New Acland Coal Mine Stage 3 Project

Annual Groundwater Monitoring Report 2023

New Acland Mine

NEW ACLAND COAL

Contents

Tables

Figures

Document History and Status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
0.0	04/03/2024	ML			Draft
1	25/03/2024	ML	PK	25/03/2024	Final
2					
3					
4					

Last saved:	25/03/2024
File name:	Annual Groundwater Monitoring Report 2023
Author:	Michael Law
Name of organisation:	New Acland Coal Pty Ltd
Name of Project:	New Acland Stage 3 Project
Name of document:	Annual Groundwater Monitoring Report 2023
Document version:	1

1. Introduction

1.1. Purpose

New Acland Coal Pty Ltd (NAC) currently operates the NAC open cut coal mine on Mining Lease (ML) 50170 and ML 50216 (NAC Mine). The NAC mine is subject to the Stage 03 Environmental Authority (EA) EPML00335713, which came into effect on 22 November 2023 with the addition of MLs 50232 and 700002. The EA conditions stipulated in Schedule D1 to D30 detail the compliance requirements for monitoring and management of groundwater at the NAC mine. These conditions can be found in **Appendix 3**.

This report fulfils the requirements of Condition D28 of Schedule D: Groundwater.
Condition D28 - An Annual Groundwater Monitoring Report (AGMR) is required to be completed and submitted to the administering authority on a yearly basis by 1 April of each year (excluding exploration activities).

The AGMR must include:

- the water monitoring data;
- analysis based on applying the groundwater quality and standing water level of all groundwater monitoring bores (including compliance and interpretation) listed within Table D1: Groundwater monitoring locations and frequency (ML50232) and Table D4 – Groundwater Monitoring Bores (ML50216 and ML50170);
- an assessment of long-term water quality and water level trends at all groundwater monitoring bores (including compliance and interpretation) listed in Table D1: Groundwater monitoring locations and frequency (ML50232) and Table D4 – Groundwater Monitoring Bores (ML50216 and ML50170);
- details of any review undertaken of the groundwater conceptual model; and
- an assessment of any differences between the groundwater level impact predicted and actual impacts for any corresponding period.

The AGMR has been prepared using the results of groundwater monitoring undertaken to meet the requirements of the EA and exclusively covers the 2023 monitoring period.

1.2. Methodology

Groundwater monitoring undertaken included Standing Water Level (SWL), measured monthly, and Water Quality (WQ) collected at least bi-annually. All sampling was completed in general accordance with the following guidelines and standards.

- AS/NZS 5667.1:1998, Water Quality-Sampling Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (Standards Australia, 1998).
- Department of Environment and Science (DES) Monitoring and Sampling Manual, Environmental Protection (Water) Policy 2009 (DES, 2018).

In addition, Standard Operating Procedures (SOPs) were followed to maintain integrity and ensure all sampling procedures are completed in accordance with the relevant guidelines and standards.

1.3. Sample Locations

Table 1 below provides a summary of EA listed groundwater bores monitored as part of the AGMR. Refer to **Appendix A** for the groundwater bore location maps.

Table 1 Summary of NAC Mine EA Monitoring Bore Network

Bore Name	Bore Type	Aquifer Monitored
27PcR	Interpretation	Balgowan Coal Sequence
28PcR	Interpretation	Balgowan Coal Sequence
84PbR	Compliance	Main Range Volcanics
CSMH1Rb	Compliance	Balgowan Coal Sequence
10PbR	Compliance	Main Range Volcanics
4517WB	Compliance	Acland Coal Sequence
4518WB	Compliance	Acland Coal Sequence
25PcR	Interpretation	Balgowan Coal Sequence
26PcR	Interpretation	Balgowan Coal Sequence
3316_WB	Compliance	Acland Coal Sequence
2289PcR Lower	Interpretation	Balgowan Coal Sequence
BMH1	Compliance	Main Range Volcanics
2291Pc	Interpretation	Balgowan Coal Sequence
81P	Interpretation	Acland Coal Sequence
109P	Interpretation	Main Range Volcanics
GW05A	Interpretation	Main Range Volcanics
GW16A	Interpretation	Main Range Volcanics
GW15A	Interpretation	Main Range Volcanics
GW13B	Interpretation	Waipanna Coal Sequence
114P	Interpretation	Acland Coal Sequence
116P	Interpretation	Acland Coal Sequence
119P	Interpretation	Acland Coal Sequence
118P (120WB)	Interpretation	Acland Coal Sequence
113Pgcb	Interpretation	Acland Coal Sequence
GW05B	Interpretation	Acland Coal Sequence
GW06B	Interpretation	Acland Coal Sequence
GW10	Interpretation	Acland Coal Sequence
GW08C	Interpretation	Marburg Sandstone
GW09C	Interpretation	Marburg Sandstone

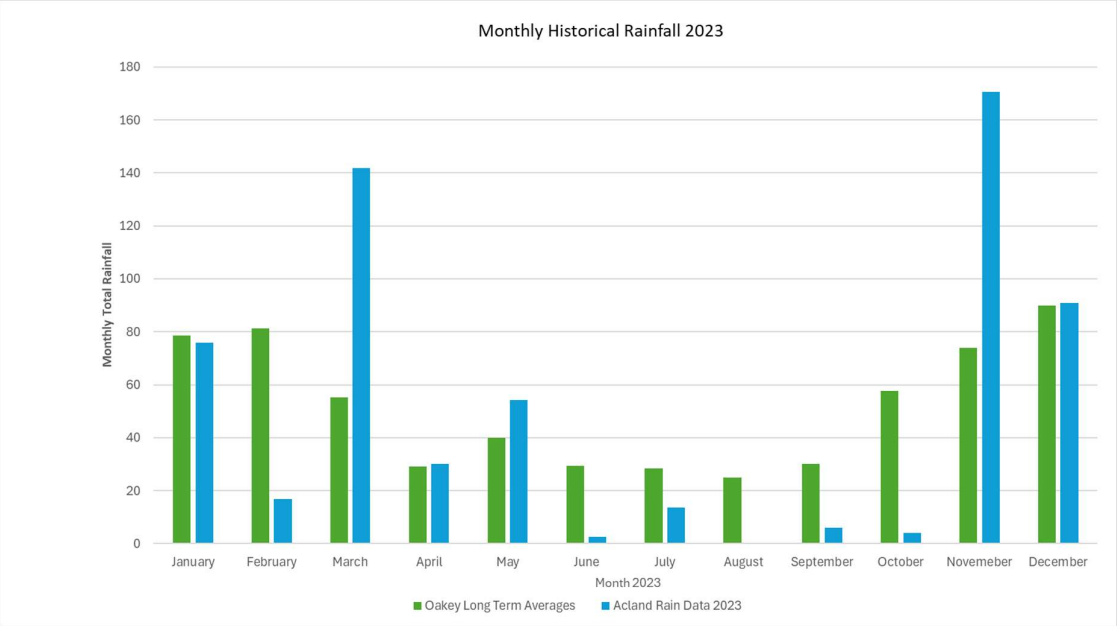
Bore Name	Bore Type [1]	Aquifer Monitored [2]
GW09A	Interpretation	Oakey Creek Alluvium
GW09B	Interpretation	Acland Coal Sequence
GW11B	Interpretation	Marburg Sandstone
18PcR2	Compliance	Balgowan Coal Sequence
18PbR2	Compliance	Main Range Volcanics
82PcR	Compliance	Acland Coal Sequence
132WBR	Interpretation	Balgowan Coal Sequence
133WBR	Interpretation	Balgowan Coal Sequence
BCS3	Compliance	Balgowan Coal Sequence
BCS4	Compliance	Balgowan Coal Sequence
LCA1	Compliance	Lagoon Creek Alluvium
LCA2	Compliance	Lagoon Creek Alluvium
111PgC Lower	Compliance	Acland Coal Sequence
112PgC	Interpretation	Acland Coal Sequence
GW11A	Interpretation	Main Range Volcanics
3307WB	Interpretation	Mine Pit Backfill
GW07B	Interpretation	Acland Coal Sequence

2. 2023 Monitoring Results

2.1. Rainfall

Rainfall data was obtained from an on-site weather station at NAC Mine and the Oakey Aerodrome Site 041359 (BOM, 2023) located approximately 15 kilometres (km) south-southeast of NAC Mine. **Figure 1** below displays the mean total monthly rainfall at Oakey Aerodrome since 1970 and the total monthly rainfall at NAC for 2023 monitoring round. The on-site weather station recorded a rainfall total of 607.2 millimetres (mm) in 2023, indicating that NAC Mine experienced average rainfall overall when compared to the long-term total average annual rainfall for the area of 618.9 mm (BOM, 2023). However, **Figure 1** clearly indicates most of the rain fell in the months of March and November.

Figure 1 Historic Rainfall vs Actual 2023



2.2. Groundwater Levels

As part of the EA conditions, groundwater level monitoring is conducted by NAC staff monthly, with the results of this monitoring shown below in **Tables 2** (mTOC) and **Table 3** (mAHD) and on hydrographs **Figures 2 - 8**. Bores highlighted red in **Table 2** have been found to be unsuitable for monitoring due to age, damage or blockages. A replacement bore program is underway with new bore updates to EA Schedule D planned in the next EA amendment.

As per Conditions D11 (for ML50232) and D21 (ML50170 and ML50216) of the EA, groundwater levels are required to be compared to the reference levels and trigger level thresholds in Table D3 of the EA to assess compliance status. There were no exceedances of

the declining groundwater level triggers for the 2023 monitoring period for bores where trigger and reference levels have been developed.

Water level trends across the groundwater sequences varied in 2023. Slight decreases in the Main Range Volcanic Basalt were noted, bore 10PbR recorded a decrease of 3.31m over the 2023 period, however this is less than the EA trigger threshold of 5.79m **(Figure 2).**

The Balgowan Coal Sequence showed general increases, with bore 26PcR recording the highest rise of 1.18m over the monitoring period **(Figure 5)**.

Both slight decreases and increases were recorded the Acland Coal Sequence dependant on the location, variations across the 2023 period were all less than 0.4m change in either direction **(Figure 3 & 4).**

Table 2 Groundwater Level Data (meters Below Top of Casing)

	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Hole No.	16/01/23 & 17/01/23	13/2/23, 16/2/23, 21/2/23	20/03/23 - 24/03/23	12/04/23 - 14/04/2023	22/05/23 - 23/05/2023	29/06/2023, 4/07/2023, 5/07/2023, 6/07/2023	19/07/2023 - 21/07/2023	24/08/2023 - 1/09/2023	22/09/2023	31/10/2023	23/11/2023	13/12/2023
BMH1	12.949	13.568	14.135	14.386	14.822	15.111	15.213	15.465	15.61	15.78	15.84	15.94
CSMHR_A	71.554	71.565	71.440	71.425	DRY	11.49	71.512	71.554	71.5	71.5	71.6	71.41
CSMHR_B	94.346	94.312	94.320	94.25	94.201	94.001	93.995	94	93.9	93.76	93.456	93.4
BCS3			35.325	35.205	35.431	34.777	34.643	34.495	34.43	34.34	34.097	34.07
BCS4		37.436	37.484	37.442	37.59	37.61	37.612	37.632	37.6	37.61	37.455	37.36
LCA1	5.355	5.355	5.590	DRY	DRY	DRY	DRY	Dry	Dry	Dry	Dry	Dry
LCA2	dry	dry	7.905	DRY	DRY	DRY	DRY	Dry	Dry	Dry	Dry	Dry
10PbR	9.918	10.424	10.960	11.205	11.711	12.213	12.29	12.615	12.71	13.05	13.124	13.23
18pbr	15.486	15.737	15.759	15.111	15.799	16.224	16.44	16.782	16.98	17.18	17.17	17.02
18PbR2	16.389	16.819	17.005	16.578	17.21	17.338	17.56	17.889	18.12	18.37	18.36	18.2
18pcr	43.560	43.352	43.882	42.945	42.801	42.65	42.64	42.615	42.66	42.7	42.6	42.57
18PcR2			43.381	42.9	42.829	42.661	42.595	42.578	42.6	42.67	42.57	42.53
25PcR	72.216	72.199	72.204	72.125	72.319	72.175	72.215	72.272	72.21	72.22	Blocked	Blocked
26PcR	63.489	63.336	63.331	63.312	63.223	62.994	62.998	62.795	62.7	62.61	62.292	62.31
27PcR	47.905	47.874	47.610	47.699	47.762	47.557	47.512	47.444	47.38	47.12	46.94	
28PcR	26.499	26.189	26.131	26.181	26.192	26.006	26.003	25.924	25.86	25.79	25.8	25.61
81Pc	35.743	35.682	35.569	35.489	35.493	35.275	35.212					
82PcR	18.996	19.011	19.355	19.448	19.61	19.177	19.775	19.546	19.9	20.1	20.053	20.13
84PbR	8.363	8.625	9.850	9.096	9.449	9.635	9.716	10.013	10.23	10.15	10.15	10.48
109P	17.833	17.741	18.383	18.171	18.311	18.559	17.648	18.668	18.8	19.27	19.18	
111PCG_upperR							27.317	27.398	27.9	28.05	28.03	28.16
112PgC_R			61.690	50.944	51.262	51.005	51.033	51.069	51.04	51.05	51.06	51.02
113PcB	7.242	7.190	7.2	7.219	7.299	7.383	7.401	7.433	7.42	7.43	7.45	7.39
114Pc	53.976	53.871	53.842	53.764	53.886	53.885	53.92	53.87	53.81	53.75	53.75	53.74
116P	35.846	35.501	35.801	Inaccessable	35.965	35.994	35.884	35.826	35.8	35.76	35.63	35.62
118Pc	14.319	14.283	14.169	N/A	14.87	14.225	14.221	14.225	14.22	14.14	14.14	14.42
119Pc	16.303	16.268	16.311	16.259	16.312	16.222	16.294	16.201	16.18	16.14	16.15	16.13
132WbR	4.211	4.240	4.239	4.225	4.311	4.365	4.389	4.444	4.46	4.45	4.41	4.46
133WbR	17.906	17.594	14.557	17.481	17.551	17.501	17.553	17.522	17.58	17.55	17.45	17.43
2289 Low er	15.285	15.231	15.125	15.202	15.178	15.56	15.05	15.032	15.01	15.03	14.84	14.98
2291Pc	39.734	39.652	39.655	39.599	39.689	39.555	39.557	39.555	39.49	39.45	39.43	39.38
3307Ps	57.085	57.037					57.17	11.338	57.2	57.28	57.27	
3316Pc	23.405	23.352	23.333	23.264	23.285	23.303	23.301	23.296	23.34	23.34	23.252	23.23
4517Pc	29.401	29.5	29.601	29.622	29.762	29.678	29.683	29.752	29.82	30.04	30.042	30.25
4518Pc	12.488	12.328	12.450	12.456	12.644	12.625	12.63	12.667	12.68	12.71	12.592	12.64
GW05A	3.216	3.587	3.615	3.6	4.121	4.451	4.447	4.719	4.81	5.11	5.07	5.12
GW05B	49.785	49.686	99.610	49.519	49.566	49.551	49.559	49.535	49.54	49.44	49.39	49.35
GW06B	27.231	27.169	27.141	27.053	27.121	27.151	27.114	27.133	32.47	27.72	27.43	27.54
GW07B	57.068	57.061	58.369									
GW08C(3)	79.799	80.248	80.390	80.444	80.83	80.991	80.984	81.119	81.19	81.46	81.48	81.65
GW09A	16.183	16.088	16.000	15.913	16.129	15.997	15.943	15.985	16	15.94	15.86	15.96
GW09B	15.205	15.212	15.235	15.119	15.235	14.994	14.935	14.998	14.92	14.89	14.8	14.77
GW09C	14.988	14.977	15.119	15.989	15.893	14.997	14.942	14.94	14.93	14.86	14.74	14.72
GW10	43.665	43.695	43.612	43.531	43.672	43.555	43.422	43.401	43.35	43.35	43.3	43.34
GW11A	9.734	10.388	10.250									
GW11B	54.479	54.444	54.406	54.395	54.442	53.99	54.293	54.227	54.23	54.26	54.11	54.13
GW13B	29.399	29.345	29.342	29.296	29.41	29.435	29.444	29.447	29.46	29.53	29.52	29.39
GW15A	29.439	29.377	29.346	29.239	29.499	29.325	29.3	29.333	29.27	29.21	29.22	29.13
GW16A	15.769	15.679	15.788	15.657	15.823	15.776	15.778	15.772	15.74	15.78	15.69	15.67

Table 3 Groundwater Level Data (meters Australian Height Datum)

Hole No.	RL Casing	Jan-23 16/01/23 & 17/01/23	Feb-23 13/2/23, 16/2/23, 21/2/23	Mar-23 20/03/23 - 24/03/23	Apr-23 12/04/23 - 14/04/2023	May-23 22/05/23 - 23/05/2023	Jun-23 29/06/2023, 4/07/2023, 5/07/2023, 6/07/2023	Jul-23 19/07/2023 - 21/07/2023	Aug-23 24/08/2023 - 1/09/2023	Sep-23 22/09/2023	Oct-23 31/10/2023	Nov-23 23/11/2023	Dec-23 13/12/2023
BMH1	455.175	442.226	441.607	441.04	440.789	440.353	440.064	439.962	439.71	439.565	439.395	439.335	439.235
CSMHR_A	496.973	425.419	425.408	425.533	425.548	Dry	485.483	425.461	425.419	425.473	425.473	425.373	425.563
CSMHR_B	497.472	403.126	403.16	403.152	403.222	403.271	403.471	403.477	403.472	403.572	403.712	404.016	404.072
BCS3	436.705	#N/A	#N/A	401.38	401.5	401.274	401.928	402.062	402.21	402.275	402.365	402.608	402.635
BCS4	430.877	#N/A	393.441	393.393	393.435	393.287	393.267	393.265	393.245	393.277	393.267	393.422	393.517
LCA1	420.815	415.46	415.46	415.225	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LCA2	434.165	Dry	Dry	426.26	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
10PbR	438.175	428.257	427.751	427.215	426.97	426.464	425.962	425.885	425.56	425.465	425.125	425.051	424.945
18pbr	460.218	444.732	444.481	444.459	445.107	444.419	443.994	443.778	443.436	443.238	443.038	443.048	443.198
18PbR2	460.193	443.804	443.374	443.188	443.615	442.983	442.855	442.633	442.304	442.073	441.823	441.833	441.993
18pcr	460.178	416.618	416.826	416.296	417.233	417.377	417.528	417.538	417.563	417.518	417.478	417.578	417.608
18PcR2	460.193	#N/A	#N/A	416.812	417.293	417.364	417.532	417.598	417.615	417.593	417.523	417.623	417.663
25PcR	498.710	426.493	426.51	426.505	426.584	426.39	426.534	426.494	426.437	426.499	426.489	Blocked	Blocked
26PcR	498.197	434.708	434.861	434.866	434.885	434.974	435.203	435.199	435.402	435.497	435.587	435.905	435.887
27PcR	484.985	437.08	437.111	437.375	437.286	437.223	437.428	437.473	437.541	437.605	437.865	438.045	#N/A
28PcR	457.138	430.639	430.949	431.007	430.957	430.946	431.132	431.135	431.214	431.278	431.348	431.338	431.528
81Pc	450.120	414.377	414.438	414.551	414.631	414.627	414.845	414.908					
82PcR	441.439	422.443	422.428	422.084	421.991	421.829	422.262	421.664	421.893	421.539	421.339	421.386	421.309
84PbR	448.728	440.365	440.103	438.878	439.632	439.279	439.093	439.012	438.715	438.498	438.578	438.578	438.248
109P	479.167	461.334	461.426	460.784	460.996	460.856	460.608	461.519	460.499	460.367	459.897	459.987	#N/A
111PgCLower_r	431.43	#N/A	405.987	405.913	405.667	404.587	404.032	403.794	403.711	403.352	403.112	403.12	403.002
112PgC_R	441.902	#N/A	#N/A	380.212	390.958	390.64	390.897	390.869	390.833	390.862	390.852	390.842	390.882
113PcB	414.580	407.338	407.39	407.38	407.361	407.281	407.197	407.179	407.147	407.16	407.15	407.13	407.19
114Pc	436.144	382.168	382.273	382.302	382.38	382.258	382.259	382.224	382.274	382.334	382.394	382.394	382.404
116P	426.076	390.23	390.575	390.275	No access	390.111	390.082	390.192	390.25	390.276	390.316	390.446	390.456
118Pc	407.380	393.061	393.097	393.211	No access	392.51	393.155	393.159	393.155	393.16	393.24	393.24	392.96
119Pc	408.300	391.997	392.032	391.989	392.041	391.988	392.078	392.006	392.099	392.12	392.16	392.15	392.17
132WbR	425.973	421.762	421.733	421.734	421.748	421.662	421.608	421.584	421.529	421.513	421.523	421.563	421.513
133WbR	438.72	420.809	421.121	424.158	421.234	421.164	421.214	421.162	421.193	421.135	421.165	421.265	421.285
2289 Lower	447.640	432.355	432.409	432.515	432.438	432.462	432.079	432.595	432.608	432.63	432.61	432.8	432.66
2291Pc	461.313	421.579	421.661	421.658	421.714	421.624	421.758	421.756	421.758	421.823	421.863	421.883	421.933
3307Ps	508.474	451.389	451.437	#N/A	#N/A	450.849	450.775	451.304	497.136	451.274	451.194	451.204	
3316Pc	434.232	410.827	410.88	410.899	410.968	410.947	410.929	410.931	410.936	410.892	410.892	410.98	411.002
4517Pc	436.7	407.299	407.2	407.099	407.078	406.938	407.022	407.017	406.948	406.88	406.66	406.658	406.45
4518Pc	419.99	407.502	407.662	407.54	407.534	407.346	407.365	407.36	407.323	407.31	407.28	407.398	407.35
GW05A	461.556	458.34	457.969	457.941	457.956	457.435	457.105	457.109	456.837	456.746	456.446	456.486	456.436
GW05B	461.286	411.501	411.6	361.676	411.767	411.72	411.735	411.727	411.751	411.746	411.846	411.896	411.936
GW06B	429.392	402.161	402.223	402.251	402.339	402.271	402.241	402.278	402.259	396.922	401.672	401.962	401.852
GW07B	464.42	407.352	407.359	406.051									
GW08C(3)	409.31	329.511	329.062	328.92	328.866	328.48	328.319	328.326	328.191	328.12	327.85	327.83	327.66
GW09A	407.412	391.229	391.324	391.412	391.499	391.283	391.415	391.469	391.427	391.412	391.472	391.552	391.452
GW09B	407.647	392.442	392.435	392.412	392.528	392.412	392.653	392.712	392.649	392.727	392.757	392.847	392.877
GW09C	407.792	392.804	392.815	392.673	391.803	391.899	392.795	392.85	392.852	392.862	392.932	393.052	393.072
GW10	446.902	403.237	403.207	403.29	403.371	403.23	403.347	403.48	403.501	403.552	403.552	403.602	403.562
GW11A	463.389	453.655	453.001	453.139									
GW13B	429.782	400.383	400.437	400.44	400.486	400.372	400.347	400.338	400.335	400.322	400.252	400.262	400.392
GW15A	448.92	419.481	419.543	419.574	419.681	419.421	419.595	419.62	419.587	419.65	419.71	419.7	419.79
GW16A	466.53	450.761	450.851	450.742	450.873	450.707	450.754	450.752	450.758	450.79	450.75	450.84	450.86

Figure 2 Basalt Main Range Volcanics Bore Hydrograph 2023

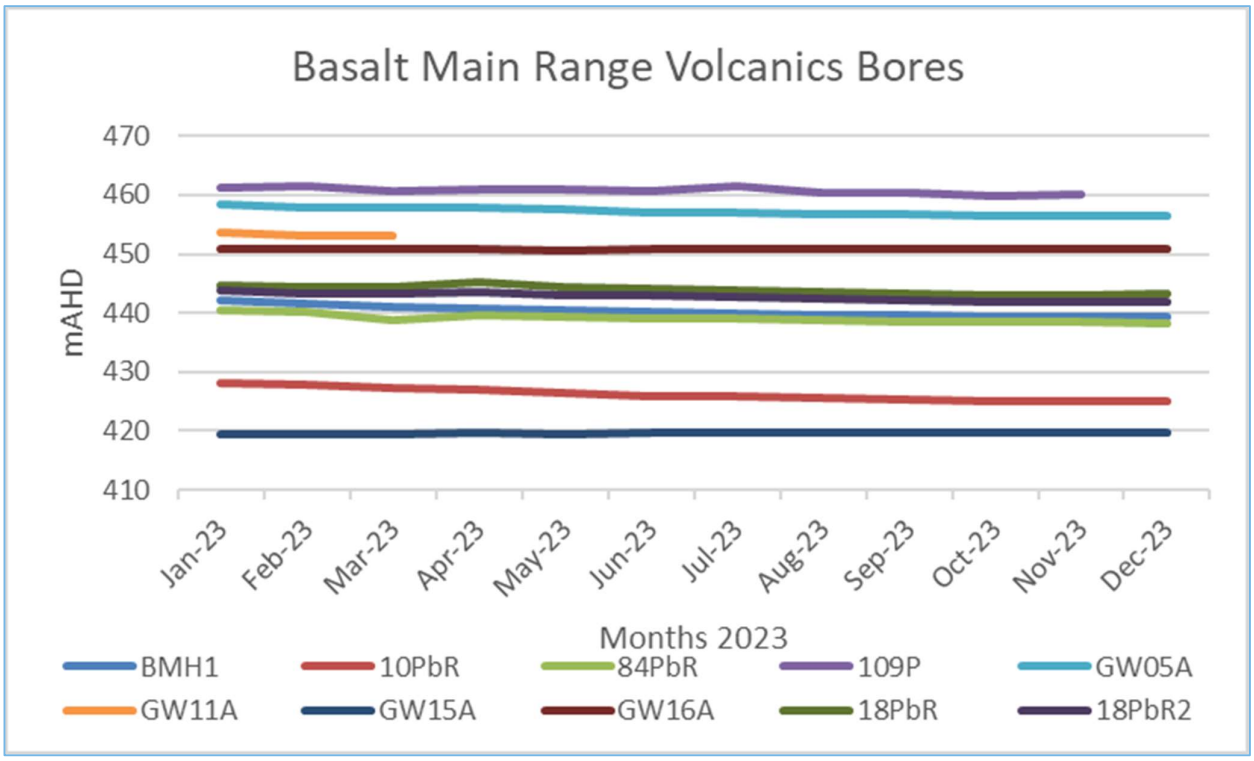


Figure 3 Acland Coal Sequence Bore Hydrograph 2023

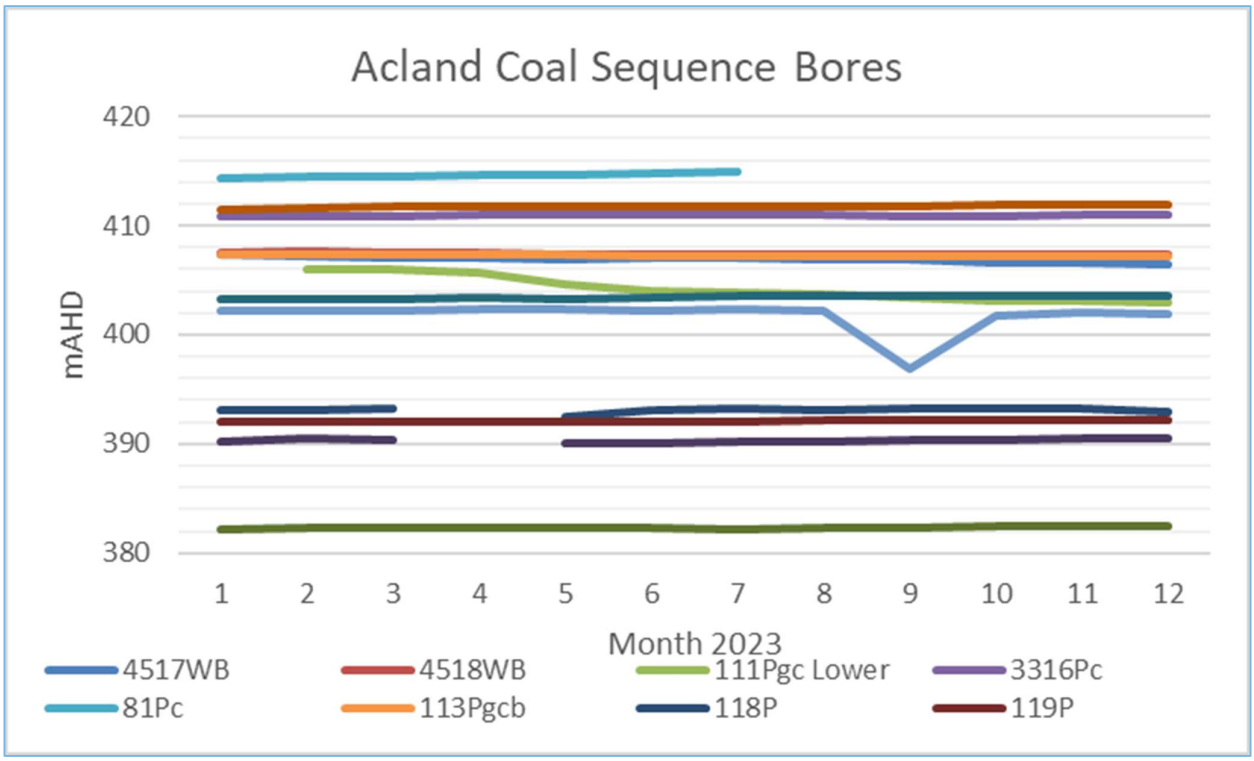


Figure 4 Acland Coal Sequence Bore Hydrograph 2023

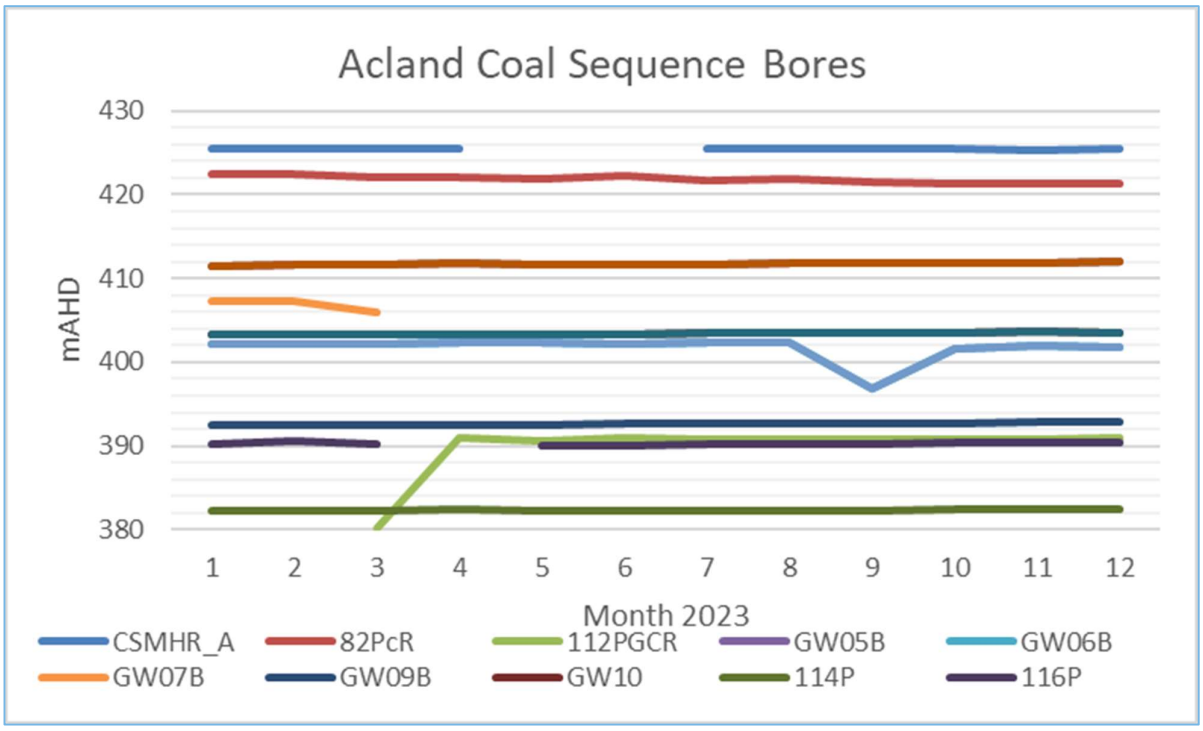


Figure 5 Balgowan Coal Sequence Bore Hydrograph 2023

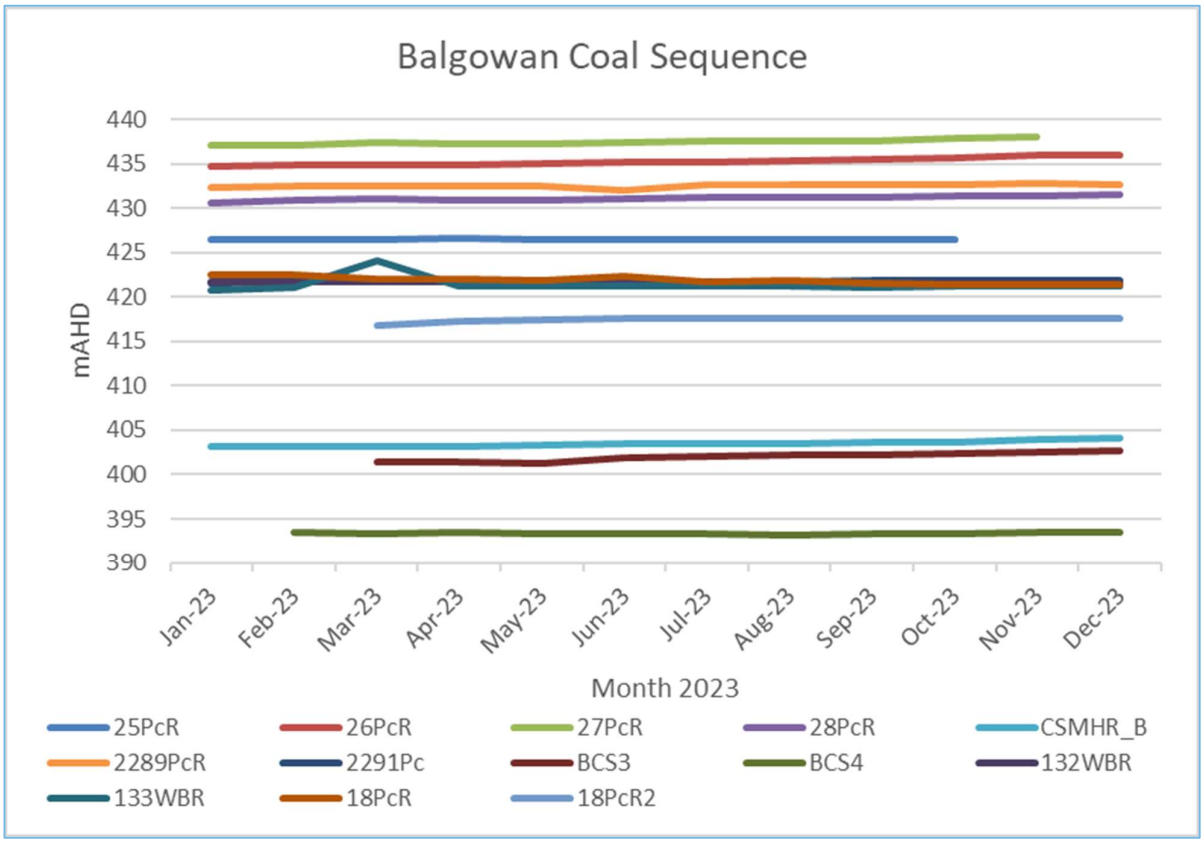


Figure 6 Marburg Sandstone Bore Hydrograph 2023

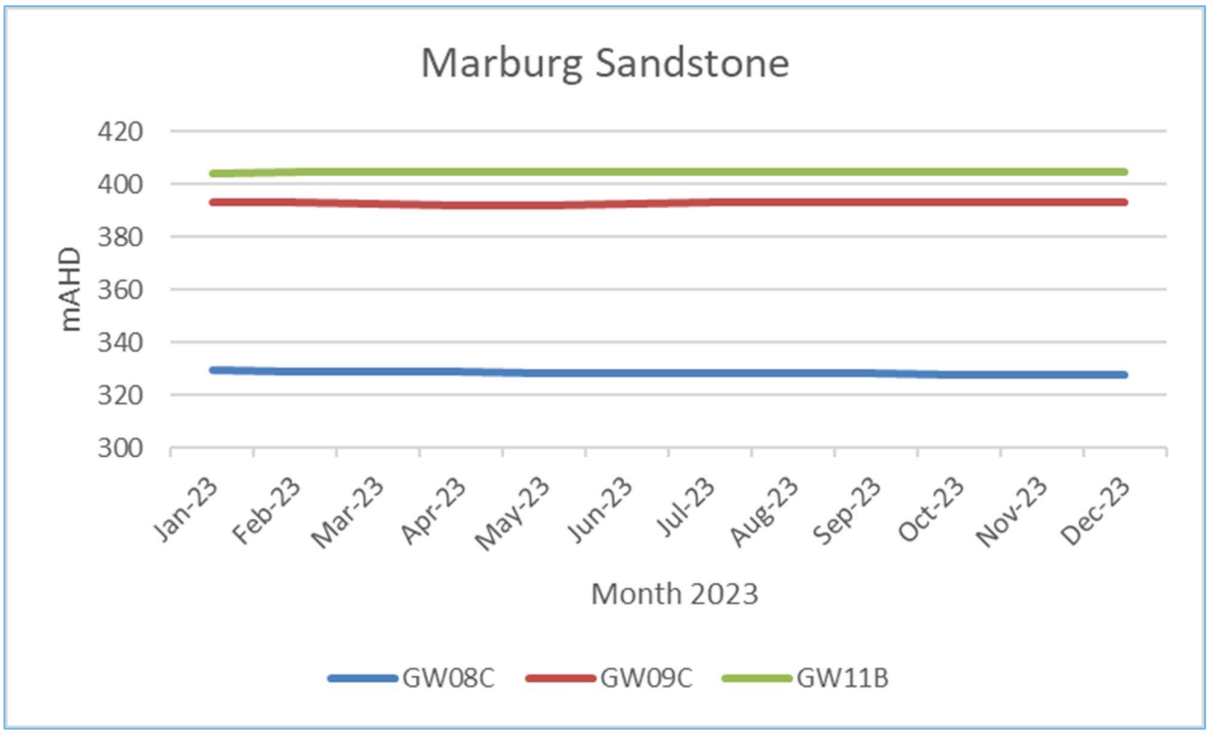


Figure 7 Oakey Creek Alluvium Bore Hydrograph 2023

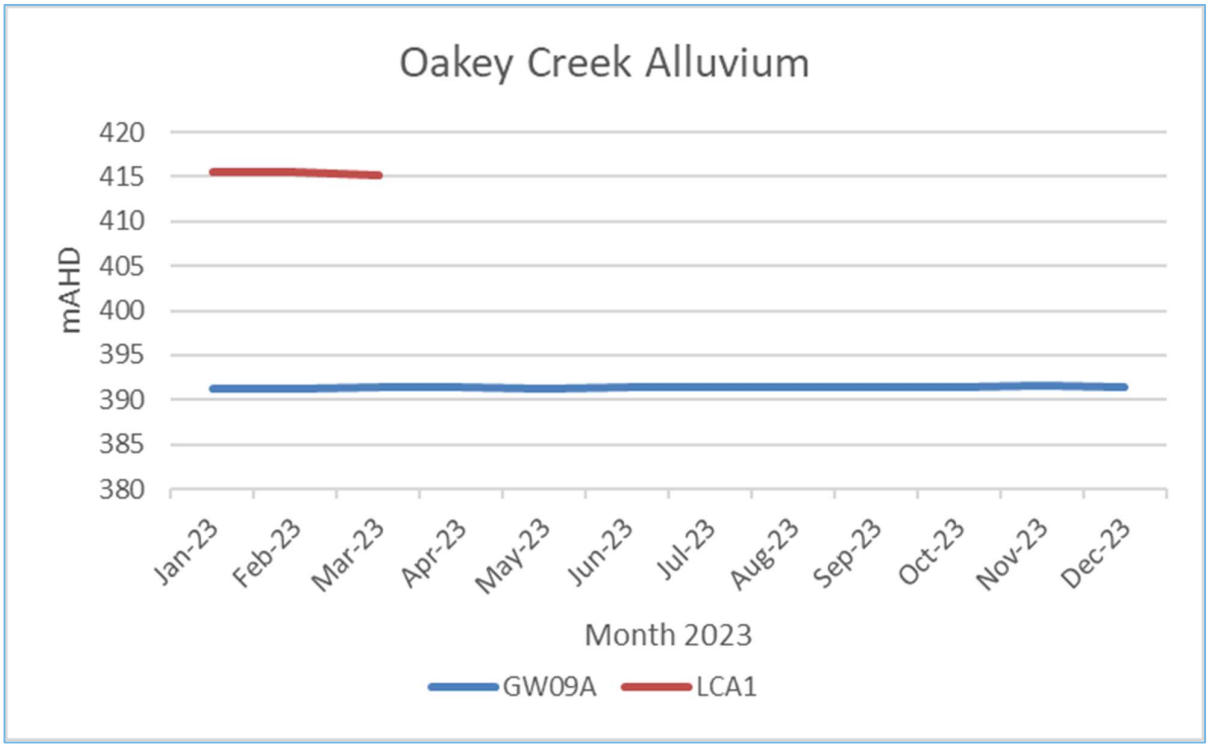
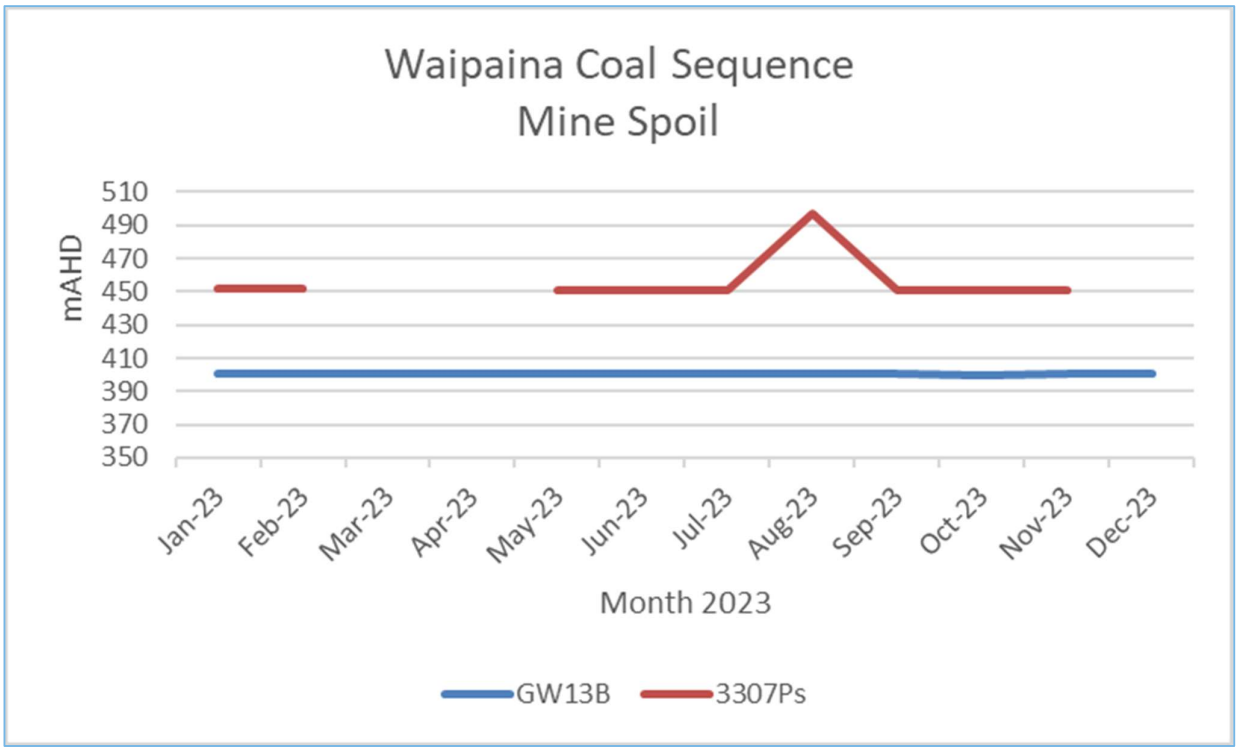


Figure 8 Waipaina coal Sequence Mine Spoil Bore Hydrograph 2023



2.3. Groundwater Quality

Groundwater quality parameters and analytical results with comparison to the EA trigger limits are shown for each monitoring bore, grouped by their respective aquifer, are shown in **Tables 4 to Table 46**.

Many of these bores appear in both Table D1 and Table D4, and therefore are subject to two sets of triggers and limits. In most cases, an exceedance of only one set of limits occurs, leading to reporting which may be unavoidably confusing.

Where exceedances have been identified, an investigation and written report was provided by our third-party consultants SLR. These reports are reproduced in Appendix 2.

The EA groundwater quality trigger limits are detailed in Schedule D, Tables D2 (for compliance bores listed under Table D1 for ML60232) and Table D5 (for compliance bores listed under Table D4 for ML50170 and ML 50216).

2.3.1. Basalt Monitoring Bore Groundwater Quality

A total of nine (9) groundwater bores were sampled within the Basalt, bore 18PbR has been decommissioned for sampling since 2022. A summary of both groundwater quality parameters and analytical results are provided in Table 4 to Table 12 respectively.

There were no exceedances of EA (EPML00335713) Table D2 (ML50232 – dark orange) trigger limits for the Basalt compliance monitoring bores. Exceedances of EA on 3

occasions triggering investigation (EPML00335713) Table D5 (ML50170 and ML50216) trigger limits during 2023 were noted for the following.

- 10PBR – NO_3 (as N)
- 18PbR2 - pH

Table 4 Groundwater Bore No. 10PbR (Basalt, Main Range Volcanics)

Groundwater Bore No. 10PbR (Basalt, Main Range Volcanics)						
Parameter	**Units**	**Groundwater Limits**	**23/01/2023 12:47**	**17/05/2023 8:10**	**01/09/2023 9:05**	**18/12/2023 10:30**
pH (Field)	pH units	6.5-7.5	6.78	6.77	6.78	6.93
EC (Field)	µS/cm	-	3249	2921	3261	2950
Temperature (Field)	Degrees C	-	23.9	20.2	22.2	28.1
Eh/Redox (Field)	(mV)	-	235	121	9.1	
DO (Field)	mg/L	-	2	2.44	2.22	
pH	pH units	-	7.59	7.99	8.11	7.92
EC	µS/cm	7460, 3346	2990	3100	3150	3120
TDS	mg/L	5000	2230	2130	2210	2030
Major Ions						
Ca	mg/L	1000	204	187	226	210
Mg	mg/L	NA	167	164	174	167
Na	mg/L	NA	184	175	183	173
K	mg/L	NA	2	2	2	2
Cl	mg/L	NA	781	740	690	679
HCO_3	mg/L	NA	501	340	403	387
SO_4	mg/L	1000, 57.7	54	51	51	61
Minor Ions						
F	mg/L	0.5	0.5	0.4	0.5	0.5
Total N	mg/L	NA	59.3	66.1	58	62.1
TKN	mg/L	NA	6	6.6	5.2	6.0
NO_x	mg/L	NA	53.3	59.5	58	56.1
NO_2	mg/L	30	<0.01	<0.01	<0.01	<0.01
NO_3	mg/L	400, 50.7	53.3	59.5	52.8	55.6
NH_3	mg/L	NA	<0.01	0.03	<0.1	<0.20
Dissolved Metals						
Al	µg/L	5000, 55	<10	<10	20	<10
As	µg/L	50, 13	<1	<1	<1	<1
Cu	µg/L	1000, 1.4	<1	<1	<1	<1
Fe	µg/L	50	<50	<50	<50	<50
Mn	µg/L	20	1	<1	<1	<1
Se	µg/L	20, 11	<10	<10	<10	<10
Ba	µg/L	NA	14	12	15	

Table 5 Groundwater Bore No. 84PbR (Basalt, Main Range Volcanics)

Groundwater Bore No. 84PbR (Basalt, Main Range Volcanics)					
Parameter	**Units**	**Groundwater Limits**	**18/01/2023 15:26**	**17/05/2023 13:25**	**29/08/2023 12:32**
pH (Field)	pH units	6.5-7.5	6.63	7.07	6.95
EC (Field)	µS/cm	-	1870	1573	1621
Temperature (Field)	Degrees C	-	24	20.7	21.2
Eh/Redox (Field)	(mV)	-	223	77.6	-4.2
DO (Field)	mg/L	-	0.16	0	0.06
pH	pH units	-	8.16	8.29	8.2
EC	µS/cm	7460, 2568	1560	1660.0	1560
TDS	mg/L	5000	1270	1160.0	1060
Major Ions					
Ca	mg/L	1000	131	100.0	103
Mg	mg/L	NA	97	87.0	78
Na	mg/L	NA	124	124	115
K	mg/L	NA	2	2	2
Cl	mg/L	NA	303	290	245
HCO_3	mg/L	NA	406	316	341
SO_4	mg/L	1000, 338	228	211	173
Minor Ions					
F	mg/L	0.2	0.2	0.2	0.2
Total N	mg/L	NA	0.9	0.3	<0.1
TKN	mg/L	NA	0.1	0.1	<0.1
NO_x	mg/L	NA	0.8	0.217	0.06
NO_2	mg/L	30	0.03	<0.01	<0.01
NO_3	mg/L	400, 16.9	0.77	0.3	0.06
NH_3	mg/L	NA	<0.01	<0.01	0.01
Dissolved Metals					
Al	µg/L	5000, 55	<10	<10	<10
As	µg/L	50, 13	<1	<1	2
Cu	µg/L	1000, 1.4	2	<1	<1
Fe	µg/L	50	<50	<50	<50
Mn	µg/L	20	13	4.0	14
Se	µg/L	20, 11	<10	<10	<10
Ba	µg/L	NA	6	3	40

Table 6 Groundwater Bore No. BMH1 (Basalt, Main Range Volcanics)

Groundwater Bore No. BMH1 (Basalt, Main Range Volcanics) (continued)					
Parameter	**Units**	**Groundwater Limits**	**18/01/2023 14:29**	**12/05/2023 11:00**	**29/09/2023 13:24**
pH (Field)	pH units	6.0-8.5	6.47	6.71	6.66
EC (Field)	µS/cm	-	1489	1330	1421
Temperature (Field)	Degrees C	-	22.8	20.7	22.1
Eh/Redox (Field)	(mV)	-	219	122.4	32.2
DO (Field)	mg/L	-	1.81	1.23	0.97
pH (Lab)	pH units	-	7.48	8.17	7.63
EC (Lab)	µS/cm	7460, 1440	1260	1200	1390
TDS (Lab)	mg/L	5000	897	819	807
Major Ions					
Ca	mg/L	1000	102	84	90
Mg	mg/L	NA	100	91	90
Na	mg/L	NA	82	81	85
K	mg/L	NA	1	1	1
Cl	mg/L	NA	69	77	79
HCO_3	mg/L	NA	813	651	619
SO_4	mg/L	1000, 18	14	13	10
Minor Ions					
F	mg/L	0.4	0.3	0.2	0.3
Total N	mg/L	NA	12.3	13	11.3
TKN	mg/L	NA	<0.5	1.1	0.7
NO_x	mg/L	NA	12.3	11.9	10.6
NO_2	mg/L	30	<0.01	<0.01	<0.01
NO_3	mg/L	400, 16.9	12.3	11.9	10.6
NH_3	mg/L	NA	0.05	<0.01	<0.01
Dissolved Metals					
Al	µg/L	5000, 55	<10	<10	<10
As	µg/L	50, 13	<1	<1	<1
Cu	µg/L	1000, 1.4	8	<1	<1
Fe	µg/L	220	<50	<50	<50
Mn	µg/L	20	<1	<1	<1
Se	µg/L	20, 11	<10	<10	<10
Ba	µg/L	NA	16	11	10

Table 7 Groundwater Bore No. 109P (Basalt, Main Range Volcanics)

Groundwater Bore No. 109P (Basalt, Main Range Volcanics) (Continued)					
Parameter	**Units**	**Groundwater Limits**	**18/01/2023 12:28**	**12/05/2023 9:50**	
pH (Field)	pH units	NA	7.53	7.75	
EC (Field)	µS/cm	-	549	499.5	
Temperature (Field)	Degrees C	-	23.3	21	
Eh/Redox (Field)	(mV)	-	215	127.5	
DO (Field)	mg/L	-	0.16	0.01	
pH (Lab)	pH units	-	8.45	8.45	
EC (Lab)	µS/cm	NA	537	528	
TDS (Lab)	mg/L	NA	342	331	
Major Ions					
Ca	mg/L	NA	14	12	
Mg	mg/L	NA	1	<1	
Na	mg/L	NA	114	112	
K	mg/L	NA	1	1	
Cl	mg/L	NA	22	22	
HCO_3	mg/L	NA	278	231	
SO_4	mg/L	NA	6	6	
Minor Ions					
F	mg/L	NA	0.3	0.3	
Total N	mg/L	NA	<0.1	0.1	
TKN	mg/L	NA	<0.1	0.1	
NO_x	mg/L	NA	0.07	<0.01	
NO_2	mg/L	NA	<0.01	<0.01	
NO_3	mg/L	NA	0.07	<0.01	
NH_3	mg/L	NA	0.02	<0.01	
Dissolved Metals					
Al	µg/L	NA	10	<10	
As	µg/L	NA	<1	<1	
Cu	µg/L	NA	4	8	
Fe	µg/L	NA	<50		
Mn	µg/L	NA	3	<50	
Se	µg/L	NA	<10	<10	
Ba	µg/L	NA	1	2	

Table 8 Groundwater Bore No. GW05A (Basalt, Main Range Volcanics)

Groundwater Bore No. GW05A (Basalt, Main Range Volcanics) (continued)					
Parameter	**Units**	**Groundwater Limits**	**18/01/2023 8:30**	**12/05/2023 7:54**	**30/08/2023 8:55**
pH (Field)	pH units	NA	6.95	6.77	6.79
EC (Field)	µS/cm	-	1282	1140	1294
Temperature (Field)	Degrees C	-	22.4	19.5	20.8
Eh/Redox (Field)	(mV)	-	174	124.1	63.7
DO (Field)	mg/L	-	3.62	4	4.89
pH (Lab)	pH units	-	8.55	8.09	8.1
EC (Lab)	µS/cm	NA	1020	1190	1240
TDS (Lab)	mg/L	NA	616	746	774
Major Ions					
Ca	mg/L	NA	24	78	87
Mg	mg/L	NA	4	56	59
Na	mg/L	NA	211	118	132
K	mg/L	NA	3	1	1
Cl	mg/L	NA	125	69	71
HCO_3	mg/L	NA	405	505	568
SO_4	mg/L	NA	22	15	15
Minor Ions					
F	mg/L	NA	0.1	0.8	0.9
Total N	mg/L	NA	0.2	12.6	12.8
TKN	mg/L	NA	0.2	1.1	1.9
NO_x	mg/L	NA	<0.01	11.5	10.9
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	11.5	10.9
NH_3	mg/L	NA	0.12	<0.01	<0.01
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	<50	<50	<50
Mn	µg/L	NA	10	<1	<1
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	198	48	47

Table 9 Groundwater Bore No. GW11AR (Basalt, Main Range Volcanics)

Groundwater Bore No. GW11AR (Basalt, Main Range Volcanics) (continued)					
Parameter	Units	Groundwater Limits	18/01/2023 10:14	19/05/2023 8;25	28/08/2023 14:32
pH (Field)	pH units	NA	7.26	7	6.91
EC (Field)	µS/cm	-	1298	1407	1638
Temperature (Field)	Degrees C	-	24.3	19.5	23.1
Eh/Redox (Field)	(mV)	-	175	60.4	50.2
DO (Field)	mg/L	-	0.13	5.67	3.1
pH (Lab)	pH units	-	8.15	8.16	7.70
EC (Lab)	µS/cm	NA	1230	1550	1580
TDS (Lab)	mg/L	NA	784	879	881
Major Ions					
Ca	mg/L	NA	53	81	79
Mg	mg/L	NA	12	61	59
Na	mg/L	NA	196	186	177
K	mg/L	NA	6	2	2
Cl	mg/L	NA	320	220	195
HCO_3	mg/L	NA	174	492	475
SO_4	mg/L	NA	22	34	33
Minor Ions					
F	mg/L	NA	0.3	1.2	1.3
Total N	mg/L	NA	0.1	9.9	10.2
TKN	mg/L	NA	0.1	1.5	2
NO_x	mg/L	NA	<0.01	8.42	8.17
NO_2	mg/L	NA	<0.01	<0.1	<0.01
NO_3	mg/L	NA	<0.01	8.42	8.15
NH_3	mg/L	NA	<0.01	<0.01	0.04
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	3
Fe	µg/L	NA	110	<50	80
Mn	µg/L	NA	56	8	52
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	25	569	240

Table 10 Groundwater Bore No. GW15A (Basalt, Main Range Volcanics)

Groundwater Bore No. GW15A (Basalt, Main Range Volcanics) (continued)					
Parameter	Units	Groundwater Limits	31/01/2023 13:29	11/05/2023 8:25	05/09/2023 9:59
pH (Field)	pH units	NA	7.13	7.35	7.25
EC (Field)	µS/cm	-	1938	1764	1963
Temperature (Field)	Degrees C	-	24.7	20.3	23.1
Eh/Redox (Field)	(mV)	-	151	-133.6	-49.4
DO (Field)	mg/L	-	0.07	0	0.03
pH (Lab)	pH units	-	7.84	8.19	8.17
EC (Lab)	µS/cm	NA	1620	1810	1880
TDS (Lab)	mg/L	NA	1170	1110	1050
Major Ions					
Ca	mg/L	NA	107	87	103
Mg	mg/L	NA	73	69	70
Na	mg/L	NA	197	170	187
K	mg/L	NA	14	13	14
Cl	mg/L	NA	426	436	429
HCO_3	mg/L	NA	479	367	388
SO_4	mg/L	NA	28	27	27
Minor Ions					
F	mg/L	NA	0.3	0.3	0.3
Total N	mg/L	NA	0.2	0.2	0.1
TKN	mg/L	NA	0.2	0.2	0.1
NO_x	mg/L	NA	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.17	0.15	0.2
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	1360	1280	1300
Mn	µg/L	NA	173	165	172
Se	µg/L	NA	<10	10	<10
Ba	µg/L	NA	455	461	447

Table 11 Groundwater Bore No. GW16A (Basalt, Main Range Volcanics)

Groundwater Bore No. GW16A (Basalt, Main Range Volcanics) (continued)					
Parameter	**Units**	**Groundwater Limits**	**08/02/2023 11:25**	**15/05/2023 15;30**	**30/08/2023** 10:22
pH (Field)	pH units	NA	6.61	6.84	6.76
EC (Field)	µS/cm	-	1789	1554	1848
Temperature (Field)	Degrees C	-	24.5	20	23.5
Eh/Redox (Field)	(mV)	-	167	45.4	72.2
DO (Field)	mg/L	-	0	0.64	0.46
pH (Lab)	pH units	-	7.89	8.11	8.12
EC (Lab)	µS/cm	NA	1710	1590	1710
TDS (Lab)	mg/L	NA	1020	963	993
Major Ions					
Ca	mg/L	NA	106	91	111
Mg	mg/L	NA	89	80	86
Na	mg/L	NA	156	142	162
K	mg/L	NA	9	8	10
Cl	mg/L	NA	208	268	321
HCO_3	mg/L	NA	769	502	543
SO_4	mg/L	NA	12	14	16
Minor Ions					
F	mg/L	NA	0.3	0.3	0.4
Total N	mg/L	NA	2.2	1.5	1.1
TKN	mg/L	NA	0.4	0.2	0.2
NO_x	mg/L	NA	1.76	1.34	0.91
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	1.76	1.34	0.91
NH_3	mg/L	NA	0.11	0.3	<0.01
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	3	<1	<1
Fe	µg/L	NA	<50	<50	<50
Mn	µg/L	NA	2	2	1
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	111	122	120

Table 12 Groundwater Bore No.18PbR2 (Basalt Main Range Volcanics)

Groundwater Bore No. 18PbR2 (Basalt, Main Range Volcanics)						
Parameter	**Units**	**Groundwater Limits**	**26/01/2023 8:36**	**15/05/2023 11:23**	**29/08/2023 10:47**	**18/12/2023 12:00**
pH (Field)	pH units	6.5-7.5	7.77	7.62	7.67	7.94
EC (Field)	µS/cm	-	841	636	731	634
Temperature (Field)	Degrees C	-	23.8	19.7	17.9	24.3
Eh/Redox (Field)	(mV)	-	205	78.1	-27.8	
DO (Field)	mg/L	-	0.65	0.43	0.42	
pH (Lab)	pH units	-	7.98	7.77	7.46	7.57
EC (Lab)	µS/cm	3.456	819	698	727	626
TDS (Lab)	mg/L	NA	490	393	396	407
Major Ions						
Ca	mg/L	NA	15	9	7	6
Mg	mg/L	NA	4	2	3	1
Na	mg/L	NA	148	139	127	117
K	mg/L	NA	2	1	1	1
Cl	mg/L	NA	203	184	190	162
HCO_3	mg/L	NA	88	49	41	48
SO_4	mg/L	33	45	33	29	6
Minor Ions						
F	mg/L	0.4	0.2	0.3	0.3	0.3
Total N	mg/L	NA	0.4	0.1	<0.1	0.4
TKN	mg/L	NA	0.2	0.1	<0.1	0.4
NO_x	mg/L	NA	0.25	<0.01	0.01	<0.01
NO_2	mg/L	NA	0.06	<0.01	<0.01	<0.01
NO_3	mg/L	6.6	0.19	<0.01	0.01	<0.01
NH_3	mg/L	NA	0.06	<0.01	<0.01	<0.01
Dissolved Metals						
Al	µg/L	55	20	20	20	20
As	µg/L	13	2	3	4	3
Cu	µg/L	14	<1	<1	<1	<1
Fe	µg/L	70	<50	<50	<50	<50
Mn	µg/L	20	4	4	<1	25
Se	µg/L	11	<10	<10	<10	<10
Ba	µg/L	NA	18	12	7	

2.3.2. Acland Coal Sequence Monitoring Bore Groundwater Quality

A total of 17 groundwater bores were sampled within the Acland Coal Sequence. A summary of both groundwater quality parameters and analytical results are provided in Table 12 to Table 24.

Exceedances of EA (EPML00335713) Table D2 (ML50232 – dark orange) and EA (EPML00335713) Table D5 (ML50170 and ML50216) trigger limits during 2023 on 3 occasions triggering investigation were noted for the following.

- 4518WB - Sulfate as SO_4, Iron
- 82PcR - EC, TDS (Table D2), Sulfate as SO_4, Iron, Manganese

Table 13 Groundwater Bore No. 4517WB (Acland Coal Sequence)

Groundwater Bore No. 4517WB (Acland Coal Sequence)					
Parameter	**Units**	**Groundwater Limits**	**23/01/2023 13:32**	**19/05/2023 11:37**	**01/09/2023 8:32**
pH (Field)	pH units	6.5-7.5	6.98	7.35	7.4
EC (Field)	µS/cm	-	1519	1334	1320
Temperature (Field)	Degrees C	-	22.8	20.7	21.2
Eh/Redox (Field)	(mV)	-	186	-95.4	-29.2
DO (Field)	mg/L	-	0.11	0	0.29
pH (Lab)	pH units	-	7.63	8.15	8.32
EC (Lab)	µS/cm	7460, 3084	1460	1480	1540
TDS (Lab)	mg/L	5000	884	844	858
Major Ions					
Ca	mg/L	1000	31	30	26
Mg	mg/L	NA	9	9	7
Na	mg/L	NA	274	290	292
K	mg/L	NA	3	3	3
Cl	mg/L	NA	359	336	332
HCO_3	mg/L	NA	341	255	266
SO_4	mg/L	1000, 35	25	24	21
Minor Ions					
F	mg/L	0.33	0.1	<0.1	0.1
Total N	mg/L	NA	0.4	0.4	0.4
TKN	mg/L	NA	0.4	0.4	0.4
NO_x	mg/L	NA	0.02	<0.01	<0.01
NO_2	mg/L	30	<0.01	<0.01	<0.01
NO_3	mg/L	400, 5	0.02	<0.01	<0.01
NH_3	mg/L	NA	0.29	0.33	0.4
Dissolved Metals					
Al	µg/L	5000, 55	<10	<10	20
As	µg/L	50, 13	2	<1	6
Cu	µg/L	1000, 1.4	<1	<1	<1
Fe	µg/L	800	470	350	310
Mn	µg/L	87	21	20	19
Se	µg/L	20, 11	<10	<10	<10
Ba	µg/L	NA	630	569	602

Table 14 Groundwater Bore No. 4518WB (Acland Coal Sequence)

Groundwater Bore No. 4518WB (Acland Coal Sequence) Cont.						
Parameter	**Units**	**Groundwater Limits**	**23/01/2023 12:03**	**10/05/2023 7:50**	**01/09/2023 9:52**	**18/12/2023 9:30**
pH (Field)	pH units	6.5-7.5	7.01	6.96	7	7.09
EC (Field)	µS/cm	-	3803	3412	3693	3190
Temperature (Field)	Degrees C	-	22.2	19.9	21.4	29.7
Eh/Redox (Field)	(mV)	-	109	-68.1	-55.5	
DO (Field)	mg/L	-	-	1.7	0.01	
pH (Lab)	pH units	-	7.7	8.14	8.16	8.1
EC (Lab)	µS/cm	7460, 4065	3500	2790	3620	3610
TDS (Lab)	mg/L	5000	2480	2320	2150	2350
Major Ions						
Ca	mg/L	1000	131	120	148	120
Mg	mg/L	NA	101	99	104	80
Na	mg/L	NA	495	436	467	468
K	mg/L	NA	4	4	4	4
Cl	mg/L	NA	1030	987	897	858
HCO_3	mg/L	NA	595	441	458	440
SO_4	mg/L	1000, 48	99	89	74	89
Minor Ions						
F	mg/L	0.4	0.4	0.4	0.4	0.4
Total N	mg/L	NA	0.4	0.4	0.4	1.3
TKN	mg/L	NA	0.4	0.4	0.4	1.3
NO_x	mg/L	NA	<0.01	0.02	<0.01	<0.01
NO_2	mg/L	30	<0.01	<0.01	<0.01	<0.01
NO_3	mg/L	400, 5	<0.01	0.02	<0.01	<0.01
NH_3	mg/L	NA	0.31	0.32	0.34	0.46
Dissolved Metals						
Al	µg/L	5000, 55	<10	<10	<10	<10
As	µg/L	50, 13	<1	<1	<1	2
Cu	µg/L	1000, 33	<1	<1	<1	<1
Fe	µg/L	1600	2470	2650	2430	1470
Mn	µg/L	87	55	54	52	70
Se	µg/L	20, 11	<10	<10	<10	<10
Ba	µg/L	NA	275	278	276	278

Table 15 Groundwater Bore No. 111PgC LowerR (Acland Coal Sequence)

Groundwater Bore No. 111PgC Lower_R (Acland Coal Sequence)						
Parameter	**Units**	**Groundwater Limits**	**25/01/2023 14:50**	**18/05/2023 14:05**	**06/09/2023 7:38**	**14/11/2023 8:30**
pH (Field)	pH units	6.5-7.5	6.81	7.04	6.82	6.94
EC (Field)	µS/cm	-	8231	7712	7967	7630
Temperature (Field)	Degrees C	-	24	21.4	21.4	25.6
Eh/Redox (Field)	(mV)	-	104	-81.9	-12	
DO (Field)	mg/L	-	0.05	0.05	0.06	
pH (Lab)	pH units	-	7.65	8.14	7.86	7.35
EC (Lab)	µS/cm	6937	7530	8130	7960	7560
TDS (Lab)	mg/L	NA	6520	5650	4630	4910
Major Ions						
Ca	mg/L	NA	310	306	311	327
Mg	mg/L	NA	236	249	220	212
Na	mg/L	NA	1030	1080	971	921
K	mg/L	NA	11	11	11	11
Cl	mg/L	NA	2660	2500	2430	2250
HCO_3	mg/L	NA	533	467	425	307
SO_4	mg/L	309	339	324	320	316
Minor Ions						
F	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
Total N	mg/L	NA	2	2.5	1.1	2.1
TKN	mg/L	NA	2	2.5	1.1	1.5
NO_x	mg/L	NA	0.03	<0.01	<0.01	0.62
NO_2	mg/L	NA	<0.01	<0.01	<0.01	<0.01
NO_3	mg/L	5	0.03	<0.01	<0.01	0.62
NH_3	mg/L	NA	1.47	1.27	1.52	1.29
Dissolved Metals						
Al	µg/L	55	<10	<10	<10	<10
As	µg/L	13	<1	<1	<1	<1
Cu	µg/L	2.4	<1	<1	<1	<1
Fe	µg/L	4900	4510	4920	5150	3070
Mn	µg/L	87	189	41	45	41
Se	µg/L	11	<10	<10	<10	<10
Ba	µg/L	NA	137	72	3830	

Table 16 Groundwater Bore No. 3316 WB (Acland Coal Sequence)

Groundwater Bore No. 3316 WB (Acland Coal Sequence) (continued)						
Parameter	**Units**	**Groundwater Limits**	**19/01/2023 11:34**	**18/05/2023 13:08**	**06/09/2023 9:10**	**14/11/2023 8:30**
pH (Field)	pH units	6.5-7.5	7.11	7.57	7.24	7.47
EC (Field)	µS/cm	-	5410	5040	5499	5340
Temperature (Field)	Degrees C	-	26.3	21.6	24.1	26.1
Eh/Redox (Field)	(mV)	-	199	-125.3	20.5	
DO (Field)	mg/L	-	0.13	0.08	0.14	
pH (Lab)	pH units	-	7.67	7.80	7.65	7.45
EC (Lab)	µS/cm	7460, 5629	5280	3960	5570	5380
TDS (Lab)	mg/L	5000	3840	3270	3070	3500
Major Ions						
Ca	mg/L	1000	186	181	194	204
Mg	mg/L	NA	36	39	36	37
Na	mg/L	NA	758	859	794	778
K	mg/L	NA	7	8	7	8
Cl	mg/L	NA	1730	1680	1710	1620
HCO_3	mg/L	NA	72	67	63	61
SO_4	mg/L	1000, 31	2	3	2	1
Minor Ions						
F	mg/L	0.2	0.1	0.1	0.1	0.1
Total N	mg/L	NA	1.9	2.4	1.1	2
TKN	mg/L	NA	1.9	2.3	1.1	2
NO_x	mg/L	NA	<0.01	0.06	<0.01	0.02
NO_2	mg/L	30	<0.01	<0.01	<0.01	<0.01
NO_3	mg/L	400, 5	<0.01	0.06	<0.01	0.02
NH_3	mg/L	NA	1.39	1.21	1.59	1.91
Dissolved Metals						
Al	µg/L	5000, 55	<10	<10	<10	<10
As	µg/L	50, 13	1	1	2	2
Cu	µg/L	1000, 1.4	<1	<1	<1	<1
Fe	µg/L	600	600	640	580	1090
Mn	µg/L	230	216	227	242	255
Se	µg/L	20, 11	<10	<10	<10	<10
Ba	µg/L	NA	3960	3780	3830	

Table 17 Groundwater Bore No. 81Pc (Acland Coal Sequence)

Groundwater Bore No. 81Pc (Acland Coal Sequence) (continued)				
Parameter	**Units**	**Groundwater Limits**	**18/05/2023 15:12**	**ecommisioned**
pH (Field)	pH units	NA	7.12	
EC (Field)	µS/cm	-	5040	
Temperature (Field)	Degrees C	-	21.6	
Eh/Redox (Field)	(mV)	-	-21.4	
DO (Field)	mg/L	-	0.08	
pH (Lab)	pH units	-	8.01	
EC (Lab)	µS/cm	NA	4340	
TDS (Lab)	mg/L	NA	3720	
Major Ions				
Ca	mg/L	NA	172	
Mg	mg/L	NA	93	
Na	mg/L	NA	945	
K	mg/L	NA	13	
Cl	mg/L	NA	1670	
HCO_3	mg/L	NA	262	
SO_4	mg/L	NA	260	
Minor Ions				
F	mg/L	NA	<0.01	
Total N	mg/L	NA	0.6	
TKN	mg/L	NA	0.6	
NO_x	mg/L	NA	0.01	
NO_2	mg/L	NA	<0.01	
NO_3	mg/L	NA	0.01	
NH_3	mg/L	NA	0.43	
Dissolved Metals				
Al	µg/L	NA	<10	
As	µg/L	NA	<1	
Cu	µg/L	NA	<1	
Fe	µg/L	NA	340	
Mn	µg/L	NA	95	
Se	µg/L	NA	<10	
Ba	µg/L	NA	48	

Table 18 Groundwater Bore No. 113Pgcb (Acland Coal Sequence)

Groundwater Bore No. 113Pgcb (Acland Coal Sequence) (continued)				
Parameter	**Units**	**Groundwater Limits**	**07/09/2023 7:20**	
pH (Field)	pH units	NA	7.04	
EC (Field)	µS/cm	-	6092	
Temperature (Field)	Degrees C	-	21	
Eh/Redox (Field)	(mV)	-	-0.9	
DO (Field)	mg/L	-	0.12	
pH (Lab)	pH units	-	7.82	
EC (Lab)	µS/cm	NA	5990	
TDS (Lab)	mg/L	NA	3670	
Major Ions				
Ca	mg/L	NA	168	
Mg	mg/L	NA	180	
Na	mg/L	NA	818	
K	mg/L	NA	5	
Cl	mg/L	NA	1510	
HCO_3	mg/L	NA	420	
SO_4	mg/L	NA	300	
Minor Ions				
F	mg/L	NA	0.5	
Total N	mg/L	NA	0.3	
TKN	mg/L	NA	0.3	
NO_x	mg/L	NA	<0.01	
NO_2	mg/L	NA	<0.01	
NO_3	mg/L	NA	<0.01	
NH_3	mg/L	NA	0.33	
Dissolved Metals				
Al	µg/L	NA	<10	
As	µg/L	NA	<1	
Cu	µg/L	NA	<1	
Fe	µg/L	NA	2350	
Mn	µg/L	NA	46	
Se	µg/L	NA	<10	
Ba	µg/L	NA	107	

Table 19 Groundwater Bore No. 118P (Acland Coal Sequence)

Groundwater Bore No. 118P (Acland Coal Sequence) (continued)				
Parameter	**Units**	**Groundwater Limits**	**30/08/2023 14:57**	
pH (Field)	pH units	NA	6.48	
EC (Field)	µS/cm	-	21041	
Temperature (Field)	Degrees C	-	22.5	
Eh/Redox (Field)	(mV)	-	-27.6	
DO (Field)	mg/L	-	0	
pH (Lab)	pH units	-	7.73	
EC (Lab)	µS/cm	NA	20800	
TDS (Lab)	mg/L	NA	15300	
Major Ions				
Ca	mg/L	NA	743	
Mg	mg/L	NA	518	
Na	mg/L	NA	3200	
K	mg/L	NA	13	
Cl	mg/L	NA	7440	
HCO_3	mg/L	NA	282	
SO_4	mg/L	NA	915	
Minor Ions				
F	mg/L	NA	<0.1	
Total N	mg/L	NA	2.6	
TKN	mg/L	NA	2.6	
NO_x	mg/L	NA	<0.01	
NO_2	mg/L	NA	<0.01	
NO_3	mg/L	NA	<0.01	
NH_3	mg/L	NA	2.12	
Dissolved Metals				
Al	µg/L	NA	2	
As	µg/L	NA	<1	
Cu	µg/L	NA	<1	
Fe	µg/L	NA	7750	
Mn	µg/L	NA	325	
Se	µg/L	NA	<10	
Ba	µg/L	NA	72	

Table 20 Groundwater Bore No. 119P (Acland Coal Sequence)

Groundwater Bore No. 119P (Acland Coal Sequence) (continued)			
Parameter	**Units**	**Groundwater Limits**	**06/09/2023 14:05**
pH (Field)	pH units	NA	7.33
EC (Field)	µS/cm	-	2733
Temperature (Field)	Degrees C	-	24.1
Eh/Redox (Field)	(mV)	-	48.6
DO (Field)	mg/L	-	0
pH (Lab)	pH units	-	8.16
EC (Lab)	µS/cm	NA	2640
TDS (Lab)	mg/L	NA	1440
Major Ions			
Ca	mg/L	NA	40
Mg	mg/L	NA	25
Na	mg/L	NA	461
K	mg/L	NA	4
Cl	mg/L	NA	738
HCO_3	mg/L	NA	251
SO_4	mg/L	NA	66
Minor Ions			
F	mg/L	NA	0.1
Total N	mg/L	NA	0.5
TKN	mg/L	NA	0.5
NO_x	mg/L	NA	<0.01
NO_2	mg/L	NA	<0.01
NO_3	mg/L	NA	<0.01
NH_3	mg/L	NA	0.59
Dissolved Metals			
Al	µg/L	NA	<10
As	µg/L	NA	<1
Cu	µg/L	NA	<1
Fe	µg/L	NA	100
Mn	µg/L	NA	35
Se	µg/L	NA	<10
Ba	µg/L	NA	181

Table 21 Groundwater Bore No. 114P (Acland Coal Sequence)

Groundwater Bore No. 114P (Coal, Acland) (Continued)				
Parameter	**Units**	**Groundwater Limits**	**17/01/2023 9:12**	**06/09/2023 14:30**
pH (Field)	pH units	NA	7.17	6.95
EC (Field)	µS/cm	-	6252	6312
Temperature (Field)	Degrees C	-	24.9	26.1
Eh/Redox (Field)	(mV)	-	158	70.9
DO (Field)	mg/L	-	4.32	0.77
pH (Lab)	pH units	-	8.23	8.02
EC (Lab)	µS/cm	NA	5910	6420
TDS (Lab)	mg/L	NA	3620	4170
Major Ions				
Ca	mg/L	NA	113	118
Mg	mg/L	NA	40	42
Na	mg/L	NA	1130	1080
K	mg/L	NA	7	8
Cl	mg/L	NA	1740	1710
HCO_3	mg/L	NA	354	2921
SO_4	mg/L	NA	224	223
Minor Ions				
F	mg/L	NA	<0.1	<0.1
Total N	mg/L	NA	1.6	1.4
TKN	mg/L	NA	1.6	**0.7**
NO_x	mg/L	NA	<0.01	**0.69**
NO_2	mg/L	NA	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01
NH_3	mg/L	NA	1.31	0.34
Dissolved Metals				
Al	µg/L	NA	<10	<10
As	µg/L	NA	<1	<1
Cu	µg/L	NA	2	<1
Fe	µg/L	NA	1200	0.28
Mn	µg/L	NA	58	9
Se	µg/L	NA	<10	<10
Ba	µg/L	NA	143	116

Table 22 Groundwater Bore No. 116P (Acland Coal Sequence)

Groundwater Bore No. 116P (Acland Coal Sequence)					
Parameter	**Units**	**Groundwater Limits**	**17/01/2023 10:25**	**08/05/2023** 13:43	**07/09/2013 9:20**
pH (Field)	pH units	NA	7.13	7.15	7.25
EC (Field)	µS/cm	-	2880	2619	2948
Temperature (Field)	Degrees C	-	23.8	20.6	22.9
Eh/Redox (Field)	(mV)	-	182	-88.9	-56.3
DO (Field)	mg/L	-	4.31	0.08	0.07
pH (Lab)	pH units	-	8.17	8.08	7.93
EC (Lab)	µS/cm	NA	2420	2500	2890
TDS (Lab)	mg/L	NA	1650	1650	1590
Major Ions					
Ca	mg/L	NA	63	57	58
Mg	mg/L	NA	28	28	24
Na	mg/L	NA	489	531	453
K	mg/L	NA	5	5	5
Cl	mg/L	NA	748	717	670
HCO_3	mg/L	NA	463	404	429
SO_4	mg/L	NA	47	75	51
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	1	0.9	0.8
TKN	mg/L	NA	1	0.9	0.8
NO_x	mg/L	NA	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.76	0.72	0.8
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	520	650	570
Mn	µg/L	NA	31	15	14
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	194	165	162

Table 23 Groundwater Bore No. GW05B (Acland Coal Sequence)

Groundwater Bore No. GW05B (Acland Coal Sequence) (continued)					
Parameter	**Units**	**Groundwater Limits**	**18/01/2023 9:10**	**12/05/2023 8:40**	**30/08/2023 9:30**
pH (Field)	pH units	NA	7.7	7.69	7.68
EC (Field)	µS/cm	-	1069	968	1073
Temperature (Field)	Degrees C	-	23.2	20.9	22.3
Eh/Redox (Field)	(mV)	-	208	-102	72.6
DO (Field)	mg/L	-	0.14	0	0.15
pH (Lab)	pH units	-	8.10	8.09	8.43
EC (Lab)	µS/cm	NA	1100	1,190	1050
TDS (Lab)	mg/L	NA	771	746	610
Major Ions					
Ca	mg/L	NA	83	19	22
Mg	mg/L	NA	61	3	4
Na	mg/L	NA	123	202	228
K	mg/L	NA	1	3	3
Cl	mg/L	NA	69	124	135
HCO_3	mg/L	NA	662	326	356
SO_4	mg/L	NA	15	22	21
Minor Ions					
F	mg/L	NA	0.8	0.1	0.2
Total N	mg/L	NA	12.2	0.2	0.3
TKN	mg/L	NA	0.7	0.2	0.3
NO_x	mg/L	NA	11.5	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	11.5	<0.01	<0.01
NH_3	mg/L	NA	0.1	0.12	0.13
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	<50	<50	<50
Mn	µg/L	NA	2	1	10
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	47	203	192

Table 24 Groundwater Bore No. GW06B (Acland Coal Sequence)

Groundwater Bore No. GW06B (Acland Coal Sequence) (continued)					
Parameter	**Units**	**Groundwater Limits**	**08/02/2023 9:10**	**11/05/2023 15:47**	**30/08/2023 14:09**
pH (Field)	pH units	NA	8.2	8.44	8.37
EC (Field)	µS/cm	-	1076	996	1093
Temperature (Field)	Degrees C	-	22.5	21.6	23.1
Eh/Redox (Field)	(mV)	-	168	-111.2	66.8
DO (Field)	mg/L	-	0.4	0.03	0.03
pH (Lab)	pH units	-	8.64	8.58	8.55
EC (Lab)	µS/cm	NA	1070	1040	1050
TDS (Lab)	mg/L	NA	656	609	593
Major Ions					
Ca	mg/L	NA	2	2	1
Mg	mg/L	NA	<1	<1	<1
Na	mg/L	NA	254	232	257
K	mg/L	NA	<1	<1	<1
Cl	mg/L	NA	172	174	184
HCO_3	mg/L	NA	339	285	296
SO_4	mg/L	NA	<1	<1	<1
Minor Ions					
F	mg/L	NA	0.4	0.4	0.5
Total N	mg/L	NA	0.5	0.3	0.3
TKN	mg/L	NA	0.5	0.3	0.3
NO_x	mg/L	NA	0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	0.01	<0.01	<0.01
NH_3	mg/L	NA	0.42	0.24	0.28
Dissolved Metals					
Al	µg/L	NA	10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	<50	<50	<50
Mn	µg/L	NA	10	9	5
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	49	52	120

Table 25 Groundwater Bore No. GW10 (Acland Coal Sequence)

Groundwater Bore No. GW10 (Acland Coal Sequence) (continued)					
Parameter	**Units**	**Groundwater Limits**	**19/01/2023 8:43**	**08/05/2023 15:30**	**05/09/2023 13:18**
pH (Field)	pH units	NA	7.44	7.49	7.5
EC (Field)	µS/cm	-	2786	2428	2833
Temperature (Field)	Degrees C	-	22.8	18.1	24.6
Eh/Redox (Field)	(mV)	-	204	-200.8	14.9
DO (Field)	mg/L	-	0.16	0.09	0.01
pH (Lab)	pH units	-	8.1	8.25	8.29
EC (Lab)	µS/cm	NA	2750	2550	2730
TDS (Lab)	mg/L	NA	1550	1530	1460
Major Ions					
Ca	mg/L	NA	54	52	46
Mg	mg/L	NA	13	13	12
Na	mg/L	NA	476	550	485
K	mg/L	NA	4	5	4
Cl	mg/L	NA	811	793	802
HCO_3	mg/L	NA	312	252	236
SO_4	mg/L	NA	18	16	16
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	0.8	1.1	0.7
TKN	mg/L	NA	0.8	1.1	0.7
NO_x	mg/L	NA	<0.01	0.3	<0.1
NO_2	mg/L	NA	<0.01	<0.01	<0.1
NO_3	mg/L	NA	<0.01	0.03	<0.1
NH_3	mg/L	NA	0.87	0.76	0.87
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	310	340	310
Mn	µg/L	NA	7	8	8
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	487	491	469

Table 26 Groundwater Bore No. GW07BR (Acland Coal Sequence)

Groundwater Bore No. GW07BR (Acland Coal Sequence) (continued)				
Parameter	**Units**	**Groundwater Limits**	**17/05/2023 11:15**	**06/09/2023 13:12**
pH (Field)	pH units	NA	7.86	7.87
EC (Field)	µS/cm	-	1755	1315
Temperature (Field)	Degrees C	-	23.9	25.3
Eh/Redox (Field)	(mV)	-	-148.3	46.3
DO (Field)	mg/L	-	0	0.01
pH (Lab)	pH units	-	8.26	8.37
EC (Lab)	µS/cm	NA	1820	1230
TDS (Lab)	mg/L	NA	962	678
Major Ions				
Ca	mg/L	NA	14	9
Mg	mg/L	NA	3	1
Na	mg/L	NA	354	259
K	mg/L	NA	3	2
Cl	mg/L	NA	479	261
HCO_3	mg/L	NA	205	212
SO_4	mg/L	NA	22	31
Minor Ions				
F	mg/L	NA	0.1	0.1
Total N	mg/L	NA	0.2	0.2
TKN	mg/L	NA	0.2	0.2
NO_x	mg/L	NA	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01
NH_3	mg/L	NA	0.24	0.11
Dissolved Metals				
Al	µg/L	NA	<10	<10
As	µg/L	NA	1	1
Cu	µg/L	NA	<1	<1
Fe	µg/L	NA	50	<50
Mn	µg/L	NA	53	13
Se	µg/L	NA	<10	<10
Ba	µg/L	NA	64	53

Table 27 Groundwater Bore No. GW09B (Acland Coal Sequence)

Groundwater Bore No. GW09B (Acland Coal Sequence) (continued)					
Parameter	**Units**	**Groundwater Limits**	**07/02/2023 10:50**	**09/05/2023 11:05**	**07/09/2023 10:40**
pH (Field)	pH units	NA	5.95	6.87	7.11
EC (Field)	µS/cm	-	2601	2244	2566
Temperature (Field)	Degrees C	-	26.6	18.9	22
Eh/Redox (Field)	(mV)	-	155	-14.8	-6.8
DO (Field)	mg/L	-	0.64	3.27	0.01
pH (Lab)	pH units	-	8.08	8.23	8.17
EC (Lab)	µS/cm	NA	2500	2150	2520
TDS (Lab)	mg/L	NA	1400	1360	1390
Major Ions					
Ca	mg/L	NA	68	66	61
Mg	mg/L	NA	62	65	61
Na	mg/L	NA	392	405	374
K	mg/L	NA	4	4	3
Cl	mg/L	NA	608	606	557
HCO_3	mg/L	NA	512	439	464
SO_4	mg/L	NA	27	25	25
Minor Ions					
F	mg/L	NA	0.4	0.5	0.5
Total N	mg/L	NA	0.5	0.6	0.3
TKN	mg/L	NA	0.5	0.66	0.3
NO_x	mg/L	NA	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.37	0.34	0.4
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	740	780	800
Mn	µg/L	NA	10	9	9
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	204	214	204

Table 28 Groundwater Bore No. 112PgC (Acland Coal Sequence)

Groundwater Bore No. 112PgC_R (Acland Coal Sequence)					
Parameter	**Units**	**Groundwater Limits**	**17/05/2023 9:27**	**01/09/2023 10:43**	**14/11/2023 8:30**
pH (Field)	pH units	NA	7.71	7.57	7.35
EC (Field)	µS/cm	-	3410	3554	3499
Temperature (Field)	Degrees C	-	22.5	24.3	27.1
Eh/Redox (Field)	(mV)	-	-86.9	-7.3	
DO (Field)	mg/L	-	0	0.05	
pH (Lab)	pH units	-	8.03	7.99	7.57
EC (Lab)	µS/cm	NA	3610	3570	3620
TDS (Lab)	mg/L	NA	2010	2030	2350
Major Ions					
Ca	mg/L	NA	54	62	55
Mg	mg/L	NA	9	9	7
Na	mg/L	NA	640	644	623
K	mg/L	NA	4	5	5
Cl	mg/L	NA	1110	1000	1040
HCO_3	mg/L	NA	108	116	111
SO_4	mg/L	NA	24	26	28
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	0.9	1.1	1.7
TKN	mg/L	NA	0.9	1.1	1.7
NO_x	mg/L	NA	0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	0.01	<0.01	<0.01
NH_3	mg/L	NA	1.02	1	1.34
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	<50	<50	<50
Mn	µg/L	NA	108	95	119
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	848	908	

Table 29 Groundwater Bore No. 82PcR (Acland Coal Sequence)

Groundwater Bore No. 82PcR (Acland Coal Sequence)						
Parameter	**Units**	**Groundwater Limits**	**31/01/2023 9:05**	**18/05/2023 12:03**	**06/09/2023 10:02**	**14/11/2023 8:30**
pH (Field)	pH units	6.5-7.5	7.05	7.07	6.9	7.00
EC (Field)	µS/cm	-	6252	7508	8789	8490
Temperature (Field)	Degrees C	-	23.3	20.7	24.4	23.4
Eh/Redox (Field)	(mV)	-	129.0	-65.6	-4.1	
DO (Field)	mg/L	-	0.17	0.05	0.09	
pH (Lab)	pH units	-	7.66	7.88	7.99	7.35
EC (Lab)	µS/cm	7460, 9015	6880	8330	8940	8340
TDS (Lab)	mg/L	5000	4140	5540	5470	5420
Major Ions						
Ca	mg/L	1000	243	296	342	350
Mg	mg/L	NA	167	207	201	198
Na	mg/L	NA	1040	1170	1110	1040
K	mg/L	NA	10	11	12	11
Cl	mg/L	NA	1620	2400	2810	2720
HCO_3	mg/L	NA	645	343	254	264
SO_4	mg/L	1000, 134	672	498	428	431
Minor Ions						
F	mg/L	0.8	0.1	<0.1	<0.1	<0.1
Total N	mg/L	NA	1	1.8	1.2	1.7
TKN	mg/L	NA	1	1.8	1.2	1.7
NO_x	mg/L	NA	<0.01	<0.01	<0.01	<0.01
NO_2	mg/L	30	<0.01	<0.01	<0.01	<0.01
NO_3	mg/L	400, 5	<0.01	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.93	1.16	1.24	1.57
Dissolved Metals						
Al	µg/L	5000, 55	20	<10	<10	<10
As	µg/L	50, 13	<1	<1	<1	<1
Cu	µg/L	1000, 1.4	<1	<1	<1	<1
Fe	µg/L	100	2460	2380	2190	1710
Mn	µg/L	87	121	125	109	195
Se	µg/L	20, 11	<10	<10	<10	<10
Ba	µg/L	NA	62	86	94	

2.3.3. Balgowan Coal Sequence Monitoring Bore Groundwater Quality

A total of 12 groundwater bores were sampled within the within the Balgowan Coal Sequence. A summary of both groundwater quality parameters and analytical results are provided in Table 30 to Table 40. Groundwater bore 18PcR was decommissioned in 2022 for water quality sampling.

There were no exceedances of EA (EPML00335713) Table D2 (ML50232 – dark orange) trigger limits for the Balgowan compliance monitoring bores. Exceedances of EA on 3 occasions triggering investigation (EPML00335713) Table D5 (ML50170 and ML50216) trigger limits during 2023 were noted for the following.

- BCS3 – pH
- BCS4 - Sulfate as SO4
- 18PcR2 - pH

Table 30 Groundwater Bore No. 18PcR2 (Balgowan Coal Sequence)

Groundwater Bore No. 18PcR2 (Balgowan Coal Sequence)					
Parameter	**Units**	**Groundwater Limits**	**15/05/2023 12:10**	**29/08/2023 11:47**	**18/12/2023 11:30**
pH (Field)	pH units	6.5-7.5	8.07	7.81	8.47
EC (Field)	µS/cm	-	755	781	779
Temperature (Field)	Degrees C	-	21.6	22.6	25.6
Eh/Redox (Field)	(mV)	-	-168.1	-38.2	
DO (Field)	mg/L	-	0.01	0.04	
pH (Lab)	pH units	-	8.02	7.96	8.03
EC (Lab)	µS/cm	3.456	796	775	765
TDS (Lab)	mg/L	NA	457	435	497
Major Ions					
Ca	mg/L	NA	14	11	11
Mg	mg/L	NA	4	3	2
Na	mg/L	NA	154	142	143
K	mg/L	NA	2	3	3
Cl	mg/L	NA	170	164	152
HCO_3	mg/L	NA	75	94	114
SO_4	mg/L	33	73	48	33
Minor Ions					
F	mg/L	0.4	0.4	0.3	
Total N	mg/L	NA	0.2	<0.1	0.2
TKN	mg/L	NA	0.2	<0.1	0.2
NO_x	mg/L	NA	<0.01	0.01	0.04
NO_2	mg/L	NA	<0.01	<0.01	0.2
NO_3	mg/L	6.6	<0.01	0.01	<0.01
NH_3	mg/L	NA	<0.01	<0.01	<0.01
Dissolved Metals					
Al	µg/L	55	<10	<10	<10
As	µg/L	13	1	3	4
Cu	µg/L	14	<1	<1	<1
Fe	µg/L	70	60	<50	50
Mn	µg/L	20	28	34	43
Se	µg/L	11	<10	<10	<10
Ba	µg/L	NA	27	16	

Table 31 Groundwater Bore No. 27PcR (Balgowan Coal Sequence)

Groundwater Bore No. 27PcR (Balgowan Coal Sequence)					
Parameter	**Units**	**Groundwater Limits**	**23/01/2023 15:21**	09/05/2023 15:47	04/09/2023 12:02
pH (Field)	pH units	NA	6.71	7.00	6.87
EC (Field)	µS/cm	-	11642	11152	12570
Temperature (Field)	Degrees C	-	24.2	20.3	22.3
Eh/Redox (Field)	(mV)	-	190	-83.3	-17.2
DO (Field)	mg/L	-	0.17	0.00	0.14
pH	pH units	-	7.28	7.64	7.65
EC	µS/cm	NA	10100	11800	12300
TDS	mg/L	NA	9660	9310	8780
Major Ions					
Ca	mg/L	NA	612	612.0	688
Mg	mg/L	NA	267	290	279
Na	mg/L	NA	1470	1590	1490
K	mg/L	NA	24	25	25
Cl	mg/L	NA	4000	4080	3970
HCO_3	mg/L	NA	205	104	112
SO_4	mg/L	NA	710.0	777	768.0
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	0.5	0.6	0.5
TKN	mg/L	NA	0.5	0.6	0.5
NO_x	mg/L	NA	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.38	0.51	0.55
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	4	4	3
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	1900	2700	2400
Mn	µg/L	NA	329	295	291
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	53	45	45

Table 32 Groundwater Bore No. 28PcR (Balgowan Coal Sequence)

Groundwater Bore No. 28PcR (Balgowan Coal Sequence)					
Parameter	**Units**	**Groundwater Limits**	**06/02/2023 14:45**	**15/05/2023 13:30**	**29/08/2023 8:20**
pH (Field)	pH units	NA	6.36	7.37	7.14
EC (Field)	µS/cm	-	9541	9033	10098
Temperature (Field)	Degrees C	-	23	20.2	20.5
Eh/Redox (Field)	(mV)	-	122	-136.4	-20.1
DO (Field)	mg/L	-	0	0	0.18
pH	pH units	-	7.53	7.6	7.44
EC	µS/cm	NA	10000	9840.0	10200
TDS	mg/L	NA	7830	6190.0	7780
Major Ions					
Ca	mg/L	NA	582	492.0	518
Mg	mg/L	NA	219	205.0	217
Na	mg/L	NA	1220	1080	1140
K	mg/L	NA	23	22	24
Cl	mg/L	NA	3290	3270	3440
HCO_3	mg/L	NA	71	59	58
SO_4	mg/L	NA	589.0	576	580.0
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	0.9	0.8	<0.5
TKN	mg/L	NA	0.9	0.8	<0.5
NO_x	mg/L	NA	0.03	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	0.03	<0.01	<0.01
NH_3	mg/L	NA	0.44	0.4	0.42
Dissolved Metals					
Al	µg/L	NA	20	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	1800	2100	2140
Mn	µg/L	NA	308	299	320
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	42	41	42

Table 33 Groundwater Bore No. CSMH1Rb (Balgowan Coal Sequence)

Groundwater Bore No. CSMH1Rb (Balgowan Coal Sequence)					
Parameter	**Units**	**Groundwater Limits**	**19/01/2023 10:15**	**23/05/2023 10:20**	**06/09/2023 11:48**
pH (Field)	pH units	6.0-8.5	7.69	8.12	7.74
EC (Field)	µS/cm	-	1653	1564	1638
Temperature (Field)	Degrees C	-	24.6	22.4	25.3
Eh/Redox (Field)	(mV)	-	217	-123.1	22.5
DO (Field)	mg/L	-	0.02	0.19	0.16
pH	pH units	-	8.05	8.1	7.86
EC	µS/cm	1703	1630	1640.0	1570
TDS	mg/L	NA	888	900.0	879
Major Ions					
Ca	mg/L	NA	32	35.0	31
Mg	mg/L	NA	5	5.0	5
Na	mg/L	NA	272	304	288
K	mg/L	NA	4	4	4
Cl	mg/L	NA	485	450	438
HCO_3	mg/L	NA	111	97	91
SO_4	mg/L	134	68	70	60
Minor Ions					
F	mg/L	0.8	<0.1	<0.1	<0.1
Total N	mg/L	NA	0.4	0.8	0.3
TKN	mg/L	NA	0.4	0.8	0.3
NO_x	mg/L	NA	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	5	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.44	0.5	0.36
Dissolved Metals					
Al	µg/L	55	10	10	20
As	µg/L	13	2	5	4
Cu	µg/L	1.4	<1	<1	<1
Fe	µg/L	200	<50	<50	<50
Mn	µg/L	87	36	39	36
Se	µg/L	11	<10	<10	<10
Ba	µg/L	NA	96	92	82

Table 27 Groundwater Bore No. 25PcR (Balgowan Coal Sequence)

Groundwater Bore No. 25PcR (Balgowan Coal Sequence) (continued)					
Parameter	**Units**	**Groundwater Limits**	**17/01/2023 13:31**	**16/05/2023 9:10**	**04/09/2023 13:42**
pH (Field)	pH units	NA	6.83	6.98	6.86
EC (Field)	µS/cm	-	9957	9063	10108
Temperature (Field)	Degrees C	-	23.8	20.6	22.8
Eh/Redox (Field)	(mV)	-	186	-75.3	-33.6
DO (Field)	mg/L	-	0.07	0.02	0.08
pH (Lab)	pH units	-	7.72	7.66	7.71
EC (Lab)	µS/cm	NA	9400	10200	10400
TDS (Lab)	mg/L	NA	7810	6720	6980
Major Ions					
Ca	mg/L	NA	523	460	553
Mg	mg/L	NA	200	190	194
Na	mg/L	NA	1180	1200	1200
K	mg/L	NA	23	22	23
Cl	mg/L	NA	3390	3210	3310
HCO_3	mg/L	NA	121	96	107
SO_4	mg/L	NA	368	372	368
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	0.5	1.6	<0.5
TKN	mg/L	NA	0.5	1.6	<0.5
NO_x	mg/L	NA	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.57	0.55	0.59
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	2970	2990	3550
Mn	µg/L	NA	106	111	110
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	54	53	52

Table 34 Groundwater Bore No. 26PcR (Balgowan Coal Sequence)

Groundwater Bore No. 26PcR (Balgowan Coal Sequence) (continued)					
Parameter	**Units**	**Groundwater Limits**	**17/01/2023 14:34**	**16/05/2023 10:41**	**04/09/2023 12:52**
pH (Field)	pH units	NA	6.92	7.13	6.93
EC (Field)	µS/cm	-	12241	11269	12429
Temperature (Field)	Degrees C	-	23.5	20.9	22.9
Eh/Redox (Field)	(mV)	-	172.0	-94.6	-33.0
DO (Field)	mg/L	-	0.00	0.00	0.05
pH (Lab)	pH units	-	7.97	8.02	7.91
EC (Lab)	µS/cm	NA	12200	12200	12500
TDS (Lab)	mg/L	NA	9310	8530	8680
Major Ions					
Ca	mg/L	NA	554	475	586
Mg	mg/L	NA	278	259	269
Na	mg/L	NA	1600	1640	1660
K	mg/L	NA	28	26	28
Cl	mg/L	NA	4010	4020	3840
HCO_3	mg/L	NA	223	179	178
SO_4	mg/L	NA	829	898	885
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	<0.5	0.8	0.5
TKN	mg/L	NA	<0.5	0.8	0.5
NO_x	mg/L	NA	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.41	0.41	0.42
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	4000	3780	4240
Mn	µg/L	NA	20	21	22
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	31	30	30

Table 35 Groundwater Bore No. 2289PcR Lower (Balgowan Coal Sequence)

Groundwater Bore No. 2289PcR Lower (Balgowan Coal Sequence) (continued)					
Parameter	**Units**	**Groundwater Limits**	**26/01/2023 14:25**	**16/05/2023 12:01**	**29/08/2023 15:30**
pH (Field)	pH units	NA	7.04	7.47	7.29
EC (Field)	µS/cm	-	4549	4079	4121
Temperature (Field)	Degrees C	-	23.6	19.9	21.7
Eh/Redox (Field)	(mV)	-	163.0	-22.1	15.2
DO (Field)	mg/L	-	1.52	0.07	0.11
pH (Lab)	pH units	-	7.85	7.96	7.65
EC (Lab)	µS/cm	NA	4220	4520	4170
TDS (Lab)	mg/L	NA	3390	2920	2680
Major Ions					
Ca	mg/L	NA	189	177	161
Mg	mg/L	NA	72	71	62
Na	mg/L	NA	602	594	561
K	mg/L	NA	13	13	13
Cl	mg/L	NA	1400	1300	1160
HCO_3	mg/L	NA	133	100	110
SO_4	mg/L	NA	264	256	210
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	0.7	0.5	0.4
TKN	mg/L	NA	0.7	0.5	0.4
NO_x	mg/L	NA	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.46	0.52	0.53
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	1030	950	750
Mn	µg/L	NA	64	58	46
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	52	49	46

Table 36 Groundwater Bore No. 2291Pc (Balgowan Coal Sequence)

Groundwater Bore No. 2291Pc (Balgowan Coal S					
Parameter	**Units**	**Groundwater Limits**	**17/01/2023 12:32**	**18/05/2023 12:10**	**04/09/2023 14:27**
pH (Field)	pH units	NA	6.73	6.88	6.81
EC (Field)	µS/cm	-	8100	7292	8250
Temperature (Field)	Degrees C	-	24	19.8	23.1
Eh/Redox (Field)	(mV)	-	163	-65.4	-28.9
DO (Field)	mg/L	-	2.33	0	0.03
pH (Lab)	pH units	-	8.01	8.03	7.97
EC (Lab)	µS/cm	NA	7710	7980	7930
TDS (Lab)	mg/L	NA	5530	5000	5340
Major Ions					
Ca	mg/L	NA	254	245	282
Mg	mg/L	NA	151	139	152
Na	mg/L	NA	1210	1150	1260
K	mg/L	NA	15	15	15
Cl	mg/L	NA	2490	2450	2480
HCO_3	mg/L	NA	401	360	312
SO_4	mg/L	NA	336	322	321
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	0.8	1.4	0.6
TKN	mg/L	NA	0.8	1.4	0.6
NO_x	mg/L	NA	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.75	0.68	0.64
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	2450	2710	2740
Mn	µg/L	NA	50	55	58
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	48	51	47

Table 37 Groundwater Bore No. 132WBR (Balgowan Coal Sequence)

Groundwater Bore No. 132WBR (Balgowan Coal Sequence)						
Parameter	**Units**	**Groundwater Limits**	**24/01/2023 14:47**	**18/05/2023 7:35**	**29/08/2023 14:10**	**18/12/2023 10:00**
pH (Field)	pH units	NA	6.49	6.54	6.42	6.66
EC (Field)	µS/cm	-	7128	6426	7291	6740
Temperature (Field)	Degrees C	-	23.1	19.8	21.8	26.7
Eh/Redox (Field)	(mV)	-	201	-63.6	71.4	
DO (Field)	mg/L	-	0.07	0	0.03	
pH (Lab)	pH units	-	7.27	7.99	7.63	7.51
EC (Lab)	µS/cm	NA	6380	7030	7300	6960
TDS (Lab)	mg/L	NA	4790	4710	4450	4520
Major Ions						
Ca	mg/L	NA	257	236	237	246
Mg	mg/L	NA	187	187	197	180
Na	mg/L	NA	1100	1150	1120	1050
K	mg/L	NA	11	10	11	10
Cl	mg/L	NA	1510	1440	1410	679
HCO_3	mg/L	NA	979	868	867	853
SO_4	mg/L	NA	941	1050	955	988
Minor Ions						
F	mg/L	NA	<0.1	<0.1	<0.1	<0.01
Total N	mg/L	NA	0.3	0.4	0.2	0.04
TKN	mg/L	NA	0.3	0.4	0.2	0.04
NO_x	mg/L	NA	<0.01	0.03	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01	<0.01
NO_3	mg/L	NA	<0.01	0.03	<0.01	<0.01
NH_3	mg/L	NA	0.2	0.22	0.16	0.14
Dissolved Metals						
Al	µg/L	NA	<10	<10	<10	<10
As	µg/L	NA	2	3	1	6
Cu	µg/L	NA	<1	<1	<1	<1
Fe	µg/L	NA	1140	1350	1250	3030
Mn	µg/L	NA	498	465	577	1190
Se	µg/L	NA	<10	<10	<10	<0.01
Ba	µg/L	NA	50	34	38	

Table 38 Groundwater Bore No. 133WBR (Balgowan Coal Sequence)

Groundwater Bore No. 133WBR (Balgowan Coal Sequence)						
Parameter	Units	Groundwater Limits	24/01/2023 13:56	18/05/2023 7:35	29/08/2023 14:48	18/12/2023 8:30
pH (Field)	pH units	NA	7.61	7.86	7.6	7.98
EC (Field)	µS/cm	-	676	373.5	398	380
Temperature (Field)	Degrees C	-	23.9	19.9	23.1	29.5
Eh/Redox (Field)	(mV)	-	208	-103.8	-7.9	
DO (Field)	mg/L	-	0.15	0.04	0.31	
pH (Lab)	pH units	-	7.81	8.25	8.01	8.10
EC (Lab)	µS/cm	NA	606	432	388	396
TDS (Lab)	mg/L	NA	373	259	237	257
Major Ions						
Ca	mg/L	NA	14	7	5	6
Mg	mg/L	NA	4	1	1	1
Na	mg/L	NA	120	90	79	81
K	mg/L	NA	2	2	1	1
Cl	mg/L	NA	103	60	53	51
HCO_3	mg/L	NA	191	133	110	120
SO_4	mg/L	NA	18	7	6	1
Minor Ions						
F	mg/L	NA	0.2	0.2	0.2	0.2
Total N	mg/L	NA	<0.1	0.02	<0.1	0.3
TKN	mg/L	NA	<0.1	0.02	<0.1	0.3
NO_x	mg/L	NA	0.01	<0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01	<0.01
NO_3	mg/L	NA	0.01	<0.01	<0.01	<0.01
NH_3	mg/L	NA	<0.01	<0.01	0.04	0.07
Dissolved Metals						
Al	µg/L	NA	<10	50	<10	<10
As	µg/L	NA	1	1	1	1
Cu	µg/L	NA	<1	<1	<1	<1
Fe	µg/L	NA	<50	130	<50	<50
Mn	µg/L	NA	24	24	16	24
Se	µg/L	NA	<10	<10	<10	<10
Ba	µg/L	NA	54	20	10	

Table 39 Groundwater Bore No. BCS3 (Balgowan Coal Sequence)

Groundwater Bore No. BCS3 (Coal, Balgowan)					
Parameter	Units	Groundwater Limits	10/05/2023 11:17	01/09/2023 7:58	18/12/2023 10:00
pH (Field)	pH units	6.5 - 7.5	8.90	8.85	8.95
EC (Field)	µS/cm		893	891	537
Temperature (Field)	Degrees C	-	22	22.5	29.9
Eh/Redox (Field)	(mV)	-	-212	-73.7	
DO (Field)	mg/L	-	0.00	0.12	
pH (Lab)	pH units	-	8.86	8.69	9.27
EC (Lab)	µS/cm	9015	879	872	861
TDS (Lab)	mg/L	NA	539	522	560
Major Ions					
Ca	mg/L	NA	4	5	4
Mg	mg/L	NA	1	<1	<1
Na	mg/L	NA	187	200	191
K	mg/L	NA	3	2	4
Cl	mg/L	NA	95	93	99
HCO_3	mg/L	NA	272	280	
SO_4	mg/L	134	7	5	6
Minor Ions					
F	mg/L	0.8	0.01	0	0
Total N	mg/L	NA	0.4	0.3	
TKN	mg/L	NA	0.4	0.3	0.6
NO_x	mg/L	NA	<0.01	<0.01	0.6
NO_2	mg/L	NA	<0.01	<0.01	0
NO_3	mg/L	5	<0.01	<0.01	<0.01
NH_3	mg/L	NA	0.28	0	0.48
Dissolved Metals					
Al	µg/L	55	80	10	10
As	µg/L	13	2	1	<1
Cu	µg/L	1.4	<1	<1	<1
Fe	µg/L	100	110	<50	<50
Mn	µg/L	87	13	6	2
Se	µg/L	11	<10	<10	<10
Ba	µg/L	NA	350	40	

Table 40 Groundwater Bore No. BCS4 (Balgowan Coal Sequence)

Groundwater Bore No. BCS4 (Coal, Balgowan)						
Parameter	**Units**	**Groundwater Limits**	**26/01/2023 10:09**	**23/05/2023 14:55**	**06/09/2023 8:18**	**14/11/2023 8:30**
pH (Field)	pH units	6.5 - 7.5	7	7.75	7.47	7.58
EC (Field)	µS/cm	-	5202	3629	3684	3695
Temperature (Field)	Degrees C	-	26	22.9	23.4	27.2
Eh/Redox (Field)	(mV)	-	190	-119.3	-5	
DO (Field)	mg/L	-	0	0	0	
pH (Lab)	pH units	-	7.94	8.10	7.89	7.71
EC (Lab)	µS/cm	9015	4820	3720	3570	3470
TDS (Lab)	mg/L	NA	3030	2060	1970	2260
Major Ions						
Ca	mg/L	NA	100	57	44	43
Mg	mg/L	NA	21	6	5	5
Na	mg/L	NA	939	727	659	655
K	mg/L	NA	6	4	4	4
Cl	mg/L	NA	1500	1040	1060	960
HCO_3	mg/L	NA	182	104	90	86
SO_4	mg/L	134	207	160	140	141
Minor Ions						
F	mg/L	0.8	<0.1	<0.1	<0.1	<0.1
Total N	mg/L	NA	1.3	1.2	0.7	1.3
TKN	mg/L	NA	1.3	1.2	0.7	1.3
NO_x	mg/L	NA	<0.01	<0.01	<0.01	0.03
NO_2	mg/L	NA	<0.01	<0.01	<0.01	<0.01
NO_3	mg/L	5	<0.01	<0.01	<0.01	<0.01
NH_3	mg/L	NA	1.06	0.79	0.75	0.03
Dissolved Metals						
Al	µg/L	55	<10	<10	<10	<10
As	µg/L	13	<1	<1	<1	<1
Cu	µg/L	1.4	<1	<1	<1	<1
Fe	µg/L	100	120	70	<50	<50
Mn	µg/L	87	244	10	76	72
Se	µg/L	11	<10	<10	<10	<10
Ba	µg/L	NA	193	101	82	

2.3.4. Marburg Sandstone Oakey Creek Alluvium and Waipanna Coal Sequence Monitoring Bore Groundwater Quality

A total of 5 groundwater bores were sampled within the Marburg Sandstone Oakey Creek Alluvium and Waipanna Coal Sequence. A summary of both groundwater quality parameters and analytical results are provided in Table 41 to Table 45.
Note that no monitoring bores in this group have trigger limits set per EA (EPML00335713) Table D2 (ML50232) and Table D5 (ML50170 and ML50216), as these are not compliance bores.

Table 41 Groundwater Bore No. GW08C (Marburg Sandstone)

Groundwater Bore No. GW08C (Marburg Sandstone) (continued)					
Parameter	**Units**	**Groundwater Limits**	**26/01/2023 11:49**	**11/05/2023** 14:35	**05/09/2023** 8:38
pH (Field)	pH units	NA	8.34	8.45	8.21
EC (Field)	µS/cm	-	2581	2442	2636
Temperature (Field)	Degrees C	-	26.1	22.1	23.5
Eh/Redox (Field)	(mV)	-	168	-251.1	-69.1
DO (Field)	mg/L	-	1.33	0.07	0.02
pH (Lab)	pH units	-	8.48	8.44	8.39
EC (Lab)	µS/cm	NA	2460	2550	2590
TDS (Lab)	mg/L	NA	1370	1410	1380
Major Ions					
Ca	mg/L	NA	8	8	8
Mg	mg/L	NA	<1	<1	<1
Na	mg/L	NA	531	498	521
K	mg/L	NA	3	3	2
Cl	mg/L	NA	716	20	733
HCO_3	mg/L	NA	301	265	232
SO_4	mg/L	NA	17	16	14
Minor Ions					
F	mg/L	NA	0.2	0.2	0.2
Total N	mg/L	NA	0.5	0.5	0.4
TKN	mg/L	NA	0.5	0.5	0.4
NO_x	mg/L	NA	0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	0.01	<0.01	<0.01
NH_3	mg/L	NA	0.36	0.47	0.53
Dissolved Metals					
Al	µg/L	NA	40	40	<10
As	µg/L	NA	8	8	8
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	<50	<50	50
Mn	µg/L	NA	15	17	16
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	207	231	212

Table 42 Groundwater Bore No. GW09A (Oakey Creek Alluvium)

Groundwater Bore No. GW09A (Oakey Creek Alluvium) (continued)					
Parameter	**Units**	**Groundwater Limits**	**07/02/2023 0.399305556**	**09/05/2023 9:53**	**07/09/2023 9:58**
pH (Field)	pH units	NA	5.83	6.92	6.96
EC (Field)	µS/cm	-	2806	2561	3005
Temperature (Field)	Degrees C	-	23.5	19.1	22.2
Eh/Redox (Field)	(mV)	-	180	134.1	-0.1
DO (Field)	mg/L	-	3.72	4.2	3.05
pH (Lab)	pH units	-	7.96	8.07	7.75
EC (Lab)	µS/cm	NA	2890	2360	2980
TDS (Lab)	mg/L	NA	1890	1720	1740
Major Ions					
Ca	mg/L	NA	93	88	90
Mg	mg/L	NA	99	102	98
Na	mg/L	NA	365	376	342
K	mg/L	NA	3	3	2
Cl	mg/L	NA	774	738	742
HCO_3	mg/L	NA	434	375	393
SO_4	mg/L	NA	20	20	18
Minor Ions					
F	mg/L	NA	0.3	0.3	0.3
Total N	mg/L	NA	2.5	2.4	2.2
TKN	mg/L	NA	0.3	0.3	2.05
NO_x	mg/L	NA	2.19	2.13	2.05
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	2.19	2.13	2.05
NH_3	mg/L	NA	0.06	<0.01	<0.01
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	<50	<50	<50
Mn	µg/L	NA	1	<1	<1
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	405	404	386

Table 43 Groundwater Bore No. GW09C (Marburg Sandstone)

Groundwater Bore No. GW09C (Margburg Sandstone) (continued)					
Parameter	Units	Groundwater Limits	07/02/2023 12:00	09/05/2023 11:30	07/09/2023 11:10
pH (Field)	pH units	NA	6.13	7.72	7.48
EC (Field)	µS/cm	-	2033	1714	1986
Temperature (Field)	Degrees C	-	27.1	19.4	22
Eh/Redox (Field)	(mV)	-	160	-215	-183.2
DO (Field)	mg/L	-	0.69	2.08	0
pH (Lab)	pH units	-	8.17	8.17	7.97
EC (Lab)	µS/cm	NA	1930	1800	1950
TDS (Lab)	mg/L	NA	1100	1060	1070
Major Ions					
Ca	mg/L	NA	50	50	47
Mg	mg/L	NA	6	6	5
Na	mg/L	NA	363	357	336
K	mg/L	NA	8	8	8
Cl	mg/L	NA	514	520	486
HCO_3	mg/L	NA	243	210	225
SO_4	mg/L	NA	38	26	33
Minor Ions					
F	mg/L	NA	<0.1	<0.1	<0.1
Total N	mg/L	NA	0.7	0.6	0.5
TKN	mg/L	NA	0.7	0.6	0.5
NO_x	mg/L	NA	0.02	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	0.02	<0.01	<0.01
NH_3	mg/L	NA	0.51	0.35	0.54
Dissolved Metals					
Al	µg/L	NA	40	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	<50	<50	<50
Mn	µg/L	NA	18	22	20
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	102	104	100

Table 44 Groundwater Bore No. GW11B (Marburg Sandstone)

Groundwater Bore No. GW11B (Marburg Sandstone) (continued)				
Parameter	Units	Groundwater Limits	19/05/2023 7:33	28/08/2023 15:30
pH (Field)	pH units	NA	7.72	6.98
EC (Field)	µS/cm	-	1714	3297
Temperature (Field)	Degrees C	-	19.4	22.4
Eh/Redox (Field)	(mV)	-	-116.3	-76.2
DO (Field)	mg/L	-	0	6.49
pH (Lab)	pH units	-	7.92	7.7
EC (Lab)	µS/cm	NA	2790	3210
TDS (Lab)	mg/L	NA	1950	1960
Major Ions				
Ca	mg/L	NA	112	107
Mg	mg/L	NA	64	65
Na	mg/L	NA	464	431
K	mg/L	NA	28	31
Cl	mg/L	NA	900	819
HCO_3	mg/L	NA	250	249
SO_4	mg/L	NA	92	126
Minor Ions				
F	mg/L	NA	0.2	0.2
Total N	mg/L	NA	0.3	0.2
TKN	mg/L	NA	0.3	0.2
NO_x	mg/L	NA	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01
NO_3	mg/L	NA	<0.01	<0.01
NH_3	mg/L	NA	0.17	0.16
Dissolved Metals				
Al	µg/L	NA	<10	<10
As	µg/L	NA	13	15
Cu	µg/L	NA	<1	<1
Fe	µg/L	NA	1160	1120
Mn	µg/L	NA	167	167
Se	µg/L	NA	<10	<10
Ba	µg/L	NA	124	119

Table 45 Groundwater Bore No. GW13B (Waipanna Coal Sequence)

Groundwater Bore No. GW13B (Waipanna Coal Sequence) (continued)					
Parameter	Units	Groundwater Limits	07/02/2023 15:25	24/05/2023 7:45	05/09/2023 10:38
pH (Field)	pH units	NA	8.51	8.12	8.1
EC (Field)	µS/cm	-	723	653	757
Temperature (Field)	Degrees C	-	22.8	19.2	23.2
Eh/Redox (Field)	(mV)	-	190	-163.8	-37.2
DO (Field)	mg/L	-	0	0	0
pH (Lab)	pH units	-	8.50	8.61	8.46
EC (Lab)	µS/cm	NA	739	745	705
TDS (Lab)	mg/L	NA	496	431	412
Major Ions					
Ca	mg/L	NA	9	9	8
Mg	mg/L	NA	3	4	3
Na	mg/L	NA	168	170	166
K	mg/L	NA	2	2	2
Cl	mg/L	NA	65	62	68
HCO_3	mg/L	NA	323	287	263
SO_4	mg/L	NA	<1	1	<1
Minor Ions					
F	mg/L	NA	0.5	0.5	<0.1
Total N	mg/L	NA	0.5	0.3	<0.1
TKN	mg/L	NA	0.5	0.3	
NO_x	mg/L	NA	0.01	<0.01	<0.01
NO_2	mg/L	NA	<0.01	<0.01	<0.01
NO_3	mg/L	NA	0.01	<0.01	<0.01
NH_3	mg/L	NA	0.2	0.16	0.17
Dissolved Metals					
Al	µg/L	NA	<10	<10	<10
As	µg/L	NA	<1	<1	<1
Cu	µg/L	NA	<1	<1	<1
Fe	µg/L	NA	<50	<50	<50
Mn	µg/L	NA	9	9	9
Se	µg/L	NA	<10	<10	<10
Ba	µg/L	NA	118	138	133

2.3.5. *Lagoon Creek Alluvium and Mine pit Backfill Groundwater Monitoring Bores Chemical Analysis Results*

A total of 3 groundwater bores lay within the Lagoon Creek Alluvium and Mine Pit Backfill aquafers. Bore 3307WB was not sampled in 2023 due to a bent casing. A replacement bore has been drilled; the EA will be updated in a future EA amendment. Groundwater bores LCA1 and LCA2 were all recorded as dry or insufficient water when sampling. There were no exceedances of EA (EPML00335713) Table D2 (ML50232) and Table D5 (ML50170 and ML50216).

2.3.6. Groundwater Quality Analysis

All groundwater bores demonstrated relativity stable water quality parameters during 2023 sampling events. Seven bores exceeded EA trigger levels requiring further investigation.

Pursuant to EA Condition D22, exceedances of EA triggers on 3 consecutive occasions require an investigation to be completed, and a written report provided to the administering authority (the Queensland Department of Environment and Science, DES) within 60 days of NAC becoming aware of the Condition D19 trigger.

Per EA Condition D22, the investigation must include a determination of whether the exceedance or difference is caused by:

I. mining activities authorised under the EA; or
II. natural variation; or
III. neighbouring land use resulting in groundwater impacts.

Exceedances of EA on 3 occasions triggering investigation (EPML00335713) Table D5 (ML50170 and ML50216) trigger limits during 2023 were noted for the following.

- 10PBR – NO3 (as N)
- 18PbR2 – pH
- 4518WB - Sulfate as SO4, Iron
- 82PcR - EC, Sulfate as SO4, Iron, Manganese
- BCS3 – pH
- BCS4 - Sulfate as SO4
- 18PcR2 – pH

SLR was engaged by New Acland Coal Pty Ltd to assist in meeting its reporting obligations regarding the triggering of New Acland Mine Environmental Authority (EA) EPML00335713 Condition D19 for a groundwater monitoring bore following the 2023 routine groundwater monitoring event. SLRs full investigation reports are included in Appendix 2.

Bores **10PbR** and **4518WB** have been the subject of exceedance investigations prior to 2023. The key findings from investigation were as follows:

- Groundwater flow directions in both the Main Range Volcanics and Acland Coal Sequence in the vicinity of the subject bores were shown to be towards NAC's operations, not away from NAC's operations. Derivations of those flow directions included consideration of the hydraulic head within in-pit water storages and the conservative (worst case) assumption that those storages are completely connected to the surrounding groundwater system. The groundwater flow directions show that there is no hydraulic mechanism for transport of sulfate or nitrate from NAC's operations to groundwater accessed by the subject bores, and NAC's operations therefore cannot be the cause of the changes in groundwater concentrations.
- The EA groundwater limits for bore 10PbR were established using the statistical analysis methods as described in DES (2021). However, the groundwater EA triggers established used with significantly less data points than is described in DES (2021). For example, four datapoints were used instead of the recommended 18, thus it can only be considered that the current EA triggers should be regarded as interim at best. The current EA groundwater triggers are not representative of long-term temporal natural groundwater quality nor form an appropriate trigger value for the detection of potential environmental harm in the EA.
- Nitrate (i.e. as N) concentrations from bore 10PbR have been historically elevated since baseline monitoring began; including prior to the provision of the EA triggers. Moreover, concentrations have been significantly above (other) EA monitoring bores and the relevant water quality objective for the protection of Environmental Values. Therefore, there is no environmental risk posed by the recent concentration increases at 10PbR. Historic anthropogenic agricultural land use activity proximal to10PbR, but not related to NAC's operations, are the likely source of this nitrate in groundwater.
- Sulfate concentrations at the 4518WB location have been historically elevated since baseline monitoring began at that bore, and prior to the recent trigger exceedance, with those baseline concentrations being significantly above other EA monitoring bores. Historic underground mines proximal to 4518WB but not related to NAC's operations are a potential source of this elevated sulfate in groundwater.
- Consideration was given to NAC surface water storages proximal to bore 4518WB to be a source of sulfate in groundwater. The data shows that surface water in the NAC related storages near to 4518WB cannot be a source of increasing sulfate

concentrations at bore 4518WB, since any infiltration of this surface water would only dilute sulfate concentrations in groundwater after June 2022.

- There is no evidence that NAC's activities have caused the concentration increases observed at the two subject bores, rather, available evidence is to the contrary such that it can be concluded that the concentration changes are not caused by NAC's activities.

Bores **18PbR2, BCS3** and **18PcR2** were installed after the finalisation of the EA triggers in May 2022. That is, the EA triggers for both bores were not based on recorded groundwater conditions, but on nominal regional Water Quality Objectives (WQO) before the bore had been installed.

The WQO adopted for the EA pH triggers at these bores was the ANZECC Aquatic Ecosystem Guideline for Southeast Australia. Monitoring results for pH at these bores have been above the upper EA limit since the commencement of monitoring at the bore. The exceedance of pH at these bores in 2023 therefore does not represent a change from previously recorded pH levels at the bore, but rather the fact that the EA trigger was not established based on site-specific data from the bore. Monitoring data for other EA Compliance and Investigation bores in the shows that whilst many bores do report pH values within the range of EA limits and ANZECC Aquatic Ecosystem Guideline for Southeast Australia WQO, pH values at or above the upper limit/WQO of 7.5 have been consistently recorded at several bores in the past and in 2023. It is evident therefore that groundwater in the EA bores does not always have pH values that sit within the ANZECC Aquatic Ecosystem Guideline for Southeast Australia WQO, and site-specific triggers may be appropriate in some cases.

Bore **BCS4** was installed after the finalisation of the EA triggers in May 2022. That is, the EA triggers for BCS4 were not based on recorded groundwater conditions at BCS4, but on nominal regional WQO (SLR, 2021) before the bore had been installed.

The WQO adopted for the EA Sulfate trigger at BCS4 was the Condamine River Basin Healthy Waters Management Plan Northeast Walloons 80th Percentile. By definition, since the WQO is defined on the 80th percentile of the regional dataset, 20% of all groundwater data from that aquifer must exceed the WQO. Monitoring results for Sufate at BCS4 have been above the EA trigger limit since the commencement of monitoring at the bore, the exceedance of Sulfate at BCS4 in 2023 therefore does not represent an increase from previously recorded Sulfate concentrations at the bore, but rather the fact that the EA trigger was not established based on site-specific data from the bore. It is noted that Sulfate concentrations at BCS4 have been steadily decreasing in each of the monitoring events since bore installation, with the last 2023 recorded concentration being approximately 32% lower than the first sample from the bore in January 2023. If the trend continues, it appears likely that results from the next monitoring event would report Sulfate concentrations at BCS4 that are below the EA trigger. It is considered therefore that the bore has not yet stabilised following drilling to provide data representative of steady state aquifer conditions. It is not uncommon for bores to require a period of time to stabilise to background conditions following drilling. Monitoring data for other EA Compliance and Investigation bores in the Balgowan Coal Sequence shows that Sulfate concentrations at other EA bores in that aquifer are relatively stable. The data also shows that some Investigation bores are more than 6 times those reported at BCS4. That is, Sulfate concentrations at BCS4 fall within the range of concentrations measured across the Balgowan Coal Sequence EA bores. It is therefore apparent that Sulfate concentrations across the Balgowan Coal Sequnce aquifer are naturally highly spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Sulfate concentrations at any particular bore. It is also evident therefore that groundwater in the Balgowan Coal Sequence EA bores does not always have Sulfate concentrations within the

HWMP Northeast Walloons 80th Percentile WQO, and site-specific triggers may be appropriate in some cases.

Bore **82PcR** was installed after the finalisation of the EA triggers in May 2022. The EA triggers for 82PcR were not based on recorded groundwater conditions at 82PcR, but on nominal regional WQO before the bore had been installed.

The WQO adopted for the EA Sulfate trigger at 82PcR was the Condamine River Basin Healthy Waters Management Plan (HWMP) Northeast Walloons 80th Percentile. Since the WQO is defined on the 80th percentile of the regional dataset, 20% of all groundwater data from that aquifer must exceed the WQO. Monitoring results for Sufate at 82PcR have been above the EA trigger limit since the commencement of monitoring at the bore. The exceedance of Sulfate at 82PcR in 2023 therefore does not represent an increase from previously recorded Sulfate concentrations at the bore, but rather the fact that the EA trigger was not established based on site-specific data from the bore. It is noted that Sulfate concentrations at 82PcR have been steadily decreasing in each of the three monitoring events since bore installation, with the last 2023 recorded concentration being approximately 36% lower than the first sample from the bore in January 2023. It is considered therefore that the bore potentially has not yet stabilised following drilling to provide data representative of steady state aquifer conditions. It is not uncommon for bores to require a period to stabilise to background conditions following drilling. Alternatively, the bore could be recovering back to steady state conditions from a peak following the wetter than average climate period in late 2021/early 2022, like the trend in sulfate seen at 4518WB. Monitoring data for other EA Compliance and Investigation bores in the Acland Coal Sequence shows that Sulfate concentrations at some Investigation bores are like those reported at 82PcR. That is, Sulfate concentrations at 82PcR fall within the range of concentrations measured across the Acland Coal Sequence EA bores. It is therefore apparent that Sulfate concentrations across the Acland Coal Sequence aquifer are naturally highly spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Sulfate concentrations at any particular bore. It is also evident therefore that groundwater in the Acland Coal Sequence EA bores does not always have Sulfate concentrations within the HWMP Northeast Walloons 80th Percentile WQO, and site-specific triggers may be appropriate in some cases.

The WQO adopted for the EA Iron trigger at 82PcR was the Condamine River Basin Healthy Waters Management Plan Northeast Walloons 80th Percentile (SLR, 2021). By definition, since the WQO is defined on the 80th percentile of the regional dataset, 20% of all groundwater data from that aquifer must exceed the WQO. Monitoring results for Iron at 82PcR have been above the EA trigger limit since the commencement of monitoring at the bore. The exceedance of Iron at 82PcR in 2023 therefore does not represent an increase from previously recorded Iron concentrations at the bore, but rather the fact that the EA trigger was not established based on site-specific data from the bore. Monitoring data for other EA Compliance and Investigation bores in the Acland Coal Sequence shows that Iron concentrations at some other EA bores are approximately double those reported at 82PcR, including for other Compliance bores. That is, Iron concentrations at 82PcR fall within the range of concentrations measured across the Acland Coal Sequence EA bores. It is therefore apparent that Iron concentrations across the Acland Coal Sequence aquifer are naturally spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Iron concentrations at any bore. It is also evident therefore that groundwater in the Acland Coal Sequence EA bores does not always have Iron concentrations within the HWMP Northeast Walloons 80th Percentile WQO, and site-specific triggers may be appropriate in some cases.

The WQO adopted for the EA Manganese trigger at 82PcR was the Condamine River Basin

Healthy Waters Management Plan Northeast Walloons 80th Percentile. Since the WQO is defined on the 80th percentile of the regional dataset, 20% of all groundwater data from that aquifer must exceed the WQO. Monitoring results for Manganese at 82PcR have been above the EA trigger limit since the commencement of monitoring at the bore. The exceedance of Manganese at 82PcR in 2023 therefore does not represent an increase from previously recorded Manganese concentrations at the bore, but rather the fact that the EA trigger was not established based on site-specific data from the bore. Monitoring data for other EA Compliance and Investigation bores in the Acland Coal Sequence shows that Manganese concentrations at some other EA bores are more than double those reported at 82PcR, including for other Compliance bores. That is, Manganese concentrations at 82PcR fall within the range of concentrations measured across the Acland Coal Sequence EA bores. It is therefore apparent that Manganese concentrations across the Acland Coal Sequence aquifer are naturally spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Manganese concentrations at any particular bore. It is also evident therefore that groundwater in the Acland Coal Sequence EA bores does not always have Manganese concentrations within the HWMP Northeast Walloons 80th Percentile WQO, and site-specific triggers may be appropriate in some cases.

2.3.7. *Water Quality Relevant Environmental Values*

Extensive and comprehensive groundwater studies have been undertaken at NAC since 2014, which demonstrate the relevant Environmental Values (EVs) of groundwater in the vicinity of the New Acland Mine. Those studies demonstrate that the relevant EVs of groundwater are:

- Main Range Volcanics aquifer: Stock watering (cattle) and Irrigation.
- Walloon Coal Measures (Acland and Balgowan Coal Sequence) aquifers: Stock watering (cattle).

The relevant guideline criteria (i.e., ANZECC & ARMCANZ (2000)) for the above-stated EVs are summarised in Table 47 below, with respect to the parameters subject to this report.

Table 46 Relevant Groundwater Use Protection Criteria

Parameter	Aquifer	Bore	EA Trigger Value (mg/L)	EV	EV Guideline Value (mg/L)	Guideline Value Source
Nitrate as N	Main Range Volcanics	10PbR	50.7	Stock Watering	400	ANZECC & ARMCANZ (2000)
				Irrigation	25-125 (Total N)	ANZECC & ARMCANZ (2000) – short-term trigger value (up to 20 years)
Sulfate	Acland Coal Sequence	4518WB	48	Stock Watering	1,000	ANZECC & ARMCANZ (2000)
		82PcR	134			
	Balgowan Coal Sequence	BCS4	134			
Iron	Acland Coal Sequence	4518WB	1.6	Stock Watering	n/a	not sufficiently toxic to stock (ANZECC & ARMCANZ, 2000)
		82PcR	0.1			
Manganese	Acland Coal Sequence	82PcR	0.087	Stock Watering	n/a	not sufficiently toxic to stock (ANZECC & ARMCANZ, 2000)
pH	Main Range Volcanics	18PbR2	6.5 – 7.5 (range)	Stock Watering	6 – 8.5 (range)	To limit corrosion and fouling of irrigation and stock watering systems (ANZECC & ARMCANZ, 2000)
				Irrigation		

Comparison of the respective EA trigger values and the relevant EV guideline criteria outlined in Table 47 indicates the following.

For bore 10PbR:

- The EA Nitrate trigger value at 10PbR is nearly 8 times lower than the ANZECC & ARMCANZ (2000) stock watering guideline criteria. Nitrate concentrations recorded at 10PbR remain significantly below the ANZECC & ARMCANZ (2000) stock watering guideline criteria. Therefore, the exceedances observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use. Nitrate is a constituent component of Total N. Total N values show that 2023 monitoring results at 10PbR have a Total N concentration at less than half the upper limit of the ANZECC & ARMCANZ (2000) guideline criteria for irrigation. Therefore, the nitrate exceedances observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for irrigation groundwater use.

For bore 4518WB:

- The ANZECC & ARMCANZ (2000) stock watering guideline criteria for Sulfate is more than 20 times greater than the EA Sulfate trigger value for 4518WB. Sulfate concentrations at 4518WB remain significantly below the ANZECC & ARMCANZ (2000) guideline criteria. Therefore, the exceedances to the current EA trigger observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.
- As described in the ANZECC & ARMCANZ (2000) stock watering guidelines, Iron is not sufficiently toxic for stock to warrant guideline value. Therefore, the exceedances to the current EA trigger for Iron observed at 4518WB do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.

For bore 18PbR2:

- The EA pH trigger value range (between the upper and lower limit) at 18PbR2 is smaller than the ANZECC & ARMCANZ (2000) guideline criteria range. The upper EA limit is a full pH point lower than the upper ANZECC & ARMCANZ (2000) guideline criteria value, with the upper ANZECC & ARMCANZ (2000) guideline criteria value being above the pH values recorded at the bore. Therefore, the exceedances observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering or irrigation groundwater use.

For bore 82PcR:

- The ANZECC & ARMCANZ (2000) stock watering guideline criteria for Sulfate is more than seven times greater than the EA Sulfate trigger value for 82PcR. Sulfate concentrations at 82PcR remain significantly below the ANZECC & ARMCANZ (2000) guideline criteria. Therefore, exceedances to the current EA trigger observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.
- As described in the ANZECC & ARMCANZ (2000) stock watering guidelines, Iron is not sufficiently toxic for stock to warrant guideline value. The exceedances to the current EA trigger for Iron observed at 82PcR do not represent any risk of environmental harm sufficient to reduce the potential for stock watering.

- As described in the ANZECC & ARMCANZ (2000) stock watering guidelines, Manganese is not sufficiently toxic for stock to warrant guideline value. The exceedances to the current EA trigger for Manganese observed at 82PcR do not represent any risk of environmental harm sufficient to reduce the potential for stock watering.

For bore BCS4:

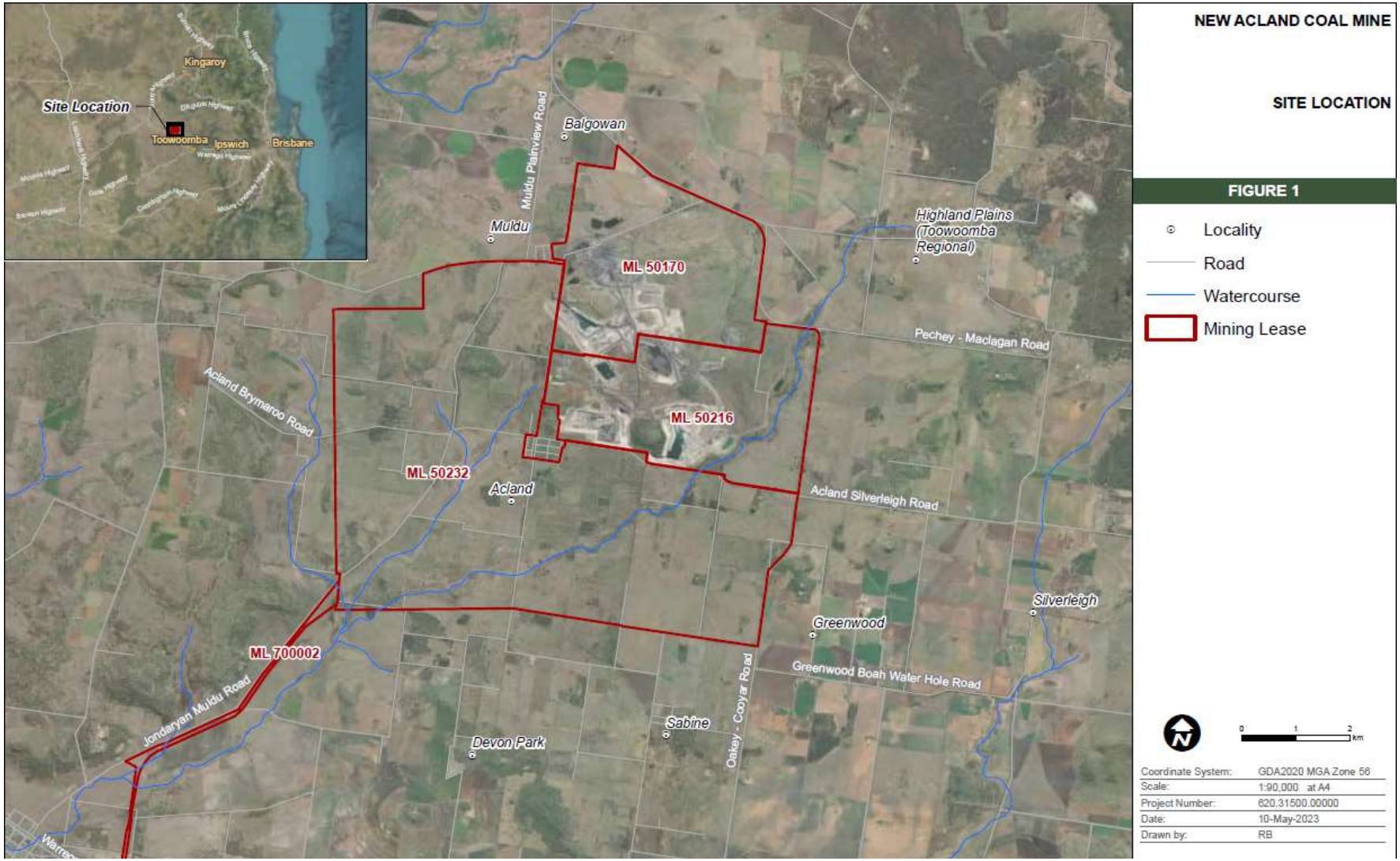
- The ANZECC & ARMCANZ (2000) stock watering guideline criteria for Sulfate is more than seven times greater than the EA Sulfate trigger value for BCS4. Sulfate concentrations at BCS4 remain significantly below the ANZECC & ARMCANZ (2000) guideline criteria. Therefore, exceedances to the current EA trigger observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.

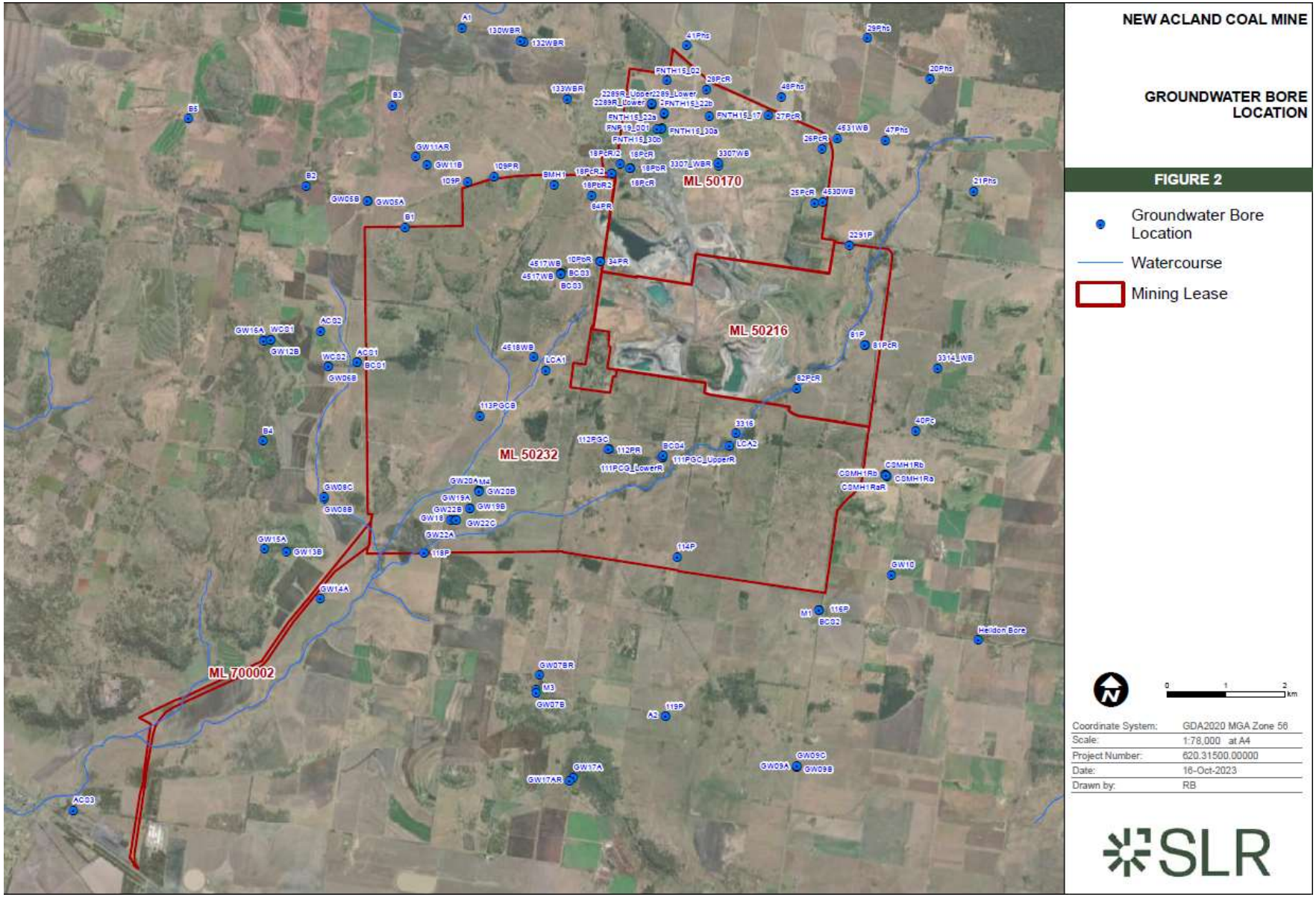
Therefore, in accordance with the above assessment, none of the exceedances noted in 2023 constitute a potential risk to actual groundwater receptors in terms of water quality concentrations.

3. Review of the Conceptual or Numerical Groundwater model

There were no reviews undertaken of the conceptual or numerical groundwater model; for the NAC site over the 2023 reporting period.

Appendix 1 – Monitoring Location Maps


NEW ACLAND COAL MINE
SITE LOCATION
FIGURE 1
Locality
Road
Watercourse
Mining Lease
Site Location
Kingaroy
Toowoomba
Ipswich
Brisbane
Balgowan
Muldu Plainview Road
Muldu
Highland Plains (Toowoomba Regional)
ML 50170
ML 50216
ML 50232
ML 700002
Pechey - Maclagan Road
Acland Brymaroo Road
Acland
Acland Silverleigh Road
Silverleigh
Greenwood
Greenwood Boah Water Hole Road
Jonderyan Muldu Road
Devon Park
Sabine
Oakey - Cooyar Road
0 1 2 km
Coordinate System: GDA2020 MGA Zone 56
Scale: 1:90,000 at A4
Project Number: 620.31500.00000
Date: 10-May-2023
Drawn by: RB


NEW ACLAND COAL MINE
GROUNDWATER BORE LOCATION
FIGURE 2
Groundwater Bore Location
Watercourse
Mining Lease
ML 50170
ML 50216
ML 50232
ML 700002
Heldon Bore
Coordinate System: GDA2020 MGA Zone 56
Scale: 1:78,000 at A4
Project Number: 620.31500.00000
Date: 16-Oct-2023
Drawn by: RB
SLR

Appendix 2 – SLR Water Quality Exceedance Reports

SLR Consulting Australia Pty Ltd
Level 16, 175 Eagle Street, Brisbane QLD 4000, Australia

July 19, 2023

Attention: Troy Cook
New Acland Coal Pty Ltd
Muldu, QLD

SLR Project No.: 620.11303

RE: New Acland Mine
EA Bore 4518WB Iron Exceedance Investigation
May 2023 Monitoring Event

Introduction

SLR have been engaged by New Acland Coal Pty Ltd (NAC) to assist NAC meet its reporting obligations in regard to the recent triggering of New Acland Mine Environmental Authority (EA) EPML00335713 Condition D16 for a groundwater monitoring bore following the May 2023 routine groundwater monitoring event:

- 4518WB in the Acland Coal Sequence aquifer - Iron concentrations above EA Table D5 Limits for three consecutive occasions.

The location of 4518WB with respect to the New Acland Mine and other EA bores in the Acland Coal Sequence are provided on **Figure 1**.

Pursuant to EA Condition D19, an investigation must now be completed, and a written report provided to the administering authority (the Queensland Department of Environment and Science, DES) within 60 days of NAC becoming aware of the first Condition D16 trigger. Per EA Condition D19, the investigation must include a determination of whether the exceedance or difference is caused by:

i. mining activities authorised under the EA; or

ii. natural variation; or

iii. neighbouring land use resulting in groundwater impacts.

This letter provides the investigation report required under EA Condition D19.

A similar investigation was conducted by SLR (2022 and 2023a) following the third consecutive exceedance for Sulfate at 4518WB in the October 2022 routine groundwater monitoring event, and then again by SLR (2023b) following the fifth consecutive exceedance for Sulfate at 4518WB in the May 2023 routine groundwater monitoring event. Discussion of those previous investigations is provided herein for context.

0 0.5 1 km

Coordinate System:	AGD 1984 AMG Zone 56
Scale:	1:40,000 at A4
Project Number:	620.31246
Date:	11-Jul-2023
Drawn by:	NT

Acland Coal Sequence EA Monitoring Bore
Existing Pit Shell
Mining Lease

NEW ACLAND COAL MINE
4518WB INVESTIGATION

LOCALITY PLAN

SLR

FIGURE 1

H:\Projects-SLR\620-BNE\620.11303 NAC03 GW Support\04 Reports\41 4518WB Investigation Q2 2023\Figures\SLR620111303.0041_F01_LocalityPlan.mxd

Triggering of EA Condition D16

Iron concentrations at 4518WB are presented in **Figure 2**, along with the relevant EA Limit. The EA Table D5 Limit for Iron at 4518WB is set at the 95th percentile of concentrations measured in groundwater at 4518WB between November 2017 and April 2021, in accordance with the DES (2021) process. Note that a statistically significant upward trend in Iron concentration at 4518WB was assessed during the development of the Limit (SLR, 2021), indicating Iron concentrations were not stable but already steadily increasing prior to the establishment of the EA Limits on 20th May 2022, and prior to the recent exceedance.

Generally, Iron concentrations are relatively low at below 3 mg/L. Immediately prior to the commencement of the EA Limits on 20th May 2022, Iron concentrations were generally very close to or at the EA Table D5 Limit. Since the commencement of the EA Limits on 20th May 2022, Iron concentrations at 4518WB have generally been above the Limit, except for a single monitoring event in July 2022 that reports spuriously low Iron concentrations, which may be the result of a laboratory error.

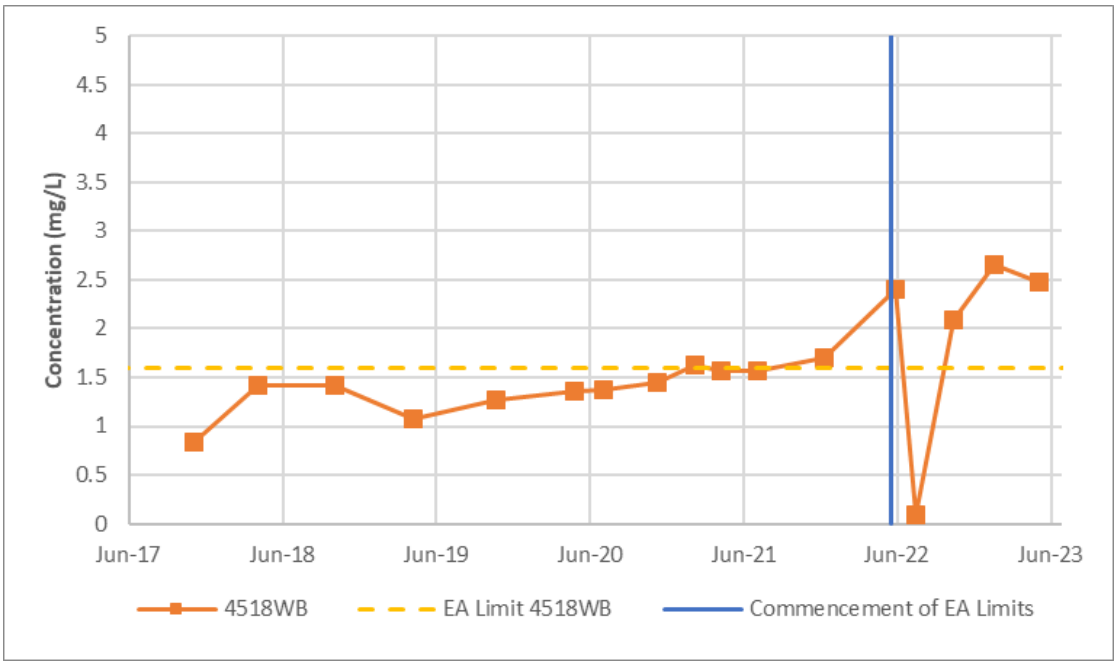


Figure 2 Iron Concentration Measured in Groundwater at 4518WB

Iron - Characterisation and Potential Sources

Geochemical Scientific (2020) has previously assisted NAC in describing the geochemical characteristics of Iron in groundwater.

As documented by Geochemical Scientific (2020), dissolved Iron is present in two valence states, ferrous iron (Fe2+) and ferric iron (Fe3+), and the solubility of iron is controlled by the redox state and pH of the host hydrologic system. Ferrous iron is geochemically stable and soluble under strongly reducing conditions (Eh < +100 mV), whereas ferric iron is soluble under highly acidic conditions (pH < 2). Since the pH of groundwater from the Acland Coal Sequence is approximately pH neutral in NAC monitoring bores, ferrous iron (Fe2+) would be the iron species present in groundwater at the NAC site.

The iron dissolution processes can only occur under highly acidic conditions (pH < 2), which releases ferric iron (Fe3+) into solution, or under strongly reducing conditions (Eh < +100 mV), which releases ferrous iron (Fe2+) into solution. Iron in groundwater is primarily sourced by dissolution of ferric iron oxyhydroxide mineral coatings such as goethite (FeOOH) from sediment surfaces. Depending on the pH and oxidation state of the groundwater system, some of the iron may also be sourced by dissolution of iron-carbonate (e.g. siderite) or iron-sulfide minerals (mackinawite or pyrite).

The iron concentrations in Walloon Coal Measures groundwater at NAC are generally considered elevated and indicate that reductive dissolution of iron oxyhydroxide minerals are significant processes occurring naturally in the area. These processes require the absence of oxygen and presence of strong reducing agents such as organic carbon (i.e. coal).

Overall, there are no known mining-related activities that have the potential to release Iron in groundwater that would not be accompanied by changes in other parameters, such as pH and redox.

Environmental Values and Water Quality Criteria

As described by SLR (2023b) the only relevant Environmental Values (EVs) of groundwater in the Acland Coal Sequence aquifer (i.e. bore 4518WB) is its potential use for stock watering (specifically cattle). As described in the ANZECC & ARMCANZ (2000) stock watering guidelines, Iron is *not sufficiently toxic* for stock to warrant trigger value. That is, there is no health risk to livestock posed by the Iron concentration exceedances at bore 4518WB.

Monitoring Data

Iron concentrations in groundwater for Acland Coal Sequence EA bores are shown in **Figure 3**. Concentrations at 4518WB are similar to those reported from bores 82Pc, 82PcR, and below those reported for bore 11PGC_LowerR. That is, Iron concentrations at 4518WB fall within the range of concentrations measured across the Acland Coal Sequence EA bores.

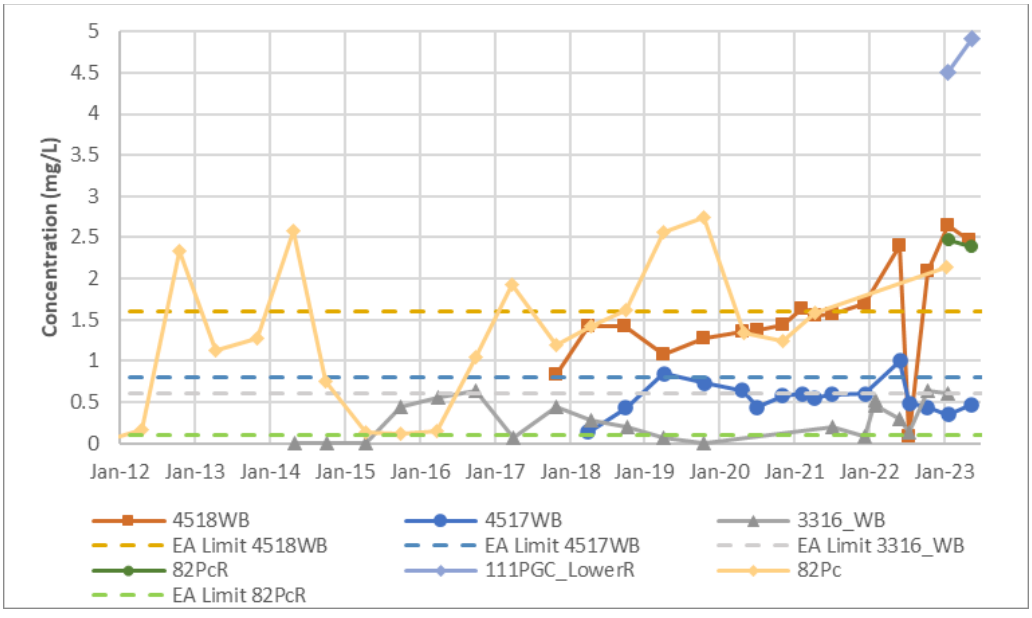


Figure 3 Iron Concentrations – Acland Coal Sequence EA Bores

As described above, the solubility of Iron is controlled by the redox state and pH of the host hydrologic system. Therefore, changes in the redox state and pH of groundwater may facilitate changes in Iron concentrations through induced dissolution reactions. In particular, pH values of <2 (as may occur as a result of acid mine impacts), or redox values of Eh < +100 mV may be indicative of conditions that facilitate changes in Iron concentrations. Redox state and pH monitoring results from 4518WB are presented as **Figure 4** below. As shown, pH has remained at or just above neutral over the monitoring record, whilst redox potential has only been recorded marginally below +100 mV three times in the monitoring record, and not since early 2021. As such, changes in pH or redox state of groundwater at 4518WB would not appear to be responsible for variations in Iron concentration.

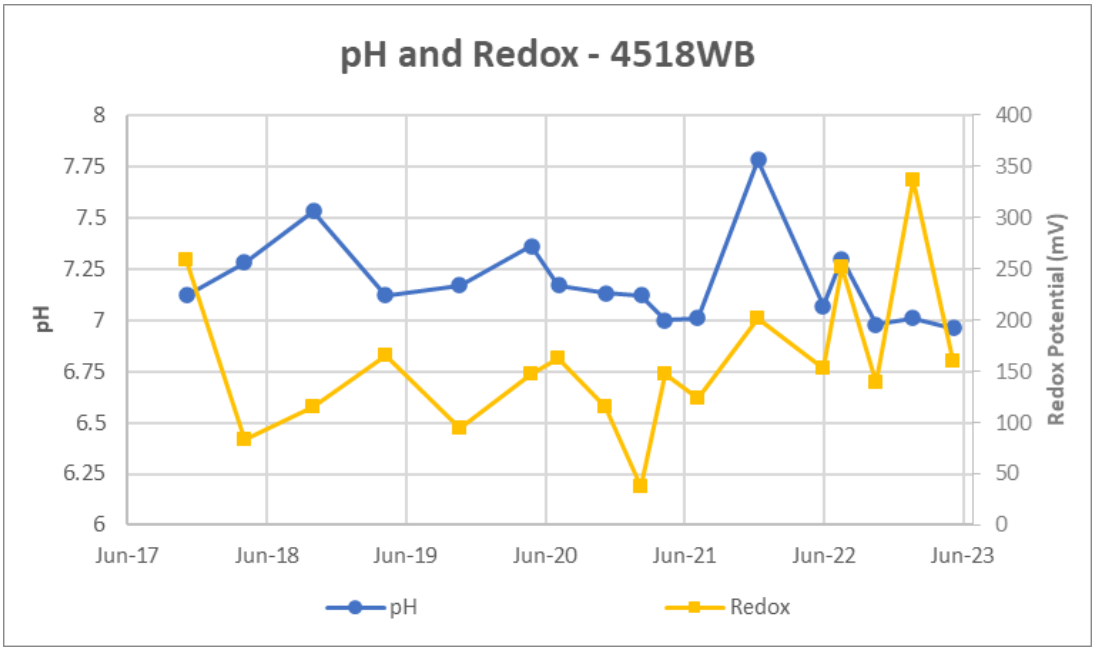


Figure 4 pH and Redox Measured in Groundwater at 4518WB

Previous Investigations at 4518WB

SLR (2022) were engaged by NAC to prepare an investigation report pursuant to EA Conditions D16 and D19 following the third consecutive exceedance of Sulfate concentrations at 4518WB during the October 2022 routine monitoring event. A supplementary investigation report was prepared by SLR (2023a), and following further exceedances of Sulfate at 4518WB in January and May 2023, an additional investigation report was prepared by SLR (2023b). The investigation reports were submitted to the Queensland Department of Environment and Science (DES) by NAC. The key findings of the investigations were:

1 The relevant Environmental Values (EVs) of groundwater in the NAC area are limited to Stock watering (cattle) for the Acland Coal Sequence aquifer (i.e. bore 4518WB).

2 The exceedances to the Sulfate EA trigger observed at the bore do not represent any risk to the only relevant Environmental Value i.e. stock watering. Therefore, it was determined that the sulfate exceedances noted at bore 4518WB do not constitute a potential risk to identified groundwater receptors in terms of their concentration.

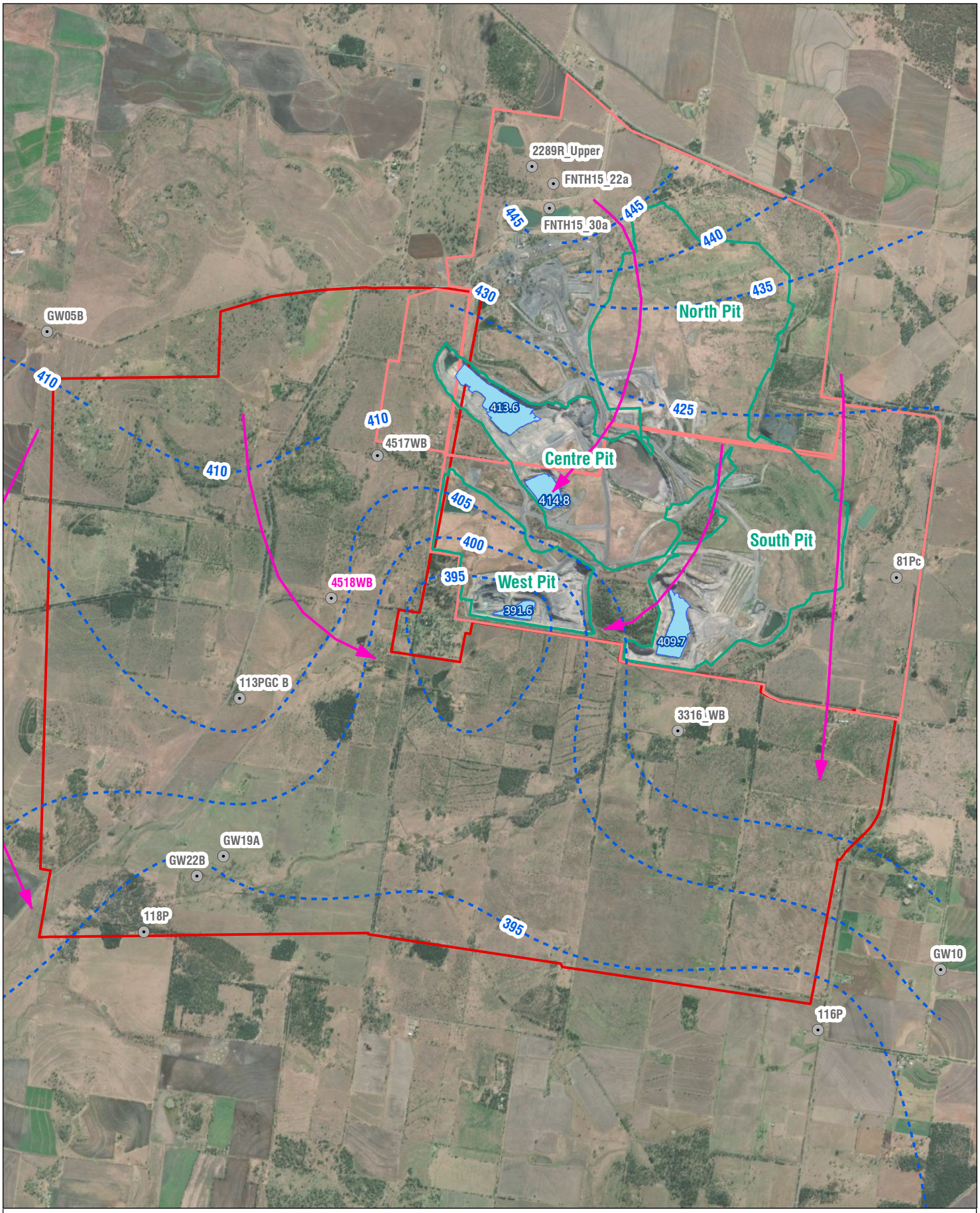
3 The groundwater flow direction in the Acland Coal Sequence in the vicinity of 4518WB is shown to be towards NAC's operations, not away from NAC's operations (**Figure 5**). Derivation of the groundwater flow direction included consideration of the hydraulic head within in-pit water storages and the conservative (worst case) assumption that those storages are completely connected to the surrounding groundwater system. The groundwater flow directions show that flow is towards the in-pit water storages and there is no hydraulic mechanism for transport of contaminants from NAC's operations to groundwater accessed by the subject bore, and NAC's operations therefore can not be the source of the changes in groundwater concentrations. That is, the transport of potential contaminants in groundwater away from the mine towards 4518WB is not plausible.

4 Consideration was given to NAC water storages on surface water drainage features proximal to bore 4518WB as a possible source of sulfate in groundwater. The water storages near 4518WB cannot be the source of increasing sulfate concentrations at 4518WB as sulfate concentrations in this water are lower than the later time values at 4518WB.

5 Overall, there is no evidence that NAC's activities are the source of the Sulfate concentration increases observed at 4518WB, rather, available evidence indicates that the concentration changes are not sourced from NAC's activities.

6 Notwithstanding the fact groundwater flow directions are demonstrated to be towards NAC's operations, the environmental risk posed by the concentration increases is negligible given:

- calculated rates of groundwater movement approximate only 1 m per year;
- the nearest third-party property with a known Walloon Coal Measures extraction bore is located 3.5 km away from 4518WB; and
- there are no identified natural environmental receptors for the Acland Coal Sequence aquifer.



0 0.5 1 km

Coordinate System:	AGD 1984 AMG Zone 56
Scale:	1:50,000 at A4
Project Number:	620.31246
Date:	11-Jul-2023
Drawn by:	NT

- Acland Coal Sequence Monitoring Bore
- In-Pit Waterbody & Elevation mAHD
- Existing Pit Shell
- Mining Lease (Stage 1 and 2)
- Mining Lease (Stage 3)
- Infererd GW Flow Direction
- Acland Coal Sequence Potentiometric Contours Oct 2022 (mAHD)

NEW ACLAND COAL MINE
4518WB INVESTIGATION

GROUNDWATER POTENTIOMETRIC SURFACE
ACLAND COAL SEQUENCE

SLR

FIGURE 5

H:\Projects-SLR\620-BNE\620.11303 NAC03 GW Support\04 Reports\41 4518WB Investigation Q2 2023\Figures\SLR620111303.0041_F05_AclandRSWL.mxd

Review of Potential Factors Influencing Iron Concentrations

EA Condition D19 requires that the investigation must include a determination of whether the exceedance or difference is caused by:

i. mining activities authorised under the EA; or

ii. natural variation; or

iii. neighbouring land use resulting in groundwater impacts.

These factors were discussed in SLR (2022), and an updated discussion is provided below as relevant to the current investigation.

Mining Activities

Prior to May 2023, New Acland Mine was in care and maintenance with only minor associated activities taking place. That is, there was no mining activity during or immediately preceding the three most recent sampling events that resulted in the Condition D16 trigger. However, just prior to the May monitoring event, mining activities had recommenced in the form of topsoil and overburden pre-stripping activities immediately south of pre-2023 mining activities. It is considered that these surface activities that commenced in early May 2023 have no potential to release iron to groundwater.

Natural Variability

As discussed above, Iron in groundwater is primarily sourced by natural dissolution of ferric iron oxyhydroxide mineral coatings such as goethite, or if pH and redox conditions allow, natural dissolution of iron-carbonate (e.g. siderite) or iron-sulfide minerals (mackinawite or pyrite). Also outlined above is the fact that Iron concentrations in groundwater at 4518WB were already trending upwards over the entire baseline dataset used to set the EA Table D5 Limit at the bore, and Iron concentrations at EA bores are quite variable. It therefore remains entirely plausible that natural variability, or movement of groundwater of naturally higher Iron concentration towards 4518WB, is responsible for the changes in Iron concentrations seen.

Neighbouring Land Use

Prior to the May 2023 monitoring event, the vast majority of land immediately adjacent to New Acland Mine remained under the ownership and management of Acland Pastoral Company. There has been no change in Acland Pastoral Company's land use activities that might have potential to release iron to groundwater.

Conclusions

The following conclusions are derived from this investigation.

- Iron in groundwater is sourced from mineral dissolution reactions that are highly pH and/or redox dependant. There are no known mining-related activities that have the potential to release Iron in groundwater that would not be accompanied by changes in pH and/or redox. No such changes in pH or redox have occurred at 4518WB, and furthermore the changes in Iron concentrations observed at 4518WB have occurred during the absence of significant mining activities (i.e. whilst the mine was on care & maintenance).

- Iron concentrations at 4518WB were already trending upward prior to the establishment of the EA Table D5 Limit, and therefore review of the Limit would be warranted in light of this existing trend. Iron concentrations at 4518WB remain relatively low and consistent with concentrations recorded in other EA bores in the Acland Coal Sequence, with some bores recording Iron concentrations almost double that recorded in 4518WB, suggesting the EA Table D5 Limit for 4518WB is not appropriate on an aquifer scale and should be reviewed.
- Iron concentrations do not pose a threat to the relevant environmental receptor for groundwater in the Acland Coal Sequence (i.e. stock watering) since Iron is not sufficiently toxic for stock to warrant trigger values in the ANZECC & ARMCANZ (2000) guidelines. Therefore there is no environmental harm that has occurred, or may occur, from the Iron exceedance at 4518WB.
- Notwithstanding the fact that there is no risk posed to environmental receptors, groundwater level monitoring data shows that groundwater flow directions in the Acland Coal Sequence are towards NAC's activities, rather than away from NAC's activities towards 4518WB. NAC's activities therefore can not be responsible for releasing Iron to groundwater that is then detected at 4518WB.
- There is no evidence that the Iron concentration exceedance at 4518WB is caused by mining activities or neighbouring land use. Given the Iron concentrations and associated trends recorded in other monitoring bores, natural variability can no be ruled out as a cause for the exceedance at 4518WB. That is, the Iron exceedance at 4518WB is most likely caused by natural variation.

Closing

We trust the information presented herein meets your expectations.

Regards,

SLR Consulting Australia Pty Ltd

References

DES, 2021. Using monitoring data to assess groundwater quality and potential environmental impacts. Version 2. Department of Environment and Science (DES), Queensland Government, Brisbane.

Geochemical Scientific, 2020. Bore Network Integrity and Implications Assessment. Prepared for New Acland Coal Pty Ltd.

SLR, 2021. New Acland Coal Mine Groundwater EA Amendment Groundwater Contaminant Limits Review. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal Pty Ltd.

SLR, 2022. New Acland Mine EA Bores 10PbR & 4518WB Exceedance Investigation. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal Pty Ltd.

SLR, 2023a. New Acland Mine EA Bores 10PbR & 4518WB Exceedance Investigation. Response to DES. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal Pty Ltd.

SLR, 2023b. New Acland Mine EA Bores 10PbR & 4518WB Exceedance Investigation. January and May 2023 Monitoring Events. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal Pty Ltd.

SLR Consulting Australia
Level 16, 175 Eagle Street, Brisbane QLD 4000, Australia

20 December 2023

SLR Ref No.: 620.11303.00427-L01-v1.0-20231219.docx

Attention: Michael Law
New Acland Coal Pty Ltd
Muldu, QLD

SLR Project No.: 620.11303.00427

RE: New Acland Mine
Groundwater EA Exceedance Investigation
Q3 2023 Monitoring Event

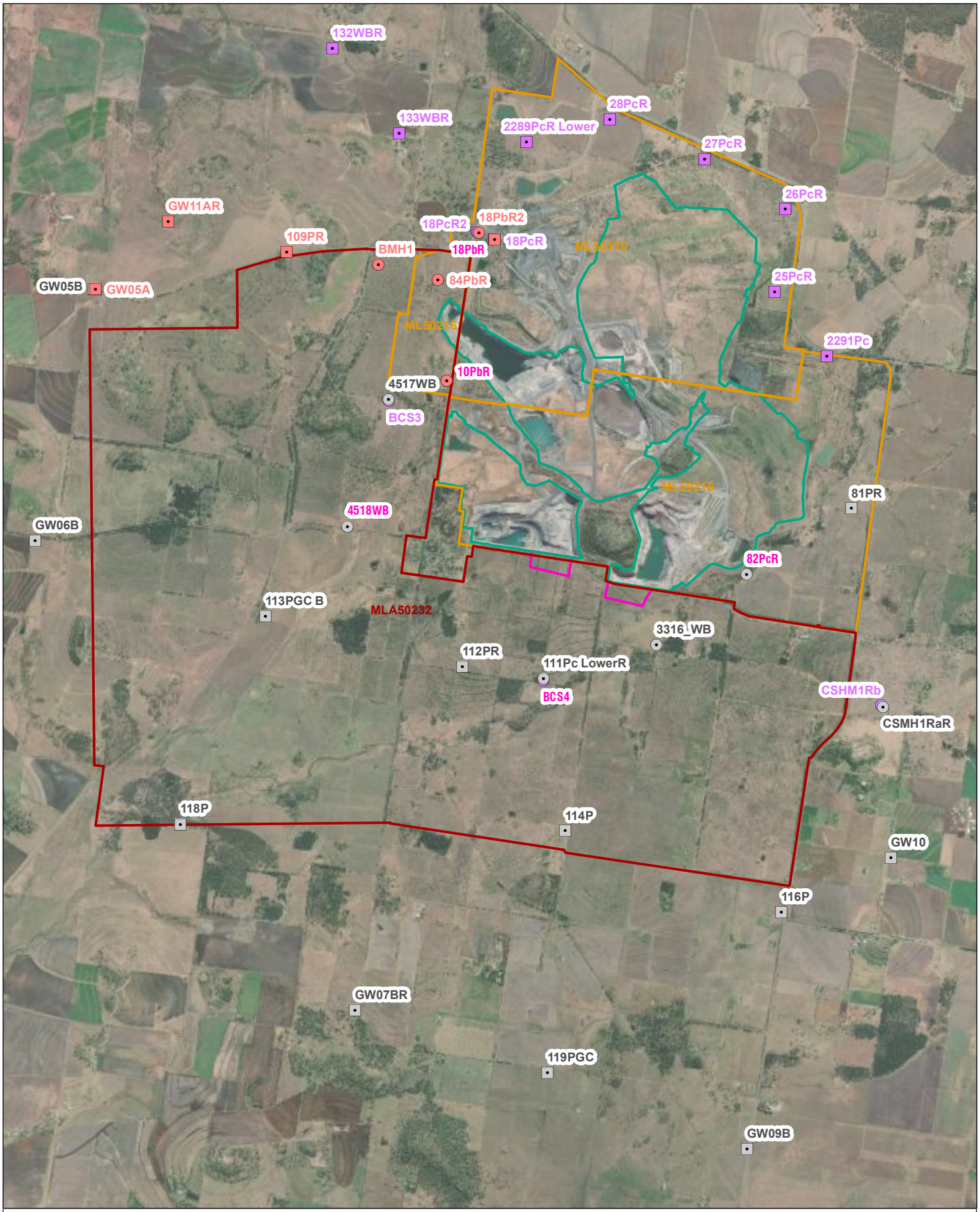
1.0 Introduction

SLR have been engaged by New Acland Coal Pty Ltd (NAC) to assist NAC meet its reporting obligations in regard to the recent triggering of New Acland Mine Environmental Authority (EA) EPML00335713 Condition D16 for a groundwater monitoring bore following the Quarter 3 (Q3) 2023 routine groundwater monitoring event:

- 10PbR in the Main Range Volcanics (basalt) aquifer:
  - Nitrate (as N) concentrations above EA Table D5 Limits for six consecutive occasions.
- 18PbR2 in the Main Range Volcanics (basalt) aquifer:
  - pH above EA Table D5 Limits for three consecutive occasions.
- 4518WB in the Acland Coal Sequence aquifer:
  - Sulfate concentrations above EA Table D5 Limits for six consecutive occasions; and
  - Iron concentrations above EA Table D5 Limits for three consecutive occasions.
- 82PcR in the Acland Coal Sequence aquifer:
  - Sulfate concentrations above EA Table D5 Limits for three consecutive occasions;
  - Iron concentrations above EA Table D5 Limits for three consecutive occasions; and
  - Manganese concentrations above EA Table D5 Limits for three consecutive occasions.
- BCS4 in the Balgowan Coal Sequence:
  - Sulfate concentrations above EA Table D5 Limits for three consecutive occasions.

Locations for the bores outlined above with respect to the New Acland Mine and other EA bores are provided on **Figure 1-1**.

Pursuant to EA Condition D19, an investigation must now be completed, and a written report provided to the administering authority (the Queensland Department of Environment and Science, DES) within 60 days of NAC becoming aware of the first Condition D16 trigger.



0 0.5 1 km

Coordinate System:	AGD 1984 AMG Zone 56
Scale:	1:56,041 at A4
Project Number:	620.31246
Date:	20-Dec-2023
Drawn by:	NT

- Stage 1 and Stage 2 Mining Leases
- Stage 3 Mining Lease
- Stage 1 and Stage 2 Pit Shell
- Stage 3 Pit Shell (Sept 2023)

EA Monitoring Bores

- Main Range Volcanics - Compliance
- Main Range Volcanics - Interpretation
- Acland Coal Sequence - Compliance
- Acland Coal Sequence - Interpretation
- Balgowan Coal Sequence - Compliance
- Balgowan Coal Sequence - Interpretation

NEW ACLAND COAL MINE Q3 2023 GROUNDWATER INVESTIGATION

LOCALITY PLAN

SLR

FIGURE 1

H:\Projects-SLR\620-BNE\620.11303 NAC03 GW Support\06 SLR Data\01 CADGIS\GW Exceedances Oct2023\SLR620.11303_F1-1_LocalityPlan.mxd

Per EA Condition D19, the investigation must include a determination of whether the exceedance or difference is caused by:

i. mining activities authorised under the EA; or

ii. natural variation; or

iii. neighbouring land use resulting in groundwater impacts.

This letter provides the investigation report required under EA Condition D19.

Similar investigations have been conducted by SLR (2022, 2023a, 2023b and 2023c) following exceedances of Nitrate as N at 10PbR, and Sulfate and Iron at 4518WB in previous routine groundwater monitoring events. Discussion of those previous investigations is provided herein for context.

2.0 Triggering of EA Condition D16

The relevant monitoring data for the bores subject to Q3 2023 exceedances is provided in **Figure 2-1** through **Figure 2-5**. Note that the EA Table D5 Limits only became effective on finalisation of the relevant EA Amendment on 20th May 2022, prior to the installation of bores 18PbR2, 82PcR and BCS4 as shown on the plots. The data also shows that the Q3 2023 exceedances at bores 10PbR and 4518WB are consistent with the previous exceedances investigated by SLR (2022, 2023a, 2023b and 2023c).

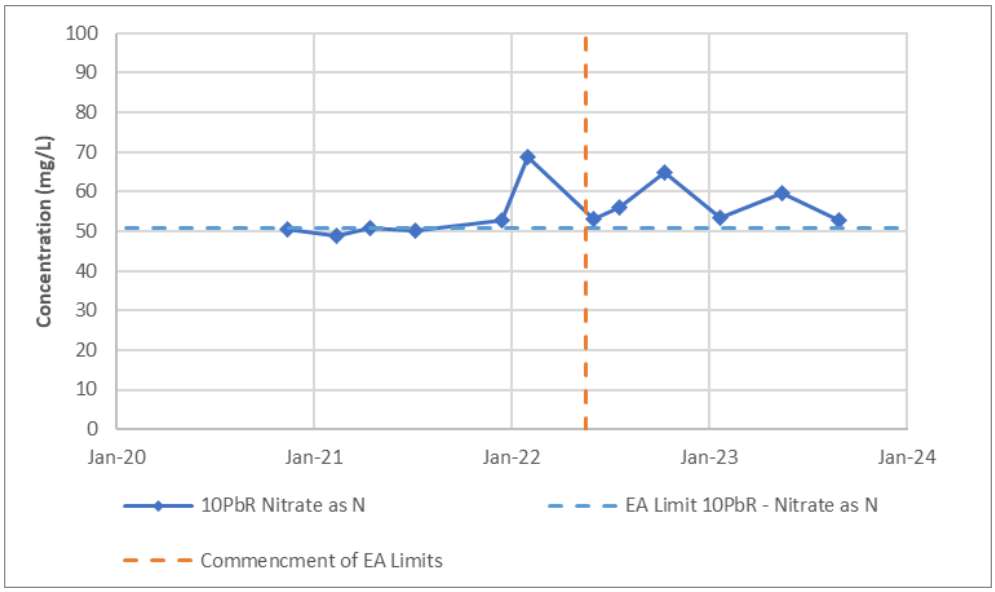


Figure 2-1 10PbR Nitrate as N

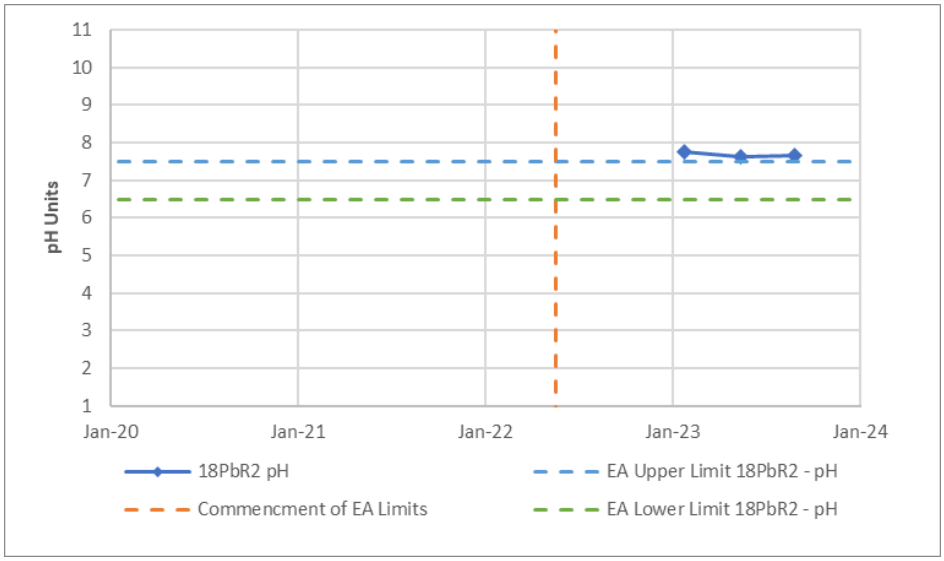


Figure 2-2 18PbR2 pH

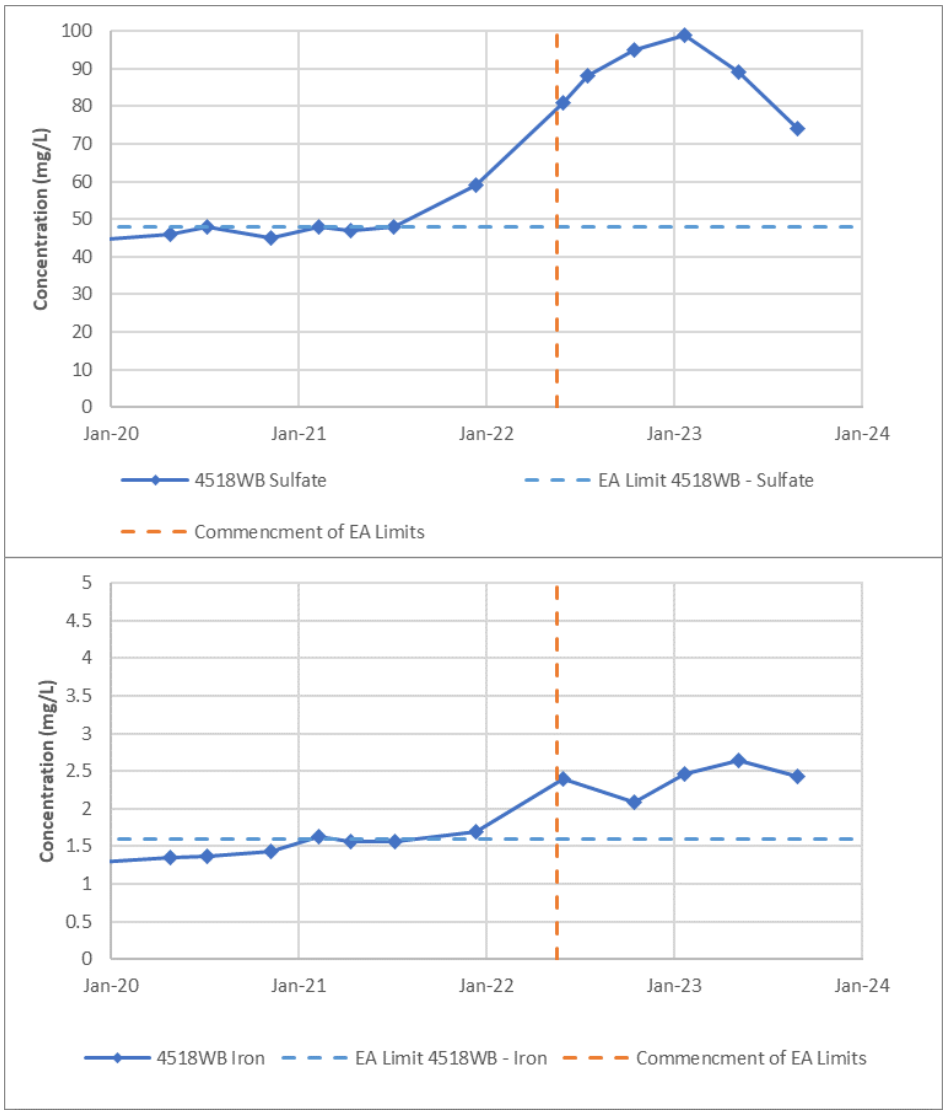


Figure 2-3 4518WB Sulfate and Iron

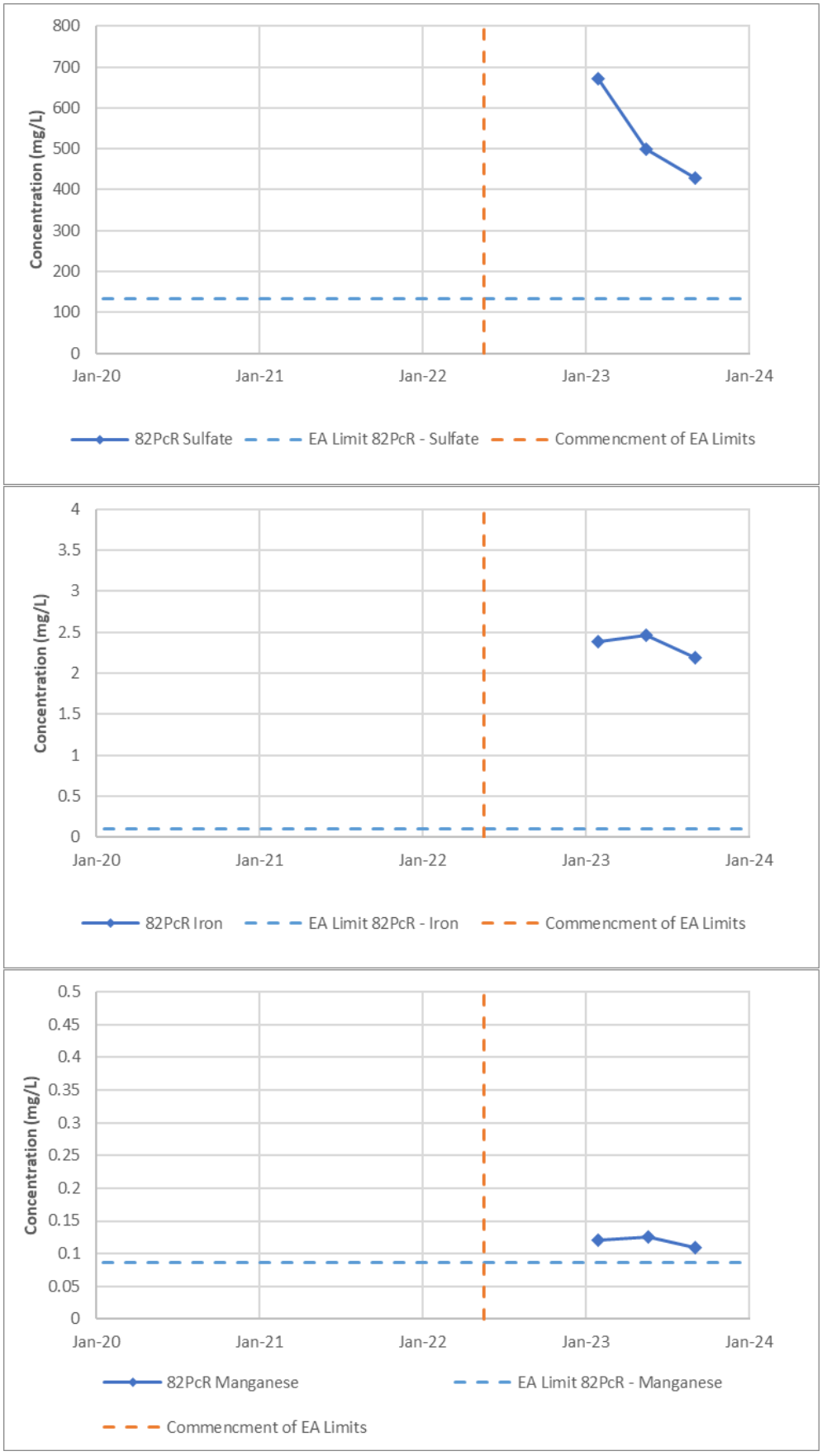


Figure 2-4 82PcR Sulfate, Iron and Manganese

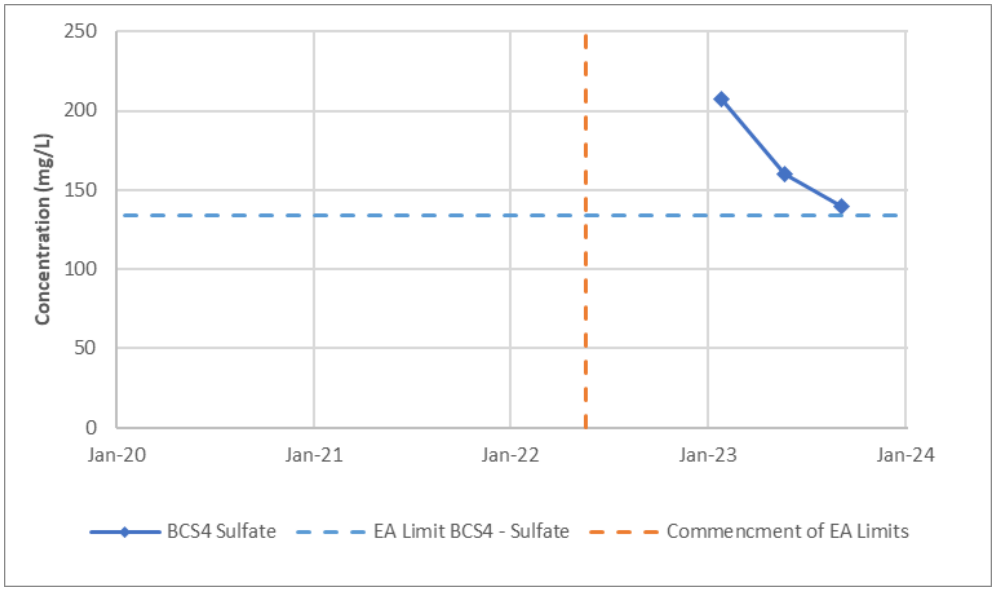


Figure 2-5 BCS4 Sulfate

3.0 Previous Investigations

As mentioned above, bores 10PbR and 4518WB have been the subject of exceedance investigations prior to the Q3 2023 monitoring event. SLR (2022) were engaged to prepare an investigation report following the third consecutive exceedances of Nitrate (as N) concentrations at 10PbR and Sulfate concentrations at 4518WB during the October 2022 routine monitoring event. The investigation report was submitted to the Queensland Department of Environment and Science (DES) by NAC on 23rd December 2022. The key findings of the SLR (2022) investigation were as follows:

1 Groundwater flow directions in both the Main Range Volcanics and Acland Coal Sequence in the vicinity of the subject bores were shown to be towards NAC's operations, not away from NAC's operations. Derivations of those flow directions included consideration of the hydraulic head within in-pit water storages and the conservative (worst case) assumption that those storages are completely connected to the surrounding groundwater system. The groundwater flow directions show that there is no hydraulic mechanism for transport of sulfate or nitrate from NAC's operations to groundwater accessed by the subject bores, and NAC's operations therefore can not be the cause of the changes in groundwater concentrations.

2 The EA groundwater limits for bore 10PbR were established using the statistical analysis methods as described in DES (2021). However, the groundwater EA triggers established used with significantly less data points than is described in DES (2021). For example, four datapoints were used instead of the recommended 18, thus it can only be considered that the current EA triggers should be regarded as interim at best. The current EA groundwater triggers are not representative of long-term temporal natural groundwater quality nor form an appropriate trigger value for the detection of potential environmental harm in the EA.

3 Nitrate (i.e. as N) concentrations from bore 10PbR have been historically elevated since baseline monitoring began; including prior to the provision of the EA triggers. Moreover, concentrations have been significantly above (other) EA monitoring bores and the relevant water quality objective for the protection of Environmental Values. Therefore, there is no environmental risk posed by the recent concentration increases at 10PbR. Historic anthropogenic agricultural land use activity proximal to

10PbR, but not related to NAC's operations, are the likely source of this nitrate in groundwater.

4 Sulfate concentrations at the 4518WB location have been historically elevated since baseline monitoring began at that bore, and prior to the recent trigger exceedance, with those baseline concentrations being significantly above other EA monitoring bores. Historic underground mines proximal to 4518WB but not related to NAC's operations are a potential source of this elevated sulfate in groundwater.

5 Consideration was given to NAC surface water storages proximal to bore 4518WB to be a source of sulfate in groundwater. The data shows that surface water in the NAC related storages near to 4518WB can not be a source of increasing sulfate concentrations at bore 4518WB, since any infiltration of this surface water would only dilute sulfate concentrations in groundwater after June 2022.

6 There is no evidence that NAC's activities have caused the concentration increases observed at the two subject bores, rather, available evidence is to the contrary such that it can be concluded that the concentration changes are not caused by NAC's activities.

Following the receipt of written feedback from DES on 28th February 2023, NAC engaged SLR (2023a) to prepare a supplementary report. The following key outcomes were documented by SLR (2023a) in the supplementary report.

1 The relevant actual Environmental Values (EVs) of groundwater in the NAC area are:

- Main Range Volcanics aquifer (i.e. bore 10PbR): Stock watering (cattle) and Irrigation.
- Acland Coal Sequence aquifer (i.e. bore 4518WB): Stock watering (cattle).

2 Comparison of the October 2022 results, the respective EA trigger values, and the relevant guideline criteria indicates:

- The EA sulfate trigger value at 4518WB is more than 20 times lower than the ANZECC & ARMCANZ (2000) guideline criteria for stock watering, and the sulfate concentration recorded in October 2022 is 10.5 times lower than the guideline criteria. Thus, the exceedances to the current EA trigger observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for groundwater use.
- The EA nitrate trigger value at 10PbR is nearly 8 times lower than the ANZECC & ARMCANZ (2000) stock watering guideline criteria, and the sulfate concentration recorded in October 2022 is 6 times lower than the guideline criteria. Thus, the exceedances to the current EA trigger observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.
- Nitrate is a constituent component of Total N. Total N values reported in SLR (2022) show that October 2022 monitoring results at 10PbR have a Total N concentration of 71.5 mg/L, which is 1.75 times less than the upper limit of the ANZECC & ARMCANZ (2000) guideline criteria for irrigation. Thus, the nitrate exceedances observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for irrigation groundwater use.

Therefore, neither of the exceedances noted at bores 4518WB and 10PbR constitute a potential risk to actual groundwater receptors in terms of water quality concentrations.

3 Notwithstanding the fact groundwater flow directions are demonstrated to be inwards towards NAC's operations, the environmental risk posed by the concentration increases at 10PbR and 4518WB is negligible given:

   - calculated rates of groundwater movement approximate only 1 m per year;
   - the nearest third-party property with a known Main Range Volcanics extraction bore is located 3.9 km away from 10PbR;
   - the nearest third-party property with a known Walloon Coal Measures extraction bore is located 3.5 km away from 4518WB; and
   - there are no identified natural environmental receptors for either aquifer.

Following the January 2023 and May 2023 routine groundwater monitoring events that reported further exceedances of Nitrate (as N) concentrations at 10PbR and Sulfate concentrations at 4518WB, SLR (2023b) prepared another investigation report. The investigation approach consisted of a review of available data to assess whether there is any information to suggest that alternate conclusions to those reported by SLR (2022 and 2023a) may be plausible. That is, the approach to the investigation was to validate (or otherwise if appropriate) the previous investigation results. The following outcomes were reached from the SLR (2023b) investigation.

1 The exceedances observed for 10PbR and 4518WB in January 2023 and May 2023 are consistent with the previous exceedances investigated by SLR (2022) that resulted from the October 2022 monitoring event.

2 There is no evidence that the findings of the SLR (2022 and 2023a) investigation are not applicable to the January 2023 and May 2023 monitoring event exceedances:

   a) Groundwater flow directions show that there is no hydraulic mechanism for transport of sulfate or nitrate from NAC's operations to groundwater accessed by the subject bores, and NAC's operations therefore can not be the cause of the changes in groundwater concentrations.

   b) Neither of the exceedances noted at bores 4518WB and 10PbR constitute water quality concentrations that are above guideline values for the most relevant Environmental Values for groundwater in the area. Rather, January 2023 and May 2023 results remain approximately 7 to 11 times below the relevant guideline values.

   c) Notwithstanding the fact groundwater flow directions are demonstrated to be inwards towards NAC's operations, the environmental risk posed by the concentration increases is negligible.

SLR (2023c) then prepared another investigation report following a reported exceedance for Iron in the May 2023 routine monitoring event at bore 4518WB. The following conclusions were derived from that investigation.

- There are no known mining-related activities that have the potential to release Iron in groundwater that would not be accompanied by changes in pH and/or redox. No such changes in pH or redox have occurred at 4518WB, and furthermore the changes in Iron concentrations observed at 4518WB have occurred during the absence of significant mining activities (i.e. whilst the mine was on care & maintenance).
- Iron concentrations at 4518WB were already trending upward prior to the establishment of the EA Table D5 Limit, and therefore review of the Limit would be warranted in light of this existing trend.

- Iron concentrations at 4518WB remain relatively low and consistent with concentrations recorded in other EA bores in the Acland Coal Sequence, with some bores recording Iron concentrations almost double that recorded in 4518WB, suggesting the EA Table D5 Limit for 4518WB is not appropriate on an aquifer scale and should be reviewed.
- Iron concentrations do not pose a threat to the relevant environmental receptor for groundwater in the Acland Coal Sequence (i.e. stock watering) since Iron is not sufficiently toxic for stock to warrant trigger values in the ANZECC & ARMCANZ (2000) guidelines. Therefore there is no environmental harm that has occurred, or may occur, from the Iron exceedance at 4518WB.
- Notwithstanding the fact that there is no risk posed to environmental receptors, groundwater level monitoring data shows that groundwater flow directions in the Acland Coal Sequence remain towards NAC's activities, rather than away from NAC's activities towards 4518WB. NAC's activities therefore can not be responsible for releasing Iron to groundwater that is then detected at 4518WB.
- There is no evidence that the Iron concentration exceedance at 4518WB is caused by mining activities or neighbouring land use. Given the Iron concentrations and associated trends recorded in other monitoring bores, natural variability can no be ruled out as a cause for the exceedance at 4518WB. That is, the Iron exceedance at 4518WB is most likely caused by natural variation.

4.0 Analysis of Groundwater Movement

The analysis of groundwater flow directions is a fundamental first step in the investigation of groundwater quality variability. This is due to the fact that movement of solutes in groundwater is controlled overwhelmingly by groundwater flow hydraulics. Therefore, consistent with the investigations prepared by SLR (2022, 2023a and 2023b), an assessment of the most recent groundwater level monitoring data collected under the EA has been undertaken to review groundwater flow directions and the potential movement of solutes in groundwater.

4.1 Main Range Volcanics

Groundwater level data to September 2023 for the Main Range Volcanics EA monitoring bores is provided as **Figure 4-1**. The monitoring data shows that groundwater elevations in the Main Range Volcanics have generally been relatively stable over 2023, with slight declining trends evident following peak levels in 2022 following the particularly wetter than average climate period in late 2021/early 2022. It is noted that bore 10PbR show the most significant groundwater level response to the climate variability in late 2021/early 2022.

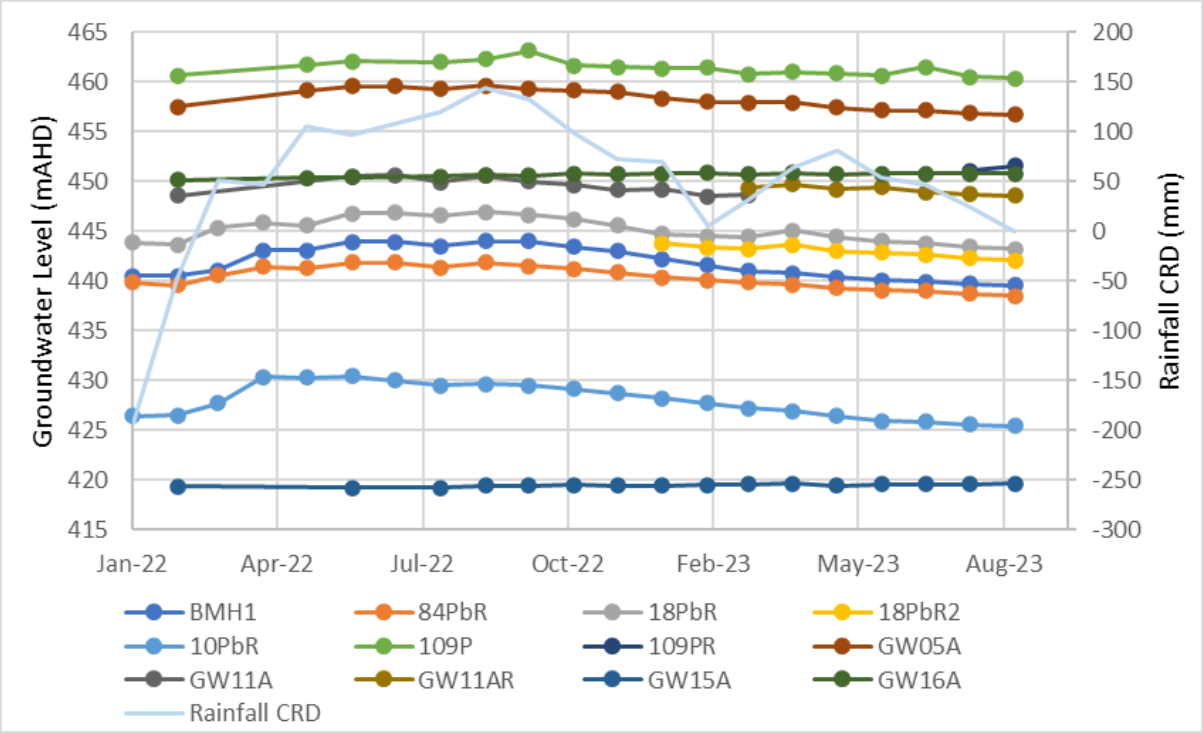
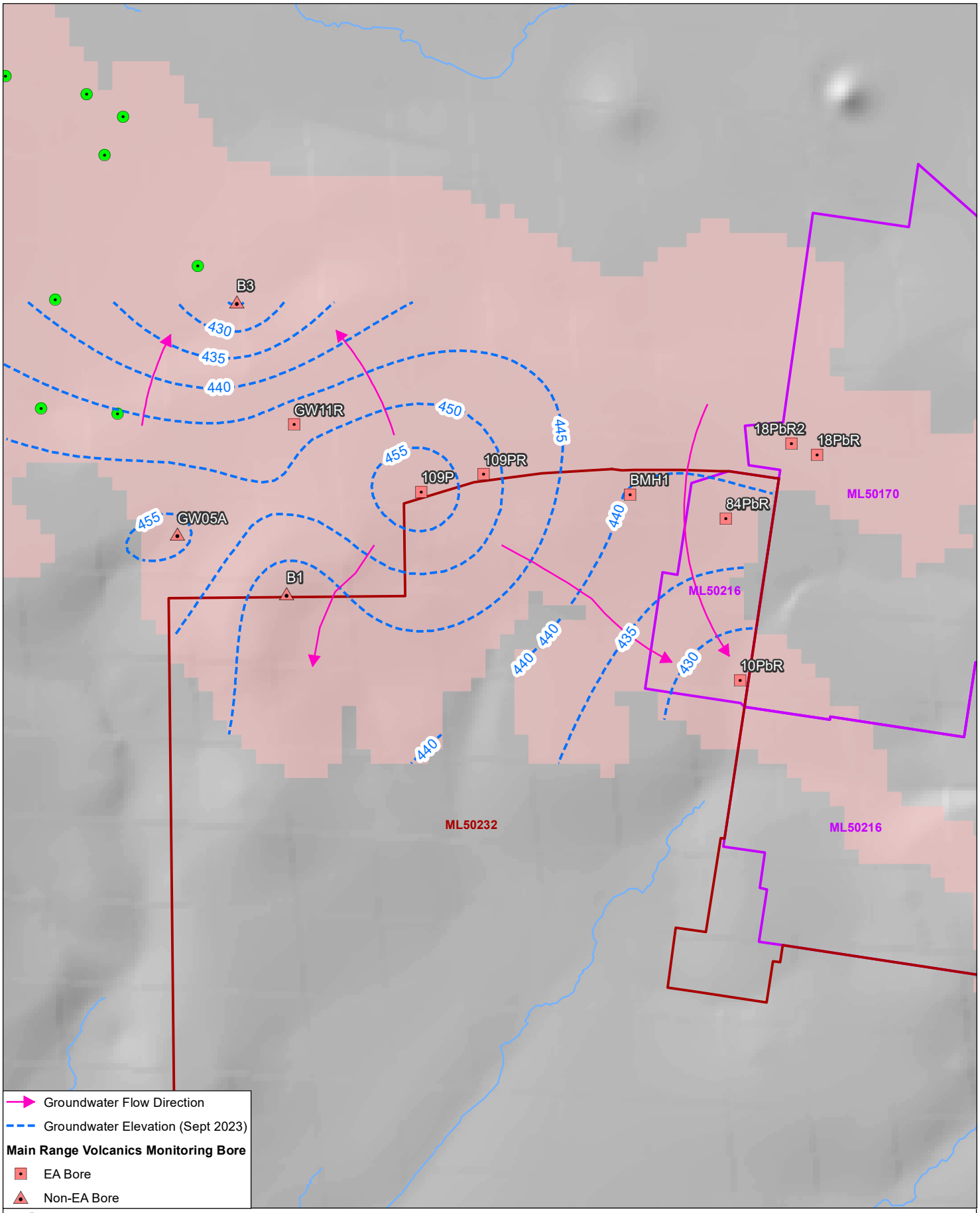


Figure 4-1 Groundwater Levels - Main Range Volcanics EA Bores

A potentiometric surface map for the Main Range Volcanics has been developed using September 2023 monitoring data from the New Acland Mine's extensive groundwater monitoring network (**Figure 4-2**). The potentiometric surface map indicates that groundwater flow in September 2023 in the Main Range Volcanics is from the northwest towards the New Acland Mine and bore 10PbR, consistent with flow direction mapping reported in SLR (2022). That is, flow mapping indicates there remains no groundwater flow mechanism for transport of solutes in groundwater away from mining activities towards 10PbR.



Groundwater Flow Direction

Groundwater Elevation (Sept 2023)

Main Range Volcanics Monitoring Bore

EA Bore

Non-EA Bore

0 0.5 1 km

Coordinate System:	AGD 1984 AMG Zone 56
Scale:	1:35,000 at A4
Project Number:	620.11303.00424
Date:	20-Dec-2023
Drawn by:	AS

Surface Drainage

Stage 1 and Stage 2 Mining Leases

Stage 3 Mining Lease

Modelled Formation Extent

Surveyed Operational Third-Party Bore - MRV

NEW ACLAND COAL MINE
Q3 2023 GROUNDWATER INVESTIGATION

MAIN RANGE VOLCANICS GROUNDWATER LEVELS

SLR

FIGURE 4-2

H:\Projects-SLR\620-BNE\620.11303 NAC03 GW Support\06 SLR Data\01 CADGIS\GW Exceedances Oct2023\SLR620.11303_F4-2_BasaltWLs.mxd

4.2 Acland Coal Sequnce

Groundwater level data to September 2023 for the Acland Coal Sequence EA monitoring bores is provided as **Figure 4-3**. The monitoring data shows that groundwater elevations in the Acland Coal Sequence have been relatively stable over 2023, with very subtle declining trends evident at some bores following peak levels in 2022 following the particularly wetter than average climate period in late 2021/early 2022.

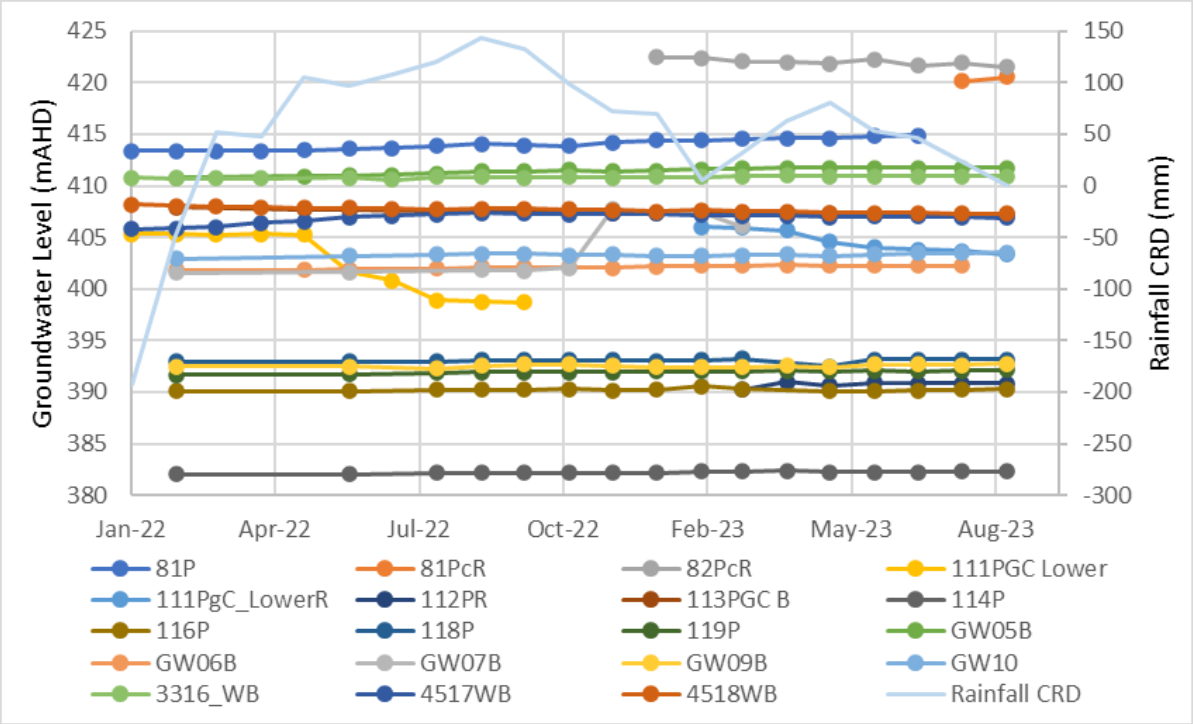
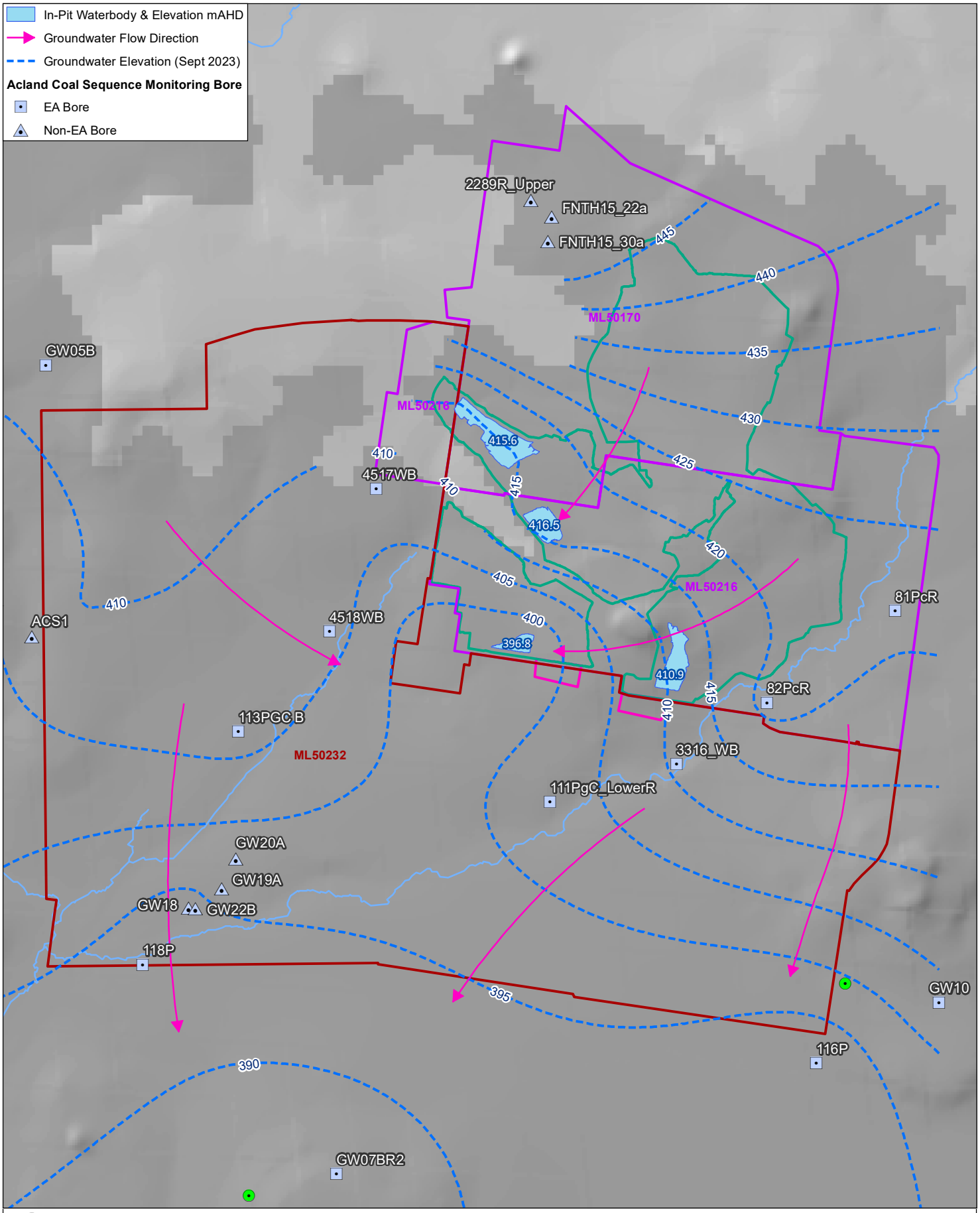


Figure 4-3 Groundwater Levels – Acland Coal Sequence EA Bores

A potentiometric surface map for the Acland Coal Sequence has been developed (**Figure 4-4**) using September 2023 monitoring data from the New Acland Mine's extensive groundwater monitoring network, and measured elevations of in-pit water storages considered in hydraulic connection with the Acland Coal Sequence, as shown on the figure. The potentiometric surface map indicates that groundwater flow in September 2023 in the Acland Coal Sequence is generally consistent with flow direction mapping reported in SLR (2022), being:

- North to south-southwest across the historic mining areas on ML 50170 and ML 50216, towards current mine pit voids in the southwest of ML 50216;
- From the west-northwest in the western part of ML 50232, towards current mine pit voids in the southwest of ML 50216; and
- Southwards in the southern half of ML 50232.

It is evident in the groundwater flow mapping that the current mine pit voids in the southwest of ML 50216 exert a dominant hydraulic control on the groundwater flow system in the Acland Coal Sequence, consistent with passive groundwater discharge to the mine pits.



0 0.5 1 km

Coordinate System:	AGD 1984 AMG Zone 56
Scale:	1:50,000 at A4
Project Number:	620.11303.00424
Date:	20-Dec-2023
Drawn by:	AS

- Surface Drainage
- Stage 1 and Stage 2 Mining Leases
- Stage 3 Mining Lease
- Stage 1 and Stage 2 Pit Shell
- Stage 3 Pit Shell (Sept 2023)
- Modelled Formation Extent
- Surveyed Operational Third-Party Bore - ACS

NEW ACLAND COAL MINE
Q3 2023 GROUNDWATER INVESTIGATION

ACLAND COAL SEQUENCE GROUNDWATER LEVELS

SLR

FIGURE 4-4

H:\Projects-SLR\620-BNE\620.11303 NAC03 GW Support\06 SLR Data\01 CADGIS\GW Exceedances Oct2023\SLR620.11303_F4-4_AclandWLs.mxd

4.3 Balgowan Coal Sequence

Groundwater level data to September 2023 for the Balgowan Coal Sequence EA monitoring bores is provided as **Figure 4-5**. The monitoring data shows that groundwater elevations in the Balgowan Coal Sequence have been relatively stable over 2023, with some slight increasing trends evident at some bores, which may in part be a delayed response to the particularly wetter than average climate period in late 2021/early 2022.

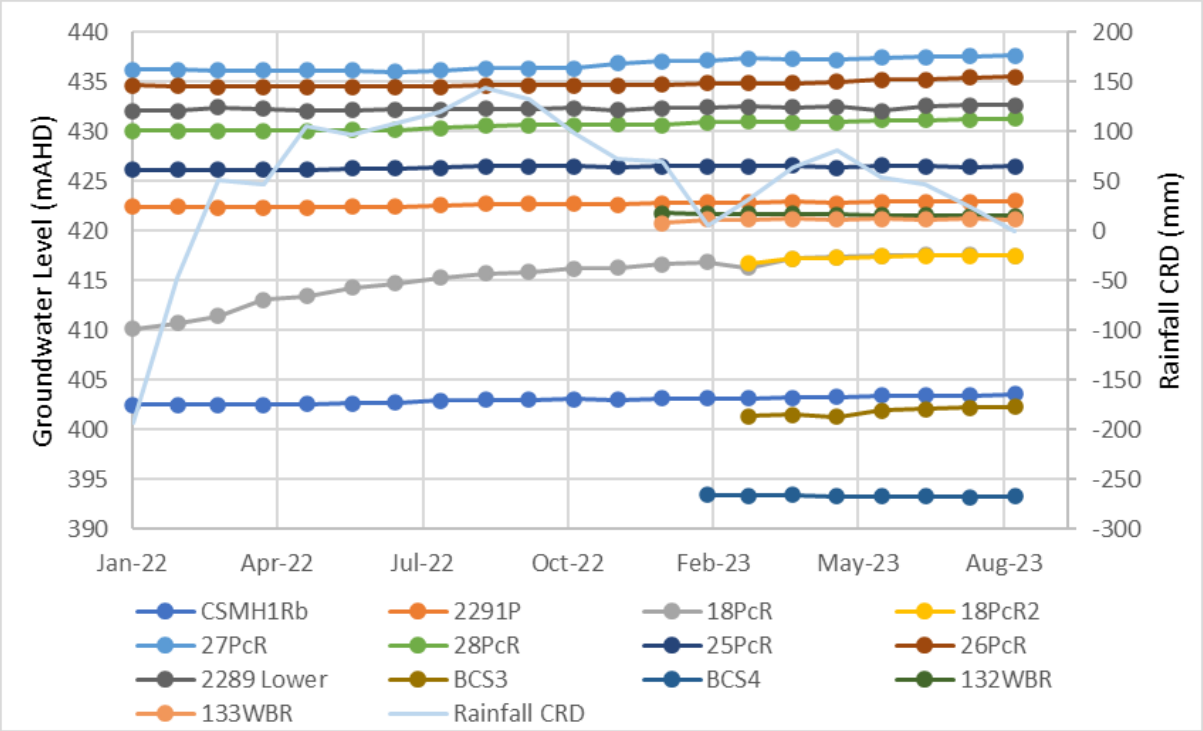
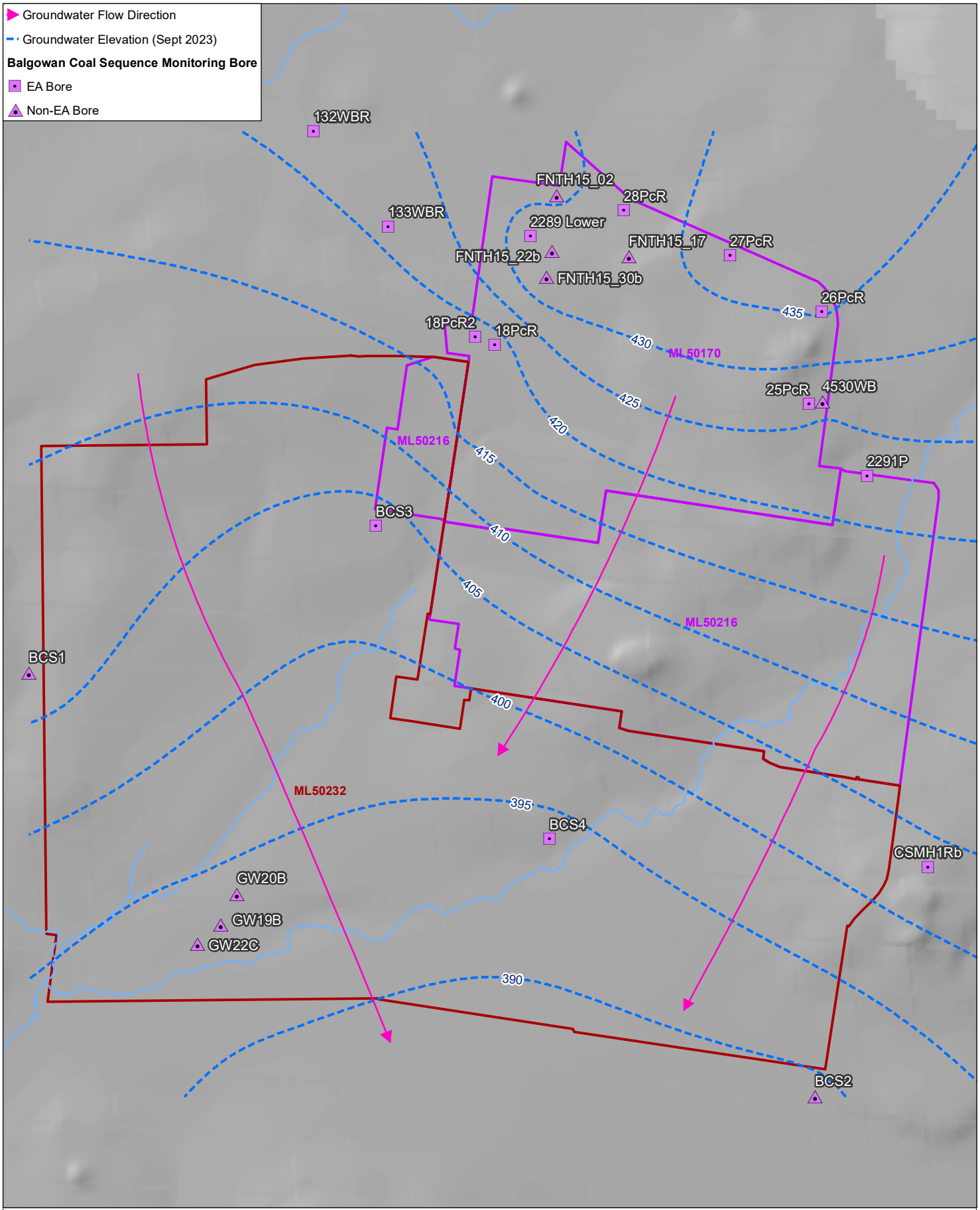


Figure 4-5 Groundwater Levels – Balgowan Coal Sequence EA Bores

A potentiometric surface map for the Balgowan Coal Sequence has been developed using September 2023 monitoring data from the New Acland Mine's extensive groundwater monitoring network (**Figure 4-6**). The potentiometric surface map indicates that groundwater flow in September 2023 in the Balgowan Coal Sequence is:

- North-northeast to south-southwest across ML 50170 and ML 50216;
- North-northeast to south-southwest across the eastern half of ML 50232; and
- North-northwest to south-southeast across the western half of ML 50232.

There is minimal evidence of the influence of current mine pit voids on groundwater flow patterns in the Balgowan Coal Sequence, which is expected since the formation generally lies at significant depth below the active mine pits.



0 0.5 1 km

Coordinate System:	AGD 1984 AMG Zone 56
Scale:	1:50,000 at A4
Project Number:	620.11303.00424
Date:	20-Dec-2023
Drawn by:	AS

Surface Drainage

Stage 1 and Stage 2 Mining Leases

Stage 3 Mining Lease

Modelled Formation Extent

Surveyed Operational Third-Party Bore - BCS

NEW ACLAND COAL MINE
Q3 2023 GROUNDWATER INVESTIGATION

BALGOWAN COAL SEQUENCE GROUNDWATER LEVELS

SLR

FIGURE 4-6

H:\Projects-SLR\620-BNE\620.11303 NAC03 GW Support\06 SLR Data\01 CADGIS\GW Exceedances Oct2023\SLR620.11303_F4-6_BalgowanWLs.mxd

5.0 Q3 2023 Groundwater Quality

Reporting of the Q3 2023 investigation groundwater quality analysis is split into two parts:

1. Bores and exceedances subject to previous investigations in SLR (2022, 2023a, 2023b and 2023c), and
2. New exceedances at bores not subject to previous investigations.

For reference, the dataset for all EA bores (Compliance and Investigation) for the relevant aquifers and parameters subject to this investigation report is provided as **Attachment A**.

5.1 Continuation of Previous Exceedances

5.1.1 10PbR

5.1.1.1 Nitrate as N

Monitoring data presented in **Attachment A** shows that the Q3 2023 exceedance for Nitrate as N at bore 10PbR is a continuation of the same exceedances reported in SLR (2022, 2023a and 2023b). That is, the Q3 2023 exceedances does not represent a departure from the trends previously investigated. Although there is some ongoing variability between monitoring events, Nitrate as N concentrations at 10PbR are shown to be generally on a decreasing trend from their highest levels recorded in early 2022 coincident with the significantly wetter than average climate period.

Monitoring data for other EA Compliance and Investigation bores in the Main Range Volcanics (**Attachment A**) shows relatively consistent Nitrate as N concentrations, noting that concentrations at all other bores are significantly less than those reported at 10PbR. This suggests that the location of 10PbR is in an area of elevated Nitrate as N concentrations in the Main Range Volcanics, with a potential local source, as previously reported by SLR (2022). The general declining trend in concentrations at 10PbR also supports the SLR (2022) finding that the sudden increase in concentrations in early 2022 may be related to historic anthropogenic agricultural land use activity proximal to 10PbR (not related to NAC's operations), combined with the recent significantly wetter than average climate period.

5.1.2 4518WB

5.1.2.1 Sulfate

Monitoring data presented in **Attachment A** shows that the Q3 2023 exceedance for Sulfate at bore 4518WB is a continuation of the same exceedances reported in SLR (2022, 2023a and 2023b). That is, the Q3 2023 exceedance does not represent a departure from the trends previously investigated. Sulfate concentrations at 4518WB are shown to have declined by approximately 25% over the two most recent monitoring events, having peaked in the January 2023 monitoring event.

Monitoring data for other EA Compliance and Investigation bores in the Acland Coal Sequence (**Attachment A**) shows relatively consistent Sulfate concentrations, noting that concentrations at some Investigation bores are significantly higher than those reported at 4518WB. That is, Sulfate concentrations at 4518WB fall within the range of concentrations measured across the Acland Coal Sequence EA bores. It is therefore apparent that Sulfate concentrates across the Acland Coal Sequnce aquifer are naturally highly spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Sulfate concentrations at any particular bore.

5.1.2.2 Iron

Monitoring data presented in **Attachment A** shows that the Q3 2023 exceedance for Iron at bore 4518WB is a continuation of the same exceedances reported in SLR (2023c). That is, the Q3 2023 exceedance does not represent a departure from the trends previously investigated. Iron concentrations at 4518WB are shown to have been gradually increasing over the entire monitoring record, though appear to have been relatively stable over the last three monitoring events.

Monitoring data for other EA Compliance and Investigation bores in the Acland Coal Sequence (**Attachment A**) shows relatively consistent Iron concentrations at most bores, noting that concentrations at some other Compliance and Investigation bores are approximately double those reported at 4518WB. That is, Iron concentrations at 4518WB fall within the range of concentrations measured across the Acland Coal Sequence EA bores. It is therefore apparent that Iron concentrates across the Acland Coal Sequnce aquifer are naturally spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Iron concentrations at any particular bore.

5.2 New Exceedances

5.2.1 18PbR2

18PbR2 was installed in December 2022, after the finalisation of the EA triggers in May 2022. That is, the EA triggers for 18PbR2 were not based on recorded groundwater conditions at 18PbR2, but on nominal regional Water Quality Objectives (WQO) (SLR, 2021), before the bore had been installed.

5.2.1.1 pH

The WQO adopted for the EA pH triggers at 18PbR2 was the ANZECC Aquatic Ecosystem Guideline for South East Australia (SLR, 2021).

Monitoring results for pH at 18PbR2 have been above the upper EA limit since the commencement of monitoring at the bore, with the Q3 2023 monitoring event representing the third sampling event at the bore. The exceedance of pH at 18PbR2 in Q3 2023 therefore does not represent a change from previously recorded pH levels at the bore, but rather the fact that the EA trigger was not established on the basis of site specific data from the bore.

Monitoring data for other EA Compliance and Investigation bores in the Main Range Volcanics (**Attachment A**) shows that whilst the majority of bores do report pH values within the range of EA limits and ANZECC Aquatic Ecosystem Guideline for South East Australia WQO, pH values at or above the upper limit/WQO of 7.5 have been consistently recorded at several bores in the past and in Q3 2023. It is evident therefore that groundwater in the Main Range Volcanics EA bores does not always have pH values that sit within the ANZECC Aquatic Ecosystem Guideline for South East Australia WQO, and site-specific triggers may be appropriate in some cases.

5.2.2 82PcR

82PcR as installed in November 2022, after the finalisation of the EA triggers in May 2022. That is, the EA triggers for 82PcR were not based on recorded groundwater conditions at 82PcR, but on nominal regional WQO (SLR, 2021) before the bore had been installed.

5.2.2.1 Sulfate

The WQO adopted for the EA Sulfate trigger at 82PcR was the Condamine River Basin Healthy Waters Management Plan (HWMP) North East Walloons 80th Percentile (SLR, 2021). By definition, since the WQO is defined on the 80th percentile of the regional dataset, 20% of all groundwater data from that aquifer must exceed the WQO.

Monitoring results for Sufate at 82PcR have been above the EA trigger limit since the commencement of monitoring at the bore, with the Q3 2023 monitoring event representing the third sampling event at the bore. The exceedance of Sulfate at 82PcR in Q3 2023 therefore does not represent an increase from previously recorded Sulfate concentrations at the bore, but rather the fact that the EA trigger was not established on the basis of site specific data from the bore. It is noted that Sulfate concentrations at 82PcR have been steadily decreasing in each of the three monitoring events since bore installation, with the Q3 2023 recorded concentration being approximately 36% lower than the first sample from the bore in January 2023. It is considered therefore that the bore potentially has not yet stabilised following drilling to provide data representative of steady state aquifer conditions. It is not uncommon for bores to require a period of time to stablise to background conditions following drilling. Alternatively, the bore could be recovering back to steady state conditions from a peak following the wetter than average climate period in late 2021/early 2022, similar to the trend in sulfate seen at 4518WB.

Monitoring data for other EA Compliance and Investigation bores in the Acland Coal Sequence (**Attachment A**) shows that Sulfate concentrations at some Investigation bores are similar to those reported at 82PcR. That is, Sulfate concentrations at 82PcR fall within the range of concentrations measured across the Acland Coal Sequence EA bores. It is therefore apparent that Sulfate concentrations across the Acland Coal Sequnce aquifer are naturally highly spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Sulfate concentrations at any particular bore. It is also evident therefore that groundwater in the Acland Coal Sequence EA bores does not always have Sulfate concentrations within the HWMP North East Walloons 80th Percentile WQO, and site-specific triggers may be appropriate in some cases.

5.2.2.2 Iron

The WQO adopted for the EA Iron trigger at 82PcR was the Condamine River Basin Healthy Waters Management Plan North East Walloons 80th Percentile (SLR, 2021). By definition, since the WQO is defined on the 80th percentile of the regional dataset, 20% of all groundwater data from that aquifer must exceed the WQO.

Monitoring results for Iron at 82PcR have been above the EA trigger limit since the commencement of monitoring at the bore, with the Q3 2023 monitoring event representing the third sampling event at the bore. The exceedance of Iron at 82PcR in Q3 2023 therefore does not represent an increase from previously recorded Iron concentrations at the bore, but rather the fact that the EA trigger was not established on the basis of site specific data from the bore.

Monitoring data for other EA Compliance and Investigation bores in the Acland Coal Sequence (**Attachment A**) shows that Iron concentrations at some other EA bores are approximately double those reported at 82PcR, including for other Compliance bores. That is, Iron concentrations at 82PcR fall within the range of concentrations measured across the Acland Coal Sequence EA bores. It is therefore apparent that Iron concentrations across the Acland Coal Sequnce aquifer are naturally spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Iron concentrations at any particular bore. It is also evident therefore that groundwater in the Acland Coal Sequence EA bores does not always have Iron

concentrations within the HWMP North East Walloons 80th Percentile WQO, and site-specific triggers may be appropriate in some cases.

5.2.2.3 Manganese

The WQO adopted for the EA Manganese trigger at 82PcR was the Condamine River Basin Healthy Waters Management Plan North East Walloons 80th Percentile (SLR, 2021). By definition, since the WQO is defined on the 80th percentile of the regional dataset, 20% of all groundwater data from that aquifer must exceed the WQO.

Monitoring results for Manganese at 82PcR have been above the EA trigger limit since the commencement of monitoring at the bore, with the Q3 2023 monitoring event representing the third sampling event at the bore. The exceedance of Manganese at 82PcR in Q3 2023 therefore does not represent an increase from previously recorded Manganese concentrations at the bore, but rather the fact that the EA trigger was not established on the basis of site specific data from the bore.

Monitoring data for other EA Compliance and Investigation bores in the Acland Coal Sequence (**Attachment A**) shows that Manganese concentrations at some other EA bores are more than double those reported at 82PcR, including for other Compliance bores. That is, Manganese concentrations at 82PcR fall within the range of concentrations measured across the Acland Coal Sequence EA bores. It is therefore apparent that Manganese concentrations across the Acland Coal Sequnce aquifer are naturally spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Manganese concentrations at any particular bore. It is also evident therefore that groundwater in the Acland Coal Sequence EA bores does not always have Manganese concentrations within the HWMP North East Walloons 80th Percentile WQO, and site-specific triggers may be appropriate in some cases.

5.2.3 BCS4

BCS4 as installed in January 2023, after the finalisation of the EA triggers in May 2022. That is, the EA triggers for BCS4 were not based on recorded groundwater conditions at BCS4, but on nominal regional WQO (SLR, 2021) before the bore had been installed.

5.2.3.1 Sulfate

The WQO adopted for the EA Sulfate trigger at BCS4 was the Condamine River Basin Healthy Waters Management Plan North East Walloons 80th Percentile (SLR, 2021). By definition, since the WQO is defined on the 80th percentile of the regional dataset, 20% of all groundwater data from that aquifer must exceed the WQO.

Monitoring results for Sufate at BCS4 have been above the EA trigger limit since the commencement of monitoring at the bore, with the Q3 2023 monitoring event representing the third sampling event at the bore. The exceedance of Sulfate at BCS4 in Q3 2023 therefore does not represent an increase from previously recorded Sulfate concentrations at the bore, but rather the fact that the EA trigger was not established on the basis of site specific data from the bore. It is noted that Sulfate concentrations at BCS4 have been steadily decreasing in each of the three monitoring events since bore installation, with the Q3 2023 recorded concentration being approximately 32% lower than the first sample from the bore in January 2023. If the trend continues, it appears likely that results from the next monitoring event would report Sulfate concentrations at BCS4 that are below the EA trigger. It is considered therefore that the bore has not yet stabilised following drilling to provide data representative of steady state aquifer conditions. It is not uncommon for bores to require a period of time to stablise to background conditions following drilling.

Monitoring data for other EA Compliance and Investigation bores in the Balgowan Coal Sequence (**Attachment A**) shows that Sulfate concentrations at other EA bores in that aquifer are relatively stable. The data also shows that some Investigation bores are more than 6 times those reported at BCS4. That is, Sulfate concentrations at BCS4 fall within the range of concentrations measured across the Balgowan Coal Sequence EA bores. It is therefore apparent that Sulfate concentrations across the Balgowan Coal Sequnce aquifer are naturally highly spatially variable, and movement of groundwater within the Acland Coal Sequence would therefore form a plausible explanation for temporal variability in Sulfate concentrations at any particular bore. It is also evident therefore that groundwater in the Balgowan Coal Sequence EA bores does not always have Sulfate concentrations within the HWMP North East Walloons 80th Percentile WQO, and site-specific triggers may be appropriate in some cases.

6.0 Environmental Risk

6.1 Relevant Environmental Values

As described by SLR (2023a), extensive and comprehensive groundwater studies have been undertaken at NAC since 2014, which demonstrate the relevant Environmental Values (EVs) of groundwater in the vicinity of the New Acland Mine. Those studies demonstrate that the relevant EVs of groundwater are:

- Main Range Volcanics aquifer: Stock watering (cattle) and Irrigation.
- Walloon Coal Measures (Acland and Balgowan Coal Sequence) aquifers: Stock watering (cattle).

The relevant guideline criteria (i.e., ANZECC & ARMCANZ (2000)) for the above-stated EVs are summarised in **Table 1** below, with respect to the parameters subject to this investigation.

Table 1 Relevant Groundwater Use Protection Criteria

Parameter	Aquifer	Bore	EA Trigger Value (mg/L)	EV	EV Guideline Value (mg/L)	Guideline Value Source
Nitrate as N	Main Range Volcanics	10PbR	50.7	Stock Watering	400	ANZECC & ARMCANZ (2000)
				Irrigation	25-125 (Total N)	ANZECC & ARMCANZ (2000) – short-term trigger value (up to 20 years)
Sulfate	Acland Coal Sequence	4518WB	48	Stock Watering	1,000	ANZECC & ARMCANZ (2000)
		82PcR	134			
	Balgowan Coal Sequence	BCS4	134			
Iron	Acland Coal Sequence	4518WB	1.6	Stock Watering	n/a	not sufficiently toxic to stock (ANZECC & ARMCANZ, 2000)
		82PcR	0.1			
Manganese	Acland Coal Sequence	82PcR	0.087	Stock Watering	n/a	not sufficiently toxic to stock (ANZECC & ARMCANZ, 2000)
pH	Main Range Volcanics	18PbR2	6.5 – 7.5 (range)	Stock Watering	6 – 8.5 (range)	To limit corrosion and fouling of irrigation and stock watering systems (ANZECC & ARMCANZ, 2000)
				Irrigation		

n/a = not applicable

6.2 Comparison of Q3 2023 Exceedances with Environmental Values Guideline Criteria

Comparison of the respective EA trigger values and the relevant EV guideline criteria outlined in **Table 1** indicates the following.

- For bore 10PbR:
  - The EA Nitrate trigger value at 10PbR is nearly 8 times lower than the ANZECC & ARMCANZ (2000) stock watering guideline criteria. Nitrate concentrations recorded at 10PbR remain significantly below the ANZECC & ARMCANZ (2000) stock watering guideline criteria. Therefore, the exceedances observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.
  - Nitrate is a constituent component of Total N. Total N values show that Q3 2023 monitoring results at 10PbR have a Total N concentration of 58.0 mg/L, which is less than half the upper limit of the ANZECC & ARMCANZ (2000) guideline criteria for irrigation. Therefore, the nitrate exceedances observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for irrigation groundwater use.

- For bore 4518WB:
  - The ANZECC & ARMCANZ (2000) stock watering guideline criteria for Sulfate is more than 20 times greater than the EA Sulfate trigger value for 4518WB. Sulfate concentrations at 4518WB remain significantly below the ANZECC & ARMCANZ (2000) guideline criteria. Therefore, the exceedances to the current EA trigger observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.
  - As described in the ANZECC & ARMCANZ (2000) stock watering guidelines, Iron is *not sufficiently toxic* for stock to warrant guideline value. Therefore, the exceedances to the current EA trigger for Iron observed at 4518WB do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.
- For bore 18PbR2
  - The EA pH trigger value range (between the upper and lower limit) at 18PbR2 is smaller than the ANZECC & ARMCANZ (2000) guideline criteria range. The upper EA limit is a full pH point lower than the upper ANZECC & ARMCANZ (2000) guideline criteria value, with the upper ANZECC & ARMCANZ (2000) guideline criteria value being above the pH values recorded at the bore. Therefore, the exceedances observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering or irrigation groundwater use.
- For bore 82PcR
  - The ANZECC & ARMCANZ (2000) stock watering guideline criteria for Sulfate is more than seven times greater than the EA Sulfate trigger value for 82PcR. Sulfate concentrations at 82PcR remain significantly below the ANZECC & ARMCANZ (2000) guideline criteria. Therefore, exceedances to the current EA trigger observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.
  - As described in the ANZECC & ARMCANZ (2000) stock watering guidelines, Iron is *not sufficiently toxic* for stock to warrant guideline value. The exceedances to the current EA trigger for Iron observed at 82PcR do not represent any risk of environmental harm sufficient to reduce the potential for stock watering.
  - As described in the ANZECC & ARMCANZ (2000) stock watering guidelines, Manganese is *not sufficiently toxic* for stock to warrant guideline value. The exceedances to the current EA trigger for Iron observed at 82PcR do not represent any risk of environmental harm sufficient to reduce the potential for stock watering.
- For bore BCS4
  - The ANZECC & ARMCANZ (2000) stock watering guideline criteria for Sulfate is more than seven times greater than the EA Sulfate trigger value for BCS4. Sulfate concentrations at BCS4 remain significantly below the ANZECC & ARMCANZ (2000) guideline criteria. Therefore, exceedances to the current EA trigger observed at the bore do not represent any risk of environmental harm sufficient to reduce the potential for stock watering groundwater use.

Therefore, in accordance with the above assessment, none of the exceedances noted in Q3 2023 constitute a potential risk to actual groundwater receptors in terms of water quality concentrations.

6.3 Rates of Groundwater Movement

The travel distance that groundwater moves with time can be calculated using a simplification of Darcy's Law, by taking into account the aquifer hydraulic conductivity and the hydraulic head gradient between two points in the aquifer.

SLR (2018) reported the following approximate mean horizontal hydraulic conductivities:

- Main Range Volcanics – 0.25 m/day
- Acland Coal Sequence – 0.15 m/day
- Balgowan Coal Sequnce – 0.27 m/day

The hydraulic head gradients in the Main Range Volcanics, Acland Coal Sequence and Balgowan Coal Sequence aquifers proximal to the bores subject to this investigation can be estimated from the potentiometric surfaces presented in **Section 4.0** as:

- Main Range Volcanics – 5 m head over 450 m = 0.011 m/m
- Acland Coal Sequence – 5 m head over 450 m = 0.011 m/m
- Balgowan Coal Sequence – 5 m head over 850 m = 0.0059 m/m

Therefore, the calculated groundwater travel distance with time for the three aquifers (i.e. flow velocity is):

- Main Range Volcanics – 0.003 m/day = 1.0 m/year
- Acland Coal Sequence – 0.002 m/day = 0.61 m/year
- Balgowan Coal Sequence – 0.002 m/day = 0.58 m/year

The above analysis shows that, notwithstanding the fact concentrations remain below the relevant EV guideline criteria, and the fact that groundwater flow directions for the Main Range Volcanics and Acland Coal Sequence are demonstrated to be inwards towards NAC's operations, the environmental risk posed by the exceedances is negligible given:

- calculated rates of groundwater movement approximate only 0.5 to 1 m per year;
- the nearest known Main Range Volcanics third-party extraction bore is located and 4.3 km away from 18PbR and 4.7 km away from 10PbR;
- the nearest known Acland Coal Sequence third-party extraction bore is located 4.2 km away from 4518WB;
- the nearest known Acland Coal Sequence third-party extraction bore is located 2.9 km away from 82PcR;
- the nearest known Balgowan Coal Sequence third-party extraction bore is located 5.2 km away from BCS4; and
- there are no identified natural environmental receptors for any of the three aquifers subject to this investigation (SLR, 2022b).

7.0 Review of Potential Factors Influencing Groundwater Quality Concentrations

EA Condition D19 requires that the investigation must include a determination of whether the exceedance or difference is caused by:

i. mining activities authorised under the EA; or

ii. natural variation; or

iii. neighbouring land use resulting in groundwater impacts.

These factors were discussed in SLR (2022, 2023b and 2023c), and an updated discussion is provided below as relevant to the current investigation.

Mining Activities

Prior to May 2023, New Acland Mine was in care and maintenance with only minor associated activities taking place. That is, there was no mining activity during or immediately preceding the sampling events that resulted in the first Condition D16 trigger at bores 10PbR and 4518WB. However, just prior to the May 2023 monitoring event, mining activities had recommenced in the form of topsoil and overburden pre-stripping activities immediately south of pre-2023 mining activities. Mining activities continued after May 2023 and mining of first coal on ML50232 occurred on or about 14 September 2023.

Notwithstanding the fact that there has been a change in mining activities undertaken by NAC during 2023, groundwater flow directions in the Acland Coal Sequence and Main Range Volcanics are demonstrated to be towards NAC's mining activities and therefore these mining activities can not be responsible for the exceedances recorded in those aquifers in Q3 2023.

For the Balgowan Coal Sequence, groundwater levels indicate a groundwater flow direction that is generally towards the BCS4 bore from ML 50216. However, the BCS4 bore is on ML 50232 where that aquifer lies at significant depth below NAC's mining activities on ML 50216 and ML 50232, and therefore there is no mechanism for the introduction of contaminants at NAC's operations on those ML's to the Balgowan Coal Sequence aquifer. Although the Balgowan Coal Sequence was exposed to direct mining disturbance in the westernmost part of ML 50170 in 2020 (SLR, 2020), the groundwater potentiometric mapping shows that groundwater does not flow from that area towards BCS4. Furthermore, it has been demonstrated in **Section 5.2.3** of this investigation report that the Q3 2023 exceedance at BCS4 is not a result of a change in groundwater quality within the Balgowan Coal Sequence, but by the setting of an EA trigger limit that is inappropriate for the Balgowan Coal Sequence aquifer at the BCS4 location.

Natural Variability

It has been demonstrated in **Section 5.1** that the Q3 2023 exceedances at bores 10PbR and 4518WB are a continuation of the exceedances subject to previous investigations since late 2022 (SLR, 2022, 2023a, 2023b and 2023c), and there is no new evidence that the results of those investigations are invalid. In accordance with the results of those investigations:

- Bore 10PbR
    - It is likely that the cause of the Nitrate as N concentration increases at 10PbR is a temporal increase in groundwater recharge to the Main Range Volcanics from the recent significantly wetter climate period, with that groundwater recharge carrying a dissolved Nitrate as N load from a non-mining related surficial source close to 10PbR. That is, the cause of the Nitrate as N concentration increase at 10PbR is a combination of natural climatic variability coupled with local non-mining related neighbouring land use.
- Bore 4518WB
    - It is likely that the cause of Sulfate concentration increases at 4518WB is a temporal increase in groundwater recharge to the Acland Coal Sequence from the recent significantly wetter climate period, and/or associated flushing

of higher Sulfate concentration groundwater within historic (predating the New Acland Mine) underground mine workings close to 4518WB. That is, the cause of the Sulfate concentration increase at 4518WB is a combination of natural climatic variability coupled with local neighbouring land use (i.e. historic mining activities pre New Acland Mine.

- Iron concentrations in groundwater at 4518WB were already trending upwards over the entire baseline dataset used to set the EA trigger limit at the bore, and Iron concentrations at EA bores are quite variable. It is therefore entirely plausible that natural variability, or movement of groundwater of naturally higher Iron concentration towards 4518WB, is responsible for the changes in Iron concentrations seen at that bore.

For recently installed bores 18PbR2, 82PcR and BCS4, the Q3 2023 exceedances have been demonstrated in **Section 5.2** to be a result of the setting of EA trigger limits based on regional WQO or Guideline values that do not appropriately account for the natural spatial variability in groundwater quality within those aquifers. That is, it is evident that natural variability is responsible for the exceedances at those bores, and site-specific trigger limits should be derived for those bores once a sufficient quantum of data is obtained in accordance with DES (2021) requirements.

Neighbouring Land Use

Prior to the May 2023 monitoring event, the vast majority of land immediately adjacent to New Acland Mine remained under the ownership and management of Acland Pastoral Company. There is no evidence of a change in Acland Pastoral Company's land use activities that might have potential to release contaminants to groundwater.

It has been demonstrated in **Section 5.1** that the Q3 2023 exceedances at bores 10PbR and 4518WB are a continuation of the exceedances subject to previous investigations since late 2022 (SLR, 2022, 2023a, 2023b and 2023c). In accordance with the outcomes of those investigations, historic land use activities prior to the New Acland Mine may be linked to the water quality changes seen at those bores.

8.0 Conclusions and Recommendations

The conclusions reached from this investigation are as follows.

1. Exceedances reported at bores 10PbR and 4518WB in Q3 2023 are continuations of exceedances previously investigated at those bores. The current investigation continues to support the results of those previous investigations, being:
    a. EA trigger values have been set based on a baseline dataset that does not meet the recommended requirements outlined in DES (2021) for quantity of data.
    b. For the parameters that have exceeded EA trigger values, EA trigger values are significantly lower than the relevant Environmental Values protection guideline criteria.
    c. For the parameters that have exceeded EA trigger values, concentrations remain significantly below the relevant Environmental Values protection guideline criteria (where available) and therefore there is no risk of environmental harm.
    d. Groundwater flow directions in the vicinity of the bores are towards NAC's operations, rather than away from NAC's operations, and therefore there is no hydraulic mechanism for transport of solutes in groundwater away from

NAC's operations towards the bores and release of solutes from NAC's operations cannot be a cause of concentration increases seen at the bores.

e. Recent variability in some parameter concentrations at those bores may be related to a temporal increase in groundwater recharge, and/or groundwater movement, associated with the recent significantly wetter climate period and historical non-NAC land use activities near to those bores.

2. New exceedances reported at bores 18PbR2, 82PcR and BCS4 in Q3 2023 are a result of the third sampling event at these recently installed bores. This investigation has found that:
    a. EA trigger values at these bores have been set based on nominal regional water quality objectives, rather than site specific data.
    b. By definition, it is expected that the nominal regional water quality objectives are exceeded at 20% of bores since they are derived from the 80th percentile of the regional dataset.
    c. Relevant parameter concentrations at these bores (for the parameters that have exceeded EA trigger values) have been above the regional water quality objectives since the commencement of monitoring.
    d. Relevant parameter concentrations at these bores (for the parameters that have exceeded EA trigger values) are in line with concentrations recorded at other EA bores.
    e. For the parameters that have exceeded EA trigger values, concentrations remain significantly below the relevant Environmental Values protection guideline criteria (where available) and therefore there is no risk of environmental harm.
3. There is no evidence that any of the exceedances reported in Q3 2023 are a result of NAC's activities.
4. Calculated groundwater flow rates are sufficiently low that there is negligible potential for groundwater at any of the bores subject to exceedances to reach a third-party extraction bore within the next century.

In light of the outcome from this investigation that the EA trigger levels are inappropriate for the background groundwater concentrations for some parameters, it is recommended that EA trigger levels be revisited. A recommended approach is to adopt the relevant EV protection criteria (i.e. ANZECC & ARMCANZ (2000) stock watering guidelines) until such time as a sufficient dataset is available at each bore to develop site-specific trigger values in accordance with the requirements of DES (2021). That is, "*a minimum of 18 samples over at least 12 and preferably 24 months"*.

Closure

We trust the information presented in this report meets your expectations.

Regards,

SLR Consulting Australia

9.0 References

DES, 2021. Using monitoring data to assess groundwater quality and potential environmental impacts. Version 2. Department of Environment and Science (DES), Queensland Government, Brisbane.

SLR, 2018. New Acland Stage 3 Project 2017-2018 Groundwater Model Update Numerical Model Report. Prepared by SLR Consulting Australia Pty Ltd for New Hope Group.

SLR, 2020. New Acland Coal Mine Bore 18PcR Investigation. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal.

SLR, 2021. New Acland Coal Mine Groundwater EA Amendment Groundwater Contaminant Limits Review. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal Pty Ltd.

SLR, 2022. New Acland Mine EA Bores 10PbR & 4518WB Exceedance Investigation. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal Pty Ltd.

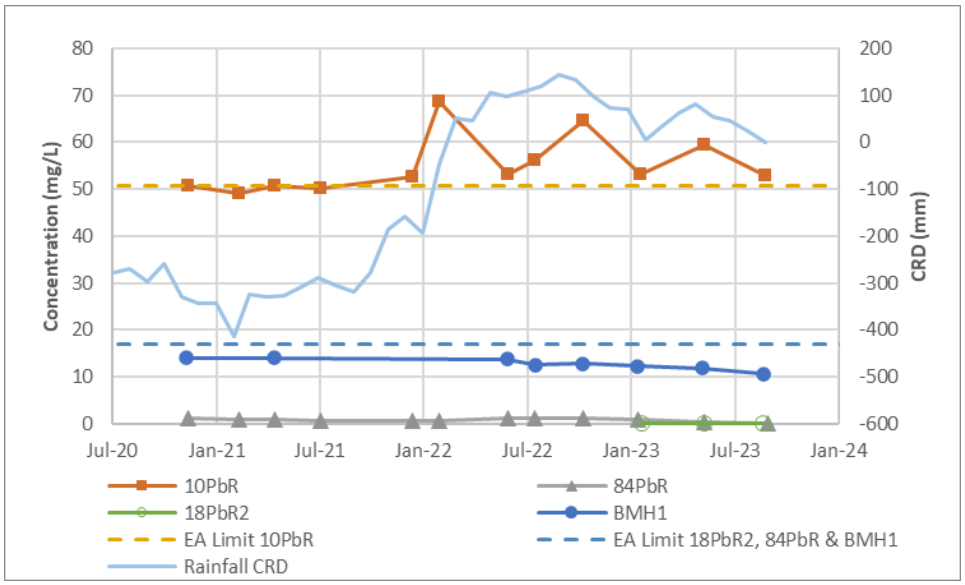
SLR, 2023a. New Acland Mine EA Bores 10PbR & 4518WB Exceedance Investigation. Response to DES. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal Pty Ltd.

SLR, 2023b. New Acland Mine EA Bores 10PbR & 4518WB Exceedance Investigation. January and May 2023 Monitoring Events. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal Pty Ltd.

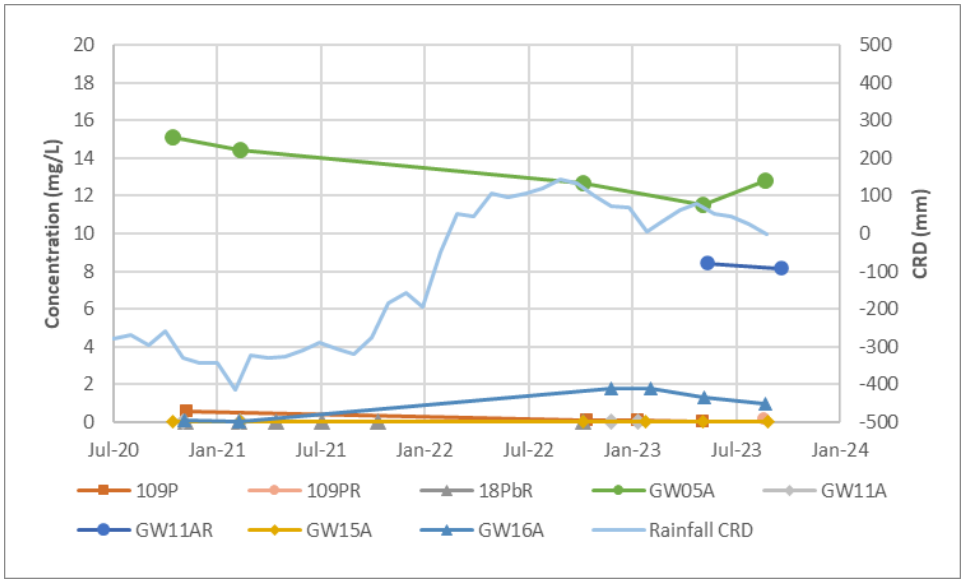
SLR, 2023c. New Acland Mine EA Bore 4518WB Iron Exceedance Investigation May 2023 Monitoring Event. Prepared by SLR Consulting Australia Pty Ltd for New Acland Coal Pty Ltd.

Attachment A Monitoring Data

Main Range Volcanics - Nitrate as N

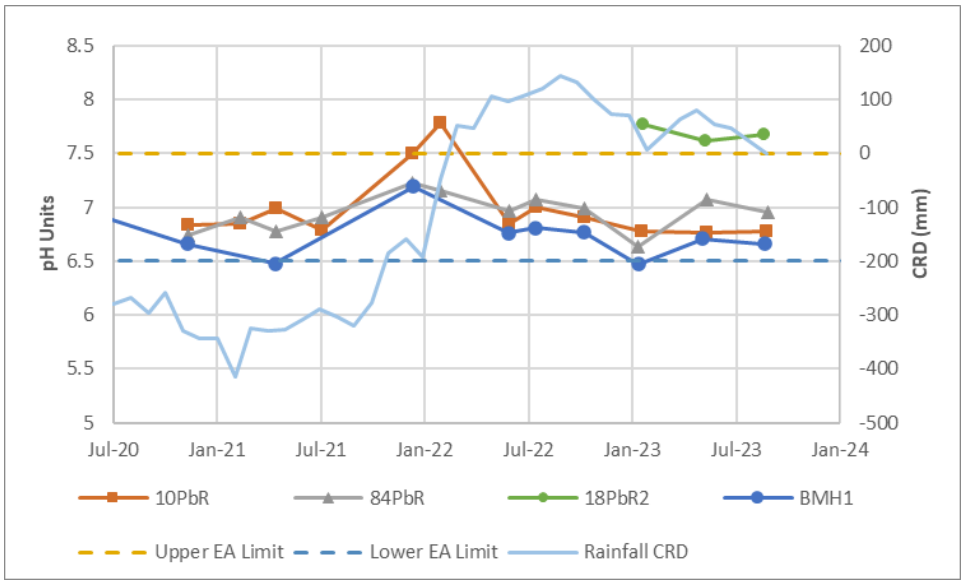


Compliance Bores

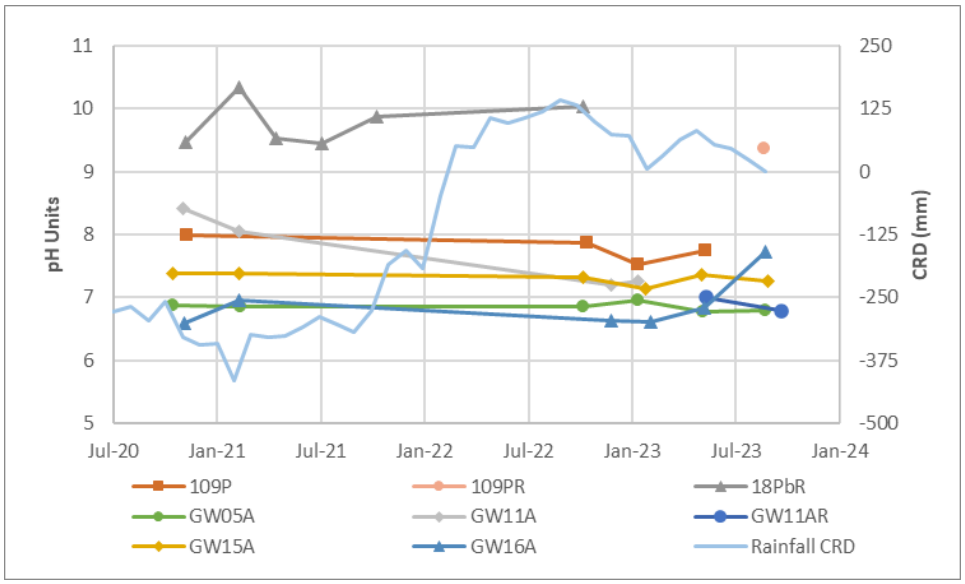


Interpretation Bores

Main Range Volcanics - pH

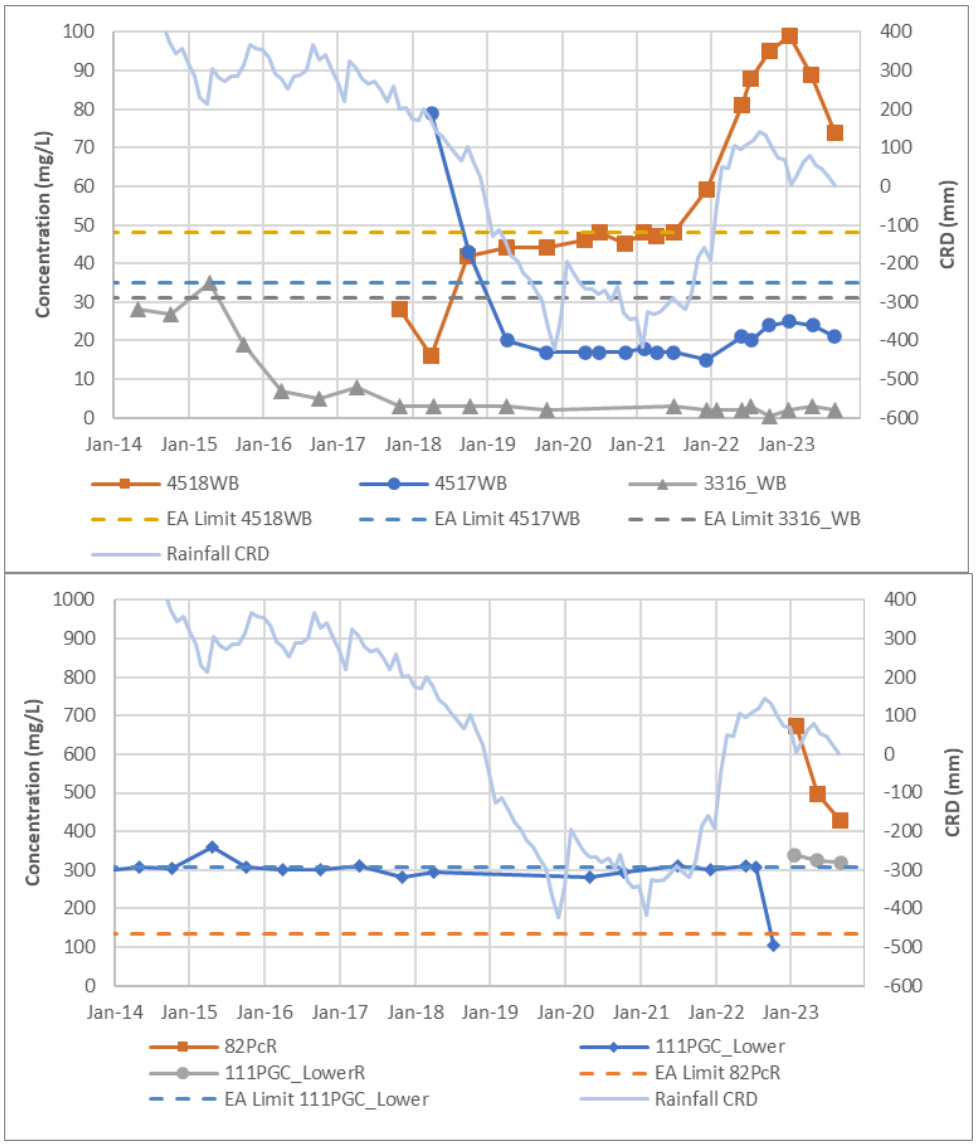


Compliance Bores



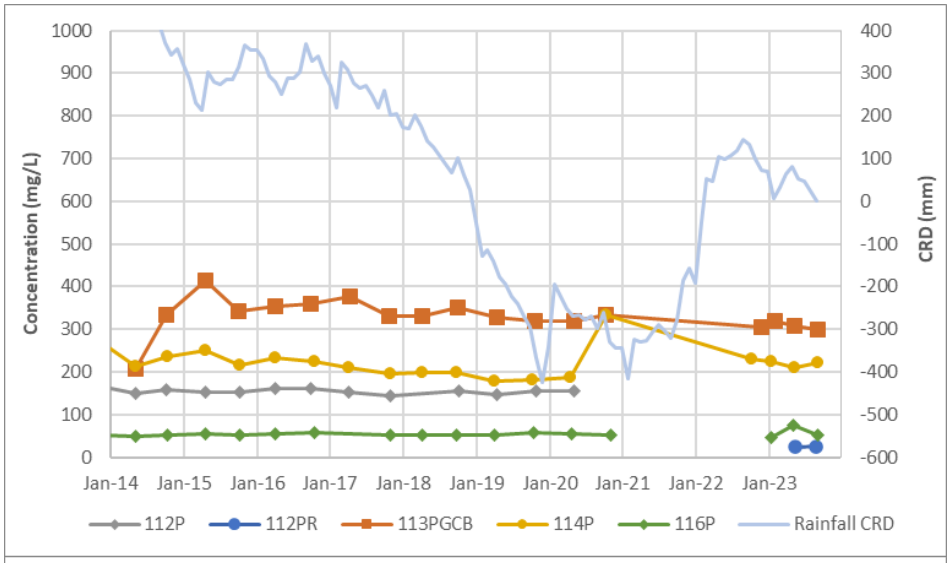
Interpretation Bores

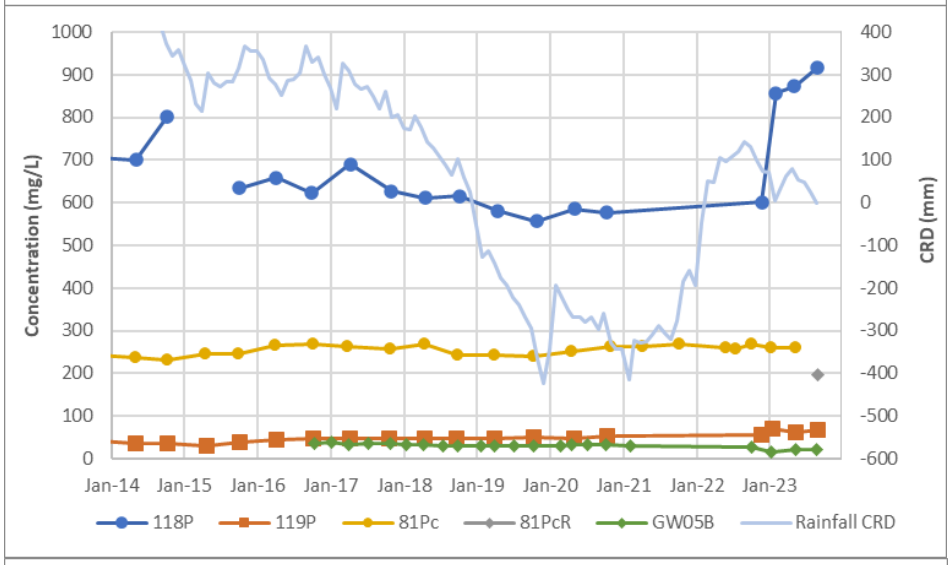
Acland Coal Sequence - Sulfate

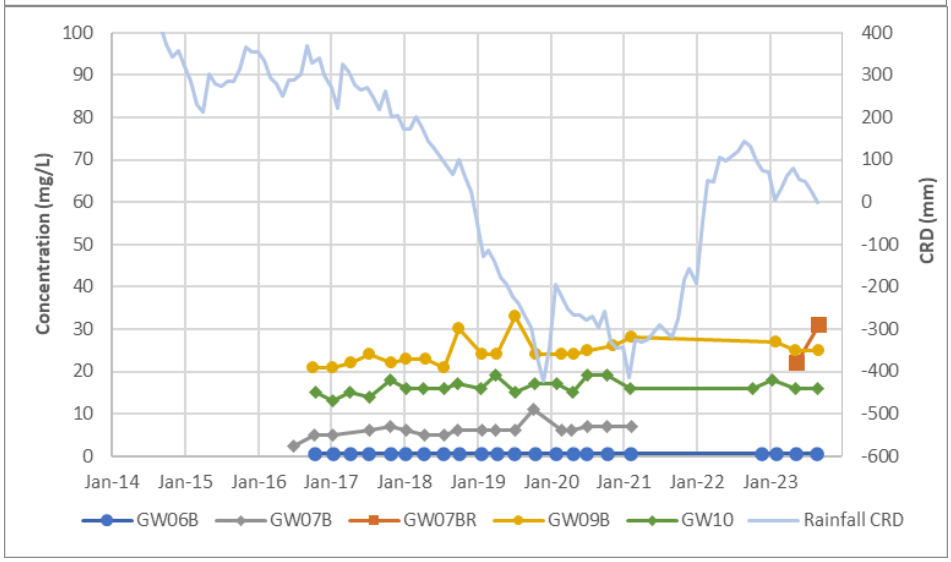


Compliance Bores

Acland Coal Sequence – Sulfate (continued)

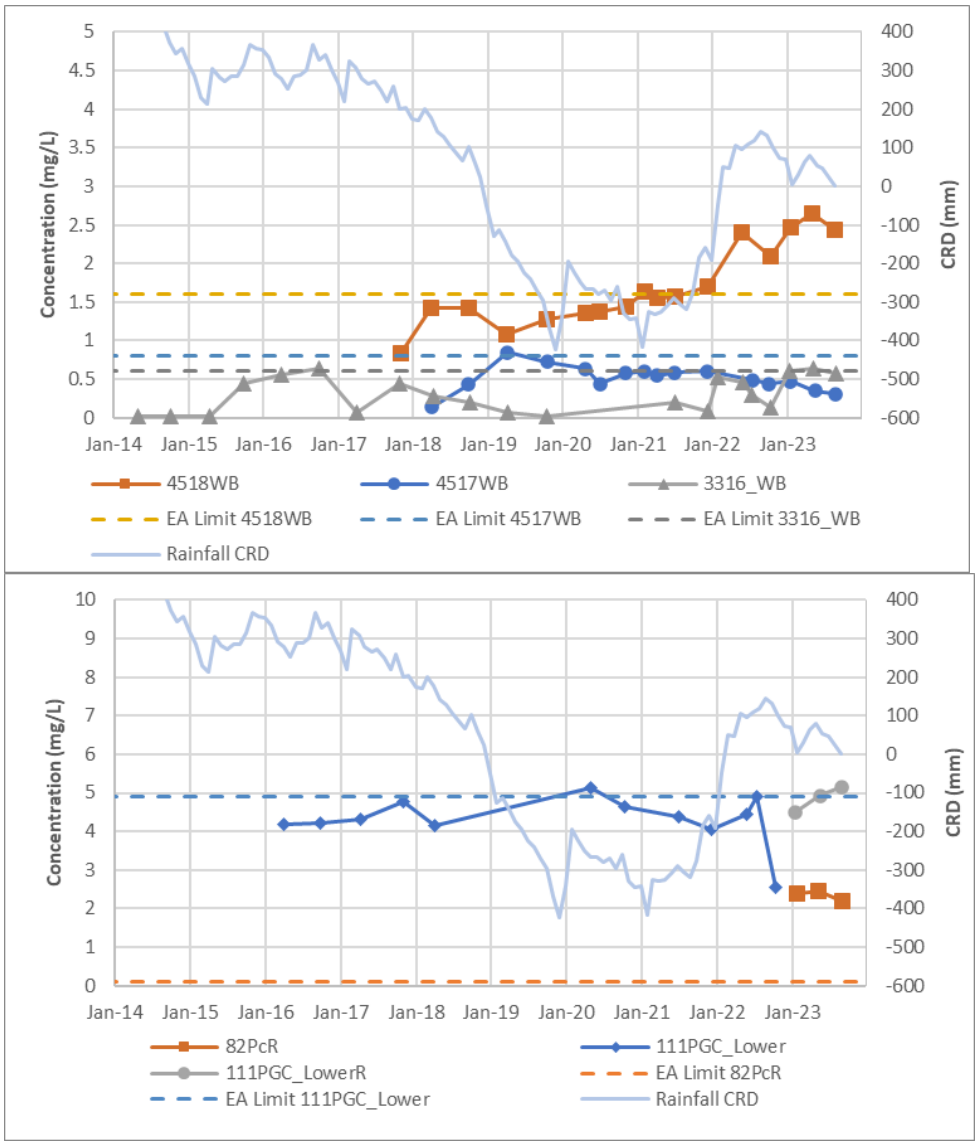






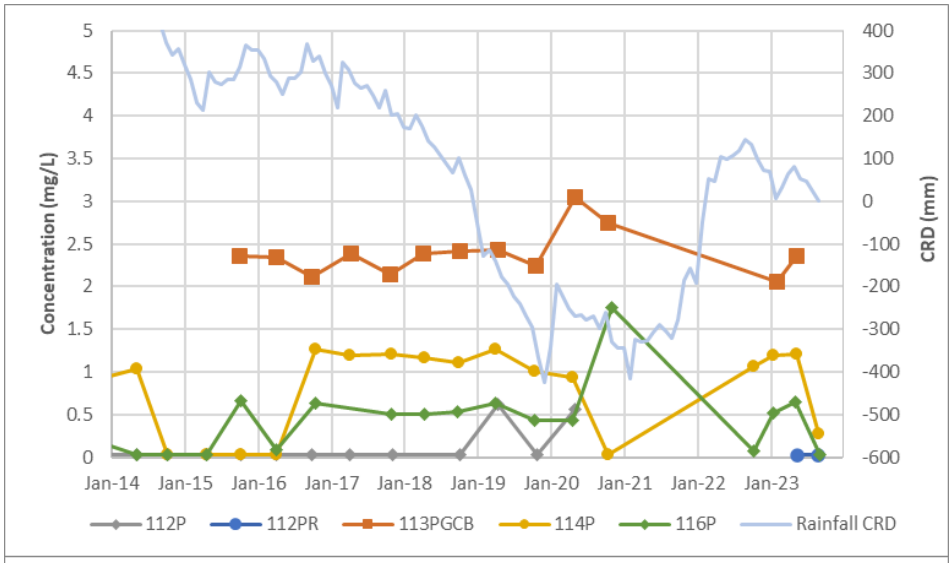
Interpretation Bores

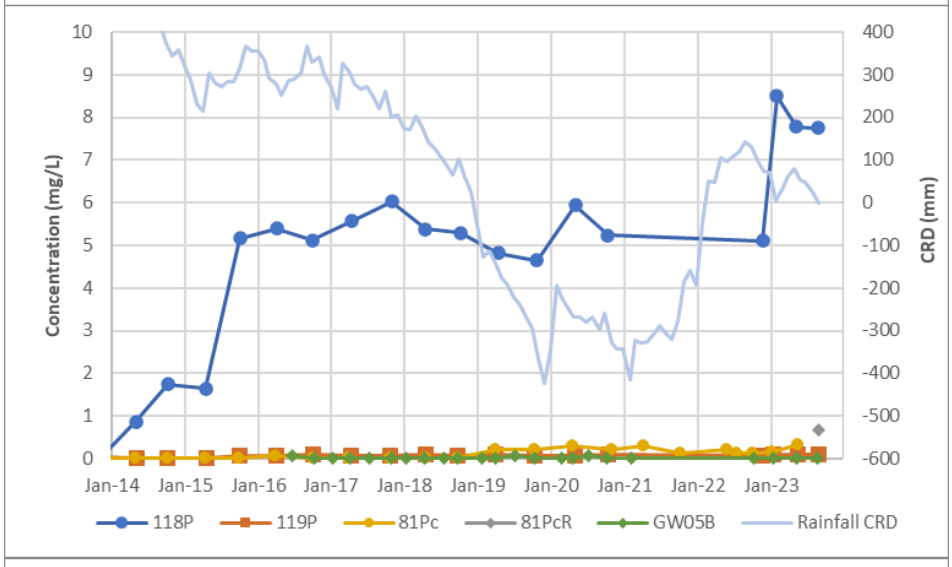
Acland Coal Sequence - Iron

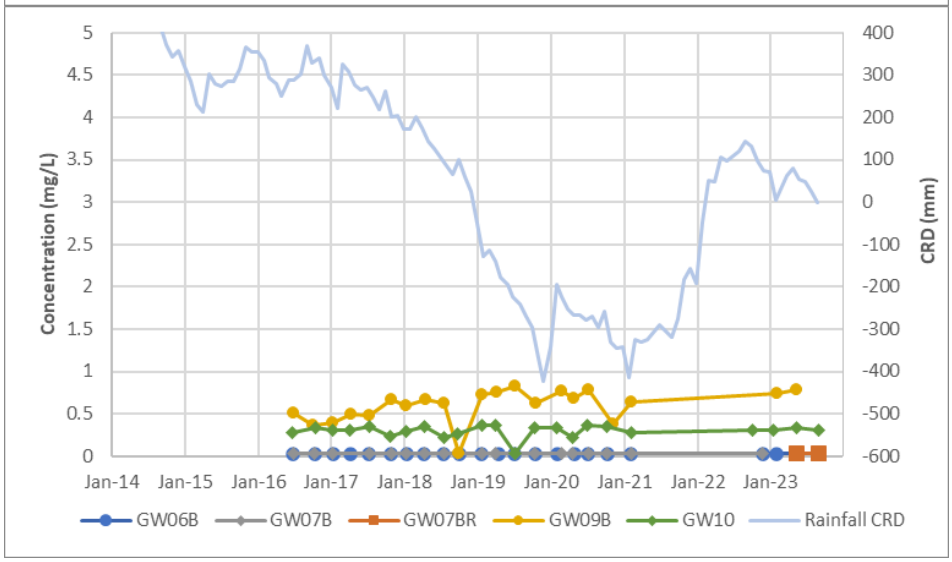


Compliance Bores

Acland Coal Sequence – Iron (continued)

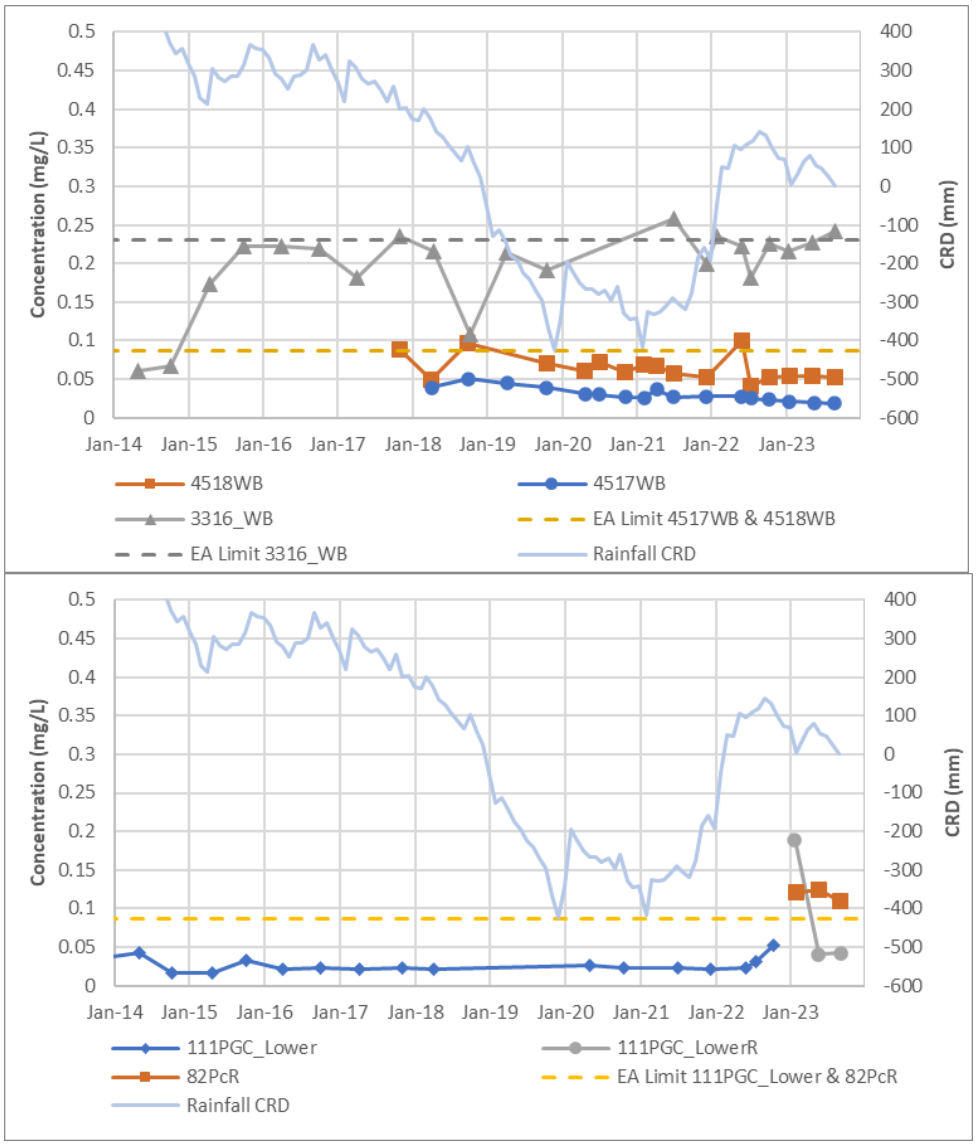






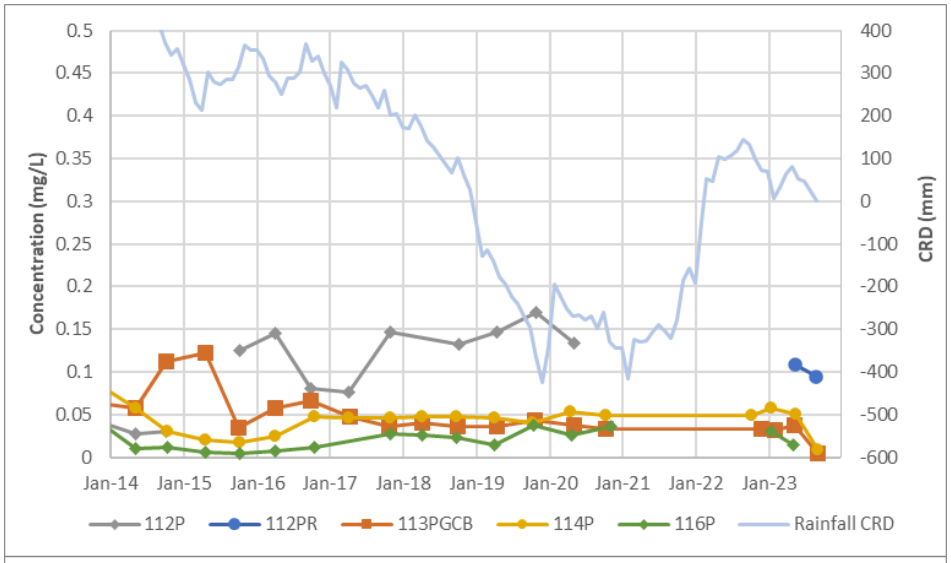
Interpretation Bores

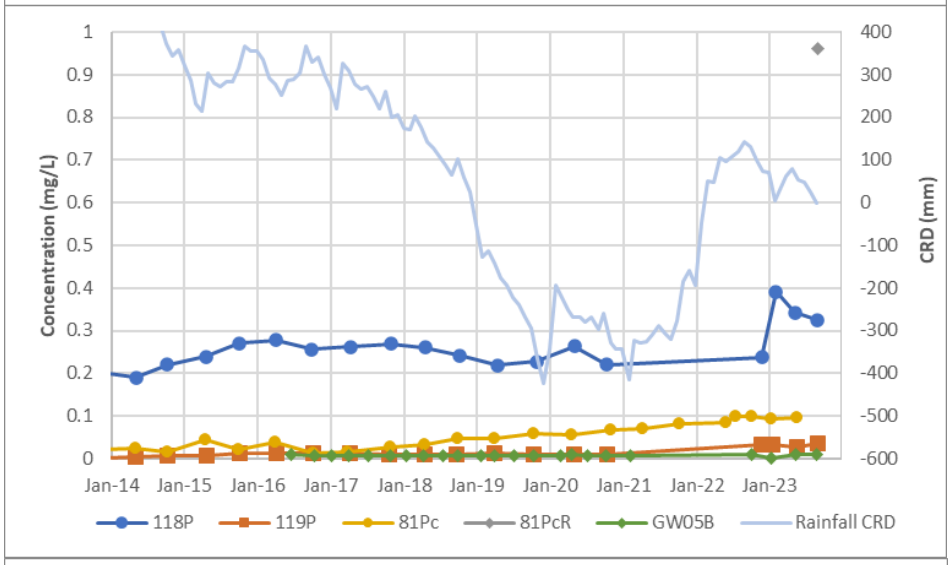
Acland Coal Sequence - Manganese

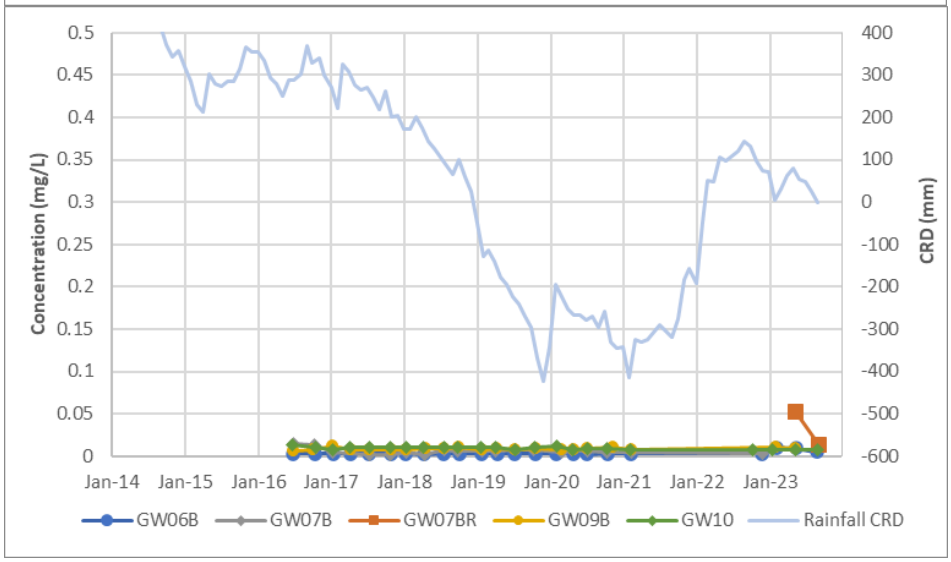


Compliance Bores

Acland Coal Sequence – Manganese (continued)

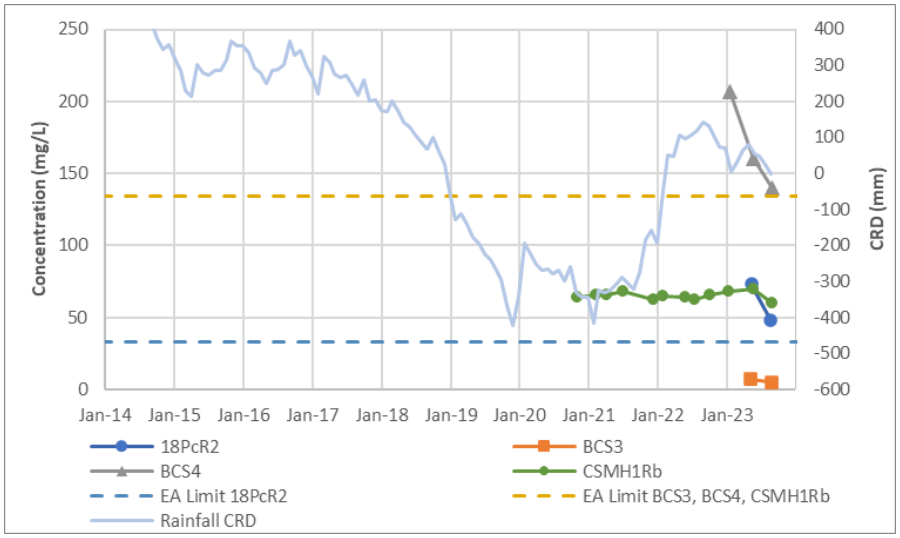




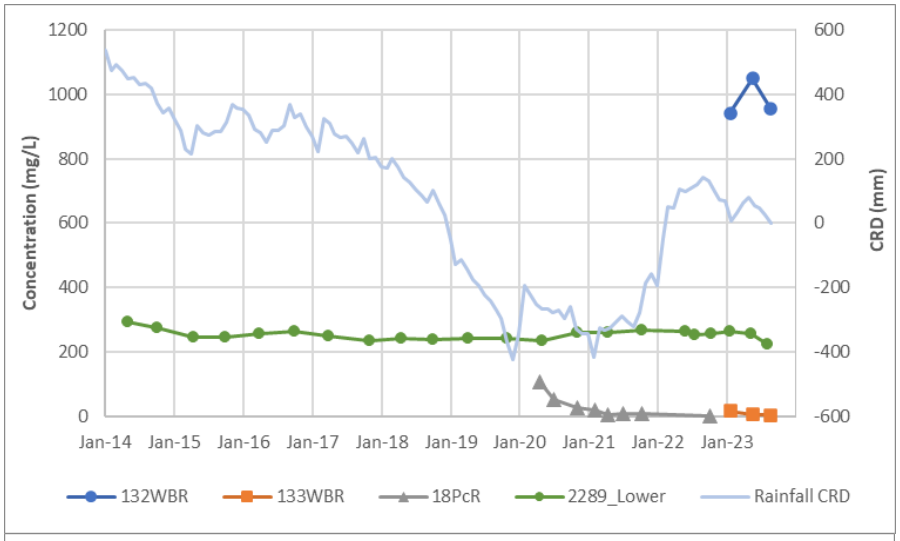


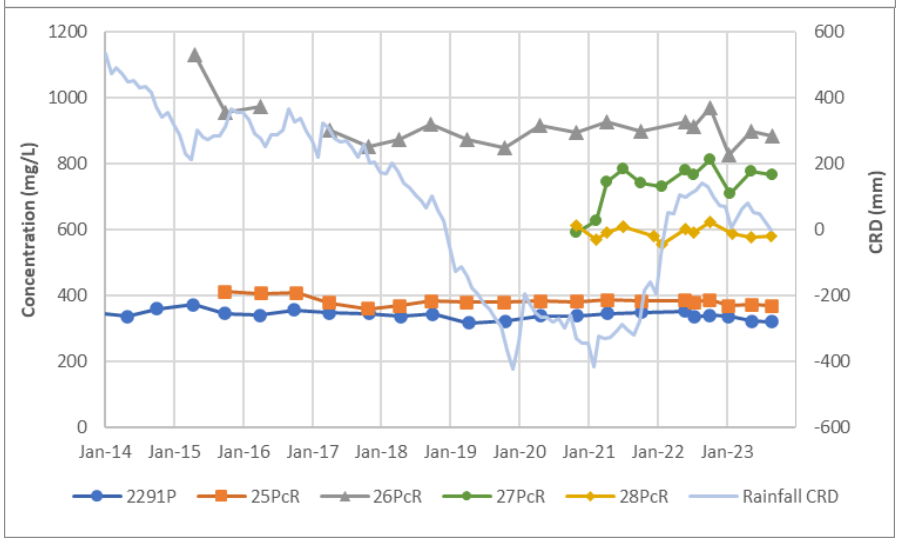
Interpretation Bores

Balgowan Coal Sequence - Sulfate



Compliance Bores





Interpretation Bores

Appendix 3 – Extracted EA Conditions Schedule D

Schedule D: Groundwater	
D1	Conditions **D2** to **D9** apply to all activities. Conditions **D10** to **D14** apply to mining activities on ML50232. Conditions **D15** to **D24** and **D26** apply to mining activities on ML50170 and ML50216. Conditions **D25** and **D27** to **D30** apply to all mining activities.
D2	The environmental authority holder must not release contaminants to groundwater.
D3	All determinations of groundwater monitoring and biological monitoring must be performed by an appropriately qualified person.
D4	Monitoring and sampling of groundwater must comply with the latest edition of the administering authority's Monitoring and Sampling Manual.
D5	The construction, maintenance and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimises impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring.
D6	The location of monitoring bores must take into consideration the location of any voids, Tailings Storage Facilities, hazardous waste rock dumps, location and depth of aquifers and hydro geological factors within the host rocks which may allow the movement of hazardous contaminants.
D7	By **22 March 2024**, provide a report to the administering authority proposing a leachate monitoring program suitable to ensure achievement of condition **G12** and condition **D9**. The program, at a minimum, must include: • an assessment of the likely contaminants of concerns of any potential leachate from the landfill units depicted in **Figure G1 – Authorised landfill unit** for inclusion in **Table D2: Groundwater quality triggers and limits (ML50232)**; and • the location of at least one downgradient compliance bore (MB_L1) from the 'New Tip Location' depicted in **Figure G1 – Authorised landfill unit**; and • interpretation bores in the relevant aquifer to the areas of landfill shown in **Figure G1 – Authorised landfill unit**; and • any relevant compliance bores that are downgradient from the areas of landfill shown in **Figure G1 – Authorised landfill unit**.
D8	Within **twenty (20) business days** of receiving comments from the administering authority on the report required by condition **D7**, update and implement the leachate monitoring program.
D9	By **22 November 2025**, the environmental authority holder must submit to the administering authority all leachate contaminant limits listed as TBAs in **Table D2 – Groundwater quality triggers and limits**. The limits must be based on at least eighteen (18) months of groundwater quality monitoring results with at least eight (8) sampling events, and determined in accordance with the methodology and matters stated in the guideline "*Using monitoring data to assess groundwater quality and potential environmental impacts"*, February 2021 as amended from time to time.
ML50232	
D10	Groundwater quality and levels must be monitored at the locations and frequencies defined in **Table D1 – Groundwater monitoring locations and frequency (ML50232)** for quality characteristics identified in **Table D2 – Groundwater quality triggers and limits (ML50232)**.
D11	Groundwater levels when measured at the monitoring locations specified in **Table D1 – Groundwater monitoring locations and frequency (ML50232)** must not exceed the groundwater level trigger thresholds specified in **Table D3 – Groundwater level monitoring ((ML50232, ML50216 and ML50170)**.

Schedule D: Groundwater	
D12	If quality characteristics of groundwater from compliance bores identified in **Table D1 – Groundwater monitoring locations and frequency** exceed any of the trigger levels stated in **Table D2 – Groundwater quality triggers and limits** or any bores in **Table D1 – Groundwater monitoring locations and frequency** exceed any of the groundwater level trigger threshold stated in **Table D3 – Groundwater level monitoring (ML50232, ML50216 and ML50170)**, the environmental authority holder must compare the compliance monitoring bore results to the interpretation bore results and complete an investigation in accordance with the *ANZECC and ARMCANZ 2000*.
D13	Results of monitoring of groundwater from compliance bores identified in **Table D1 – Groundwater monitoring locations and frequency**, must not exceed any of the limits defined in **Table D2 – Groundwater quality triggers and limits** as a result of mining activity.
D14	By **1 May 2025,** the environmental authority holder must submit to the administering authority: a) all contaminant trigger levels listed as TBA in **Table D2 – Groundwater quality triggers and limits** (other than those listed as 'leachate contaminant limits'); and b) all levels listed as TBA in **Table D3 – Groundwater level monitoring (ML50232, ML50216 and ML50170)**.

Table D1: Groundwater monitoring locations and frequency (ML50232)

Groundwater Monitoring Bore	Monitoring Bore Type	Aquifer	Latitude (GDA94)	Longitude (GDA94)	Parameter and Monitoring Frequency
84PbR (84P)	Compliance	Main Range Volcanics	27°16' 37.509"S	151°41' 25.57"E	Groundwater levels: monthly Groundwater quality: Six monthly to include: Aluminium (Al) Arsenic (As) Calcium (Ca) Selenium (Se) Chloride (Cl) Copper (Cu) Fluorine (F) Iron (Fe), Total Nitrogen (Total N) Potassium (K) Magnesium (Mg) Manganese (Mn) Sodium (Na) Sulphate (SO_4) Bicarbonate (HCO_3) Total dissolved solids (TDS) Electrical conductivity (EC) Acidity/alkalinity (pH).
10PbR (843)	Compliance	Main Range Volcanics	27°17' 14.194"S	151°41' 28.74"E	
BMH1	Compliance	Main Range Volcanics	27°16' 31.8205"S	151°41' 01.3574"E	
109P	Interpretation	Main Range Volcanics	27°16' 30.77"S	151°40' 8.38"E	
GW05A (1A)	Interpretation	Main Range Volcanics	27°16' 39.74"S	151°39' 6.41"E	
GW16A (2A)	Interpretation	Main Range Volcanics	27°17' 56.21"S	151°38' 1.14"E	
GW15A (4A)	Interpretation	Main Range Volcanics	27°19' 51.11"S	151°38' 0.21"E	
GW11A (7A)	Interpretation	Main Range Volcanics	27°16' 15.2"S	151°39' 36.35"E	
GW13B (4B)	Interpretation	Waipanna Coal Sequence	27°19' 52.67"S	151°38' 13.5"E	
4517WB (848)	Compliance	Acland Coal Sequence	27°17' 20.7594"S	151°41' 05.0394"E	
CSMH1Ra (CSMH1)	Compliance	Acland Coal Sequence	27°19' 13.674" S	151°44' 23.776"E	
81P	Interpretation	Acland Coal Sequence	27°18' 02.0176"S	151°44' 12.6361"E	
82PcR (82P)	Compliance	Acland Coal Sequence	27°18' 35.078" S[1]	151°43' 21.176"E[1]	
4518WB (83P)	Compliance	Acland Coal Sequence	27°18' 06.7374"S	151°40' 47.6733"E	
112PGC	Interpretation	Acland Coal Sequence	27°18' 58.95"S	151°41' 33.6"E	
3316_WB	Compliance	Acland Coal Sequence	27°18' 50.919"S	151°42' 52.792"E	
114P	Interpretation	Acland Coal Sequence	27°19' 57.96"S	151°42' 14.86"E	
116P	Interpretation	Acland Coal Sequence	27°20' 28.27"S	151°43' 42.43"E	
119PGC	Interpretation	Acland Coal Sequence	27°21' 25.69"S	151°42' 6.67"E	
118P (120WB)	Interpretation	Acland Coal Sequence	27°19' 54.11"S	151°39' 38.52"E	
113PGCB (121WB)	Interpretation	Acland Coal Sequence	27°18' 38.96"S	151°40' 14.09"E	
GW05B (1B)	Interpretation	Acland Coal Sequence	27°16' 39.66"S	151°39' 5.83"E	
GW06B (2B)	Interpretation	Acland Coal Sequence	27°18' 10.77"S	151°38' 40.83"E	
GW07B (3B)	Interpretation	Acland Coal Sequence	27°21' 12.75"S	151°40' 47.05"E	
GW09B (5B)	Interpretation	Acland Coal Sequence	27°21' 54.22"S	151°43' 27.43"E	
GW10 (6)	Interpretation	Acland Coal Sequence	27°20' 9.01"S	151°44' 27.12"E	

18PcR (18P)	Interpretation	Balgowan Coal Sequence	27°16’ 23.101”S	151°41’ 48.686”E	
25PcR (25P)	Interpretation	Balgowan Coal Sequence	27°16’ 43.1426”S	151°43’ 42.1855”E	
26PcR (26P)	Interpretation	Balgowan Coal Sequence	27°16’ 13.3728”S	151°43’ 46.9456”E	
27PcR (27P)	Interpretation	Balgowan Coal Sequence	27°15’ 54.904”S	151°43’ 14.255”E	
28PcR (28P)	Interpretation	Balgowan Coal Sequence	27°15’ 40.027”S	151°42’ 36.061”E	
2289 Lower (2289P)	Interpretation	Balgowan Coal Sequence	27°15’ 47.9126”S	151°42’ 02.0952”E	
2291P (2291P)	Interpretation	Balgowan Coal Sequence	27°17’ 06.7898”S	151°44’ 03.2127”E	
GW08C (4C)	Interpretation	Marburg Sandstone	27°19’ 22.75”S	151°38’ 37.37”E	
GW09C (5C)	Interpretation	Marburg Sandstone	27°21’ 53.79”S	151°43’ 27.48”E	
GW09A (5A)	Interpretation	Oakey Creek Alluvium	27°21’ 54.64”S	151°43’ 27.36”E	
GW11B (7B)	Interpretation	Marburg Sandstone	27°16’ 20.01”S	151°39’43.16”E	
3307WB (8)	Interpretation	Mine Pit backfill	27°16’ 22.21”S	151°42’ 43.19”E	
MB_L1*	Compliance*	Mine Pit backfill	TBC	TBC	

Note: The monitoring ID and location of bores as otherwise specified in the approved Groundwater Management and Monitoring Program will be consolidated with those specified in Table D4, with all monitoring bores being confirmed with two years and consequential updates and consolidation to Table D3 and Table D5.
*_Groundwater quality only, with additional analytes as per Table 2 note 6.

Table D2: Groundwater quality triggers and limits (ML50232)

Parameter	Units	Contaminant Limit [1]	Monitoring frequency
Al	mg/l	5.0	Half yearly
As	mg/l	0.05	Half yearly
Ca	mg/l	1000	Half yearly
Se	mg/l	0.02	Half yearly
Cl	mg/l	TBA	Half yearly
Cu	mg/l	1.0 [2]	Half yearly
F	mg/l	TBA [5]	Half yearly
Fe	mg/l	TBA [5]	Half yearly
NO_3	mg/l	400	Half yearly
NO_2	mg/l	30	Half yearly
K	mg/l	TBA [5]	Half yearly
Mg	mg/l	TBA [5]	Half yearly
Mn	mg/l	TBA [5]	Half yearly
Na	mg/l	TBA [5]	Half yearly
SO_4	mg/l	1000	Half yearly
HCO_3	mg/l	TBA [5]	Half yearly
TDS	mg/l	5000 [2,3]	Half yearly
EC	mg/l	7460 [2,3,4]	Half yearly
pH	unit	TBA [5]	Half yearly
Cr	mg/l	TBA[6]	Half yearly
Ni	mg/l	TBA[6]	Half yearly
Hg	mg/l	TBA[6]	Half yearly
Pb	mg/l	TBA[6]	Half yearly
NH_4	mg/l	TBA[6]	Half yearly
Zn	mg/l	TBA[6]	Half yearly
Cd	mg/l	TBA[6]	Half yearly
PAH	mg/l	TBA[6]	Half yearly
TPH	mg/l	TBA[6]	Half yearly
MAH	mg/l	TBA[6]	Half yearly
Total organic carbon	mg/l	TBA[6]	Half yearly

NOTE:
[1] Based on Stockwater limits defined in ANZECC (2000).
[2] Defined for beef cattle based on landholder bore survey results.
[3] Existing bores 27P, 28P, 2289 and 118P background levels already exceed this limit prior to mine operation.
[4] Based on EC to TDS conversion factor of 0.67 as per ANZECC (2000).
[5] TBAs to be revised once adequate sampling has been undertaken by the holder which must be completed within 2 years of commencement of this environmental authority to add groundwater bores that measure groundwater quality and the triggers and limits relevant to each bore.
[6]Leachate contaminant limits: only for bores identified in the report required by condition D7, TBAs to be revised as per condition D9.

Table D3: Groundwater level monitoring (ML50232, ML50216 and ML50170)

Monitoring Point	Level trigger threshold	Reference Level
84PbR (84P)	5.79	TBA
18PbR	4.57	TBA
18PbR2	TBA[1]	TBA
10PbR (843)	5.79	TBA
BMH1	6.14	440
4517WB (848)	TBA[1]	404.5
CSMH1Rb (CSMH1)	3.74	TBA
81Pc (81P)	TBA[1]	412.3
82PcR (82P)	TBA[1]	TBA
4518WB (83P)	TBA[1]	409
111PGC Lower	TBA[1]	TBA
112PGC (122PGC)	TBA[1]	399.2
109P	TBA[1]	TBA
GW05A (1A)	TBA[1]	TBA
GW16A (2A)	TBA[1]	TBA
GW15A (4A)	TBA[1]	TBA
GW11A (7A)	TBA[1]	TBA
GW13B (4B)	TBA[1]	TBA
3316_WB	TBA[1]	TBA
114P	33.12	381.7
116P	23.75	389.6
119PGC	14.46	392
118P (120WB)	15.79	393
113PGCB (121WB)	TBA[1]	TBA
GW05 (1B)	TBA[1]	TBA
GW06 (2B)	TBA[1]	TBA
GW07B (3B)	TBA[1]	TBA
GW09B (5B)	TBA[1]	TBA
GW10 (6)	TBA[1]	TBA
CSMH1RA (CSMH1)	TBA[1]	TBA
18PcR (18 P)	TBA[1]	408.5
25PcR (25P)	TBA[1]	TBA
26PcR (26P)	0.52	434.5
27PcR (27P)	0.11	TBA
28PcR (28P)	0.29	TBA
BCS4	TBA[1]	TBA

Monitoring Point	Level trigger threshold	Reference Level
132WBR	TBA[1]	TBA
133WBR	TBA[1]	TBA
BCS3	TBA[1]	TBA
2289 Lower (2289P)	TBA[1]	TBA
2291Pc (2291P)	TBA[1]	TBA
GW08C (4C)	TBA[1]	TBA
GW09C (5C)	TBA[1]	TBA
GW09A (5A)	TBA[1]	TBA
LCA1	TBA[1]	TBA
LCA1	TBA[1]	TBA
GW11B (7B)	TBA[1]	TBA
3307WB (9)	TBA[1]	TBA

NOTE: [1] To be provided – Water level trigger thresholds will be proposed following 12 months of monitoring of the new bores and following the first update of the groundwater model prior to the operation of the revised project.

Schedule D: Groundwater	
ML50216 and ML50170	
D15	Groundwater quality must be monitored every **six (6) months** at the locations defined in **Table D4 – Groundwater Monitoring Bores (ML50216 and ML50170)** and shown in **Figure D1 – Groundwater monitoring points (ML50216 and ML50170)** for quality characteristics identified in **Table D5 – Groundwater limits (ML50216 and ML50170).**
D16	For new monitoring bores identified in **Table D4 – Groundwater Monitoring Bores (ML50216 and ML50170),** groundwater quality must be monitored every **three (3) months** until **twelve (12) monitoring events** have been completed for quality characteristics identified in **Table D5 – Groundwater limits (ML50216 and ML50170)**.
D17	If the contaminant limits specified in **Table D5 – Groundwater limits (ML50216 and ML50170)** are exceeded at any time at any compliance bore, groundwater quality monitoring as per condition **D13** must occur every **three (3) months**, until such time as no limits have been exceeded on **three (3) consecutive three-monthly monitoring events**. NOTE: Groundwater monitoring can recommence at **six (6) monthly intervals** once **three (3) consecutive three-monthly monitoring events** compliant with the limits set under **Table D5 – Groundwater Limits** have been achieved.
D18	Standing groundwater levels must be monitored monthly at the locations defined in **Table D4 – Groundwater Monitoring Bores (ML50216 and ML50170).**
D19	Results of groundwater quality monitoring, conducted in accordance with conditions **D15**, **D16** and **D17**, must not be exceeded at the same monitoring bore on **three (3) consecutive monitoring events** for any single contaminant limit specified in **Table D5 – Groundwater Limits (ML50216 and ML50170)**.
D20	If the contaminant limits specified in **Table D5 – Groundwater Limits** are exceeded on **three (3) consecutive occasions**, the environmental authority holder must notify the administering authority within **one (1) Business day** of receiving the results.
D21	If bore groundwater levels, monitored under condition **D18**, exceed any of the groundwater level trigger thresholds stated in **Table D3 – Groundwater Limits (ML50232, ML50216 and ML50170),** the environmental authority holder must compare the compliance monitoring bores to the interpretation bore results and complete an investigation in accordance with the ANZECC and ARMCANZ 2000.

Schedule D: Groundwater	
D22	If an exceedance is determined under condition **D19** or an exceedance is identified in condition **D21**, at any monitoring bore: a) an investigation must be completed and a written report provided to the administering authority within **sixty (60) days** of becoming aware of the exceedance or difference; and b) the report must include a determination of whether the exceedance or difference is caused by: (i) mining activities authorised under this environmental authority; or (ii) natural variation; or (iii) neighbouring land use resulting in groundwater impacts.
D23	If the investigation under condition **D22** determines that the exceedance was a result of the mining activities, including rehabilitation, authorised under this environmental authority, then further investigation must be undertaken to establish whether environmental harm has occurred or may occur, and the extent thereof.
D24	If an investigation undertaken under condition **D23** determines that environmental harm has or may occur, the holder of this environmental authority must: a) implement immediate mitigation measures to reduce the potential for environmental harm; b) develop long-term mitigation measures to address any existing groundwater contamination and prevent recurrence of groundwater contamination which must be implemented in a reasonable time period, and c) provide a report of the completed mitigation measures and proposed long-term mitigation measures to the administering authority within **twenty-eight (28) days** of submission of the report under condition **D22**.
D25	The results of groundwater monitoring conducted under Condition **D10**, Condition **D15**, Condition **D16**, Condition **D17** and Condition **D18** must be submitted to the administering authority via WaTERS by **1 April** each year for the monitoring conducted in the calendar year prior.
D26	The location and Surface RL of new bores, identified in **Table D4 – Groundwater Monitoring Bores (ML50216 and ML50170),** must be provided to the administering authority within **one (1) month** of installation. New monitoring bores must be installed by **28 February 2023**.
Groundwater Monitoring and Management Program	
D27	An updated Groundwater Monitoring and Management Program (GMMP) must be developed by **1 April 2023** and implemented. The GMMP must: a) identify all potential sources of groundwater contamination from mining activities including construction and rehabilitation activities; b) include a hydrogeological conceptual groundwater model; c) identify all environmental values that must be protected; d) include details of groundwater levels in all identified aquifers present across and adjacent to the site to confirm existing groundwater flow paths; e) include estimates of the groundwater inflow to rehabilitated landforms and surface water ingress to groundwater from flooding events using the groundwater model; f) ensure all potential groundwater impacts, including groundwater contamination and groundwater drawdown due to mining activities including construction and rehabilitation activities are identified, monitored, and mitigated; g) ensure adequate groundwater monitoring and data analysis is undertaken to achieve the following objectives: (i) detect any impacts to groundwater level due to the mining activities, including construction and rehabilitation activities; (ii) detect any impacts to groundwater quality due to the mining activities, including construction and rehabilitation activities; (iii) determine compliance with conditions **D17** and **D19**; and (iv) determine trends in groundwater quality;

Schedule D: Groundwater	
	h) include groundwater management and monitoring methodologies that must also be implemented for the duration of all mining activities, including construction and rehabilitation activities; i) include a quality assurance and control program that must also be implemented for the duration of all mining activities, including construction and rehabilitation activities; and j) include a process that must be carried out every **two (2) years** and results in an updated GMMP, that at a minimum includes identification of improvements to the GMMP and addresses any comments provided by the administering authority.
D28	An Annual Groundwater Monitoring Report (AGMR) is required to be completed and submitted to the administering authority on a yearly basis by **1 April** of each year (excluding exploration activities). The AGMR must include: a) the water monitoring data; b) analysis based on applying the groundwater quality and standing water level of all groundwater monitoring bores (including compliance and interpretation) listed within **Table D1: Groundwater monitoring locations and frequency (ML50232)** and **Table D4 – Groundwater Monitoring Bores (ML50216 and ML50170)**; c) an assessment of long-term water quality and water level trends at all groundwater monitoring bores (including compliance and interpretation) listed in **Table D1: Groundwater monitoring locations and frequency (ML50232)** and **Table D4 – Groundwater Monitoring Bores (ML50216 and ML50170)**; d) details of any review undertaken of the groundwater conceptual model; and e) an assessment of any differences between the groundwater level impact predicted and actual impacts for any corresponding period.
D29	Notwithstanding the requirements of conditions **D16** to **D24** (inclusive), groundwater level increases or decreases as measured in monitoring bores, when caused by seepage from Tailings Storage Facility or environmental dam must be notified within **fourteen (14) days** from becoming aware of the cause of the seepage to the administering authority.
D30	The following information must be recorded in relation to all groundwater quality and water level sampling: (a) the date on which the sample was taken; (b) the time at which the sample was taken; (c) the monitoring bore at which the sample was taken; and (d) The results of all monitoring.

Table D4: Groundwater Monitoring Bores (ML50216 and ML50170)

Monitoring Bore	Location		Aquifer	Monitoring Bore Type	Surface RL (m)
	Latitude	Longitude			
10PbR	27°17' 14.194"S	151°41' 28.74"E	Main Range Volcanics	Compliance	437.53
84PbR	27°16' 37.509"S	151°41' 25.57"E	Main Range Volcanics	Compliance	448.21
18PbR	27° 16' 23.336" S	151° 41' 48.809" E	Main Range Volcanics	Interpretation	459.57
18PbR2[1]	27° 16' 26.893" S[1]	151° 41' 37.176" E[1]	Main Range Volcanics	Compliance	TBC[2]
BMH1	27°16' 31.8205"S	151°41' 01.3574"E	Main Range Volcanics	Compliance	454.34
81Pc	27°18' 02.0176"S	151°44' 12.6361"E	Acland Coal Sequence	Interpretation	460.37
82PcR[1]	27° 18' 35.078" S[1]	151° 43' 21.176" E[1]	Acland Coal Sequence	Compliance	TBC[2]
4517WB	27°17' 20.7594"S	151°41' 05.0394"E	Acland Coal Sequence	Compliance	436.07
4518WB	27°18' 06.7374"S	151°40' 47.6733"E	Acland Coal Sequence	Compliance	419.38
111PGC Lower	27° 19' 2.67" S	151° 42' 6.27" E	Acland Coal Sequence	Compliance	430.87
3316_WB	27° 18' 50.919" S	151° 42' 52.792" E	Acland Coal Sequence	Compliance	433.48
2289PcR Lower	27°15' 47.9126"S	151°42' 02.0952"E	Balgowan Coal Sequence	Interpretation	447.14
2291Pc	27°17' 06.7898"S	151°44' 03.2127"E	Balgowan Coal Sequence	Interpretation	461.27
25PcR	27°16' 43.1426"S	151°43' 42.1855"E	Balgowan Coal Sequence	Interpretation	498.04
26PcR	27°16' 13.3728"S	151°43' 46.9456"E	Balgowan Coal Sequence	Interpretation	497.69
27PcR	27°15' 54.904"S	151°43' 14.255"E	Balgowan Coal Sequence	Interpretation	484.42
28PcR	27°15' 40.027"S	151°42' 36.061"E	Balgowan Coal Sequence	Interpretation	456.48
CSMH1Rb	27° 19' 13.674" S	151° 44' 23.776" E	Balgowan Coal Sequence	Compliance	496.91
132WBR[1]	27° 15' 15.315" S[1]	151° 40' 36.199" E[1]	Balgowan Coal Sequence	Interpretation	TBC[2]
133WBR[1]	27° 15' 50.049" S[1]	151° 41' 6.698" E[1]	Balgowan Coal Sequence	Interpretation	TBC[2]
18PcR	27°16' 23.101"S	151°41' 48.686"E	Balgowan Coal Sequence	Interpretation	459.57
18PcR2[1]	27° 16' 26.893" S[1]	151° 41' 37.176" E[1]	Balgowan Coal Sequence	Compliance	TBC[2]
BCS3[1]	27° 17' 21.460" S[1]	151° 41' 5.829" E[1]	Balgowan Coal Sequence	Compliance	TBC[2]
BCS4[1]	27° 19' 2.71" S[1]	151° 42' 7.07" E[1]	Balgowan Coal Sequence	Compliance	TBC[2]
LCA1[1]	27° 18' 14.225" S[1]	151° 40' 55.178" E[1]	Lagoon Creek Alluvium	Compliance	TBC[2]
LCA2[1]	27° 18' 57.523" S[1]	151° 42' 48.176" E[1]	Lagoon Creek Alluvium	Compliance	TBC[2]

NOTE:
[1] New monitoring bore: location approximate and are to be confirmed following drilling and provided under condition **D26**.
[2] Surface elevation and total depth are to be confirmed following drilling and provided under condition **D26**.

Table D5: Groundwater Limits (ML50216 and ML50170)

Location	Quality Characteristic	pH (field)	Electrical Conductivity (Lab)	Fluoride	Sulfate	Aluminium (dissolved)	Arsenic (dissolved)	Copper (dissolved)	Iron (dissolved)	Manganese (dissolved)	Selenium (dissolved)	Nitrate	Bicarbonate, sodium, carbonate, calcium, chloride, potassium, magnesium.
	Limit type	Range	Maximum	Maximum	Maximum	Maximum	Maximum	Maximum	Maximum	Maximum	Maximum	Maximum	Interpretation Only
	Unit	pH units	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	N/A
84PbR		6.5 -7.5 [A]	2568 [C]	0.2 [F]	338 [F]	0.055 [G]	0.013 [G]	0.0014 [G]	0.05 [C]	0.02 [C]	0.011 [H]	16.9 [C]	N/A
82PcR			9015 [D]	0.8 [D]	134 [D]				0.1 [D]	0.087 [D]		5 [D]	
BCS3													
BCS4													
18PcR2			3456 [E]	0.4 [E]	33 [E]				0.0 7[E]	0.02 [E]		6.6 [E]	
18PbR2													
LCA1													
LCA2													
CSMH1Rb		6 - 8.5 [B]	1703 [F]	0.8 [D]	134 [F]				0.2 [F]	0.087 [D]		5 [D]	
10PbR		6.5 -7.5 [A]	3346 [F]	0.5 [C]	57.7 [F]				0.05 [C]	0.02 [C]		50.7 [F]	
111PGC Lower			6937 [F]	0.1 [F]	309 [F]			0.0024 [F]	4.9 [F]	0.087 [D]		5 [D]	
3316_WB			5629 [F]	0.2 [F]	31 [F]			0.0014 [G]	0.6 [F]	0.23 [F]		5 [D]	
4517WB			3084 [F]	0.33 [F]	35 [F]				0.8 [F]	0.087 [D]		5 [D]	
4518WB			4065 [F]	0.4 [F]	48 [F]			0.033 [F]	1.6 [F]	0.087 [D]		5 [D]	
BHM1		6 - 8.5 [B]	1440 [F]	0.4 [F]	18 [F]			0.0014 [G]	0.22 [F]	0.02 [C]		16.9 [C]	

NOTE:
A ANZECC Aquatic Ecosystem Guideline for South East Australia
B ANZECC Livestock Drinking Water Guidelines
C Lower Condamine Basalt 80th Percentile WQO
D North East Walloons 80th Percentile WQO
E Woolowins near stream 80th Percentile WQO
F 95th percentile site specific value
G ANZECC Aquatic Ecosystem (95-99%) Protection Guideline (ANZG 2018)
H ANZECC Aquatic Ecosystem (95%) Protection Guideline (ANZG 2018)