Report Prepared for Jellinbah Group Pty Ltd

MACKENZIE NORTH PROJECT

ANNUAL GROUNDWATER MONITORING REPORT 2022-2023 WATER YEAR

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Attachment C Drawdown Predictions at End of Mining from Groundwater Model

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 mining had progressed to a level that was below the groundwater level in the Permian sediments (the Quaternary alluvium within the mining area is dry). The area of mining that occurred below the groundwater level in the Permian sediments has extended during the 2021-2022 water year (the period covered by this report). These observations are discussed in Section 6.1 of this report.

This Annual Monitoring Report covers the period 1 July 2022 to 30 June 2023 (the 2022 to 2023 water year), but references earlier data as required for analysis of water level and water quality trends.

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 below in Table 1-1.

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

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

AWL Condition	Requirement	Report Section
	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
	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.*	Discussed in Section 6

2.0 GEOLOGY AND HYDROGEOLOGY

The geology and hydrogeology of the Mackenzie North Project area has been reported in AGE (2013)[2]. 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.

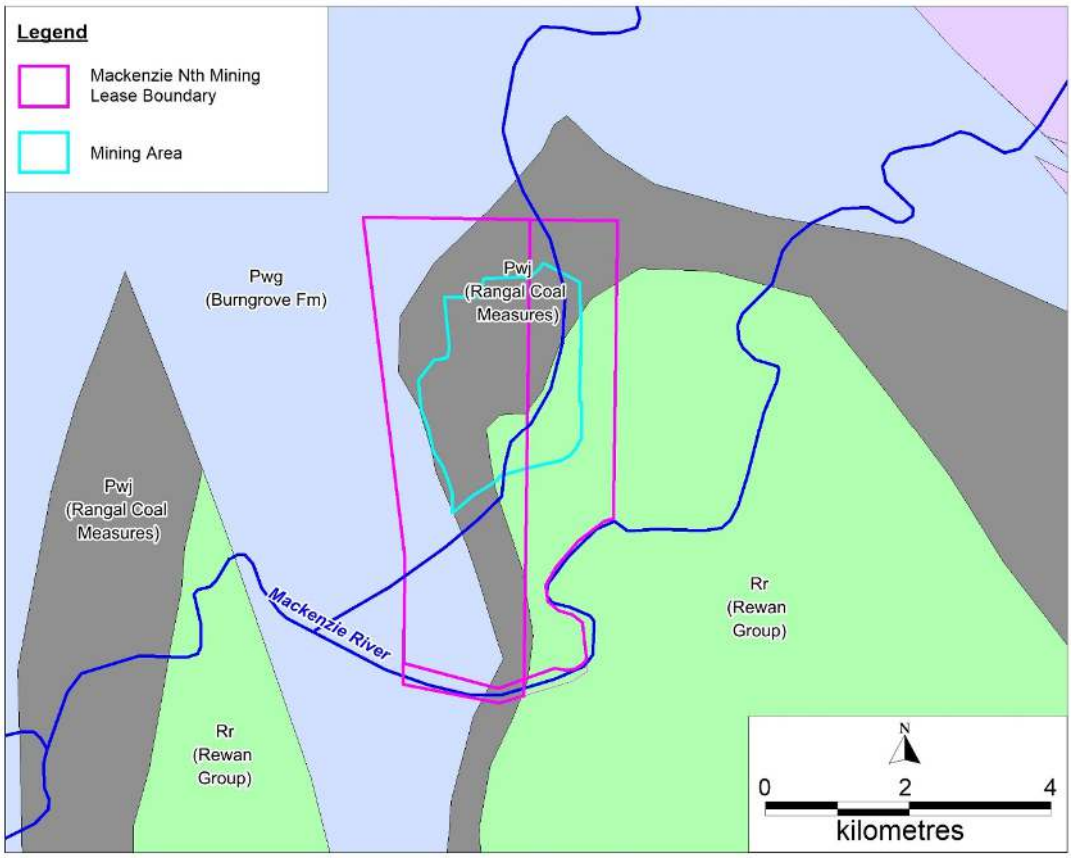


Figure 2-1: Solid Geology

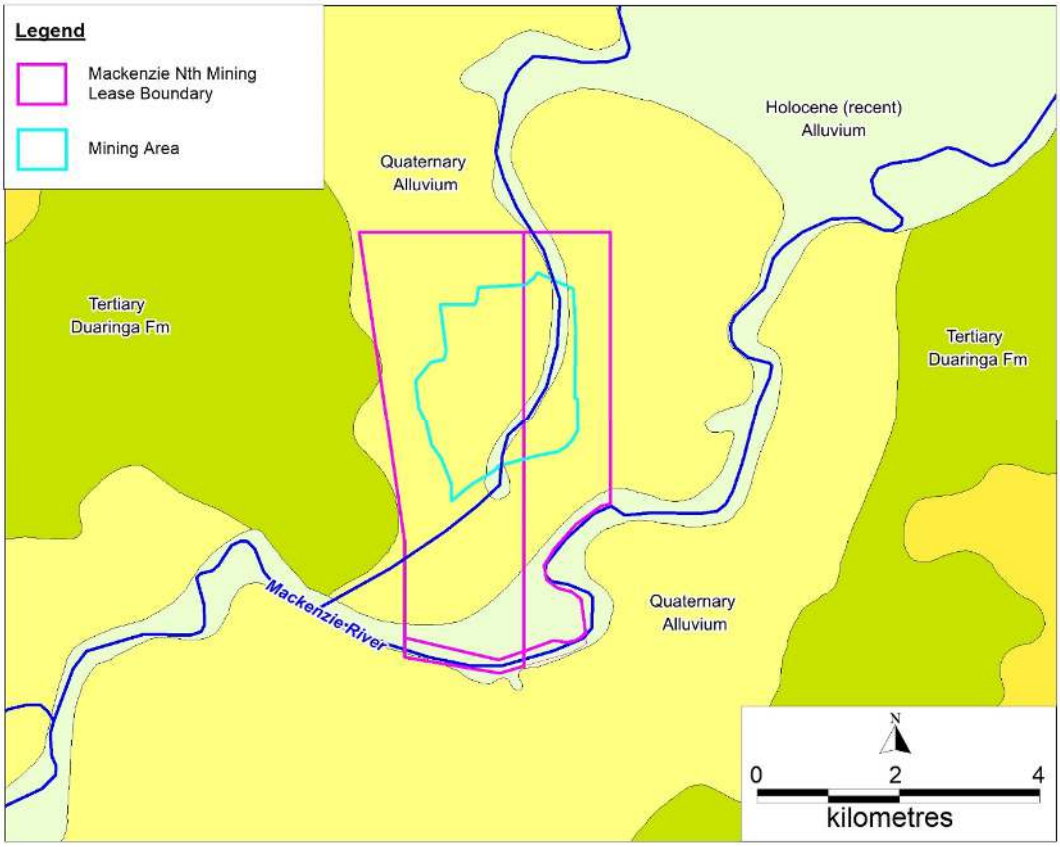


Figure 2-2: 1:100,000 Scale Surface Geology

3.0 RAINFALL DATA

Rainfall data for the Project site has been obtained from the Queensland Government SILO Data Drill website, for a location that corresponds to the centre of the Project area. 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). SILO data is utilised for the period up to May 2018, after which data from the automatic weather station (AWS) at Mackenzie North has been used (as shown below in Figure 3-1).

Figure 3-1 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 above-average wet season of 2010-2011 is evident from the RRM curve, followed by a period of generally below-average rainfall between 2012 and the end of 2021. A period of above-average rainfall between November 2021 and March 2023 is evident from the increasing trend of the RRM curve over that period. Discussion of rainfall data in relation to the bore hydrographs is discussed in Section 5.2.2.

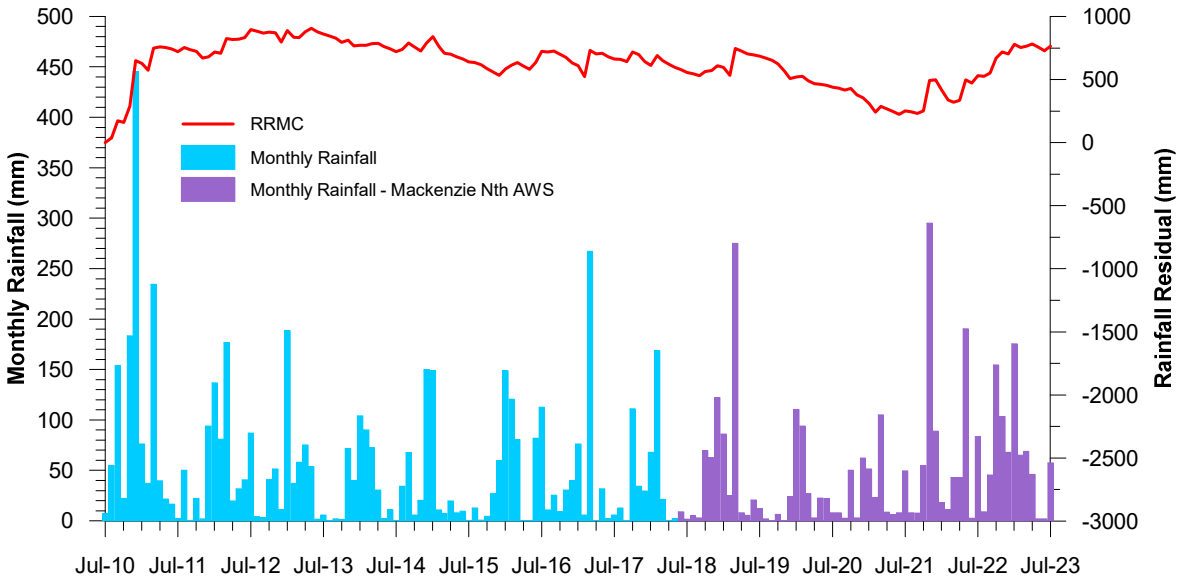


Figure 3-1: Monthly Rainfall Data and Residual Mass Curve

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.

The three alluvial monitoring bores that are between the mining operation and the Mackenzie River (JMR4WA, JMR24WA and JMR25WA) have been fitted with dataloggers in accordance with the requirements outlined in Table 4-1. Water level data for these bores is discussed in Section 5.2.2.

Changes to the groundwater monitoring network during the July 2021 to June 2022 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, and no bores were decommissioned during the reporting period; i.e. there were no changes to the monitoring bore network during the 2022 – 2023 reporting period.

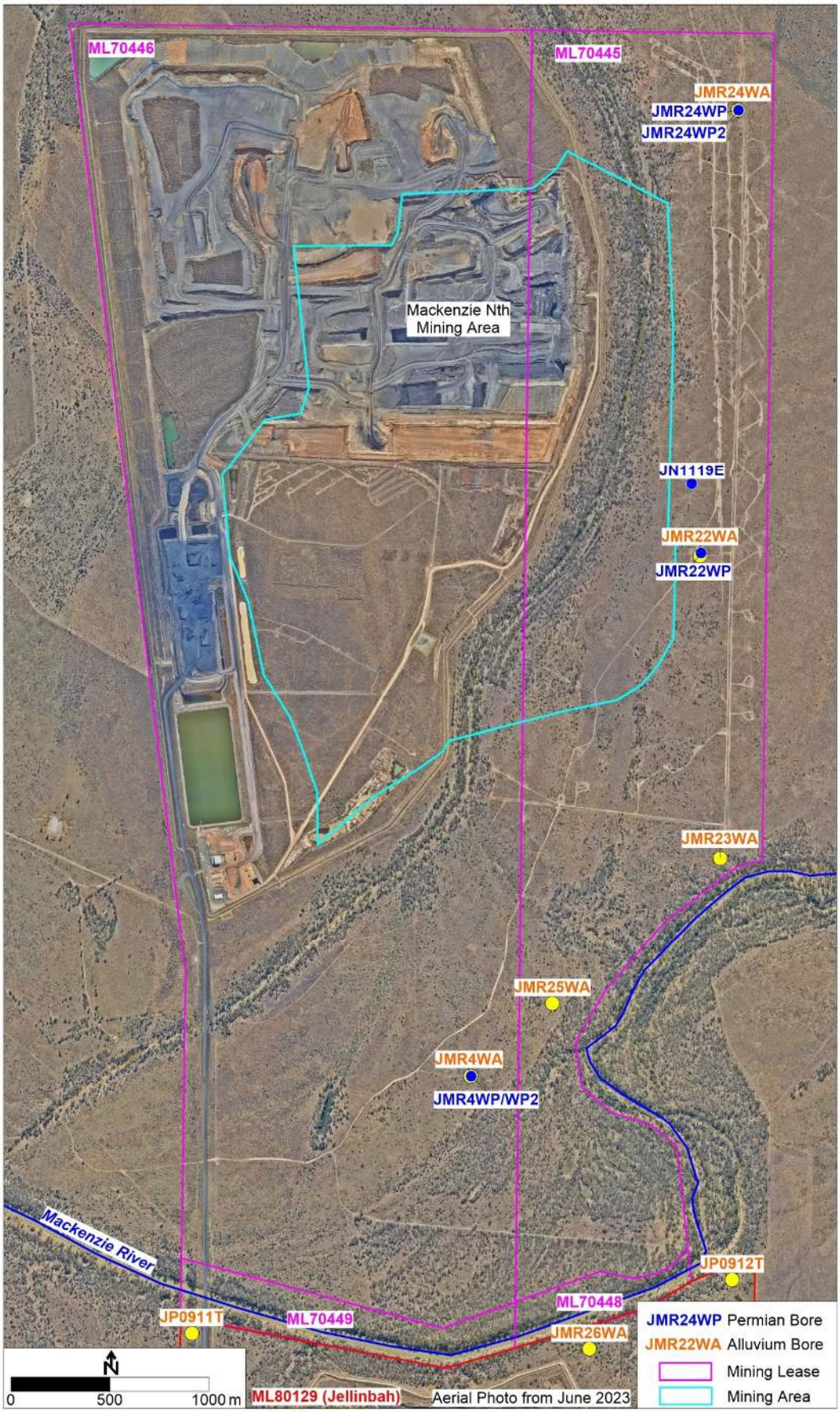


Figure 4-1: Groundwater Monitoring Bore Locations

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 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):
			  ○ Aluminium
			  ○ Arsenic
			  ○ Boron
			  ○ Cadmium
			  ○ Chromium
			  ○ Copper
			  ○ Iron
			  ○ Lead
			  ○ Manganese
			  ○ Mercury
			  ○ Molybdenum
			  ○ Nickel
			  ○ Selenium
			  ○ Silver
			  ○ Uranium
			  ○ Vanadium
			  ○ 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 Assessment of Groundwater Monitoring Data

5.2.1 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 generally 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 (i.e. pH, electrical conductivity, major ions, metals/metalloids, total petroleum hydrocarbons) are provided in the summary table that is included as Attachment B to this report. Available data for Electrical Conductivity (EC) and pH are shown graphically below as Figure 5-1 and Figure 5-2 respectively; these data are included within the report and discussed below, as EC and pH are useful overall indicators of changes in groundwater quality.

5.2.1.1 Electrical Conductivity (EC) Data

Available field EC data are presented in Figure 5-1 below and are summarised as follows:

- JMR4WA (alluvium) – the field EC range is from 4,197 µS/cm to 7,189 µS/cm, with a mean of 6,062 µS/cm and median of 6,161 µS/cm (15 samples);
- JMR4WP (Pollux Seam) – the field EC range is from 7,450 µS/cm to 9,833 µS/cm, with a mean of 8,885 µS/cm and median of 9,009 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 seven samples taken from JMR4WP2 between November 2020 and May 2023, the EC range was from 3,803 µS/cm to 6,190 µS/cm, with a mean of 4,320 µS/cm and median of 4,046 µS/cm;
- JMR24WP and JMR24WP2 (Pollux Seam) – the field EC range is from 7,670 µS/cm to 9,490 µS/cm in JMR24WP (8 samples) and 6,912 to 8,587 µS/cm in JMR24WP2 (9 samples), with a mean for the combined dataset of 7,803 µS/cm and median of 7,814 µS/cm. A single EC value of 11,491 µS/cm for JMR24WP2 in January 2021 is excluded from the statistical analysis as it appears to be an outlier. The data is retained in the dataset that is included as Attachment B;
- JMR25WA (alluvium) – the field EC range is from 1,171 µS/cm to 2,358 µS/cm, with a mean of 1,574 µS/cm and median of 1,337 µS/cm (12 samples). The water level has fallen below the base of the bore and there is now insufficient water to obtain water quality samples at this site;
- JN1119E (Pollux Seam – replacement bore for JMR22WP) - the field EC range is from 10,851 µS/cm to 13,958 µS/cm (9 samples), with a mean of 12,534 µS/cm and median of 12,757 µS/cm. A single EC value of 17,353 µS/cm for the first sampling event in November 2019 is excluded from the statistical analysis as it appears to be an outlier. The data is retained in the dataset that is included as Attachment B;
- JMR22WP (Pollux Seam – replacement bore for JN1119E) – the bore has continued to be sampled and has a field EC range from 14,657 µS/cm to 18,096 µS/cm (9 samples), with a mean of 16,709 µS/cm and median of 17,152 µS/cm.

5.2.1.2 pH Data

Available field pH data are presented in Figure 5-2 below and are 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 8.6 to 11.97 between November 2019 (initial sample) and April 2020, with field pH in the range of 11.88 to 12.08 since that

time. It is possible that the bore has experienced grouting issues during construction, however the following observations are also made, as discussed in the 2020-2021 annual report:

- 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 June 2022, reducing from 9.79 in April 2020 to 7.84 in April 2023. A single field value of 10.99 in October 2022 appears to be an outlier, as the pH was <9.0 for the four previous readings as well as the following reading (refer Figure 5-2);

- 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. It is also recommended that an assessment 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.

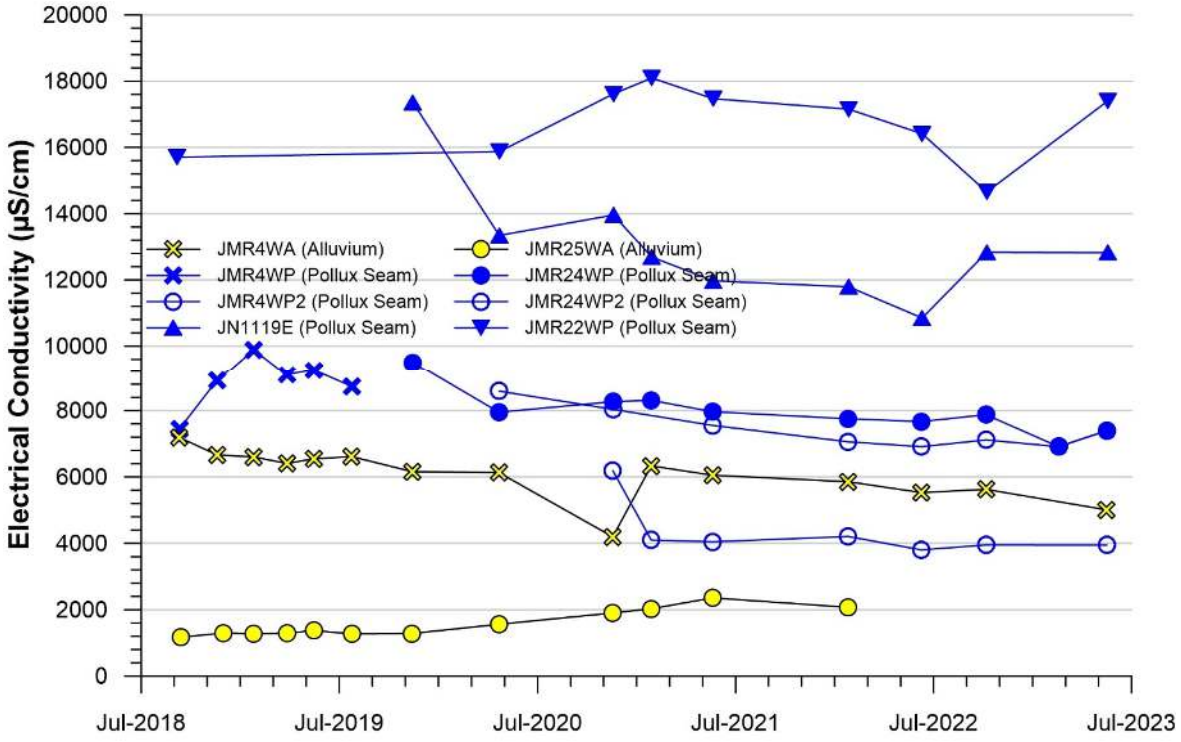


Figure 5-1: Field Electrical Conductivity (EC) Data

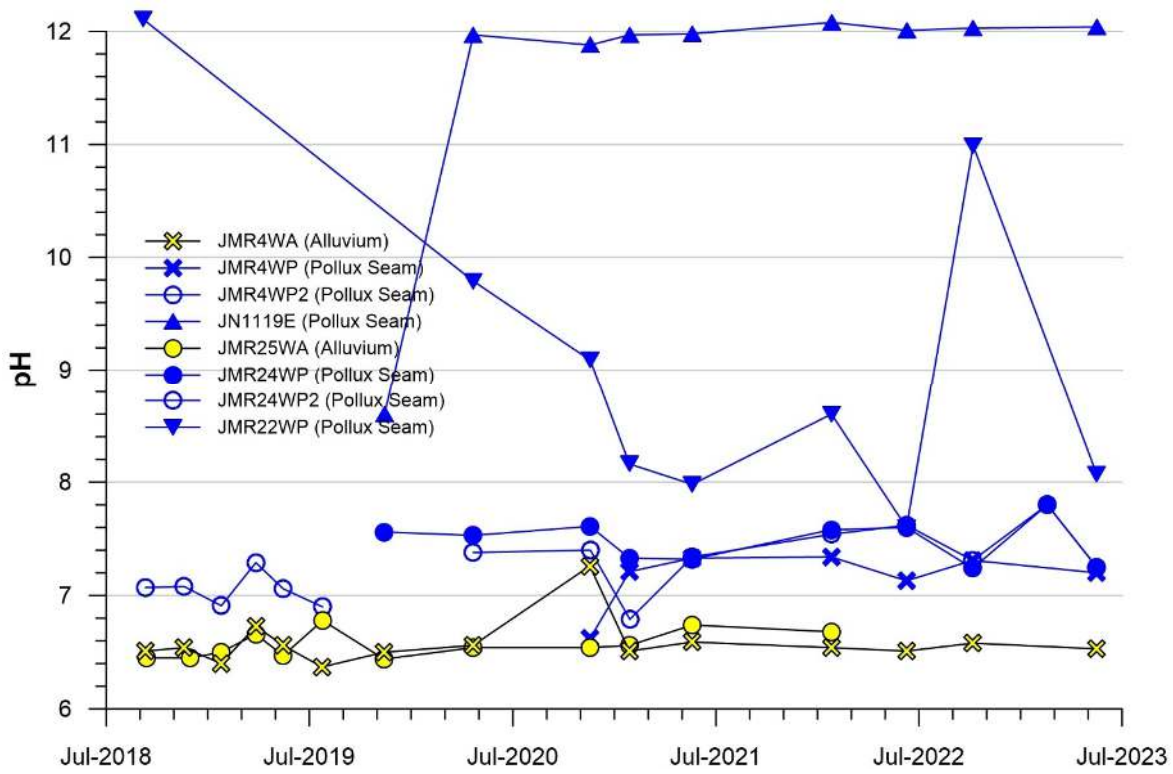


Figure 5-2: Field pH Data

5.2.2 Groundwater Level Monitoring

Groundwater level monitoring is undertaken for the bores and monitoring frequencies identified above in Table 5-1 . Water level data is included in Attachment A and is shown graphically in Figure 5-3. Figure 5-4 shows available water level data from the logger fitted in bore JMR4WA, compared to manual water level data and daily rainfall data, with the same data shown for bore JMR23WA in Figure 5-5 and for JMR25WA in Figure 5-6. Figure 5-7 shows the water level in the area adjacent to the mine, relative to groundwater level contours for 2012 (i.e. pre-mining). Observations from Figure 5-3, Figure 5-4 and

include:

- A plot is included in Figure 5-3 of 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 to November 2021 followed by an increasing trend due to generally above-average rainfall conditions since that time.
- The majority of bores record a water level reduction between July 2017 and May 2021, for example bore JMR4WA 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 noted in Section 3.0, above-average rainfall occurred in November 2021 and May 2022 that is interpreted to have caused recharge and subsequently rising groundwater levels at a number of groundwater monitoring sites.
- With respect to bores that monitor the Permian sediments, observations include:
    - Bores JMR24WP and JMR24WP2 (located adjacent to each other at the same site) recorded a significant rise in water level between the August 2021 and January 2022 monitoring events, which is interpreted to be related to the above-average November rainfall. These bores continued to show a water level rise in monitoring events to June 2022, which is interpreted to be related to additional recharge from the above-average rainfall in May 2022. These bores are screened within overburden sediment, rather than the coal seams, and therefore have a degree of hydraulic isolation from the coal seam groundwater unit. Based on available water level data for these bores it is interpreted that the Permian groundwater level at this location is not impacted by mining;
    - Bore JN1119E is located approximately 800 m from the area where mining is occurring below the water table (at June 2023 – refer Figure 6-2) and the bore is within the zone of predicted groundwater level impact from mining (refer Figure 7-2). The rate of water level reduction at this site is greater than the rate of water level reduction at other Permian sites and it is interpreted that mining impacts are evident at this site; and,
    - Other Permian monitoring bores (JMR4WP, JMR22WP) are not interpreted to be impacted by mining at this stage. A reduction in water level for the August 2021 monitoring event is evident in bore JMR22WP, but subsequent readings returned to the same general trend as prior monitoring events.
- With respect to bores that monitor the Quaternary and Tertiary alluvium, observations include:
    - JMR4WA – available water level data is shown in Figure 5-3; the water level at this site was in decline since monitoring commenced in October 2015 until early 2022, when a flattening of the hydrograph followed by a small water level rise occurred. The groundwater level trend at this site is interpreted to be related to climatic conditions, with the hydrograph following the general trend of the rainfall residual mass curve. Figure 5-4 shows available data logger data for JMR4WA, which has been collected at 6-hourly intervals since November 2020. Figure 5-4 also includes daily rainfall data from the Mackenzie North AWS; high rainfall periods in November 2021 and May 2022 correspond with minor increases in water level in the logger data. The logger water level rapidly returns to the pre-rainfall level; however, the reducing water level trend slows down after November 2021, indicating

that the above-average November 2021 rainfall provided some recharge to the alluvial aquifer at this location.

- 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 became dry in October 2018 when it is interpreted that the water level fell below the base of the bore due to climatic conditions. However, water was recorded above the base of bore in June 2022 and has also been recorded for monitoring events in February and May 2023. The bore has a datalogger fitted that records at 6-hourly intervals, with available data shown in Figure 5-5. The logger data was assessed as being unreliable for the period prior to January 2023, which is interpreted to be related to the logger being submerged after a long period of being dry. The increase in water level is interpreted to be related to the recharge conditions that have been observed at site since the above-average rainfall period than commenced in November 2021; and,
- JMR25WA –the water level at this site was recorded as 2.26 m above base of bore when monitoring commenced in October 2018 and the bore was recorded as being at the base of the bore in June 2022 and dry in August 2022. The water level reduction at this site is interpreted to be related to climatic conditions. JMR25WA has a data logger fitted that records at 6-hourly intervals, with logger data shown in Figure 5-6. The logger was installed approximately 0.5 m above the base of the bore. The water level fell below the base of the logger in ~August 2021 and, as stated above, manual data indicates that the water level was at the base of the bore in June 2022. The bore was dry for monitoring events in August and October 2022, but recorded water above the base of bore for the February and May 2023 monitoring events, indicating a degree of groundwater recharge at this site due to the above-average rainfall conditions described above. The water level remains below the base of the data logger, so no logger data is available for this period as shown in Figure 5-6.
- Bores JP0911T and JP0912T monitor the Tertiary alluvium to the south of the Mackenzie River. Both bores recorded a slight water level rise between March and June 2022 that is interpreted to be related to recharge from the above-average rainfall in May 2022. From Figure 5-3 a decrease in the rate of wate level decline followed by a small rise in water levels is evident at both sites.

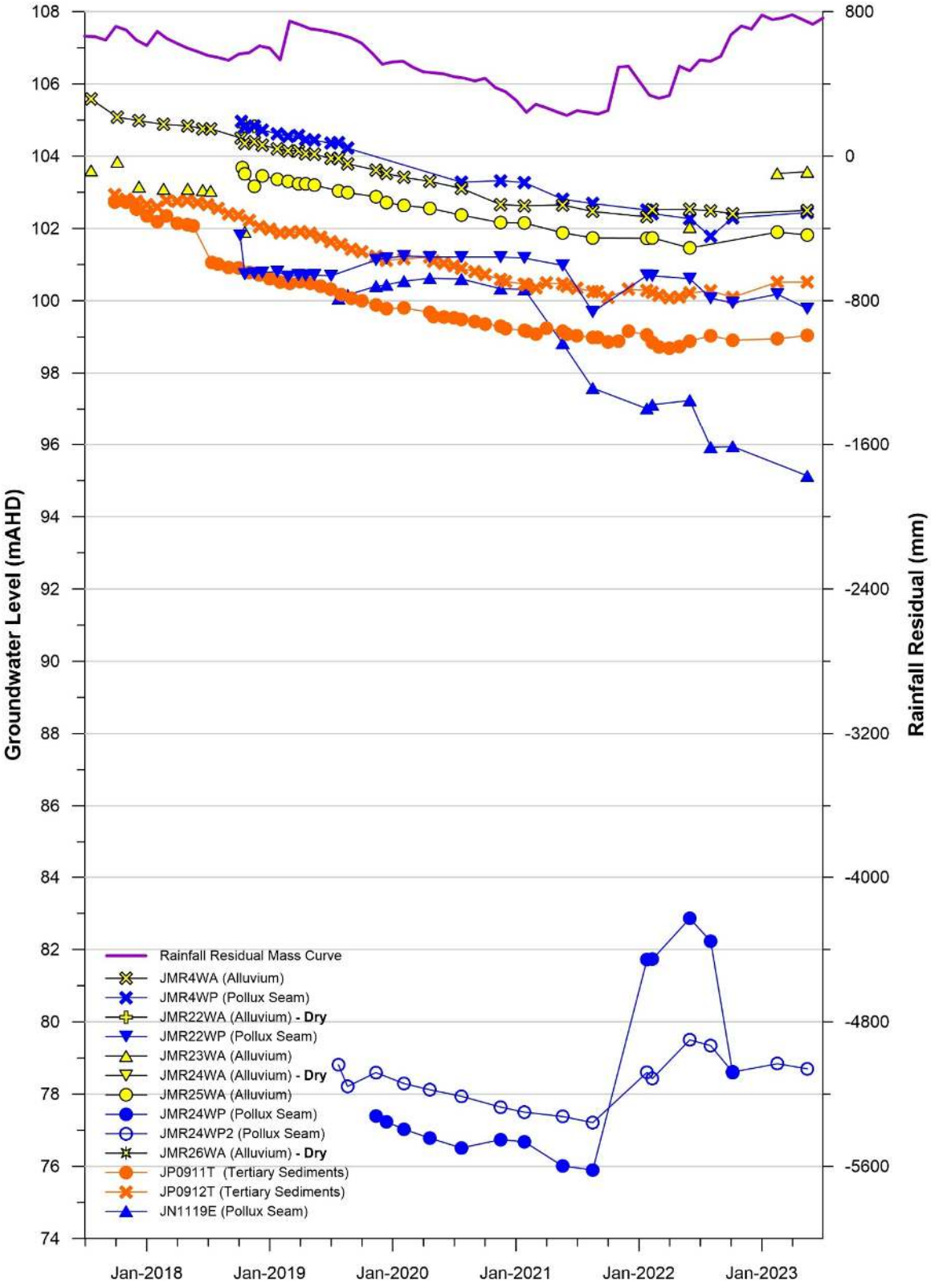


Figure 5-3: Water Level Hydrographs for Groundwater Monitoring Bores

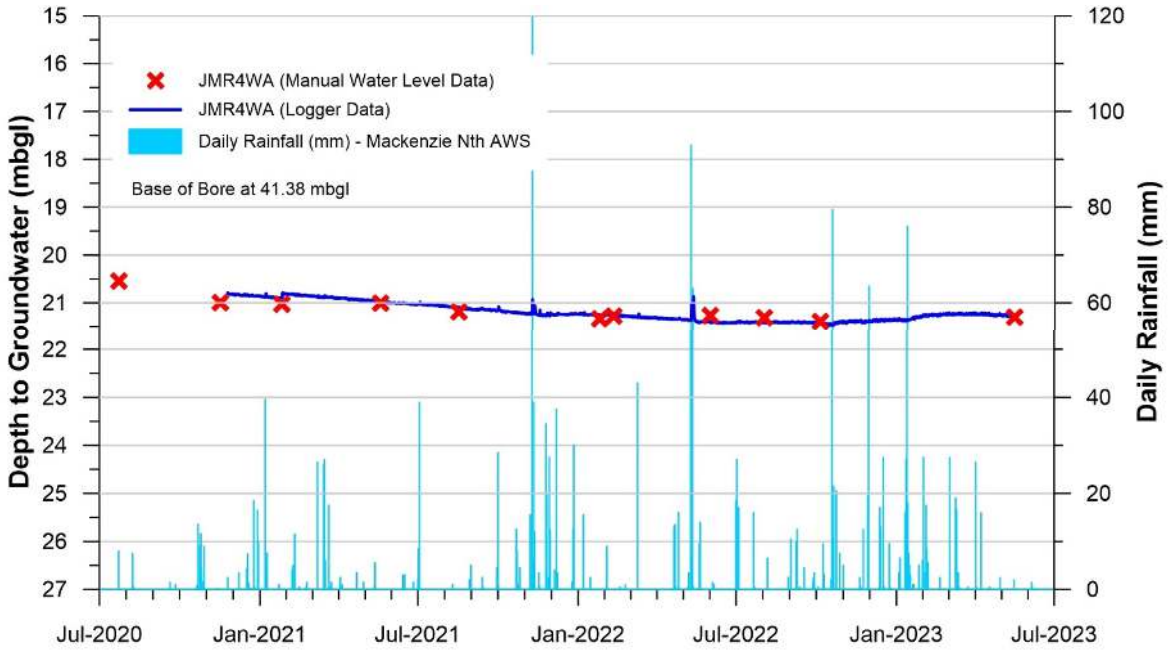


Figure 5-4: Datalogger and Manual Water Level Data – Bore JMR4WA

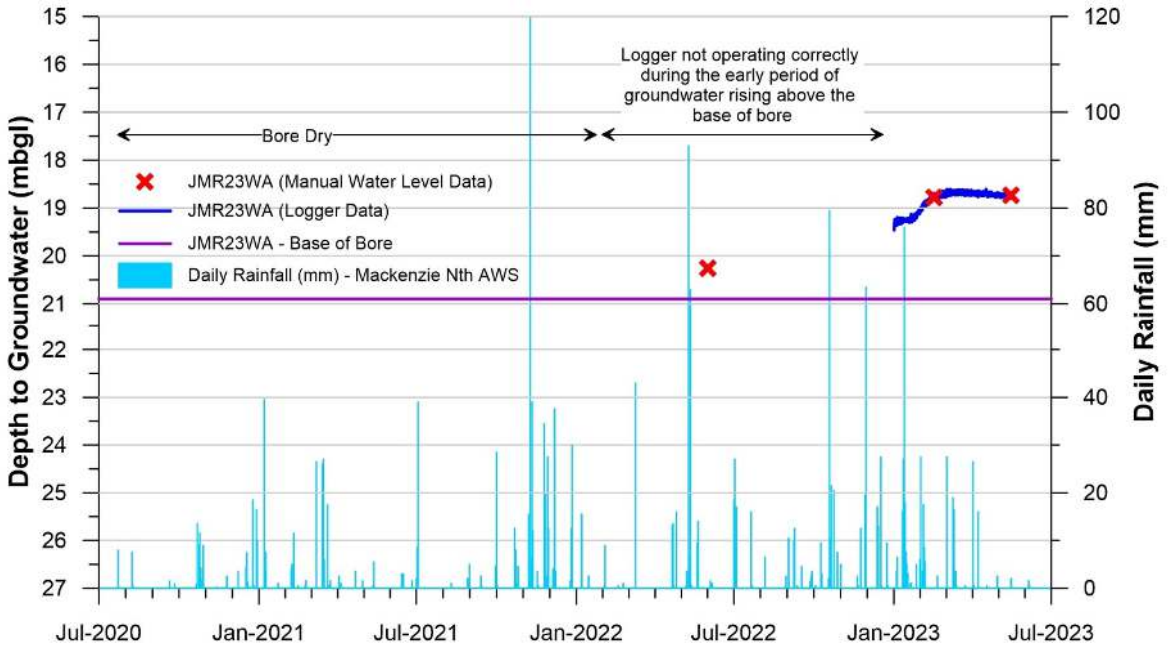


Figure 5-5: Datalogger and Manual Water Level Data – Bore JMR23WA

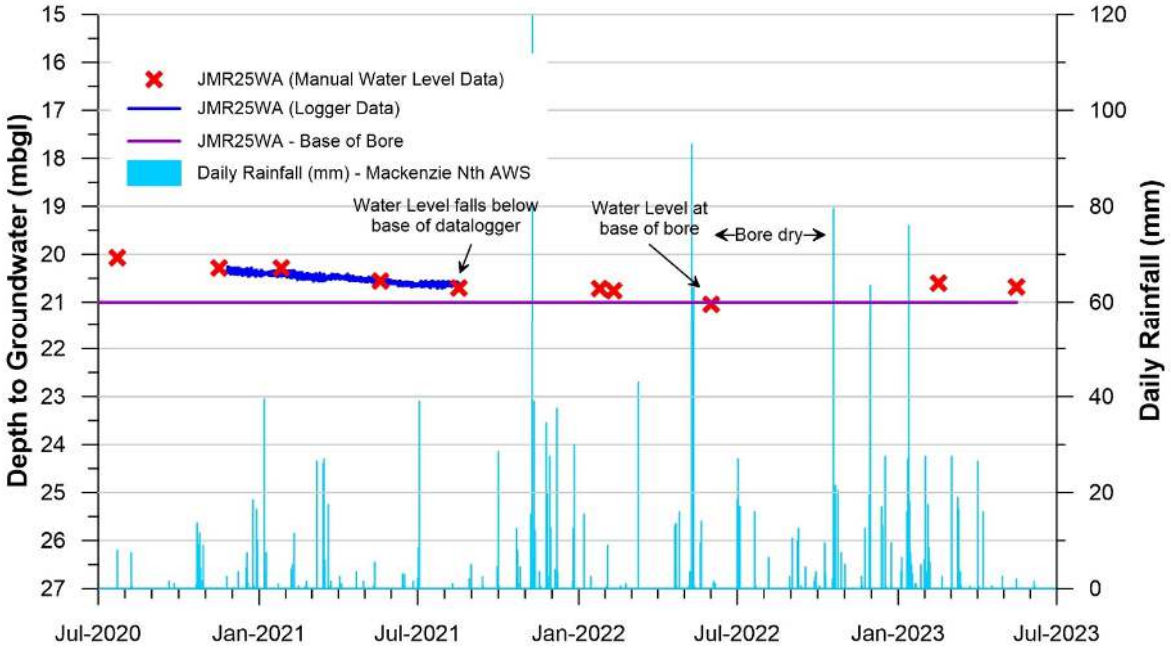


Figure 5-6: Datalogger and Manual Water Level Data – Bore JMR25WA

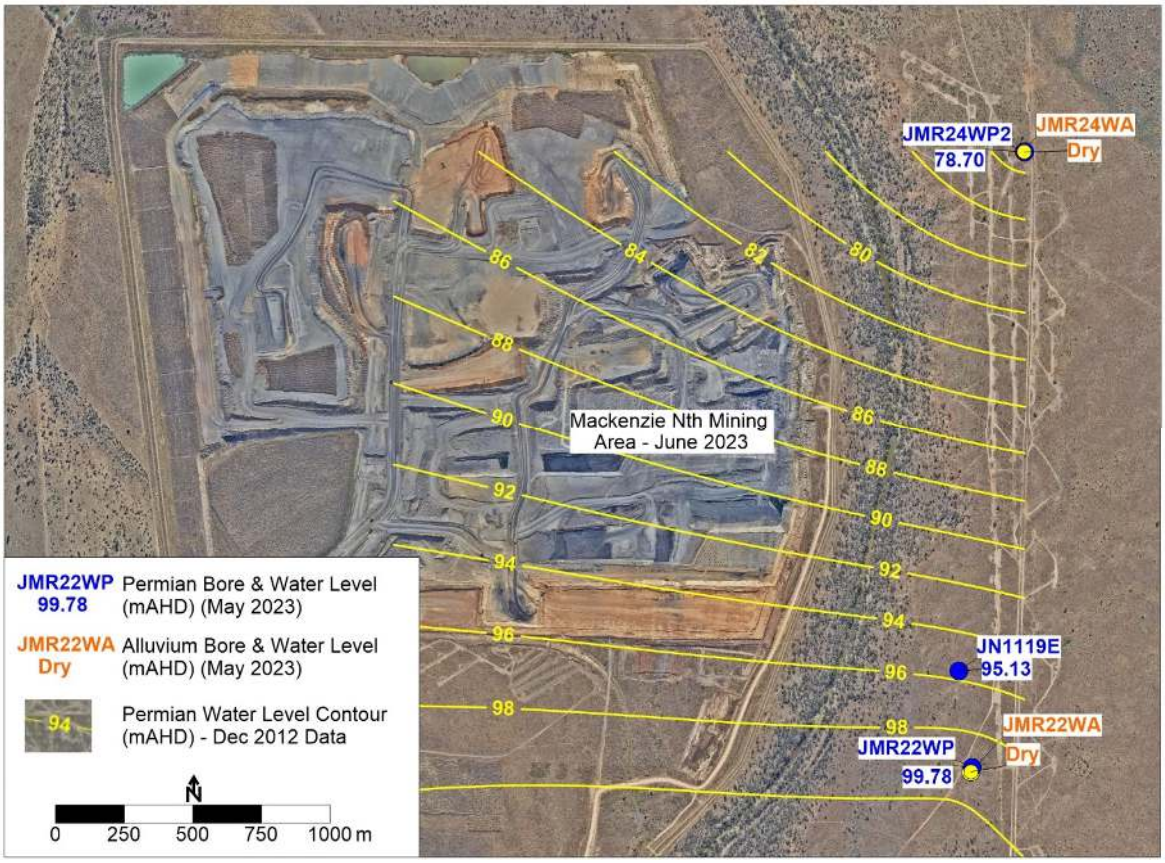


Figure 5-7: Groundwater Levels in May 2023 Compared to 2012 Permian Water Levels

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 2023 are shown below in Figure 6-1 . The deepest area of mining (eastern side of pit) was at ~20 mAHD at June 2023 compared to a ground elevation at the adjacent crest of ~120 mAHD, i.e. the deepest area of mining at June 2022 was ~100 metres below ground level (mbgl).

Figure 6-2 shows the depth of mining at June 2023 below the pre-mining groundwater level, and includes:

- Contours showing the depth of mining at June 2023 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 65 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. It is therefore concluded that, at the current 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.
- Groundwater level contours for the Permian groundwater unit, based on water level data available for December 2012 from AGE (2013);
- Groundwater level data for bores in the Quaternary alluvium that are closest to the mining area, at May 2023. 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 June 2022. It is noted that the water levels at June 2022 are similar or slightly higher than the water level contours from December 2012. However, from review of the bore hydrographs (Figure 5-3) it is interpreted that the water level in bore JN1119E is being impacted by mining. The bore is located approximately 800 m from the area where mining is occurring below the water table and the bore is within the zone of predicted groundwater level impact from mining.

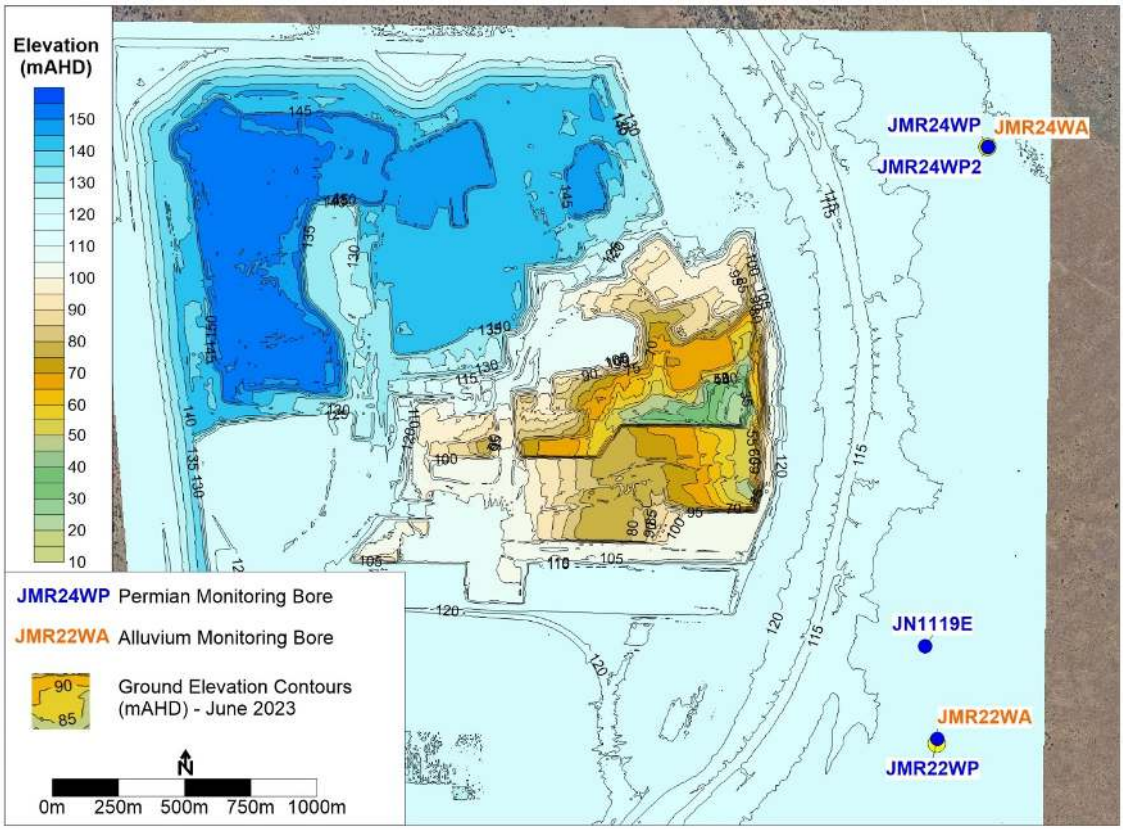


Figure 6-1: Depth and Extent of Mining at June 2023

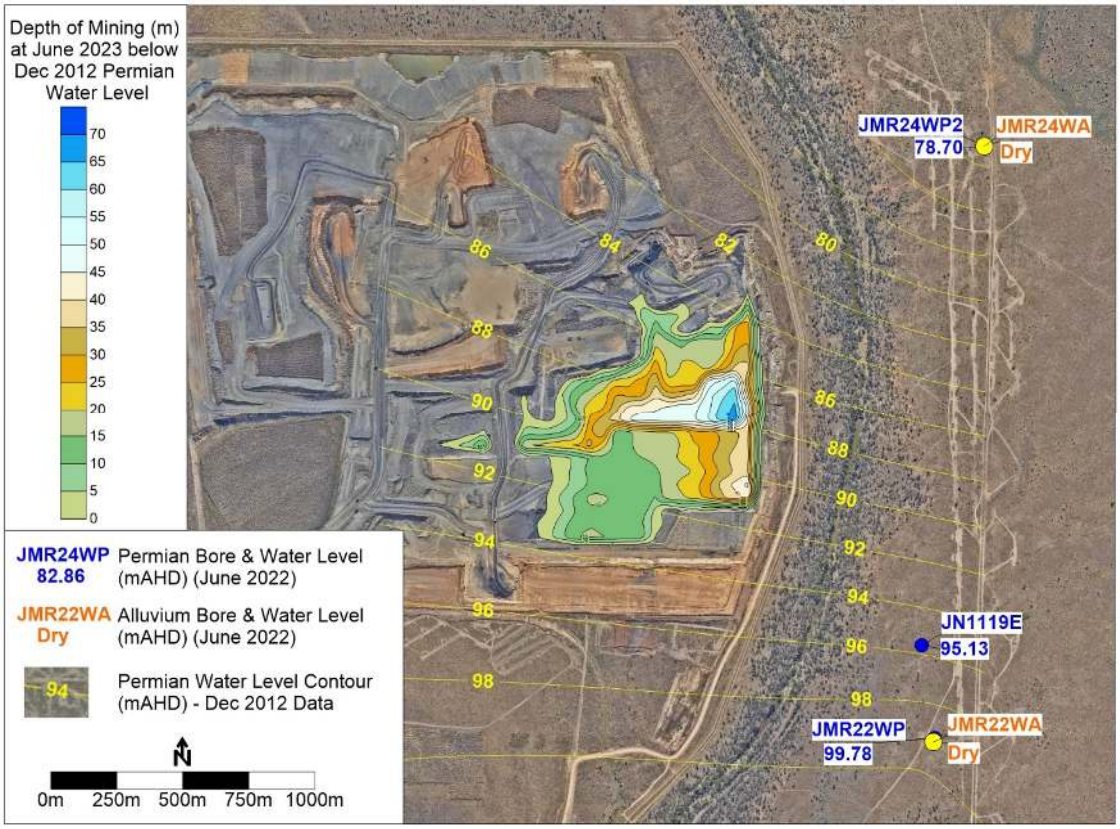


Figure 6-2: Extent of Mining below Groundwater Level – June 2023

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:

- 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 has previously been assessed (for previous annual reports) the take of associated water commenced in around June 2021 and that the review of the numerical underground water model would therefore be required by June 2023;
- The numerical model has recently been updated, with the first phase of modelling competed by June 2023 and the final phase of modelling (which included a comparison between the updated model and the original (AGE 2013) model completed by September 30 2023 (Report No. JBT01-072-016);
- As the completion and submission date of the modelling report corresponds with the completion date of this report, it is proposed that a comparison between the current water level and model predicted water level be undertaken as part of the next annual report, by which time the Department of Environment and Science (DES) will have completed their review of the report.

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 2022) 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 Figure 7-1 and Figure 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 be 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 2022, are discussed below in Section 7.2.2.

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:

- No new private bores have been drilled within the area shown in Figure 7-1 during the 2022-2023 reporting period;
- A number of bores exist 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

[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.

[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.

for bore locations). As noted in previous annual reports, 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.

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:

- No new private bores have been drilled within the area shown in Figure 7-2 during the 2021-2022 reporting period;
- 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.

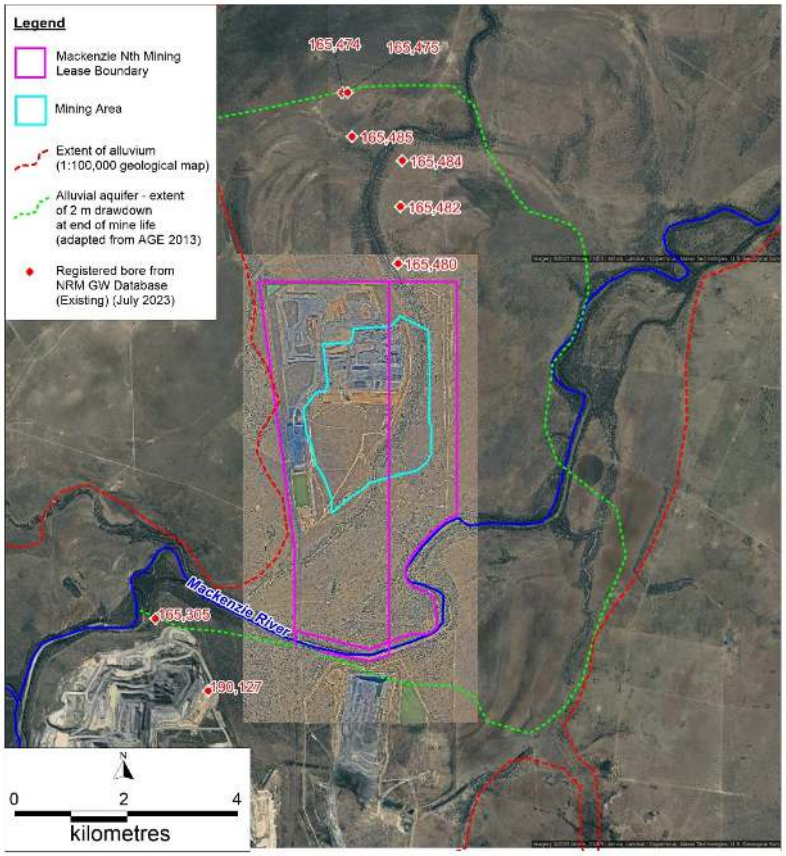


Figure 7-1: Bore Locations relative to the Affected Area off the Alluvial Aquifer

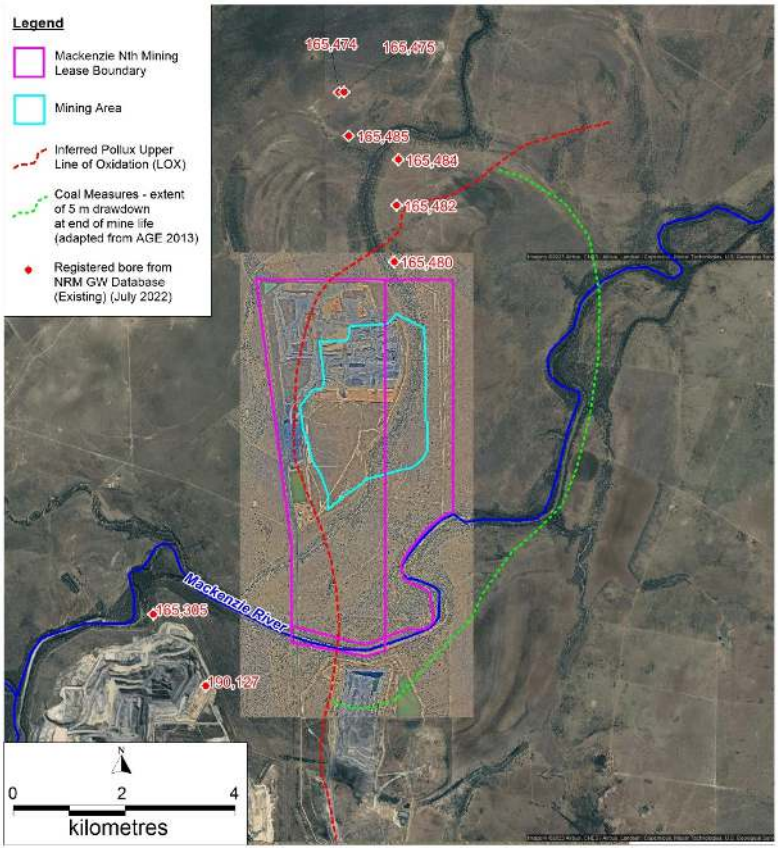


Figure 7-2: Bore Locations relative to the Affected Area of the Permian Coal Measures

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 12-month period covered by this report, no new groundwater monitoring bores have been installed and no bores have been decommissioned.
- Groundwater level observations are discussed in Section 5.2.2 and observations of note include:
  - Groundwater levels were in decline at most monitoring sites between the commencement of monitoring and approximately the start of 2022. However, a number of bores showed a reduction in the rate of water level decline and in some cases an increase in groundwater level that is interpreted to indicate groundwater recharge that has occurred in response to generally above-average rainfall conditions that commenced in November 2021;
  - At bore JMR23WA (alluvium) groundwater was recorded above the base of bore during the June 2022 monitoring event, which is the first time that groundwater has been recorded at this site since October 2018 when the water level fell below the base of the bore. The increase in water level at this site is interpreted to be related to above-average rainfall conditions as discussed above;
  - Permian monitoring bore JN1119E is located approximately 800 m from the area where mining is occurring below the water table (at June 2023 – refer Figure 6-2) and the bore is within the zone of predicted groundwater level impact from mining. The rate of water level reduction at this site is greater than the rate of water level reduction at other Permian sites and it is interpreted that mining impacts are evident at this site; and,
  - 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, JMR24WA, JMR25WA and JMR26WA.
- Groundwater quality observations are discussed in Section 5.2.1. Observations of note include:
  - Field Electrical Conductivity (EC) data:
    - For groundwater monitoring bores within alluvial sediments, the EC range is from 822 µS/cm to 7,189 µS/cm, with a mean of 3,848 µS/cm and median of 4,197 µS/cm. EC trends at individual bores are relatively stable, as discussed in Section 5.2.1.1.
    - For groundwater monitoring bores within Permian sediments, the EC range is from 3,803 µS/cm to 18,096 µS/cm, with a mean of 10,096 µS/cm and median of 8,921 µS/cm. EC trends at individual bores are relatively stable, as discussed in Section 5.2.1.1.
  - Field pH data - available field pH data is presented in Figure 5-2 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 8.6 to 11.97 between November 2019 (initial sample) and April 2020, with field pH in the range of 11.88 to 12.08 since that time.
    - Bore JMR22WP was re-developed in November 2018 and recorded a field pH of 12.11. On the basis of the high pH reading, 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).
- JMR22WP has continued to be sampled and has recorded a steady decrease in pH between April 2020 and June 2022, reducing from 9.79 in April 2020 to 7.84 in April 2023. A single field value of 10.99 in October 2022 appears to be an outlier, as the pH was <9.0 for the four previous readings as well as the following reading.
- On the basis of current pH chemistry, it is concluded that JMR22WP is a more reliable indicator of water chemistry than JN1119E. However, it is recommended that both bores continue to be sampled for both water level and water quality and that the water quality results be reviewed with consideration for the potential impacts of high EC.
- It is also recommended that an assessment 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.

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.

  With respect to the above requirements it is noted that:
  - 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 has previously been assessed (for previous annual reports) the take of associated water commenced in around June 2021 and that the review of the numerical underground water model would therefore be required by June 2023;
  - The numerical model has recently been updated, with the first phase of modelling competed by June 2023 and the final phase of modelling (which included a comparison between the updated model and the original (AGE 2013) model completed by September 30 2023 (Report No. JBT01-072-016);
  - As the completion and submission date of the modelling report corresponds with the completion date of this report, it is recommended that a comparison between the current water level and model predicted water level be undertaken as part of the next annual report, by which time the Department of Environment and Science (DES) will have completed their review of the report.

  Recommendation: it is recommended that a comparison between the current water level and model predicted water level be undertaken as part of the next annual report, by which time the Department of Environment and Science (DES) will have completed their review of the report.

- 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	JMR4WP2	JMR22WA	JMR22WP	JN1119E	JMR23WA	JMR24WA	JMR24WP	JMR24WP2	JMR25WA	JMR26WA	JP0911T	JP0912T
15-Dec-2012	Dry	17.01	dry	22.80		18.70	dry	47.40		16.90	16.60		
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			22.20	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		21.18	Dry	36.73	2.85	19.87			
01-Dec-2018											Dry	24.82	21.19
10-Dec-2018	19.97	19.99	Dry	22.07		21.18	Dry	36.71	1.72	19.59			
01-Jan-2019											Dry	24.93	21.26
24-Jan-2019	20.08	20.09	Dry	22.04		21.18	Dry	36.69		19.68			
01-Feb-2019											Dry	25.02	21.36
25-Feb-2019	20.14	20.16	Dry	22.18		21.18	Dry	37.02		19.73			
01-Mar-2019											Dry	25.06	21.35
27-Mar-2019	20.13	20.14	Dry	22.14		21.18	Dry	36.98		19.80			
01-Apr-2019											Dry	25.00	21.32
18-Apr-2019	20.21	20.25	Dry	22.15		21.19	Dry	37.06		19.81			
01-May-2019											Dry	25.05	21.38
13-May-2019	20.23	20.27	Dry	22.14		21.19	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		21.19	Dry		41.66				
24-Jul-2019	20.34	20.34	Dry		21.97	21.19	Dry		42.65	20.00	Dry		
01-Aug-2019											Dry	25.36	21.69
20-Aug-2019	20.49	20.49	Dry		21.87	21.19	Dry		43.25	20.05			
01-Sep-2019											Dry	25.46	21.82

Mackenzie North Groundwater Level Monitoring

Standing Water Level (SWL) - metres below top of casing (mTOC)

Date	JMR4WA	JMR4WP2	JMR22WA	JMR22WP	JN1119E	JMR23WA	JMR24WA	JMR24WP	JMR24WP2	JMR25WA	JMR26WA	JP0911T	JP0912T
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	21.20	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
01-Jul-2021											Dry	26.51	22.89
17-Aug-2021	21.81	22.02	Dry	23.16	24.45	Dry	Dry	45.56	44.25	21.3	Dry	26.55	22.98
01-Sep-2021											Dry	26.55	22.99
01-Oct-2021											Dry	26.68	23.14
01-Nov-2021											Dry	26.66	
01-Dec-2021											Dry	26.38	22.92
25-Jan-2022	21.96	22.2	Dry	22.15	25.02	Dry	Dry	39.74	42.86	21.31	Dry	26.48	22.95
10-Feb-2022	21.90	22.22	Dry	22.19	25.10	Dry	Dry	39.53	42.90	21.36	Dry	26.69	23.01
01-Mar-2022											Dry	26.81	23.09
01-Apr-2022											Dry	26.85	23.16
01-May-2022											Dry	26.80	23.14
01-Jun-2022	21.89	22.36	Dry	22.27	24.98	21.04	Dry	38.4	41.83	21.64	Dry	26.65	23.03
02-Aug-2022	21.93	22.85	Dry	22.81	26.3		Dry	39.03	41.99	Dry	Dry	26.51	22.97
06-Oct-2022	22.01	22.34	Dry	22.94	26.28		Dry	42.67	42.72	Dry	Dry	26.63	23.15
16-Feb-2023			Dry	22.70		19.56	Dry		42.49	21.20	Dry	26.59	22.73
16-May-2023	21.92	22.19	Dry	23.10	27.09	19.51	Dry		42.63	21.28	Dry	26.50	22.73

* 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 access

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)	C10 - C14 Fraction (SVSG)	C15 - C28 Fraction (SVSG)	C29 - C36 Fraction (SVSG)	C10 - C36 (sum) Fraction (SVSG)
		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				
JMR22WP	16-Feb-2023	12.41	12.1	10748	10400	5770	371	<1	1320	35	1960	68	1000	101	<1	1100	<20	70	150	<50	220				
JMR22WP	16-May-2023	7.84	8.07	16551	17400	10800	108	68	3660	10	6000	1	<1	<1	144	144	<20	<50	<100	<50	<50	<50	<100	<50	<50
JMR23WA	16-Feb-2023	7.23	6.97	944	899	632	48	32	103	3	90	24	<1	<1	326	326	<20	<50	<100	<50	<50				
JMR23WA	16-May-2023	6.8	7.87	822	753	445	44	26	80	3	73	10	<1	<1	270	270	<20	<50	<100	<50	<50	<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				
JMR24WP	24-Jan-2022	7.58	8.04	7752	7790	5140	189	137	1300	8	2720	1	<1	<1	212	212	<20	<50	<100	<50	<50				
JMR24WP	08-Jun-2022	7.6	8.09	7670	7830	5260	181	132	1300	8	2680	1	<1	<1	204	204	<20	<50	<100	<50	<50				
JMR24WP	05-Oct-2022	7.24	7.77	7875	8230	4630	168	126	1290	7	2630	2	<1	<1	221	221	<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				
JMR24WP2	24-Jan-2022	7.54	8.07	7059	7110	4550	144	97	1290	7	2350	<1	<1	<1	282	282	<20	50	150	120	320				
JMR24WP2	08-Jun-2022	7.62	8.2	6912	7060	4460	134	93	1270	6	2260	<1	<1	<1	266	266	<20	<50	<100	80	80				
JMR24WP2	05-Oct-2022	7.31	7.89	7116	7460	4410	120	90	1280	6	2280	6	<1	<1	298	298	<20	<50	<100	<50	<50				
JMR24WP2	16-Feb-2023	7.8	7.47	6912	6390	4030	122	82	1160	7	2100	1	<1	<1	311	311	<20	<50	<100	<50	<50				
JMR24WP2	16-May-2023	7.25	8.12	7397	8060	4560	157	122	1230	8	2540	1	<1	<1	207	207	<20	<50	<100	<50	<50	<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				
JMR25WA	24-Jan-2022	6.68	7.48	2072	2070	1670	130	80	183	5	590	3	<1	<1	270	270	<20	<50	170	120	290				
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				
JMR4WA	24-Jan-2022	6.54	7.42	5856	5820	4020	235	214	622	7	1590	91	<1	<1	677	677	<20	50	130	<50	180				
JMR4WA	08-Jun-2022	6.51	7.69	5529	5710	3850	231	229	659	8	1550	74	<1	<1	617	617	<20	<50	360	50	410				
JMR4WA	05-Oct-2022	6.58	7.26	5627	5960	3990	219	213	644	7	1500	87	<1	<1	646	646	<20	<50	150	<50	150				
JMR4WA	15-May-2023	6.53	7.93	5010	5430	3060	192	198	574	8	1400	74	<1	<1	554	554	<20	50	110	<50	160	<50	<100	<50	<50
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				
JMR4WP	24-Jan-2022	7.34	8.05	4207	4220	2330	63	56	670	4	1140	48	<1	<1	503	503	<20	<50	<100	<50	<50				
JMR4WP	08-Jun-2022	7.13	8.14	3803	3930	2170	68	66	723	4	1040	43	<1	<1	457	457	<20	<50	<100	<50	<50				
JMR4WP	05-Oct-2022	7.31	7.89	3952	3990	2180	66	57	733	5	1010	42	<1	<1	486	486	<20	<50	<100	<50	<50				
JMR4WP2	16-May-2023	7.2	8.29	3946	3510	2170	67	58	726	5	1040	40	<1	<1	462	462	<20	<50	<100	<50	<50	<50	<100	<50	<50
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				

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)	C10 - C14 Fraction (SVSG)	C15 - C28 Fraction (SVSG)	C29 - C36 Fraction (SVSG)	C10 - C36 (sum) Fraction (SVSG)
		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				
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				
JN1119E	24-Jan-2022	12.08	12	11791	11300	6340	22	<1	2250	12	2870	18	712	253	<1	964	<20	70	200	<50	270				
JN1119E	08-Jun-2022	12.01	11.6	10851	10300	5770	5	<1	2300	11	3100	14	379	394	<1	773	<20	50	130	<50	180				
JN1119E	05-Oct-2022	12.03	11.8	12838	12700	5910	15	<1	2470	11	3140	12	733	340	<1	1070	<20	50	110	<50	160				
JN1119E	16-May-2023	12.04	12	12822	11800	5390	94	<1	2240	11	2580	16	805	414	<1	1220	<20	80	140	<50	220	<50	<100	<50	<50

Mackenzie North Groundwater Quality Monitoring

Dissolved Metals/Metalloids Data

Bore ID	Sample Date	Dissolved Metals																	
		Aluminium	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Vanadium	Zinc	Boron	Iron
		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
JMR22WP	16-Feb-2023	0.06	0.001	<0.0001	0.061	<0.001	0.008	0.002	<0.001	<0.0001	0.094	0.004	<0.01	<0.001	<0.001	<0.01	<0.005	0.14	0.1
JMR22WP	16-May-2023	0.01	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	0.084	<0.0001	0.002	0.001	<0.01	<0.001	<0.001	<0.01	0.011	0.52	0.06
JMR23WA	16-Feb-2023	<0.01	0.02	<0.0001	<0.001	0.001	<0.001	<0.001	0.822	<0.0001	0.003	0.006	<0.01	<0.001	<0.001	<0.01	<0.005	0.08	2.09
JMR23WA	16-May-2023	0.01	0.005	<0.0001	<0.001	0.001	<0.001	<0.001	0.911	<0.0001	0.002	0.004	<0.01	<0.001	<0.001	<0.01	<0.005	<0.05	1.89
JMR24WP	12-Nov-2019	<0.01	0.002	<0.0001	0.004	<0.001	<0.001	<0.001	0.193	<0.0001	0.008	0.02	<0.01	<0.001	<0.001	<0.01	0.01	0.51	<0.05
JMR24WP	20-Apr-2020	<0.01	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.196	<0.0001	0.001	0.009	<0.01	<0.001	<0.001	<0.01	0.014	0.49	<0.05
JMR24WP	16-Nov-2020	<0.01	0.002	<0.0001	0.002	<0.001	0.003	<0.001	0.214	<0.0001	0.004	0.017	<0.01	<0.001	<0.001	<0.01	0.019	0.36	<0.05
JMR24WP	26-Jan-2021	<0.01	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	0.22	<0.0001	0.002	0.005	<0.01	<0.001	<0.001	<0.01	0.017	0.46	<0.05
JMR24WP	19-May-2021	<0.01	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	0.218	<0.0001	0.002	0.004	<0.01	<0.001	<0.001	<0.01	0.017	0.46	<0.05
JMR24WP	24-Jan-2022	<0.01	0.002	<0.0001	0.016	<0.001	0.002	<0.001	0.248	<0.0001	0.016	0.072	<0.01	<0.001	<0.001	<0.01	0.014	0.51	<0.05
JMR24WP	08-Jun-2022	<0.01	0.002	<0.0001	<0.001	<0.001	0.002	<0.001	0.2	<0.0001	0.001	0.004	<0.01	<0.001	<0.001	<0.01	0.016	0.61	<0.05
JMR24WP	05-Oct-2022	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.219	<0.0001	0.002	0.008	<0.01	<0.001	<0.001	<0.01	0.03	0.55	<0.05
JMR24WP2	20-Apr-2020	<0.01	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.257	<0.0001	0.002	0.005	<0.01	<0.001	<0.001	<0.01	0.012	0.43	0.2
JMR24WP2	17-Nov-2020	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.258	<0.0001	0.002	0.006	<0.01	<0.001	<0.001	<0.01	0.047	0.39	0.21
JMR24WP2	27-Jan-2021	0.02	0.003	<0.0001	0.003	<0.001	<0.001	<0.001	0.321	<0.0001	0.002	0.002	<0.01	<0.001	0.002	<0.01	<0.005	1.26	0.06
JMR24WP2	19-May-2021	<0.01	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.217	<0.0001	0.002	0.003	<0.01	<0.001	<0.001	<0.01	0.011	0.5	0.16
JMR24WP2	24-Jan-2022	`	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.23	<0.0001	0.002	0.004	<0.01	<0.001	<0.001	<0.01	0.008	0.6	<0.05
JMR24WP2	08-Jun-2022	<0.01	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.202	<0.0001	0.003	0.003	<0.01	<0.001	<0.001	<0.01	0.008	0.64	<0.05
JMR24WP2	05-Oct-2022	<0.01	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.204	<0.0001	0.002	0.006	<0.01	<0.001	<0.001	<0.01	0.024	0.59	0.45
JMR24WP2	16-Feb-2023	<0.01	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.168	<0.0001	0.002	0.001	<0.01	<0.001	<0.001	<0.01	0.007	0.6	0.1
JMR24WP2	16-May-2023	0.01	0.003	<0.0001	<0.001	<0.001	<0.001	<0.001	0.219	<0.0001	0.001	0.001	<0.01	<0.001	<0.001	<0.01	0.014	0.5	0.37
JMR25WA	11-Sep-2018	0.01	<0.001	<0.0001	<0.001		0.002	<0.001		<0.0001		0.001	<0.01				0.014		<0.05
JMR25WA	29-Nov-2018	<0.01	<0.001	<0.0001	<0.001	-	0.002	<0.001	0.015	<0.0001	<0.001	0.002	<0.01	<0.001	<0.001	<0.01	<0.005	<0.05	<0.05
JMR25WA	24-Jan-2019	<0.01	<0.001	<0.0001	0.001	<0.001	0.001	<0.001	0.016	<0.0001	<0.001	0.002	<0.01	<0.001	<0.001	<0.01	<0.005	<0.05	<0.05
JMR25WA	27-Mar-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.01	<0.0001	<0.001	0.001	<0.01	<0.001	<0.001	<0.01	<0.005	<0.05	<0.05
JMR25WA	15-May-2019	<0.01	<0.001	<0.0001	<0.001	0.001	<0.001	<0.001	0.088	<0.0001	<0.001	0.002	<0.01	<0.001	<0.001	<0.01	<0.005	<0.05	<0.05
JMR25WA	25-Jul-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.006	<0.0001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.01	<0.005	<0.05	<0.05
JMR25WA	12-Nov-2019	<0.01	<0.001	0.0002	<0.001	<0.001	0.005	<0.001	0.022	<0.0001	<0.001	0.005	<0.01	<0.001	<0.001	<0.01	0.013	<0.05	<0.05
JMR25WA	20-Apr-2020	<0.01	<0.001	<0.0001	<0.001	0.003	<0.001	<0.001	0.216	<0.0001	<0.001	0.012	<0.01	<0.001	<0.001	<0.01	0.005	<0.05	<0.05
JMR25WA	16-Nov-2020	<0.01	<0.001	<0.0001	<0.001	<0.001	0.001	<0.001	0.055	<0.0001	<0.001	0.007	<0.01	<0.001	0.001	<0.01	0.011	<0.05	<0.05
JMR25WA	26-Jan-2021	<0.01	0.001	<0.0001	<0.001	0.006	<0.001	<0.001	0.769	<0.0001	<0.001	0.014	<0.01	<0.001	0.002	<0.01	<0.005	<0.05	0.09
JMR25WA	19-May-2021	<0.01	0.002	<0.0001	<0.001	0.01	<0.001	<0.001	1.9	<0.0001	0.001	0.023	<0.01	<0.001	0.002	<0.01	<0.005	<0.05	0.34
JMR25WA	24-Jan-2022	<0.01	0.004	<0.0001	0.001	0.012	<0.001	<0.001	3.03	<0.0001	0.002	0.021	<0.01	<0.001	0.001	<0.01	0.006	0.07	4.43
JMR4WA	09-Sep-2018	<0.01	<0.001	<0.0001	<0.001		<0.001	<0.001		<0.0001		<0.001	<0.01				<0.005		5.61
JMR4WA	18-Nov-2018	<0.01	<0.001	<0.0001	<0.001	-	<0.001	<0.001	1.64	<0.0001	<0.001	<0.001	<0.01	<0.001	0.001	<0.01	<0.005	0.13	5.9
JMR4WA	24-Jan-2019	<0.01	<0.001	<0.0001	0.002	<0.001	<0.001	<0.001	1.94	<0.0001	<0.001	0.001	<0.01	<0.001	0.001	<0.01	<0.005	<0.05	6.69
JMR4WA	27-Mar-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.9	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005	0.05	6.49
JMR4WA	15-May-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.67	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005	<0.05	6.45
JMR4WA	24-Jul-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.88	<0.0001	<0.001	<0.001	<0.01	<0.001	0.001	<0.01	<0.005	0.06	6.92
JMR4WA	12-Nov-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.72	<0.0001	<0.001	0.004	<0.01	<0.001	<0.001	<0.01	<0.005	<0.05	5.54
JMR4WA	20-Apr-2020	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.55	<0.0001	<0.001	0.003	<0.01	<0.001	0.002	<0.01	<0.005	<0.05	4.59
JMR4WA	16-Nov-2020	<0.01	0.015	<0.0001	<0.001	<0.001	0.015	<0.001	0.075	<0.0001	0.004	0.007	<0.01	<0.001	0.002	<0.01	0.061	0.16	<0.05
JMR4WA	26-Jan-2021	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.93	<0.0001	<0.001	0.008	<0.01	<0.001	0.002	<0.01	0.01	0.05	5.11
JMR4WA	19-May-2021	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.59	<0.0001	<0.001	0.006	<0.01	<0.001	0.002	<0.01	<0.005	<0.05	4.57
JMR4WA	24-Jan-2022	<0.01	<0.001	<0.0001	0.013	<0.001	<0.001	<0.001	1.5	<0.0001	0.012	0.062	<0.01	<0.001	<0.001	<0.01	<0.005	<0.05	4.64
JMR4WA	08-Jun-2022	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.64	<0.0001	<0.001	0.017	<0.01	<0.001	0.002	<0.01	0.006	0.09	3.9
JMR4WA	05-Oct-2022	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.49	<0.0001	<0.001	0.005	<0.01	<0.001	0.001	<0.01	<0.005	<0.05	5.36
JMR4WA	15-May-2023	0.01	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.23	<0.0001	<0.001	0.004	<0.01	<0.001	<0.001	<0.01	0.062	0.06	3.67
JMR4WP	09-Sep-2018	<0.01	<0.001	<0.0001	<0.001		<0.001	<0.001		<0.0001		0.001	<0.01				<0.005		0.14
JMR4WP	18-Nov-2018	<0.01	<0.001	<0.0001	<0.001	-	<0.001	<0.001	0.096	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.016	0.25	0.21
JMR4WP	24-Jan-2019	<0.01	<0.001	<0.0001	0.001	<0.001	<0.001	<0.001	0.104	<0.0001	<0.001	0.001	<0.01	<0.001	<0.001	<0.01	0.006	0.18	0.13
JMR4WP	27-Mar-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.11	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.009	0.19	0.13
JMR4WP	15-May-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	0.001	<0.001	0.111	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.012	0.17	0.1

Mackenzie North Groundwater Quality Monitoring

Dissolved Metals/Metalloids Data

Bore ID	Sample Date	Dissolved Metals																	
		Aluminium	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Vanadium	Zinc	Boron	Iron
		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
JMR4WP	25-Jul-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.107	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.007	0.21	0.07
JMR4WP	16-Nov-2020	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.6	<0.0001	<0.001	0.012	<0.01	<0.001	0.002	<0.01	0.012	<0.05	4.17
JMR4WP	26-Jan-2021	<0.01	0.021	<0.0001	<0.001	0.001	<0.001	<0.001	0.178	<0.0001	0.006	0.003	<0.01	<0.001	0.001	<0.01	0.007	0.16	0.5
JMR4WP	19-May-2021	<0.01	0.014	<0.0001	<0.001	<0.001	<0.001	<0.001	0.135	<0.0001	0.004	0.006	<0.01	<0.001	<0.001	<0.01	<0.005	0.14	<0.05
JMR4WP	24-Jan-2022	<0.01	0.005	<0.0001	0.003	<0.001	<0.001	<0.001	0.152	<0.0001	0.006	0.02	<0.01	<0.001	<0.001	<0.01	<0.005	<0.05	0.15
JMR4WP	08-Jun-2022	<0.01	0.004	<0.0001	<0.001	<0.001	<0.001	<0.001	0.141	<0.0001	0.003	0.019	<0.01	<0.001	<0.001	<0.01	<0.005	0.23	0.07
JMR4WP	05-Oct-2022	<0.01	0.004	<0.0001	<0.001	<0.001	<0.001	<0.001	0.171	<0.0001	0.007	0.009	<0.01	<0.001	<0.001	<0.01	<0.005	0.18	<0.05
JMR4WP2	16-May-2023	0.01	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.187	<0.0001	0.002	0.002	<0.01	<0.001	<0.001	<0.01	<0.005	0.18	0.13
JN1119E	13-Nov-2019	<0.01	0.007	<0.0001	<0.001	<0.001	<0.001	<0.001	0.01	<0.0001	0.007	0.002	<0.01	<0.001	<0.001	<0.01	0.009	0.52	<0.05
JN1119E	20-Apr-2020	0.07	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	0.038	0.001	<0.01	<0.001	<0.001	<0.01	<0.005	0.21	<0.05
JN1119E	16-Nov-2020	0.02	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	0.05	0.003	<0.01	<0.001	<0.001	<0.01	0.011	0.18	<0.05
JN1119E	26-Jan-2021	0.02	0.002	0.0002	<0.001	<0.001	<0.001	<0.001	<0.001	0.0003	0.077	0.001	<0.01	<0.001	<0.001	<0.01	<0.005	0.18	<0.05
JN1119E	19-May-2021	0.02	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001	0.066	0.003	<0.01	<0.001	<0.001	<0.01	<0.005	0.14	<0.05
JN1119E	24-Jan-2022	0.24	0.001	<0.0001	0.001	<0.001	<0.001	<0.001	<0.001	0.0002	0.065	0.009	<0.01	<0.001	<0.001	<0.01	<0.005	0.16	<0.05
JN1119E	08-Jun-2022	0.03	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001	0.06	0.002	<0.01	<0.001	<0.001	<0.01	0.006	0.22	<0.05
JN1119E	05-Oct-2022	0.06	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	0.058	0.001	<0.01	<0.001	<0.001	<0.01	<0.005	0.21	<0.05
JN1119E	16-May-2023	0.02	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	0.069	0.002	<0.01	<0.001	<0.001	<0.01	<0.005	0.13	<0.05

Mackenzie North Groundwater Quality Monitoring

Total Metals/Metalloids Data

Bore ID	Sample Date	Total Metals																	
		Aluminium	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Vanadium	Zinc	Boron	Iron
		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
JMR22WP	16-Feb-2023	0.13	0.002	<0.0001	0.065	<0.001	0.012	0.002	0.002	<0.0001	0.107	0.005	<0.01	<0.001	<0.001	<0.01	0.028	0.14	0.17
JMR22WP	16-May-2023	0.05	0.003	<0.0001	0.001	<0.001	0.002	<0.001	0.092	<0.0001	0.003	0.002	<0.01	<0.001	<0.001	<0.01	0.017	0.49	0.18
JMR23WA	16-Feb-2023	2.38	0.023	<0.0001	0.007	0.003	0.028	0.002	0.981	<0.0001	0.004	0.013	<0.01	<0.001	0.001	0.02	0.024	0.07	6.65
JMR23WA	16-May-2023	12.1	0.01	0.0002	0.029	0.012	0.109	0.019	1.41	<0.0001	0.002	0.041	<0.01	<0.001	0.001	0.05	0.086	0.07	22.6
JMR24WP	12-Nov-2019	0.32	0.003	<0.0001	0.007	<0.001	0.003	<0.001	0.199	<0.0001	0.004	0.007	<0.01	<0.001	<0.001	<0.01	0.052	0.49	0.46
JMR24WP	20-Apr-2020	1.38	0.002	<0.0001	0.006	0.001	0.009	0.003	0.23	<0.0001	0.001	0.012	<0.01	<0.001	<0.001	<0.01	0.028	0.45	2.42
JMR24WP	16-Nov-2020	0.44	0.002	<0.0001	0.002	0.001	0.003	0.001	0.219	<0.0001	0.003	0.009	<0.01	<0.001	<0.001	<0.01	0.015		0.61
JMR24WP	26-Jan-2021	0.09	0.002	<0.0001	<0.001	<0.001	0.003	<0.001	0.222	<0.0001	0.003	0.007	<0.01	<0.001	<0.001	<0.01	0.022		0.37
JMR24WP	19-May-2021	0.04	0.002	<0.0001	<0.001	<0.001	0.002	<0.001	0.216	<0.0001	0.002	0.005	<0.01	<0.001	<0.001	<0.01	0.025	0.44	0.35
JMR24WP	24-Jan-2022	0.88	0.004	<0.0001	0.009	0.002	0.014	0.005	0.305	<0.0001	0.002	0.009	<0.01	<0.001	<0.001	<0.01	0.059	0.5	3.66
JMR24WP	08-Jun-2022	0.33	0.004	<0.0001	0.003	<0.001	0.019	0.003	0.235	<0.0001	0.002	0.007	<0.01	<0.001	<0.001	<0.01	0.047	0.57	2.32
JMR24WP	05-Oct-2022	0.19	0.001	<0.0001	0.002	<0.001	0.003	<0.001	0.216	<0.0001	0.002	0.009	<0.01	<0.001	<0.001	<0.01	0.037	0.51	0.69
JMR24WP2	20-Apr-2020	0.44	0.002	<0.0001	0.007	<0.001	0.003	<0.001	0.282	<0.0001	0.004	0.009	<0.01	<0.001	<0.001	<0.01	0.074	0.5	0.84
JMR24WP2	17-Nov-2020	0.16	0.001	<0.0001	0.004	<0.001	0.007	<0.001	0.271	<0.0001	0.003	0.009	<0.01	<0.001	<0.001	<0.01	0.071		0.54
JMR24WP2	27-Jan-2021	6.07	0.012	0.0001	0.033	0.004	0.018	0.007	0.366	<0.0001	0.003	0.026	<0.01	<0.001	0.003	0.02	0.462		8.42
JMR24WP2	19-May-2021	0.06	0.001	<0.0001	0.002	<0.001	0.002	<0.001	0.222	<0.0001	0.002	0.006	<0.01	<0.001	<0.001	<0.01	0.031	0.45	0.36
JMR24WP2	24-Jan-2022	0.75	0.001	<0.0001	0.005	<0.001	0.006	<0.001	0.246	<0.0001	0.002	0.006	<0.01	<0.001	<0.001	<0.01	0.036	0.6	0.86
JMR24WP2	08-Jun-2022	0.1	0.001	<0.0001	0.001	<0.001	0.004	<0.001	0.215	<0.0001	0.002	0.004	<0.01	<0.001	<0.001	<0.01	0.03	0.68	0.51
JMR24WP2	05-Oct-2022	0.06	<0.001	<0.0001	0.001	<0.001	0.002	<0.001	0.188	<0.0001	0.002	0.006	<0.01	<0.001	<0.001	<0.01	0.037	0.58	0.58
JMR24WP2	16-Feb-2023	0.08	0.001	<0.0001	0.001	<0.001	0.003	<0.001	0.185	<0.0001	0.003	0.002	<0.01	<0.001	<0.001	<0.01	0.027	0.69	0.29
JMR24WP2	16-May-2023	0.56	0.004	<0.0001	0.002	<0.001	0.003	0.001	0.244	<0.0001	0.002	0.003	<0.01	<0.001	<0.001	<0.01	0.026	0.52	1.4
JMR25WA	11-Sep-2018	89.3	0.028	0.0003	0.202		0.209	0.046		0.0002		0.241	<0.01				0.302		152
JMR25WA	29-Nov-2018	14.7	0.009	<0.0001	0.028	-	0.057	0.01	1.38	<0.0001	<0.001	0.04	<0.01	<0.001	0.002	0.06	0.055	<0.05	27.4
JMR25WA	24-Jan-2019	15.2	0.008	<0.0001	0.025	0.022	0.035	0.008	0.942	<0.0001	<0.001	0.034	<0.01	<0.001	0.001	0.06	0.048	<0.05	25
JMR25WA	27-Mar-2019	11.4	0.014	<0.0001	0.018	0.022	0.04	0.01	0.924	<0.0001	<0.001	0.052	<0.01	<0.001	0.002	0.05	0.043	<0.05	20.7
JMR25WA	15-May-2019	13.5	0.008	<0.0001	0.024	0.021	0.024	0.007	0.929	<0.0001	<0.001	0.026	<0.01	<0.001	0.001	0.05	0.04	<0.05	21.4
JMR25WA	25-Jul-2019	7.42	0.007	<0.0001	0.013	0.016	0.019	0.006	0.64	<0.0001	<0.001	0.02	<0.01	<0.001	<0.001	0.03	0.036	0.1	13.5
JMR25WA	12-Nov-2019	13	0.005	<0.0001	0.019	0.016	0.051	0.005	0.668	<0.0001	<0.001	0.026	<0.01	<0.001	0.001	0.04	0.042	<0.05	19.1
JMR25WA	20-Apr-2020	23.5	0.009	0.0002	0.046	0.035	0.053	0.044	1.16	<0.0001	<0.001	0.058	<0.01	<0.001	0.002	0.09	0.07	<0.05	41.9
JMR25WA	16-Nov-2020	5.16	0.002	<0.0001	0.011	0.006	0.016	0.003	0.17	<0.0001	<0.001	0.017	<0.01	<0.001	0.002	0.02	0.037		8.1
JMR25WA	26-Jan-2021	36.4	0.01	0.0002	0.084	0.049	0.149	0.031	1.9	0.0004	<0.001	0.102	<0.01	<0.001	0.005	0.15	0.146		70.6
JMR25WA	19-May-2021	49.4	0.019	0.0007	0.132	0.144	0.496	0.114	8.42	0.0009	<0.001	0.276	<0.01	<0.001	0.018	0.33	0.314	<0.05	95.1
JMR25WA	24-Jan-2022	465	0.075	0.0047	1.01	0.629	2.56	2.01	23	0.0024	<0.005	1.27	<0.05	<0.005	0.105	2.11	2.22	0.11	562
JMR4WA	09-Sep-2018	0.03	<0.001	0.0001	<0.001		<0.001	<0.001		<0.0001		<0.001	<0.01				<0.005		5.41
JMR4WA	18-Nov-2018	<0.01	<0.001	<0.0001	<0.001	-	<0.001	<0.001	1.76	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005	0.06	6.01
JMR4WA	24-Jan-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.83	<0.0001	<0.001	<0.001	<0.01	<0.001	0.001	<0.01	<0.005	<0.05	6.69
JMR4WA	27-Mar-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.84	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005	0.05	6.78
JMR4WA	15-May-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.73	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005	<0.05	6.07
JMR4WA	24-Jul-2019	0.02	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.85	<0.0001	<0.001	<0.001	<0.01	<0.001	0.002	<0.01	<0.005	0.1	7.28
JMR4WA	12-Nov-2019	0.03	<0.001	0.0002	<0.001	<0.001	<0.001	<0.001	1.81	<0.0001	<0.001	0.005	<0.01	<0.001	0.002	<0.01	0.006	0.06	6.27
JMR4WA	20-Apr-2020	0.02	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.93	<0.0001	<0.001	0.004	<0.01	<0.001	0.003	<0.01	<0.005	<0.05	5.67
JMR4WA	16-Nov-2020	0.02	0.014	<0.0001	<0.001	<0.001	0.014	<0.001	0.077	<0.0001	0.005	0.007	<0.01	<0.001	0.002	<0.01	0.053		<0.05
JMR4WA	26-Jan-2021	0.05	<0.001	0.0001	<0.001	<0.001	0.003	<0.001	1.85	<0.0001	<0.001	0.01	<0.01	<0.001	0.003	<0.01	0.019		5.67
JMR4WA	19-May-2021	0.01	<0.001	0.0001	<0.001	<0.001	0.002	<0.001	1.62	<0.0001	<0.001	0.006	<0.01	<0.001	0.002	<0.01	0.01	<0.05	4.76
JMR4WA	24-Jan-2022	0.02	<0.001	<0.0001	0.002	<0.001	<0.001	<0.001	1.75	<0.0001	<0.001	0.012	<0.01	<0.001	0.002	<0.01	0.006	<0.05	5.94
JMR4WA	08-Jun-2022	0.05	<0.001	<0.0001	<0.001	<0.001	0.004	<0.001	1.7	<0.0001	<0.001	0.018	<0.01	<0.001	0.002	<0.01	0.013	0.09	4.54
JMR4WA	05-Oct-2022	0.03	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	1.36	<0.0001	<0.001	0.005	<0.01	<0.001	<0.001	<0.01	0.005	<0.05	5.11
JMR4WA	15-May-2023	0.04	0.001	<0.0001	0.002	<0.001	0.002	<0.001	1.37	<0.0001	<0.001	0.005	<0.01	<0.001	<0.001	<0.01	0.07	0.07	3.93
JMR4WP	09-Sep-2018	0.02	<0.001	<0.0001	<0.001		<0.001	<0.001		<0.0001		0.002	<0.01				<0.005		0.18
JMR4WP	18-Nov-2018	0.01	<0.001	<0.0001	<0.001	-	<0.001	<0.001	0.091	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.007	0.2	0.2

Mackenzie North Groundwater Quality Monitoring

Total Metals/Metalloids Data

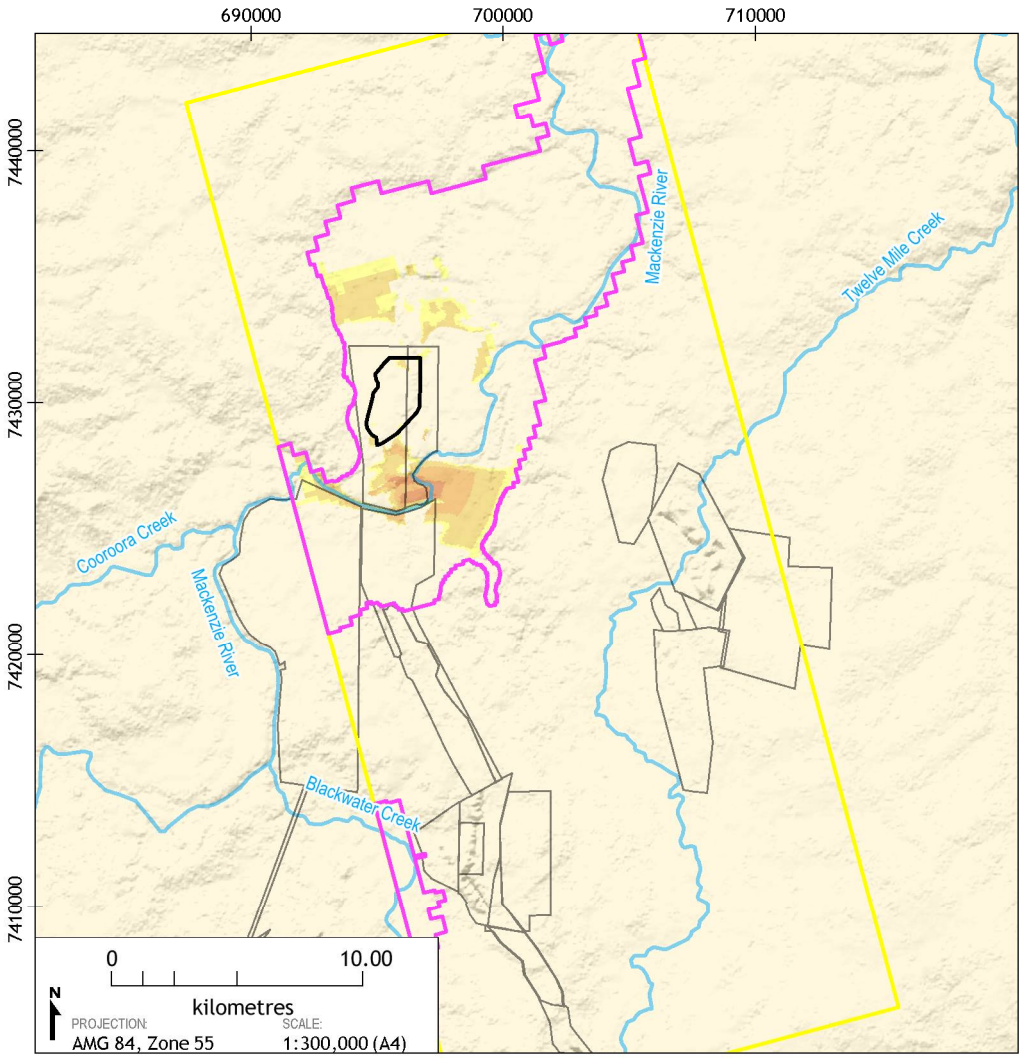
Bore ID	Sample Date	Total Metals																	
		Aluminium	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Vanadium	Zinc	Boron	Iron
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
JMR4WP	24-Jan-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.095	<0.0001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.01	0.18	0.14
JMR4WP	27-Mar-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.107	<0.0001	0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.008	0.21	0.13
JMR4WP	15-May-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.103	<0.0001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.01	0.006	0.18	0.11
JMR4WP	25-Jul-2019	<0.01	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.12	<0.0001	0.002	<0.001	<0.01	<0.001	<0.001	<0.01	0.009	0.29	0.08
JMR4WP	16-Nov-2020	0.04	<0.001	0.0001	<0.001	<0.001	0.004	<0.001	1.6	<0.0001	<0.001	0.012	<0.01	<0.001	0.002	<0.01	0.013		4.71
JMR4WP	26-Jan-2021	0.08	0.023	<0.0001	<0.001	0.001	0.002	<0.001	0.184	<0.0001	0.006	0.005	<0.01	<0.001	0.001	<0.01	0.016		0.74
JMR4WP	19-May-2021	0.1	0.014	<0.0001	0.001	<0.001	0.002	<0.001	0.149	<0.0001	0.005	0.008	<0.01	<0.001	<0.001	<0.01	0.026	0.15	0.24
JMR4WP	24-Jan-2022	0.01	0.006	<0.0001	0.003	<0.001	<0.001	<0.001	0.185	<0.0001	0.004	0.004	<0.01	<0.001	<0.001	<0.01	0.015	0.21	0.23
JMR4WP	08-Jun-2022	0.1	0.005	<0.0001	<0.001	<0.001	0.002	<0.001	0.142	<0.0001	0.003	0.021	<0.01	<0.001	<0.001	<0.01	0.019	0.22	0.35
JMR4WP	05-Oct-2022	0.06	0.003	<0.0001	0.003	<0.001	0.002	<0.001	0.157	<0.0001	0.007	0.01	<0.01	<0.001	<0.001	<0.01	0.027	0.18	0.17
JMR4WP2	16-May-2023	0.02	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	0.203	<0.0001	0.002	0.003	<0.01	<0.001	<0.001	<0.01	0.011	0.19	0.17
JN1119E	13-Nov-2019	11.6	0.012	<0.0001	0.013	0.008	0.025	0.013	0.203	<0.0001	0.006	0.016	<0.01	<0.001	0.003	0.02	0.062	0.51	12.7
JN1119E	20-Apr-2020	1.29	0.002	<0.0001	0.006	<0.001	0.002	0.002	0.023	<0.0001	0.07	0.003	<0.01	<0.001	<0.001	<0.01	0.01	0.22	1.13
JN1119E	16-Nov-2020	0.04	0.002	<0.0001	<0.001	<0.001	0.002	<0.001	0.001	0.0009	0.069	0.002	<0.01	<0.001	<0.001	<0.01	<0.005		0.21
JN1119E	26-Jan-2021	0.1	0.002	0.0002	0.002	<0.001	0.001	<0.001	0.009	0.0005	0.082	0.004	<0.01	<0.001	<0.001	<0.01	<0.005		0.19
JN1119E	19-May-2021	0.06	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	0.0003	0.08	0.002	<0.01	<0.001	<0.001	<0.01	<0.005	0.14	0.06
JN1119E	24-Jan-2022	0.83	0.002	<0.0001	0.002	<0.001	0.001	<0.001	0.001	0.0002	0.084	0.004	<0.01	<0.001	<0.001	<0.01	<0.005	0.16	0.06
JN1119E	08-Jun-2022	0.06	0.002	<0.0001	<0.001	<0.001	0.002	<0.001	<0.001	0.0003	0.075	0.003	<0.01	<0.001	<0.001	<0.01	<0.005	0.14	0.06
JN1119E	05-Oct-2022	0.25	0.001	<0.0001	0.003	<0.001	<0.001	<0.001	0.002	<0.0001	0.057	0.003	<0.01	<0.001	<0.001	<0.01	<0.005	0.15	0.11
JN1119E	16-May-2023	0.03	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0002	0.08	0.003	<0.01	<0.001	<0.001	<0.01	<0.005	0.14	<0.05

ATTACHMENT C

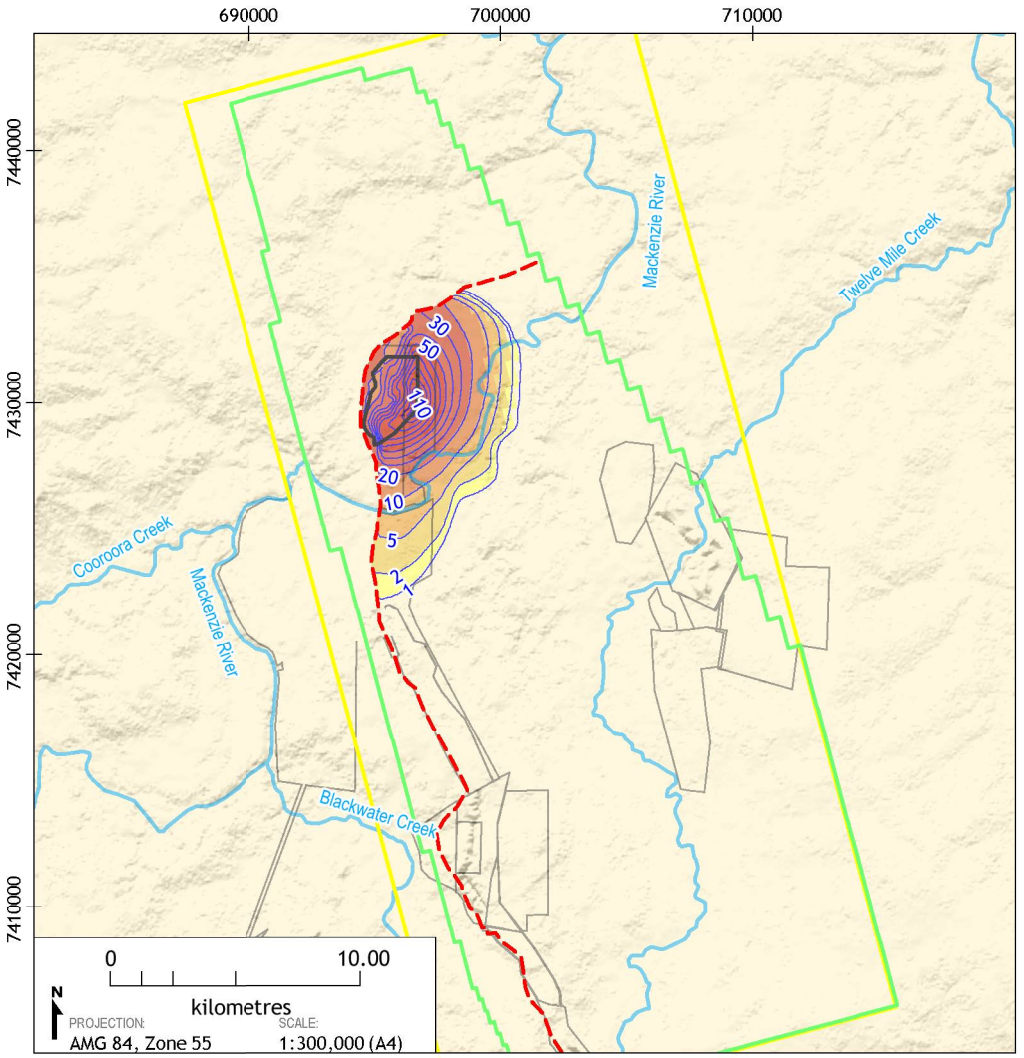
Drawdown Predictions at End of Mining

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**