ROLLESTON
OPEN CUT

GLENCORE

Rolleston Open Cut Annual Groundwater Report - 2022

Report

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1. Introduction

Rolleston Open Cut (ROC) is an established open cut mine located in the south-western part of the Bowen Basin within the Central Highlands Regional Council area, some 18 kilometres west of Rolleston township and 58 kilometres south-east of Springsure. The operation is situated within the catchment of Meteor Creek which flows into the Comet River and ultimately to the Fitzroy River.

Production commenced in 2005 and the mine is currently approved to produce up to nineteen million tonnes of coal per year, the majority of which is exported through the port of Gladstone. ***Figure 1-1*** shows ROC's referral area under EPBC 2011/5965 and the groundwater monitoring network.

Activities undertaken to date within the Rolleston Coal Expansion Project (RCEP) footprint have occurred in the Rolleston South Pit, with mining progressing from the western strips towards the eastern pit limit. Alluvial groundwater likely has ingress from strips in the Rolleston South Pit. The Rolleston South Pit does not have any basalt material.

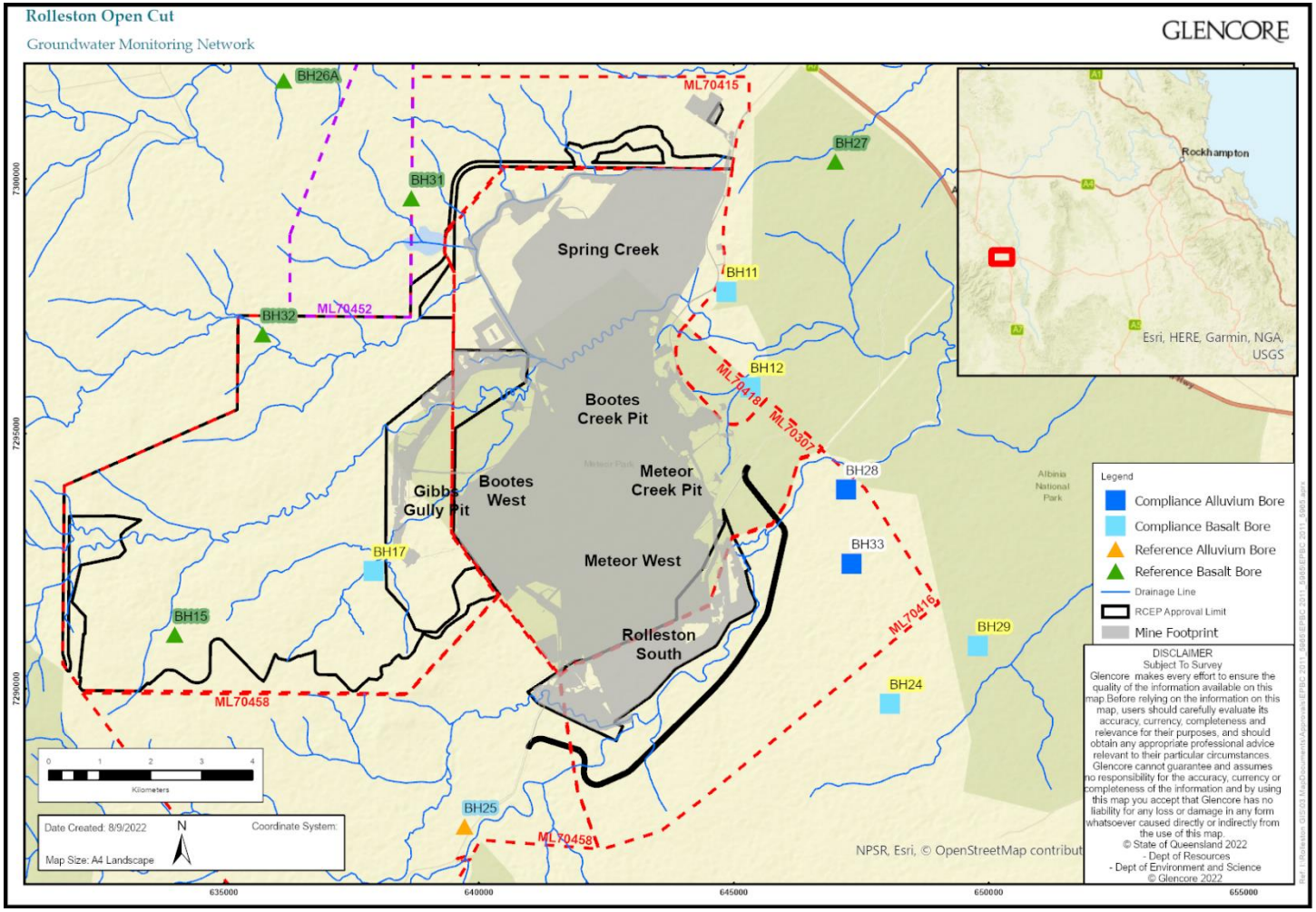

Figure 1-1 - RCEP Area and Groundwater Monitoring Network

2. Climate

Long-term rainfall at nearby Rolleston Township and recent rainfall for the mine site is provided in ***Figure 2-1***. Between 2013 and 2021 ROC has experienced below average rainfall for each calendar year. Rainfall to date in 2022 is average.

Total rainfall for the period of September 2021 to August 2022 inclusive was 693.0 mm, which is above the annual long term average rainfall (638.2 mm). As the region has received below average rainfall for the last 10 years, there has been limited opportunity for the groundwater aquifer to recharge.

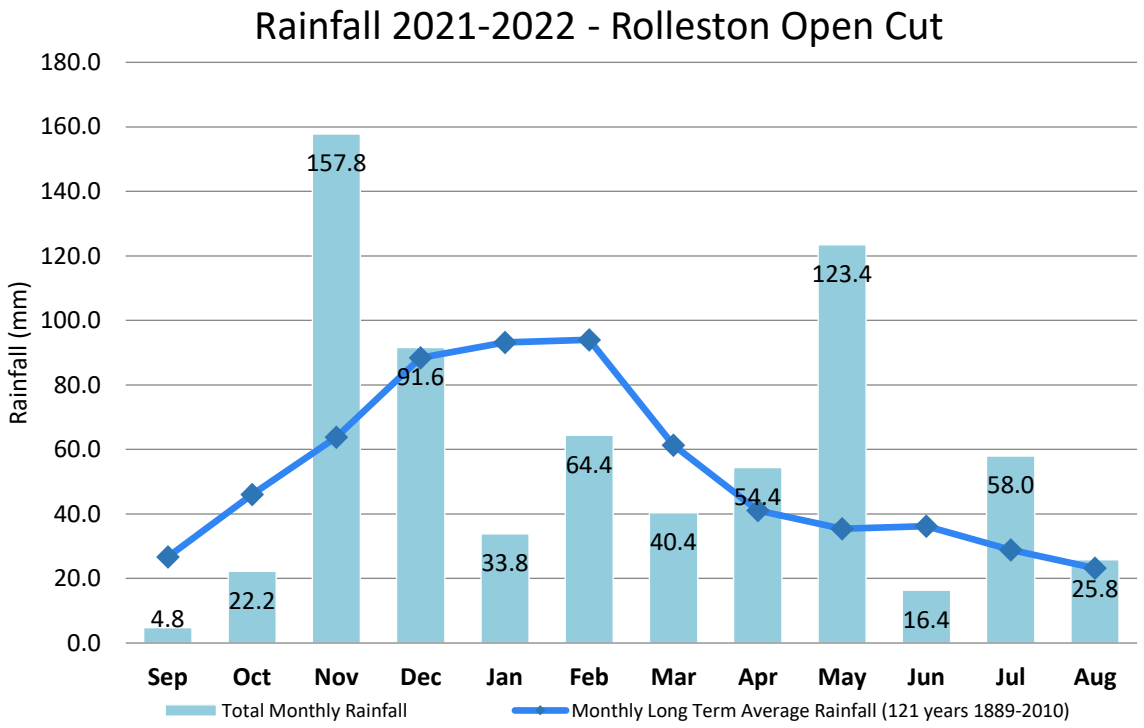

Figure 2-1 - Rolleston Open Cut 2021/2022 rainfall

3. Groundwater Monitoring History

In general, the geology of the Rolleston region consists of Quaternary alluvium, Tertiary basalt, and Permian Blackwater/Blenheim Subgroups which host economic coal seams. Groundwater occurs within each of these geological units. However, the Tertiary basalt rock formation and the Quaternary alluvium are the two dominant aquifers accessed as a groundwater source throughout the region.

Groundwater monitoring at Rolleston Open Cut (ROC) commenced in 2002 as part of the data collection for the 2002 Environmental Management Overview Strategy (EMOS). Pre-2010 groundwater monitoring was only undertaken for Standing Water Level (SWL) and only one sampling round was undertaken in 2002 for the EMOS. In 2010, an intensive groundwater monitoring program commenced in order to develop investigation trigger levels for ongoing monitoring.

The 2010 monitoring network comprised 3 coal bores, 1 alluvium bore and 6 basalt bores. Trigger levels were determined for the collective network (i.e. not separated out by aquifer type) after 12 months of sampling monthly. The limits were based on the 80th percentile of the samples. In 2012, the network was expanded to include 1 sandstone/siltstone bore and 2 alluvium bores in the Meteor Creek floodplain. Two basalt bores had also been mined out.

In 2015, the Environmental Authority (EA) EPML00370013 for ROC was updated to include the RCEP activities. As part of the EA amendment to incorporate the RCEP, separate groundwater investigation trigger levels were determined for the basalt and alluvium bores, while coal/permian aquifer bores were no longer listed. The amended EA included 5 Reference Basalt, 1 Reference Alluvium, 6 Compliance Basalt and 3 Compliance Alluvium bores. To incorporate the RCEP footprint the groundwater monitoring locations were expanded further away from the existing mining area and monitoring network. Of the original bores, only 3 basalt bores (BH6, BH11 and BH12) have continued to be monitored, however, in May 2022, the basalt bore BH6 was mined out.

In 2016, ROC and the Department of Environment and Science (DES) recognised the groundwater trigger investigation limits set pre-RCEP would not be appropriate for some of the new monitoring bores. During 2016, and again in 2019, ROC and DES reviewed all available data to determine more appropriate investigation limits. The resultant trigger investigation limits for analytes with sufficient samples available were based on the 95th percentile. The trigger investigation limits for other analytes were based on the Comet River Sub-basin Zone 13 shallow aquifer 80th percentile of the Environmental groundwater quality objective[1]. The current bore network being monitored is listed in ***Table 3-1*** and shown in ***Figure 1-1***.

[1] *Department of Environment and Heritage Protection (2013) Comet River Sub-basin Environmental Values and Water Quality Objectives – Basin No. 130 (part), including all waters of the Comet River Sub-basin, September 2011*

Rolleston Open Cut Groundwater Monitoring Network				
Monitoring Point	**Comet River Sub-basin Groundwater Zone**	**Bore Type**	**Aquifer Type**	**Screen Interval (mbgl)**
BH15	13-Deep	Reference	Basalt	54 – 57
BH26A	13-Deep	Reference	Basalt	51 – 54
BH27	25-Deep	Reference	Basalt	67 – 70
BH31	13-Shallow	Reference	Basalt	21 – 27
BH32	13-Shallow	Reference	Basalt	05 – 25
BH25	13-Shallow	Reference	Alluvium	24 – 30
BH6	25-Shallow	Compliance	Basalt	06 – 23
BH11	25-Deep	Compliance	Basalt	49 – 59
BH12	25-Deep	Compliance	Basalt	39 – 49
BH17	13-Deep	Compliance	Basalt	69 – 86
BH24	25-Deep	Compliance	Basalt	27 – 34
BH29	25-Deep	Compliance	Basalt	30 – 46
BH33	25-Shallow	Compliance	Alluvium	20 – 23
BH28	25-Shallow	Compliance	Alluvium	16 – 22
BH30	25-Shallow	Groundwater Dependent Ecosystem Piezometer	Alluvium	12 – 15

Shallow: <30m depth; Deep: >30m depth

Table 3-1 - Rolleston Open Cut Groundwater Monitoring Network

4. Standing Water Level (SWL)

The SWL history of all the compliance bores in the groundwater monitoring network is presented in ***Figure 4-1***. From the three bores that have been monitored since 2003 the SWL within the basalt aquifers was relatively stable until the end of 2009. During the higher than average rainfall period between 2010 – 2012, the basalt aquifers were recharged, and the water levels rose. During the drier period since 2012, the SWL in these bores has been falling to pre-2010 levels.

BH6, the shallowest of these bores, had already reached a state similar to the pre-2010 levels by 2015, and may have been influenced by mining activities in alignment with the groundwater model. Mining in Meteor West has progressed to the east, resulting in BH6 being mined out by May 2022.

Bore BH29 in Albinia National Park has been recording a declining SWL beyond the EA level Trigger Threshold of 2 m. However, over the last 12 months, the rate of SWL decrease has reduced, with only an additional decline in SWL of 7 cm recorded between August 2021 and May 2022, compared to SWL decreases of 28 cm and 93 cm during 2019-2020 and 2020-2021 respectively. An increase in SWL of 10 cm was recorded between February and May 2022, and may be associated with the above average monthly rainfall experienced in April and May 2022.

BH30 is a shallow bore installed to monitor potential impact on Groundwater Dependent Ecosystems; this bore is very responsive to rainfall.

The remaining bores have demonstrated a gradually declining trend in SWL towards the pre-2010 levels, as observed in BH11 & BH12, which is to be expected during the dry period.

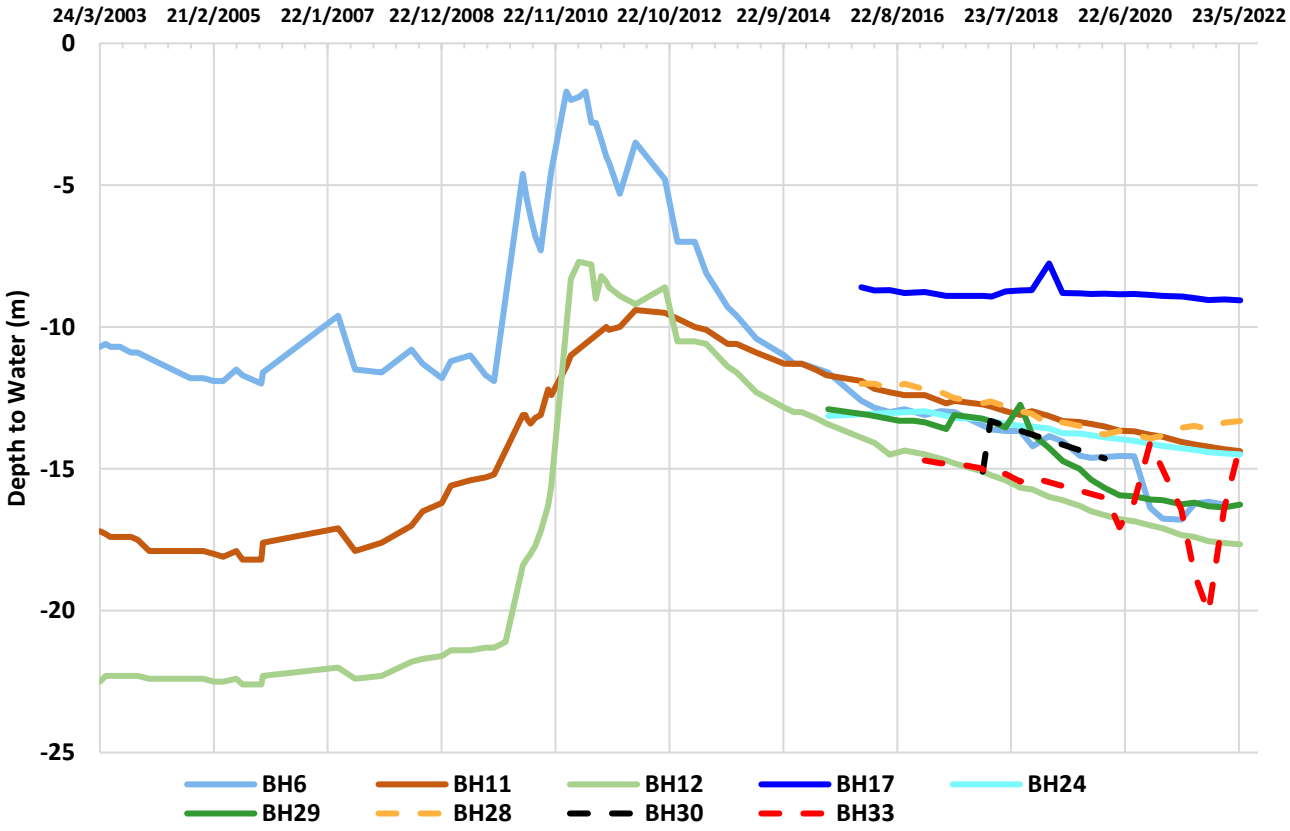

Figure 4-1 - ROC Monitoring Bores SWL

5. Discussion of Results

The studies conducted for the RCEP Environmental Impact Statement (EIS) modelled that the residual impact on groundwater after mining will be that each mining pit, or void, will act as a groundwater sink. Water within the voids will not flow outwards into regional systems. As the pits at ROC are not a source for groundwater, it will be highly unlikely that mining operations would affect groundwater quality. The EIS also found that within the vicinity of ROC there were 35 operational basalt bores and 18 alluvial bores used for stock water and 2 alluvial bores potentially could be used for irrigation.

The data presented in ***Appendix A*** and ***Appendix B*** show that during the 2021/2022 reporting period, investigations were triggered in each quarter under ROC's EA, with groundwater quality exceedances recorded for three of the compliance monitoring bores (one basalt bore, and two alluvial bores). For each sampling round, an investigation was undertaken and reported to the DES. The reports concluded that exceedances of the trigger investigation limits were not due to any mining related impact, and that no environmental harm had occurred as a result of mining activities.

In the Annual 2020/2021 Associated Water Monitoring Report, the potential cause(s) of the groundwater level reduction in BH29 was examined. The consultant that undertook the review concluded that:

> *"Basalt bore BH29's observed water level trend does not correlate with basalt bore BH6's water level trend, which is located nearer to the mining area. BH29's observed water levels also do not correlate with other basalt monitoring bores (BH11, BH12, BH27) located a similar distance away from the mine. Furthermore, BH29's water level trend does not correlate with the CRD trend. When considering the water levels and geological formation's hydraulic characteristics currently available for BH29, there is no evidence to show that the observed drawdown is related to mining activities."*
>
> *"There is no direct hydraulic gradient from the area currently being mined (Rolleston South Pit) to the Tertiary basalt screened at BH29. The Tertiary basalt is underlain by the Triassic Rewan formation that is known to have low hydraulic conductivities (AGE, 2019[2]) and therefore is likely to prevent a direct hydraulic connection between mining operations and the Tertiary basalt."*[3]

The BH29 result is therefore not considered to pose any potential for environmental harm as a result of mining activities.

[2] *Australasian Groundwater and Environmental Consultants Pty Ltd (2019). Underground Water Investigation Report for ATP769 Paranui Pilot Project, prepared for Westside Corporation, project No. G1631B, June 2019. Accessed via https://environment.des.qld.gov.au/__data/assets/pdf_file/0029/87419/atp769-uwir.pdf*

[3] *Australasian Groundwater and Environmental Consultants Pty Ltd (2021). Rolleston Coal Mine 2020/2021 Annual Groundwater Monitoring Report. ROL5000.001 – Rolleston Coal Mine 2020/2021 AGMR – v02.02*

Appendix A - EA Compliance Basalt Bores August 2021 – May 2022 Groundwater Monitoring Results

	Date	Field pH (pH unit)	Field EC (µS/cm)	Dissolved Calcium (mg/L)	Sulfate as SO4 (mg/L)	Dissolved Aluminium (µg/L)	Dissolved Arsenic (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Chromium (µg/L)	Dissolved Copper (µg/L)	Fluoride (µg/L)	Dissolved Lead (µg/L)	Dissolved Molybdenum (µg/L)	Dissolved Nickel (µg/L)	Dissolved Selenium (µg/L)	Dissolved Zinc (µg/L)	TPH C6 - C9 Fraction (µg/L)	TPH C10 - C36 Fraction (sum) (µg/L)
EA Trigger Values		6.5 - 9.5	2650	102	125	140	11	0.3	60	80	800	3	10	5	10	300	20	50
Water Quality Objectives#	**Zone 13 Deep[1]**	8.2	1950	72	67	-	-	-	-	35	370	-	-	-	-	135	-	-
	Zone 25 Shallow[2]	8.19	1420	59	48	-	-	-	-	-	400	-	-	-	-	-	-	-
	Zone 25 Deep[3]	8.5	1345	30	38	-	-	-	-	-	379	-	-	-	-	507	-	-
BH6[2]	Aug-21	7.66	1334	32	25	<10	2	<0.1	<1	<1	300	<1	2	<1	<10	<5	<20	<50
	Nov-21	7.70	1328	33	24	<10	2	<0.1	<1	<1	300	<1	2	<1	<10	<5	<20	<50
	Feb-22	7.58	1289	29	24	<10	2	<0.1	<1	<1	200	<1	1	<1	<10	<5	<20	<50
	May-22	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BH11[3]	Aug-21	8.27	1183	2	<1	<10	11	<0.1	<1	<1	700	<1	30	<1	<10	<5	<20	<50
	Nov-21	8.35	1178	2	<1	<10	11	<0.1	<1	<1	700	<1	33	<1	<10	<5	<20	<50
	Feb-22	8.26	1178	2	<1	<10	10	<0.1	<1	<1	700	<1	26	<1	<10	<5	<20	<50
	May-22	8.26	1187	2	<1	<10	11	<0.1	<1	<1	800	<1	34	<1	<10	<5	<20	<50
BH12[3]	Aug-21	6.98	1528	76	7	<10	<1	<0.1	<1	<1	200	<1	1	<1	<10	<5	<20	<50
	Nov-21	7.01	1512	79	7	<10	<1	<0.1	<1	<1	100	<1	2	<1	<10	<5	<20	<50
	Feb-22	6.95	1458	73	7	<10	<1	<0.1	<1	<1	100	<1	1	<1	<10	<5	<20	<50
	May-22	6.97	1415	70	8	<10	<1	<0.1	<1	<1	200	<1	1	<1	<10	<5	<20	<50
BH17[1]	Aug-21	9.20	920	1	<1	20	1	<0.1	<1	<1	300	<1	6	<1	<10	<5	<20	<50
	Nov-21	9.24	908	1	<1	20	1	<0.1	<1	<1	300	<1	6	<1	<10	<5	<20	<50
	Feb-22	9.08	902	<1	<1	30	<1	<0.1	<1	<1	300	<1	5	<1	<10	<5	<20	<50
	May-22	9.06	919	1	<1	30	1	0.3	<1	10	300	<1	6	<1	<10	41	<20	<50
BH24[3]	Aug-21	7.11	2530	91	67	<10	<1	<0.1	<1	<1	300	<1	1	<1	<10	70	<20	<50
	Nov-21	7.15	2515	91	64	<10	<1	<0.1	<1	<1	300	<1	1	<1	<10	46	<20	<50
	Feb-22	7.31	2473	88	28	<10	2	<0.1	<1	<1	200	<1	1	<1	<10	5	<20	<50
	May-22	7.36	2292	79	3	<10	2	<0.1	<1	<1	200	<1	2	<1	<10	<5	<20	<50
BH29[3]	Aug-21	7.61	1257	39	105	<10	<1	<0.1	<1	<1	200	<1	2	<1	<10	<5	<20	<50
	Nov-21	7.65	1246	38	101	<10	<1	<0.1	<1	<1	100	<1	3	<1	<10	<5	<20	<50
	Feb-22	7.55	1233	35	102	<10	<1	<0.1	<1	<1	100	<1	2	<1	<10	<5	<20	<50
	May-22	7.59	1226	35	102	<10	<1	<0.1	<1	<1	200	<1	3	<1	<10	<5	<20	<50

Comet River Sub-basin environmental groundwater quality objectives (80th percentile)
Shallow: <30m depth; Deep: >30m depth

Appendix B - EA Compliance Alluvial Bores August 2021 – May 2022 Groundwater Monitoring Results

	Date	Field pH (pH unit)	Field EC (µS/cm)	Chlorine (mg/L)	Sodium (mg/L)	Dissolved Aluminium (µg/L)	Dissolved Arsenic (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Chromium (µg/L)	Dissolved Copper (µg/L)	Fluoride (µg/L)	Dissolved Iron (µg/L)	Dissolved Lead (µg/L)	Dissolved Lithium (µg/L)	Dissolved Molybdenum (µg/L)	Dissolved Nickel (µg/L)	Dissolved Selenium (µg/L)	Dissolved Zinc (µg/L)	TPH C6 - C9 Fraction (µg/L)	TPH C10 - C36 Fraction (sum) (µg/L)
EA Trigger Values		6.5 - 9.5	1810	245	113	160	15	0.2	30	14	700	200	1	20	3	10	10	240	20	50
Water Quality Objectives	**Zone 25 Shallow**	8.19	1420	194	267	-	-	-	-	-	400	20	-	-	-	-	-	-	-	-
BH33	Aug-21	7.67	1066	39	109	<10	<1	<0.1	<1	<1	300	200	<1	12	<1	<1	<10	62	<20	<50
	Nov-21	7.56	1067	38	110	<10	<1	<0.1	<1	<1	300	230	<1	13	<1	1	<10	62	<20	<50
	Feb-22	7.37	1219	40	104	<10	<1	<0.1	<1	<1	200	750	<1	8	<1	4	<10	104	<20	<50
	May-22	7.48	1069	35	111	<10	<1	<0.1	<1	<1	300	370	<1	12	<1	3	<10	102	<20	<50
BH28	Aug-21	7.22	1399	107	62	<10	<1	<0.1	37	<1	200	<50	<1	3	<1	<1	<10	<5	<20	<50
	Nov-21	7.24	1385	104	65	<10	<1	<0.1	39	<1	200	<50	<1	3	<1	<1	<10	<5	<20	<50
	Feb-22	7.18	1376	108	68	<10	<1	<0.1	56	<1	200	<50	<1	3	<1	<1	<10	<5	<20	<50
	May-22	7.17	1391	93	60	<10	<1	<0.1	59	<1	200	<50	<1	1	1	<1	<10	<5	<20	<50

Comet River Sub-basin environmental groundwater quality objectives (80th percentile)
Shallow: <30m depth; Deep: >30m depth

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