Report Prepared for Jellinbah Group Pty Ltd

MACKENZIE NORTH PROJECT

ANNUAL GROUNDWATER MONITORING REPORT 2020-2021 WATER YEAR

June 2022

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JBT Consulting Pty Ltd

John Bradley
PRINCIPAL HYDROGEOLOGIST

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1.0 INTRODUCTION

This Annual Groundwater Monitoring Report for the Mackenzie North Project (the Project) has been prepared by JBT Consulting on behalf of the Jellinbah Group Pty Ltd (Jellinbah) to satisfy the conditions of the Project's Associated Water Licence (AWL) number 618107. The groundwater monitoring activities that are discussed in this report are also undertaken to satisfy the requirements of the Project's Environmental Authority (EA) No. EPML00516813 and are undertaken in accordance with the Project's Underground Water Monitoring Program (UWMP)[1].

Jellinbah Resources have an obligation under the Associated Water Licence (AWL) for the Mackenzie North Project to prepare an Annual Monitoring Report, with the report requirements outlined in Condition 47 of the AWL. It is also a requirement of the Annual Monitoring Report and Condition 49 of the AWL that the report include details of the any review of the numerical underground water model. The Annual Monitoring Report requirements under Conditions 47 and 49 of the AWL, as well as the section of the report in which they are addressed, are shown below in Table 1-1.

With respect to the mining schedule at Mackenzie North Mine it is noted that:

- Pre-stripping operations commenced at the Project site in November 2019;
- Mining of coal commenced in August 2020;
- By end June 2021 (the end of the period covered by this report) mining had progressed to a level that was below the groundwater level in the Permian sediments (the Quaternary alluvium is dry). The implications of this observation are discussed in Section 6.0.

This Annual Monitoring Report covers the period 1 July 2020 to 30 June 2021 (the 2020 to 2021 water year), but references earlier data as required for analysis of water level and water quality trends.

Table 1-1: AWL Reporting Requirements and Report Section

AWL Condition	Requirement	Report Section
47	*The Licensee must provide an Annual Monitoring Report to the chief executive. These reports must include:*	
	a) *the underground water levels in the monitoring bores of the approved Underground Water Monitoring Program;*	Section 5.1, Attachment A
	b) any changes in water quality in the monitoring bores;	Section 5.2, Attachment B
	c) maps showing the actual water level drawdown contours caused by the take of associated water for each aquifer;	Discussed in Section 5.1
	d) details of any review undertaken of the numerical underground water model since the previous Annual Monitoring Report, as required under Conditions 48 or 49;	Section 6

[1] Jellinbah Mine – Mackenzie North Underground Water Monitoring Program. Document No. JBT01-072-001, August 2019

AWL Condition	Requirement	Report Section
	e) an assessment of any differences between the actual water level impact and the impact predicted for the same period in the most current numerical underground water model;	Section 6
	f) details of any bores which are predicted by the most current numerical underground water model to be located in the affected area; and	Section 7
	g) raw data provided in a format as requested by the chief executive.	Attachment A, Attachment B
49	*The Licensee, through an appropriately qualified person, must review the numerical underground water model within two years from the commencement of the take of associated water authorised under this licence and at least 5 years thereafter. The review must provide a revised numerical underground water model based on a transient calibration. The review and revised model must include:* *a) incorporation of measured mine dewatering volumes and underground water monitoring data;* *b) any revised hydrogeological conceptualisation and assumptions of the model, including:* *(i) any revised geological interpretation;* *(ii) any revised hydrogeological parameters or assumptions on recharge; and* *(iii) any assumptions of outflows from springs and other water users;* *c) an update of predicted impacts including:* *(i) any revised predicted impacts on springs and watercourses dependent on underground water flow, and other users, including any changes to the affected area;* *(ii) any revised predicted underground water inflows into mine workings during mining operations and post closure;* *(iii) maps showing the revised prediction of the total water level impact from the commencement of underground extraction to post closure;* *(iv) maps showing the difference between these predicted water level impacts and the water level impacts as predicted at the time of application for this water licence;* *(v) sensitivity analysis; and* *d) an evaluation of the accuracy of the predicted impacts from the model.* *The first review undertaken within two years of commencement of take must also include a peer review.*	Discussed in Section 6

This report has been prepared to satisfy the requirements of Condition 47 of the AWL, and discusses the requirements under Condition 49 of the AWL, as outlined above in Table 1-1.

2.0 GEOLOGY AND HYDROGEOLOGY

The geology and hydrogeology of the Mackenzie North Project area has been reported in AGE (2013)[2] and relevant elements are summarised below to provide background and context to the groundwater data review.

The Project is located within the central part of the Bowen Basin, an early Permian to middle Triassic-age basin that covers an area of approximately 160,000 km^2 and which contains the majority of the mineable coal in Queensland. Table 2-1 shows the stratigraphic relationship and description of sediments that occur within the Project Area, which include Bowen Basin sediments (Late Permian Burngrove Formation and Rangal Coal Measures and the Triassic Rewan Group) that are overlain by Quaternary alluvium. Figure 2-1 shows the Bowen Basin solid geology[3] for the Project area. From Figure 2-1 it is evident that the Project area is underlain predominantly by sediments of the Rangal Coal Measures, with the underlying Burngrove Formation occurring in the west of the Project area and the overlying Rewan Group sediments occurring in the eastern and south-eastern area of the Project. The Rangal Coal Measures contain the target coal seams for mining at Mackenzie North, i.e. the Pollux Upper seam and the Pollux Lower seam. Underlying the Rangal Coal Measures are sedimentary sequences of the Burngrove Formation.

The Permian and Triassic units are overlain by unconsolidated Tertiary and Quaternary-age sediments, with the Quaternary-age alluvial sediments associated with current and prior channels and flood plains of the Mackenzie River. The surface geology of the project area is shown on Figure 2-2. From review of Figures 2-1 and 2-2 it is evident that the Project area is underlain by Quaternary alluvium, which is deposited directly over sediments of the Permian Rangal Coal Measures in the central part of the Project area (the majority of the proposed disturbance area for the Project).

Table 2-1: Stratigraphy of the Mackenzie North Area (after AGE 2013)

Geological Age	Unit	Lithology	Thickness (m)
Quaternary / Tertiary	Alluvium	Unconsolidated soil, silty clay, sand, and gravel. Basal sand and gravel thickens towards the Mackenzie River.	~14 m to 42 m
Triassic	Rewan Formation	Green-grey claystone, siltstone and sandstone with a minor pebbly conglomerate unit at its base.	0 m to 100 m
Late Permian	Rangal Coal Measures	Feldspathic and lithic sandstone, carbonaceous mudstone, siltstone, tuff, and coal seams. Coal seams include:	100 + m
		- Aries	0 – 2.2 m
		- Castor	0 – 1.1 m
		- Pollux Upper	0 – 7.6 m
		- Pollux Lower	0 – 6.4 m
	Burngrove Formation	Sandstone, siltstone, mudstone and banded coal seams, frequently interbedded with tuff and tuffaceous mudstone	>200 m

2 Mackenzie North Groundwater Assessment. Report prepared for Australasian Resource Consultants Pty Ltd (AARC) by Australasian Groundwater and Environmental Consultants (AGE). Project No. G1512, May 2013.

3 In the Bowen Basin solid geology map the surficial unconsolidated Quaternary and Tertiary geology has been stripped off to reveal the relationship of the underlying Triassic and Permian sediments. Data source: Bowen Basin Structural Geology 2008. Geological map and digital dataset prepared by Sliwa, R., Hamilton, S., Hodgkinson, J. & Draper, J., copyright CSIRO and Queensland Department of Mines and Energy, 2008.

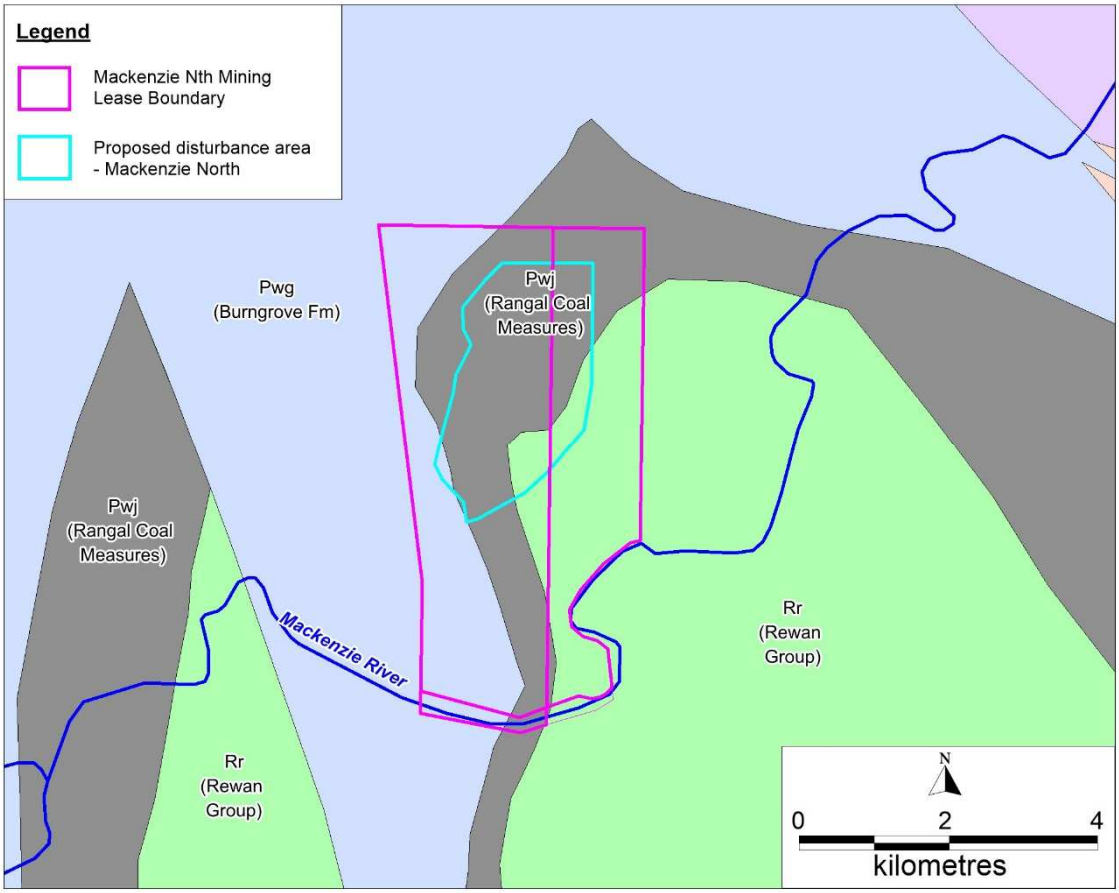


Figure 2-1: Solid Geology

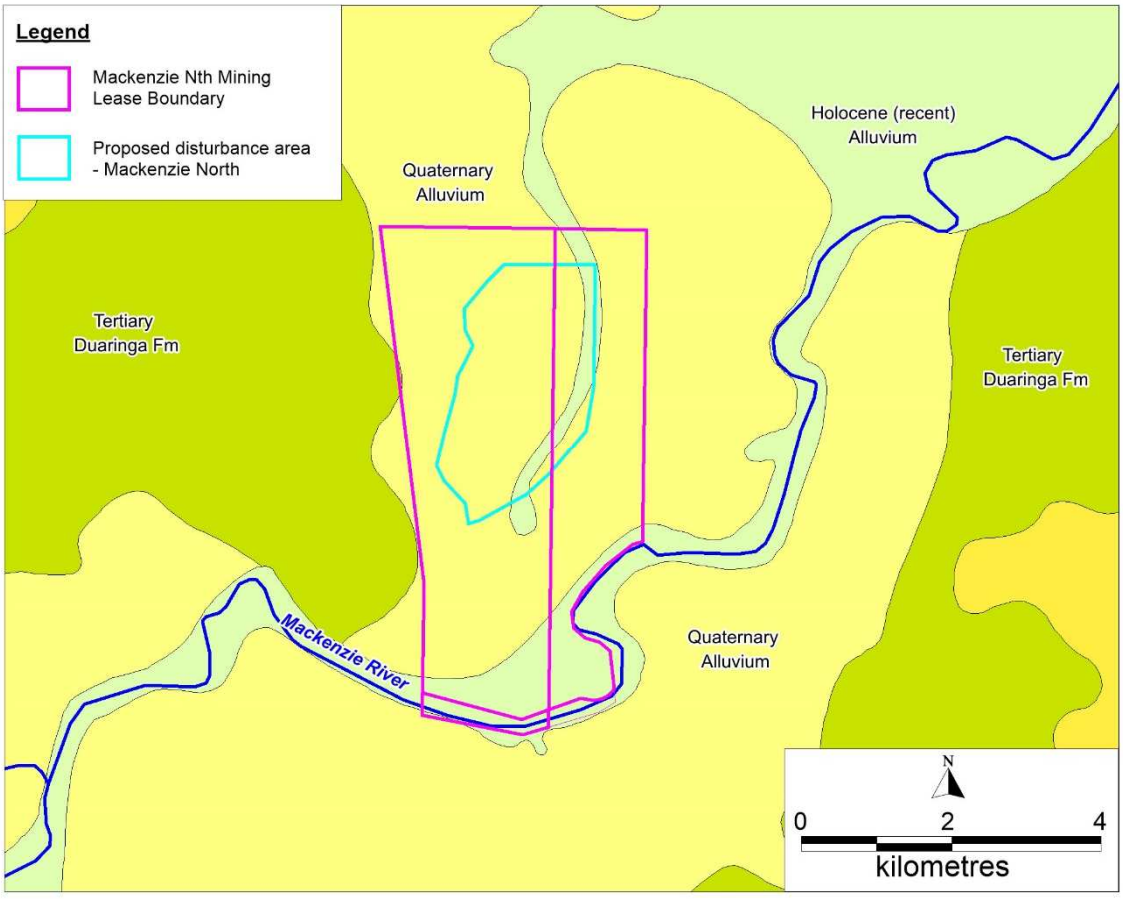


Figure 2-2: 1:100,000 Scale Surface Geology

3.0 RAINFALL DATA

Rainfall data for the Project site has been obtained from the Queensland Government SILO Data Drill website. The Data Drill accesses grids of climate data available from surrounding Bureau of Meteorology (BoM) point observations and then creates interpolated climate values for the requested location. The interpolated climate data are calculated for the requested location using splining and kriging techniques, based on the proximity of surrounding BoM point observations. The data provided by the SILO Data Drill are therefore synthetic, although they have been derived from observed values which were recorded at surrounding climate recording stations. The advantage of using the SILO Data Drill is that rainfall, evaporation, temperature and other climate data can be derived for any location throughout Australia and is continuous (no missing records).

The SILO climate data was obtained for the following map coordinates, which correspond to the approximate centre of the Project area:

- Latitude -23.20º South
- Longitude 148.90º East

Figure 3-1 shows the total and average monthly rainfall for the past 10 years (i.e. from 1 July 2010 to 30 June 2021, for data derived from SILO data drill), and also presents a rainfall residual mass (RRM) curve for the data.

The RRM is calculated by subtracting the long-term average monthly rainfall from the actual monthly rainfall, to provide a monthly “departure” from average conditions. If the monthly rainfall is above average, the resulting rainfall departure number is positive, whereas if the rainfall is below average, the number is negative. A number of below-average rainfall months will result in a falling RRM curve, while a number of above average rainfall months will result in a rising RRM curve. The RRM curve is used extensively in groundwater investigations due to the strong correlation in many locations between the RRM and groundwater level trends.

The RRM curve shows an upward trend from 2010 to 2012 due to above-average rainfall over that period, but has been in decline due to generally below-average rainfall conditions from 2012 to present to present; this indicates a potential for falling shallow groundwater levels over the past 8-9 years.

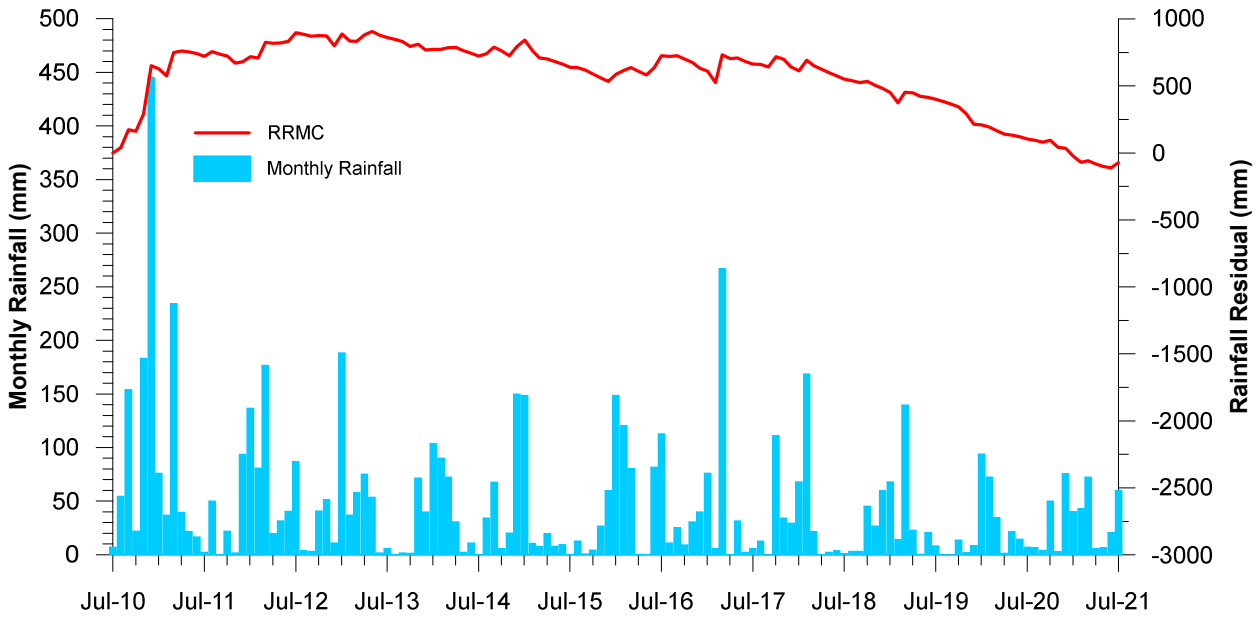


Figure 3-1: Monthly Rainfall Data and Residual Mass Curve

4.0 GROUNDWATER MONITORING BORES

4.1 Description of Monitoring Network

The Mackenzie North UWMP includes monitoring of eleven bores at eight sites as shown below in Table 4-1 (the table shows nine bores but currently includes bore JMR24WP and adjacent replacement bore JMR24WP2). Eight bores monitor groundwater within the Quaternary alluvium, with three bores in the Permian coal measures – two within the Pollux seam and one within the Permian overburden. In accordance with Condition C50 of the EA, replacement monitoring bores will be constructed (potentially at an alternative location) if any of the bores are decommissioned due to mining. The bores will also be replaced if they become unserviceable for any other reason (e.g. due to bore collapse or failure). Monitoring sites and monitoring frequency are shown in Table 4-1 and bore locations are presented in Figure 4-1.

All existing bores in the monitoring network were assessed in August/September 2018 for bore integrity, and confirmation of bore depth, and were re-developed prior to commencement of water quality and water level sampling under the AWL.

Changes to the groundwater monitoring network during the July 2020 to June 2021 reporting period are discussed below in Section 4-2.

Table 4-1: Mackenzie North Groundwater Monitoring Bores

Monitoring Bore ID	Longitude (GDA94)	Latitude (GDA94)	Groundwater Unit	Monitoring Frequency	
				Water Level	Water Quality
JMR4WP*	148.91539	-23.25304	Permian – Pollux Seam	Quarterly	Six-monthly
JMR4WA	148.91536	-23.25305	Alluvium	Data logger (daily)	Six-monthly
JMR22WA	148.92639	-23.22912	Alluvium	Quarterly	n/a
JN1119E	148.92593	-23.22582	Permian – Pollux Seam	Quarterly	Six-monthly
JMR23WA	148.92758	-23.24291	Alluvium	Data logger (daily)	Six-monthly
JMR24WA	148.92796	-23.20871	Alluvium	Quarterly	n/a
JMR24WP	148.92797	-23.20870	Permian Overburden	Quarterly	Six-monthly
JMR24WP2**	148.92797	-23.20870	Permian Overburden	Quarterly	Six-monthly
JMR25WA	148.91937	-23.24965	Alluvium	Data logger (daily)	Six-monthly
JP0911T	148.90179	-23.26490	Tertiary	Quarterly	n/a
JP0912T	148.92841	-23.26212	Tertiary	Quarterly	n/a
JMR26WA	148.92140	-23.26541	Alluvium	Quarterly	n/a

* JMR4WP was replaced in April 2020 by JMR4WP2 (refer below)

** JMR24WP2 is a replacement bore for JMR24WP (refer below). Both bores are currently monitored

4.2 Changes to Monitoring Bore Network

No new groundwater bores were drilled during the reporting period. However, bore JMR4WP2 (Pollux Seam) was drilled in April 2020 as a replacement for bore JMR4WP. The dedicated water quality sampling pump had become stuck in JMR4WP and it was assessed following field inspection that the casing had become bent and that the bore would need to be redrilled. Bore JMR4WP2 was sampled for the first time in November 2020 and was sampled 3 times during the report period (November 2020, January and May 2021)

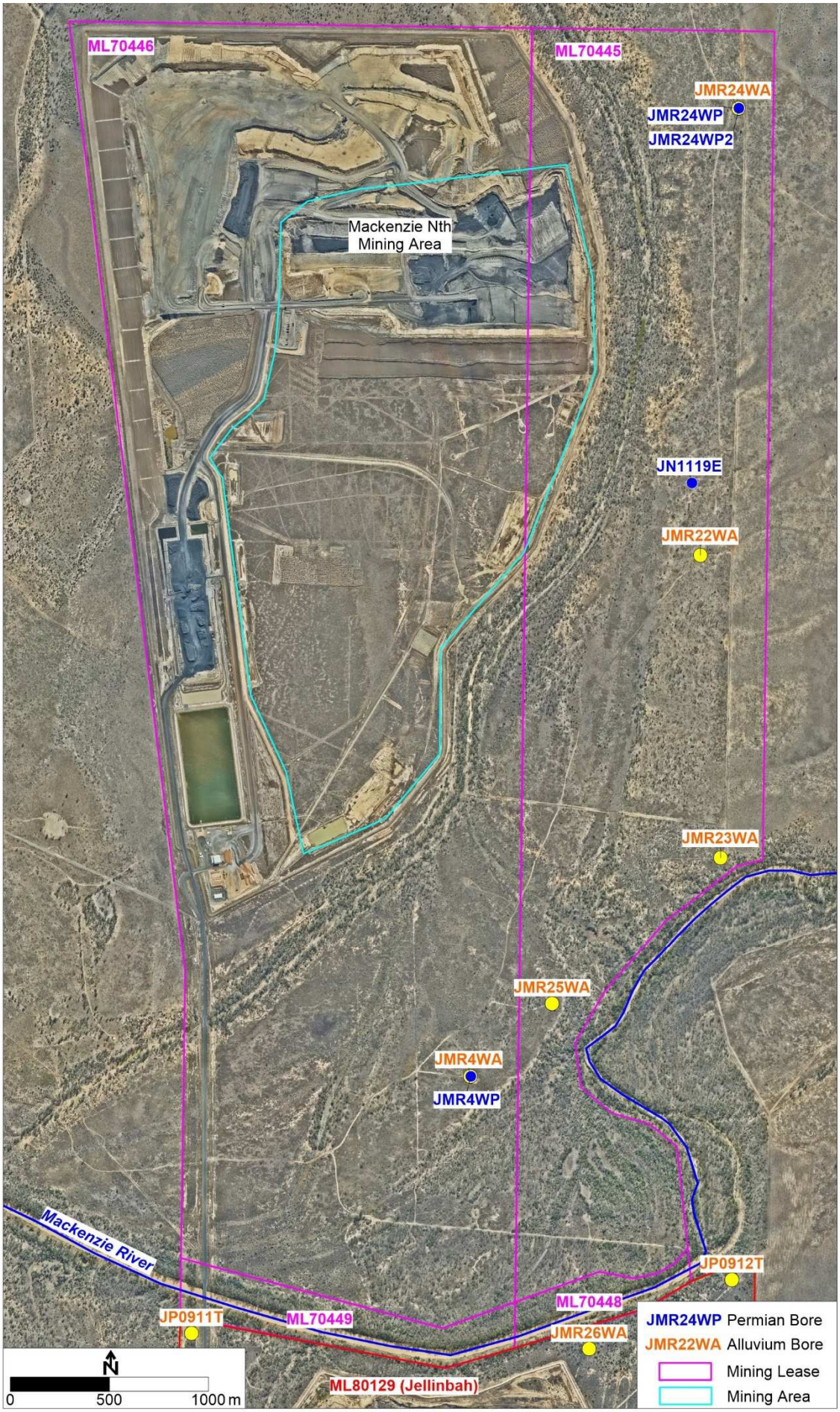


Figure 4-1: Groundwater Monitoring Bore Locations

5.0 GROUNDWATER MONITORING

5.1 Monitoring Requirements

5.1.1 Water Level Monitoring

Water level monitoring is undertaken at all sites on a quarterly basis, with data loggers fitted to a number of alluvial monitoring bores (refer Table 3-1). The alluvial bores that are to be fitted with data loggers are located adjacent to the Mackenzie River. The logger data from these bores is analysed to establish seasonal variations in water levels, including response to rainfall recharge and response to flow events in the Mackenzie River.

5.1.2 Water Quality Monitoring

Groundwater quality monitoring is undertaken at the bore sites, monitoring frequency and for the parameters shown below in Table 5-1.

Table 5-1: Water Quality Sampling Parameters and Frequency

Monitoring Bore ID	Groundwater Unit	Monitoring Frequency	Parameters
JMR4WP*	Permian – Pollux Seam	Six monthly	• pH (field and laboratory) • EC (field and laboratory) • TDS • Major Ions (Calcium, Magnesium, Sodium, Potassium, Chloride, Sulphate, Alkalinity (carbonate, bicarbonate, hydroxide, total)) • Metals/metalloids (total and dissolved, by ICP-MS/FIMS): o Aluminium o Arsenic o Boron o Cadmium o Chromium o Copper o Iron o Lead o Manganese o Mercury o Molybdenum o Nickel o Selenium o Silver o Uranium o Vanadium o Zinc • Total Petroleum Hydrocarbons (C6-C9, C10-36)
JMR4WA	Alluvium	Six monthly	
JN1119E	Permian – Pollux Seam	Six monthly	
JMR23WA	Alluvium	Six monthly	
JMR24WP**	Permian Overburden	Six monthly	
JMR25WA	Alluvium	Six monthly	

* JMR4WP has been replaced by JMR4WP2

** JMR24WP has been replaced by JMR24WP2

5.2 Groundwater Monitoring Data

5.2.1 Groundwater Level Monitoring

Groundwater level monitoring is undertaken for the bores and monitoring frequencies identified above in Table 3-1. Water level data is included in Attachment A and is shown graphically below in Figure 5-1. Observations from Figure 5-1 include:

- Figure 5-1 includes a plot for the rainfall residual mass curve (discussed in Section 3), which indicates a general potential for reducing shallow groundwater levels due to generally below-average rainfall conditions during the period covered by the data shown in Figure 5-1;
- The majority of bores record a water level reduction over the period shown in Figure 5-1, for example bore JMR4WA has recorded a reduction in water level of -2.93 m between July 2017 and May 2021; this reduction in water level is interpreted to be related to below-average rainfall conditions over the monitoring period;
- As shown in Figure 5-1, the groundwater elevation is significantly lower in bores JMR24WP and JMR24WP2 relative to other groundwater monitoring bores. Figure 5-2 shows the groundwater elevation in bores close to the Mackenzie North mining area in May 2021 compared to Permian groundwater elevation contours for December 2012, which were generated from water level data contained in AGE (2013). The December 2012 show a groundwater flow direction for the Permian sediments that is generally from south to north, with the Permian groundwater elevation in December 2012 broadly similar to the observed level in May 2021. Therefore, the low groundwater elevation that is observed in JMR24WP/WP2 is interpreted to be related to the location of the bore (i.e. it is the northern-most bore relative to other Permian groundwater monitoring bores) and, based on the May 2021 groundwater level relative to the December 2012 groundwater level, it is interpreted that the Permian groundwater level at this location is not impacted by mining.
- With respect to bores that monitor the Quaternary alluvium:
    - Two of the bores that monitor alluvial sediments have been dry for their full period of record, including JMR24WA (monitoring commenced October 2018) and JMR26WA (monitoring commenced in November 2018);
    - JMR22WA has been dry since December 2018. Monitoring commenced in October 2018, but the water level was at the base of bore at that time;
    - JMR23WA has been dry since October 2018 when it is interpreted that the water level fell below the base of the bore due to climatic conditions; and,
    - JMR25WA – the water level is close to base of bore at this site; the water level was recorded as 2.26 m above base of bore when monitoring commenced in October 2018 and was 0.45 m above base of bore in May 2021. The water level reduction at this site is interpreted to be related to climatic conditions.

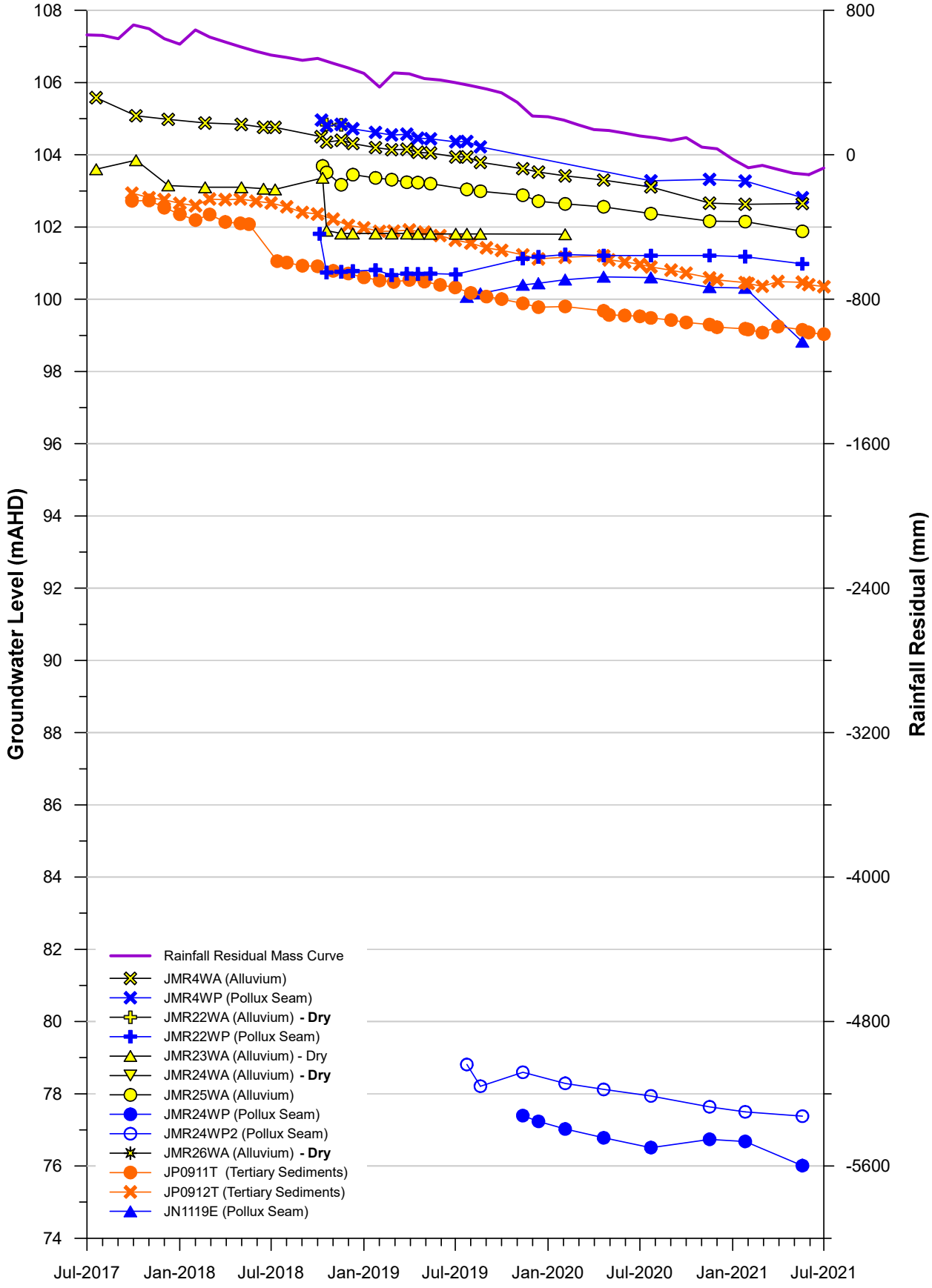


Figure 5-1: Water Level Hydrographs for Groundwater Monitoring Bores

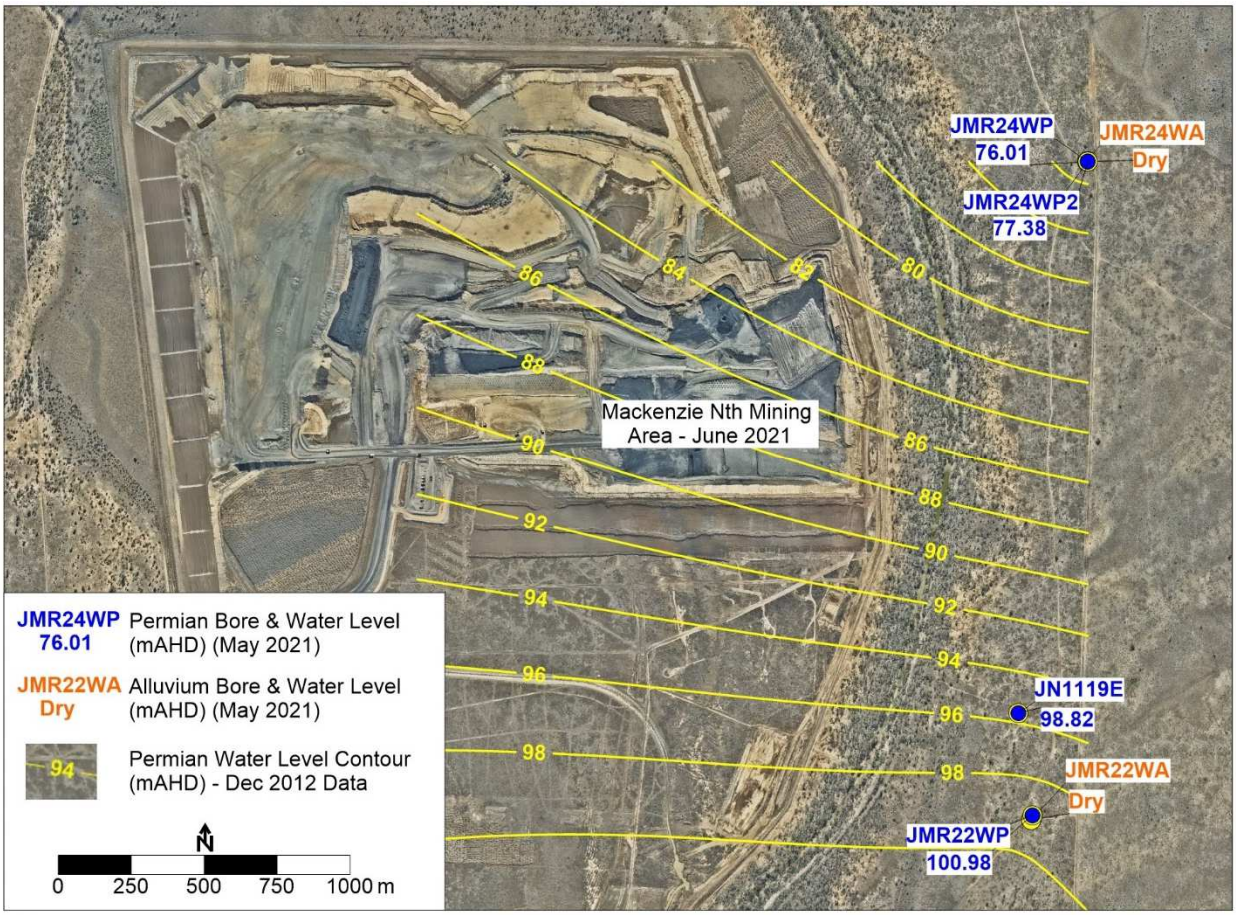


Figure 5-2: Groundwater Levels in May 2021 Compared to 2012 Permian Water Levels

5.2.2 Groundwater Quality Monitoring

Water quality sampling has been undertaken at 6-monthly intervals for the bores and sampling parameters shown in Table 5-1, with the exception of bore JMR23WA where there has been insufficient water for water quality sampling for all sampling events (the water level in JMR23WA is generally just above the base of screens).

All available water quality data is provided in the summary table that is included as Attachment B to this report. Available data for Electrical Conductivity (EC) and pH is shown graphically below as Figure 5-3 and Figure 5-4 respectively; these data is included within the report as EC and pH are useful overall indicators of changes in water quality and are discussed below.

5.2.2.1 Electrical Conductivity (EC) Data

Available field EC data is presented in Figure 5-3 below and is summarised as follows:

- JMR4WA (alluvium) – the field EC range is from 4,197 µS/cm to 7,189 µS/cm (11 samples);
- JMR4WP (Pollux Seam) – the field EC range is from 7,450 µS/cm to 9,833 µS/cm (6 samples to July 2019, after which it was not possible to sample for water quality due to a sample pump becoming stuck in the bore). The bore was redrilled at a nearby location as bore JMR4WP2 in April 2020. For the three samples taken from JMR4WP2 between November 2020 and May 2021, the EC range was from 4,046 µS/cm to 6,190 µS/cm;
- JMR24WP and JMR24WP2 (Pollux Seam) – the field EC range is from 7,950 µS/cm to 9,490 µS/cm in JMR24WP (5 samples) and 8,587 to 11,491 µS/cm in JMR24WP2 (4 samples), with the value of 11,491 µS/cm appearing to be an outlier;

- JMR25WA (alluvium) – the field EC range is from 1,171 µS/cm to 2,358 µS/cm (11 samples)
- JN1119E (Pollux Seam – replacement bore for JMR22WP) - the field EC range is from 11,974 µS/cm to 17,353 µS/cm (5 samples), with the value of 17,353 µS/cm appearing to be an outlier from the first sampling event. As noted in the previous annual report, the EC (both field and laboratory) decreased significantly between the initial (November 2019) and April 2020 sampling events, with a significant change also noted in the pH data for this bore. This is discussed further in Section 5.2.2.2 below.

5.2.2.2 pH Data

Available field pH data is presented in Figure 5-4 below and is summarised as follows:

- The field pH for the monitoring bores is generally in the range 6.3 to 7.5;
- The exception is bore JN1119E (Pollux Seam), where the field pH increased from 8.35 to 11.97 between November 2019 (initial sample) and April 2020, with field pH in the range of 11.4 to 11.6 since that time. It is possible that the bore has experienced grouting issues during construction, however the following observations are also made:
  - Bore JMR22WP was re-developed in November 2018 and recorded a field pH of 12.11;
  - On the basis of the high field pH in bore JMR22WP a replacement bore was drilled as JN1119E. This bore was located some distance from JMR22WP due to drilling issues with the attempted replacement bore at the site of JMR22WP;
  - As stated above, JN1119E is now recording high pH, which may be indicative of grouting issues or some other cause (for example, site geological personnel advise that the bore is located in the area of basic dykes, where the groundwater could locally be expected to be alkaline);
  - The original bore (JMR22WP) has continued to be sampled and has recorded a steady decrease in pH between April 2020 and May 2021, reducing from 9.79 in April 2020 to 7.98 in May 2021 (refer Figure 5-4);
- It is recommended that bores JN1119E and JMR22WP continue to be sampled for water level and water quality and that the pH trends of each bore continue to be reviewed. Following a further 12 months of sampling, an assessment should be undertaken by a suitably qualified person into the likely cause of the pH variation in bores JN1119E and JMR22WP, with recommendations made as appropriate for any further investigations or actions required.

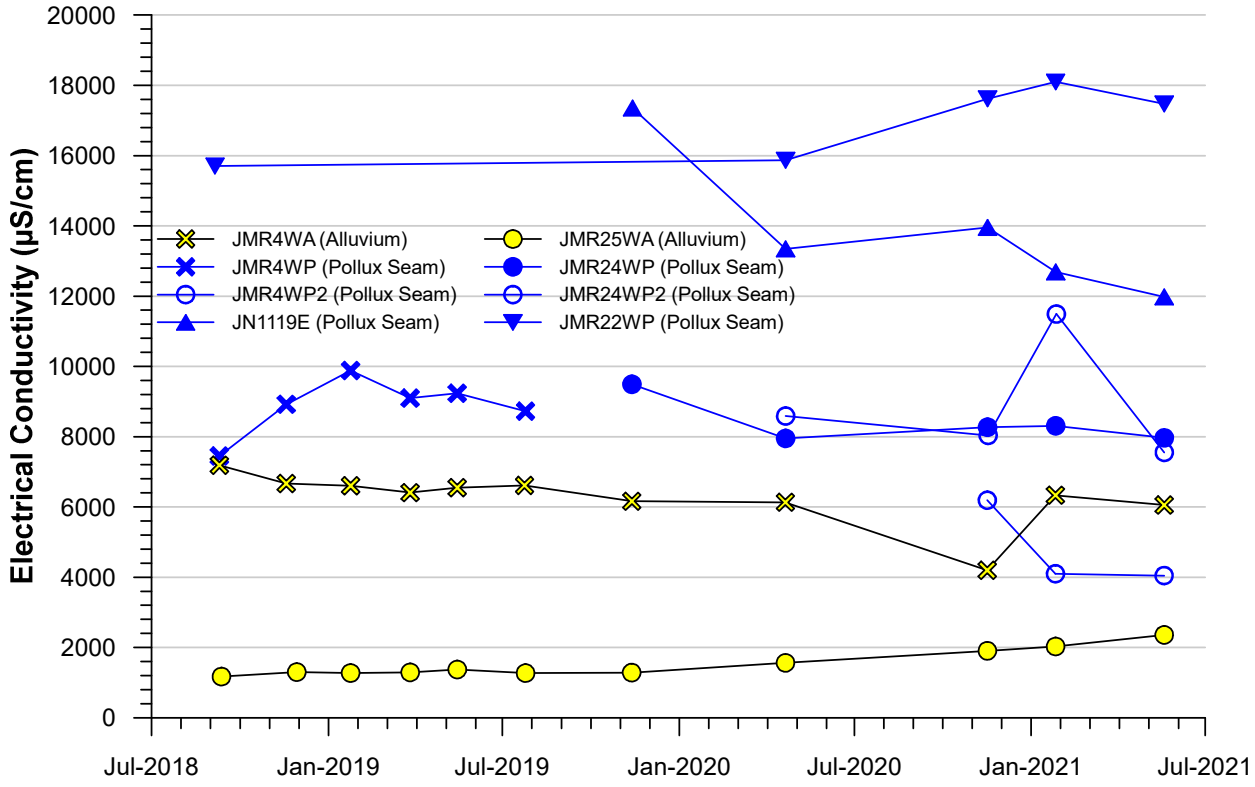


Figure 5-3: Graph of Field Electrical Conductivity (EC) Data

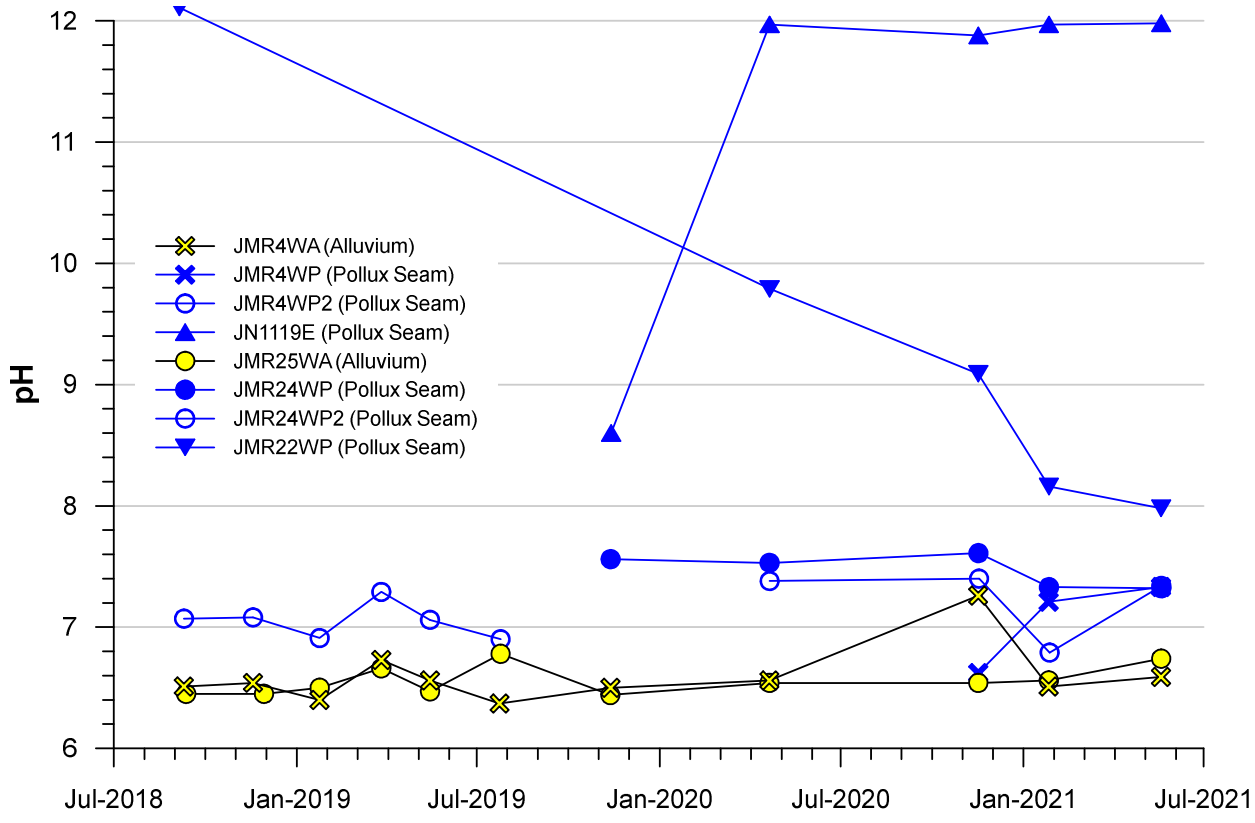


Figure 5-4: Graph of Field pH Data

6.0 IMPACT OF MINING ON GROUNDWATER LEVELS & MODEL REVIEW

6.1 Impact of Mining on Groundwater Levels

The extent of mining and ground elevation contours at June 2021 are shown below in Figure 6-1. The floor of mining is generally at the elevation of ~80 mAHD compared to a ground surface elevation of ~123 mAHD, i.e. the depth of mining at June 2021 was ~43 mbgl. The deepest area of mining (eastern side of pit) was at ~60 mAHD at June 2021, i.e. ~63 mbgl.

With respect to the extent of mining below groundwater level the following observations are made in reference to Figure 6-2, which shows the following:

- Groundwater level contours for the Permian groundwater unit, based on water level data available for December 2012 in AGE (2013);
- Groundwater level data for bores in the Quaternary alluvium that are closest to the mining area, at May 2021. It is noted that both bores shown in Figure 6-2, (JMR22WA and JMR24WA) are dry; these bores were also dry in December 2012 (AGE 2013) and have been dry for every monitoring event since that time. It is also noted that alluvial bore JMR18WA, which was located within the current mining area and has now been destroyed, was also dry in December 2012. It is therefore concluded that the Quaternary alluvium is dry in the current area of mining;
- Groundwater level data for Permian bores close to the mining area, at May 2021. It is noted that the water levels at May 2021 are similar or slightly higher than the water level contours from December 2012; therefore, it is concluded that there have been no measurable groundwater level impacts in the groundwater monitoring bores from mining to date;
- Contours showing the depth of mining at June 2021 below the groundwater level contours for December 2012. These contours are taken to represent the approximate depth of mining below the groundwater level, which is in the order of 10 – 15 m in the deepest areas of mining. Based on discussions with mine personnel, there have been no observations of groundwater inflow to the mine at this stage. This is not surprising because, although an area exists where mining is occurring below the groundwater level, at a depth below ground level of ~43-63 m (as stated above), it is generally observed for Bowen Basin coal mines that, for that depth of mining, the rate of groundwater inflow would be less than the rate of evaporation and that this would give the impression of a dry pit.

6.2 Requirement for Review of Numerical Model

With respect to numerical modelling it is a requirement of Condition 47 of the AWL that:

> *The Licensee must provide an Annual Monitoring Report to the chief executive. These reports must include:*
>
> *d) details of any review undertaken of the numerical underground water model since the previous Annual Monitoring Report, as required under Conditions 48 or 49;*
>
> *e) an assessment of any differences between the actual water level impact and the impact predicted for the same period in the most current numerical underground water model.*

With respect to the above requirements it is noted that:

- As stated above in Section 6-1, although there was a limited area of mining below the groundwater level in June 2021, there have been no observations to date of groundwater inflows to the mine and there is no evidence of mining impacts in the groundwater monitoring bores that are discussed in this report (and shown in Figure 6-2);
- Condition 47 (d) requires that a review of the numerical underground water model be undertaken within two years from the commencement of the take of associated water under the AWL. It is assessed that

the take of associated water commenced in around June 2021 and that the review of the numerical underground water model should be completed by June 2023; and,

- With respect to Condition 47 (e) – although it is assessed that the take of associated water commenced during the period covered by this report, it is also concluded that are no groundwater level impacts to compare to predicted impacts.

It is therefore concluded that there is no requirement as yet to compare available water level data to the drawdown predictions from the current numerical model.

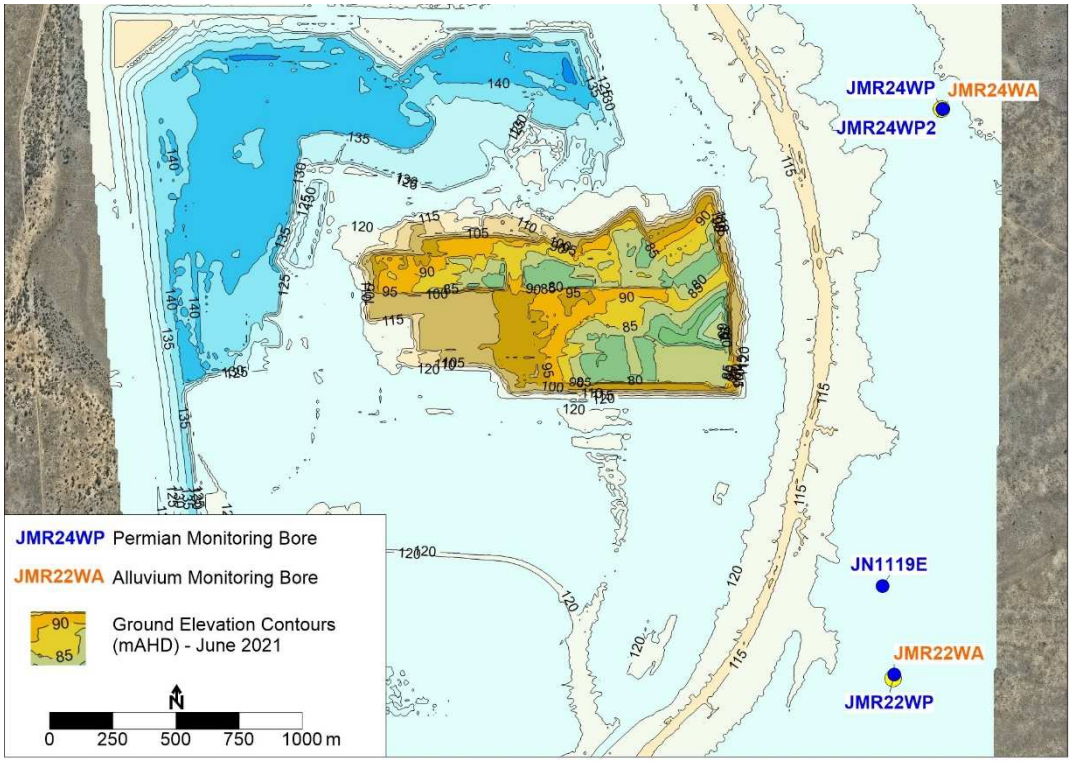


Figure 6-1: Depth and Extent of Mining at June 2021

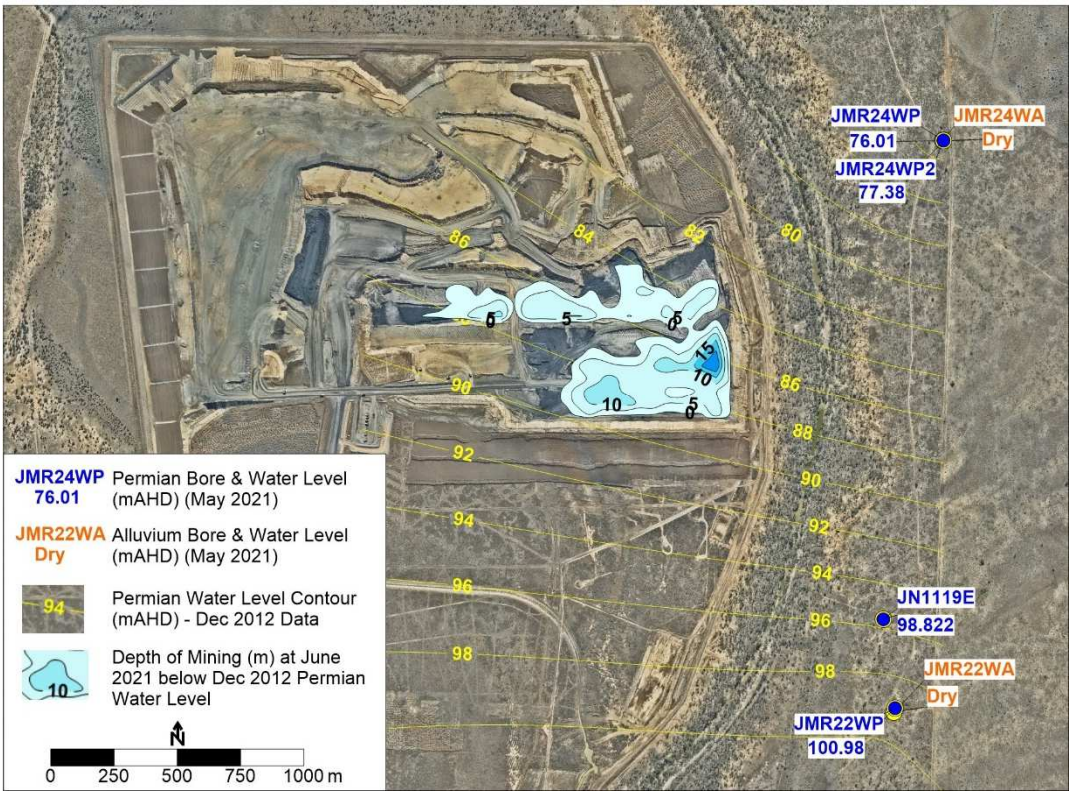


Figure 6-2: Extent of Mining below Groundwater Level – June 2021

7.0 PRIVATE BORES WITHIN THE AFFECTED AREA

7.1 Definition of Affected Area

Section 47 (f) of the AWL required that the Annual Monitoring Report must include *"details of any bores which are predicted by the most current numerical underground water model to be located in the affected area".* The Project's AWL defines the "affected area" as follows:

> *"affected area" for the purpose of this licence, means the area identified by the most current numerical underground water model where the water level is predicted to decline, at any time because of the Authorised Purpose authorised by this associated water licence, by more than –*
>
> *a) For a consolidated aquifer – 5 m; or,*
>
> *b) For an unconsolidated aquifer – 2 m.*

There are two groundwater units that require consideration within the Project area, being:

- The Quaternary alluvium, which is assessed to be an unconsolidated aquifer; and,
- The underlying Permian coal measures, which are assessed to be a consolidated aquifer.

The assessment that is outlined below considers the results of a groundwater bore census that was undertaken for a previous phase of groundwater investigations, as well as data from a recent download (data current to July 2021) of the DoR groundwater database.

7.2 Assessment of Available Data

7.2.1 Previous Investigations

A bore census was undertaken in 2013 as part of the field investigations for the Mackenzie North Groundwater Assessment[4]; the bore census included review of data from the DoR groundwater database as well as discussions with landholders. It was concluded from the bore census that there were no active groundwater bores within 10 km of the Project area, with all private groundwater bores within a 10 km radius assessed to be abandoned and destroyed. It should be noted that the only bore from the bore census that is shown on Figures 7-1 and 7-2 (below) is bore RN 111533 – the other bores in the bore census table are outside the area of the figures and therefore not considered further in this report. It is also noted that a 10 km radius from the Project area includes both the tenure area (i.e. the Mining Lease area) as well as the affected area for the Quaternary alluvium and Permian coal measures (as discussed further in the following sections).

A bore survey is generally required to locate bores that are not within the DoR Groundwater Database – bores that are not in the database tend to be old bores, and it is reasonable to assume that any recently drilled bores will have been captured in updates of the database (i.e. that the bore census captured any older bores that may not me in the groundwater database, but that database updates will capture any recently drilled bores). Since the date of the 2013 bore census, additional groundwater bores have been drilled that are within the affected area. These bores, which include data from a DoR groundwater database update from July 2021, are discussed below in Section 7.2.2.

[4] Mackenzie North Groundwater Assessment. Report prepared for Australasian Resource Consultants Pty Ltd (AARC) by Australasian Resource Consultants Pty Ltd (AGE). Project No. G1512, June 2013.

7.2.2 Current Assessment

7.2.2.1 Determination of "Affected Area"

The affected area as defined in the AWL (refer Section 7.1) has been determined based on predicted drawdown data at the end of mine life, as presented in the report for the most current numerical underground water model[5]. The predicted model drawdown data has been digitised for presentation in this report, with the results discussed in Sections 7.2.2.2 and 7.2.2.3 below. The original model drawdown contours are included as Attachment C.

7.2.2.2 Quaternary Alluvium – Unconsolidated Aquifer

For the purpose of this assessment the Quaternary alluvium is assumed to be an unconsolidated aquifer as defined in the Project's AWL. The limit of 2 m drawdown at the end of mine life[3] has been used to establish the limit of the affected area for the unconsolidated alluvial aquifer, with the limit of the affected area shown below in Figure 7-1. It should be noted that the original model output (Attachment C) presented drawdown data for the alluvial aquifer as shaded regions rather than contours. The extent of 2 m drawdown that is shown on Figure 7-1 has been digitised to follow the approximate extent of the 2 m drawdown as shown on the original model figure.

From Figure 7-1 and from review of available data, the following observations are made:

- Of the bores shown on Figure 7-1, only bore RN 111553 was identified in the 2013 bore census (AGE 2013). The bore is located outside the tenure area and the affected area; it is also noted that this bore was determined from the 2013 bore census to be "abandoned and destroyed" and the most recent data from the Department of Resources (DoR) groundwater database (current to July 2021) lists the bore as "abandoned";
- A recent download of the DoR groundwater database (current to July 2021) identified a number of new bores (drilled around August 2017) that are north of the Mackenzie North tenure area, but inside the affected area (bore RN's 165479, 165480, 165482, 165483, 165484, 165485, 165474 and 165475 – refer Figure 7-1 for bore locations). Jellinbah personnel have contacted the relevant landowner, who confirmed that the bores are not landowner bores. Based on data available from the DoR groundwater database it is concluded that the bores are groundwater investigation/ monitoring bores that are located within the adjacent Yarrabee Coal Company lease area; and,
- Bores RN165305 and RN190127 are located south of the Mackenzie River at the edge of the affected area (Figure 7-1). These bores are 50 mm diameter PVC bores that are screened within the alluvium and it is assessed that these bores are groundwater monitoring bores within the adjacent Curragh Mine lease.

It is concluded that there are no private landholder groundwater bores within the tenure area or the affected area of the alluvial aquifer and that there is therefore no requirement for further assessment under Section 47(f) of the AWL.

[5] Predictive drawdown contours from the most recent groundwater model have been obtained from the following report:
"Groundwater model results are presented in "Mackenzie North Groundwater Assessment. Report prepared for Australasian Resource Consultants Pty Ltd (AARC) by Australasian Resource Consultants Pty Ltd (AGE). Project No. G1512, June 2013".
Predictive drawdown contours at model year 27 (corresponding to end of mining operations) have been used for this assessment.

7.2.2.3 Permian Coal Measures – Consolidated Aquifer

For the purpose of this assessment, the Permian coal measures are assumed to be a consolidated aquifer as defined in the Project's AWL (refer Section 1). The limit of 5 m drawdown at the end of mine life[6] has been used to establish the limit of the affected area for the consolidated Permian coal measures aquifer (based on modelled drawdown contours for the Pollux Upper seam), with the limit of the affected area shown below on Figure 7-2. From Figure 7-2 and from review of available data, the following observations are made:

- With respect to the locations of private groundwater bores within the Project's tenure area or the affected area for the Permian coal measures, the observations and comments that were made in Section 7.2.2.2 above also apply to the Permian coal measures aquifer, i.e. that there are no existing landowner bores within the tenure area or affected area and that the bores shown on Figure 7-2 to be within the affected area are groundwater investigation/ monitoring bores associated with the adjacent Yarrabee Coal Project;
- It is therefore concluded that there are no private landholder groundwater bores within the Project's tenure area or the affected area for the Permian coal measures and therefore that there is no requirement for further assessment under Section 47(f) of the AWL.

7.3 Conclusions from Assessment of Private Bores

Based on the assessment discussed above it is concluded that:

- There are no private groundwater bores within the affected area of either the Quaternary alluvial aquifer or the Permian Coal Measures; and,
- There is therefore no requirement for further assessment under Section 47 (f) of the AWL

[6] Predictive drawdown contours from the most recent groundwater model have been obtained from the following report:
"Groundwater model results are presented in "Mackenzie North Groundwater Assessment. Report prepared for Australasian Resource Consultants Pty Ltd (AARC) by Australasian Resource Consultants Pty Ltd (AGE). Project No. G1512, June 2013".
Predictive drawdown contours at model year 27 (corresponding to end of mining operations) have been used for this assessment.

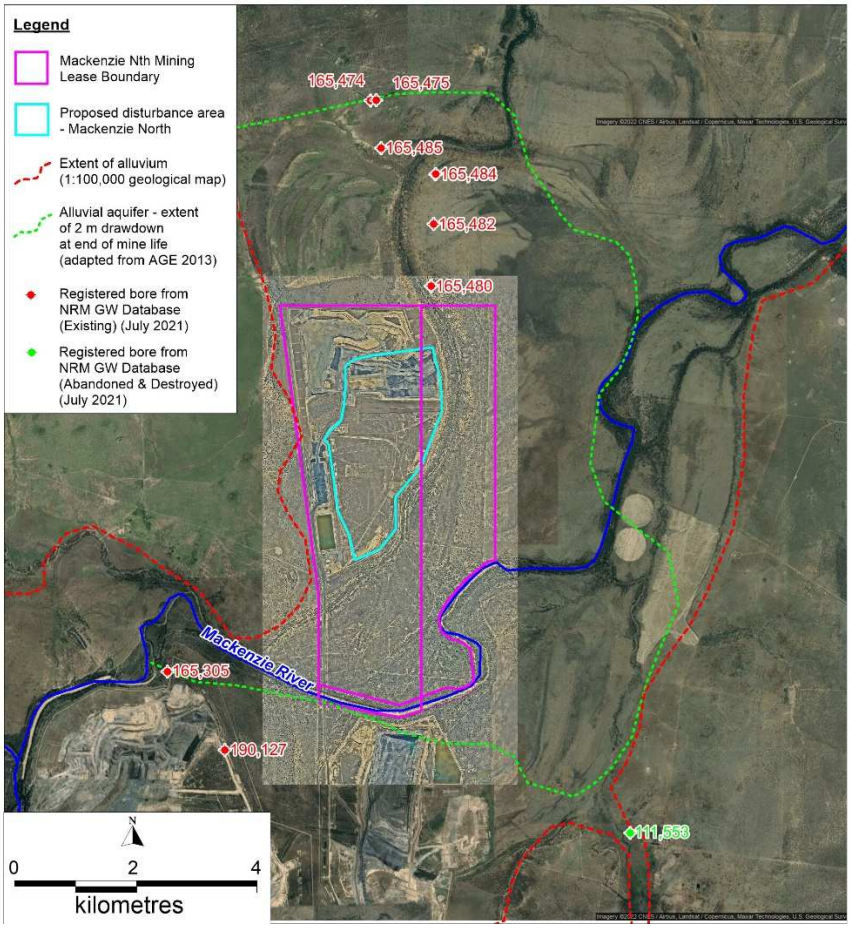


Figure 7-1: Bore Locations relative to the Affected Area off the Alluvial Aquifer

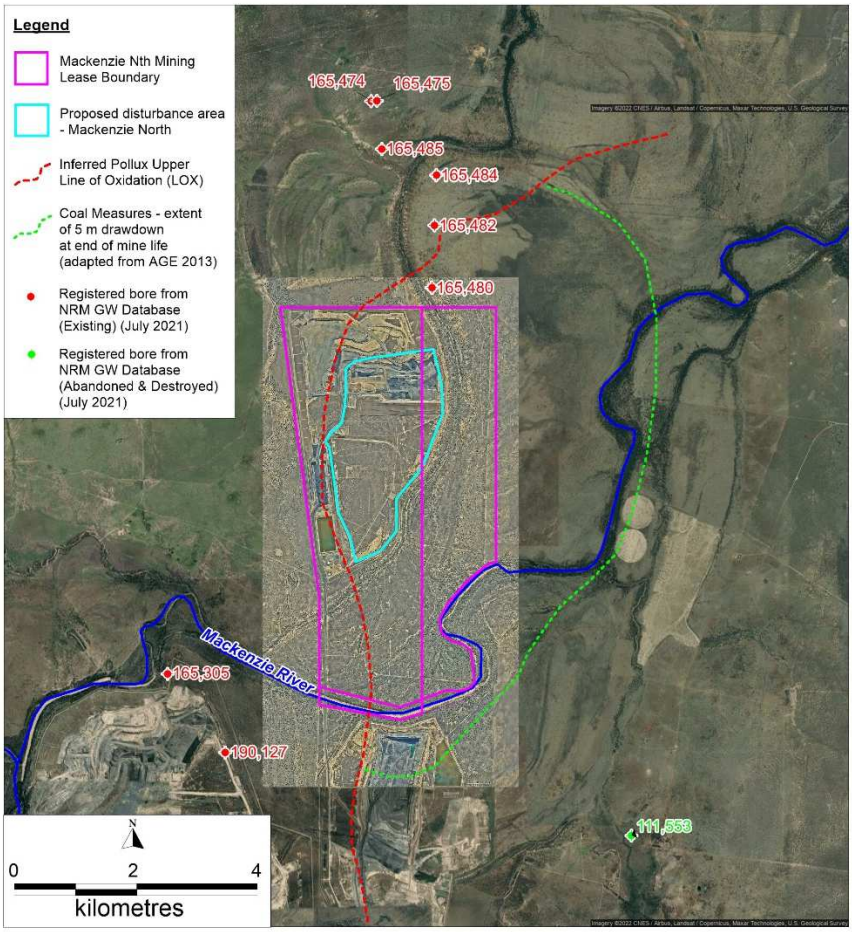


Figure 7-2: Bore Locations relative to the Affected Area of the Permian Coal Measures

8.0 SUMMARY AND CONCLUSIONS

Following review of available data the following summary and conclusions are made:

- Monitoring of groundwater level and groundwater quality is occurring at 11 monitoring sites, at a frequency and for parameters that are in accordance with the requirements of the Project's Associated Water Licence (AWL) number 618107.
- During the previous (approximate) 12-month period covered by this report, no new groundwater monitoring bores have been installed. However, bore JMR4WP2 (Pollux Seam), which was drilled in April 2020 as a replacement for bore JMR4WP, was sampled for the first time during the reporting period
- Groundwater level observations are discussed in Section 5.2.1 and observations of note include:
  - The majority of bores record a water level reduction over the period between July 2017 and May 2021; this reduction in water level is interpreted to be related to below-average rainfall conditions over that period.
  - A number of bores that monitor the Quaternary alluvium are either dry or record a water level that is just above the base of bore. These bores include JMR22WA, JMR23WA, JMR24WA, JMR25WA and JMR26WA.
- Groundwater quality observations are discussed in Section 5.2.2. Observations of note include:
  - Field Electrical Conductivity (EC) data:
    - JMR4WA (alluvium) – the field EC range is from 6,133 µS/cm to 7,189 µS/cm (8 samples);
    - JMR4WP (Pollux Seam) – the field EC range is from 7,450 µS/cm to 9,833 µS/cm (6 samples).
    - JMR24WP and JMR24WP2 (Pollux Seam) – the field EC range is from 7,950 µS/cm to 9,490 µS/cm in JMR24WP (2 samples) and 8587 µS/cm in JMR24WP2 (1 sample). The data record is short at these sites and further data will be required to establish trends;
    - JMR25WA (alluvium) – the field EC range is from 1,171 µS/cm to 1,561 µS/cm (8 samples)
    - JN1119E (Pollux Seam – replacement bore for JMR22WP) - the field EC range is from 13,343 µS/cm to 17,353 µS/cm (2 samples).
  - Field pH Data
    - The field pH for the monitoring bores is generally in the range 6.3 to 7.5;

Available field pH data is presented in Figure 5-4 below and is summarised as follows:

- The field pH for the monitoring bores is generally in the range 6.3 to 7.5;
- The exception is bore JN1119E (Pollux Seam), where the field pH increased from 8.35 to 11.97 between November 2019 (initial sample) and April 2020, with field pH in the range of 11.4 to 11.6 since that time. It is possible that the bore has experienced grouting issues during construction, however the following observations are also made:
  - Bore JMR22WP was re-developed in November 2018 and recorded a field pH of 12.11;
  - On the basis of the high field pH in bore JMR22WP a replacement bore was drilled as JN1119E. This bore was located some distance from JMR22WP due to drilling issues with the attempted replacement bore at the site of JMR22WP;
  - As stated above, JN1119E is now recording high pH, which may be indicative of grouting issues or some other cause (for example, site geological personnel advise that the bore is located in the area of basic dykes, where the groundwater could locally be expected to be alkaline);

- The original bore (JMR22WP) has continued to be sampled and has recorded a steady decrease in pH between April 2020 and May 2021, reducing from 9.79 in April 2020 to 7.98 in May 2021 (refer Figure 5-4);

Recommendation: it is recommended that bores JN1119E and JMR22WP continue to be sampled for water level and water quality and that the pH trends of each bore continue to be reviewed. Following a further 12 months of sampling, an assessment should be undertaken by a suitably qualified person into the likely cause of the pH variation in bores JN1119E and JMR22WP, with recommendations made as appropriate for any further investigations or actions required.

- Condition 47 of the AWL requires that the annual monitoring report must include:
  - details of any review undertaken of the numerical underground water model since the previous Annual Monitoring Report, as required under Conditions 48 or 49;
  - an assessment of any differences between the actual water level impact and the impact predicted for the same period in the most current numerical underground water model.

  Pre-stripping operations commenced at the Project site in November 2019 and mining of coal commenced in August 2020. By end June 2021 (the end of the period covered by this report) it is assessed that mining had commenced below the water table (i.e. below the potentiometric surface in the Permian coal measures, as the overlying Quaternary alluvium is dry in the current mining area). However, the area of mining below the water table at June 2021 was limited, and there have been no observations of groundwater inflow to the mine workings or impacts on the groundwater monitoring bores that are discussed in this report.

  Condition 47 (e) of the AWL requires "*an assessment of any differences between the actual water level impact and the impact predicted for the same period in the most current numerical underground water model".* It is concluded that, at June 2021, there was no assessable impact on groundwater levels and therefore that no assessment was required against the groundwater modelling predictions.

  Condition 47 (d) of the AWL requires that a review of the numerical underground water model be undertaken within two years from the commencement of the take of associated water under the AWL. It is assessed that the take of associated water commenced in around June 2021 and that the review of the numerical underground water model should be completed by June 2023.

  Recommendation: It is recommended that, in accordance with the requirements of AWL Condition 47 (d), a review of the numerical underground water model be undertaken by a suitably qualified person, with the review to be completed by June 2023.

- Section 47 (f) of the AWL required that the Annual Monitoring Report must include *"details of any bores which are predicted by the most current numerical underground water model to be located in the affected area".* As noted in Section 7.3 of this report,
  - There are no private groundwater bores within the affected area of either the Quaternary alluvial aquifer or the Permian Coal Measures; and,
  - There is therefore no requirement for further assessment under Section 47 (f) of the AWL.

ATTACHMENT A

Water Level Monitoring Data

Mackenzie North Groundwater Level Monitoring
Standing Water Level (SWL) - metres below top of casing (mTOC)

Date	JMR4WA	JMR4WP	JMR22WA	JMR22WP	JN1119E	JMR23WA	JMR24WA	JMR24WP	JMR24WP2	JMR25WA	JMR26WA	JP0911T	JP0912T
12-Oct-2015	18.45					20.00							
17-May-2017	18.50					19.30							
19-Jul-2017	18.70					19.40							
28-Sep-2017												22.81	20.30
06-Oct-2017	19.20					19.15							
01-Nov-2017												22.80	20.43
01-Dec-2017												23.00	20.48
09-Dec-2017	19.30					19.85							
01-Jan-2018												23.19	20.59
01-Feb-2018												23.35	20.65
20-Feb-2018	19.40					19.90							
01-Mar-2018												23.19	20.46
01-Apr-2018												23.40	20.48
01-May-2018												23.44	20.47
03-May-2018	19.44					19.90							
18-May-2018												23.46	
01-Jun-2018													20.53
16-Jun-2018	19.52					19.94							
01-Jul-2018													20.58
09-Jul-2018	19.52					19.96							
13-Jul-2018												24.48	
01-Aug-2018												24.52	20.68
01-Sep-2018												24.61	20.83
01-Oct-2018												24.62	20.88
05-Oct-2018				21.04									
08-Oct-2018	19.78												
09-Oct-2018		19.75						35.90					
11-Oct-2018						19.64			22.14	19.35			
19-Oct-2018	19.93	19.91	17.96	22.11		21.10	Dry	36.74		19.53			
01-Nov-2018											Dry	24.75	21.02
17-Nov-2018	19.88	19.87	17.97	22.09		Dry	Dry	36.73	2.79	19.87			
01-Dec-2018											Dry	24.82	21.19
10-Dec-2018	19.97	19.99	Dry	22.07		Dry	Dry	36.71	1.66	19.59			
01-Jan-2019											Dry	24.93	21.26
24-Jan-2019	20.08	20.09	Dry	22.04		Dry	Dry	36.69		19.68			
01-Feb-2019											Dry	25.02	21.36
25-Feb-2019	20.14	20.16	Dry	22.18		Dry	Dry	37.02		19.73			
01-Mar-2019											Dry	25.06	21.35
27-Mar-2019	20.13	20.14	Dry	22.14		Dry	Dry	36.98		19.80			
01-Apr-2019											Dry	25.00	21.32
18-Apr-2019	20.21	20.25	Dry	22.15		Dry	Dry	37.06		19.81			
01-May-2019											Dry	25.05	21.38
13-May-2019	20.23	20.27	Dry	22.14		Dry	Dry	37.06		19.84			
01-Jun-2019											Dry	25.14	21.48
01-Jul-2019											Dry	25.21	21.60
02-Jul-2019	20.34	20.35	Dry	22.16		Dry	Dry		41.66				
24-Jul-2019	20.34	20.34	Dry		21.97	Dry	Dry		42.65	20.00	Dry		
01-Aug-2019											Dry	25.36	21.69
20-Aug-2019	20.49	20.49	Dry		21.87	Dry	Dry		43.25	20.05			
01-Sep-2019											Dry	25.46	21.82
01-Oct-2019											Dry	25.53	21.89
12-Nov-2019	20.67	NM	Dry	21.73	21.63	Dry	Dry	44.07	42.87	20.16	Dry	25.65	22.01
13-Dec-2019	20.76	NM	Dry	21.68	21.59	Dry	Dry	44.23		20.33	Dry	25.76	22.12
04-Feb-2020	20.87	NM	Dry	21.61	21.49	Dry	Dry	44.44	43.17	20.40	Dry	25.81	22.08
20-Apr-2020	20.98	NM	Dry	21.64	21.41	Dry	Dry	44.68	43.34	20.48	Dry	25.74	22.08
01-May-2020											Dry	25.74	22.04
01-Jun-2020											Dry	25.86	22.04
01-Jul-2020											Dry	25.97	22.15
23-Jul-2020	21.17	21.43	No access	21.64	21.43	No access	No access	44.95	43.52	20.67	Dry	25.99	22.21
01-Sep-2020											Dry	26.01	22.28
01-Oct-2020											Dry	26.06	22.35
16-Nov-2020	21.62	21.39	Dry	21.64	21.7	Dry	Dry	44.72	43.82	20.88	Dry	26.11	22.44
01-Dec-2020											Dry	26.18	22.52
26-Jan-2021	21.65	21.44	Dry	21.67	21.72	Dry	Dry	44.78	43.96	20.89	Dry	26.24	22.65
01-Feb-2021											Dry	26.31	22.71
01-Mar-2021											Dry	26.36	22.78
01-Apr-2021											Dry	26.38	22.81
19-May-2021	21.63	21.9	Dry.	21.87	23.21	Dry.	Dry.	45.45	44.08	21.16	Dry	26.46	22.88
01-Jun-2021											Dry	26.46	22.84

* JN1119E is a replacement bore for JMR22WP for water quality sampling. Water level data is collected from both bores
** JMR24WP2 is a replacement bore for JMR24WP for water quality sampling. Water level data is collected from both bores
No access - road to bore closed due to rain and no safe acces

ATTACHMENT B

Water Quality Monitoring Data

Mackenzie North Groundwater Quality Monitoring

pH, EC, TDS, Major Ions, Hydrocarbon Data

Bore ID	Sample Date	pH		Electrical Conductivity		TDS	Major Ions										Total Petroleum Hydrocarbons				
		Field	Lab	Field	Lab	Total Dissolved Solids (TDS)	Calcium	Magnesium	Sodium	Potassium	Chloride	Sulfate	Hydroxide Alkalinity	Carbonate Alkalinity	Bicarbonate Alkalinity	Total Alkalinity	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)
		pH	pH	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L
JMR4WA	09-Sep-2018	6.51	7.05	7189	6570	3610	271	275	783	8	1620	96	<1	<1	838	838	<20	60	140	<50	200
JMR4WA	18-Nov-2018	6.54	6.97	6665	6450	3980	290	253	793	8	1440	81	<1	<1	834	834	<20	<50	<100	<50	<50
JMR4WA	24-Jan-2019	6.4	7.13	6604	6360	4280	299	253	784	8	1670	78	<1	<1	843	843	<20	<50	<100	<50	<50
JMR4WA	27-Mar-2019	6.73	7.68	6407	6400	3990	294	254	795	8	1510	88	<1	<1	832	832	<20	70	130	<50	200
JMR4WA	15-May-2019	6.56	7.07	6547	6070	4440	302	247	757	8	1720	102	<1	<1	794	794	<20	70	130	<50	200
JMR4WA	24-Jul-2019	6.37	7.03	6614	6550	4170	286	233	727	8	1660	105	<1	<1	882	882	<20	<50	<100	<50	<50
JMR4WA	12-Nov-2019	6.5	7.51	6161	6230	4310	287	228	716	7	1660	100	<1	<1	763	763	<20	<50	2170	850	3020
JMR4WA	20-Apr-2020	6.56	7.36	6133	6320	3800	244	236	683	8	1660	98	<1	<1	704	704	<20	<50	<100	<50	<50
JMR4WA	16-Nov-2020	7.26	7.88	4197	4040	2270	77	68	743	4	1100	66	<1	<1	475	475	<20	<50	<100	<50	<50
JMR4WA	26-Jan-2021	6.51	7.65	6333	6110	4240	260	240	676	7	1680	99	<1	<1	679	679	<20	<50	220	<50	220
JMR4WA	19-May-2021	6.59	7.55	6053	5890	3840	227	196	577	7	1640	93	<1	<1	668	668	<20	<50	140	<50	140
JMR4WP	09-Sep-2018	7.07	7.65	7450	6870	4050	140	110	1070	5	1860	38	<1	<1	458	458	<20	<50	<100	<50	<50
JMR4WP	18-Nov-2018	7.08	7.44	8921	8600	5010	252	143	1490	7	2710	22	<1	<1	428	428	<20	<50	<100	<50	<50
JMR4WP	24-Jan-2019	6.91	7.54	9883	9500	5620	263	153	1570	6	3160	22	<1	<1	432	432	<20	<50	<100	<50	<50
JMR4WP	27-Mar-2019	7.29	8.01	9096	9070	5620	280	146	1610	7	2830	18	<1	<1	428	428	<20	<50	<100	<50	<50
JMR4WP	15-May-2019	7.06	7.68	9235	8620	5650	345	149	1650	7	3060	22	<1	<1	419	419	<20	<50	<100	<50	<50
JMR4WP	25-Jul-2019	6.9	7.59	8725	8760	5250	254	128	1380	6	2800	18	<1	<1	480	480	<20	<50	<100	<50	<50
JMR4WP	16-Nov-2020	6.62	7.28	6190	5920	4270	267	241	710	8	1640	98	<1	<1	696	696	<20	<50	160	<50	160
JMR4WP	26-Jan-2021	7.21	8.13	4099	3980	2170	62	65	695	4	1060	64	<1	<1	473	473	20	<50	<100	<50	<50
JMR4WP	19-May-2021	7.33	8.11	4046	3930	2170	61	53	621	4	1070	56	<1	<1	476	476	20	<50	<100	<50	<50
JMR22WP	20-Apr-2020	9.79	9.23	15872	16500	10100	121	47	3300	13	5690	11	<1	38	10	49	<20	<50	<100	<50	<50
JMR22WP	16-Nov-2020	9.09	8.97	17614	16800	10300	131	60	3720	12	6240	3	<1	47	48	94	<20	<50	<100	<50	<50
JMR22WP	26-Jan-2021	8.16	8.01	18096	17500	10800	99	64	3520	9	6500	2	<1	<1	91	91	<20	<50	<100	<50	<50
JMR22WP	19-May-2021	7.98	7.86	17471	17100	10900	97	61	3380	10	6360	2	<1	<1	102	102	<20	<50	<100	<50	<50
JMR24WP	12-Nov-2019	7.56	8.14	9490	9570	6530	224	131	1590	8	3270	8	<1	<1	222	222	<20	<50	<100	<50	<50
JMR24WP	20-Apr-2020	7.53	7.97	7950	8250	5190	202	152	1220	8	2670	<1	<1	<1	198	198	<20	<50	<100	<50	<50
JMR24WP	16-Nov-2020	7.61	7.98	8269	7860	5570	203	147	1300	9	2800	4	<1	<1	215	215	<20	<50	<100	<50	<50
JMR24WP	26-Jan-2021	7.33	7.98	8308	8020	5210	191	144	1200	7	2850	12	<1	<1	204	204	<20	<50	<100	<50	<50
JMR24WP	19-May-2021	7.32	7.94	7966	7810	4510	180	124	1170	7	2740	2	<1	<1	203	203	<20	<50	<100	<50	<50
JMR24WP2	20-Apr-2020	7.38	7.96	8587	8870	5500	182	125	1420	8	2910	2	<1	<1	204	204	<20	<50	<100	<50	<50
JMR24WP2	17-Nov-2020	7.4	7.86	8036	7730	5190	172	111	1370	7	2750	<1	<1	<1	214	214	<20	<50	<100	<50	<50
JMR24WP2	27-Jan-2021	6.79	7.8	11491	11200	6420	281	171	1910	8	3430	404	<1	<1	992	992	70	<50	960	610	1570
JMR24WP2	19-May-2021	7.34	7.96	7553	7400	4250	139	90	1150	7	2550	<1	<1	<1	233	233	<20	<50	<100	<50	<50
JMR25WA	11-Sep-2018	6.45	7.01	1171	1190	905	67	43	66	5	282	14	<1	<1	161	161	<20	<50	100	50	150
JMR25WA	29-Nov-2018	6.45	6.93	1299	1200	738	81	44	80	5	298	17	<1	<1	153	153	<20	<50	<100	<50	<50
JMR25WA	24-Jan-2019	6.5	6.99	1273	1200	1010	82	44	83	5	302	15	<1	<1	171	171	<20	<50	<100	<50	<50
JMR25WA	27-Mar-2019	6.66	7.51	1292	1260	909	93	49	97	6	297	16	<1	<1	163	163	<20	<50	<100	<50	<50
JMR25WA	15-May-2019	6.47	7.14	1374	1220	919	96	50	96	5	334	16	<1	<1	166	166	<20	<50	<100	<50	<50
JMR25WA	25-Jul-2019	6.78	7.03	1272	1280	815	82	43	87	5	316	14	<1	<1	184	184	<20	<50	<100	<50	<50
JMR25WA	12-Nov-2019	6.44	7.32	1285	1280	942	90	45	99	5	327	8	<1	<1	189	189	<20	<50	<100	<50	<50
JMR25WA	20-Apr-2020	6.54	7.44	1561	1560	1040	99	60	122	3	401	6	<1	<1	197	197	<20	<50	<100	<50	<50
JMR25WA	16-Nov-2020	6.54	7.16	1904	1870	1430	120	74	159	4	522	5	<1	<1	242	242	<20	<50	<100	<50	<50
JMR25WA	26-Jan-2021	6.56	7.55	2029	1920	1460	113	74	153	2	545	6	<1	<1	235	235	<20	<50	<100	<50	<50
JMR25WA	19-May-2021	6.74	7.71	2358	2220	1510	124	77	178	2	656	2	<1	<1	276	276	<20	<50	<100	60	60
JN1119E	13-Nov-2019	8.6	8.35	17353	18000	11400	98	99	3550	10	6300	3	<1	5	119	124	<20	<50	<100	80	80
JN1119E	20-Apr-2020	11.97	11.6	13343	13100	7670	90	<1	2550	17	3860	11	396	113	<1	509	<20	50	170	<50	220
JN1119E	16-Nov-2020	11.88	11.6	13958	12800	6880	81	<1	2680	18	4060	10	468	109	<1	578	<20	50	280	<50	330
JN1119E	26-Jan-2021	11.97	11.4	12691	11400	5310	7	<1	2240	12	3520	16	349	308	<1	657	<20	<50	240	<50	240
JN1119E	19-May-2021	11.98	11.6	11974	11100	6360	<1	<1	2240	12	3290	16	433	294	<1	727	<20	<50	210	<50	210

Mackenzie North Groundwater Quality Monitoring

Dissolved Metals/Metalloids Data

Bore ID	Sample Date	Dissolved Metals																	
		Aluminium	Arsenic	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Vanadium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
JMR4WA	09-Sep-2018	<0.01	<0.001	0.00	<0.0001	<0.001	-	<0.001	5.61	<0.001	-	<0.0001	-	<0.001	<0.01	-	-	-	<0.005
JMR4WA	18-Nov-2018	<0.01	<0.001	0.13	<0.0001	<0.001	-	<0.001	5.9	<0.001	1.64	<0.0001	<0.001	<0.001	<0.01	<0.001	0.001	<0.01	<0.005
JMR4WA	24-Jan-2019	<0.01	<0.001	<0.05	<0.0001	0.002	<0.001	<0.001	6.69	<0.001	1.94	<0.0001	<0.001	0.001	<0.01	<0.001	0.001	<0.01	<0.005
JMR4WA	27-Mar-2019	<0.01	<0.001	0.05	<0.0001	<0.001	<0.001	<0.001	6.49	<0.001	1.9	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005
JMR4WA	15-May-2019	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	6.45	<0.001	1.67	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005
JMR4WA	24-Jul-2019	<0.01	<0.001	0.06	<0.0001	<0.001	<0.001	<0.001	6.92	<0.001	1.88	<0.0001	<0.001	<0.001	<0.01	<0.001	0.001	<0.01	<0.005
JMR4WA	12-Nov-2019	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	5.54	<0.001	1.72	<0.0001	<0.001	0.004	<0.01	<0.001	<0.001	<0.01	<0.005
JMR4WA	20-Apr-2020	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	4.59	<0.001	1.55	<0.0001	<0.001	0.003	<0.01	<0.001	0.002	<0.01	<0.005
JMR4WA	16-Nov-2020	<0.01	0.015	0.16	<0.0001	<0.001	<0.001	0.015	<0.05	<0.001	0.075	<0.0001	0.004	0.007	<0.01	<0.001	0.002	<0.01	0.061
JMR4WA	26-Jan-2021	<0.01	<0.001	0.05	<0.0001	<0.001	<0.001	<0.001	5.11	<0.001	1.93	<0.0001	<0.001	0.008	<0.01	<0.001	0.002	<0.01	0.01
JMR4WA	19-May-2021	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	4.57	<0.001	1.59	<0.0001	<0.001	0.006	<0.01	<0.001	0.002	<0.01	<0.005
JMR4WP	09-Sep-2018	<0.01	<0.001	0.00	<0.0001	<0.001	-	<0.001	0.14	<0.001	-	<0.0001	-	0.001	<0.01	-	-	-	<0.005
JMR4WP	18-Nov-2018	<0.01	<0.001	0.25	<0.0001	<0.001	-	<0.001	0.21	<0.001	0.096	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.016
JMR4WP	24-Jan-2019	<0.01	<0.001	0.18	<0.0001	0.001	<0.001	<0.001	0.13	<0.001	0.104	<0.0001	<0.001	0.001	<0.01	<0.001	<0.001	<0.01	0.006
JMR4WP	27-Mar-2019	<0.01	<0.001	0.19	<0.0001	<0.001	<0.001	<0.001	0.13	<0.001	0.11	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.009
JMR4WP	15-May-2019	<0.01	<0.001	0.17	<0.0001	<0.001	<0.001	0.001	0.1	<0.001	0.111	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.012
JMR4WP	25-Jul-2019	<0.01	<0.001	0.21	<0.0001	<0.001	<0.001	<0.001	0.07	<0.001	0.107	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.007
JMR4WP	16-Nov-2020	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	4.17	<0.001	1.6	<0.0001	<0.001	0.012	<0.01	<0.001	0.002	<0.01	0.012
JMR4WP	26-Jan-2021	<0.01	0.021	0.16	<0.0001	<0.001	0.001	<0.001	0.5	<0.001	0.178	<0.0001	0.006	0.003	<0.01	<0.001	0.001	<0.01	0.007
JMR4WP	19-May-2021	<0.01	0.014	0.14	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.135	<0.0001	0.004	0.006	<0.01	<0.001	<0.001	<0.01	<0.005
JMR22WP	20-Apr-2020	<0.01	0.003	0.39	<0.0001	0.002	<0.001	<0.001	<0.05	<0.001	0.003	<0.0001	0.016	<0.001	<0.01	<0.001	<0.001	<0.01	0.011
JMR22WP	16-Nov-2020	<0.01	0.004	0.23	<0.0001	0.001	<0.001	<0.001	<0.05	<0.001	0.018	<0.0001	0.008	0.001	<0.01	<0.001	<0.001	<0.01	0.011
JMR22WP	26-Jan-2021	<0.01	0.003	0.44	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.04	<0.0001	0.008	0.001	<0.01	<0.001	<0.001	<0.01	0.01
JMR22WP	19-May-2021	<0.01	0.004	0.46	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.079	<0.0001	0.005	0.003	<0.01	<0.001	<0.001	<0.01	<0.005
JMR24WP	12-Nov-2019	<0.01	0.002	0.51	<0.0001	0.004	<0.001	<0.001	<0.05	<0.001	0.193	<0.0001	0.008	0.02	<0.01	<0.001	<0.001	<0.01	0.01
JMR24WP	20-Apr-2020	<0.01	0.001	0.49	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.196	<0.0001	0.001	0.009	<0.01	<0.001	<0.001	<0.01	0.014
JMR24WP	16-Nov-2020	<0.01	0.002	0.36	<0.0001	0.002	<0.001	0.003	<0.05	<0.001	0.214	<0.0001	0.004	0.017	<0.01	<0.001	<0.001	<0.01	0.019
JMR24WP	26-Jan-2021	<0.01	0.002	0.46	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.22	<0.0001	0.002	0.005	<0.01	<0.001	<0.001	<0.01	0.017
JMR24WP	19-May-2021	<0.01	0.002	0.46	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.218	<0.0001	0.002	0.004	<0.01	<0.001	<0.001	<0.01	0.017
JMR24WP2	20-Apr-2020	<0.01	0.001	0.43	<0.0001	<0.001	<0.001	<0.001	0.2	<0.001	0.257	<0.0001	0.002	0.005	<0.01	<0.001	<0.001	<0.01	0.012
JMR24WP2	17-Nov-2020	<0.01	<0.001	0.39	<0.0001	<0.001	<0.001	<0.001	0.21	<0.001	0.258	<0.0001	0.002	0.006	<0.01	<0.001	<0.001	<0.01	0.047
JMR24WP2	27-Jan-2021	0.02	0.003	1.26	<0.0001	0.003	<0.001	<0.001	0.06	<0.001	0.321	<0.0001	0.002	0.002	<0.01	<0.001	0.002	<0.01	<0.005
JMR24WP2	19-May-2021	<0.01	0.001	0.50	<0.0001	<0.001	<0.001	<0.001	0.16	<0.001	0.217	<0.0001	0.002	0.003	<0.01	<0.001	<0.001	<0.01	0.011
JMR25WA	11-Sep-2018	0.01	<0.001	-	<0.0001	<0.001	-	0.002	<0.05	<0.001	-	<0.0001	-	0.001	<0.01	-	-	-	0.014
JMR25WA	29-Nov-2018	<0.01	<0.001	<0.05	<0.0001	<0.001	-	0.002	<0.05	<0.001	0.015	<0.0001	<0.001	0.002	<0.01	<0.001	<0.001	<0.01	<0.005
JMR25WA	24-Jan-2019	<0.01	<0.001	<0.05	<0.0001	0.001	<0.001	0.001	<0.05	<0.001	0.016	<0.0001	<0.001	0.002	<0.01	<0.001	<0.001	<0.01	<0.005
JMR25WA	27-Mar-2019	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.01	<0.0001	<0.001	0.001	<0.01	<0.001	<0.001	<0.01	<0.005
JMR25WA	15-May-2019	<0.01	<0.001	<0.05	<0.0001	<0.001	0.001	<0.001	<0.05	<0.001	0.088	<0.0001	<0.001	0.002	<0.01	<0.001	<0.001	<0.01	<0.005
JMR25WA	25-Jul-2019	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.006	<0.0001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.01	<0.005
JMR25WA	12-Nov-2019	<0.01	<0.001	<0.05	0.0002	<0.001	<0.001	0.005	<0.05	<0.001	0.022	<0.0001	<0.001	0.005	<0.01	<0.001	<0.001	<0.01	0.013
JMR25WA	20-Apr-2020	<0.01	<0.001	<0.05	<0.0001	<0.001	0.003	<0.001	<0.05	<0.001	0.216	<0.0001	<0.001	0.012	<0.01	<0.001	<0.001	<0.01	0.005
JMR25WA	16-Nov-2020	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	0.001	<0.05	<0.001	0.055	<0.0001	<0.001	0.007	<0.01	<0.001	0.001	<0.01	0.011
JMR25WA	26-Jan-2021	<0.01	0.001	<0.05	<0.0001	<0.001	0.006	<0.001	0.09	<0.001	0.769	<0.0001	<0.001	0.014	<0.01	<0.001	0.002	<0.01	<0.005

Mackenzie North Groundwater Quality Monitoring

Dissolved Metals/Metalloids Data

Bore ID	Sample Date	Dissolved Metals																
		Aluminium	Arsenic	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Vanadium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
JMR25WA	19-May-2021	<0.01	0.002	<0.05	<0.0001	<0.001	0.01	<0.001	0.34	<0.001	1.9	<0.0001	0.001	0.023	<0.01	<0.001	0.002	<0.01	<0.005
JN1119E	13-Nov-2019	<0.01	0.007	0.52	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.01	<0.0001	0.007	0.002	<0.01	<0.001	<0.001	<0.01	0.009
JN1119E	20-Apr-2020	0.07	0.001	0.21	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	<0.0001	0.038	0.001	<0.01	<0.001	<0.001	<0.01	<0.005
JN1119E	16-Nov-2020	0.02	0.002	0.18	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	0.0011	0.05	0.003	<0.01	<0.001	<0.001	<0.01	0.011
JN1119E	26-Jan-2021	0.02	0.002	0.18	0.0002	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	0.0003	0.077	0.001	<0.01	<0.001	<0.001	<0.01	<0.005
JN1119E	19-May-2021	0.02	0.002	0.14	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	0.0001	0.066	0.003	<0.01	<0.001	<0.001	<0.01	<0.005

Mackenzie North Groundwater Quality Monitoring

Total Metals/Metalloids Data

Bore ID	Sample Date	Total Metals																	
		Aluminium	Arsenic	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Vanadium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
JMR4WA	09-Sep-2018	0.03	<0.001	-	0.0001	<0.001	-	<0.001	5.41	<0.001	-	<0.0001	-	<0.001	<0.01	-	-	-	<0.005
JMR4WA	18-Nov-2018	<0.01	<0.001	0.06	<0.0001	<0.001	-	<0.001	6.01	<0.001	1.76	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005
JMR4WA	24-Jan-2019	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	6.69	<0.001	1.83	<0.0001	<0.001	<0.001	<0.01	<0.001	0.001	<0.01	<0.005
JMR4WA	27-Mar-2019	<0.01	<0.001	0.05	<0.0001	<0.001	<0.001	<0.001	6.78	<0.001	1.84	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005
JMR4WA	15-May-2019	<0.01	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	6.07	<0.001	1.73	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005
JMR4WA	24-Jul-2019	0.02	<0.001	0.10	<0.0001	<0.001	<0.001	<0.001	7.28	<0.001	1.85	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005
JMR4WA	12-Nov-2019	0.03	<0.001	0.06	0.0002	<0.001	<0.001	<0.001	6.27	<0.001	1.81	<0.0001	<0.001	0.005	<0.01	<0.001	0.002	<0.01	0.006
JMR4WA	20-Apr-2020	0.02	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	5.67	<0.001	1.93	<0.0001	<0.001	0.004	<0.01	<0.001	0.003	<0.01	<0.005
JMR4WA	16-Nov-2020	0.02	0.014	-	<0.0001	<0.001	<0.001	0.014	<0.05	<0.001	0.077	<0.0001	0.005	0.007	<0.01	<0.001	0.002	<0.01	0.053
JMR4WA	26-Jan-2021	0.05	<0.001	-	0.0001	<0.001	<0.001	0.003	5.67	<0.001	1.85	<0.0001	<0.001	0.01	<0.01	<0.001	0.003	<0.01	0.019
JMR4WA	19-May-2021	0.01	<0.001	<0.05	0.0001	<0.001	<0.001	0.002	4.76	<0.001	1.62	<0.0001	<0.001	0.006	<0.01	<0.001	0.002	<0.01	0.01
JMR4WP	09-Sep-2018	0.02	<0.001	-	<0.0001	<0.001	-	<0.001	0.18	<0.001	-	<0.0001	-	0.002	<0.01	-	-	-	<0.005
JMR4WP	18-Nov-2018	0.01	<0.001	0.20	<0.0001	<0.001	-	<0.001	0.2	<0.001	0.091	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.007
JMR4WP	24-Jan-2019	<0.01	<0.001	0.18	<0.0001	<0.001	<0.001	<0.001	0.14	<0.001	0.095	<0.0001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.01
JMR4WP	27-Mar-2019	<0.01	<0.001	0.21	<0.0001	<0.001	<0.001	<0.001	0.13	<0.001	0.107	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.008
JMR4WP	15-May-2019	<0.01	<0.001	0.18	<0.0001	<0.001	<0.001	<0.001	0.11	<0.001	0.103	<0.0001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.006
JMR4WP	25-Jul-2019	<0.01	<0.001	0.29	<0.0001	<0.001	<0.001	<0.001	0.08	<0.001	0.12	<0.0001	0.002	<0.001	<0.01	<0.001	<0.001	<0.01	0.009
JMR4WP	16-Nov-2020	0.04	<0.001	-	0.0001	<0.001	<0.001	0.004	4.71	<0.001	1.6	<0.0001	<0.001	0.012	<0.01	<0.001	0.002	<0.01	0.013
JMR4WP	26-Jan-2021	0.08	0.023	-	<0.0001	<0.001	0.001	0.002	0.74	<0.001	0.184	<0.0001	0.006	0.005	<0.01	<0.001	0.001	<0.01	0.016
JMR4WP	19-May-2021	0.1	0.014	0.15	<0.0001	0.001	<0.001	0.002	0.24	<0.001	0.149	<0.0001	0.005	0.008	<0.01	<0.001	<0.001	<0.01	0.026
JMR22WP	20-Apr-2020	1.85	0.006	0.37	<0.0001	0.041	0.002	0.02	2.37	0.016	0.162	<0.0001	0.022	0.008	<0.01	<0.001	<0.001	<0.01	0.062
JMR22WP	16-Nov-2020	0.24	0.004	-	<0.0001	0.004	<0.001	0.004	0.24	0.003	0.03	<0.0001	0.01	0.002	<0.01	<0.001	<0.001	<0.01	0.017
JMR22WP	26-Jan-2021	0.73	0.004	-	<0.0001	0.005	<0.001	0.005	0.79	0.005	0.061	<0.0001	0.008	0.004	<0.01	<0.001	<0.001	<0.01	0.026
JMR22WP	19-May-2021	0.25	0.004	0.41	<0.0001	0.002	<0.001	0.003	0.32	0.002	0.093	<0.0001	0.006	0.003	<0.01	<0.001	<0.001	<0.01	0.024
JMR24WP	12-Nov-2019	0.32	0.003	0.49	<0.0001	0.007	<0.001	0.003	0.46	<0.001	0.199	<0.0001	0.004	0.007	<0.01	<0.001	<0.001	<0.01	0.052
JMR24WP	20-Apr-2020	1.38	0.002	0.45	<0.0001	0.006	0.001	0.009	2.42	0.003	0.23	<0.0001	0.001	0.012	<0.01	<0.001	<0.001	<0.01	0.028
JMR24WP	16-Nov-2020	0.44	0.002	0.00	<0.0001	0.002	0.001	0.003	0.61	0.001	0.219	<0.0001	0.003	0.009	<0.01	<0.001	<0.001	<0.01	0.015
JMR24WP	26-Jan-2021	0.09	0.002	-	<0.0001	<0.001	<0.001	0.003	0.37	<0.001	0.222	<0.0001	0.003	0.007	<0.01	<0.001	<0.001	<0.01	0.022
JMR24WP	19-May-2021	0.04	0.002	0.44	<0.0001	<0.001	<0.001	0.002	0.35	<0.001	0.216	<0.0001	0.002	0.005	<0.01	<0.001	<0.001	<0.01	0.025
JMR24WP2	20-Apr-2020	0.44	0.002	0.50	<0.0001	0.007	<0.001	0.003	0.84	<0.001	0.282	<0.0001	0.004	0.009	<0.01	<0.001	<0.001	<0.01	0.074
JMR24WP2	17-Nov-2020	0.16	0.001	-	<0.0001	0.004	<0.001	0.007	0.54	<0.001	0.271	<0.0001	0.003	0.009	<0.01	<0.001	<0.001	<0.01	0.071
JMR24WP2	27-Jan-2021	6.07	0.012	-	0.0001	0.033	0.004	0.018	8.42	0.007	0.366	<0.0001	0.003	0.026	<0.01	<0.001	0.003	0.02	0.462
JMR24WP2	19-May-2021	0.06	0.001	0.45	<0.0001	0.002	<0.001	0.002	0.36	<0.001	0.222	<0.0001	0.002	0.006	<0.01	<0.001	<0.001	<0.01	0.031
JMR25WA	11-Sep-2018	89.3	0.028	0.00	0.0003	0.202	-	0.209	152	0.046	-	0.0002	-	0.241	<0.01	-	-	-	0.302
JMR25WA	29-Nov-2018	14.7	0.009	<0.05	<0.0001	0.028	-	0.057	27.4	0.01	1.38	<0.0001	<0.001	0.04	<0.01	<0.001	0.002	0.06	0.055
JMR25WA	24-Jan-2019	15.2	0.008	<0.05	<0.0001	0.025	0.022	0.035	25	0.008	0.942	<0.0001	<0.001	0.034	<0.01	<0.001	0.001	0.06	0.048
JMR25WA	27-Mar-2019	11.4	0.014	<0.05	<0.0001	0.018	0.022	0.04	20.7	0.01	0.924	<0.0001	<0.001	0.052	<0.01	<0.001	0.002	0.05	0.043
JMR25WA	15-May-2019	13.5	0.008	<0.05	<0.0001	0.024	0.021	0.024	21.4	0.007	0.929	<0.0001	<0.001	0.026	<0.01	<0.001	0.001	0.05	0.04
JMR25WA	25-Jul-2019	7.42	0.007	0.10	<0.0001	0.013	0.016	0.019	13.5	0.006	0.64	<0.0001	<0.001	0.02	<0.01	<0.001	<0.001	0.03	0.036
JMR25WA	12-Nov-2019	13	0.005	<0.05	<0.0001	0.019	0.016	0.051	19.1	0.005	0.668	<0.0001	<0.001	0.026	<0.01	<0.001	0.001	0.04	0.042
JMR25WA	20-Apr-2020	23.5	0.009	<0.05	0.0002	0.046	0.035	0.053	41.9	0.044	1.16	<0.0001	<0.001	0.058	<0.01	<0.001	0.002	0.09	0.07
JMR25WA	16-Nov-2020	5.16	0.002	-	<0.0001	0.011	0.006	0.016	8.1	0.003	0.17	<0.0001	<0.001	0.017	<0.01	<0.001	0.002	0.02	0.037

Mackenzie North Groundwater Quality Monitoring

Total Metals/Metalloids Data

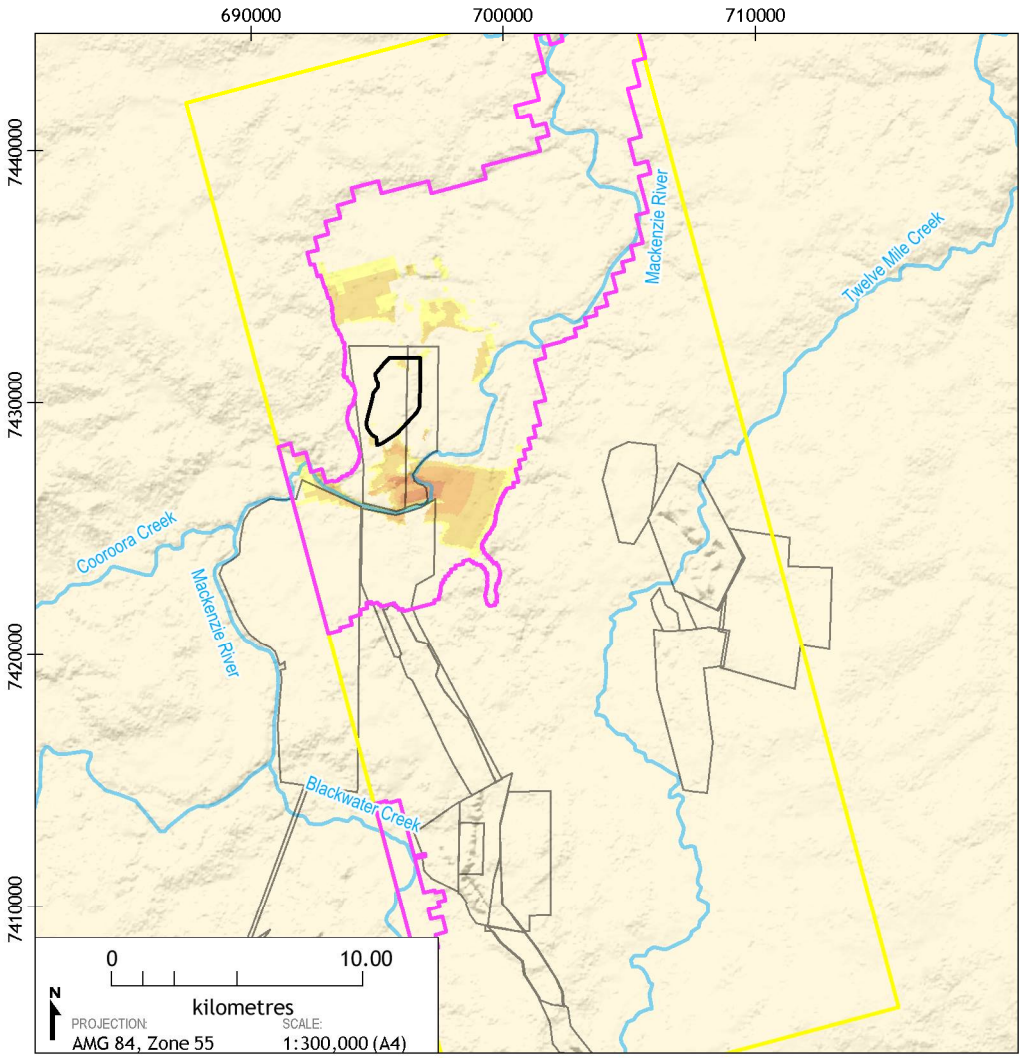
Bore ID	Sample Date	Total Metals																
		Aluminium	Arsenic	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Vanadium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
JMR25WA	26-Jan-2021	36.4	0.01	-	0.0002	0.084	0.049	0.149	70.6	0.031	1.9	0.0004	<0.001	0.102	<0.01	<0.001	0.005	0.15	0.146
JMR25WA	19-May-2021	49.4	0.019	<0.05	0.0007	0.132	0.144	0.496	95.1	0.114	8.42	0.0009	<0.001	0.276	<0.01	<0.001	0.018	0.33	0.314
JN1119E	13-Nov-2019	11.6	0.012	0.51	<0.0001	0.013	0.008	0.025	12.7	0.013	0.203	<0.0001	0.006	0.016	<0.01	<0.001	0.003	0.02	0.062
JN1119E	20-Apr-2020	1.29	0.002	0.22	<0.0001	0.006	<0.001	0.002	1.13	0.002	0.023	<0.0001	0.07	0.003	<0.01	<0.001	<0.001	<0.01	0.01
JN1119E	16-Nov-2020	0.04	0.002	-	<0.0001	<0.001	<0.001	0.002	0.21	<0.001	0.001	0.0009	0.069	0.002	<0.01	<0.001	<0.001	<0.01	<0.005
JN1119E	26-Jan-2021	0.1	0.002	-	0.0002	0.002	<0.001	0.001	0.19	<0.001	0.009	0.0005	0.082	0.004	<0.01	<0.001	<0.001	<0.01	<0.005
JN1119E	19-May-2021	0.06	0.002	0.14	<0.0001	<0.001	<0.001	<0.001	0.06	<0.001	0.001	0.0003	0.08	0.002	<0.01	<0.001	<0.001	<0.01	<0.005

ATTACHMENT C

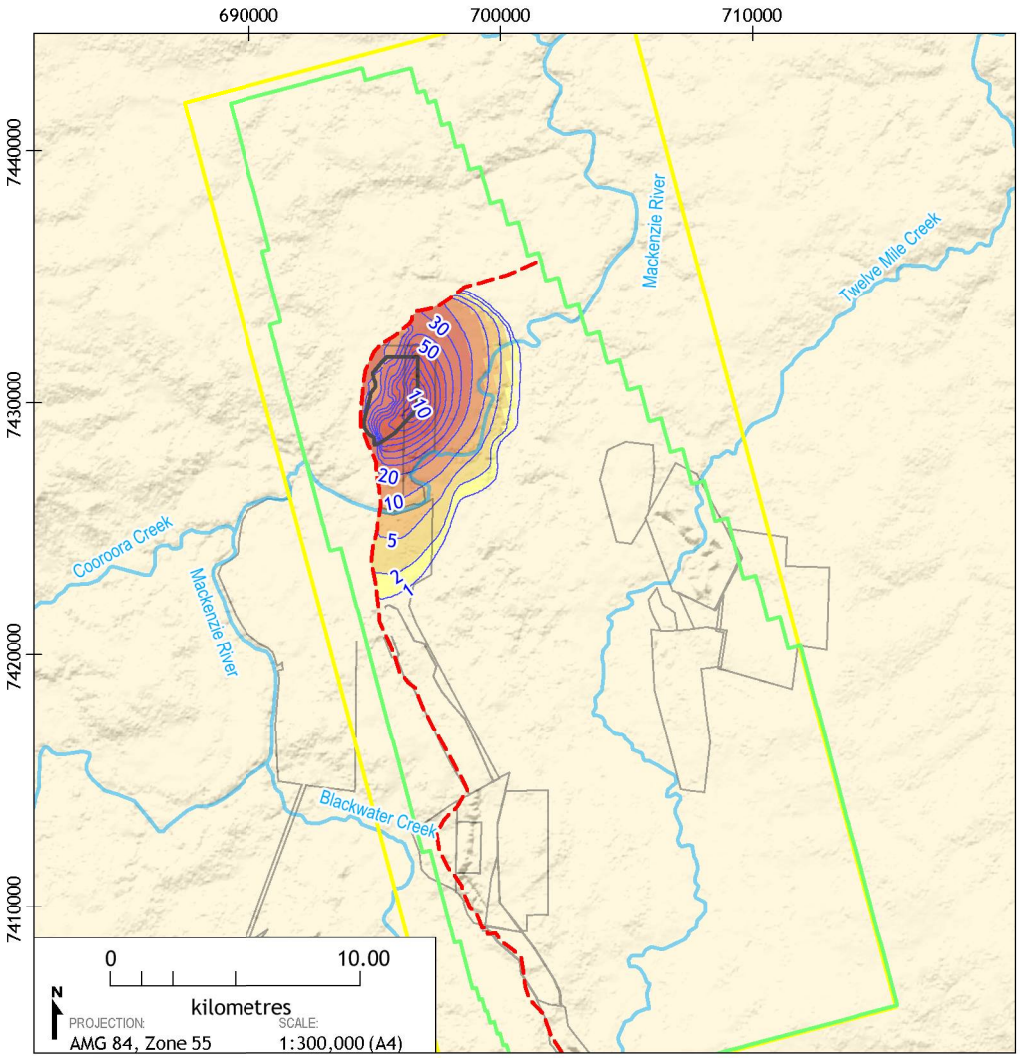
Drawdown Predictions at End of Mining

from Groundwater Model

Predicted Drawdown - Layer 2 (Alluvium)



Predicted Drawdown - Layer 9 (Pollux Lower)



LEGEND:

- Proposed Disturbance Area
- Mining Lease
- Model Extent
- Watercourse
- Modelled Extent of Alluvium
- Active Model Cells Extent of Layer 9
- Predicted Drawdown (m)
- Inferred Pollux Upper LOX

Predicted Drawdown (m)

1 to 2		20 to 50	
2 to 5		50 to 100	
5 to 10		100 to 120	
10 to 20			

Mackenzie North (G1512)

Predicted Drawdown Layer 2 and Layer 9 Year 27

DATE: 19/6/2013

FIGURE No: **B-15**