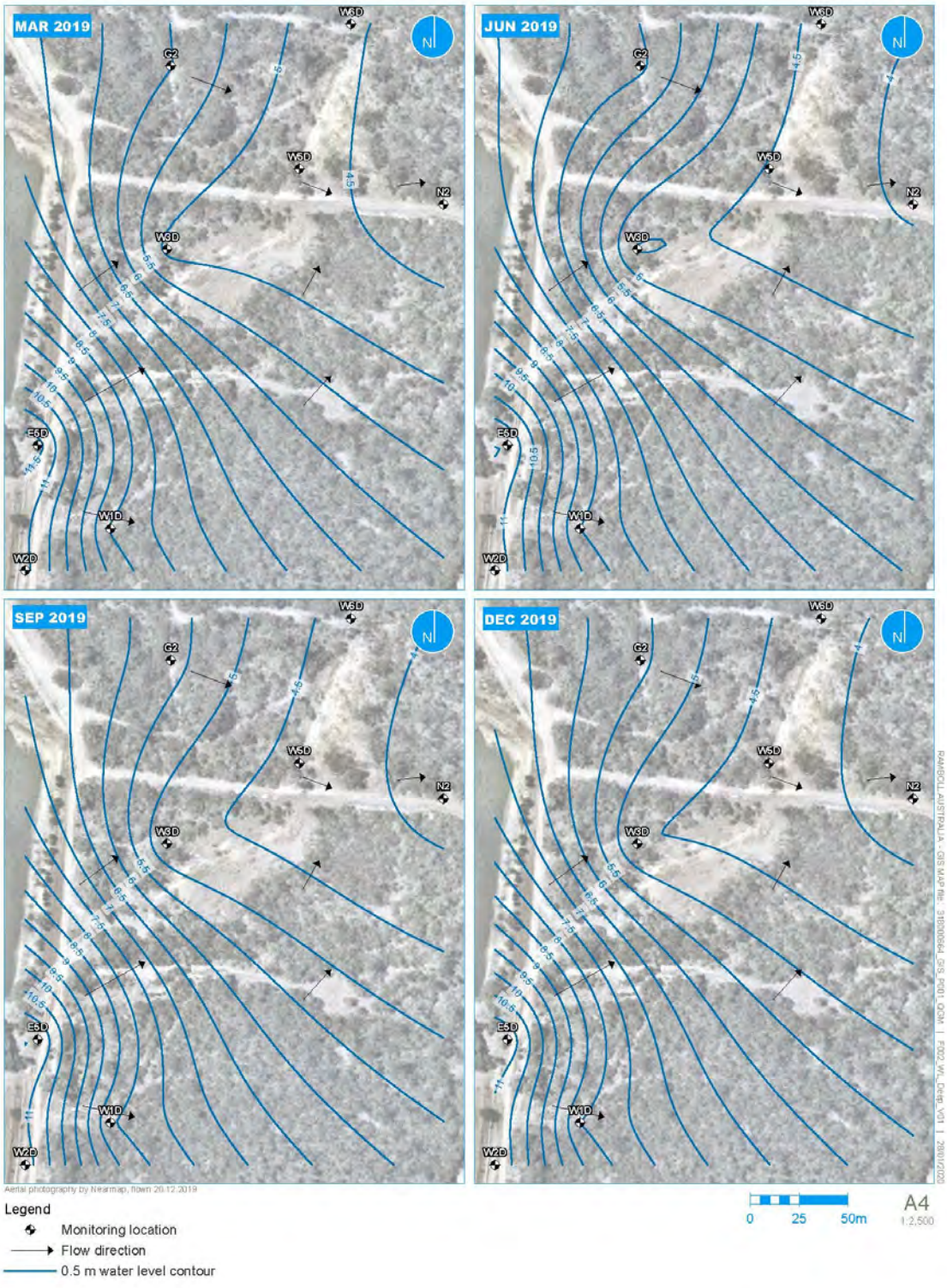
Deep Aquifer June 2017

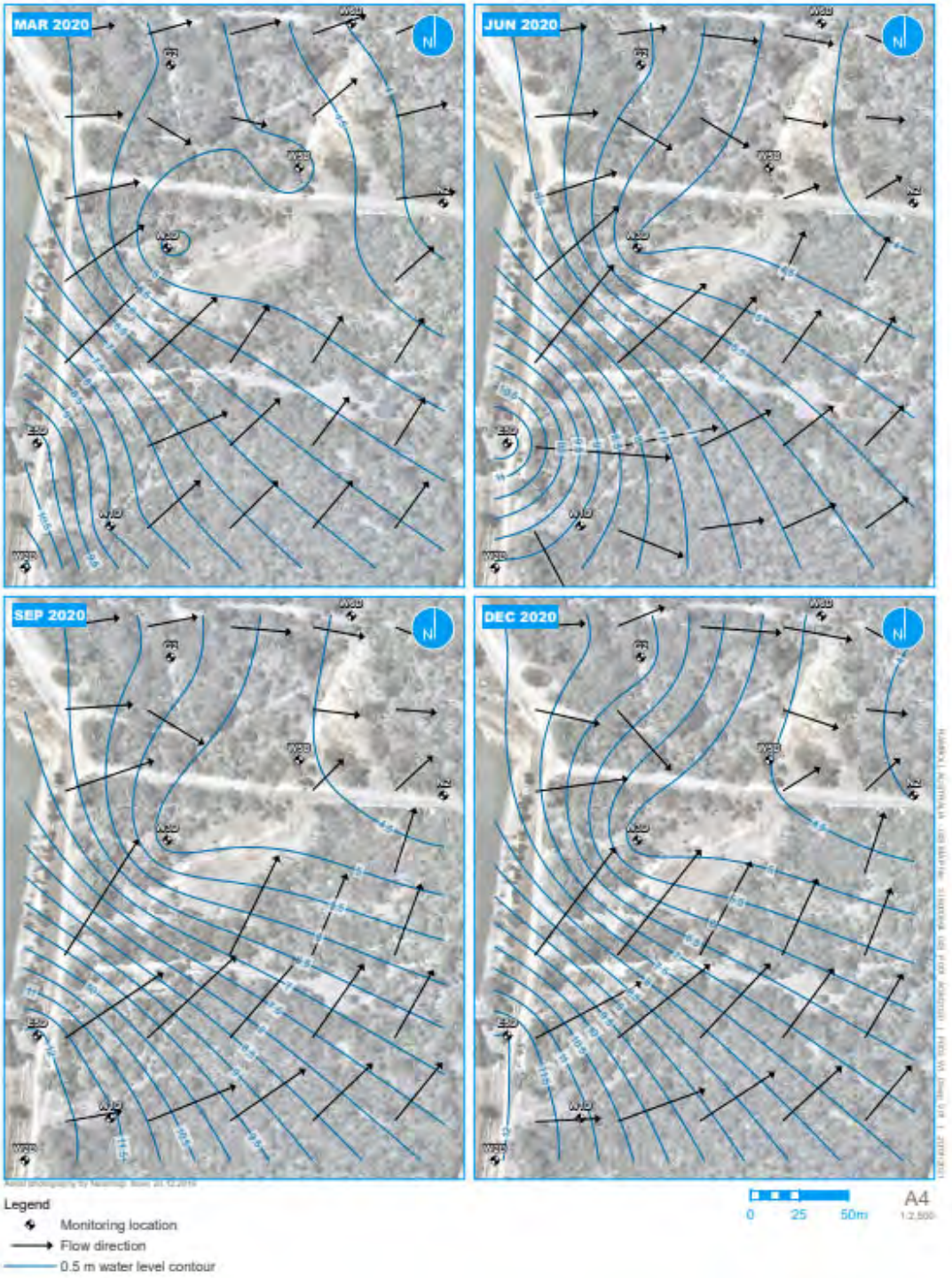
Deep Aquifer September 2017

Deep Aquifer December 2017


W6D
G2
W5D
N2
E5D
W1D
Deep Aquifer September 2018


W6D
G2
W5D
N2
E5D
W1D
Deep Aquifer December 2018


MAR 2019
JUN 2019
SEP 2019
DEC 2019
W6D
G2
W5D
N2
W3D
E5D
W1D
W2D
N
Aerial photography by Nearmap, flown 26.12.2019
Legend
Monitoring location
Flow direction
0.5 m water level contour
0
25
50m
A4
1:2,500


MAR 2020
JUN 2020
SEP 2020
DEC 2020
Legend
Monitoring location
Flow direction
0.5 m water level contour
0
25
50m
A4

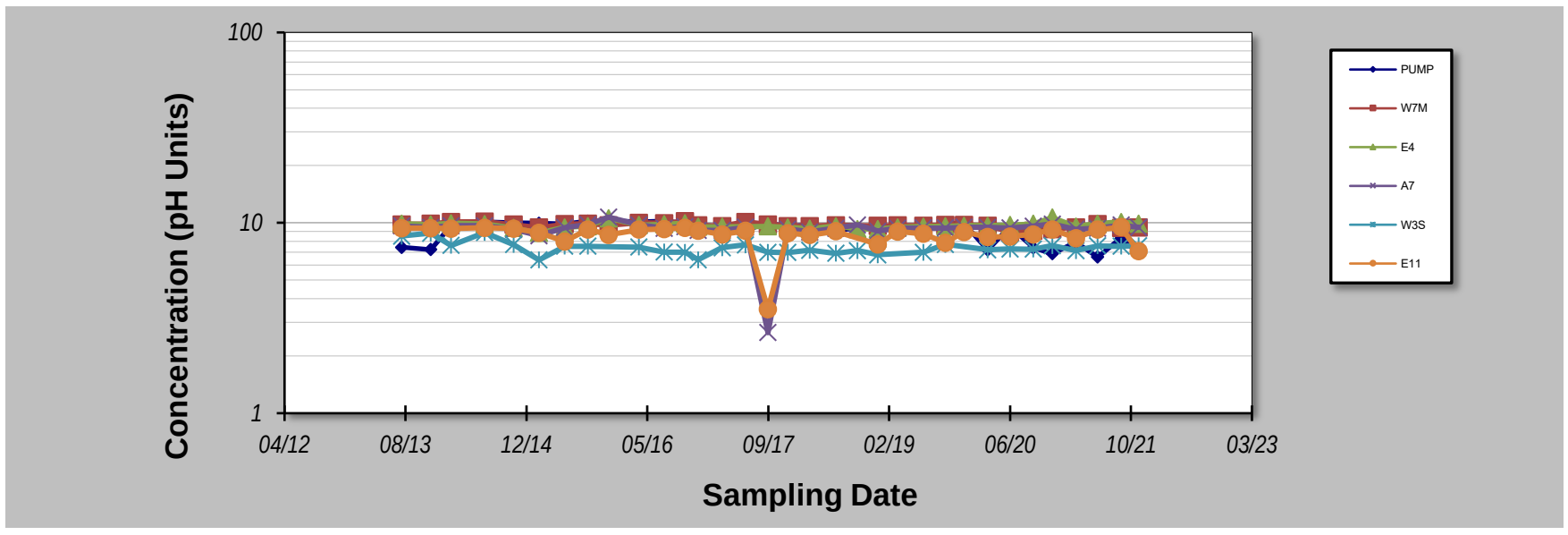
APPENDIX 8
MANN-KENDALL TREND ANALYSIS

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **pH**
Concentration Units: **pH Units**

Sampling Point ID:	PUMP	W7M	E4	A7	W3S	E11	
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	7.45	9.81	9.91	9.63	8.53	9.36	
2	26-Nov-13	7.24	9.87	9.79	9.47	8.82	9.36	
3	18-Feb-14	9.65	10.1	9.94	9.67	7.61	9.33	
4	7-Jul-14	10.14	10.12	9.84	9.66	8.89	9.41	
5	4-Nov-14	10.01	9.78	9.4	9.24	7.68	9.32	
6	17-Feb-15	9.95	9.44	8.84	8.56	6.38	8.86	
7	3-Jun-15	9.87	9.82	9.46	9.45	7.53	7.97	
8	7-Sep-15	10.22	9.91	9.62	9.8	7.53	9.23	
9	2-Dec-15	10.27	9.7	10.57	10.71		8.65	
10	5-Apr-16	10.13	9.99	9.73	9.75	7.46	9.2	
11	19-Jul-16	10.22	9.95	9.83	9.37	7.02	9.29	
12	12-Oct-16	9.98	10.17	9.94	9.57	7.01	9.41	
13	6-Dec-16	9.72	9.68	9.53	9.15	6.4	9.1	
14	15-Mar-17	9.56	9.61	9.53	9.12	7.4	8.7	
15	20-Jun-17	9.2	10.1		9.49	7.66	9.07	
16	21-Sep-17	9.9	9.8	9.59	2.65	7	3.51	
17	12-Dec-17	9.6	9.6	9.46	9.27	6.99	8.83	
18	13-Mar-18	9.73	9.61	9.32	8.96	7.19	8.62	
19	28-Jun-18	9.17	9.7	9.62	9.36	6.91	9.02	
20	26-Sep-18			9.29	9.75	7.14		
21	19-Dec-18	9.55	9.63	9.27	9.06	6.8	7.7	
22	11-Mar-19	9.42	9.68	9.47	9.38		8.99	
23	26-Jun-19	9.43	9.65	9.56	9.4	7.01	8.76	
24	24-Sep-19	9.89	9.73	9.58	9.39	7.7	7.87	
25	11-Dec-19	9.93	9.75	9.67	9.48		8.95	
26	17-Mar-20	7.2	9.67	9.65	9.46	7.21	8.41	
27	17-Jun-20	9.59	8.97	9.73	9.4	7.29	8.48	
28	22-Sep-20	7.4	9.1	9.87	9.6	7.28	8.69	
29	9-Dec-20	6.88	9.28	10.64	9.85	7.59	9.24	
30	17-Mar-21	7.9	9.47	9.56	9.26	7.14	8.3	
31	15-Jun-21	6.61	9.86	9.91	9.36	7.57	9.21	
32	20-Sep-21	8.32	9.42	10.1	9.73	7.53	9.48	
33	1-Dec-21	6.91	9.44	9.89	9.46	7.58	7.09	
34								
35								
Coefficient of Variation:		0.13	0.03	0.04	0.13	0.08	0.13	
Mann-Kendall Statistic (S):		-213	-207	49	-12	-54	-164	
Confidence Factor:		>99.9%	>99.9%	78.1%	56.7%	82.7%	99.6%	
Concentration Trend:		Decreasing	Decreasing	No Trend	Stable	Stable	Decreasing	



Notes:

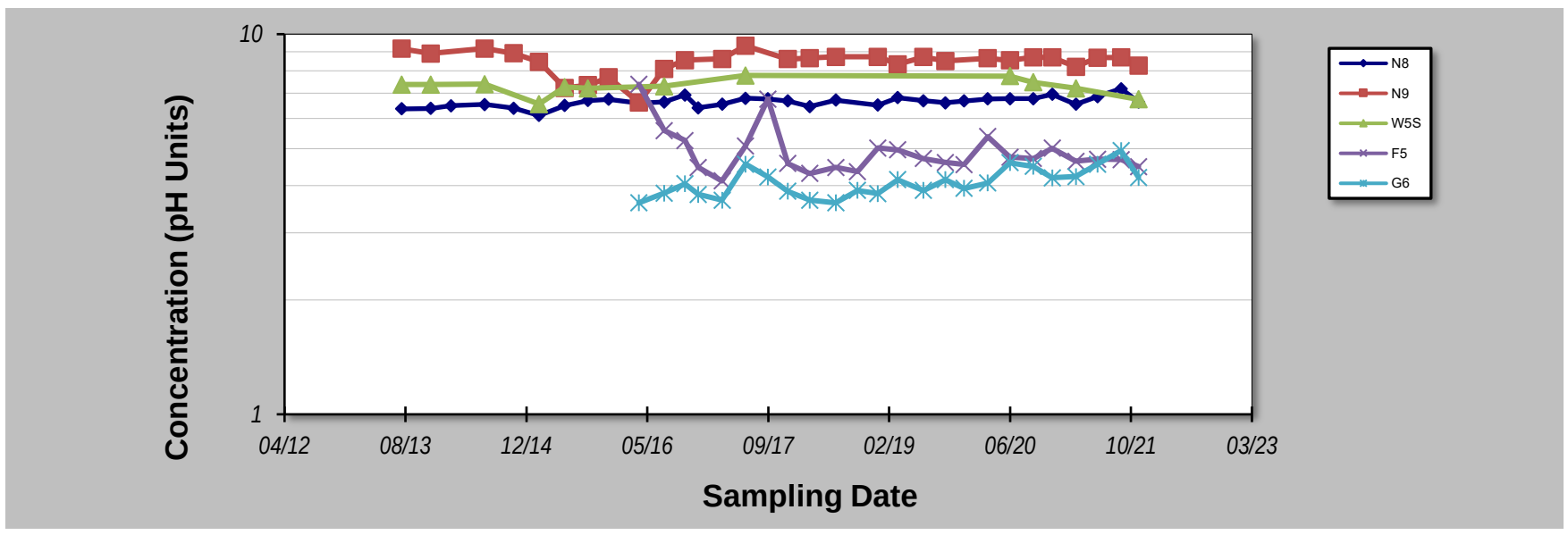
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **pH**
Concentration Units: **pH Units**

Sampling Point ID:	N8	N9	W5S	F5	G6		
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	6.36	9.16	7.37				
2	26-Nov-13	6.38	8.9	7.37				
3	18-Feb-14	6.48						
4	7-Jul-14	6.53	9.17	7.39				
5	4-Nov-14	6.39	8.91					
6	17-Feb-15	6.11	8.46	6.55				
7	3-Jun-15	6.49	7.22	7.26				
8	7-Sep-15	6.69	7.34	7.2				
9	2-Dec-15	6.74	7.7					
10	5-Apr-16	6.59	6.61		7.38	3.6		
11	19-Jul-16	6.63	8.11	7.29	5.58	3.82		
12	12-Oct-16	6.92	8.54		5.25	4.04		
13	6-Dec-16	6.4			4.46	3.79		
14	15-Mar-17	6.54	8.61		4.11	3.66		
15	20-Jun-17	6.78	9.32	7.79	5.08	4.55		
16	21-Sep-17	6.76			6.75	4.21		
17	12-Dec-17	6.67	8.6		4.57	3.86		
18	13-Mar-18	6.45	8.65		4.3	3.66		
19	28-Jun-18	6.71	8.72		4.46	3.6		
20	26-Sep-18				4.35	3.88		
21	19-Dec-18	6.51	8.72		5.02	3.81		
22	11-Mar-19	6.81	8.33		4.96	4.14		
23	26-Jun-19	6.68	8.71		4.71	3.88		
24	24-Sep-19	6.6	8.5		4.6	4.14		
25	11-Dec-19	6.67			4.54	3.93		
26	17-Mar-20	6.76	8.64		5.38	4.06		
27	17-Jun-20	6.77	8.53	7.76	4.75	4.59		
28	22-Sep-20	6.77	8.7	7.47	4.71	4.49		
29	9-Dec-20	6.95	8.69		5.01	4.19		
30	17-Mar-21	6.54	8.21	7.2	4.63	4.22		
31	15-Jun-21	6.85	8.67		4.69	4.55		
32	20-Sep-21	7.19	8.68		4.68	4.94		
33	1-Dec-21	6.63	8.27	6.74	4.48	4.2		
34								
35								
Coefficient of Variation:		0.03	0.07	0.05	0.15	0.09		
Mann-Kendall Statistic (S):		231	-11	-4	-42	139		
Confidence Factor:		>99.9%	57.8%	58.0%	84.4%	>99.9%		
Concentration Trend:		Increasing	Stable	Stable	Stable	Increasing		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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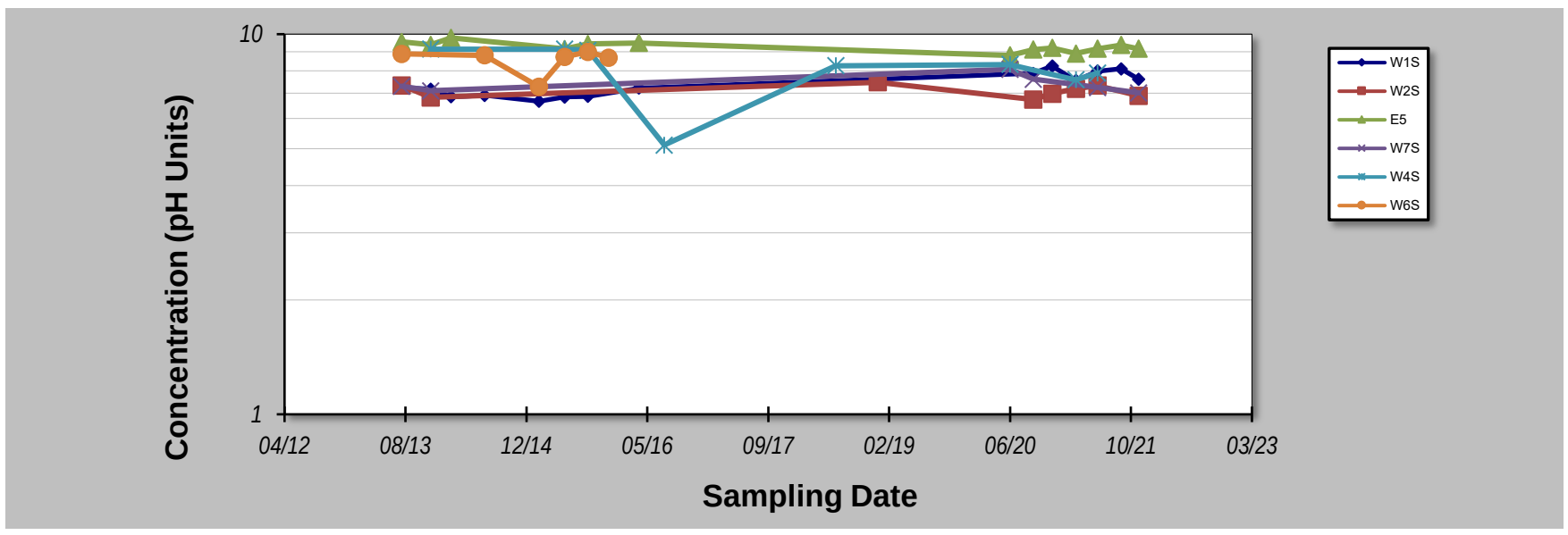
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **pH**
Concentration Units: **pH Units**

Sampling Point ID:	W1S	W2S	E5	W7S	W4S	W6S	
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	7.22	7.33	9.54	7.29		8.87	
2	26-Nov-13	7.17	6.82	9.37	7.1	9.13		
3	18-Feb-14	6.84		9.78				
4	7-Jul-14	6.9					8.79	
5	4-Nov-14							
6	17-Feb-15	6.66					7.27	
7	3-Jun-15	6.83		9.14		9.13	8.72	
8	7-Sep-15	6.86		9.42		9.07	8.98	
9	2-Dec-15						8.67	
10	5-Apr-16	7.21		9.48				
11	19-Jul-16					5.11		
12	12-Oct-16							
13	6-Dec-16							
14	15-Mar-17							
15	20-Jun-17							
16	21-Sep-17							
17	12-Dec-17							
18	13-Mar-18							
19	28-Jun-18					8.26		
20	26-Sep-18							
21	19-Dec-18		7.47					
22	11-Mar-19							
23	26-Jun-19							
24	24-Sep-19							
25	11-Dec-19							
26	17-Mar-20							
27	17-Jun-20			8.79	8.08	8.32		
28	22-Sep-20	7.89	6.73	9.11	7.61			
29	9-Dec-20	8.24	6.97	9.2				
30	17-Mar-21	7.55	7.19	8.89		7.58		
31	15-Jun-21	7.99	7.32	9.15	7.24	7.91		
32	20-Sep-21	8.11		9.36				
33	1-Dec-21	7.61	6.89	9.16	7.01			
34								
35								
Coefficient of Variation:		0.07	0.04	0.03	0.05	0.16	0.07	
Mann-Kendall Statistic (S):		41	-2	-24	-5	-15	-3	
Confidence Factor:		98.7%	54.8%	91.8%	76.5%	95.8%	64.0%	
Concentration Trend:		Increasing	Stable	Prob. Decreasing	Stable	Decreasing	Stable	



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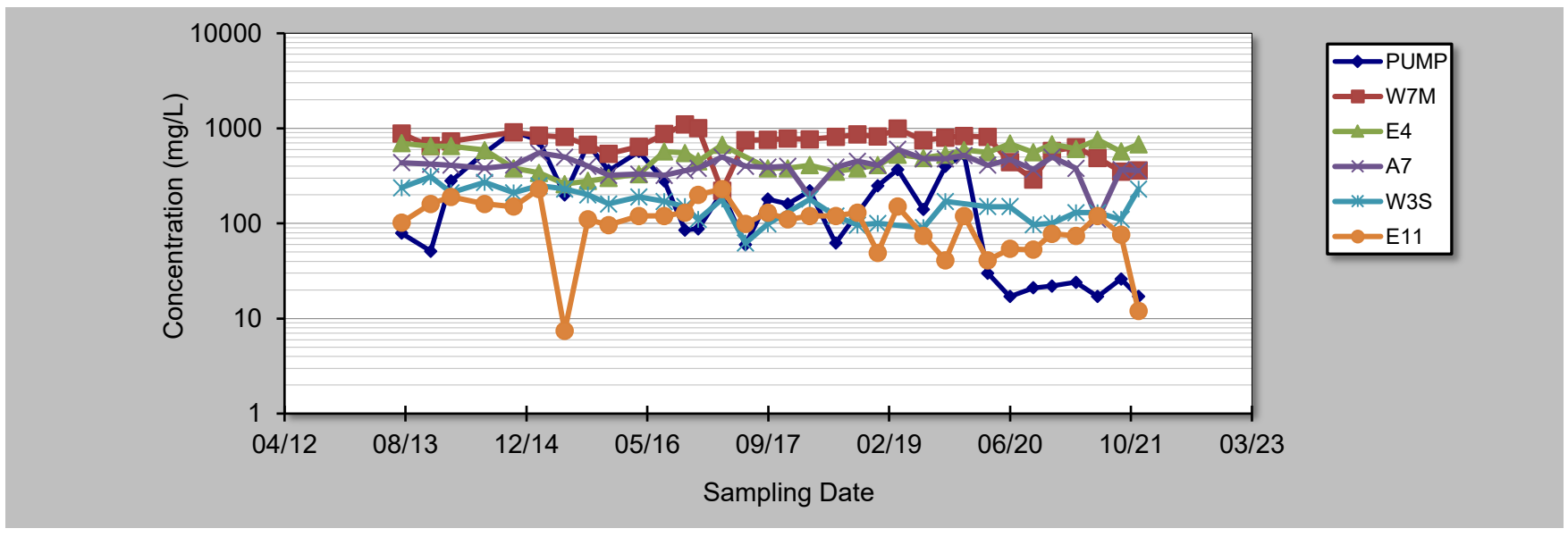
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **Soluble Fluoride**
Concentration Units: **mg/L**

Sampling Point ID:	PUMP	W7M	E4	A7	W3S	E11	
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	79	878	699	436	237	102	
2	26-Nov-13	51	650	650	420	310	160	
3	18-Feb-14	280	730	650	410	210	190	
4	7-Jul-14	550		590	380	270	160	
5	4-Nov-14	930	910	380	410	210	150	
6	17-Feb-15	740	840	340	550	250	230	
7	3-Jun-15	200	810	260	500	230	7.4	
8	7-Sep-15	680	670	280	400	200	110	
9	2-Dec-15	360	540	300	320	160	96	
10	5-Apr-16	570	640	330	330	190	120	
11	19-Jul-16	280	870	570	320	170	120	
12	12-Oct-16	85	1100	550	360	150	130	
13	6-Dec-16	88	1000	450	380	110	200	
14	15-Mar-17	210	220	670	500	180	230	
15	20-Jun-17	60	750		400	62	99	
16	21-Sep-17	180	760	380	390	99	130	
17	12-Dec-17	160	780	380	400		110	
18	13-Mar-18	220	770	410	190	180	120	
19	28-Jun-18	62	810	350	390	120	120	
20	26-Sep-18		860	380	450	96	130	
21	19-Dec-18	250	820	410	410	100	49	
22	11-Mar-19	370	990	530	600		150	
23	26-Jun-19	140	750	490	480	90	74	
24	24-Sep-19	400	800	530	480	170	41	
25	11-Dec-19	530	830	590	520		120	
26	17-Mar-20	30	810	560	410	150	41	
27	17-Jun-20	17	440	690	470	150	54	
28	22-Sep-20	21	290	560	370	97	53	
29	8-Dec-20	22	580	680	500	100	78	
30	17-Mar-21	24	630	610	380	130	74	
31	15-Jun-21	17	490	760	110	130	120	
32	20-Sep-21	26	350	570	370	110	76	
33	1-Dec-21	17	360	680	360	230	12	
34								
35								
Coefficient of Variation:		1.02	0.30	0.28	0.23	0.38	0.50	
Mann-Kendall Statistic (S):		-206	-128	143	-28	-207	-190	
Confidence Factor:		>99.9%	98.1%	99.0%	66.1%	>99.9%	99.9%	
Concentration Trend:		Decreasing	Decreasing	Increasing	Stable	Decreasing	Decreasing	



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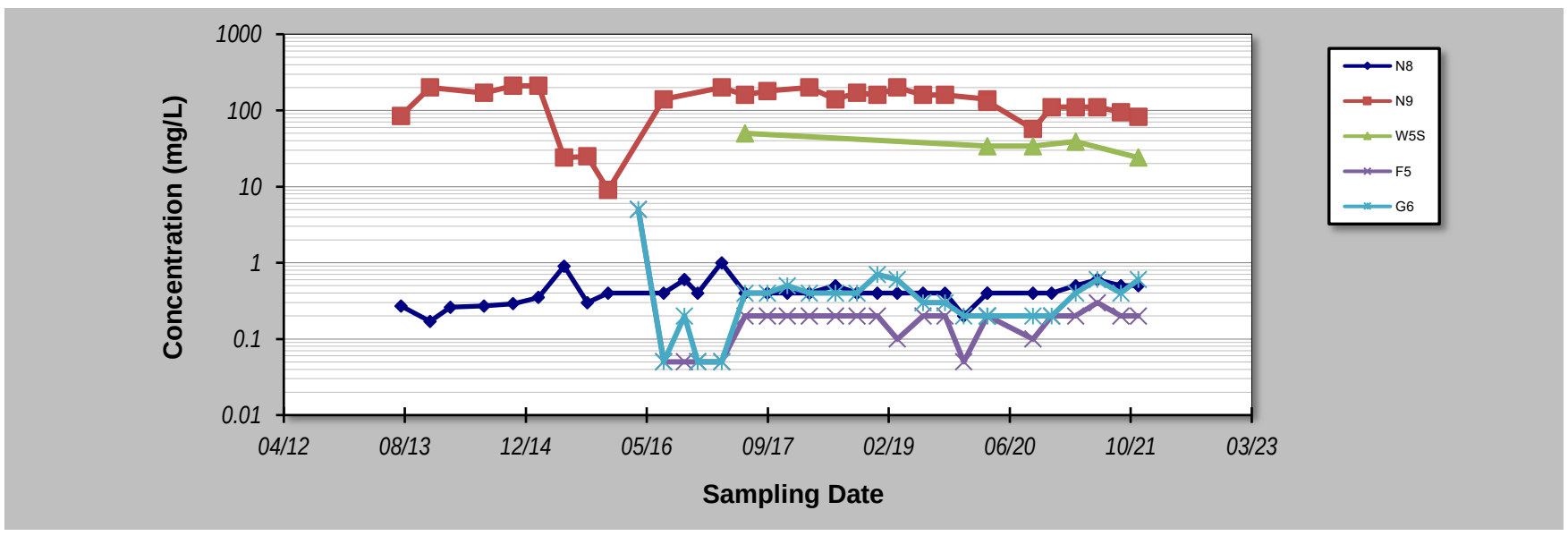
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **Soluble Fluoride**
Concentration Units: **mg/L**

Sampling Point ID:	N8	N9	W5S	F5	G6		
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	0.27	85					
2	26-Nov-13	0.17	200					
3	18-Feb-14	0.26						
4	7-Jul-14	0.27	170					
5	4-Nov-14	0.29	210					
6	17-Feb-15	0.35	210					
7	3-Jun-15	0.9	24					
8	7-Sep-15	0.3	25					
9	2-Dec-15	0.4	9					
10	5-Apr-16				5	5		
11	19-Jul-16	0.4	140		0.05	0.05		
12	12-Oct-16	0.6			0.05	0.2		
13	6-Dec-16	0.4			0.05	0.05		
14	15-Mar-17	1	200		0.05	0.05		
15	20-Jun-17	0.4	160	50	0.2	0.4		
16	21-Sep-17	0.4	180		0.2	0.4		
17	12-Dec-17	0.4			0.2	0.5		
18	13-Mar-18	0.4	200		0.2	0.4		
19	28-Jun-18	0.5	140		0.2	0.4		
20	26-Sep-18	0.4	170		0.2	0.4		
21	19-Dec-18	0.4	160		0.2	0.7		
22	11-Mar-19	0.4	200		0.1	0.6		
23	26-Jun-19	0.4	160		0.2	0.3		
24	24-Sep-19	0.4	160		0.2	0.3		
25	11-Dec-19	0.2			0.05	0.2		
26	17-Mar-20	0.4	140		0.2	0.2		
27	17-Mar-20	0.4	130	34	0.2	0.2		
28	22-Sep-20	0.4	57	34	0.1	0.2		
29	8-Dec-20	0.4	110		0.2	0.2		
30	17-Mar-21	0.5	110	39	0.2	0.4		
31	15-Jun-21	0.6	110		0.3	0.6		
32	20-Sep-21	0.5	95		0.2	0.4		
33	1-Dec-21	0.5	82	24	0.2	0.6		
34								
35								
Coefficient of Variation:		0.40	0.44	0.26	2.71	1.82		
Mann-Kendall Statistic (S):		178	-103	-5	54	25		
Confidence Factor:		99.8%	98.4%	82.1%	90.5%	72.2%		
Concentration Trend:		Increasing	Decreasing	Stable	Prob. Increasing	No Trend		



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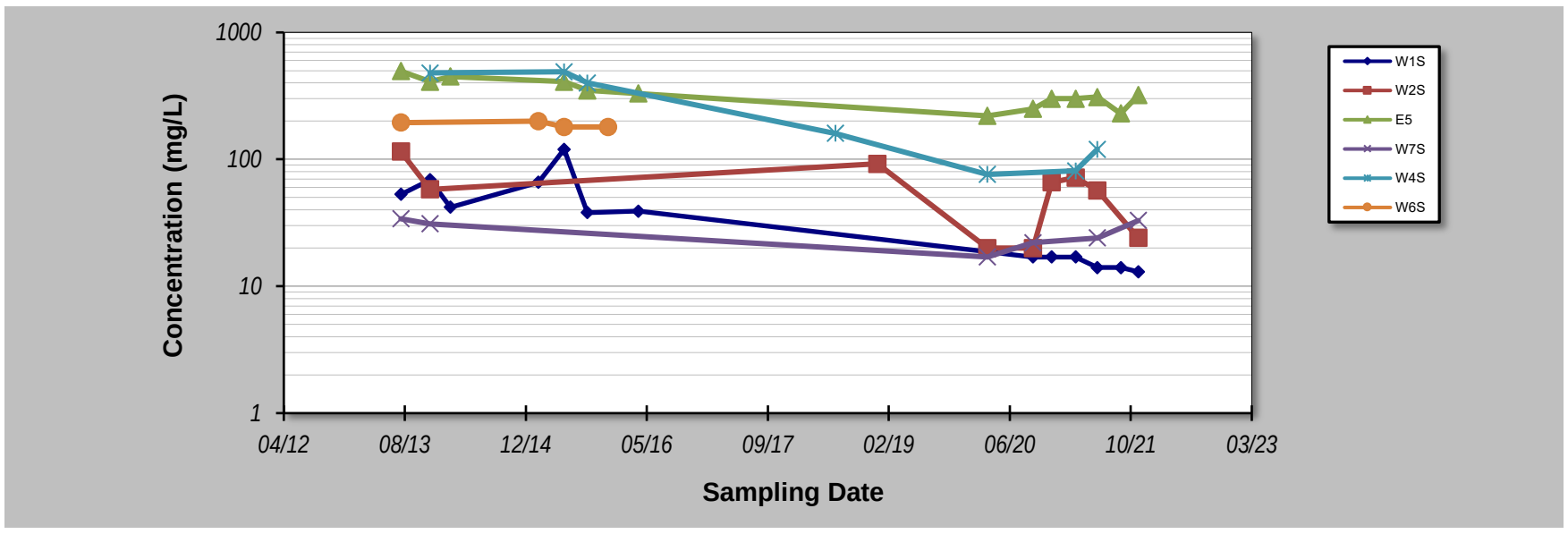
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **Soluble Fluoride**
Concentration Units: **mg/L**

Sampling Point ID:	W1S	W2S	E5	W7S	W4S	W6S	
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	53	115	495	34		195	
2	26-Nov-13	69	58	410	31	480		
3	18-Feb-14	42		450				
4	7-Jul-14							
5	4-Nov-14							
6	17-Feb-15	66					200	
7	3-Jun-15	120		410		490	180	
8	7-Sep-15	38		350		400		
9	2-Dec-15						180	
10	5-Apr-16	39		330				
11	19-Jul-16							
12	12-Oct-16							
13	6-Dec-16							
14	15-Mar-17							
15	20-Jun-17							
16	21-Sep-17							
17	12-Dec-17							
18	13-Mar-18							
19	28-Jun-18					160		
20	26-Sep-18							
21	19-Dec-18		92					
22	11-Mar-19							
23	26-Jun-19							
24	24-Sep-19							
25	11-Dec-19							
26	17-Mar-20							
27	17-Mar-20		20	220	17	76		
28	22-Sep-20	17	20	250	22			
29	8-Dec-20	17	66	300				
30	17-Mar-21	17	72	300		81		
31	15-Jun-21	14	57	310	24	120		
32	20-Sep-21	14		230				
33	1-Dec-21	13	24	320	33			
34								
35								
Coefficient of Variation:		0.78	0.57	0.25	0.26	0.74	0.05	
Mann-Kendall Statistic (S):		-58	-11	-42	-1	-13	-3	
Confidence Factor:		>99.9%	84.6%	99.5%	50.0%	96.5%	72.9%	
Concentration Trend:		Decreasing	Stable	Decreasing	Stable	Decreasing	Stable	



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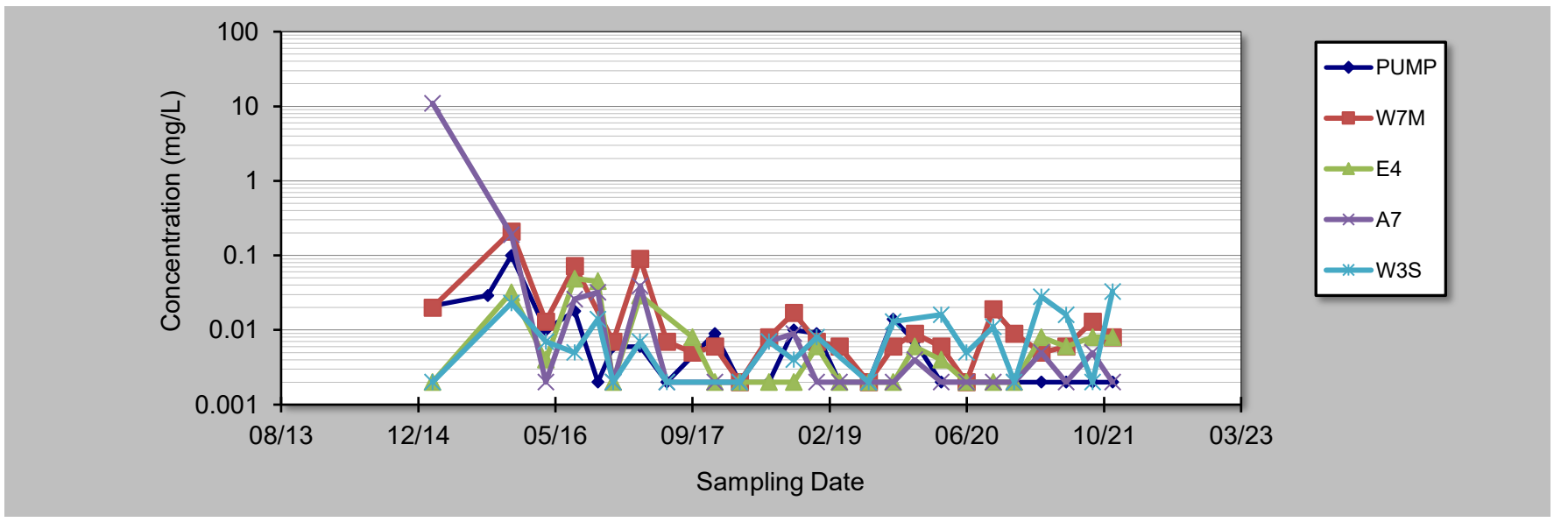
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Dec-21	Job ID:	318001103
Facility Name:	Hydro Kurri Kurri	Constituent:	Free Cyanide
Conducted By:	Jake Bourke	Concentration Units:	mg/L

Sampling Point ID:	PUMP	W7M	E4	A7	W3S		
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15	0.021	0.02	0.002	11	0.002		
2	3-Jun-15							
3	7-Sep-15	0.029						
4	2-Dec-15	0.1	0.21	0.032	0.19	0.023		
5	5-Apr-16	0.01	0.013	0.004	0.002	0.007		
6	19-Jul-16	0.018	0.072	0.049	0.026	0.005		
7	12-Oct-16	0.002		0.045	0.032	0.014		
8	6-Dec-16	0.006	0.007	0.002	0.002	0.002		
9	15-Mar-17	0.006	0.09	0.029	0.039	0.007		
10	20-Jun-17	0.002	0.007		0.002	0.002		
11	21-Sep-17		0.005	0.008				
12	12-Dec-17	0.009	0.006	0.002	0.002			
13	13-Mar-18	0.002	0.002	0.002	0.002	0.002		
14	28-Jun-18	0.002	0.008	0.002	0.007	0.007		
15	26-Sep-18	0.01	0.017	0.002	0.009	0.004		
16	19-Dec-18	0.009	0.007	0.006	0.002	0.008		
17	11-Mar-19	0.002	0.006	0.002	0.002			
18	26-Jun-19	0.002	0.002	0.002	0.002	0.002		
19	24-Sep-19	0.014	0.006	0.002	0.002	0.013		
20	11-Dec-19	0.007	0.009	0.006	0.004			
21	17-Mar-20	0.002	0.006	0.004	0.002	0.016		
22	17-Jun-20	0.002	0.002	0.002	0.002	0.005		
23	22-Sep-20	0.002	0.019	0.002	0.002	0.011		
24	8-Dec-20	0.002	0.009	0.002	0.002	0.002		
25	17-Mar-21	0.002	0.005	0.008	0.005	0.028		
26	15-Jun-21	0.002	0.006	0.006	0.002	0.016		
27	20-Sep-21	0.002	0.013	0.008	0.005	0.002		
28	1-Dec-21	0.002	0.008	0.008	0.002	0.033		
29								
30								
Coefficient of Variation:		1.91	2.00	1.44	4.84	0.93		
Mann-Kendall Statistic (S):		-145	-70	-16	-82	43		
Confidence Factor:		99.9%	94.6%	63.6%	97.1%	88.0%		
Concentration Trend:		Decreasing	Prob. Decreasing	No Trend	Decreasing	No Trend		



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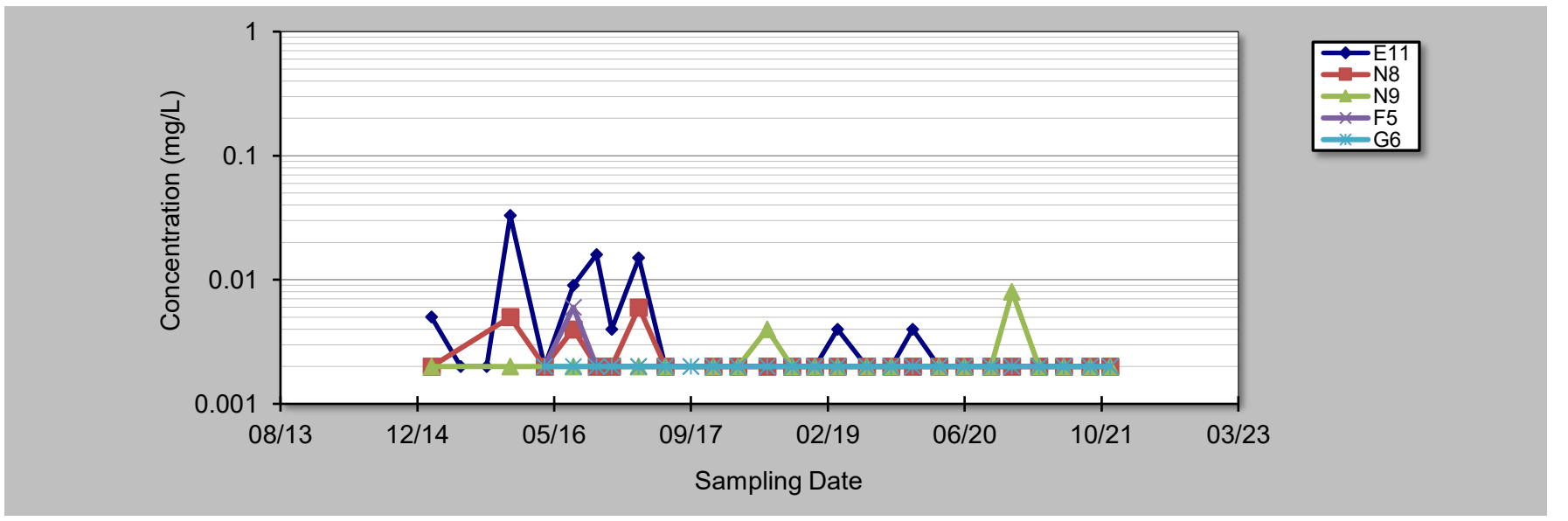
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **Free Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	E11	N8	N9	F5	G6		
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15	0.005	0.002	0.002				
2	3-Jun-15	0.002						
3	7-Sep-15	0.002						
4	2-Dec-15	0.033	0.005	0.002				
5	5-Apr-16	0.002	0.002		0.002	0.002		
6	19-Jul-16	0.009	0.004	0.002	0.006	0.002		
7	12-Oct-16	0.016	0.002		0.002	0.002		
8	6-Dec-16	0.004	0.002		0.002	0.002		
9	15-Mar-17	0.015	0.006	0.002	0.002	0.002		
10	20-Jun-17	0.002	0.002	0.002	0.002	0.002		
11	21-Sep-17				0.002	0.002		
12	12-Dec-17	0.002	0.002	0.002	0.002	0.002		
13	13-Mar-18	0.002	0.002	0.002	0.002	0.002		
14	28-Jun-18	0.002	0.002	0.004	0.002	0.002		
15	26-Sep-18	0.002	0.002	0.002	0.002	0.002		
16	19-Dec-18	0.002	0.002	0.002	0.002	0.002		
17	11-Mar-19	0.004	0.002	0.002	0.002	0.002		
18	26-Jun-19	0.002	0.002	0.002	0.002	0.002		
19	24-Sep-19	0.002	0.002	0.002	0.002	0.002		
20	11-Dec-19	0.004	0.002		0.002	0.002		
21	17-Mar-20	0.002	0.002	0.002	0.002	0.002		
22	17-Jun-20	0.002	0.002	0.002	0.002	0.002		
23	22-Sep-20	0.002	0.002	0.002	0.002	0.002		
24	8-Dec-20	0.002	0.002	0.008	0.002	0.002		
25	17-Mar-21	0.002	0.002	0.002	0.002	0.002		
26	15-Jun-21	0.002	0.002	0.002	0.002	0.002		
27	20-Sep-21	0.002	0.002	0.002	0.002	0.002		
28	1-Dec-21	0.002	0.002	0.002	0.002	0.002		
29								
30								
Coefficient of Variation:		1.43	0.44	0.57	0.38	0.00		
Mann-Kendall Statistic (S):		-95	-51	7	-21	0		
Confidence Factor:		97.5%	87.7%	57.1%	68.9%	49.0%		
Concentration Trend:		Decreasing	Stable	No Trend	Stable	Stable		



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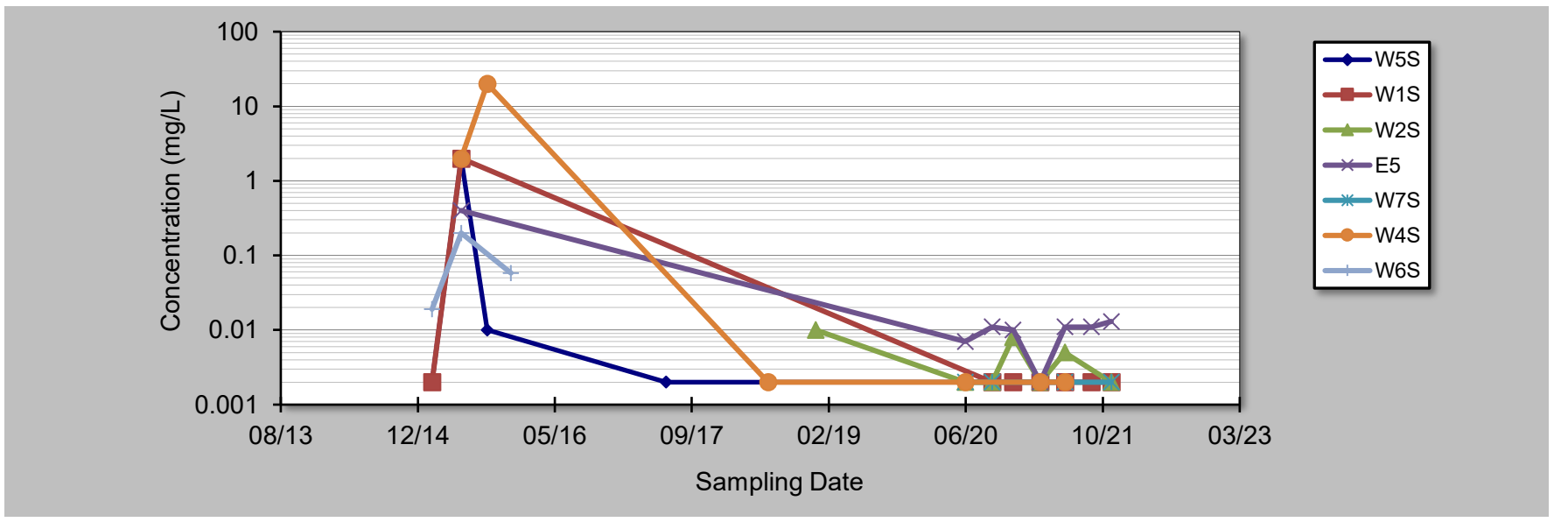
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **Free Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	W5S	W1S	W2S	E5	W7S	W4S	W6S
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15	0.002	0.002					0.019
2	3-Jun-15	2	2		0.4		2	0.2
3	7-Sep-15	0.01					20	
4	2-Dec-15							0.058
5	5-Apr-16							
6	19-Jul-16							
7	12-Oct-16							
8	6-Dec-16							
9	15-Mar-17							
10	20-Jun-17	0.002						
11	21-Sep-17							
12	12-Dec-17							
13	13-Mar-18							
14	28-Jun-18						0.002	
15	26-Sep-18							
16	19-Dec-18			0.01				
17	11-Mar-19							
18	26-Jun-19							
19	24-Sep-19							
20	11-Dec-19							
21	17-Mar-20							
22	17-Jun-20	0.002		0.002	0.007	0.002	0.002	
23	22-Sep-20	0.002	0.002	0.002	0.011	0.002		
24	8-Dec-20		0.002	0.008	0.01			
25	17-Mar-21	0.002	0.002	0.002	0.002		0.002	
26	15-Jun-21		0.002	0.005	0.011	0.002	0.002	
27	20-Sep-21		0.002		0.011			
28	1-Dec-21	0.002	0.002	0.002	0.013	0.002		
29								
30								
Coefficient of Variation:		2.79	2.81	0.76	2.38	0.00	2.19	1.03
Mann-Kendall Statistic (S):		-9	-5	-5	3	0	-7	1
Confidence Factor:		83.2%	68.3%	71.9%	59.4%	37.5%	86.4%	
Concentration Trend:		No Trend	No Trend	Stable	No Trend	Stable	No Trend	



Notes:

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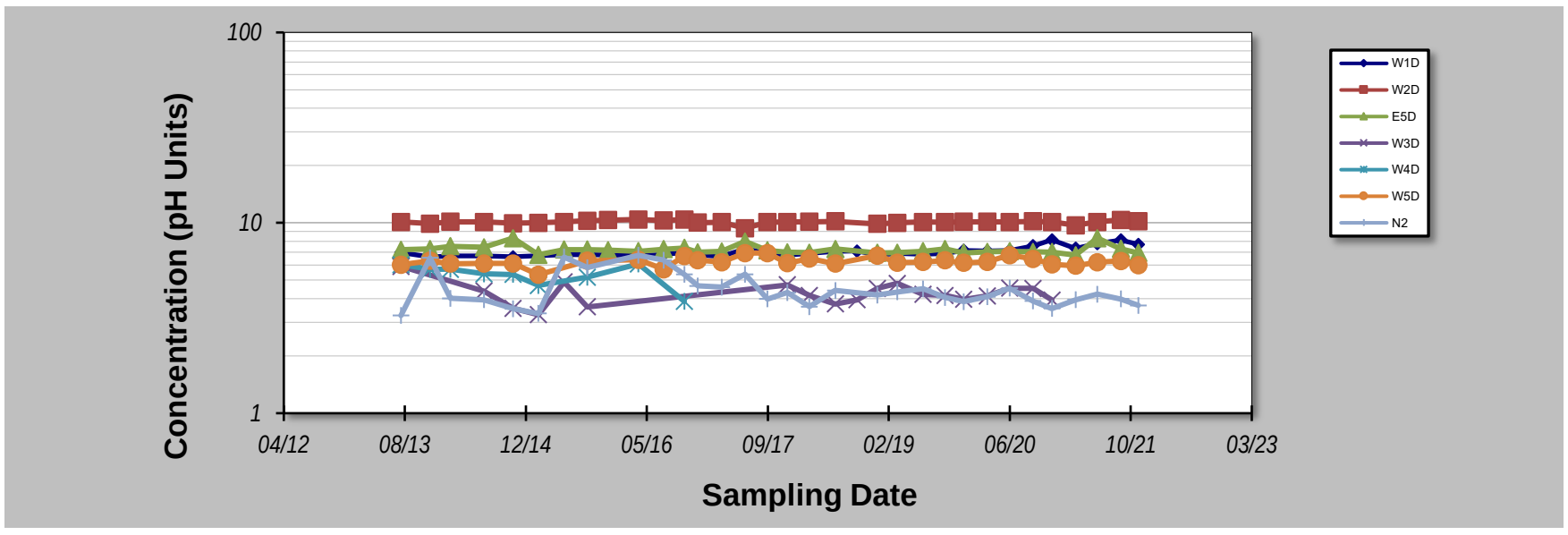
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **pH**
Concentration Units: **pH Units**

Sampling Point ID:	W1D	W2D	E5D	W3D	W4D	W5D	N2
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	6.98	10.09	7.22	5.91	6.02	6.02	3.26
2	26-Nov-13	6.62	9.9	7.29		5.7	6.32	6.54
3	18-Feb-14	6.7	10.13	7.53		5.7	6.1	4.01
4	7-Jul-14	6.71	10.1	7.44	4.38	5.4	6.11	3.94
5	4-Nov-14	6.63	9.94	8.32	3.56	5.36	6.11	3.54
6	17-Feb-15		9.99	6.8	3.29	4.69	5.34	3.34
7	3-Jun-15	6.82	10.11	7.23	4.89			6.61
8	7-Sep-15	6.79	10.27	7.23	3.62	5.18	6.32	5.81
9	2-Dec-15		10.34	7.18				
10	5-Apr-16	6.73	10.42	7.1		6.08	6.4	6.75
11	19-Jul-16	6.82	10.29	7.27			5.7	6.37
12	12-Oct-16	7.02	10.4	7.39		3.87	6.7	5.35
13	6-Dec-16	6.78	10.02	7			6.37	4.67
14	15-Mar-17	6.67	10.07	7.08			6.21	4.59
15	20-Jun-17	7.3	9.37	7.97			6.94	5.37
16	21-Sep-17	6.95	10.08	7.16			6.93	3.98
17	12-Dec-17	6.78	10.1	7	4.72		6.13	4.31
18	13-Mar-18	6.91	10.14	6.97	4.16		6.5	3.63
19	28-Jun-18	7.07	10.18	7.29	3.75		6.1	4.41
20	26-Sep-18	7.12			3.94			
21	19-Dec-18	6.76	9.87	6.95	4.53		6.72	4.18
22	11-Mar-19	6.92	9.99	6.96	4.81		6.18	4.34
23	26-Jun-19	6.83	10.1	7.1	4.21		6.23	4.51
24	24-Sep-19	6.91	10.08	7.3	4.15		6.35	4.05
25	11-Dec-19	7.16	10.14	6.95	3.96		6.16	3.85
26	17-Mar-20	7.12	10.12	7.05	4.14		6.24	4.09
27	17-Jun-20	7.17	10.11	7.1	4.54		6.76	4.54
28	22-Sep-20	7.57	10.18	7.04	4.53		6.46	3.88
29	9-Dec-20	8.14	10.09	7.02	3.93		6.05	3.55
30	17-Mar-21	7.34	9.72	6.77			5.95	3.94
31	15-Jun-21	7.78	10.11	8.32			6.21	4.22
32	20-Sep-21	8.13	10.37	7.31			6.31	3.98
33	1-Dec-21	7.71	10.19	6.95			6	3.68
34								
35								
Coefficient of Variation:		0.06	0.02	0.05	0.14	0.13	0.05	0.22
Mann-Kendall Statistic (S):		287	51	-136	-2	-19	25	-105
Confidence Factor:		>99.9%	79.0%	98.6%	51.4%	97.0%	66.4%	96.2%
Concentration Trend:		Increasing	No Trend	Decreasing	Stable	Decreasing	No Trend	Decreasing



Notes:

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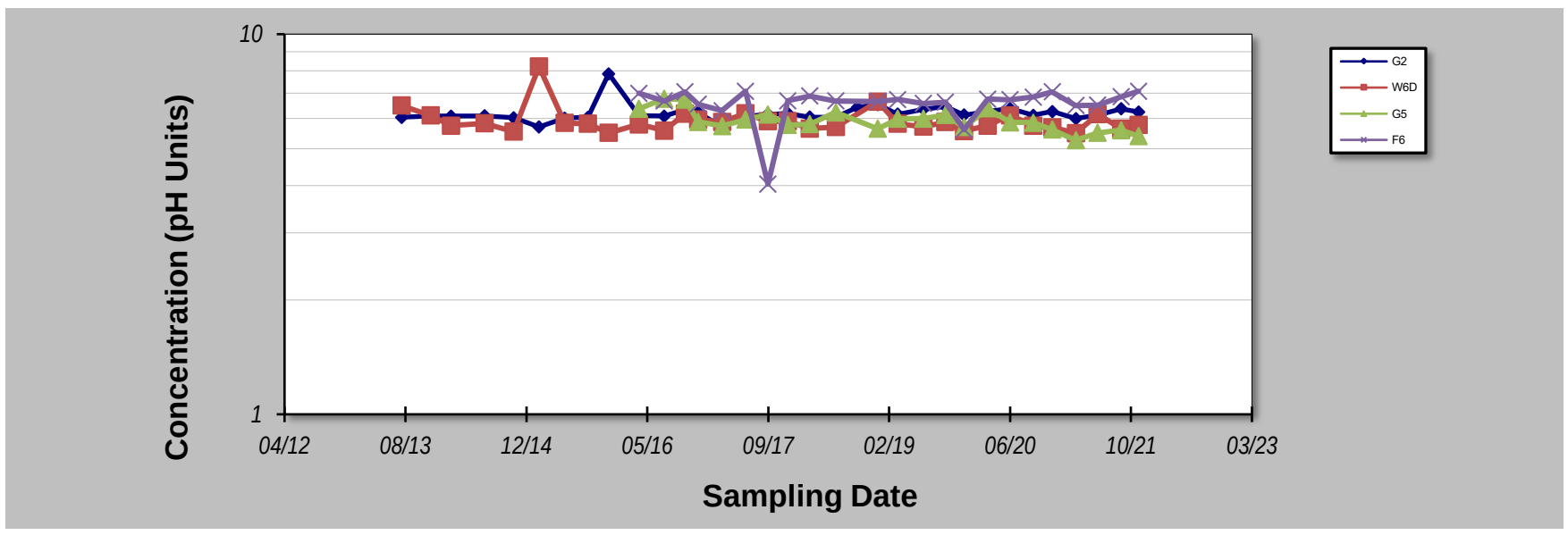
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **pH**
Concentration Units: **pH Units**

Sampling Point ID:	G2	W6D	G5	F6			
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	6.04	6.49					
2	26-Nov-13	6.09	6.11					
3	18-Feb-14	6.09	5.75					
4	7-Jul-14	6.1	5.83					
5	4-Nov-14	6.03	5.54					
6	17-Feb-15	5.7	8.22					
7	3-Jun-15	6.01	5.84					
8	7-Sep-15	6.04	5.81					
9	2-Dec-15	7.87	5.5					
10	5-Apr-16	6.11	5.79	6.36	6.99			
11	19-Jul-16	6.09	5.58	6.77	6.67			
12	12-Oct-16	6.33	6.17	6.72	7.05			
13	6-Dec-16	6.22	5.96	5.88	6.54			
14	15-Mar-17	5.71	5.88	5.73	6.29			
15	20-Jun-17	6.08	6.19	5.96	7.08			
16	21-Sep-17	6.16	5.9	6.15	4.03			
17	12-Dec-17	6.19	5.9	5.77	6.68			
18	13-Mar-18	6.05	5.65	5.8	6.88			
19	28-Jun-18	6.05	5.7	6.23	6.67			
20	26-Sep-18	6.42						
21	19-Dec-18	6.53	6.65	5.64	6.66			
22	11-Mar-19	6.16	5.81	5.99	6.73			
23	26-Jun-19	6.35	5.71	6	6.57			
24	24-Sep-19	6.46	5.87	6.13	6.62			
25	11-Dec-19	6.13	5.56	5.7	5.61			
26	17-Mar-20	6.26	5.75	6.38	6.75			
27	17-Jun-20	6.37	6.12	5.86	6.72			
28	22-Sep-20	6.12	5.75	5.85	6.83			
29	9-Dec-20	6.26	5.69	5.61	7.05			
30	17-Mar-21	6	5.49	5.26	6.49			
31	15-Jun-21	6.12	6.16	5.5	6.51			
32	20-Sep-21	6.36	5.65	5.59	6.84			
33	1-Dec-21	6.24	5.78	5.39	7.08			
34								
35								
Coefficient of Variation:		0.06	0.08	0.07	0.10			
Mann-Kendall Statistic (S):		158	-84	-123	12			
Confidence Factor:		99.3%	91.0%	>99.9%	61.3%			
Concentration Trend:		Increasing	Prob. Decreasing	Decreasing	No Trend			



Notes:

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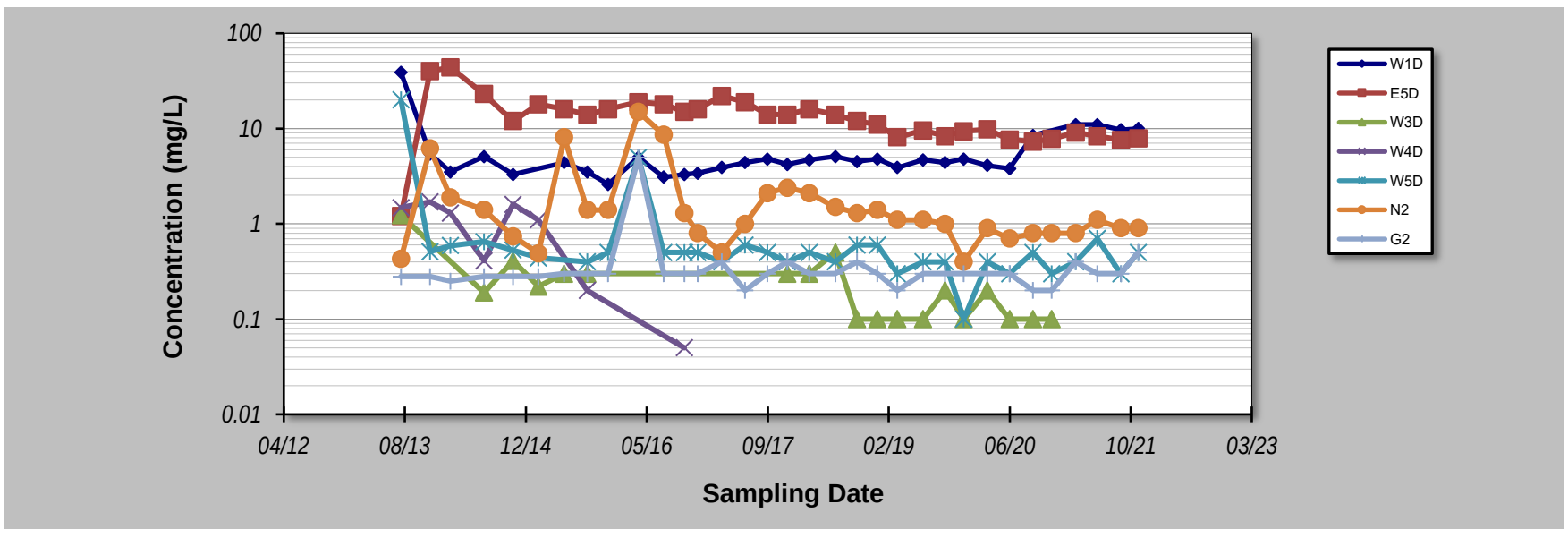
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **Soluble Fluoride**
Concentration Units: **mg/L**

Sampling Point ID:	W1D	E5D	W3D	W4D	W5D	N2	G2
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	39	1.21	1.23	1.48	20	0.43	0.28
2	26-Nov-13	5.4	40		1.7	0.51	6.2	0.28
3	18-Feb-14	3.5	44		1.3	0.59	1.9	0.25
4	7-Jul-14	5.1	23	0.19	0.41	0.65	1.4	0.28
5	4-Nov-14	3.3	12	0.41	1.6	0.53	0.74	0.28
6	17-Feb-15		18	0.22	1.1	0.44	0.49	0.28
7	3-Jun-15	4.4	16	0.3			8.1	0.3
8	7-Sep-15	3.5	14	0.3	0.2	0.4	1.4	0.3
9	2-Dec-15	2.6	16			0.5	1.4	0.3
10	5-Apr-16	5	19			5	15	5
11	19-Jul-16	3.1	18			0.5	8.6	0.3
12	12-Oct-16	3.3	15		0.05	0.5	1.3	0.3
13	6-Dec-16	3.4	16			0.5	0.8	0.3
14	15-Mar-17	3.9	22			0.4	0.5	0.4
15	20-Jun-17	4.4	19			0.6	1	0.2
16	21-Sep-17	4.8	14			0.5	2.1	0.3
17	12-Dec-17	4.2	14	0.3		0.4	2.4	0.4
18	13-Mar-18	4.7	16	0.3		0.5	2.1	0.3
19	28-Jun-18	5.1	14	0.5		0.4	1.5	0.3
20	26-Sep-18	4.5	12	0.1		0.6	1.3	0.4
21	19-Dec-18	4.8	11	0.1		0.6	1.4	0.3
22	11-Mar-19	3.9	8.1	0.1		0.3	1.1	0.2
23	26-Jun-19	4.7	9.6	0.1		0.4	1.1	0.3
24	24-Sep-19	4.4	8.3	0.2		0.4	1	0.3
25	11-Dec-19	4.8	9.4	0.1		0.1	0.4	0.3
26	17-Mar-20	4.1	9.8	0.2		0.4	0.9	0.3
27	17-Jun-20	3.8	7.7	0.1		0.3	0.7	0.3
28	22-Sep-20	8.5	7.3	0.1		0.5	0.8	0.2
29	8-Dec-20		7.8	0.1		0.3	0.8	0.2
30	17-Mar-21	11	9.1			0.4	0.8	0.4
31	15-Jun-21	11	8.3			0.7	1.1	0.3
32	20-Sep-21	9.7	7.6			0.3	0.9	0.3
33	1-Dec-21	10	7.9			0.5	0.9	0.5
34								
35								
Coefficient of Variation:		1.04	0.60	1.01	0.68	2.91	1.42	1.85
Mann-Kendall Statistic (S):		127	-310	-80	-18	-177	-139	98
Confidence Factor:		98.4%	>99.9%	99.8%	98.4%	99.8%	98.4%	93.3%
Concentration Trend:		Increasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Prob. Increasing



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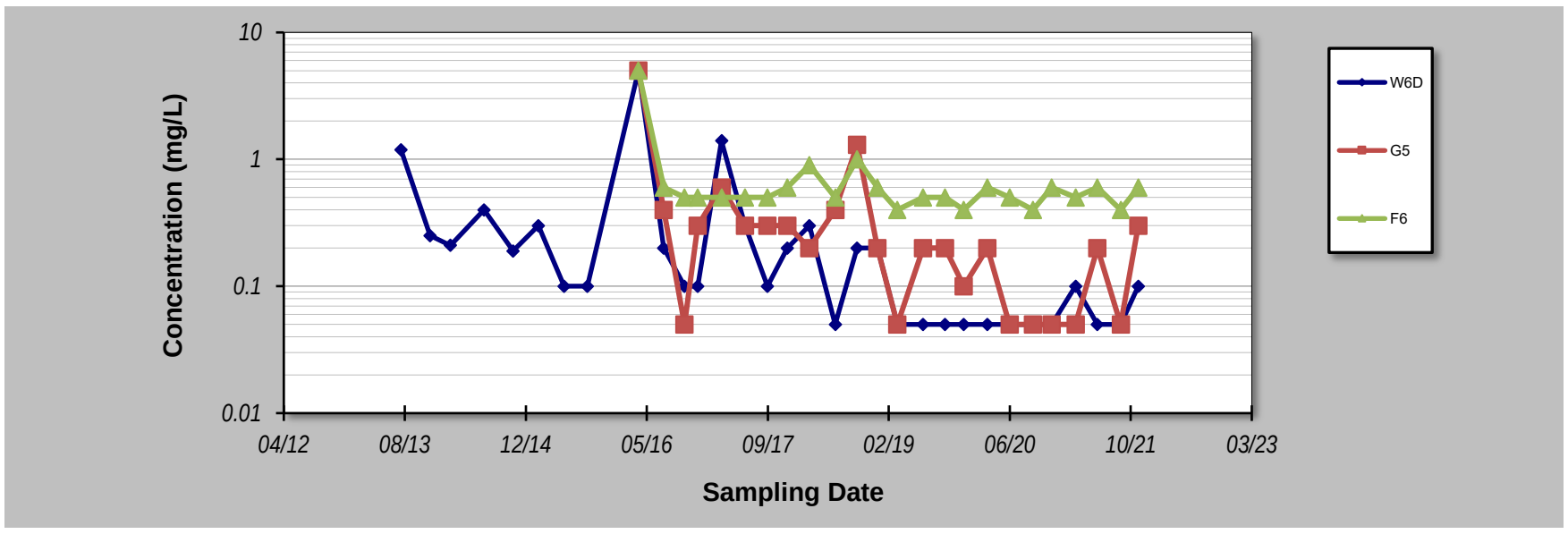
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **Soluble Fluoride**
Concentration Units: **mg/L**

Sampling Point ID:	W6D	G5	F6				
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	1.19						
2	26-Nov-13	0.25						
3	18-Feb-14	0.21						
4	7-Jul-14	0.4						
5	4-Nov-14	0.19						
6	17-Feb-15	0.3						
7	3-Jun-15	0.1						
8	7-Sep-15	0.1						
9	2-Dec-15							
10	5-Apr-16	5	5	5				
11	19-Jul-16	0.2	0.4	0.6				
12	12-Oct-16	0.1	0.05	0.5				
13	6-Dec-16	0.1	0.3	0.5				
14	15-Mar-17	1.4	0.6	0.5				
15	20-Jun-17	0.3	0.3	0.5				
16	21-Sep-17	0.1	0.3	0.5				
17	12-Dec-17	0.2	0.3	0.6				
18	13-Mar-18	0.3	0.2	0.9				
19	28-Jun-18	0.05	0.4	0.5				
20	26-Sep-18	0.2	1.3	1				
21	19-Dec-18	0.2	0.2	0.6				
22	11-Mar-19	0.05	0.05	0.4				
23	26-Jun-19	0.05	0.2	0.5				
24	24-Sep-19	0.05	0.2	0.5				
25	11-Dec-19	0.05	0.1	0.4				
26	17-Mar-20	0.05	0.2	0.6				
27	17-Jun-20	0.05	0.05	0.5				
28	22-Sep-20	0.05	0.05	0.4				
29	8-Dec-20	0.05	0.05	0.6				
30	17-Mar-21	0.1	0.05	0.5				
31	15-Jun-21	0.05	0.2	0.6				
32	20-Sep-21	0.05	0.05	0.4				
33	1-Dec-21	0.1	0.3	0.6				
34								
35								
Coefficient of Variation:		**2.48**	**2.22**	**1.25**				
Mann-Kendall Statistic (S):		**-241**	**-121**	**-38**				
Confidence Factor:		**>99.9%**	**99.9%**	**81.9%**				
Concentration Trend:		Decreasing	Decreasing	No Trend				



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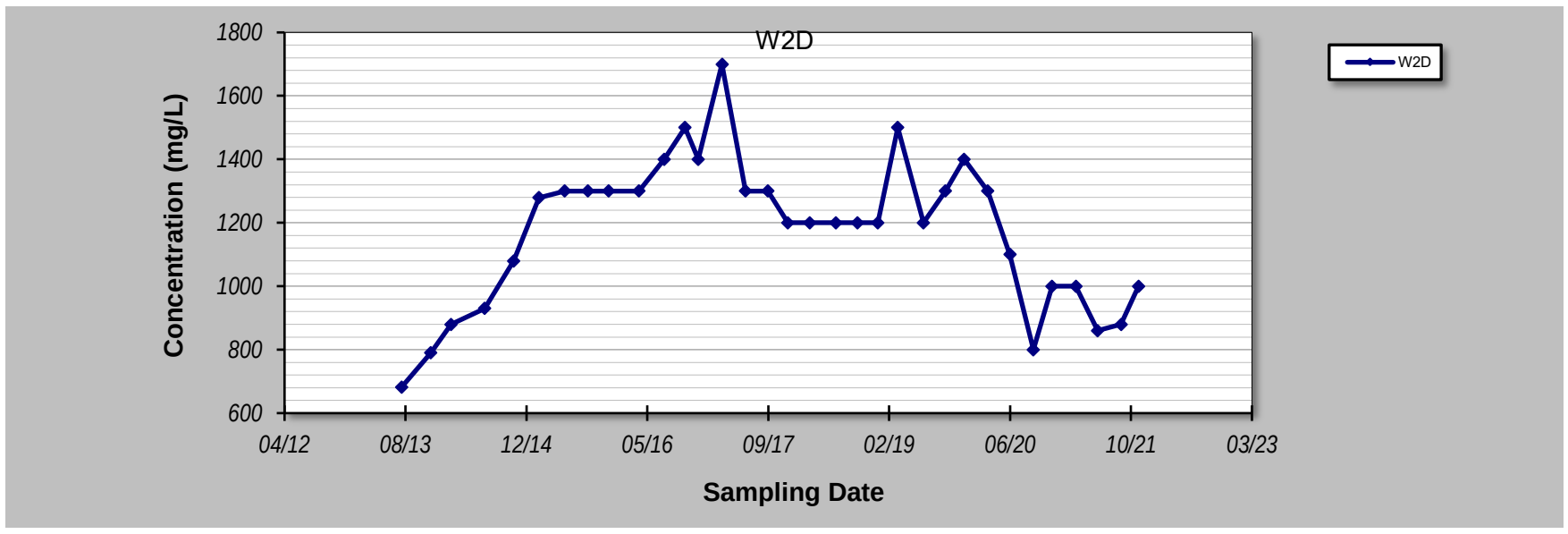
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **Soluble Fluoride**
Concentration Units: **mg/L**

Sampling Point ID: **W2D**

Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	682						
2	26-Nov-13	790						
3	18-Feb-14	880						
4	7-Jul-14	930						
5	4-Nov-14	1080						
6	17-Feb-15	1279						
7	3-Jun-15	1300						
8	7-Sep-15	1300						
9	2-Dec-15	1300						
10	5-Apr-16	1300						
11	19-Jul-16	1400						
12	12-Oct-16	1500						
13	6-Dec-16	1400						
14	15-Mar-17	1700						
15	20-Jun-17	1300						
16	21-Sep-17	1300						
17	12-Dec-17	1200						
18	13-Mar-18	1200						
19	28-Jun-18	1200						
20	26-Sep-18	1200						
21	19-Dec-18	1200						
22	11-Mar-19	1500						
23	26-Jun-19	1200						
24	24-Sep-19	1300						
25	11-Dec-19	1400						
26	17-Mar-20	1300						
27	17-Jun-20	1100						
28	22-Sep-20	800						
29	8-Dec-20	1000						
30	17-Mar-21	1000						
31	15-Jun-21	860						
32	20-Sep-21	880						
33	1-Dec-21	1000						
34								
35								
Coefficient of Variation:		**0.20**						
Mann-Kendall Statistic (S):		**-41**						
Confidence Factor:		**73.1%**						
Concentration Trend:		Stable						



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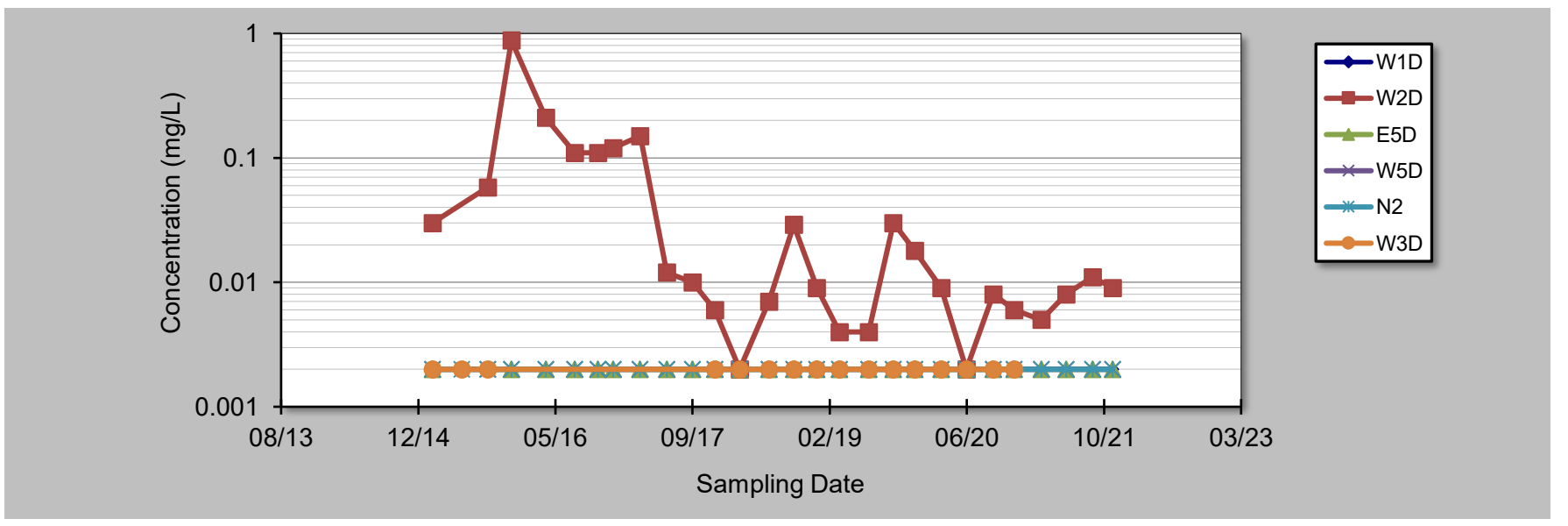
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Dec-21**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318001103**
Constituent: **Free Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	W1D	W2D	E5D	W5D	N2	W3D	
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15		0.03	0.002	0.002	0.002	0.002	
2	3-Jun-15					0.002	0.002	
3	7-Sep-15		0.058		0.002	0.002	0.002	
4	2-Dec-15		0.88	0.002	0.002	0.002		
5	5-Apr-16	0.002	0.21	0.002	0.002	0.002		
6	19-Jul-16	0.002	0.11	0.002	0.002	0.002		
7	12-Oct-16	0.002	0.11	0.002	0.002	0.002		
8	6-Dec-16	0.002	0.12	0.002	0.002	0.002		
9	15-Mar-17	0.002	0.15	0.002	0.002	0.002		
10	20-Jun-17	0.002	0.012	0.002	0.002	0.002		
11	21-Sep-17		0.01	0.002	0.002	0.002		
12	12-Dec-17	0.002	0.006	0.002	0.002	0.002	0.002	
13	13-Mar-18	0.002	0.002	0.002	0.002	0.002	0.002	
14	28-Jun-18	0.002	0.007	0.002	0.002	0.002	0.002	
15	26-Sep-18	0.002	0.029	0.002	0.002	0.002	0.002	
16	19-Dec-18	0.002	0.009	0.002	0.002	0.002	0.002	
17	11-Mar-19	0.002	0.004	0.002	0.002	0.002	0.002	
18	26-Jun-19	0.002	0.004	0.002	0.002	0.002	0.002	
19	24-Sep-19	0.002	0.03	0.002	0.002	0.002	0.002	
20	11-Dec-19	0.002	0.018	0.002	0.002	0.002	0.002	
21	17-Mar-20	0.002	0.009	0.002	0.002	0.002	0.002	
22	17-Jun-20	0.002	0.002	0.002	0.002	0.002	0.002	
23	22-Sep-20	0.002	0.008	0.002	0.002	0.002	0.002	
24	8-Dec-20	0.002	0.006	0.002	0.002	0.002	0.002	
25	17-Mar-21	0.002	0.005	0.002	0.002	0.002		
26	15-Jun-21	0.002	0.008	0.002	0.002	0.002		
27	20-Sep-21	0.002	0.011	0.002	0.002	0.002		
28	1-Dec-21	0.002	0.009	0.002	0.002	0.002		
29								
30								
Coefficient of Variation:		0.00	2.48	0.00	0.00	0.00	0.00	
Mann-Kendall Statistic (S):		0	-148	0	0	0	0	
Confidence Factor:		48.9%	99.9%	49.1%	49.2%	49.2%	48.2%	
Concentration Trend:		Stable	Decreasing	Stable	Stable	Stable	Stable	



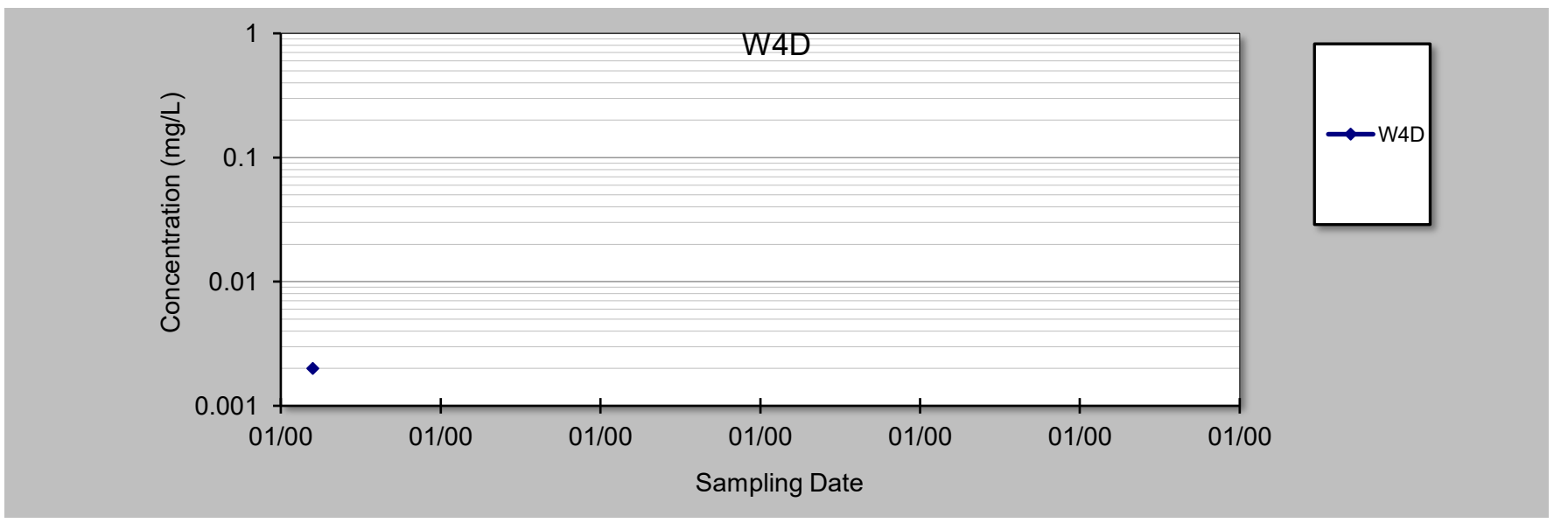
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Dec-21	Job ID:	318001103
Facility Name:	Hydro Kurri Kurri	Constituent:	Free Cyanide
Conducted By:	Jake Bourke	Concentration Units:	mg/L

Sampling Point ID:	G2	W6D	G5	F6	W4D		
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15	0.002	0.002			0.002		
2	3-Jun-15	0.002						
3	7-Sep-15		0.002					
4	2-Dec-15	0.002	0.002					
5	5-Apr-16	0.002	0.002	0.002	0.002			
6	19-Jul-16	0.002	0.002	0.006	0.002			
7	12-Oct-16	0.002	0.002	0.002	0.002			
8	6-Dec-16	0.002	0.002	0.002	0.002			
9	15-Mar-17	0.002	0.002	0.002	0.002			
10	20-Jun-17	0.002	0.002	0.002	0.002			
11	21-Sep-17	0.002	0.002	0.002	0.002			
12	12-Dec-17	0.002	0.002	0.002	0.002			
13	13-Mar-18	0.002	0.002	0.002	0.002			
14	28-Jun-18	0.002	0.002	0.002	0.002			
15	26-Sep-18	0.002	0.002	0.002	0.002			
16	19-Dec-18	0.002	0.002	0.002	0.002			
17	11-Mar-19	0.002	0.002	0.002	0.002			
18	26-Jun-19	0.002	0.002	0.002	0.002			
19	24-Sep-19	0.002	0.002	0.002	0.002			
20	11-Dec-19	0.002	0.002	0.002	0.002			
21	17-Mar-20	0.002	0.002	0.002	0.002			
22	17-Jun-20	0.002	0.002	0.002	0.002			
23	22-Sep-20	0.002	0.002	0.002	0.002			
24	8-Dec-20	0.002	0.002	0.002	0.002			
25	17-Mar-21	0.002	0.002	0.002	0.002			
26	15-Jun-21	0.002	0.002	0.002	0.002			
27	20-Sep-21	0.002	0.002	0.002	0.002			
28	1-Dec-21	0.002	0.002	0.002	0.002			
29								
30								
Coefficient of Variation:		0.00	0.00	0.38	0.00			
Mann-Kendall Statistic (S):		0	0	-21	0			
Confidence Factor:		49.2%	49.2%	68.9%	49.0%			
Concentration Trend:		Stable	Stable	Stable	Stable			



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