BHP

Mt Arthur Coal

Annual Review FY22

11 November 2022

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Table 1: Annual Review title block

Document Details	
Name of Operation	Mt Arthur Coal
Name of Operator	Hunter Valley Energy Coal Pty Ltd
Project Approvals	PA 09_0062 (MOD 1) PA 06_0091
Name of holder of project approvals	Hunter Valley Energy Coal Pty Ltd
Mining Leases	CCL 744, CL 396, ML 1358, ML 1487, ML 1548, ML1593, ML1655, ML 1739, ML 1757, MPL 263
Name of holder of mining leases	Hunter Valley Energy Coal Pty Ltd; Mt Arthur Coal Pty Limited
Water Licences	WAL 917, WAL 918, WAL 1296, WAL 18141, WAL 18247, WAL 41495, WAL 41556, WAL 41557, WAL 18175
Name of holder of water licences	Hunter Valley Energy Coal Pty Ltd
Mining Operations Plan Commencement Date	1 September 2021 (as approved 15 July 2021)
Mining Operations Plan Completion Date	30 June 2024
Annual Review Commencement Date	1 July 2021
Annual Review Completion Date	30 June 2022
I, Hannah Farr, certify that this audit report is a true and accurate record of the compliance status of Mt Arthur Coal for the period 1 July 2021 to 30 June 2022 and that I am authorised to make this statement on behalf of Hunter Valley Energy Coal Pty Ltd. Note. • The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000. • The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).	
Name of authorised reporting officer	Hannah Farr
Title of authorised reporting officer	Manager HSE – Mt Arthur Coal
Signature of authorised reporting officer	
Date	11 November 2022

1 Statement of Compliance

A statement of Mt Arthur Coal's compliance with its project approvals and mining leases is presented in Table 2 with four identified non-compliances during the reporting period being discussed in Table 3.

Table 2: Statement of compliance

Were all conditions of the relevant approval(s) complied with?	
PA 09_0062	NO
EPL 11457	NO
EPBC 2011/5866	YES
EPBC 2014/7377	YES
ML	YES

Table 3: Non-compliance summary

Relevant approval	Condition	Description Summary	Compliance Status	Comment	Report Reference
PA09_0062	5 & 10 (Schedule 5)	CCC Documentation	Non-compliant (Administrative)	May 2021 CCC Pre-read and CCC meeting minutes were not uploaded to the BHP Website.	Section 11
PA09_0062	1 (Schedule 5)	Complaints	Non-compliant (Low)	A complainant was not contacted within 48 hours of the complaint due to an error occurring with the hotline service provider.	Section 11
PA09_0062	9 (Schedule 3)	Noise TARP Incident	Non-compliant (Low)	An exceedance of the noise criteria was triggered resulting in a failure to implement the Noise Management Plan.	Section 11
PA09_0062 & EPL11457	10 (Schedule 3)	Blast Incident	Non-compliant (Low)	A blast registered a Peak Resultant vibration of 13.5mm/s at the Denman Road West monitor (BP09). The incident was not recorded as an exceedance following further inestigation.	Section 11
PA09_0062 & EPL11457	27 (Schedule 3) & L1.1	Pollution of Waters	Non-compliant (Low)	Overtopping of mine water dam	Section 11

Note: Compliance Status key for Table 3

Risk Level	Colour code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: ➢ potential for serious environmental consequences, but is unlikely to occur; or ➢ potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: ➢ potential for moderate environmental consequences, but is unlikely to occur; or ➢ potential for low environmental consequences, but is likely to occur

Administrative non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

Acronyms

Acronyms	
AHMP	Aboriginal Heritage Management Plan
ARA	Annual rapid assessment
BioMP	Biodiversity Management Plan
BMP	Blast Management Plan
CASA	Civil Aviation Safety Authority
CCC	Community Consultative Committee
CCL	Consolidated coal lease
CHPP	Coal handling and preparation plant
CL	Coal lease
CRD	Cumulative rainfall departure
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DoEE	Former Federal Department of the Environment and Energy is now part of DAWE
DP&E	Former NSW Department of Planning and Environment now DPIE
DPIE	NSW Department of Planning, Industry and Environment. The change occurred on 1 July 2019
DRE	Former Division of Resources and Energy
DRG	Former Division of Resources and Geoscience
EA	Environmental assessment
EIS	Environmental impact statement
EL	Exploration licence
EMS	Environmental management system
EPA	NSW Environment Protection Authority
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
FY	Financial year
GPA	Ground pasture assessment
HRSTS	Hunter River Salinity Trading Scheme

HSE	Health, Safety and Environment
HVAS	High volume air sampler
HVEC	Hunter Valley Energy Coal (Mt Arthur Coal)
IROC	Integrated Remote Operations Centre
MAC	Mt Arthur Coal
ML	Mining lease
MOP	Mining Operations Plan
MSC	Muswellbrook Shire Council
NGER	*National Greenhouse and Energy Reporting Act 2007*
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PA	Project Approval
RACI	Responsible, accountable, consult and inform
RAW	Rapid assessment walkover
ROM	Run of mine
UAV	Unmanned aerial vehicle
VPA	Voluntary Planning Agreement
VWP	Vibrating wire piezometers

2 Introduction

The Mt Arthur Coal Complex, located approximately five kilometres south west of Muswellbrook in the Upper Hunter Valley in New South Wales (NSW) includes the Mt Arthur Coal Open Cut, the Mt Arthur Coal Underground Project (no underground operations are currently taking place), Coal Handling and Preparation Plant (CHPP), rail loop and rail load out. The Mt Arthur Coal Complex (including biodiversity offset areas) and surrounding region is shown in Figure 1 and Figure 2.

This Annual Review details the environmental and community performance for the period from 1 July 2021 to 30 June 2022 for operations at the Mt Arthur Coal Complex.

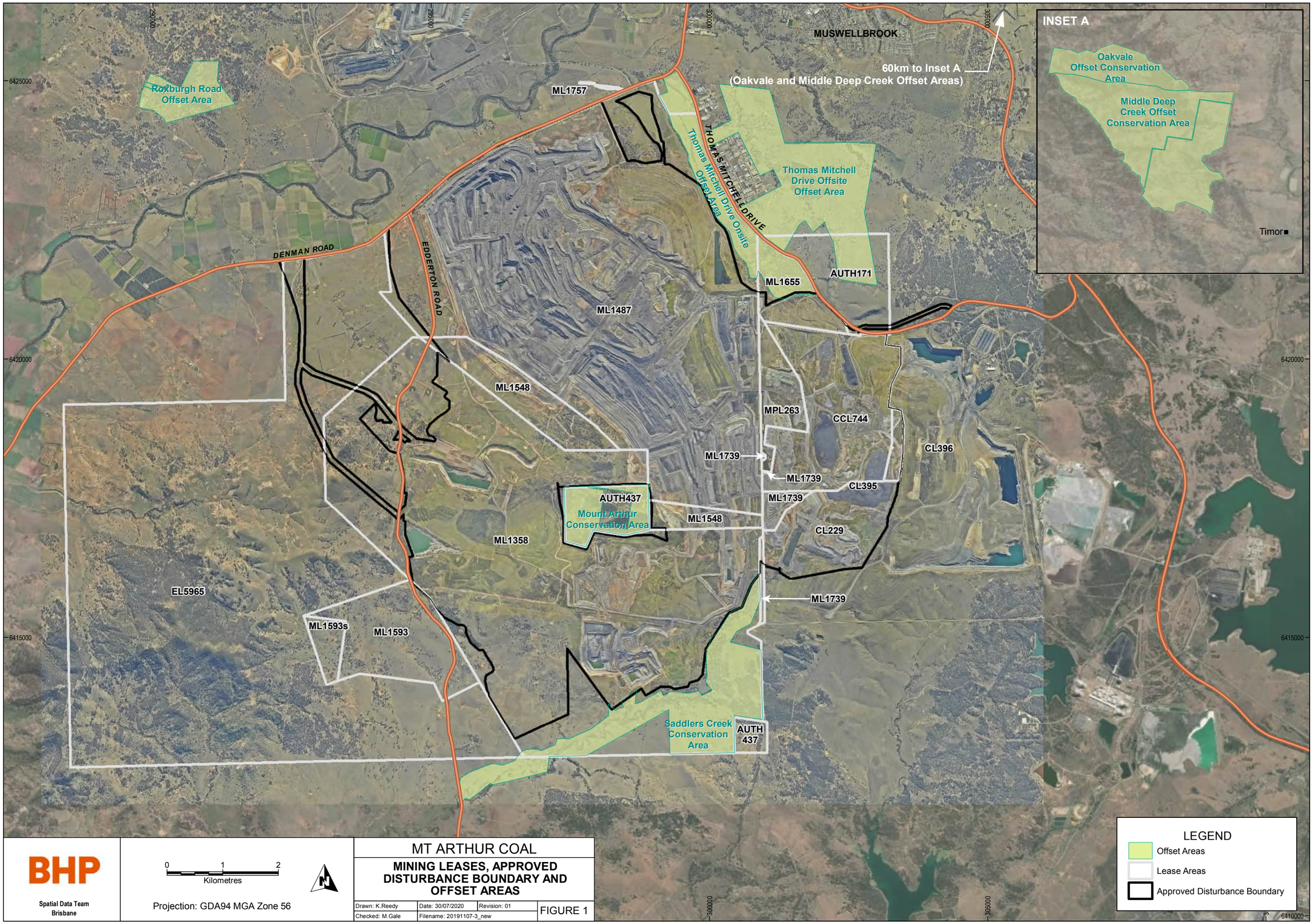
This document has been prepared in accordance with the Annual Review guidelines issued by the former NSW Department of Planning and Environment (DPIE) in October 2015 and fulfils statutory reporting requirements required in mining leases and Schedule 5 Condition 3 of the Mt Arthur Coal Mine Open Cut Consolidation Project Approval Modification 1 (09_0062 MOD 1).

This report was prepared in consultation with the NSW Resources Regulator, the Department of Planning and Environment (DPE), Muswellbrook Shire Council (MSC), NSW Environment Protection Authority (EPA) and Department of Industry – Lands & Water. The report is distributed to a range of external stakeholders and is available on the BHP website at https://www.bhp.com/sustainability/environment/regulatory-information/.

Contact details for personnel associated with environmental management at Mt Arthur Coal can be found in Table 4.

Table 4: Mt Arthur Coal management contact details

Name and role	Phone contact details
Grant Clouten, General Manager, BHP Mt Arthur Coal	(02) 6544 5800
Hannah Farr, Manager Health, Safety and Environment, Mt Arthur Coal	(02) 6544 5800



BHP

Spatial Data Team
Brisbane

0 1 2
Kilometres

Projection: GDA94 MGA Zone 56

MT ARTHUR COAL

MINING LEASES, APPROVED DISTURBANCE BOUNDARY AND OFFSET AREAS

Drawn: K.Reedy	Date: 30/07/2020	Revision: 01	FIGURE 1
Checked: M.Gale	Filename: 20191107-3_new		

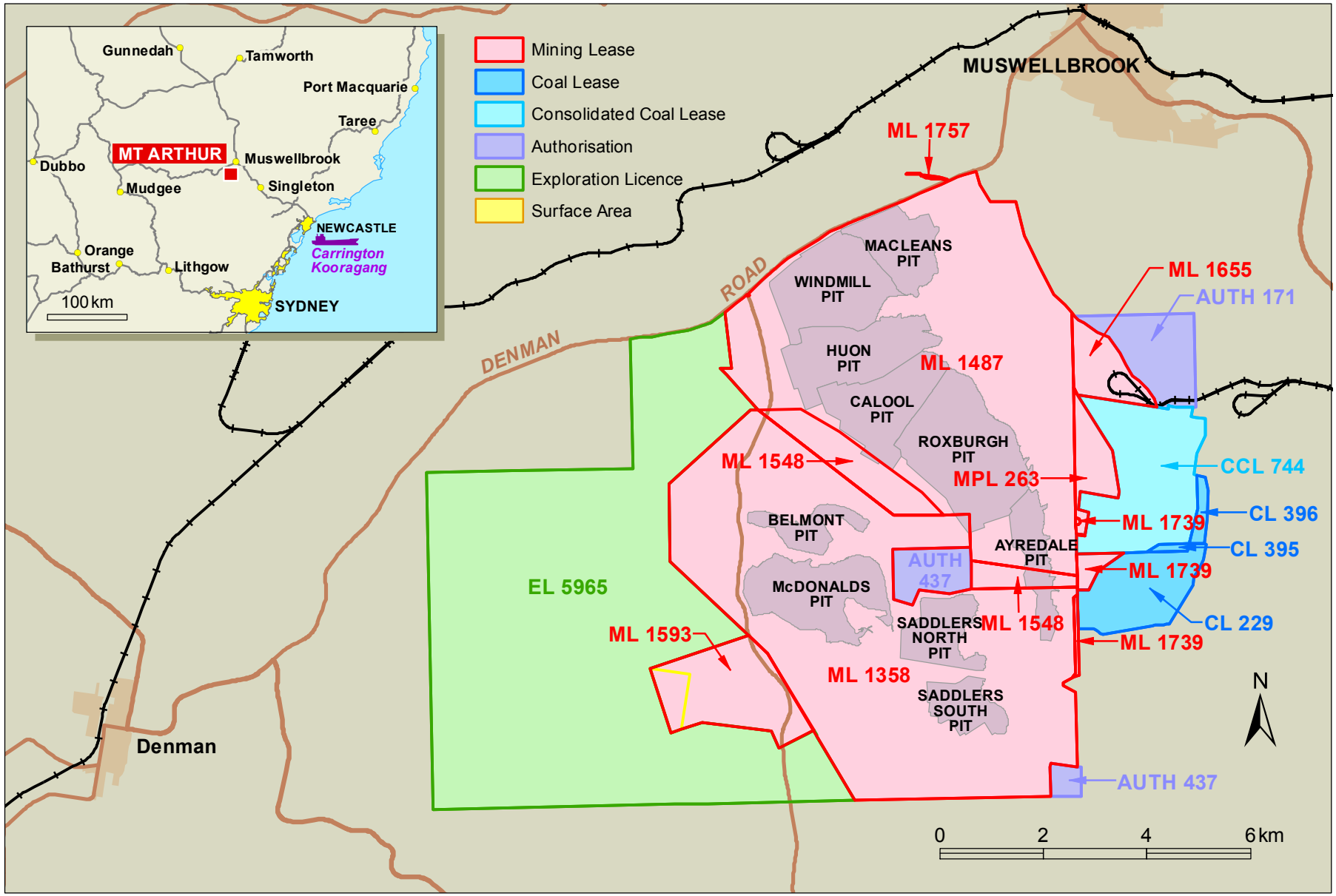


Figure 2: Mt Arthur Coal Locality Plan

Product generated by Mine2Map at 12:11:52 AEST on 11/12/2018

3 Approvals

Mt Arthur Coal has a number of statutory approvals, leases and licences that regulate activities on site. During the reporting period, the following approvals/ amendments occurred:

Mining Lease (ML) 1487 was renewed. Table 5 shows Mt Arthur Coal's existing statutory approvals as at 30 June 2021.

Table 5: Mt Arthur Coal's existing statutory approvals as at 30 June 2022

Description	Issue date	Expiry date
Project approvals issued by the DOP		
Mt Arthur Coal Mine Open Cut Consolidation Project Modification 1 (09_0062 MOD 1)	26/09/2014	30/06/2026
Mt Arthur Coal Mine Underground Project (06_0091)	02/12/2008	31/12/2030
Mining leases and exploration licences issued by the DRG		
CCL 744	03/07/1989	21/01/2028
CL 396	23/06/1992	03/02/2024
ML 1358	21/09/1994	21/09/2036
ML 1487	13/06/2001	12/06/2043
ML 1548	31/05/2004	30/05/2025
ML 1593	30/04/2007	29/04/2028
ML 1655	03/03/2011	03/03/2032
ML 1739	25/07/2016	25/07/2037
ML1757	07/07/2017	07/07/2038
MPL 263	17/10/1990	17/10/2032
A 171	18/10/2004	^
A 437	04/03/1991	^
EL 5965	14/07/2007	15/07/2026
Drayton sublease CL 395	13/04/2006 (registered 14/06/2013)	21/01/2029
Drayton sublease CL 229	13/04/2006 (registered 14/06/2013)	02/02/2024
EPL issued by the EPA		
EPL 11457	09/10/2001 (varied on 1/3/2021)	Not specified
EPBC approval issued by the DAWE		

Description	Issue date	Expiry date
EPBC 2011/5866	30/04/2012 (varied on 29/06/2017)	30/06/2026
EPBC 2014/7377	05/12/2016	30/06/2026

^ Application for renewal lodged with the DRG and renewal is currently pending.

4 Operations Summary

4.1 Mining Operations

Mining and processing operations at Mt Arthur Coal continued 24 hours a day, seven days a week during the reporting period. Mining continued within the Ayredale, Calool, Roxburgh, Saddlers and Windmill open cut pits. Thiess, a subsidiary of the CIMIC Group, operates under a total services contract to mine the Ayredale and Roxburgh pits, located in the southern areas of the Mt Arthur Coal mine. Overburden and interburden material was removed by excavator / shovel and transported via rear dump truck to overburden emplacements, including visual dumps 4 to 5 (VD4 to VD5), contingency dumps 1 to 5 (CD1 to CD5), Out Of Pit Dump North (OP1N), conveyor corridor dump (CC1) and Saddlers dump. Raw coal was extracted by excavator and transported to the CHPP by rear dump truck.

Raw coal was processed at the CHPP, with approximately 14 million tonnes of product coal being railed to the port of Newcastle for export. Coarse coal waste (rejects) was co-disposed within overburden emplacements and fine coal waste (tailings) was pumped to the tailings storage emplacement in East Pit. Production figures for raw, product and waste materials produced during the reporting period are summarised in Table 6.

Table 6: Production summary

Material	Unit	Approved limit	Previous reporting period (actual)	This reporting period (actual)	Next reporting period (estimate)
Overburden	bank cubic meters	N/A	122,148,000	117,714,618	132,211,041
Run-of-mine coal	tonnes	32,000,000	19,852,000	19,820,201	20,807,511
Coarse and fine reject	tonnes	N/A	3,614,499	3,252,124	4,230,675
Tailings	tonnes (dry)	N/A	1,621,613	1,699,478	1,923,034
Product (saleable) coal	tonnes	27,000,000 (by rail)	14,326,000	13,700745	14,501,278

4.2 Other Operations

Other operations at Mt Arthur Coal during the reporting period included:

- *Land Preparation:* During the reporting period approximately 242,000 cubic metres of topsoil was recovered from 113 hectares of clearing ahead of mining and for additional dump space using excavators, dozers and trucks. Material was either stockpiled, or placed directly onto reshaped areas to be rehabilitated where able to, with the remaining topsoil being stockpiled. Between 100 to 300 millimetres of topsoil was recovered during stripping.
- *Infrastructure Construction and Management*: The following major projects were commenced, progressed or completed during the reporting period:
    - Relocation of powerlines to facilitate the forward mine plan;
    - Commencement of the second phase of the Tailings Dam Stage 2 raise project involving the downstream raising of an existing embankment by 10 meters to provide ongoing tailings storage capacity;
    - Establish an out of pit dump (OP1N) to cater for insufficient dump capacity on low wall over five year plan, particularly with impact of monocline;
    - Old Edderton Road partially removed to facilitate approved extension of Windmill Pit
    - Substation relocation from Belmont to WM north Pit

- Complete relocation of infrastructure to facilitate the approved extension of Windmill Pit, including the opening of the realigned Edderton Road in accordance with alignment Option 2 presented in PA 09_0062 originally granted in 2010;
- Complete removal of circa 3.8km of old conveyor up to AGL Boundary including removal of redundant coal bin and associated structures;
- Installation of additional water pipelines and associated pumps to support ongoing water management strategies;
- Started Drayton Void pumping and pipeline upgrade works – involves approximately 16 kilometres of pipeline, two 150 L/s electric pontoon pumps and associated electrical works;
- Installation of sediment control structures downstream of the southern conveyor corridor and OP1N overburden emplacement areas prior to dump construction;
- Started Denman Rd and Thomas Mitchell Drive intersection upgrade works
- Closure works for the Main Dam and Northcut TSF, comprising:
    - Closure of the Northcut TSF through, dewatering, surface capping and construction of a buttress along the western perimeter of the facility to final landform requirements.
    - Planning and works to move toward de-prescription and risk reduction of the Main Dam through installation of a Culvert
    - Removal of Dam 4.

During the reporting period there were no variations from the current MOP related to construction works on site.

4.3 Employment Details

As at 30 June 2020, Mt Arthur Coal employed 875 permanent and fixed-term contract employees and approximately 1265 contractors on a full-time equivalent basis. Approximately 40 per cent of Mt Arthur Coal's employees resided in the local government areas of Muswellbrook and Singleton as at 30 June 2022.

4.4 Next Reporting Period

Forecast operations for the next reporting period, in particular significant changes in the mine, include:

- Expand out of pit dump (OP1N) to cater for upper mining material;
- Relocation of powerlines to facilitate the forward mine plan;
- Continue installation of additional water pipelines and associated pumps to support ongoing water management strategies;
- Finishing off Drayton Void pumping and pipeline upgrade works – involves approximately 16 kilometres of pipeline, two 150 L/s electric pontoon pumps and associated electrical works;
- Continue second phase of the Tailings Dam Stage 2 raise project involving the downstream raising of an existing embankment by 10 meters to provide ongoing tailings storage capacity;
- Substation relocation from Windmill south to Calool north to facilitate forward mine plan
- Finish Denman Rd and Thomas Mitchell Drive intersection upgrade works; and
- Complete noise and dust monitoring equipment upgrades.

5 Actions Required from Previous Annual Review

The DPE notified HVEC by letter dated 1 November 2021 that the amended FY21 Annual Review was considered by the Department to satisfy the requirements of the Project Approval and the Department's Annual Review Guideline, October 2015.

Regulator feedback following review of the FY21 Annual Review is summarised in Table 7. Regulator feedback on additional requirements to be considered during the preparation of the FY22 Annual Review is also summarised in Table 7.

Table 7: Actions required from FY21 Annual Review and additional requirements for FY22 Annual Review

Action required	Requested by	Action taken by HVEC	FY22 Annual Review section
Regulator feedback from FY21 Annual Review			
No specific feedback from FY21 has been provided for consideration in the development of the FY22 Annual Review.	NSW Resources Regulator, DPE and EPA	N/A	N/A
No Regulator feedback on additional requirements for the FY22 Annual Review was received in line with the Annual Review Guideline, October 2015.			

6 Environmental Performance

6.1 Noise

6.1.1 Environmental Management

Noise management at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-MTP-032 Noise Management Plan; and
- MAC-ENC-PRO-056 Noise Management Procedure.

The Noise Management Plan was prepared to fulfil the requirements of project approval, meet conditions of Environmental Protection Licence (EPL) 11457, as well as manage and minimise mine noise impact on the community and environment.

Mt Arthur Coal has eight statutory monitoring locations as detailed in the Noise Management Plan and four real-time monitoring locations utilised for internal use. Noise monitoring locations are shown in Figure 3.

6.1.2 Environmental Performance

An analysis of monthly attended noise monitoring results indicates Mt Arthur Coal's operations did not exceed the $L_{Aeq(15min)}$ or the $L_{A1(1min)}$ limits during the reporting period. A summary of results from Mt Arthur Coal's attended noise monitoring in the reporting period is provided in Table 8. Where a remeasure was required on the same night to determine the sustained noise level, only the remeasure result has been used to calculate tabulated results.

$L_{Aeq(15min)}$ noise level predictions modelled for 2022 in the 2013 noise impact assessment were used for comparison with monitoring results for this reporting period, as shown in Table 8. Maximum $L_{Aeq(15min)}$ noise results are generally below modelled predictions with the exception of NP10. However, noise levels (maximum 39dB) were below than the approval relevant criteria of 39dB.

A comparison of FY22 noise monitoring results to previous reporting years is assessed and presented in Table 9. FY22 $L_{Aeq(15min)}$ noise levels are slightly higher than historical results for the noise monitoring locations NP07, NP10, NP13 and NP14 (an increase of maximum 3dB). While a decrease in the noise levels was observed from the noise monitoring locations NP12, NP15 and NP16 (a decrease of maximum 7dB). Maximum noise result at NP04 remains at the same level as per previous monitoring period (FY21). Data capture was 100 per cent at all attended noise monitoring sites.

The additional impact of low frequency noise was assessed in accordance with the EPA's 2017 Noise Policy for Industry. None of the noise measurements recorded during the reporting period satisfied the conditions outlined in the Noise Policy for Industry to require assessment of low-frequency noise.

6.1.3 Complaints and Reportable Incidents

A total of 6 noise complaints were received from the Community Response Line during the reporting period, this was no change from FY21. All complaints were investigated, with noise levels generated by Mt Arthur Coal being measured within internal management benchmarks at the nearest real-time monitor, whenever noise data was available. Investigations indicated that the nearest real-time monitor did not record any exceedances or distribute any alerts.

An exceedance of the noise criteria was reported at NP04 from the routine attended noise monitoring on 18 October 2021. A Show Cause notice was received on 17 November 2021 regarding the alleged breach and an Official Caution from the DPE was received on 26 May 2022. Further information is provided on the Section 11.

6.1.4 Proposed Improvements

As proposed in the last reporting period, Mt Arthur Coal has installed three noise compasses for unattended noise monitoring with improved capability, monitoring and technology.

Table 8: Monthly attended night time noise monitoring results in decibels

Noise Monitoring Location	$L_{Aeq(15min)}$ dB			$L_{A1(1min)}$ dB		Trend / key management implications	Implemented / proposed management actions
	Approval criteria	2022 prediction	Reporting period performance (min/ log ave/ max^)	Approval criteria	Reporting period performance (min/log ave/max^)		
NP04	38	38	25 / 35 / 38	45	25 / 42 / 47	Exceedance occurred on 18 October 2021. Further information provided in Section 11.	Continuation of management and monitoring in accordance with Noise Management Plan
NP07	39	38	25 / 33 / 38	45	25 / 37 / 41		
NP10	39	36	25 / 36 / 39	45	25 / 38 / 41		
NP12	39	39	34 / 35 / 35	45	38* / 38 / 38*		
NP13	35	N/A	25 / 28 / 31	45	25 / 30 / 33*		
NP14	35	35	26 / 31 / 34	45	29 / 37 / 40		
NP15	35	36	28* / 31 / 32	45	33 / 38 / 42		
NP16	37	36	25 / 28 / 30	45	30 / 32 / 34		

^ Measurable noise levels only – does not include *inaudible* or *not measurable* results
* Noise emission limits do not apply due to winds greater than three metres per second (at a height of 10 metres), or temperature inversion conditions greater than or equal to four degrees Celsius per 100 metres.

Table 9: Attended noise monitoring results in decibels in comparison to previous years

Noise Monitoring Location	FY22		FY21		FY20	
	Min	Max	Min	Max	Min	Max
$L_{Aeq(15\ min)}$ dB						
NP04	25	38	IA	38*	IA	35*
NP07	25	38	IA	37*	IA	34*
NP10	25	39	IA	38*	IA	37*
NP12	34	35*	IA	36*	IA	34*
NP13	25	31*	IA	27*	IA	27
NP14	26	34*	IA	32*	IA	34*
NP15	28*	32*	IA	34*	IA	32*
NP16	25	30	IA	37*	IA	37*
$L_{Aeq(1\ min)}$ dB						
NP04	25	47*	IA	46*	IA	40*
NP07	25	41	IA	40*	IA	37
NP10	25	41	IA	45*	IA	39*
NP12	38*	38*	IA	40*	IA	35*

Noise Monitoring Location	FY22		FY21		FY20	
	Min	Max	Min	Max	Min	Max
NP13	25	33*	IA	30*	IA	34
NP14	29	40	IA	37*	IA	43
NP15	33	42*	IA	39*	IA	43
NP16	30	34	IA	41*	IA	41*

* Noise emission limits do not apply due to winds greater than three metres per second (at a height of 10 metres), or temperature inversion conditions greater than or equal to four degrees Celsius per 100 metres.
IA – Mt Arthur Coal's operations were inaudible.

BHP

Geospatial Team
Brisbane

1:53,500

0 1 2
Kilometres

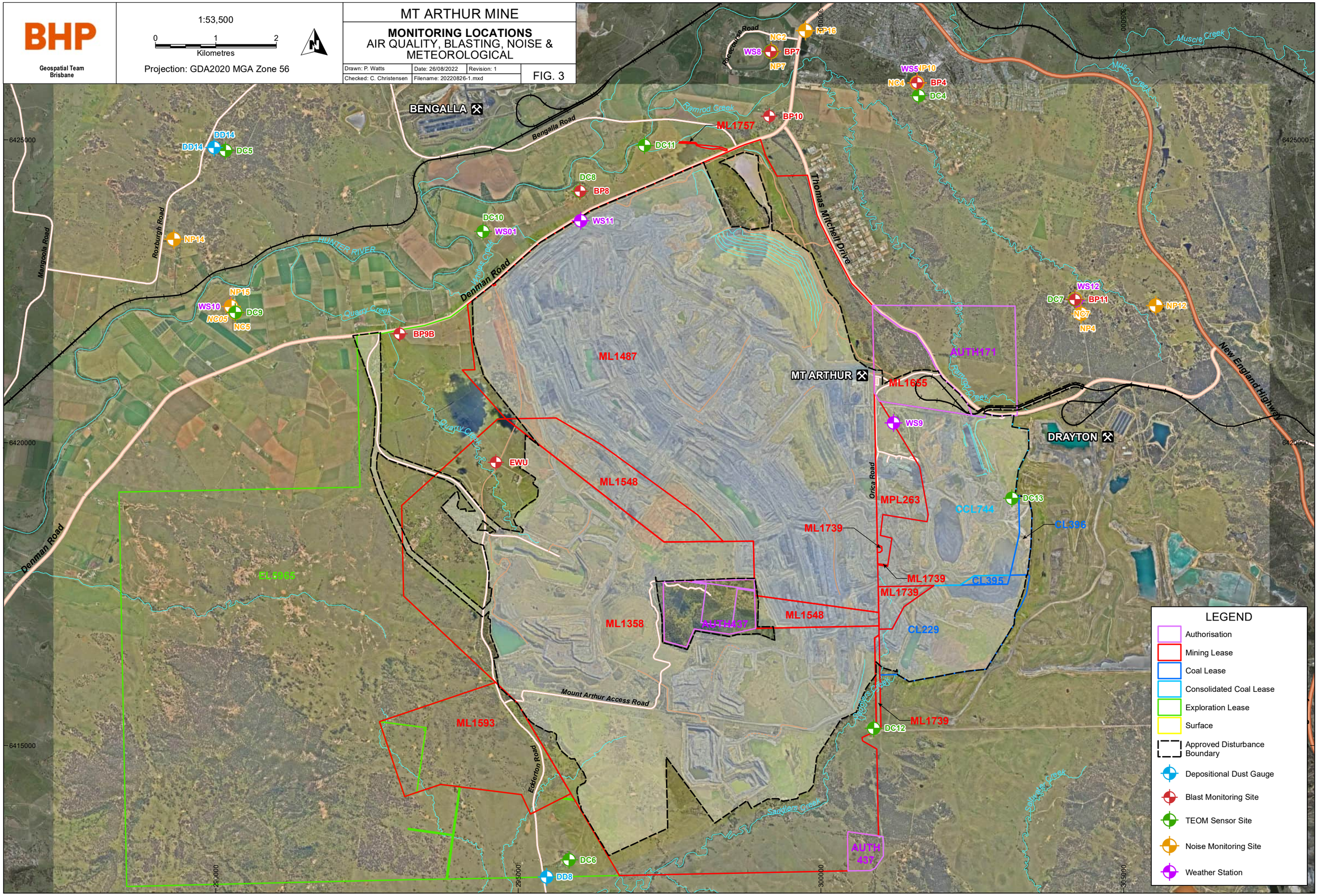
Projection: GDA2020 MGA Zone 56

MT ARTHUR MINE

MONITORING LOCATIONS
AIR QUALITY, BLASTING, NOISE & METEOROLOGICAL

Drawn: P. Watts	Date: 26/08/2022	Revision: 1
Checked: C. Christensen	Filename: 20220826-1.mxd	

FIG. 3



LEGEND

- Authorisation
- Mining Lease
- Coal Lease
- Consolidated Coal Lease
- Exploration Lease
- Surface
- Approved Disturbance Boundary
- Depositional Dust Gauge
- Blast Monitoring Site
- TEOM Sensor Site
- Noise Monitoring Site
- Weather Station

6.2 Blasting

6.2.1 Environmental Management

Blasting at Mt Arthur Coal is managed in accordance with MAC-ENC-MTP-015 Blast Management Plan.

The Blast Management Plan details the relevant blast overpressure and vibration impact assessment criteria and compliance procedures and controls related to open cut blasting activities. It includes the blast monitoring program, as well as public infrastructure monitoring requirements, and road closures. It also includes the blast fume management strategy, which aims to minimise visible blast fume and reduce potential for offsite fume migration.

Mt Arthur Coal has five statutory blast monitors:

- BP04 (South Muswellbrook);
- BP07 (Sheppard Avenue);
- BP09B (Denman Road West);
- BP10 (Yammanie North); and
- BP11 (Balmoral Road).

Blast monitoring locations are shown in Figure 3.

During the reporting period a blast monitor on Denman Road West (previously BP09) was relocated to a new location along Denman Road (now BP09B). This relocation was the result of an investigation finding with the Department of Planning and Environment required to provide more accurate and representative blast monitoring results of the nearest sensitive receptor. The Blast Management Plan and Environmental Protection Licence were amended to allow this change and the new monitor came online as of the 20th April 2022. This new location is shown in Figure 3.

The modification project approval states a ground vibration limit for public infrastructure of 50 millimetres per second (mm/s), unless Mt Arthur Coal has a written agreement with the relevant owner of the public infrastructure to exceed these criteria and advised the former DPIE in writing of the terms of the agreement. Written agreements with Roads and Maritime Services (RMS), Telstra and Ausgrid are in place allowing increases in the ground vibration blast impact assessment criteria as follows:

- 150 mm/s with no allowable exceedances (RMS, Ausgrid);
- 10 per cent of the total number of blasts over a period of 12 months are allowed to exceed 100 mm/s (Telstra, Ausgrid); and
- Notification prior to blasting for blasts predicted to exceed 100 mm/s at Denman Road (RMS).

6.2.2 Environmental Performance

During the reporting period 185 blasts were undertaken. Blast data capture rates for the reporting period were 100 per cent at all statutory sites.

Blasting was undertaken between 8 am and 5 pm Monday to Saturday, with no blasts being undertaken on Sundays or public holidays. One blast resulted in blast ground vibration monitoring results above the maximum 10 mm/s limit of 13.5mm/s at Denman Rd West on 23 July 2021. Investigations determined that there was no impact above the compliance criteria at the nearest private residence. This blast is discussed further in the Incidents and Non-Compliance section of this report. No blasts recorded an airblast overpressure result above the maximum 120 dBL limit.

Of the 185 blast events fired during the reporting period, three (1.62 per cent) exceeded the airblast overpressure criteria of 115 dBL and four (2.16 per cent) exceeded the ground vibration criteria of 5 mm/s, hence remaining below the five per cent allowable exceedance limits.

Results reflect predictions made in the modification environmental assessment and do not show a significant difference in average or maximum results compared to previous reporting periods with the exception of the exceedance that occurred at BP09 which was subsequently investigated and determined to have no impact above 10mm/s at the nearest private residence. A comparison of FY22 blast monitoring results with previous years is provided in Table 10.

In accordance with the Blast Management Plan, potential impacts to public infrastructure were calculated for blasts in Windmill and Roxburgh pits with all blasts meeting the agreed criteria.

Table 10: Summary of statutory blast monitoring results

Parameter	Statistic	FY22	FY21	FY20
Ground vibration (mm/s)	Average	0.24	0.24	0.21
	Maximum valid result	13.50 (at BP09)	8.55 (at BP09)	5.96 (at BP09)
	Valid blasts above 5 mm/s threshold	4	4	1
Airblast overpressure (dBL)	Average	95.5	94.6	95.3
	Maximum valid result	118.8 (at BP10)	119.6(at BP09)	117.7(at BP10)
	Valid blasts above 115 dBL threshold	3	6	4

6.2.3 Complaints and Reportable Incidents

During the reporting period, 9 blast complaints were recorded, this remains unchanged from FY21. These complaints are discussed further in Section 9. Reportable blast incidents are discussed in Section 11.

6.2.4 Proposed Improvements

Continued updates on the Site Law database will be undertaken in FY23.

A review of the Blast Matrices will be undertaken in FY23. This will improve the blast impact risk identification process undertaken prior to each blast and reduce the risk of impacts to community and environment as a result of blasting.

6.3 Meteorological Data

6.3.1 Environmental Management

Meteorological monitoring at Mt Arthur Coal is managed in accordance with MAC-ENC-MTP-040 Air Quality Management Plan.

Mt Arthur Coal's primary statutory real-time meteorological station located at the mine's industrial area (WS09) is an essential component of the operation's environmental monitoring system. Wind speed, wind direction, temperature, rainfall, solar radiation and humidity data is collected at 15-minute intervals and relayed using radio telemetry.

A secondary statutory real-time meteorological station, located off site to the north-west of the mine at Wellbrook (WS10), also provides representative weather data for the mine site, including prevailing wind conditions, and is used in conjunction with WS09 to determine the presence and strength of temperature inversions in the local atmosphere as part of the pre-blast environmental assessment. These meteorological stations are shown on Figure 3.

Both statutory meteorological stations comply with the Australian Standard 2923-1987 *Ambient Air – Guide for measurement of horizontal wind for air quality applications* and the EPA's 2017 Noise Policy for Industry.

6.3.2 Environmental Performance

Meteorological data capture rate for the reporting period was 94.31 per cent at WS09 and 98.54 percent at WS10.

Total rainfall for the reporting period was around 768 mm, which is approximately 24 per cent higher than the long-term average of 619 mm. Wind direction at Mt Arthur Coal (WS09) during the reporting period was predominantly from the north-west to north (Winter/Spring); and south-east and north to north-east (Summer/Autumn).

6.3.3 Proposed Improvements

Mt Arthur Coal will continue to record and utilise meteorological data from its two statutory monitors during the next reporting period.

6.4 Air Quality

6.4.1 Environmental Management

Air quality at Mt Arthur Coal is managed in accordance with MAC-ENC-MTP-040 Air Quality Management Plan.

Mt Arthur Coal operates an air quality monitoring network consisting of:

- Two statutory dust deposition gauges recording dust deposition, which are derived from mining and non-mining activities. These provide a measure of changing air quality;
- Six statutory real-time dust monitors, referred to as tapered element oscillating microbalance samplers (TEOMs), which record PM_{10} levels on a continuous basis;
- Five additional TEOMs, which also record continuous PM_{10} levels are included in the monitoring network. These are non-statutory and are used for proactive internal management purposes; and
- A Dust Control System, which is monitored 24 hours a day, seven days a week by the onsite Dispatch team who contact in field personnel to activate the Dust Trigger Action Response Plan (TARP) when dust trigger levels are exceeded. Operational responses are recorded in the Dust Control System.

Air Quality monitoring locations are shown in Figure 3.

Mt Arthur Coal utilises a predictive dust model that predicts meteorological conditions and PM_{10} concentrations up to 72 hours in advance. This tool is used for operational dust management planning and notification of mining supervisors when adverse weather conditions are predicted.

6.4.2 Environmental Performance

Air dispersion modelling completed for the 2022 representative mining scenario, as part of the 2013 environmental assessment, has been used to evaluate monitoring results for the reporting period.

Depositional Dust Gauges

The results from the statutory depositional dust monitoring results are summarised in Table 11. Depositional dust gauge data capture rates for the reporting period were 100 per cent at all statutory sites.

For the reporting period, no statutory depositional dust gauges exceeded the annual average assessment criteria, as shown in Table 11.

Monitoring results for the reporting period were lower than previous years, indicating that the wet conditions experienced throughout the reporting period may have had an influence on monitoring results.

Table 11: Comparison of annual average deposited dust results

Monitor Location	Approval criteria (annual average)	Annual average depositional dust (g/m^2/month)			Trend / key management implications	Implemented / proposed management actions
		FY22	FY21	FY20		
Edderton Homestead (DD08)	4 g/m^2/ month	1.1	1.7	2.0	No exceedances	Continue dust management in accordance with AQMP
Roxburgh Road (DD14)		2.2	2.7	3.0		

Tapered Element Oscillating Microbalance Samplers

A summary of the results from the statutory real-time TEOM PM_{10} monitoring sites for the reporting period is provided in Table 12.

The data capture for the most monitors were above the 90 percent target as shown below. Two monitors, DC11 and DC12, had 86% and 81% data captured, respectively, due to difficulties encountered to access those sites during wet period. Mt Arthur Coal will continue upgrades to both the accessibility to the dust monitoring stations and improve system accuracy and reliability.

- DC02 – 98%
- DC04 – 93%
- DC05 – 96%
- DC06 – 99%
- DC07 – 96%
- DC08 – 92%
- DC09 – 98%
- DC10 – 92%
- DC11 – 86%
- DC12 – 81%
- DC13 – 97%

During the reporting period, the short term 24-hour cumulative impact assessment criteria (50 $\mu g/m^3$) slightly exceeded at the statutory Sheppard Avenue TEOM monitoring site – DC02 (50.2 $\mu g/m^3$). This exceedance of the cumulative criteria was reported to the DPE, as recorded in Table 13. For the recorded exceedances it was determined that the incremental increase in concentrations due to the Mt Arthur Coal project was less than 50 $\mu g/m^3$.

Mt Arthur Coal's statutory TEOM monitoring sites remained below the long-term annual impact assessment criteria. The decreasing trend in annual averages has continued to FY22. Similar to previous reporting period, this trend may be attributed to much higher rainfall in FY22 which was 24% above the long-term average.

Air dispersion modelling predictions for the 2022 mining scenario have been used to evaluate annual average TEOM PM_{10} results for the reporting period, as summarised in Table 12.

Table 12: Summary of TEOM PM_{10} monitoring results using validated data

Monitor location	Approval criteria (µg/m³)	2022 – predicted cumulative (µg/m³) +	TEOM PM_{10} monitoring results (µg/m³)						Trend / key management implications	Implemented / proposed management actions
			FY22		FY21		FY20			
			Max 24-hour avg	Annual Ave µg/m³	Max 24-hour avg	^Annual Ave µg/m³	Max 24-hour avg	Annual Ave µg/m³		
Sheppard Avenue (DC02)	Short term 24-hour average: 50 Long term annual average: 30	18	50	16	63	20	217#	27	No valid exceedances of the incremental impact assessment criteria due to the Mt Arthur Coal project. All TEOMs experienced a drop in the average.	Continue dust management in accordance with AQMP
South Muswellbrook (DC04)		19	42	17	79	19	194#	20		
Roxburgh Road (DC05)		19	43	14	43	11	213#	13		
Edderton Homestead (DC06)		N/A	35	11	36	11	215#	14		
Antiene (DC07)		18	37	14	52	15	209#	20		
Wellbrook (DC09)		17	45	15	53	15	194#	23		

The 24-hour impact assessment criteria of 50 µg/m3 was exceeded due to an extraordinary weather event as agreed by the Secretary, therefore this result is excluded from application of the criterion.
^adjusted long term average. The adjusted value is after the removal of all extraordinary event days where criterion does not apply.
+ these predictions were modelled in 2013, Emissions from Bengalla Mine are not included in these cumulative predictions as detailed emissions information for the Bengalla Continuation Project were not publicly available for inclusion in the modelling for 2022. This has led to the predicted cumulative levels being potentially artificially low.

Table 13: 24-hour PM_{10} exceedances and calculated Mt Arthur Coal incremental impact for statutory TEOMs

Date of event	Monitor location	24-hour PM_{10} result (µg/m^3)	Mt Arthur Coal contribution (µg/m^3) (incremental impact)	Declared extraordinary event by Secretary *
12/09/2021	Shephard Avenue DC02	50.2	12.1	No

Note: The results reported in this table are based on data as reported to regulators.
* Criterion doesn't apply under extraordinary event as agreed by the Secretary, as per Note d of Schedule 3, Condition 20 of PA 09_0062. Calculation of the Mt Arthur Coal contribution is not applicable for these declared events.

Total Suspended Particulates

TEOM PM_{10} monitoring data is used to calculate annual average total suspended particulate (TSP) levels. TSP results were calculated by multiplying the annual average PM_{10} results by 2.5, in accordance with the approved AQMP. During the reporting period, TSP remained below the long-term annual impact assessment criteria at all statutory sites, as shown in Table 14. TSP at each of the monitoring locations were below the reported values for FY21 and/or FY20, except for Roxburgh Road (DC05). TSP level at DC05 (34 µg/m^3) was slightly higher than the level recorded in FY20 (33 µg/m^3). Generally, the lower TSP levels recorded in FY22 can primarily be attributed to the increased rainfall in this monitoring period which was 24% above the long-term average, see Section 6.3.

Table 14: Summary of total suspended particulate results

Site name	Approval criteria	TSP annual average monitoring results (µg/m^3)			Trend / key management implications	Implemented / proposed management actions
		FY22	FY21	FY20		
Sheppard Avenue (DC02)	Long term annual average: 90 µg/m^3	41	50	68	No exceedances	Continue dust management in accordance with AQMP
South Muswellbrook (DC04)		43	47	50		
Roxburgh Road (DC05)		34	27	33		
Edderton Homestead (DC06)		28	27	35		
Antiene (DC07)		34	38	50		
Wellbrook (DC09)		37	38	58		

6.4.3 Complaints and Reportable Incidents

A single dust-related complaint was received from the Community Response Line during the reporting period. This is lower than FY21 (4 dust complaints). The complaint was investigated and results indicated that real-time dust levels and 24-hour averages remained within regulatory limits at the monitoring location nearest to the complainant.

Mt Arthur Coal's real time dust monitoring system, implemented in 2019, has improved the site's capability to better monitor and manage its dust performance, which is evidenced in the reduction in the number of dust related complaints during this and the previous reporting periods.

6.4.4 Proposed Improvements

In line with the principles of continuous improvement that are integral to the site Environmental Management System, Mt Arthur Coal will continue upgrades to the Dust Control System in the next reporting period to improve system accuracy and reliability, including the installation of new TEOMs and UPSs during the next reporting period (FY23).

6.5 Biodiversity

6.5.1 Environmental Management

Flora and fauna at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-MTP-047 Rehabilitation Strategy;
- MAC-ENC-MTP-050 Biodiversity Management Plan (BioMP);
- MAC-ENC-PRO-012 Land Management (internal document);
- MAC-ENC-PRO-080 Rehabilitation and Ecological Monitoring Procedure (REMP, internal document); and
- MAC-HSE-PRO-002 Pest Animal Management Procedure (internal document).

The BioMP outlines Mt Arthur Coal's biodiversity management and monitoring approach, addressing both State and Commonwealth approval conditions in relation to biodiversity management.

The biodiversity offset areas managed by Mt Arthur Coal, as per the BioMP, are as follows:

- Mt Arthur Conservation Area (100.8 hectares);
- Saddlers Creek Conservation Area (431.3 hectares);
- Thomas Mitchell Drive Offset Area (on-site) (219.4 hectares);
- Thomas Mitchell Drive Offset Area (off-site) (492 hectares);
- Roxburgh Road 'Constable' Offset Area (109 hectares); and
- Middle Deep Creek Offset Area (1257 hectares).

In accordance with the modification project approval, long-term security for the Mt Arthur Coal biodiversity offset areas is provided through conservation agreements, formally registered on title.

Mt Arthur Coal undertakes annual flora and fauna monitoring to track progress against the BioMP and MOP objectives. The monitoring program tracks the condition of habitat areas over time and ensures that the BioMP's established performance indicators and project approval requirements are being met. The program includes 22 active monitoring sites throughout site woodland rehabilitation areas and remnant vegetation areas onsite and within offset areas. Remnant vegetation monitoring sites are used to assess mine impact and natural regeneration, as well providing reference data for comparative assessment of rehabilitation monitoring sites.

Plantings occurred in Saddlers Creek, Thomas Mitchell Drive (offsite) and Middle Deep Creek with over 4000 trees being planted in over 130 hectares. Planting will continue into early FY 23 with another 4000 trees

Weed Assessment and Treatment

Mt Arthur Coal conducted an annual weed assessment in FY22. A site weed action plan was used to inform weed treatment works.

Mt Arthur Coal's weed treatment programs are guided by the Hunter Regional Strategic Weed Management Plan 2017 – 2022 (Hunter Local Land Services, 2017). Mt Arthur Coal primarily targets Weeds of National Significance, as well as State Priority weeds and Regional Priority weeds for the Hunter Region, declared under the Biosecurity Act 2015.

Pest Animal Control

Feral animal presence is continually monitored through scheduled inspections and workforce feedback. Information from these sources is used to plan the feral animal control programs across the mine site and all biodiversity offset and conservation areas.

The vertebrate pest management program continued during the reporting period, with the annual campaign utilising 1080 baiting to target wild dogs (Canis lupus familiaris) and foxes (Vulpes vulpes). Additionally a soft jaw trapping program was carried out target wild dogs (Canis lupus familiaris) and foxes (Vulpes vulpes). The offset areas targeted Foxes and cats using trapping).

6.5.2 Environmental Performance

The annual ecological development monitoring program, consisting of vegetation community assessment and fauna surveys, was undertaken in November and December 2021, and February 2022 by independent consultants. The REMP monitoring schedule identifies a total of 5 monitoring sites scheduled to be monitored in FY22. Those sites are listed in Table 15.

Table 15 FY22 rehabilitation monitoring sites

Site Name	Site Location	Vegetation Type (PCT No.)	Treatment Type	Easting (MGA56)	Northing (MGA56)	First Year of Monitoring	Reference site
VB3	Visual Bund - Box Gum Woodland Establishment Area	Box Gum Woodland (1606*)	Rehabilitation	298529	6423293	2008 (FY09)	MA6 (Mt Arthur Conservation Area)
VB2	Visual Bund - Box Gum Woodland Establishment Area	Box Gum Woodland (1606*)	Rehabilitation	299327	6423177	2004 (FY05)	MA6 (Mt Arthur Conservation Area)
Dump 11	Dump 11 - Eastern Woodland Corridor	Woodland (1604**)	Rehabilitation	302822	6420201	2019 (FY20)	MA4 (Mt Arthur Conservation Area)
MD1	Main Dam - Eastern Woodland Corridor	Woodland (1604**)	Rehabilitation	301408	6420437	2020 (FY21)	MA4 (Mt Arthur Conservation Area)
CD1	Central Dump - Central Woodland Corridor	Woodland (1604**)	Rehabilitation	299969	6419995	2009 (FY10)	MA4 (Mt Arthur Conservation Area)

* = White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter

** = Narrow-leaved Ironbark -Grey Box - Spotted Gum shrub - grass open forest of the central and lower Hunter

Biodiversity Monitoring Results

Results of flora and vertebrate fauna species for the monitoring sites are provided in Table 16, along with a condition assessment score, which indicates ecological health based on condition attributes such as dieback, canopy health, erosion, vegetation patch shape, epicormic growth, weed invasion, mid strata native density, ground strata native density and connectivity of vegetation.

Results for the one rehabilitation site, a new monitoring area brought online this reporting period after reaching the requisite 3m in growth.

Table 16: Summary of native and introduced flora species within 20 x 20 m plots and condition scores across FY22 sites

Item	Rehabilitation Site				
	VB3	VB2	Dump 11	MD1	CD1
Native species (No.)	18	19	16	21	32
Native species (% of total)	46%	53%	53%	60%	57%
Introduced species (No.)	21	17	14	14	24
Introduced species (% of total)	54%	47%	47%	40%	43%
Total species	39	36	30	35	56
Total condition score out of 32	25	25	25	25	26

VB3

This monitoring site is a rehabilitation site located in the north-east rehabilitation woodland corridor. This area was rehabilitated with pasture in 2006, and subsequently planted with tubestock of Box-Gum Woodland species in FY13. The rehabilitated vegetation present is considered to be 'best-fit' to PCT 1606 White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter, which conforms to the threatened ecological community White Box – Yellow Box – Blakely's Red Gum Grassy Woodland (Box Gum Woodland) listed under both the BC Act and EPBC Act. The monitoring site was established in FY18, and FY22 represents the third monitoring event for this site (second monitoring event utilising the BAM for the collection of floristic data). Comparison of VB3 data between FY21 and FY22 data, reference site and benchmark values is presented in Table 17.

A tree canopy is yet to develop at this site with only small trees present (5-9 cm diameter at breast height (DBH)) comprised primarily of *Eucalyptus albens* x *moluccana* and *Eucalyptus blakelyi* (Blakely's Red Gum) individuals. A small open native shrub layer is present that includes the natives *Solanum cinereum* (Narrawa Burr) and *Solanum campanulatum*. The ground stratum is dominated by the exotic grass *Megathyrsus maximus* (70% cover) as well as *Galenia pubescens* (Galenia) and *Hyparrhenia hirta* (Coolatai Grass). The most prevalent native groundcovers present include *Dichanthium sericeum* (Queensland Bluegrass) and *Eriochloa pseudoacrotricha* (Early Spring Grass).

Table 17 VB3: Comparison between historic data, reference site and benchmark values

Site ID/ Year	Tree Richness	Shrub Richness	Grass and Grass like Richness	Forb Richness	Fern Richness	Other Richness	Tree Cover (%)	Shrub Cover (%)	Grass and Grass Like Cover (%)	Forb Cover (%)	Fern Cover (%)	Other Cover (%)	Large Tree Threshold Size (cm)	Number of Large Trees	Total Length Fallen Logs (m)	Litter Cover (%)
PCT: 1606 White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter																
Benchmark values	6	13	10	13	2	5	68	49	30	8	1	3	50	3	53	50
MA6	4	7	9	24	2	9	90	13.6	51.2	3.4	0.2	1.2	-	0	12.5	60
VB3 (FY21)	2	3	3	5	0	0	1.3	2.3	7	0.5	0	0	-	-	-	21
VB3 (FY22)	2	2	7	5	0	2	4	0.4	10.8	1.4	0	0.2	-	-	-	27.4
VB2 (FY22)	1	3	4	9	1	1	20	3.2	0.5	0.9	0.2	0.1	-	-	-	33.2

The total native fauna species richness recorded at VB3 in FY22 was 17 species. Species richness has increased steadily over the monitoring years with FY22 recording the highest native species richness and lowest introduced species richness to date. Increases in native species richness is likely a result of the continued growth of rehabilitated vegetation providing better habitat for fauna. The Large Bent-winged Bat (*Miniopterus orianae oceanensis*) was recorded at VB3. This species is listed as vulnerable under the BC Act. One introduced species was recorded: the European Rabbit (*Oryctolagus cuniculus*).

VB2

This monitoring site is a rehabilitation site located in the north-east rehabilitation woodland corridor. This area was originally seeded and fertilised in 2003 with a mix of introduced pasture groundcover species and native tree and shrub species. The rehabilitated vegetation present is within an area designated to be rehabilitated as Box Gum Woodland, consistent with PCT 1606 White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter, which conforms to the threatened ecological community White Box – Yellow Box – Blakely's Red Gum Grassy Woodland (Box Gum Woodland) listed under both the BC Act and EPBC Act. However, the area contains no canopy species characteristic of this PCT or Box Gum Woodland. FY22 represents the third monitoring event for this site (first monitoring event utilising the BAM for the collection of floristic data). Comparison of VB2 data between historic data, reference site and benchmark values are presented in Table 18.

A tree canopy is yet to develop at this site with only small to medium trees present (5-29 cm diameter at breast height (DBH)) comprised entirely of *Corymbia maculata* (Spotted Gum) individuals. A small open native shrub layer is present that includes the natives *Acacia implexa* (Hickory Wattle), *Enchylaena tomentosa* (Ruby Saltbush) and *Myoporum montanum*). The ground stratum is dominated by the exotic grass *Megathyrsus maximus* (55% cover) as well as *Hyparrhenia hirta* (Coolatai Grass) and *Setaria parviflora*. The most prevalent native groundcovers present include *Austrostipa verticillata* (Slender Bamboo Grass) and *Cheilanthes sieberi* (Rock Fern).

Table 18 VB2: Comparison between historic data, reference site and benchmark values

Site ID/ Year	Tree Richness	Shrub Richness	Grass and Grass like Richness	Forb Richness	Fern Richness	Other Richness	Tree Cover (%)	Shrub Cover (%)	Grass and Grass Like Cover (%)	Forb Cover (%)	Fern Cover (%)	Other Cover (%)	Large Tree Threshold Size (cm)	Number of Large Trees	Total Length Fallen Logs (m)	Litter Cover (%)
PCT: 1606 White Box – Narrow-leaved Ironbark – Blakely's Red Gum shrubby open forest of the central and upper Hunter																
Benchmark values	6	13	10	13	2	5	68	49	30	8	1	3	50	3	53	50
MA6 (FY21)	4	7	9	24	2	9	90	13.6	51.2	3.4	0.2	1.2	-	0	12.5	60
VB2 (FY22)	1	3	4	9	1	1	20	3.2	0.5	0.9	0.2	0.1	-	-	-	33.2

The total native fauna species richness recorded at VB2 in FY22 was 25 species. When comparing FY22 results to initial monitoring of VB2 in FY10, native species richness has increased by 11 species, while introduced species have reduced by three (3) species. Increases in native species richness is likely a result of the continued growth of rehabilitated vegetation providing better habitat for fauna. A total of three threatened fauna species were recorded at VB2 in FY22 that included the Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Southern Myotis (*Myotis macropus*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*). These three species are listed as vulnerable under the BC Act. One introduced species was recorded: the European Rabbit (*Oryctolagus cuniculus*).

Dump 11

This monitoring site is a rehabilitation site located in the east rehabilitation woodland corridor near Thomas Mitchell Drive. Rehabilitation of the site commenced prior to 1995, with the rehabilitated vegetation present considered to be

'best-fit' to PCT 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum shrub – grass open forest on the central and lower Hunter. The monitoring site was established in FY20 and FY22 represents the third monitoring event for this site (third monitoring event utilising the BAM for the collection of floristic data). Comparison of Dump 11 data between historic data, reference site and benchmark values are presented in Table 19.

The vegetation canopy is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus blakelyi x tereticornis* (integrade) (up to 30 cm DBH) with few small regrowth trees present. The native shrub layer is sparse and is limited to regrowth canopy trees and *Acacia salicina* (Cooba). Exotic shrubs present include *Gomphocarpus fruticosus* (Narrow-Leaved Cotton Bush) and *Opuntia stricta* (Common Prickly Pear). The ground layer is dominated by exotic grasses and forbs including *Megathyrsus maximus* (65% cover), *Hyparrhenia hirta* (Coolatai Grass), *Melinis repens* (Red Natal Grass) and *Asphodelus fistulosus* (Onion Weed). Native groundcovers are present in low numbers and include *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Panicum effusum* (Hairy Panic) and *Cymbopogon refractus* (Barbed Wire Grass).

Table 19 Dump 11: Comparison between historic data, reference site and benchmark values

Site ID/ Year	Tree Richness	Shrub Richness	Grass and Grass like Richness	Forb Richness	Fern Richness	Other Richness	Tree Cover (%)	Shrub Cover (%)	Grass and Grass Like Cover (%)	Forb Cover (%)	Fern Cover (%)	Other Cover (%)	Large Tree Threshold Size (cm)	Number of Large Trees	Total Length Fallen Logs (m)	Litter Cover (%)
PCT: 1604 Narrow-leaved Ironbark -Grey Box - Spotted Gum shrub - grass open forest of the central and lower Hunter																
Benchmark values	5	8	12	14	2	5	53	16	58	9	1	4	50	3	40	40
MA4 (FY21)	3	8	11	18	0	8	40.5	2.7	58.3	2.3	0	0.8	-	0	5	52
Dump 11 (FY20)	2	0	4	3	0	2	15	0	10.2	0.04	0	0.2	-	-	-	37
Dump 11 (FY21)	2	0	1	5	0	2	25	0	0.1	0.6	0	0.2	-	-	-	50
Dump 11 (FY22)	3	0	4	7	0	2	20.1	0	3.5	0.8	0	0.2	-	-	-	32

The total native fauna species richness recorded at Dump 11 in FY22 was 17 species. When comparing FY22 results to initial monitoring of Dump 11 in FY20, native species richness has increased by five (5) species, while introduced species have reduced by one (1) species. Increases in native species richness is likely a result of the continued growth of rehabilitated vegetation providing better habitat for fauna. The Large Bent-winged Bat (*Miniopterus orianae oceanensis*) was the only threatened fauna species recorded at VB3. This species is listed as vulnerable under the BC Act. No introduced species were recorded at Dump 11 in FY22.

MD1

This monitoring site is a rehabilitation site located in the east rehabilitation woodland corridor near Thomas Mitchell Drive. Rehabilitation of the site commenced prior to FY14, with the rehabilitated vegetation present considered to be 'best-fit' to PCT 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum shrub – grass open forest on the central and lower Hunter. The monitoring site was established in FY21 and FY22 represents the second monitoring event for this site. Comparison of MD1 data between historic data, reference site and benchmark values are presented in Table 20.

A tree canopy is present at this site that is comprised entirely of *Corymbia maculata* (Spotted Gum) individuals (up to 30 cm DBH). A small open native shrub layer is present that includes the natives *Acacia salicina* (Cooba) and *Eremophila debilis* (Amulla). The ground stratum is dominated by the exotic grass *Megathyrsus maximus* (45% cover) as well as *Galenia pubescens* (Galenia) and *Melinis repens* (Red Natal Grass). Native groundcovers are present in low numbers and coverage, and include the grasses *Eriochloa pseudoacrotricha* (Early Spring Grass), *Cymbopogon refractus* (Barbed Wire Grass) and *Aristida ramosa* (Purple Wiregrass).

Table 20 MD1: Comparison between historic data, reference site and benchmark values

Site ID/ Year	Tree Richness	Shrub Richness	Grass and Grass like Richness	Forb Richness	Fern Richness	Other Richness	Tree Cover (%)	Shrub Cover (%)	Grass and Grass Like Cover (%)	Forb Cover (%)	Fern Cover (%)	Other Cover (%)	Large Tree Threshold Size (cm)	Number of Large Trees	Total Length Fallen Logs (m)	Litter Cover (%)
PCT: 1604 Narrow-leaved Ironbark -Grey Box - Spotted Gum shrub - grass open forest of the central and lower Hunter																
Benchmark values	5	8	12	14	2	5	53	16	58	9	1	4	50	3	40	40
MA4 (FY21)	3	8	11	18	0	8	40.5	2.7	58.3	2.3	0	0.8	-	0	5	52
MD1 (FY21)	2	2	7	4	1	2	31	0.3	1.5	0.6	0.1	0.2	-	-	-	71
MD1 (FY22)	2	1	10	6	1	1	43	0.1	5.7	1.0	0.1	0.2	-	-	-	77

The total native fauna species richness recorded at MD1 in FY22 was 25 species. When comparing FY22 results to initial monitoring of MD1 in FY21, native species richness has increased by nine (9) species, while introduced species has remained unchanged at zero (0). Increases in native species richness is likely a result of the continued growth of rehabilitated vegetation providing better habitat for fauna.

CD1

This monitoring site is a rehabilitation site located in the central east rehabilitation woodland corridor. Rehabilitation of the site commenced in 2008, with the rehabilitated vegetation present considered to be 'best-fit' to PCT 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum shrub – grass open forest on the central and lower Hunter. The monitoring site was established in FY16 and FY22 represents the third monitoring event for this site (first monitoring event utilising the BAM for the collection of floristic data). Comparison of CD1 data between historic data, reference site and benchmark values are presented in Table 21.

A tree canopy is yet to develop at this site with only small trees present (5-29 cm diameter at breast height (DBH)) comprised primarily of *Corymbia maculata* (Spotted Gum), *Eucalyptus blakelyi* (Blakely's Red Gum), *Eucalyptus albens* x *moluccana* and *Eucalyptus crebra* (Narrow-leaved Ironbark) individuals. A small open native shrub layer is present that includes the natives *Myoporum montanum* (Western Boobialla), *Acacia implexa* (Hickory Wattle), *Acacia falcata* and *Eremophila debilis* (Amulla). The ground stratum is dominated by the native grass *Microlaena stipoides* var. *stipoides* (Weeping Grass) (50% cover), with *Dichanthium sericeum* (Queensland Bluegrass) and *Chloris ventricosa* (Tall Chloris) also present (10% cover each). The most prevalent native non-grass species present include *Vittadinia sulcata, Geranium solanderi* (Native Geranium) and *Dichondra repens* (Kidney Weed). Exotic groundcovers present with ≥ 5% cover includes *Megathyrsus maximus, Galenia pubescens* (Galenia) and *Verbena bonariensis* (Purpletop).

Table 21 CD1: Comparison between historic data, reference site and benchmark values

Site ID/ Year	Tree Richness	Shrub Richness	Grass and Grass like Richness	Forb Richness	Fern Richness	Other Richness	Tree Cover (%)	Shrub Cover (%)	Grass and Grass Like Cover (%)	Forb Cover (%)	Fern Cover (%)	Other Cover (%)	Large Tree Threshold Size (cm)	Number of Large Trees	Total Length Fallen Logs (m)	Litter Cover (%)
PCT: 1604 Narrow-leaved Ironbark -Grey Box - Spotted Gum shrub - grass open forest of the central and lower Hunter																
Benchmark values	5	8	12	14	2	5	53	16	58	9	1	4	50	3	40	40
MA4 (FY21)	3	8	11	18	0	8	40.5	2.7	58.3	2.3	0	0.8	-	0	5	52
CD1 (FY22)	6	6	11	7	0	2	26	2.2	84.6	1.5	0	0.2	-	-	-	32

The total native fauna species richness recorded at CD1 in FY22 was 20 species. When comparing FY22 results to initial monitoring of CD1 in FY10, native species richness has increased by 13 species, while introduced species has reduced by three (3) species. Increases in native species richness is likely a result of the continued growth of rehabilitated vegetation providing better habitat for fauna. The Large Bent-winged Bat (*Miniopterus orianae oceanensis*) was recorded at CD1 in FY22. This species is listed as vulnerable under the BC Act. No introduced species were recorded at CD1 in FY22.

Assessment against MOP Completion Criteria

VB3 is located within Domain E Rehabilitation – Box Gum Woodland, and it is considered that rehabilitation at VB3 is now at Phase 4 Ecosystem and Landuse Establishment as per the 2021 RMP. An assessment of the rehabilitation site VB3 against specific performance and completion criteria for rehabilitated vegetation is shown in Table 22 and is taken from the 2021 MOP.

Table 22: VB3 assessment against phase and domain specific criteria

Domain Specific Rehabilitation Objectives	VB3	Compliance Assessment
Phase – 4. Ecosystem and Landuse Establishment		
Rehabilitation species composition (seed mix or tubestock) drawn from the species list in the RMP**Error! Reference source not found.**.	VB3 is proposed to be rehabilitated as Box Gum Woodland with species identified in Table 13 (not Table 12) of the RMP. A total of 11 species identified in Table 13 of the RMP were recorded at VB3 in FY22, while 25 species recorded are not identified in Table 13 of the RMP.	Partially compliant
All structural dominant species represented compared with analogue site.	VB3 includes *Eucalyptus albens* x *moluccana* that is the dominant canopy species at its reference site (MA6), but does not include *Notelaea microcarpa* which is the dominant shrub at site MA6 or either of the dominant grasses at MA6 being *Aristida ramosa* and *Austrostipa scabra*.	Partially compliant

Domain Specific Rehabilitation Objectives	VB3	Compliance Assessment
The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm is comparable to that of the local remnant vegetation.	The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm at VB3 is lower than its reference site, MA6.	Not compliant
The total number of native plant species is comparable to the local remnant vegetation.	The total number of native plant species at VB3 is 18, while 52 native species were recorded at MA6 in FY21.	Not compliant
The number of tree, shrub and sub-shrub species is comparable to that of the local remnant vegetation.	The total number of tree, shrub and sub-shrub species recorded at VB3 (n=4) is less than 50% to what was recorded at MA6 in FY21 (n=11).	Not compliant
Species composition for revegetation will be aimed at establishing a complex community structure consisting of groundcover, understory and canopy according to the RMP.	Species composition at VB3 appears to be aimed at establishing a complex community structure as native groundcovers, understory and canopy species characteristic of species identified in Table 13 of the RMP have been planted. It is noted that Table 8 of the RMP identifies indicative composition of areas to be rehabilitated as 'native woodland', not 'Box Gum Woodland'.	Compliant
Nesting boxes (various bird, squirrel glider, possum and bat) and natural habitat features (including large rocks, logs/coarse woody debris, hollow bearing timber) are placed in established native woodland rehabilitation.	No nesting boxes are present; however bushrock and logs/coarse woody debris are present (albeit in low numbers).	Partially compliant
Number of weed species and surface area comparable to reference sites.	Number of weed species (n=21) and surface area (81%) recorded at VB3 is far higher than number of weed species (n=7) and surface area (0.8%) at reference site MA6 recorded in FY21.	Not compliant
Pest animal infestation comparable to reference sites.	The European rabbit was recorded at VB3 while no feral species were recorded at reference site MA6. It is noted that targeted fauna surveys were undertaken at VB3 while none were undertaken at MA6, increasing the likelihood of feral animal detection at VB3 compared to MA6. It is further noted that feral dogs, rabbits and cats have been recorded within the Mt Arthur Conservation Area previously (where MA6 is located).	Partially compliant
Rehabilitated native vegetation distribution will link areas of onsite and near-site native vegetation, and be consistent with the biodiversity corridors consistent with the latest version of the DRG Synoptic Plan.	Although not within a biodiversity corridor identified in the DRG Synoptic Plan, VB3 forms part of a rehabilitation corridor that will link to the biodiversity corridors identified in the DRG Synoptic Plan.	Compliant

Domain Specific Rehabilitation Objectives	VB3	Compliance Assessment
The Box-Gum reestablishment area based on the north-eastern slope of Visual Dump 1 will be established with a species mix (seed or tubestock) drawn from the species list presented in Table 13.	A total of 11 species identified in Table 13 of the RMP were recorded at VB3 in FY22, while 25 species recorded are not identified in Table 13 of the RMP.	Partially compliant
Site is considered to be partially compliant with rehabilitation objectives as 2 (two) objectives are 'compliant', five (5) objectives are 'partially compliant' and four (4) objectives are 'not compliant'.		

Dump 11 is located within Domain D Rehabilitation – Native Woodland, and it is considered that rehabilitation at Dump 11 is now at Phase 4 Ecosystem and Landuse Establishment as per the 2021 RMP update.

An assessment of the rehabilitation site Dump 11 against specific performance and completion criteria for rehabilitated vegetation is shown in Table 23 and is taken from the 2021 MOP.

Table 23 Dump 11 assessment against phase and domain specific criteria

Domain Specific Rehabilitation Objectives	Dump 11 (Domain D)	Compliance Assessment
Phase – 4. Ecosystem and Landuse Establishment		
Rehabilitation species composition (seed mix or tubestock) drawn from the species list in **Error! Reference source not found.**.	Dump 11 is proposed to be rehabilitated as Native Woodland with species identified in Table 12 of the RMP. A total of 14 species identified in Table 12 of the RMP were recorded at Dump 11 in FY22, while 16 species recorded are not identified in Table 12 of the RMP.	Partially compliant
All structural dominant species represented compared with analogue site.	Dump 11 contains the canopy species *Corymbia maculata* which is the dominant canopy species at reference site MA4. No shrub species were recorded at Dump 11. The dominant groundcover species recorded at reference site MA4 are the native grasses *Austrostipa scabra* and *Aristida ramosa*, neither of which were recorded at Dump 11.	Partially compliant
The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm is comparable to that of the local remnant vegetation.	The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm at Dump 11 is lower than its reference site, MA4.	Not compliant
The total number of native plant species is comparable to the local remnant vegetation.	The total number of native plant species at Dump 11 is 16, while 48 native species were recorded at MA4 in FY21.	Not compliant
The number of tree, shrub and sub-shrub species is comparable to that of the local remnant vegetation.	The total number of tree, shrub and sub-shrub species recorded at Dump 11 (n=3) is less than 50% to what was recorded at MA4 in FY21 (n=11).	Not compliant

Domain Specific Rehabilitation Objectives	Dump 11 (Domain D)	Compliance Assessment
Species composition for revegetation will be aimed at establishing a complex community structure consisting of groundcover, understory and canopy according to the RMP.	Dump 11 has a canopy cover of 20%, understorey cover of 0% and native groundcover of 4.5%, which are all below the condition targets identified in Table 8 of the RMP.	Not compliant
Nesting boxes (various bird, squirrel glider, possum and bat) and natural habitat features (including large rocks, logs/coarse woody debris, hollow bearing timber) are placed in established native woodland rehabilitation.	No nesting boxes or logs/coarse woody debris are present; however large rocks are present.	Partially compliant
Number of weed species and surface area comparable to reference sites.	Number of weed species (n=14) recorded at Dump 11 is similar to the number of weed species (n=11) recorded at reference site MA4 in FY21, but surface area (80.2%) recorded at Dump 11 is far greater to what was recorded at MA4 (1.5%).	Not compliant
Pest animal infestation comparable to reference sites.	No feral species were recorded at Dump 11.	Compliant
Rehabilitated native vegetation distribution will link areas of onsite and near-site native vegetation, and be consistent with the biodiversity corridors consistent with the latest version of the DRG Synoptic Plan.	Although not within a biodiversity corridor identified in the DRG Synoptic Plan, Dump 11 forms part of a rehabilitation corridor that will link to the biodiversity corridors identified in the DRG Synoptic Plan.	Compliant
Site is considered to be partially compliant with rehabilitation objectives as two (2) objectives are ‘compliant’, three (3) objectives are ‘partially compliant’ and five (5) objectives are ‘not compliant’.		

MD1 is located within Domain D Rehabilitation – Native Woodland, and it is considered that rehabilitation at MD1 is now at Phase 4 Ecosystem and Landuse Establishment as identified in the RMP.

An assessment of the rehabilitation site MD1 against the relevant domain specific rehabilitation objectives identified in the RMP is shown in Table 24.

Table 24 MD1 assessment against phase and domain specific criteria

Domain Specific Rehabilitation Objectives	MD1 (Domain D)	Compliance Assessment
Phase – 4. Ecosystem and Landuse Establishment		
Rehabilitation species composition (seed mix or tubestock) drawn from the species list in the RMP.	MD1 is proposed to be rehabilitated as Native Woodland with species identified in Table 12 of the RMP. A total of 16 species identified in Table 12 of the RMP were recorded at MD1 in FY22, while 19 species recorded are not identified in Table 12 of the RMP.	Partially compliant
All structural dominant species represented compared with analogue site.	MD1 contains the canopy species *Corymbia maculata* which is the dominant canopy species at reference site MA4. Only one shrub species (*Eremophila debilis*) was recorded at MD1. This species was also recorded at MA4; however, it is not a dominant shrub at MA4. The dominant groundcover species recorded at reference site MA4 are the native grasses *Austrostipa scabra* and *Aristida ramosa*, both of which were recorded at MD1, albeit in relatively low numbers.	Partially compliant
The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm is comparable to that of the local remnant vegetation.	The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm at MD1 is lower than its reference site, MA4.	Not compliant
The total number of native plant species is comparable to the local remnant vegetation.	The total number of native plant species at MD1 is 21, while 48 native species were recorded at MA4 in FY21.	Not compliant
The number of tree, shrub and sub-shrub species is comparable to that of the local remnant vegetation.	The total number of tree, shrub and sub-shrub species recorded at MD1 (n=3) is less than 50% to what was recorded at MA4 in FY21 (n=11).	Not compliant
Species composition for revegetation will be aimed at establishing a complex community structure consisting of groundcover, understory and canopy according to the RMP.	MD1 has a canopy cover of 43%, understorey cover of 0.1% and native groundcover of 7%. With the exception of canopy cover, all other values are below the condition targets identified in Table 8 of the RMP.	Partially compliant
Nesting boxes (various bird, squirrel glider, possum and bat) and natural habitat features (including large rocks, logs/coarse woody debris, hollow bearing timber) are placed in established native woodland rehabilitation.	No nesting boxes or logs/coarse woody debris are present; however large rocks are present.	Partially compliant
Number of weed species and surface area comparable to reference sites.	Number of weed species (n=14) recorded at MD1 is similar to the number of weed species (n=11) recorded at reference site MA4 in FY21, but surface area (57.2%) recorded at MD1 is far greater to what was recorded at MA4 (1.5%).	Not compliant

Domain Specific Rehabilitation Objectives	MD1 (Domain D)	Compliance Assessment
Pest animal infestation comparable to reference sites.	No feral species were recorded at MD1.	Compliant
Rehabilitated native vegetation distribution will link areas of onsite and near-site native vegetation, and be consistent with the biodiversity corridors consistent with the latest version of the DRG Synoptic Plan.	MD1 forms part of the biodiversity corridors identified in the DRG Synoptic Plan.	Compliant
Site is considered to be partially compliant with rehabilitation objectives as two (2) objectives are 'compliant', four (4) objectives are 'partially compliant' and four (4) objectives are 'not compliant'.		

CD1 is located within Domain D Rehabilitation – Native Woodland, and it is considered that rehabilitation at CD1 is now at Phase 4 Ecosystem and Landuse Establishment as identified in the RMP.

An assessment of the rehabilitation site MD1 against the relevant domain specific rehabilitation objectives identified in the RMP is shown in Table 25.

Table 25 MD1 assessment against phase and domain specific criteria

Domain Specific Rehabilitation Objectives	CD1 (Domain D)	Compliance Assessment
Phase – 4. Ecosystem and Landuse Establishment		
Rehabilitation species composition (seed mix or tubestock) drawn from the species list in the RMP.	CD1 is proposed to be rehabilitated as Native Woodland with species identified in Table 12 of the RMP. A total of 22 species identified in Table 12 of the RMP were recorded at CD1 in FY22, while 34 species recorded are not identified in Table 12 of the RMP.	Partially compliant
All structural dominant species represented compared with analogue site.	CD1 contains the canopy species *Corymbia maculata* which is the dominant canopy species at reference site MA4. The dominant shrub species at reference site MA4 included *Spartothamnella juncea, Myoporum montanum* and *Psydrax odorata*. Only *Myoporum montanum* was recorded at CD1. The dominant groundcover species recorded at reference site MA4 are the native grasses *Austrostipa scabra* and *Aristida ramosa*, neither of which were recorded at CD1.	Partially compliant
The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm is comparable to that of the local remnant vegetation.	The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm at CD1 is lower than its reference site, MA4; however, shrub density (i.e. cover) is only 0.5 lower. It is also noted that the diversity of non-juvenile trees (n=6) at CD1 is higher than MA4 (n=3).	Not compliant

Domain Specific Rehabilitation Objectives	CD1 (Domain D)	Compliance Assessment
The total number of native plant species is comparable to the local remnant vegetation.	The total number of native plant species at CD1 is 32, while 48 native species were recorded at MA4 in FY21. This is considered to be comparable to local remnant vegetation.	Compliant
The number of tree, shrub and sub-shrub species is comparable to that of the local remnant vegetation.	The total number of tree, shrub and sub-shrub species recorded at CD1 (n=12) is greater to what was recorded at MA4 in FY21 (n=11).	Compliant
Species composition for revegetation will be aimed at establishing a complex community structure consisting of groundcover, understory and canopy according to the RMP.	CD1 has a canopy cover of 26%, understorey cover of 2.2% and native groundcover of ~86%, which are all within condition targets identified in Table 8 of the RMP.	Compliant
Nesting boxes (various bird, squirrel glider, possum and bat) and natural habitat features (including large rocks, logs/coarse woody debris, hollow bearing timber) are placed in established native woodland rehabilitation.	No nesting boxes are present; however both logs/coarse woody debris and large rocks are present.	Partially compliant
Number of weed species and surface area comparable to reference sites.	Number of weed species (n=24) and surface area (32.1%) recorded at CD1 is higher than the number of weed species (n=11) and surface area (1.5%) recorded at MA4.	Not compliant
Pest animal infestation comparable to reference sites.	No feral species were recorded at CD1.	Compliant
Rehabilitated native vegetation distribution will link areas of onsite and near-site native vegetation, and be consistent with the biodiversity corridors consistent with the latest version of the DRG Synoptic Plan.	Although not within a biodiversity corridor identified in the DRG Synoptic Plan, CD1 forms part of a rehabilitation corridor that will link to the biodiversity corridors identified in the DRG Synoptic Plan.	Compliant
Site is considered to be partially compliant with rehabilitation objectives as five (5) objectives are 'compliant', three (3) objectives are 'partially compliant' and two (2) objectives are 'not compliant'.		

Weed Control

FY22 weed assessment work consisted of the following elements

- Biodiversity monitoring weed assessment work completed by independent consultants as part of the Rehabilitation and Ecological Monitoring Program and Conservation Agreement monitoring; and
- A whole of site weed survey.

The following weed species were targeted during the reporting period:

- African boxthorn (*Lycium ferocissimum*);
- Prickly Pear (*Opuntia stricta*);

- Tiger pear (*Opuntia aurantiaca*);
- Blue heliotrope (*Heliotropium amplexicaule*);
- Mother of millions (*Bryophyllum species*)
- Bathurst burr (*Xanthium spinosum*)
- Marshmallow weed (*Malva parviflora*)
- Artichoke thistle (*Cynara cardunculus* L.)
- Sweet briar (*Rosa rubiginosa*)
- Cobblers pegs (*Bidens pilosa*)
- Cotton bush (*Gomphocarpus sp*.);
- Galenia (*Galenia pubescens*)
- Silver-leaved Nightshade (*Solanum elaeagnifolium*); and
- African Turnip weed (*Sisymbrium thellungii*).

Mt Arthur Coal targeted over 442 hectares of operational land for weed treatment during the reporting period. The treatment focused in the north eastern portion of the site, including the VD1 VD4 and VD5 rehabilitation areas, operational area surrounding the Environmental Dam and western areas of the site off of Thomas Mitchell Drive adjacent the rail loop and Export Stockpile. Refer to Appendix 6 for figures showing weed treatment locations of operational areas.

Weed treatment for Biodiversity Offset Areas treated for included:

- Thomas Mitchell Drive Onsite Offset Area (Slashing of annual weeds and control of Coolatai Grass
- Thomas Mitchell Drive Offsite Offset Areas (slashing of annual weeds, spaying of Prickly Pear and Boxthorn)
- Saddlers Creek Offset Area (Boxthorn control)
- Middle Deep Creek Offset Area (Large infestation of St Johns Wort controlled by spraying and Mechanical Methods)
- Roxburgh (African Olive and Boxthorn)

Pest Animal Control

During May and June 2022 a wild dog and fox control program was carried out utilising soft jaw traps and 1080 baiting was completed across the Mt Arthur Coal mine site operational areas. During the campaign 100 baits were laid across 50 locations, with 52 baits taken. Table 26 shows the breakdown of species and baits taken.

Table 26: Soft Jaw Trapping and 1080 Baiting control program results for FY22

Species	Count
Fox	1
Wild Dog	3
Unknown takes	52

Complaints and Reportable Incidents

There were no biodiversity complaints received in FY22. Mt Arthur Coal did not receive any government fines or penalties related to flora and fauna during the reporting period and there were no related reportable incidents.

Proposed Improvements

Mt Arthur Coal will continue to implement the REMP during the next reporting period, with monitoring of woodland rehabilitation, remnant woodland community sites and revegetation/regeneration areas within conservation areas. Mt Arthur Coal will also continue to implement annual landform stability assessments of existing rehabilitation in the next reporting period. Investigate the use of remote sensing in the assessment of landform stability as part of the review of the REMP and complete the review of the aerial weed assessment.

Mt Arthur Coal will continue removing waste items and repairing sections of fence that require maintenance in conservation and biodiversity offset areas during the next reporting period.

During the next reporting period, Mt Arthur Coal will also implement another vertebrate pest management program on site. Improvements in the management of additional pest animal species will be a particular focus, with expanded shooting, trapping and baiting programs to be completed to include rabbits, goats and pigs.

Note that next reporting period domains will be updated to reflect the new domains based on the NSW Resources Regulators

6.6 Visual Amenity and Lighting

6.6.1 Environmental Management

Visual amenity and lighting management at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-PRO-080 Rehabilitation and Ecological Monitoring;
- MAC-PRD-PRO-073 Procedure for Lighting Plant Movement and Setup; and
- MAC-ENC-PRO-077 Light Management Procedure.

Mt Arthur Coal's visual assessment procedure ensures overburden emplacement development is monitored and assessed against modelled predictions in the environmental assessment.

Management measures presented in the Light Management Procedure aim to control and reduce the impact of lighting on the surrounding area. The procedure is used in conjunction with the procedure for lighting plant movement and setup, which advises operational staff on correct alignment of lights to avoid offsite impact.

6.6.2 Environmental Performance

Visual impact inspections were completed in August of 2021. The inspection indicated that locations to the east of Mt Arthur Coal have extensive views of rehabilitated overburden dumps, with reduced visual contrast to surrounding non-mined landforms and peripheral visual impact from active mining activities. From locations to the north and west, a distinct visual contrast between mining activity and the surrounding non-mined landscape is evident due to exposure to low wall overburden dumps. For all locations the shape and size of the overburden dumps are within the predicted model shown in the environmental assessment.

Management measures designed to reduce the visual impact created by the overburden emplacement have been incorporated into the mine plan. Such measures include:

- The integration of tree corridors on overburden emplacements as part of progressive rehabilitation;
- Incorporating micro relief features (stag trees, ripping, rock features and habitat trees) throughout overburden emplacements to provide an enhanced naturally appearing landform and fauna habitat;
- The practical consideration of geomorphic designs on emplacements to sustainably manage water and create a natural looking and stable landform;
- The strategic design and rehabilitation of overburden emplacements for increased visual shielding of operations;
- Establishing visual and ecological planting patterns of native trees to achieve landscape patterns that complement the existing spatial distribution of tree and grass cover in a grazing landscape; and
- Minimising exposure of work areas to sensitive receivers where possible, largely through the timely rehabilitation of visible overburden emplacements.

6.6.3 Complaints and Reportable Incidents

During the reporting period, 18 lighting complaints were received, which is higher than FY21 (14 complaints). On notification of the complaints, immediate action was taken to locate and redirect the offending lights, in response to addressing the complainant's concerns. These complaints are discussed further in Section 9.

Mt Arthur Coal did not receive any government fines or penalties related to lighting or visual amenity during the reporting period and there were no related reportable incidents.

6.6.4 Proposed Improvements

During the reporting period Mt Arthur Coal continued to incorporate fluvial geomorphic principles into the design of overburden emplacements. Rehabilitated landforms were reshaped to facilitate natural surface flow processes, resulting in a final shape that more closely mimics the adjacent non-mined landscape and reduces visual impact. This process will be developed further in subsequent reporting periods.

Lighting from Mt Arthur Coal will continue to be implemented in accordance with the Light Management Procedure and managed to minimise impacts on the local community whilst maintaining the minimum level necessary for operational and safety needs.

6.7 Aboriginal Cultural Heritage

6.7.1 Environmental Management

Aboriginal cultural heritage at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-MTP-042 Aboriginal Heritage Management Plan.

Mt Arthur Coal has implemented a management plan that provides the framework to identify, assess, monitor, protect and manage Aboriginal cultural heritage. The management plan assists Mt Arthur Coal to mitigate the impacts of its operations on Aboriginal cultural heritage, comply with the requirements of the *National Parks and Wildlife Act 1974*, *Environmental Planning and Assessment Act 1979* and the modification project approval and continue its active partnership with the Aboriginal community.

A major review of the Mt Arthur Coal Aboriginal Heritage Management Plan was approved in February 2022 by DOP following consultation with the Registered Aboriginal Parties.

6.7.2 Environmental Performance

Minor survey and / or salvage activities and due diligence assessments were also completed and recorded during the reporting period for the following site works in accordance with the methodology detailed in the Aboriginal Heritage Management Plan:

- Areas required for future mining and overburden emplacement
- Exploration Drill Site Rehabilitation
- Minor changes to roads, access tracks and powerlines
- Offset Planting Areas
- Planned hazard reduction burn sites at the Saddlers Creek Conservation Area

All site cards required by section 89A of the National Parks and Wildlife Act have been lodged with Heritage NSW.

As an interim measure, a revised short form cultural awareness training package has been rolled out to new trainees and targeted employees and contractors, while a new ‘cultural consciousness’ training package described in the proposed improvement section below, is being developed following endorsement from Elders of the outline of the training.

Grinding grooves and Scar trees within the Site boundary and Biodiversity Offset areas were audited by an archologist and RAPs as required by the Aboriginal Heritage Management Plan. The Report “Mt Arthur Coal Aboriginal Heritage Plan 2021 Scarred Trees and Grinding Grooves Audit Inspection” prepared by Arrow Heritage Consultants documented the inspection. No issues were identified by the report, however natural weathering is occurring, as expected.

6.7.3 Complaints and Reportable Incidents

Mt Arthur Coal did not receive any complaints, government fines or penalties related to Aboriginal cultural heritage during the reporting period and there were no related reportable incidents.

6.7.4 Proposed Improvement

All measures to protect Aboriginal Cultural Heritage described in the approved Aboriginal Heritage Management are planned to continue along with continued consultation with our key Aboriginal stakeholders.

HVEC continues to work with Elders and other key Aboriginal stakeholders to develop a refresher cultural consciousness training package. The training outline has been developed and agreed. The next step is to procure an indigenous stakeholder (s) to assist with developing the content and delivering the training.

6.8 European Cultural Heritage

6.8.1 Environmental Management

European cultural heritage at Mt Arthur Coal is managed in accordance with the:

- MAC-ENC-MTP-046 European Heritage Management Plan;
- MAC-ENC-MTP-048 Edinglassie and Rous Lench Conservation Management Plan - Volume 1;
- MAC-ENC-MTP-049 Edinglassie and Rous Lench Conservation Management Plan - Volume 2; and
- MAC-ENC-PRG-004 Edinglassie and Rous Lench Heritage Management Program.

Mt Arthur Coal has implemented several management plans that provide the framework to identify, assess, monitor, and conserve European cultural heritage. Mt Arthur Coal owns and manages five heritage-listed homesteads as follows:

- Edinglassie Homestead (state significance);
- Rous Lench Homestead (state significance);
- Edderton Homestead Complex (local significance);
- Belmont Homestead Complex (local significance); and
- Balmoral Homestead (local significance).

The two State-significant historic heritage items with possible impacts from the Mt Arthur Coal operation are the Edinglassie and Rous Lench homesteads.

The European Heritage Management Plan assists Mt Arthur Coal to coordinate and manage the European heritage items affected or potentially affected by its operations, comply with the requirements of the *Heritage Act 1977* and the modification project approval and mitigate impacts of its operations on European cultural heritage.

6.8.2 Environmental Performance

Edinglassie and Rouse Lench Complex

During the reporting period, Mt Arthur Coal inspected Edinglassie and, Rouse Lench and related buildings to ensure properties were maintained to an acceptable standard.

Annual actions described in the Conservation Management Plan were undertaken such as pest control, ground maintenance, annual inspections, fire protection and check of sewerage system. A detailed structural inspection and report was undertaken by a structural engineer of both the Edinglassie and Rouse Lench properties. The report recommended repairing roof leeks before commencing on internal restoration at Edinglassie.

Short to medium term actions continue including removing creepers from buildings. Major restoration work was undertaken at Eddinglassie following the structural engineer's report under guidance of a heritage consultant. A new roof was installed on the Eddinglassie main homestead and servants quarters, drainage improvements from buildings and exterior painting at Eddinglassie and the servant quarters.

Longer term actions will be rolled out based on the structural engineers report and guidance from the heritage consultant.

Edinglassie Homestead 2022

Rouse Lench Homestead 2022.

Balmoral Homestead

Restoration works were also undertaken at Balmoral Homestead under guidance of a heritage consultant. Works included an engineer's structural inspection. Renovations included drainage works, interior painting, lower floor replacement and improvements to the outdoor function deck.

Hospital Building

The hospital building is unlikely to be impacted by the current mine plan and therefore a detailed management plan hasn't been triggered. The building is in poor condition with doors and windows being vandalised. A security fence has been installed and the curtilage has been mowed to prevent impact from bushfire.

MAC has been working with the Denman Historicl Society and Council to relocate the building to the Denman Historical Village. The logistics associated with finding asuitable means of transport has been difficult with two transport companies withdrawing from the work.

A heritage consultant was engaged to undertake 3D modelling of the hospital to assist with the historical recording of the building.

It is likely that all windows and doors will be boarded in the next year to protect the building from vandalism and weather damage.

Beer Homestead and Slab Hut

The hospital building is unlikely to be impacted by the current mine plan and therefore a detailed management plan hasn't been triggered.

6.8.3 Complaints and Reportable Incidents

Mt Arthur Coal did not receive any complaints, government fines or penalties related to European cultural heritage during the reporting period and there were no related reportable incidents.

6.8.4 Proposed Improvements

All heritage structures are planned to remain in situ during the next reporting period with no impacts predicted from the current mine plan. Inspections and maintenance measures will continue to be implemented during the next reporting period to conserve all historic homesteads and related buildings. MAC continues to invest in restoration of its heritage properties with large scale works being undertaken in the past year and planned into the next financial year. MAC will continue to explore the feasibility of moving the Hospital Building.

6.9 Contaminated Land and Hydrocarbon Contamination

6.9.1 Environmental Management

Contaminated land at Mt Arthur Coal is managed in accordance with the following internal documents:

- MAC-ENC-PRO-029 Spill Response;
- MAC-ENC-PRO-074 Contaminated Land Management; and
- MAC-STE-PRO-013 Hazardous Materials Management Procedure.

Hydrocarbons and other hazardous substances are kept in designated storage compounds designed and managed in accordance with relevant standards and procedures. Monitoring and inspection programs are maintained for these facilities to ensure hazardous materials and wastes are being adequately stored and disposed of and that any spills or leaks are promptly reported and managed.

Mt Arthur continued to carry out work during the reporting period to transition away from the use of long chain PFAS firefighting foams on site in line with the requirements under the Protection of the Environment Operations (General) Amendment (PFAS Firefighting Foam) Regulation 2021. Mt Arthur will continue to work towards the phase out deadline of 26th September 2022.

6.9.2 Environmental Performance

During the reporting period, all spills were controlled and contained immediately using emergency spill kits or earthmoving equipment to form a temporary bund. Small spills were disposed of offsite by Mt Arthur Coal's waste contractor.

6.9.3 Complaints and Reportable Incidents

Mt Arthur Coal did not receive any complaints, government fines or penalties related to contaminated land or hydrocarbon contamination during the reporting period and there were no related reportable incidents.

6.9.4 Proposed Improvements

Mt Arthur Coal is currently undertaking a project to improve and re-build the onsite contaminated site management area expected to be complete in FY23. Mt Arthur will continue to manage contaminated land and hydrocarbon contamination in accordance with project approval and legislative requirements.

6.10 Spontaneous Combustion

6.10.1 Environmental Management

Spontaneous combustion at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-PRG-002 Spontaneous Combustion Control Program.

Mt Arthur Coal has implemented a spontaneous combustion control program to prevent, monitor, control and report outbreaks of spontaneous combustion.

6.10.2 Environmental Performance

Spontaneous combustion at Mt Arthur Coal is predominantly confined to old mining areas at Bayswater No. 2 and the Drayton sublease area. This is a result of the higher levels of carbon and sulphuric material in the coal seams mined in these Greta measures in comparison to those mined in current active mining areas.

During the reporting period there was a decrease in the area recorded as being affected by spontaneous combustion at Mt Arthur Coal. A total of 2412 m² of land was treated for spontaneous combustion in the reporting period. A summary of spontaneous combustion in the reporting period is shown in Table 27.

Table 27: Summary of spontaneous combustion at Mt Arthur Coal in FY22

Month	Total area affected at start of month (m²):	Area naturally extinguished in month (m²):	Area treated in month (m²):	New areas discovered in month (m²):	Total area remaining at end of month (m²):
July	8910	0	2	43	8951
August	8951	0	1	0	8950
September	8950	0	0	5	8954
October	8954.5	62	0	18	8910
November	8910	0	0	40	8950
December	8950	0	0	3	8954
January	8954	0	0	0	8954
February	8954	0	926	338	8365
March	8365	0	34	36	8367
April	8367	0	326	131	8173
May	8173	0	0	197	8370
June	8370	0	1123	215	7461
Total		62	2412	1026	

6.10.3 Complaints and Reportable Incidents

During the reporting period there were no complaints related to spontaneous combustion.

Mt Arthur Coal did not receive any government fines or penalties related to spontaneous combustion during the reporting period.

6.10.4 Proposed Improvements

Mt Arthur Coal will continue to monitor spontaneous combustion during the next reporting period, and cap readily accessible areas.

6.11 Bushfire

6.11.1 Environmental Management and Performance

Bushfire at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-PRO-076 Bushfire Prevention Procedure (internal document); and
- MAC-STE-PRO-010 Emergency Procedure – Bushfires (internal document).

Specific prevention and fire suppression control measures are implemented in order to protect remnant vegetation communities as well as Mt Arthur Coal infrastructure. Preventative measures include fuel load assessment and reduction programs, the establishment and maintenance of fire breaks and the prevention of ignition sources. Fire suppression and control is achieved through on-site fire-fighting equipment, including a rescue truck and water carts, facilitated by a network of roads and vehicle access trails, which provide access to all areas of Mt Arthur Coal owned land. Mt Arthur Coal also maintained a trained emergency response team on each shift. Fire extinguishers are fitted in vehicles and buildings.

No grass or bushfires occurred on site or at the conservation or offset areas during the reporting period.

6.11.2 Complaints and Reportable Incidents

Mt Arthur Coal did not receive any complaints, government fines or penalties related to bushfire during the reporting period and there were no related reportable incidents.

6.11.3 Proposed Improvements

During the next reporting period Mt Arthur Coal will continue to manage bushfire risk in accordance with relevant procedures.

6.12 Greenhouse Gas and Energy

6.12.1 Environmental Management

Greenhouse gas and energy at Mt Arthur Coal are managed in accordance with the MAC-ENC-MTP-040 Air Quality Management Plan.

Mt Arthur Coal undertakes regular reviews and monitoring of greenhouse gas emissions and energy efficiency initiatives to ensure that greenhouse gas emissions per tonne of product coal are kept to the minimum practicable level. During the reporting period Mt Arthur Coal continued greenhouse gas and energy consumption monitoring with the use of a centralised database to assist with monthly tracking and reporting of key emission sources. A key focus during the reporting period was to ensure the operation complied with the regulations under the *National Greenhouse and Energy Reporting* (NGER) *Act 2007*.

6.12.2 Environmental Performance

Total emissions were 583 kt CO2-e in the FY22 reporting period, of which direct (scope 1) emissions accounted for 86.4 per cent, and scope 2 emissions from the use of grid-based electricity accounted for the remaining 13.6 per

cent. As in the previous reporting period, Mt Arthur Coal used NGER Method 2 measurement of its open fugitive emissions, which reduced slightly in absolute terms (to 42.7 kt CO2-e) and as a proportion of total scope 1 emissions (8.5 per cent). Nevertheless fugitive emissions are expected to increase over time as mining progresses into areas with higher in-situ methane contents.

Fuel combustion will continue to constitute the bulk of emissions from Mt Arthur Coal, accounting for 91.5 per cent of scope 1 emissions and 79 per cent of total emissions in the reporting period. Energy use was similarly dominated by diesel fuel (93.2 per cent), with other fuels accounting for just under two per cent and electricity making up the balance.

6.12.3 Complaints and Reportable Incidents

Mt Arthur Coal did not receive any complaints, government fines or penalties related to greenhouse gas or energy during the reporting period and there were no related reportable incidents.

6.12.4 Proposed Improvements

BHP is committed to reducing its operational emissions globally. In FY22 BHP achieved its company-wide short-term target to maintain emissions at or below FY17 levels while continuing to grow its business. The company also has set a medium-term goal to reduce its operational emissions by at least 30% by 2030 on the way towards its longer-term commitment to achieve net-zero operational GHG emissions by FY50, consistent with the Paris Agreement. Mt Arthur Coal will continue to investigate and, where feasible, implement projects to reduce fossil fuel energy consumption and greenhouse gas emissions in accordance with BHP's sustainability commitments, including the company's greenhouse gas emission targets.

6.13 Waste Management

6.13.1 Environmental Management

Waste at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-PRO-033 Waste Handling and Disposal (internal document).

6.13.2 Environmental Performance

During the reporting period Mt Arthur Coal's activities, generated approximately 7,815 tonnes of both recycled and non-recycled waste sent off site for management. This an increase of approximately 102% per cent on the FY21 total of 3,977 tonnes. Approximately 6,378 tonnes (82 per cent) of the total waste produced and sent off site for management was recycled during the reporting period, as shown in Figure 4. This is a decrease of the FY21 percentage recycled off site total of 6,450 tonnes (84 per cent).

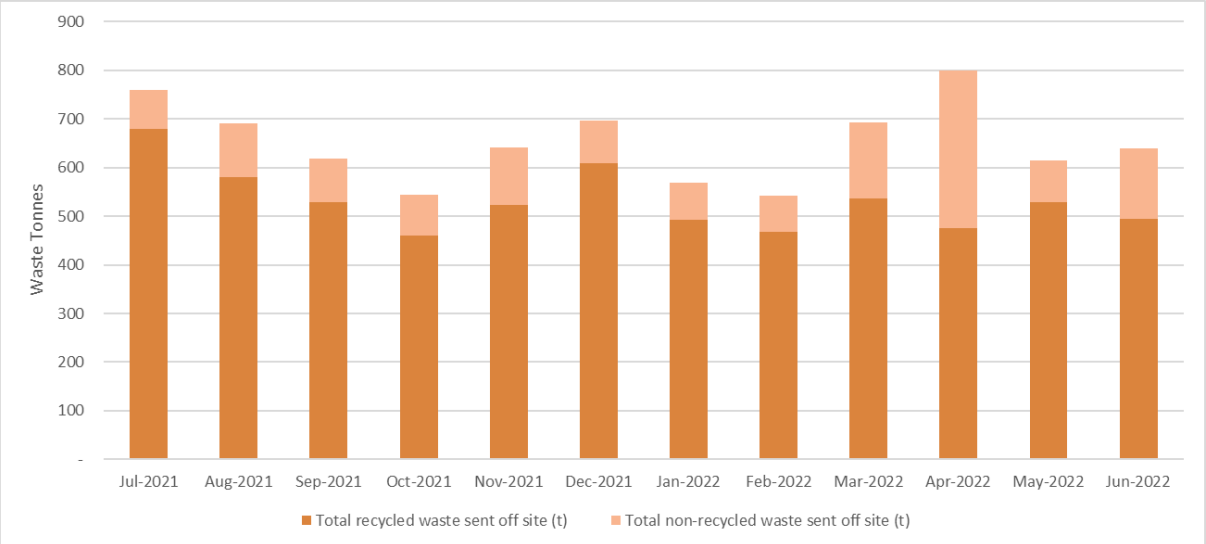


Figure 4: Waste disposal from Mt Arthur Coal

6.13.3 Complaints and Reportable Incidents

Mt Arthur Coal did not receive any complaints, government fines or penalties related to waste during the reporting period and there were no related reportable incidents.

6.13.4 Proposed Improvements

During the next reporting period Mt Arthur Coal will continue to manage waste in accordance with relevant procedures.

6.14 Public Safety

6.14.1 Environmental Management / Performance

During the reporting period Mt Arthur Coal maintained a boundary security fence around much of the perimeter of its site to ensure no unauthorised access to mining areas. A number of boom gates also exist to restrict unauthorised or unintentional access to the active mining and infrastructure areas. Routine patrols of these boundaries and access points are conducted through the engagement of third party security specialists and by internal statutory compliance personnel with no identified security or access breaches occurring during the reporting period.

During the reporting period Mt Arthur Coal maintained a permanent emergency response team consisting of BHP Emergency Services Officers and Paramedics. These personnel, along with the existing emergency response team, provide a professional emergency response service to site. The team are dedicated to ongoing continuous improvement, standardisation and preventative work.

6.14.2 Complaints and Reportable Incidents

Mt Arthur Coal did not receive any complaints, government fines or penalties related to public safety during the reporting period and there were no related reportable public safety incidents.

6.14.3 Proposed Improvements

Mt Arthur Coal will continue to maintain and monitor site security and ensure public safety during the next reporting period. An audit of the site perimeter fence will be completed in FY23.

7 Water Management

Water at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-MTP-034 Site Water Management Plan (WMP);

7.1 Water Balance

7.1.1 Environmental Management / Performance

Mt Arthur Coal maintains a site water balance model incorporating surface and groundwater inputs and outputs. The model is used to interpret current conditions and forecast future mine water inventories and use. The model build generally aligns to the Minerals Council of Australia Water Accounting Framework.

Mt Arthur Coal discharges water into the Hunter River from its licensed discharge point under the Hunter River Salinity Trading Scheme (HRSTS). There was no water discharged during FY22 under the HRSTS.

Water use totaled 8,597 ML during the reporting period. The use is a total of model outputs including evaporation, product entrainment and task loss. This is a slight increase in water usage compared to the 8,205 ML used in FY21.

The largest input to site is typically rainfall as outlined in the modification project environmental assessment.

Mt Arthur Coal extracted 1,665.3 ML from the Hunter River under water extraction licence, shown in Table 28.

Mt Arthur Coal continued to source water from the Muswellbrook Shire Council treated effluent scheme to reduce the demand from other external sources. An estimated 700 ML of recycled effluent was brought onto site for reuse in site operations.

Table 28: Water take for FY22

Water Licence number	Water sharing plan, source and management zone	Entitlement (Unit Shares)	Passive take / inflows (ML)	Active pumping (ML)	Total (ML)
WAL 917 20AL201126	Hunter Regulated River Water Source (High Security), Zone 1A Management Zone	2,197	-	486	486
WAL 918 20AL201127	Hunter Regulated River Water Source (General Security), Zone 1A Management Zone	3,564	-	1179.3	1179.3
WAL 1296	Hunter Regulated River Water Source (Supplementary), Zone 1A Management Zone	301	-	0	0
WAL 18141	Hunter Regulated River Alluvial Water Source, U/S Glennies Creek Management Zone	104	50*	-	50*
WAL 18247	Hunter Regulated River Alluvial Water Source, U/S Glennies Creek Management Zone	247	191*	-	191*
WAL 41495	Sydney Basin-North Coast Groundwater Source	750	750^	-	750^
WAL 41556	Sydney Basin-North Coast Groundwater Source	250	58^	-	58^

* Alluvial inflow has been calculated, based on predicted flux to and from alluvium (ML/day) as reported in the EIS, to be a total of 241 ML, which has been allocated across the two alluvial licences.

^ Groundwater seepage has been calculated, based on predicated average inflow to the pits (ML/day) as reported in the EIS, to be a total of 808 ML, which has been allocated across the two groundwater licences.

7.1.2 Proposed Improvements

Mt Arthur Coal will continue to use site water collected in both in-pit and out-of-pit storages prior to the use of water from the Hunter River. Where plans indicate that there would be sufficient water stored on site, water allocations for the Hunter River will continue to be offered to leaseholders and near neighbours as a temporary transfer.

7.2 Erosion and Sediment

7.2.1 Environmental Management

Erosion and sediment at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-PRO-060 Erosion and Sediment Control Plan;
- MAC-ENC-MTP 034 Site Water Management Plan

7.2.2 Environmental Performance

Total suspended solids (TSS) results remained low during the reporting period at the majority of statutory sites. The TSS results were mostly consistent compared with results from previous financial years. TSS results are summarised in Table 30, with further results presented in Appendix 1 - Surface Water Quality Monitoring Results. Water management structures were also routinely inspected after rain events > 25mm and maintained to ensure they are performing to design and prevent impacts on downstream waters.

During the reporting period monitoring of riparian vegetation was undertaken as part of the annual riparian vegetation and channel stability assessment, in accordance with the Water Management Plan. Table 29 summarises the results of the riparian vegetation assessment undertaken at the monitoring sites. Monitoring was not undertaken during FY21 due to COVID related delays. The results of the FY22 channel stability assessment show an overall increase in species richness with a larger portion of native species recorded.

The results of the monitoring indicated that the overall cover of riparian vegetation was generally adequate and sufficiently developed to minimise erosion. The results of monitoring also indicated that the creeks are generally stable and/or stabilising and that this is taking place naturally as the riparian vegetation and ground cover regenerates.

No active remediation or treatment was recommended except for control of priority woody weeds in creek lines, and the exclusion of stock on lands owned by Mt Arthur Coal.

Table 29: Riparian vegetation assessment - species diversity and total condition scores for FY22

Site	SW03 (Saddlers Creek)			SW04 (Quarry Creek)			SW12 (Ramrod Creek)			SW15 (White's Creek Diversion)		
	FY22	FY20	FY19	FY22	FY20	FY19	FY22	FY20	FY19	FY22	FY20	FY19
Number of native species (% of total)	57 (72)	34 (79)	46 (68)	17 (52)	9 (60)	15 (47)	30 (53)	17 (61)	30 (65)	21 (45)	8 (40)	16 (41)
Number of introduced species (% of total)	22 (28)	9 (21)	22 (32)	16 (48)	6 (40)	17 (53)	27 (47)	11 (39)	16 (35)	26 (55)	12 (60)	20 (59)
Total number of species	79	43	68	33	15	32	57	28	46	47	20	36
Total condition score (% of 32)	26 (81)	25 (78)	27 (84)	24 (75)	21 (78)	25 (81)	24 (75)	25 (81)	25 (81)	25 (81)	24 (75)	24 (75)

7.2.3 Complaints and Reportable Incidents

Mt Arthur Coal did not record any erosion or sediment control complaints or incidents during the reporting period.

7.2.4 Proposed Improvements

Improvements that occurred during the reporting period include:

- Completed a review of the MAC catchment to ensure adequate sediment controls are in place.
- Commenced clean out of key sediment dams.
- Inspections completed of sediment dams post storm events to ensure appropriate management and pump out strategies are in place.
- Erosion and sediment controls are implemented as part of the Permit to Disturb process and inspected on an as needed basis.

7.3 Surface Water

7.3.1 Environmental Management

Surface water at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-MTP-034 Site Water Management Plan (WMP);
- MAC-ENC-PRO-059 Site Water Balance;
- MAC-ENC-PRO-084 Water Monitoring Procedure (internal document); and
- MAC-ENC-PRO-032 Water Management (internal document).

The MAC-ENC-MTP-034 Site Water Management Plan was revised during the reporting period, submitted to DPIE in April 2020 and was under assessment at the time of writing this report. The revised WMP incorporates each of the site water management documents referenced above into a single consolidated WMP.

Water quality downstream of Mt Arthur Coal's operation is currently monitored by an independent consultant at five statutory monitoring sites, plus Mt Arthur Coal's licensed discharge point.

Mt Arthur Coal's Site Water Management Plan outlines measures for managing water on site, while the Surface Water Monitoring Program establishes impact assessment criteria against which monitoring results are compared. Impact assessment criteria are presented as trigger values which, if exceeded, lead to a response such as more intensive monitoring, investigation and if required, remedial action.

Mt Arthur is currently undertaking a Pollution Reduction Program as required by EPL 11457. The Program is focusing on reducing risk of offsite water discharge by realigning and improving mine water pipelines. This Program is forecasted to be complete in 2023 with the first stage being finalised on 30 September 2023.

7.3.2 Environmental Performance

A summary of the surface water quality data for statutory sites during the reporting period is provided in Table 30, with further results provided in Appendix 1 - Surface Water Quality Monitoring Results.

Water quality parameters in natural watercourses surrounding the mine including Saddlers Creek (SW02 and SW03), Quarry Creek (SW04), Ramrod Creek (SW12) and Whites Creek (SW15) were subject to normal variations in response to the ephemeral nature of the creeks, local geology and weather conditions. Water quality parameters are only recorded at the HRSTS discharge point (SW28) during discharge, and no HRSTS discharge occurred during the reporting period.

Surface water pH measured at individual statutory sites remained relatively constant during the reporting period and within the impact assessment trigger levels of 6.5-9.0 at all times. Surface water EC measured at individual statutory sites remained below impact assessment trigger levels during the reporting period with the exception of SW12 which recorded elevated results in July, August and September 2021, the results were investigated and were determined to be invalid due to no flow in the creek. Surface water TSS measured at individual statutory sites remained below trigger levels during the reporting period with the exception of SW15 which exceeded the Stage 2 trigger twice, this did not trigger to reporting protocol in the Surface Water and Groundwater Response Plan. Results are summarised in Table 30.

SW02 was dry during the reporting period. SW03 access was restricted due to heavy rainfall for two months. SW12 was dry for one month. SW15 was too low to sample for one month.

Surface water monitoring locations are shown in Figure 5.

North

SW28
SW15
ML 1757
GW21
VWP3 1-2
VWP2
GW16
X1MB
GW38P
GW38A
GW39P
GW48
GW40A
GW41A
GW49
VWP4 1-5
VWP5 1-5
VWP6 1-5
BCGW18
SW4
OD1078
ML 1548
VWP7 1-5
ML 1358
X10MB
GW43
EWPC33
ML 1487
SW12
A171
ML1655
MPL 263
CCL 744
ML1739
CL396
SUBLEASE CL395
ML1739
ML 1548
SUBLEASE CL229
SW2
ML1739
EL 5965
ML1593
ML1593
GW44
BCGW22P
BCGW22A
ML 1358
GW45
SW3
GW46
GW2
A437
GW47

Legend
Surface Water
Groundwater

BHP

Mt Arthur Coal Pty Limited

A.C.N. 000 181 902 A.B.N. 83 000 181 902

Thomas Mitchell Drive Muswellbrook 2333

Mt Arthur Mine- Monitoring Locations Groundwater and Surface Water

Drawn:	JR	Drawing No:	ENV-0014
Department:	SURVEY	Scale	1:50000 @A3
Date:	07/12/2020	Page	1 of 1

Table 30: Summary of statutory surface water quality monitoring results

Site	Impact Assessment Criteria Trigger Values			Monitoring Results			Trend/ key management implications	Implemented / proposed management actions
				min	ave	max		
SW02	pH	6.5 – 9.0		-	-	-	No assessment criteria triggered. Dry during the reporting period	Gain approval of the revised WMP. Continue managing surface water in accordance with site WMP
	EC (µS/cm)	Stage 1	12,365	-	-	-		
		Stage 2	13,900					
	TSS (mg/L)	Stage 1	219	-	-	-		
		Stage 2	277					
SW03	pH	6.5 – 9.0		7.07	7.74	8.29	No assessment criteria triggered	
	EC (µS/cm)	Stage 1	10,133	658	2,985	5,520	No assessment criteria triggered	
		Stage 2	11,402					
	TSS (mg/L)	Stage 1	37	<5	12	24	No assessment criteria triggered	
		Stage 2	46					
SW04	pH	6.5 – 9.0		7.39	7.80	8.34	No assessment criteria triggered	
	EC (µS/cm)	Stage 1	13,959	2,317	6,721	11,970	No assessment criteria triggered	
		Stage 2	15,509					
	TSS (mg/L)	Stage 1	82	<5	11	15	No assessment criteria triggered	
		Stage 2	104					
SW12	pH	6.5 – 9.0		7.42	7.97	8.39	No assessment criteria triggered	
	EC (µS/cm)	Stage 1	6,659	502	5,168	8,360	During the reporting period there were three subsequent Stage 2 triggers of the EC criteria at SW12. These were reported to DPE with no further action required.	
		Stage 2	7,153					
	TSS (mg/L)	Stage 1	555	<5	16	42	No assessment criteria triggered	
		Stage 2	708					
SW15	pH	6.5 – 9.0		7.33	7.55	7.74	There were no reportable TSS incidents during the reporting period.	
	EC (µS/cm)	Stage 1	7,128	45	814	1,168		
		Stage 2	8,262					
	TSS (mg/L)	Stage 1	103	<5	48	145		
		Stage 2	130					

7.3.3 Complaints and Reportable Incidents

Mt Arthur Coal did not have any complaints relating to surface water.

Mt Arthur Coal had one reportable incident relating to surface water. The incident that occurred was a mine water dam overtopping due to significant rainfall. The incident was reported to the EPA and DPE. The incident is discussed further in Section 11.

7.3.4 Proposed Improvements

Mt Arthur Coal will be updating the site Water Management Plan during the next reporting period and continue to implement the PRP as required in EPL 11457.

7.4 Ground Water

7.4.1 Environmental Management

Ground water at Mt Arthur Coal is managed in accordance with:

- MAC-ENC-MTP-034 Site Water Management Plan; and
- MAC-ENC-PRO-084 Water Monitoring Procedure

Mt Arthur Coal's Site Water Management Plan (WMP) aims to minimise any adverse impacts on aquifers in proximity to the operation, including the two major aquifer areas, the hard rock coal measures and the shallow alluvial deposits associated with the Hunter River.

The WMP includes a Groundwater Monitoring Program, in accordance with Schedule 3 Condition 29 and 33 of Development Consent 09_0062. The Groundwater Monitoring Program outlined in Section 9.3 of the WMP details the monitoring methodology, monitoring locations, frequency impact assessment criteria (water levels and quality), mine inflows/licensing, impacts to private bores and groundwater dependent ecosystems (GDEs), cut-off wall and flood levee monitoring and monitoring records.

The WMP was updated on the 10th of December 2020 and approved by the Department of Planning and Environment (DPE) on the 6th of October 2021. Updates to the WMP were made based on additional work conducted on site and numerical modelling.

Between 2021 and 2022 a groundwater investigation was undertaken due to various exceedances being detected at several bores in the monitoring network, outlined further in Tables 26 and 27. This investigation involved assessment of current bore location, condition and trigger levels. The investigation resulted in the recommendation to update the Water Management Plan, which will be completed in FY23.

7.4.2 Environmental Performance

A groundwater review was undertaken by an external specialist consultant for the reporting period. The scope of work included:

- Comparison between modelled and observed water levels to June 2022;
- Compare monitoring data to drawdown predictions for the Mt Arthur Coal Consolidation Project Environmental Assessment and the current modelling for the approved operations;
- Review site water quality monitoring data, field reports and laboratory reports and check performance;
- Review of groundwater triggers and report on any trigger exceedances, where review will be based on both the current established groundwater triggers for the site; and
- Review performance of the cut-off wall using available data.

The full Annual Groundwater assessment report is included as Appendix 2.

Drawdown and cut off wall performance

There has generally been a negligible change in water levels within the Hunter River alluvium. However, the change in total drawdown did vary spatially, with bores closer to mining (GW16, GW21, X1MB) recording a minor decline in levels, while bores further to the west (GW38A (IW4030), GW40A, GW41A (IW4029)) recorded a slight increase in water levels.

Groundwater levels in the bores along Saddlers Creek have fluctuated over time, potentially in response to rainfall trends, with an overall increasing trend in groundwater levels since the end of 2020. However, since monitoring began in 2016 there has been an overall minor decline in water levels (increased drawdown) within the Saddlers Creek alluvium. The change in total drawdown varied spatially, with bore GW45, located in the upper reaches of Saddlers Creek, recording the most drawdown.

There has been a general decline in groundwater levels within the Permian coal measures to the southwest of open cut operations, showing a response to the progression of mining to the southwest. However, in-pit water storage (Belmont, MacDonald and Saddlers pits) potentially buffers the extent of drawdown in localised areas.

To monitor drawdown within the Hunter River alluvium, VWPs were installed near the cut-off wall to monitor the Permian coal measures underlying the Hunter River alluvium. The VWP sensors monitor:

- VWP1 - Edinglassie Seam (footwall) at 204.5 m depth (-69.0 mAHD) (decommissioned in 2020)
- VWP2 - F4 fault at 216.5 m depth (-81.1 mAHD)
- VWP3 - Sensor 1 - Edinglassie Seam (hanging wall) at 227.0m depth (-91.6 mAHD)
- VWP3 - Sensor 2 - Ramrod Creek Seam at 241 m depth (-105.6 mAHD).

Continuous data has been captured by the VWPs since December 2013. However, the footwall of the Edinglassie Seam is no longer monitored as VWP1 has been decommissioned due to sensor failure. VWP3 PL2 also failed in June 2020. The sensors should be replaced to continue monitoring in this area.

Groundwater levels have declined 87 m in the F4 fault, 107 m in the Edinglassie Seam and 103 m in the Ramrod Creek Seam, since installation. The Hunter River alluvium and shallow weathered sandstone (regolith) was previously monitored by bore GW42 which is located adjacent to the VWPs. However, monitoring of GW42 ceased in June 2021 due to the intermittent nature of groundwater within the bore. Although not as proximal to the cut-off wall as GW42, bore GW16 also monitor the Hunter River alluvium, located approximately 400 m to the northwest of the cut-off wall. Bore GW16 has been used to compare trends in the coal seams and alluvium, as a substitute for GW42 in the interim until a replacement bore for GW42 is installed.

Groundwater levels at GW16 have fluctuated over time but have remained relatively stable, with a slight increase of 0.57 m between March 2008 and June 2022. Depressurisation observed in the Permian coal measures has not impacted on the Hunter River alluvium and regolith groundwater levels observed in bore GW16.

Groundwater level data is available in the area at bores close to the Hunter River (GW21, GW38A and X1MB) and close to the cut-off wall (GW16). All of the bores recorded a similar stable to slightly rising trend over the monitoring period. Groundwater levels in the Hunter River alluvium bores fluctuate in response to rainfall and streamflow trends.

The relatively stable groundwater level trends shown in the alluvial bores indicate that the depressurisation observed in the Permian coal measures does not appear to have impacted on the Hunter River alluvium groundwater levels. Monitoring of the Hunter River alluvium shows no adverse impact from mining activities on alluvial groundwater conditions and beneficial use of groundwater.

This is further expanded upon in Appendix 2 Ground Water Monitoring Results and Groundwater Level Drawdown Analysis .

Groundwater Level

Groundwater level data collected over the reporting period have been compared to the trigger values outlined in the WMP. Bores BCGW18 and GW44 and VWPs VWP3 (P1), VWP04 (all seams), and VWP07 (Piercefield Seam) recorded groundwater level exceedances as outlined in Table 31 below.

Table 31: Groundwater Level Trigger Exceedances

Bore ID	Exceedance	Screened Lithology	Location	Comment
BCGW18	Six water level readings below trigger level of 147.30 mAHD since March 2021	Arrowfield Seam	On site – west of MAC	The purpose of bore BCGW18 is monitoring of the Arrowfield Seam, close to an old channel of Quarry Creek, and to monitor the impact of mining activities adjacent to mining areas to the west of MAC. The bore is located within 1 km of the open cut pit and close to an old channel of Quarry Creek and west of MAC open cut (Huon Pit). Groundwater levels in bore BCGW18 have gradually declined since October 2012 and has been recorded as dry and below the trigger level of 147.3 mAHD, since March 2021. Comparison

Bore ID	Exceedance	Screened Lithology	Location	Comment
				between modelled and observed water levels indicates that depressurisation of the coal seam was predicted at BCGW18. Initial review indicates no adverse impacts beyond those predicted for the approved operations. The trigger exceedances were reported to DPE in June 2022.
GW44	Seven water level readings below trigger level of 99.9 mAHD since December 2020	Woodlands Hill Seam	On site – west of Saddlers Pit South	The purpose of bore GW44 is monitoring of groundwater response in the Woodlands Hill Seam to mining. The bore is located 200 m west of Saddlers Pit. The field sheets indicate that a total depth check on the bore is not conducted during field monitoring. The depth should be checked and any sediment in the base of the bore should be cleaned out, if required. The 2020 network review (Umwelt, 2021a) recommended that GW44 be used for water level monitoring only as sampling is difficult due to the depth of the bore (133 m). Groundwater levels in GW44 have gradually declined since July 2018, declining below the water level trigger of 99.9 mAHD from December 2020 onwards. Comparison between modelled and observed water levels indicates that depressurisation of the coal seam was predicted at GW44. However, the model shows a delay in the timing compared to the observed data. This may relate to timing within the model drain package. Initial review indicates depressurisation of the coal seam was predicted in this area; however, there is a difference in the timing that may relate to how the model drain package represents actual mine progression at site. The trigger exceedances were reported to DPE in June 2022.
VWP04	Pressure levels below trigger levels of: 42.2 mAHD (Vaux) 37.3 mAHD (Bayswater) 22.0 mAHD (Edderton) -7.5 mAHD (Edinglassie) -12.6 mAHD (Ramrod) in all coal seams monitored since October 2020	Vaux Seam Bayswater Seam Edderton Seam Edinglassie Seam Ramrod Creek Seam	On site - immediately west of MAC open pit (Windmill Pit)	Levels in the Vaux, Bayswater, Edderton, Edinglassie, and Ramrod Creek seams have exceeded the trigger levels since October 2020. The continuing declining groundwater level trend represents mining induced depressurisation as predicted for the approved operations by SLR (2020b). SLR (2020b) predicted continued drawdown in this area with simulated water levels ranging between -35.4 mAHD (Vaux) and -158.8 mAHD (Ramrod Creek) in June 2022. The measured water levels ranged from 22.8 mAHD (Vaux) to -26.8 mAHD (Ramrod Creek) in June 2022. The SLR (2020b) model predicted greater drawdown than observed and the trigger levels should be reviewed to align with levels in the latest model predictions. Initial review indicates no adverse impacts beyond those predicted for the approved operations. The trigger exceedances were reported to DPE in June 2022.

Bore ID	Exceedance	Screened Lithology	Location	Comment
VWP07 (Sensor 1)	Pressure levels below trigger level of 94.5 mAHD since October 2021	Piercefield Seam	On site - west of MAC open pit (Windmill Pit)	Levels in the Piercefield Seam have exceeded the trigger level since October 2021. The continuing declining groundwater level trend represents mining induced depressurisation as predicted for the approved operations by SLR (2020b). SLR (2020b) predicted continued drawdown in this area with simulated water levels in all seams ranging between 113.2 mAHD (Piercefield) and 9.8 mAHD (Edderton) in June 2022 (refer Error! Reference source not found.). The measured water levels ranged from 93.8 mAHD (Piercefield) to 80.5 mAHD (Edderton) in June 2022. The SLR (2020b) model predicted slightly lower starting heads in this location but does capture the trend of declining groundwater head over time consistent with the observed data. Initial review indicates no adverse impacts beyond those predicted for the approved operations and triggers should be reviewed in consideration of the model limitations. The trigger exceedances were reported to DPE in September 2022. The exceedance was not notified previously as data was not downloaded due to access issues.

Groundwater Quality

Water quality data collected over the reporting period have been compared to the trigger values outlined in the WMP. Only BCGW22P (IW4026) recorded three consecutive readings for EC constituting a reportable exceedance. An analysis of the trigger exceedance for BCGW22P (IW4026) is summarised in Table 32. BCGW22P recorded a fourth trigger exceedance in the June 2022 monitoring which has subsequently been reported to DPE.

Trigger exceedances have been reviewed by comparing groundwater levels and climate indicated by the cumulative rainfall departure plot. Graphs of pH and EC for all monitoring bores are presented in Appendix 2.

Table 32: Groundwater Quality Trigger Exceedances

Bore ID	Exceedance	Screened Lithology	Location	Comment	Action
BCGW 22P (IW4026)	Eleven EC readings above the Stage 1 trigger level of 14320 µS/cm since December 2019	Glen Munro Seam/Inter burden	On site – southwest of McDonalds Pit and north of Saddlers Creek	EC has an increasing trend, ranging from 8960 µS/cm in November 2017 to 17350 µS/cm in September 2020. An exceedance was identified in the 2021 Annual Review (Umwelt, 2021b), which recommended further investigation. The EC continued to exceed the Stage 1 trigger level throughout the 2022 reporting period. The consecutive exceedances were reported to DPE on 27 April 2022. Following the recommendations in the 2021 Annual Review, an investigation was undertaken during the 2022 reporting period determined that the slow recovery of groundwater and unique water quality results indicate the bore is not screened within the coal seam but within a low permeability interburden unit. The investigation recommended that BCGW22P (IW4026) be maintained for monitoring groundwater levels but removed from the WMP as a compliance bore and replaced with existing bores X11 and X13, which are screened within the Woodlands Hill and Glen Munro seams, respectively. The replacement bores are located up-slope of BCGW22P (IW4026), closer to the mine site. The WMP is currently being reviewed and these changes will be included in the review.	A trigger investigation has already been undertaken in March, and the response from the DPE received 19 May 2022 (DPE, 2022). A trigger exceedance was also recorded in the June 2022 monitoring round which has subsequently been reported to DPE. Remove as a compliance monitoring bore in WMP but continue to monitor water levels. Further to this, as part of the recommendations for nearby bore BCGW22A, an additional shallow bore will be installed up slope and closer to the mine area.

7.4.3 Proposed Improvements

- Undertake a review of the Water Management Plan including triggers and groundwater bore locations
- Review the condition and instrumentation of groundwater bores and complete project to restore and remediate bores where required.

8 Rehabilitation

8.1 Buildings and Infrastructure

No infrastructure or buildings were decommissioned during the reporting period.

8.2 Topsoil

Topsoil management at Mt Arthur Coal focuses on maintaining the quality of the topsoil resource as a rehabilitation growth medium. Activities undertaken during the reporting period included:

- Prioritising direct placement of topsoil;
- Testing topsoil to determine appropriate depths for stripping and recovery as well as ameliorant requirements;
- Felling and mulching trees in situ on disturbance areas to increase organic content within the topsoil that was used directly on rehabilitation areas; and
- Reusing felled trees from disturbance areas on new rehabilitation areas to provide habitat.

Additional measures generally undertaken when stockpiling topsoil include:

- Locating stockpiles so as to reduce the requirement for re-handling;
- Addition of ameliorants such as fertiliser, compost and gypsum;
- Establishing cover crops;
- Weed treatment by slashing and scalping.

Topsoil was placed and spread to an approximate depth of 200 to 300 millimetres on rehabilitation areas where required. The newly spread topsoil surface was contour cultivated prior to sowing to provide a suitable environment that encourages water infiltration in the soil.

Targeted maintenance on stockpiles included:

- Broad leaf weed treatment;
- Application of fertiliser; and
- Spreading of pasture seed mix as per the Rehabilitation Management Plan.

Approximately 61 ha of topsoil stockpiles were maintained during the reporting period (see Table 33).

Table 33 Topsoil stockpiles maintained in the reporting period.

Stockpile	Area
TSS011	1ha
TSS059	4ha
TSS070	9ha
TSS074	11ha
TSS075	10 ha
TSS082	2ha
TSS091	3ha

Stockpile	Area
TSS092	4ha
TSS099	6ha
TSS104	11ha

8.3 Landform Design

Mt Arthur Coal aims to create rehabilitation that is safe, stable and non-polluting, that is self-sustaining and comparable to the surrounding natural landscape. Landform and rehabilitation established since 2014 utilises geomorphic design and incorporates micro-relief and drainage lines for landforms designed and constructed post the current modification project approval. The geomorphic design uses the characteristics of stable natural alluvial landforms in the local environment as an analogue on which to base the design of overburden landforms

The final landform design can be seen in Figure 6 and Figure 7. Figure 6 and Figure 7 show the shaped waste rock with topsoil being placed. Although this geomorphic design has been implemented on other sites within NSW and also worldwide there are many defining characteristics that restrict its use such as space, waste characterisation, rainfall, availability of suitable rock, availability of mulch, final landuse, landform height and steepness of the landform. Mt Arthur Coal has larger higher landforms than other sites in the Hunter Valley, and is also space constrained for emplacement area. The resultant design aligns with industry best practice, but will be monitored over the coming years to ensure further natural landform design incorporates learnings and improvement from the current work.

Figure 6: Topsoil spreading at Drayton Void emplacement

Figure 7 Growth media alternate trials commenced in the reporting period

Rehabilitation of land is carried out in accordance with:

- MAC-ENC-MTP-052 Mt Arthur Coal Mining Operations Plan;
- MAC-ENC-MTP-047 Rehabilitation Strategy;
- MAC-ENC-MTP-050 Biodiversity Management Plan;
- MAC-ENC-PRO-080 Rehabilitation and Ecological Monitoring; and
- MAC-ENC-PRO-012 Land Management Procedure.

Rehabilitation is designed to achieve a stable final landform compatible with the surrounding environment and to meet the landform commitments presented in the MOP.

This reporting period saw Mt Arthur Coal increased volume and quality of newly established rehabilitation. During the reporting period Mt Arthur Coal completed (achieved Phase 4 – Ecosystem and Landuse Establishment) 52 hectares of rehabilitation across two areas (VD5 and Drayton Void) as well as 14 hectares in other phases of rehabilitation on the VD4 dump system. This exceeded the MOP target of 43 hectares to Phase 4 – Ecosystem and Landuse Establishment, as shown in Table 34. Areas of rehabilitation undertaken during the reporting period are shown in Appendix 5.

Table 34 and Table 35 provide the Mt Arthur Coal rehabilitation summary for the operation.

Table 34: Mt Arthur Coal rehabilitation claimed for FY22

Rehabilitation phase	FY22 MOP rehabilitation commitments (hectares)	FY22 areas in active rehabilitation phases (hectares)
Phase 2 – Landform Establishment	0	2.86
Phase 3 – Growing Media Development	0	10.96
Phase 4 – Ecosystem and Landuse Establishment	43	51.87
Total	43	65.69

Note: All areas calculated using GDA1994 Zone 56 coordinate system

Table 35: Mt Arthur Coal rehabilitation summary

Mine area type	Previous reporting period (FY21 actual)	This reporting period (FY22 actual)	Next reporting period (FY23 forecast)
A. Total mine footprint[1]	5,450.22	5,564.05	5,686.66
B. Total active disturbance[2]	4,297.37	4,469.61	4,565.84
C. Land being prepared for rehabilitation[3]	85.67	3.66	3.66
D. Land under active rehabilitation[4]	1,152.85	1,094.45	1,120.82
E. Completed rehabilitation[5] (as formally certified by NSW Government)	0	0	0

Note: All areas calculated using GDA1994 Zone 56 coordinate system
* Reconciled via survey from FY19
1 Total mine footprint includes all areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to mining and associated activities.
2 Total active disturbance includes all areas ultimately requiring rehabilitation.
3 Land being prepared for rehabilitation includes the sum of mine disturbed land that is under the following rehabilitation phases – decommissioning, landform establishment and growing media development (as defined in DRE MOP/Rehabilitation Management Plan Guidelines).
4 Land under active rehabilitation includes areas under rehabilitation and being managed to achieve relinquishment.
5 Completed rehabilitation requires formal signoff by the NSW Resources Regulator that the area has successfully met the rehabilitation land use objectives and completion criteria.

8.4 Other Activities

8.4.1 Weed management and pest animal control

Weed control was focussed on VDs 1, 4 and 5 as follow up to the improvement works carried out in the previous reporting period (see Biodiversity Section for details).

Improvements in managing risks associated with

A trial has commenced on VD4 to develop standard growth media alternatives to topsoil. The trial has the aims to :

- Reduce risk of topsoil deficit;
- Eliminate the weed seed bank risk in topsoil out competing the native species; and
- Closing the erosion window

The trial was broken into three areas with the following treatments:

Area 1

- Following shaping and gypsum application create a friable seed bed and incorporate gypsum; and
- Seed directly to shaped waste rock

Area 2

- Following shaping and gypsum application: Padfoot roller or similar to create a friable seed bed and incorporate gypsum;
- Spread hay to depth of ~3cm; and
- Seed directly onto spread hay.

Area 3

- Following shaping and gypsum application: Padfoot roller or similar to create a friable seed bed and incorporate gypsum;
- Application of 50m3/ha of rehab grade compost; and
- Spread seed directly onto amended waste rock.

Mt Arthur Coal continued the use of remote sensing to assess erosion, vegetation health and ecological development. However, at the time of reporting results were not available to present. **Error! Reference source not found.**

Further improvements were made to the monitoring program in the reporting period. Ecological communities listed in the project approval (Schedule 3 Condition 38) and Environment Protection and Biodiversity Conservation (EPBC) approvals were assessed to convert to best fit Plant Community Types (PCT). In identifying appropriate or 'best-fit' PCTs for the vegetation communities included in the project approvals, consideration was given to the following:

- Vegetation formation;
- Landscape position, soil and geology;
- The relative abundance of locally indigenous native species;
- Upper, mid and ground strata species including key diagnostic species; and
- Alignment with TECs.

This assessment was then compared to the exiting monitoring data at both on site rehabilitation and conservation agreement monitoring locations. This allowed for improved alignment between rehabilitation ecological development monitoring sites, reference sites and the target ecological communities listed in the approvals.

8.5 Rehabilitation Activities for Next Reporting Period

The FY23-FY25 Forward Program was submitted to the NSW Resources Regulator for the period 1 July 2022 to 30 June 2025. Performance indicators and completion criteria were developed for the Rehabilitation Management Plan (RMP) and are representative of current site techniques and information derived from monitoring data. This will be dynamic over the life of the mine, in consultation with the NSW Resources Regulator, progressing towards rehabilitation being self-sustaining on site.

Rehabilitation activities for the reporting period include the continuation of natural landform design rehabilitation techniques and the inclusion of habitat in new areas as they become available. FY23 has an annual rehabilitation area target of 67 hectares.

New rehabilitation of land will be carried out in accordance with:

- Mt Arthur Coal's FY23-FY25 Forward Program;
- Mt Arthur Coal's Rehabilitation Management Plan;
- MAC-ENC-MTP-047 Rehabilitation Strategy; and
- MAC-ENC-MTP-050 Biodiversity Management Plan.

Additional focus on improving the quality of rehabilitation of VD1 will continue in FY23 with the aim of establishing self-sustaining Box Gum woodland based vegetation community as described in the RMP.

Details of planned maintenance and improvement are provided in the Mt Arthur Coal Rehabilitation Maintenance and Improvement Program presented in Appendix 5 Rehabilitation Plan & and Monitoring Results.

Mt Arthur Coal will continue the use of remote sensing to assess erosion, vegetation health and ecological development. This will potentially provide a more detailed assessment of ecological development at Mt Arthur Coal and help guide improvement practices

9 Community

9.1 Community Engagement

Mt Arthur Coal continues to actively engage and build relationships with key stakeholders and the local community through its program of community engagement and consultation. Mt Arthur Coal's community engagement and consultation process was ongoing throughout the reporting period with the following consultation measures undertaken:

- Quarterly Community Consultative Committee (CCC) meetings
- MAC representatives attendance at Muswellbrook Chamber of Commerce & Industry, Singleton Business Chamber and Hunter Business Chamber events
- Participation in the Upper Hunter Mining Dialogue and several of its working groups
- Telephone and face-to-face engagement with neighbouring landholders as well as written correspondence
- 24 hour BHP Mt Arthur Coal Community Response Line: 1800 882 044
- Biennial Community Perception Survey, conducted by independent research firm IPSOS, to provide the local community and key stakeholders with a way to provide feedback to Mt Arthur Coal on its business activities and key issues of concern for the community.
- Comprehensive engagement with more than 80 stakeholders regarding the decision and announcement in June 2022 by BHP to retain Mt Arthur Coal in its portfolio, seek the relevant approvals to continue mining for an additional four years beyond 2026 when the current consent expires, as part of a managed process to cease mining in June 2030 and transition to closure and rehabilitation.

Mt Arthur Coal invites feedback about its activities through a free-call 24-hour Community Response Line (1800 882 044), which is advertised in local newspapers and on the BHP website at: https://www.bhp.com/sustainability/environment/regulatory-information/

9.1.1 Community Response Line

During the reporting period, Mt Arthur Coal received 40 complaints from community members and near neighbours. A comparison of complaints received during the reporting period against previous financial years is shown in

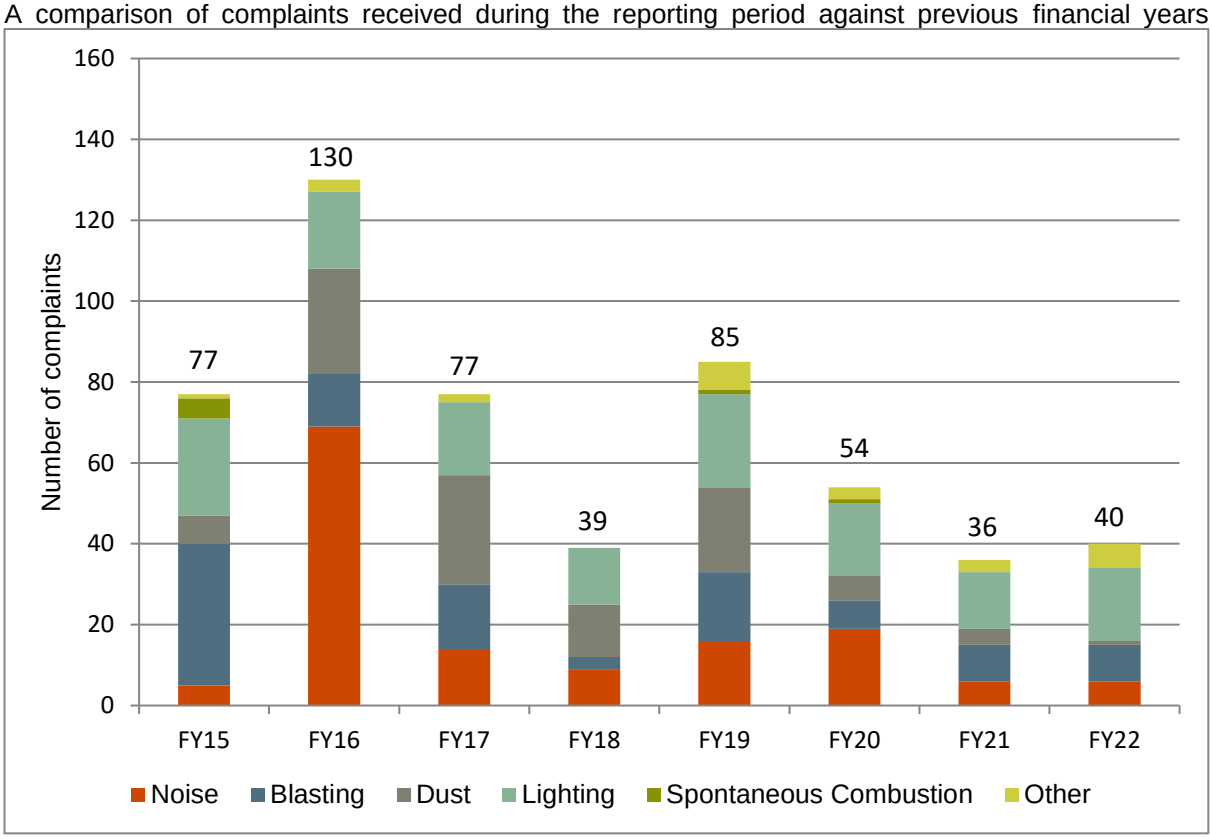


Figure **8** and a complete register of complaints is presented in Appendix 3 Community Complaints.

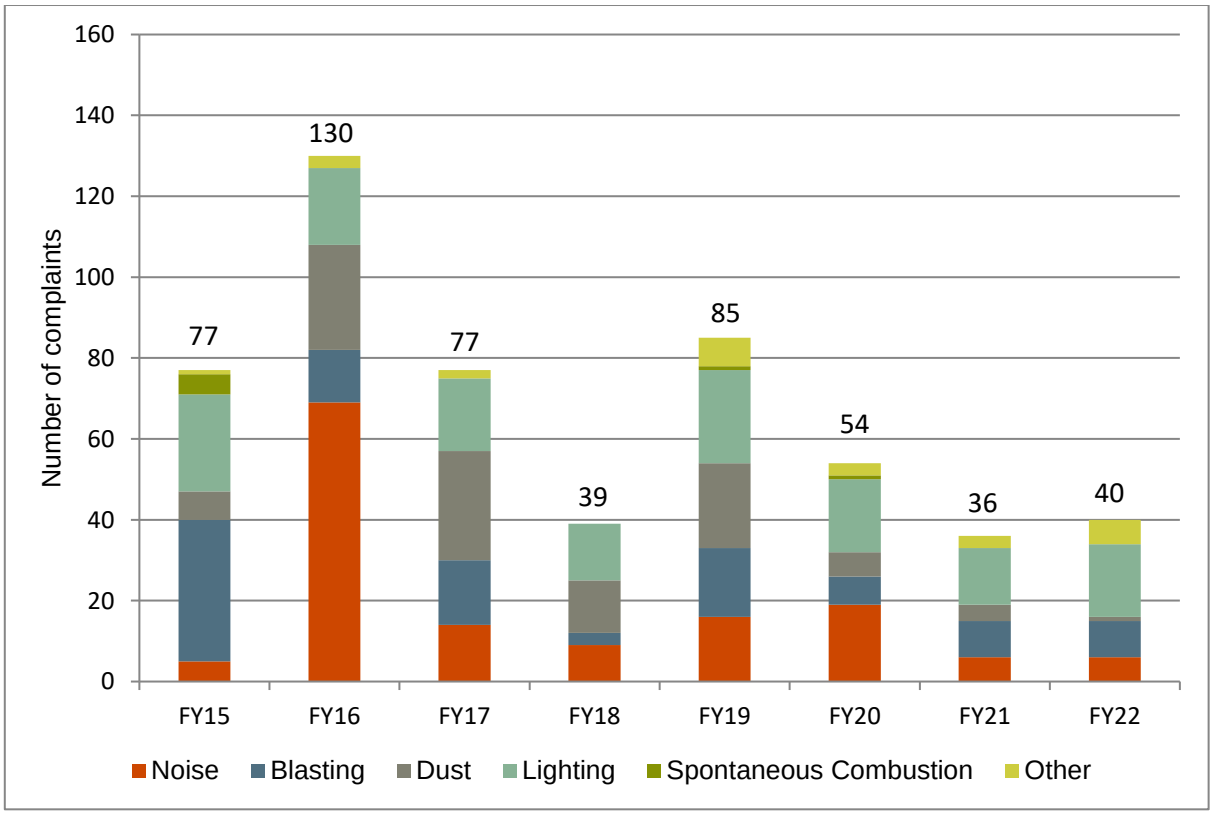


Figure 8: Comparison of complaints received during current and previous financial years

9.1.2 Q1 (July to September 2021)

Mt Arthur Coal received twenty-two (23) complaints during this period. Of the twenty-two complaints, twelve (13) were related to lighting; five (5) to blasting activity; two (2) to noise and three (3) in the “other” category related to a failure to respond to a lighting complaint, attendance of the MAC Community Response Line and availability of CCC minutes on the BHP website.

Of the twenty-two (23) complaints received for the three-month reporting period, fourteen (14) came from residents at Roxburgh Rd, four (4) were from Bureen Road, two were from Racecourse Rd (2), three (3) were from Muswellbrook.

9.1.3 Q2 (October to December 2021)

Mt Arthur Coal received nine (9) complaints during this period. Of the nine complaints, four (4) were related to lighting; one (1) to blasting activity; one (1) was related to noise; one (1) to dust and two (2) in the “other” category related to: debris on the road of Thomas Mitchell Drive as a result of MAC South/Thiess not washing LVs thoroughly before leaving operations; and one related to traffic safety for one of our contractors using Thomas Mitchell Drive and Denman Road – a traffic controller was immediately engaged.

Of the nine (9) complaints received for the three-month reporting period, four (4) came from residents at Roxburgh Rd, four (4) from Muswellbrook, one (1) from Sheppard Avenue.

9.1.4 Q3 (January to March 2022)

Mt Arthur Coal received five (5) complaints during this period. Of the five complaints, one (1) was related to lighting; two (2) to blasting activity; and two (2) to noise.

Of the five (5) complaints received for the three-month reporting period, four (4) came from residents at Roxburgh Road, one (1) from Racecourse Road.

There were no exceedances during this period.

In January 2022, the telecommunications carrier who operates the Mt Arthur Coal Community Response Line completed a system upgrade which resulted in notifications of community complaints to BHP Mt Arthur Coal being disrupted. Notifications were not received by BHP Mt Arthur Coal between 28 December and 26 January. As a result our community complaints response process was not activated for 2 complaints received during this period. The regulator was advised of the outage. This incident is outlined further in Section 11.

9.1.5 Q4 (April to June 2022)

Mt Arthur Coal received three (3) complaints during this period. One (1) in the “other” category related to roadwork delays at Thomas Mitchell Drive in April, one (1) for noise and one (1) for blast noise/overpressure.

Of the three (3) complaints received for the three-month reporting period, one (1) was from Roxburgh Road, one (1) from the Sydney Street crossing due to roadwork and one (1) from Denman Road.

9.1.6 Website

Mt Arthur Coal provides information about the operation through the BHP website at https://www.bhp.com/sustainability/environment/regulatory-information/, including project approval documents, blast schedules, coal transport information, Community Consultative Committee (CCC) meeting minutes, community complaint records, environmental monitoring information, independent environmental audits, environmental management plans, EPBC compliance reports and Annual Reviews. Note that the Annual Coal Transport Report is now provided as part of this Annual Review in Appendix 4.

9.1.7 Community Consultative Committee

During the reporting period, Mt Arthur Coal coordinated four CCC meetings in accordance with the Community Consultative Committee Guidelines (DPE, 2019) on:

- 15 September 2021
- 10 November 2021

- 9 February 2022
- 18 May 2022

Mt Arthur Coal also participated in two Joint CCC meetings with Maxwell Infrastructure Malabar Coal held on:

- 8 December 2021
- 15 June 2022

9.2 Community Investment

During the reporting period Mt Arthur Coal voluntary contributed $358,000 to the local community.

Central to Mt Arthur Coal's commitment to the local community is its Voluntary Planning Agreement (VPA) with Muswellbrook Shire Council, of which $660,946 was provided in FY22 toward the Mt Arthur Coal Community Fund. Established under the *Environmental Planning and Assessment Act 1979*, the VPA is an annual commitment that contributes to public amenities and services that may be impacted by the growth of mining operations.

9.2.1 Local Buying Program

Mt Arthur Coal continues to engage and support eligible small, local and indigenous businesses by procuring goods and services through the Local Buying Program – a program delivered in partnership between BHP and C-Res, a cost-neutral entity. A record $16,597,044 was spent in NSW in FY22, primarily in the shires of Muswellbrook, Singleton and Upper Hunter.

9.2.2 Local Buying Foundation

The Local Buying Foundation is an important element of the Local Buying Program; each time BHP procures goods and services through the Program additional funds are provided to the Local Buying Foundation. The Foundation directs these funds to programs, initiatives and events that focus on building stronger and more resilient local business communities.

Since the Foundation's inception in NSW in 2017, a total of 35 projects have been supported at a value of nearly $700,000 within the Singleton, Muswellbrook and Upper Hunter Shires.

10 Independent Audit

An Independent Environmental Audit (IEA was undertaken at Mt Arthur Coal in during September and October 2020. The IEA covered the Mt Arthur Coal Complex. The IEA period was 1 July 2017 to 30 June 2020. The IEA was the three - year period based on the date of the previous IEA. The Department of Planning Industry and Environment (DPIE) endorsed the following IEA team in the letter dated 12 June 2020:

- Chris Jones – (Integrated Environmental Management Australia - IEMA) - Lead Auditor and Surface Water Specialist;
- Nathan Archer – (SLR Consulting Australia Pty Ltd - SLR) Assistant Auditor and Noise/Blasting Specialist;
- Ali Naghizadeh (SLR) – Air Quality Specialist;
- Clayton Richards (Mine Soils) – Rehabilitation Specialist; and
- Katarina David (Independent Consultant) – Groundwater

The IEA covered the requirements of Schedule 5 Condition 9 of the Project Approval (PA 09-0062).

The IEA included a series of specialists including surface water, groundwater, noise/blast, air and rehabilitation.

The IEA generally identified a high level of compliance with no high or medium risks identified during the IEA.

As summarised in Table 36 the following non – compliances were observed:

- There were eight low risk non – compliances and four administrative non – compliances for the Project Approval;
- There were three low risk non – compliances and four administrative non – compliances for the Environment Protection Licence;
- There were four low risk non – compliances and one administrative non – compliances for the Mitigation Measures and Management from Mt Arthur Coal Open Cut Modification - Environmental Assessment 2013;

Table 36: Summary of IEA Non-Compliances and Recommendations

Regulatory Document	Non- Compliances		Recommendations	
	Low Risk	Administrative	Non-compliance	Improvement
Project Approval	8	4	9	15
Environment Protection Licence	3	4	2	4
Key Environmental Assessment Commitments 2013 EA	4	1	2	-
CCL 396	-	-	-	1
TOTAL	**15**	**9**	**13**	**20**

Of the 26 actions agreed with the DPIE 23 of them have been completed. The remaining 3 actions were not scheduled for completion until after this reporting period and will be completed on schedule during FY23.Table 37 and Table 38 detail the findings of the IEA and Mt Arthur Coal response and agreed action.

Table 37: 2020 Independent Environmental Audit Non-compliance Recommendations and Actions

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
Project Approval (PA09-0062)					
S3 C20	**Impact Assessment Criteria** The Proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the project do not cause exceedances of the criteria listed in Tables 6, 7 and 8 at any residence on privately-owned land (except for air quality affected land listed in Table 1).	Admin Non - Compliance	NC REC 1: Ensure that all non - compliances are recorded in the Annual Review under the Incident Reporting Section.	**Comments** NC REC 1: The evidence referenced in the audit report identified specifically that the Non-compliance related to; 1. *"The Annual Reviews recorded times where the data capture for the TEOM's was not 100%. Although the capture rate was high this still is a non - compliance, as this affects the annual average and some short term results for PM_{10}. DC09 had a data capture of 85% during the FY 2019 period. This triggers a non - compliance in relation to data collection."* Mt Arthur Coal will access and report data capture compliance in the Annual Review consistent with the accepted approach for EPA Annual Return reporting, which includes consideration for scheduled maintenance and calibrations which are in place to ensure compliant operation of the monitoring equipment. 2. *"1 July 2017 - 30 June 2018 - Table 15 (pg 34) from the FY 2018 Annual Review had the MT ARTHUR COAL contribution for the TEOM - DC09 (27 September 2017) as 51µg/m³), which is above the short term criteria for PM_{10}. This was not recorded as a non - compliance in the FY 2018 Annual Review in the Incident Section, however information was provided outlining that DPIE were notified at the time of the exceedance."*	

Table 6: Long term impact assessment criteria for particulate matter

Pollutant	Averaging period	[d] Criterion
Total suspended particulate (TSP) matter	Annual	[a] 90 µg/m³
Particulate matter < 10 µm (PM_{10})	Annual	[a] 30 µg/m³

Table 7: Short term impact assessment criterion for particulate matter

Pollutant	Averaging period	[d] Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	[a] 50 µg/m³

Table 8: Long term impact assessment criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c] Deposited dust	Annual	[b] 2 g/m²/month	[a] 4 g/m²/month

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
				Mt Arthur Coal acknowledges this omission from the non-compliance summary table (Table 3) contained within the Annual Review FY18. The exceedance was reported in Table 15 of the Annual Review FY18. **ACTION** NC REC 1: Update the annual review process document to include a task to ensure that all independent environmental audit actions relating to annual review content are reviewed and included in the Annual Review. **Forecast Completion:** 31 March 2021	**ACTION** NC REC 1: **Complete** Annual review procedure updated to include this requirement. Included in Section **Error! Reference source not found.** of this report.
S3 C33	**Groundwater Monitoring Program** The Groundwater Monitoring Program must include: (a) detailed baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores, that could be affected by the project; (b) groundwater impact assessment criteria; (c) a program to monitor:	Non - Compliant (Low Risk)	NC REC 2: MT ARTHUR COAL needs to have the Site water management plan and the GMP approved by DPIE and undertake any further monitoring considering these approved documents.	**Comments** NC REC 2: MT ARTHUR COAL submitted a new Water Management Plan to DPIE for approval in April 2020, which includes a revised groundwater monitoring program. As at December 2020 Mt Arthur Coal has responded to all Requests for Information relating to the assessment of the Water Management Plan and is awaiting approval of the plan by DPIE. Once approved Mt Arthur Coal will ensure that all further groundwater monitoring is conducted in accordance with the new Water Management Plan. **ACTION** NC REC 2:	**ACTION** NC REC 2: **Complete**

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
	• groundwater inflows to the mining operations; • impacts on regional aquifers; • impacts on the groundwater supply of potentially affected landowners; • impacts on the Hunter River and Saddlers Creek alluvial aquifers; and • impacts on any groundwater dependent ecosystems and riparian vegetation; (d) procedures for the verification of the groundwater model; and (e) reporting procedures for the results of the monitoring program and model verification.		NC REC 3: There are a number of monitoring protocols and procedures which have not been followed in spite of those being recommended: these monitoring protocols recommended in Section 4 of the 2018/2019 Groundwater Annual Review need to be made mandatory to ensure that the results are reliable and reflective of site conditions. It is recommended that quality control for groundwater data is improved. NC REC 4: A number of exceedances that are reported for Hunter River and Saddlers Creek alluvium need to be investigated and the mitigation measure/resolution provided in the next monitoring report.	A new scope of works will be issued to the groundwater monitoring contractor to commence monitoring in accordance with the revised groundwater monitoring program approved in the Water Management Plan. **Forecast Completion:** Within 3 months of approval of the Water Management Plan. **ACTION** NC REC 3: Assess and develop an action plan of all monitoring protocols recommended in the 2018/2019 Groundwater Annual Review and the more recent 2019/2020 reports. **Forecast Completion:** 31 March 2021 **ACTION** NC REC 4: An investigation has been triggered in relation to exceedances that were reported for Hunter River and Saddlers Creek alluvium. The results of the Investigation will be reported to DPIE and included in the next Annual Ground Water Review. **Forecast Completion:** 31 March 2021 **Comments** NC REC 5:	Approval of the WMP by DPE was granted in February 2021. New Scope of works issued, monitoring undertaken in accordance with the WMP. **ACTION** NC REC 3: **Complete** Monitoring protocol have been reviewed by the independent groundwater consultants for this Annual Review period and found to be substantially compliant. **ACTION** NC REC 4: **Complete** Reported in 2019-2020 Annual Review **Comments** NC REC 5:

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
			NC REC 5: GMP 2015 states that as no measurement of inflow volumes can be taken, therefore the modelled values are considered most appropriate method of estimates, unless the trigger values are exceeded. Given that trigger values were exceeded in 2018, 2019 and 2020 the impacts also need to be re-assessed.	The groundwater model was under revision in 2020 but had not been completed at the time of the Audit. The model revision was completed in November 2020. All inflow predictions have been assessed as complaint against EA predictions and the Project Approval. New Trigger levels resulting from this review have been included within the revised Water Management Plan currently with DPIE for approval. **No further action is proposed.**	No further action is proposed.
S3 C34	**Surface and Ground Water Response Plan** The Surface and Ground Water Response Plan must describe the measures and/or procedures that would be implemented to: (a) investigate, notify and mitigate any exceedances of the surface water, stream health and groundwater impact assessment criteria; (b) compensate landowners of privately-owned land whose water supply is adversely affected by the project, including provision of an alternative supply of water to the affected landowner that is equivalent to the loss attributed to the project;	Non - Compliant (Low Risk)	Groundwater: NC REC 6: Annual reporting needs to make a record of no complaints from the private bore owners.	**Comments** NC REC 6: Future annual reports will make a record of no complaints from the private bore owners following a similar format to the most recent 2019/2020 Annual Review that was assessed with this condition. **ACTION** NC REC 6: The annual review process document has been updated to include a task to ensure that all independent environmental audit actions relating to annual review content are reviewed and included in the Annual Review. **Forecast Completion:** Completed – 21/01/2021	**ACTION** NC REC 6: **Complete** Annual review procedure updated to include this requirement. Included in Section **Error! Reference source not found.** of this report.

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
	(c) minimise, prevent or offset potential groundwater leakage from the Hunter River and Saddlers Creek alluvial aquifers; and (d) mitigate and/or offset any adverse impacts on groundwater dependent ecosystems or riparian vegetation.				
S3 C45	**Aboriginal Cultural Heritage Management Plan** The Proponent shall prepare and implement an Aboriginal Heritage Management Plan for the project to the satisfaction of the Secretary. This plan must: (a) be prepared in consultation with OEH, the Aboriginal community, Council and relevant landowners; (b) include the following for the management of Aboriginal heritage on-site: • a plan of management for the Thomas Mitchell Drive Offsite Offset Area (identified in Condition 36); and • a program/procedures for:	Admin Non - Compliance	NC REC 7: Access protocols need to be determined through consultation with Aboriginal Stakeholders. Additional details on the outcome of this consultation will be provided in Section 5.5 of the ACHMP regarding access into the Thomas Mitchell Drive heritage offset area. NC REC 8: Further information is required including location and a procedure for moving and managing items within the Keeping Place. Details should be added about who is allowed to access the Keeping Place.	**Comments** NC REC 7 & NC REC 8: The Aboriginal Cultural Heritage Management Plan was being revised in 2019/2020. However due to Covid-19 restrictions through 2020 consultation with the Aboriginal Community has not been possible. DPIE have been consulted in relation to the delay in finalising the Management Plan due to consultation restrictions. **ACTION** NC REC 7 & NC REC 8: Submit the Aboriginal Cultural Heritage Management Plan incorporating the requirement of NC REC7 and NC REC 8. **Forecast Completion:** 31 August 2021	**ACTION** NC REC 7 & NC REC 8: **Complete** Aboriginal Heritage Management Plan was approved by DPE in February 2022

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
	o salvage, excavation and/or management of Aboriginal sites and potential archaeological deposits within the project disturbance area; o protection and monitoring of Aboriginal sites outside the project disturbance area, including the scarred trees and axe grinding grooves identified on the site; o managing the discovery of any new Aboriginal objects or skeletal remains during the project; o maintaining and managing access to archaeological sites by the Aboriginal community; o ongoing consultation and involvement of the Aboriginal communities in the conservation and management of Aboriginal cultural heritage on the site; and o management of the "Fairford 1" site in situ, including reasonable and feasible measures to mitigate impacts on this site, until an agreement can be reached with relevant Aboriginal stakeholders and OEH, for its salvage and relocation.				

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
S5 C4	**Revision of Strategies, Plans and Programs** Within 3 months of: (a) the submission of an annual review under condition 3 above; (b) the submission of an incident report under condition 7 below; (c) the submission of an audit under condition 9 below; or (d) any modification to the conditions of this approval, the Proponent shall review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within four weeks of the review the revised document must be submitted to the Secretary for approval.	Admin Non - Compliance	NC REC 9: In terms of the timings of updating management plans, this should be completed in accordance with Schedule 5 Condition 4 of the Development Consent.	**ACTION** NC REC 9: All management plans will be reviewed within 3 months of the submission of the IEA Report. Where this review identifies revisions are required, the revision will be undertaken within four weeks of the review. The revised document will then be submitted to the Secretary for approval. **Forecast Completion:** Review Completed: 22 April 2021 Revisions completed (where triggered): 20 May 2021	**ACTION** NC REC 9: **Complete** Reviews of management plans completed during the reporting period. A review of the Blast management plan was triggered as part of these revisions. A revised Blast Management Plan was approved by DPE in February 2022.

<table>
<tr><th>Schedule and Condition Number</th><th>Condition</th><th>Compliance Status</th><th>Recommendations</th><th>Mt Arthur Coal Response</th><th>Status</th></tr>
<tr><td colspan="4">Environment Protection Licence (EPL) 11457</td><td></td><td></td></tr>
<tr><td>M2.2</td><td>Air Monitoring Requirements

POINT 11,12,13,14
<table><tr><th>Pollutant</th><th>Units of measure</th><th>Frequency</th><th>Sampling Method</th></tr><tr><td>PM10</td><td>micrograms per cubic metre</td><td>Continuous</td><td>AM-22</td></tr></table></td><td>Admin Non - Compliance</td><td>NC REC 10: Continue to investigate methods of improving the reliability of continuous and real time monitoring systems to increase data capture.</td><td><u>Comments</u> NC REC 10:

In December 2020 Mt Arthur Coal has implemented a series of alerts to provide early warning when sites go offline. Reports are also distributed daily that provide information on the data capture for the reporting period. This allows for immediate diagnosis of equipment errors and system faults. Mt Arthur Coal believes that this new system satisfies NC REC 10. No further action is proposed.</td><td><u>Comments</u> NC REC 10:

No further action is proposed.</td></tr>
<tr><td>M2.3</td><td>POINT 15
<table><tr><th>Pollutant</th><th>Units of measure</th><th>Frequency</th><th>Sampling Method</th></tr><tr><td>Faecal Coliforms</td><td>colony forming units per 100 millilitres</td><td>Quarterly</td><td>Grab sample</td></tr></table></td><td>Admin Non - compliance</td><td>NC REC 11: Ensure all sampling undertaken to required frequencies for LDP 15.</td><td><u>ACTION</u> NC REC 11:

Develop a compliance action management system (SAP) work management strategy for sampling to ensure sampling is planned and executed in accordance with requirements.

<u>Forecast Completion:</u> 28 February 2021</td><td><u>ACTION</u> NC REC 11:

<u>Complete</u>

SAP protocol implemented in June 2021.</td></tr>
</table>

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response	Status
Key Environmental Commitments 2013 Environmental Assessment					
Groundwater	Groundwater monitoring at the Mt Arthur Coal Mine would continue to be undertaken in accordance with the Ground Water Monitoring Program (BHP Billiton, 2012e). The Ground Water Monitoring Program would be reviewed and, if necessary, revised to incorporate the Modification.	Non - Compliant (Low Risk	NC REC 12: Surface Water and Groundwater Response Plan needs to be updated if the proposed and submitted SWMP is approved by DPIE.	**Comments** NC REC 12: Mt Arthur Coal has submitted a new Water Management Plan to DPIE for approval in April 2020. The New Water Management Plan includes a revised Groundwater Response Plan. As at December 2020 Mt Arthur Coal had responded to all Requests for Information relating to the assessment of the Water Management Plan and is awaiting approval of the plan by DPIE. **No further action is proposed**.	**Comments** NC REC 12: No further action is proposed. WMP Approved in February 2021
Surface and Groundwater Response	The Surface and Groundwater Response Plan (BHP Billiton, 2012f) would be reviewed and, if necessary, revised to incorporate the Modification. Notwithstanding the negligible effects due to the	Non - Compliant (Low Risk	As per Schedule 3 Condition 34 recommendation. Annual reporting needs to make a record of no complaints from the private bore owners.	***Note: this item links directly to NC REC 6 with the comment and action replicated below.*** **Comments** NC REC 6: Future annual reports will make a record of no complaints from the private bore owners following a similar format to the most recent 2019/2020 Annual Review that was assessed with this condition **ACTION** NC REC 6: The annual review process document has been updated to include a task to ensure that all independent environmental audit actions relating to annual review content are reviewed and included in the Annual Review. **Forecast Completion:** Completed - 21/01/21	**ACTION** NC REC 6: ***Note: this item links directly to NC REC 6 completion status outlined above in NC REC 6.***

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response	Status
	Modification predicted at surrounding private bores (Appendix B), consistent with the Project Approval for the Mt Arthur Coal Mine – Open Cut Consolidation Project Statement of Commitments: In the event of interruption to water supply resulting from the Project, an alternative water supply will be provided, until such interruption ceases. The process for identifying and compensating the interruption to water supply resulting from Mt Arthur Coal operations would be in accordance with the "protocol for adverse affects to nearby users" outlined in the Surface and Groundwater Response Plan (BHP Billiton, 2012f).				

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response	Status
Groundwater	In addition, notwithstanding the minor impacts to alluvium associated with the Modification, consistent with the Project Approval for the Mt Arthur Coal Mine – Open Cut Consolidation Project Statement of Commitments: Mt Arthur Coal will continue to monitor hydro-geomorphological conditions and scrutinise for evidence of any groundwater ingress or endwall instability indicators as it progresses the previously approved mining towards the Hunter River Alluvials. Mining (other than that already approved in the MAN [Mt Arthur North] EIS) will not extend beyond a nominal 150 m buffer zone from the Hunter River Alluvials until agreement is reached with DWE	Non - Compliant (Low Risk	NC REC 13: It is recommended that the groundwater model be verified such that the predicted drawdown reflects the observed drawdown and that hydro-geomorphological conditions can be assessed accurately.	**Comments** NC REC 13: The Groundwater Model was revised and verified in 2020. This will be reported on in the next Annual Review. **ACTION** NC REC 13: The annual review process document has been updated to include a task to ensure that all independent environmental audit actions relating to annual review content are reviewed and included in the Annual Review. **Forecast Completion:** Completed - 21/01/21	**ACTION** NC REC 13: **Complete** Annual review procedure updated to include this requirement.

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response	Status
	regarding the installation of a lower permeability barrier along the point of connections of mining and the alluvium or other appropriate safeguards.				

Table 38: 2020 Independent Environmental Audit Improvement Recommendations and Actions

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Demolition/Annual Review	S2 C10 of PA	IMP REC 1	Details of demolition should be included in the Annual Review going forward.	**Comments** IMP REC 1: There is a section in the current Mt Arthur Coal template for the inclusion of Demolition works, however not all demolition works were identified at the time of completing the report., Mt Arthur Coal will ensure that all demolition works are detailed in the Annual Review. **ACTION** IMP REC 1: The annual review process document has been updated to include a task to ensure that all independent environmental audit actions relating to annual review content are reviewed and included in the Annual Review. **Forecast Completion:** Completed - 21/01/21	**ACTION** IMP REC 1: **Complete** Annual review procedure updated to include this requirement. Included in Section 8.18.1 of this report.
Noise Monitoring Locations	S3 C2	IMP REC 2	When a review of the Noise Management Plan is triggered, the monitoring locations table should be updated to provide a reference between the Project Approval and EPL monitoring identification locations.	**ACTION** IMP REC 2: Mt Arthur Coal will include this improvement recommendation in the management plan review process triggered by this IEA **Forecast Completion:** 22 April 2021	**ACTION** IMP REC 2: **Complete** Review register updated with this improvement recommendation.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Traffic Noise Criteria	S3 C6	IMP REC 3	Include reference to the traffic noise criteria and compliance with them in the Annual Reviews. The Annual Review should include information about when the most recent traffic noise assessment was undertaken and when the next one is due.	**Comments** IMP REC 3: Mt Arthur Coal will include reference to traffic noise assessments in Annual Reviews. **ACTION** IMP REC 3: The annual review process document has been updated to include a task to ensure that all independent environmental audit actions relating to annual review content are reviewed and included in the Annual Review. **Forecast Completion:** Completed - 21/01/21	**ACTION** IMP REC 3: **Complete** Annual review procedure updated to include this requirement. Included in Section **Error! Reference source not found.** of this report.
Blasting Hours	S3 C11	IMP REC 4	Include day of week in blast database addition to date to confirm blasting does not occur on Sundays or public holidays.	**ACTION** IMP REC 4: Update the blasting spreadsheet to include the day of the week. **Forecast Completion:** 31 March 2021	**ACTION** IMP REC 4: **Complete** Spreadsheet has been updated.

Air Quality – Impact Assessment Criteria	S3 C20	IMP REC 5	Reporting of exceedances' of criteria, with evidence to be provided by Mt Arthur Coal to support compliance with the 'all reasonable and feasible avoidance and mitigation measures' component of this air quality management condition.	**Comments** IMP REC 5: Mt Arthur Coal reports exceedances to the DPIE in accordance with the approved Air Quality Management Plan. An email notification is provided to the DPIE as soon as practicable after becoming aware of an exceedance of the PM10 24-hour average criterion Assessment Criteria. An investigation is then conducted to validate the monitoring result. The investigation includes calculating the contribution from Mt Arthur Coal mining activities and the reporting evidence of the reasonable and feasible mitigation measures which were implemented in line with the approved Air Quality Management Plan. Mt Arthur Coal currently reports the total number of the cumulative PM10 24-hour average criterion Assessment Criteria in the Annual Review and will provide additional detail to support compliance with the requirement to employ 'all reasonable and feasible avoidance and mitigation measures' where the mine contribution is found to have caused the exceedance of the criteria. The information provided in the previous Annual Review documents has been accepted by the DPIE. **ACTION** IMP REC 5: The annual review process document has been updated to include a task to ensure that all independent environmental audit actions relating to annual review content are reviewed and included in the Annual Review. **Forecast Completion:** Completed - 21/01/21	**ACTION** IMP REC 5: **Complete** Annual review procedure updated to include this requirement. Included in Section **Error! Reference source not found.** of this report.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Air Quality Management Plan	S3 C24	IMP REC 6	We recommend that an independent air quality specialist is engaged to complete a quality check and review of the real time air quality management system. This includes a review of the dust contributions from the site.	**ACTION** IMP REC 6: Engage an air quality specialist to complete a quality check and review of the real time air quality management system. **Forecast Completion:** 31 March 2022	**ACTION** IMP REC 6: Not yet scheduled for completion.
Rehabilitation Management Plan	S3 C44	IMP REC 7	Undertake a complete site soil balance. This is urgent and critical to long term rehabilitation planning and future costings.	**Comments** IMP REC 7: An estimated topsoil balance will be prepared as part of a Topsoil Management Plan. Previous work has been completed to undertake trials in the use of alternative growth media to ensure adequate topsoil materials available for planned rehabilitation activities. This includes trials using Mixed Waste Organic Output (MWOO), prior to the EPA revoking the general and specific Resource Recovery Orders and Resource Recovery Exemptions. **ACTION** IMP REC 7 Revise the Rehabilitation Management Plan (part of the Mining Operations Plan) to include a draft version of the Topsoil Management Plan. **Forecast completion:** June 2021	**ACTION** IMP REC 7 **Complete** Updated Rehabilitation Management Plan with Topsoil Management Plan approved by the Resources Regulator in October 2021.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Rehabilitation Management Plan	S3 C44	IMP REC 8	Soil stockpiles should be either nominated as long-term or short-term stockpiles. Long-term stockpiles should be shaped and seeded. Stockpiles were observed to not be shaped or seeded with cover crop or pastures. Soil stockpiles should be sign posted and the locations updated on a GIS based program (created by the soil balance in Point 1). No stockpile signage was observed.	**Comments** IMP REC 8: Mt Arthur Coal has a topsoil management process detailed in MAC-ENC-PRO-012 Land Management Procedure. MAC also has a GIS database of topsoil stockpile locations supplied to the Auditor as part of the August 2020 information request. **ACTION** IMP REC 8: Revise the Rehabilitation Management Plan (part of the Mining Operations Plan) to include a tracking process that matches the operational requirements and internal planning process within the Topsoil Management Plan. **Forecast completion:** June 2021	**ACTION** IMP REC 8: **Complete** Updated Rehabilitation Management Plan with Topsoil Management Plan approved by the Resources Regulator in October 2021.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Rehabilitation Management Plan	S3 C44	IMP REC 9	Soil stockpiles should be managed for weeds to avoid an increase to the weed seed bank. Stockpile was infested with weeds creating a weed seed bank for future management.	**Comments** IMP REC 9: MAC has a topsoil management process detailed in MAC-ENC-PRO-012 Land Management Procedure. Mt Arthur Coal notes that weeds present in stockpiles are annual species from a seed bank present in topsoil prior to stripping. High rainfall and warm weather broke seed dormancy of the pre-existing seed bank. This is a regional issue. Weeds treatment at Mt Arthur Coal occurs as scheduling of contractors allows. **ACTION** IMP REC 9: Revise the Rehabilitation Management Plan (part of the Mining Operations Plan) to include a more detailed topsoil management process. **Forecast completion:** June 2021	**ACTION** IMP REC 9: **Complete** Updated Rehabilitation Management Plan with Topsoil Management Plan approved by the Resources Regulator in October 2021.
Visual Amenity and Lighting	S3 C52	IMP REC 10	Recommend a Lighting Audit to assess against Australian Standards AS 4282 - 1997. This will cover fixed exterior lighting and interior lighting that could impact the outdoor environment.	**ACTION** IMP REC 10: MAC will undertake a lighting audit of high risk fixed lighting. **Forecast Completion:** 31 January 2022	**ACTION** IMP REC 10: **Complete** Lighting audit commenced in January 2022 and report finalised April 2022.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Waste	S3 C53	IMP REC 11	Ensure all contractor areas are inspected as part of general inspections as these are areas of higher risk of poorer environmental management. Ensure future oil storage and servicing areas are within bunded areas. This recommendation currently relates to the EMECO and Pit Master Areas only.	**Comments** IMP REC 11: The contractor areas referred to in the audit were scheduled for decommissioning at the time of the audit. **ACTION** IMP REC 11: The EMECO and Pit Master Areas will be decommissioned. **Forecast Completion:** 31 December 2021	**ACTION** IMP REC 11: **Complete** Emeco was demobilised from site as previously reported however the area is still in use as a result of change in available work areas at MAC. In light of this change, MAC will continue to complete scheduled audits of the area to ensure sufficient controls are in place for servicing activities. This is in line with the intent of IMP REC 13 below. No further action is proposed.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Waste	S3 C53	IMP REC 12	Consider completing a review of segregation requirements and labelling of bins across site to identify improvement opportunities.	**Comments** IMP REC 12: Mt Arthur Coal has a robust waste management system in place all bins referred to in this recommendation are colour coded to the Australian Standard for mobile bin colours AS 4123.7–2006 and are positioned in designated locations. It is also noted that due to the harsh workshop environments the longevity of labels is limited, which is why the bin colour coding is the preferred identification mechanism in these situations. This system is proving effective an inspection of the bin content during the audit showed that they were being used correctly. **No further action is proposed.**	**Comments** IMP REC 12: No further action is proposed.
Waste	S3 C53	IMP REC 13	Ensure inspections are completed at a higher interval at the Thiess Workshop as the area does not have a setup to trap potentially contaminated water/liquids prior to it leaving the Thiess workshop area. Additional controls could be put in place during servicing within this workshop to prevent leakage of hydrocarbons.	**Comments** IMP REC 13: The Layered audit process is part of the Mt Arthur Coal Field Leadership program and provides a structured audit process for identifying risks and controls, as well implementing any identified corrective actions. **ACTION** IMP REC 13: Undertake a layered audit of the hydrocarbon management and drainage in the Thiess workshop area. **Forecast Completion:** 30 May 2021	**ACTION** IMP REC 13: **Complete** Layered Audit completed in May 2021

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Management Plans	S5 C2	IMP REC 14	Cross referencing tables containing the relevant conditions should be added to Management Plans which have not received a recent update. This would include all relevant conditions of the Development Consent and EPL and commitments from the 2013 Environmental Assessment.	**ACTION** IMP REC 14: The Project Approval Controlled Document Review Checklist MAC-HSE-FRM-001 will be updated to include a requirement to access Cross Referencing tables that include all relevant conditions of the Development Consent and EPL. **Forecast Completion:** 31 March 2021	**ACTION** IMP REC 14: **Complete** Project Approval Controlled Document Review Checklist and associated process has been revised in June 2021 and updated to include a requirement to assess Cross Referencing tables that include all relevant conditions of the Development Consent and EPL.
Incident Reporting	S5 C7	IMP REC 15	Consider improving the information provided in incident reports, this may include the addition of photographs where appropriate, consistent headings and layouts for reports. This will ensure consistency across incident reporting.	**Comments** IMP REC 15: MAC has not had any comments from the EPA or DPIE that incident reporting is not to an acceptable standard. Mt Arthur Coal will however consider this recommendation when writing future reports and will continue to work with the appropriate regulators on further improvements. **No further action proposed.**	**Comments** IMP REC 15: No further action is proposed.
Discharge Monitoring Points	P1.3 of EPL	IMP REC 16	Review and update Surface Water Management Plan and Monitoring Program to reflect the EPL variation.	**Comments** IMP REC 16: The Project Approval Controlled Document Review Checklist MAC-HSE-FRM-001 includes a requirement to review any changes to the EPL since the last management plan review. **No further action is proposed**.	**Comments** IMP REC 16: No further action is proposed.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Blast Monitoring Locations	P1.4 of EPL	IMP REC 17	Clearly identify the EPL monitoring locations and ID within the BMP and Annual Reviews (ie BP04 [EPL ID 7])	**ACTION** IMP REC 17: Mt Arthur Coal will include this improvement recommendation in the management plan review process triggered by this IEA. **Forecast Completion:** 22 April 2021	**ACTION** IMP REC 17: **Complete** Blast Management Plan revised and approved by DPE in February 2022
Pollution of Waters	L1.1 of EPL	IMP REC 18	Implement the PRP for water pipelines in consultation with the EPA.	**Comments** IMP REC 18: Mt Arthur Coal is currently in consultation with EPA regarding the incident and implement the actions that result in accordance with the EPA's requirements. As this process is being controlled by the EPA regulatory instruments. **No further action is proposed**.	**Comments** IMP REC 18: No further action is proposed
Blasting	L6.1 of EPL	IMP REC 19	Include day of week in blast database addition to date to confirm blasting does not occur on Sundays or public holidays.	**ACTION** IMP REC 19: Update the blast database to include the day of the week. **Forecast Completion:** 28 February 2021	**ACTION** IMP REC 19: **Complete** Spreadsheet has been updated

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
Annual Review	CCL 396 Condition 2	IMP REC 20	Include a cross referencing table in the Annual Review outlining the conditions relevant to the Development Consent and Mining Lease.	**ACTION** IMP REC 20: The annual review process document has been updated to include a task to ensure that all independent environmental audit actions relating to annual review content are reviewed and included in the Annual Review. **Forecast Completion:** Completed - 21/01/21	**ACTION** IMP REC 20: **Complete** Project Approval Controlled Document Review Checklist and associated process has been revised in June 2021 and updated to include a requirement to assess Cross Referencing tables that include all relevant Development Consent and Mining Lease conditions.

11 Incidents and Non-compliances

Blast Vibration Incident 23 July 2021

On 23 July 2021 Hunter Valley Energy Coal (HVEC) recorded a ground vibration of 13.5mm/s at the Denman Rd West blast monitor (BP09). BP09 is located on HVEC owned land and installed in accordance with HVEC's approved Blast Management Plan. At approximately 16:16 on 23 July 2021 blast WMn_104_EG_10 (the Blast) was fired in Windmill North Pit adjacent to Denman Rd. The blast registered a Peak Resultant vibration of 13.5mm/s at the Denman Road West monitor (BP09). BP09 was located approximately 2.6km from the blast, on HVEC owned land. BP09 is one of the monitoring points used to assess compliance with the Project approval limit for Residence on privately owned land. The exceedance was reported to DPE and EPA.

Further investigation was undertaken by independent consultants and a regression analysis determined all monitored blast vibration levels resulted in a calculated maximum ground vibration level of 6 mm/s at the nearest private residence to blast monitor BP09A which recorded the elevated ground vibration level of 13.5 mm/s.

As a result of the investigation the Department noted that no exceedance of the 10 mm/s ground vibration criterion occurred at the nearest private residence to BP09. Further follow up action was undertaken further outlined in Section 6.2 where the BP09 monitor was relocated to a new location BP09B, shown in Figure 3. HVEC has included detail on this section however notes that it was determined that no exceedance of the criteria occurred.

CCC Documentation Out of Date – 16 September 2021

On 16 September 2021 DPE contacted HVEC to inform that the CCC documentation on the BHP website was out of date. Upon checking on this day, the documentation was only up to date to 7 May 2020. This is a breach of Schedule 5 Condition 5 – Community Consultative Committee and Schedule 5, Condition 11 – Access to Information.

HVEC uploaded the missing information to the BHP website on 21 September 2021. DPE assessed the breach in accordance with the Departments Compliance Policy, with the Department on this occasion, determined to record the breach with no further enforcement action.

Noise TARP Incident – 18 October 2021

As part of routine attended noise monitoring, independent consultants identified a potential exceedance at monitoring site NP04 when conducting routine monitoring on the evening of 18 October. The initial measurement commenced at 22:58 18 October, which identified mining continuum from Mt Arthur Coal Operations responsible for a site L_{Aeq} of 37dB. An additional 2dB low frequency correction factor was applicable to the reading with the resulting L_{Aeq} of 39dB, exceeding the criterion of 38dB by 1dB. Impact noise preceded by horn and impact sound was responsible for the site $L_{A1minute}$ of 45dB. Reverse alarms were also noted.

In line with the Noise Management Plan (NMP) Section 9.9, appropriate Mt Arthur Coal stakeholders were notified at 23:20 18 October 2021. Operational changes were made in line with the Mt Arthur Noise Trigger Action Response Plan. A remeasure was undertaken resulting in Mt Arthur Coal responsible for a site L_{Aeq} of 36dB with the additional low frequency modifying factor resulting in an L_{Aeq} of 38dB, complying with the criteria. However, a horn and impact sound triggered the $L_{A1minute}$ to reach 47bB this exceeding the criteria of 45dB.

Earlier during the night of 18 October Mt Arthur Coal implemented the Noise Trigger Action Response Plan (TARP) as documented in the NMP. At 22:15 two Level 2 TARP alerts were triggered for two different locations and the OCEs were notified through the real time monitoring system process.

After these alerts were raised, the statutory OCE continued to monitor operations throughout the shift until receiving the call from the independent consultants at 23:20 triggering a Level 3 TARP alert.

HVEC was made aware of the potential exceedance on the morning of 19 October 2021 and subsequently reported the event to DPE. Following this, meteorological data was analysed indicating that at the time of the remeasure, the criteria in PA09_0062 was not applicable as per Appendix 10.

The event was investigated by DPE with a Show Cause notice issued on 26 May 2022. The result of the Show Cause was the issuing of an Official Caution alleging a breach of Section 4.2 of the Environmental Planning and Assessment Act 1979, failing to comply with Schedule 3 Condition 9 of MP09_0062 by failing to implement the Noise Management Plan.

Missed Complaint – January 2022

On 25 January 2022 DPE contacted HVEC with an informal request for information regarding a complaint that had been made on 2 January 2022. Upon further investigation it was found that there had been a system interruption to the complaints handling system between 24 December 2021 and 26 January 2022, preventing HVEC from receiving any complaints through the service provider.

As the system was not active at the time of the complaint HVEC was unable to respond within 48 hours, therefore breaching Schedule 5 Condition 1 of PA09_0062.

A Warning Letter was issued by DPE on 7 February 2022 noting that HVEC had since repaired the service disruption and there was a low likelihood of recurrence, that HVEC had implemented a routine service verification task to assist in identifying and precenting future service interruptions in a timely manner and that HVEC had subsequently requested that the service provider inform them of all future system upgrades.

Overtopping of Mine Water Dam – 8 March 2022

At approximately 5:30am on 8 March it was identified that the Export Sediment Dam (SW23) was overflowing into a culvert and draining offsite towards Ramrod Creek. Water was observed flowing through the rock lined culvert and out towards Ramrod Creek on the northern side of Thomas Mitchell Drive. The sediment/mine water dam was collecting water from the surrounding catchment which includes the coal export area, nearby roads and a significant clean catchment zone. The water travelled approximately 85m onto Crown Land and into Ramrod Creek. The event was reported to DPE and EPA.

In the week leading up to the event Mt Arthur Coal received 141mm of rain, causing the water levels of the dam to rise significantly with 110mm of this falling between Midnight on 6 March to the 8 March when the dam started to overtop. On Monday 7 March temporary bunding was installed at the spillway in response to the rising dam levels. The dam was pumped dry prior to the rainfall event however from 5 March onwards the dam levels increased significantly in response to the heavy rainfall experienced. Although the dam had been pumped dry in preparation for the rain event, due to the continuing heavy rain (73mm falling between 7 March and overtop starting on 8 March) and significant run-off from the already saturated catchment, the water levels continued to rise faster than the diesel and electric pumps in place were able to draw down the water levels causing the overtopping of the dam.

On 8 March from the time the dam started to overtop to 9 March when it ceased flowing Mt Arthur recorded 58mm of rain. The regional rain and flood events experienced during this time throughout the Hunter Valley and East Coast significantly contributed to the overtopping of the dam. As the surrounding catchment of the dam had been saturated from several weeks of consistent rainfall in the area the dam was receiving 100% runoff from the catchment, rapidly filling up the dam and overwhelming drainage infrastructure in the area.

Immediately after the event occurred inspections were undertaken to determine the location of the water flow. Sampling was undertaken in four chosen locations the sample results demonstrated that the impact downstream of the culvert compared to upstream was negligible. As the water left site and passed through the culvert the salinity levels lowered significantly, causing no material harm to the creek.

Further investigation determined that no clean-up of the creek was required. An ongoing improvement project has been underway to manage this mine water dam with de-silting of the dam currently being undertaken.

DPE noted the event and determined to take no further action noting that in the week leading up to the event, HVEC received 141mm of rain, measures were taken prior to and following the incident to prevent from future occurrences. The incident was reported to the Environment Protection Authority and was reviewed during a site inspection.

Groundwater Trigger Exceedances

During the reporting period there were Groundwater Quality and Level trigger events. All trigger events reported to DPE and are detailed in Section 7.4 and 0. Assessment by expert groundwater consultants determined that the trigger events were not caused by mining activities at Mt Arthur Coal.

Mt Arthur will continue to review trigger levels to ensure they are appropriate and where required revise the Site Water Management Plan.

Air Quality Trigger Exceedance

During the reporting period there was 1 cumulative 24-hour PM10 trigger event (Cumulative 24-hour PM10 >50$\mu g/m^3$). The event was reported DPE and is detailed in Section 6.4. An investigation, in accordance with the Mt Arthur Coal Air Quality Management plan, determined that the trigger event was not caused by mining activities at Mt Arthur Coal. In accordance with the site Air Quality Management Plan and Project Approval 09-0062, Mt Arthur Coal employed all reasonable and feasible avoidance and mitigation measures.

12 Activities during Next Reporting Period

Mt Arthur Coal has established the following targets for the next reporting period:

- In the last reporting period Mt Arthur Coal has installed three new systems for unattended noise monitoring with the intention to install two new systems in the coming months with improved capability and technology.
- Update of the Noise Management Plan.
- Mt Arthur Coal will continue to assess and upgrade real time monitoring sites to improve reliability and data capture rates across all real time monitoring including replacements of TEOMs and UPS units.
- Mt Arthur Coal will roll out the use of a newly developed real time monitoring system in FY23.
- Mt Arthur Coal will continue to use remote sensing in the assessment of landform stability as part of the review of the REMP and complete the review of the aerial weed assessment.
- Mt Arthur Coal will continue to investigate and, where feasible, implement projects to reduce fossil fuel energy consumption and greenhouse gas emissions in accordance with BHP's sustainability commitments, including the company's greenhouse gas emission targets.
- Mt Arthur Coal will finalise the installation of a new hydrocarbon management area.
- Improvements to the mine water pipeline network will continue to be undertaken throughout the FY23 reporting period to reduce the risk of pollution of waters from mine water pipeline breaks in accordance with the PRP schedule.
- Mt Arthur Coal will undertake a review of the Water Management Plan to revise groundwater and surface water triggers in accordance with groundwater investigation findings.
- Mt Arthur Coal will commence a project to replace and repair current boreholes and telemetry at boreholes as required.
- Mt Arthur Coal will engage an air quality specialist to complete a quality check and review of the newly implemented real time monitoring system.

These targets will be closely monitored and an update on the status of each will be reported in the next Annual Review.

Table 39 outlines a progress summary of Mt Arthur Coal's performance against targets set for the FY21 period.

Table 39: Mt Arthur Coal's performance against targets for FY21

Target	Status	Performance
Install two new unattended noise monitoring systems in the coming months with improved capability and technology.	Completed	Systems installed with a third installation currently underway.
Review relocation options for BP09 to improve blast monitoring accuracy at neighbouring privately owned residences. If deemed appropriate relocate BP09.	Completed	BP09 relocated to a more appropriate location and Blast Management Plan revised to reflect new location

Target	Status	Performance
Mt Arthur Coal will investigate the use of remote sensing in the assessment of landform stability as part of the review of the REMP and complete the review of the aerial weed assessment.	Ongoing	Initial monitoring completed in FY21. In FY22 improved methodology was achieved by engaging alternate consultancy to complete the work. At the time of writing this report the data was still being processed
Mt Arthur Coal will continue removing waste items and repairing sections of fence that require maintenance in conservation and biodiversity offset areas during the next reporting period.	Completed	New fencing and signage around offsets installed.
During the next reporting period, Mt Arthur Coal will also implement another vertebrate pest management program on site and across all conservation and offset areas. Improvements in the management of rabbits will be a particular focus, with expanded shooting, trapping and baiting programs to be completed.	Completed	The Mt Arthur Coal vertebrate pest management program was implemented on-site, within farming properties (occupied under license), and across all conservation and offset areas. Target pest species included pigs, deer, wild dogs, feral cats and foxes.
The reviewed Aboriginal Heritage Management Plan will be submitted to DPIE and implemented during the 2022 reporting year. Mt Arthur coal is currently working with Elders and other key Aboriginal stakeholders to develop a refresher cultural awareness training package to deliver to the workforce in FY22.	Completed	Reviewed Management Plan approved by DPE 21 February 2022. The MAC Cultural Heritage Awareness training package was reviewed and updated during FY22 and is being progressively rolled out to targeted personnel.
Mt Arthur Coal will continue to investigate and, where feasible, implement projects to reduce fossil fuel energy consumption and greenhouse gas emissions in accordance with BHP's sustainability commitments, including the company's greenhouse gas emission targets.	Ongoing	BHP has committed to maintaining FY22 total GHG emissions at or below the FY17 levels while continuing to grow the business.
New sediment dams and drainage for expanded overburden emplacements in the out of pit emplacement area, will be constructed in accordance with the provisions for sediment retention basins in the Managing Urban Stormwater – Soil and Construction Volume 2E – Mines and Quarries Guidelines (DECC, 2008).	Not Required	During the reporting period a decision was made to reduce the footprint of the out of pit dump. The reduction in footprint resulted in less area of disturbance and the removal of the need for an new sediment dam to the west of the out of pit dump. All runoff from the out of pit dump is now able to be managed with drainage directing runoff to existing water infrastructure.
Improvements to the mine water pipeline network will be undertaken throughout the 2022 reporting period to reduce the risk of pollution of waters from mine water pipeline breaks.	Ongoing	Improvements are still being undertaken with the PRP program to upgrade mine water pipelines due to be completed September 2023.

Target	Status	Performance
Undertake a review of the groundwater monitoring program be rationalised based on recent findings and additional newly installed bores.	Ongoing	The Water Management Plan is currently being revised. This revision will look at the effectiveness and currency of the current groundwater monitoring program.
Review the condition and instrumentation of groundwater bores based on the recommendations the of the annual review assessment report.	Ongoing	Many groundwater bores were reviewed. A capital project is currently being undertaken to upgrade, replace and repair monitoring bores as required.
Engage an air quality specialist to complete a quality check and review of the real time air quality management system.	Complete	Air Quality specialist completed review of real time air quality management system and verified effectiveness.

Appendix 1 - Surface Water Quality Monitoring Results

Surface Water Quality Results

Site	Month	Date sampled	Flow (description)	Field pH	Field EC (uS/cm)	TSS (mg/L)
SW02	Jul-21	26 and 27/07/2021				
	Aug-21	23, 24 and 30/08/2021				
	Sep-21	20 and 21/09/2021				
	Oct-21	18 and 19/10/2021				
	Nov-21	15 and 16/11/2021				
	Dec-21	13 and 14/12/2021				
	Jan-22	10 and 11/01/2022				
	Feb-22	14 and 15/02/2022				
	Mar-22	14 and 15/03/2022				
	Apr-22	11 and 12/04/2022				
	May-22	16 and 17/05/2022				
	Jun-22	14, 15 and 16/06/2022				
	Impact Assessment Criteria Trigger Values		**Stage 1 Trigger**	**6.5< >9.0**	**12365**	**219**
			Stage 2 Trigger		**13900**	**277**
SW03	Jul-21	26 and 27/07/2021	Still	7.78	2628	<5
	Aug-21	23, 24 and 30/08/2021	Still	8.15	2546	<5
	Sep-21	20 and 21/09/2021	Still	8.29	2279	24
	Oct-21	18 and 19/10/2021	Still	7.85	2045	6
	Nov-21	15 and 16/11/2021	Still	7.24	657.6	19
	Dec-21	13 and 14/12/2021	No access due to wet weather			
	Jan-22	10 and 11/01/2022	Still	7.55	3140	10
	Feb-22	14 and 15/02/2022	Still	7.07	2850	6
	Mar-22	14 and 15/03/2022	No access due to wet weather			
	Apr-22	11 and 12/04/2022	Trickle	7.96	3070	7
	May-22	16 and 17/05/2022	Still	7.77	5520	<5
	Jun-22	14, 15 and 16/06/2022	Still	7.77	5110	10
	Impact Assessment Criteria Trigger Values		**Stage 1 Trigger**	**6.5< >9.0**	**10133**	**37**
			Stage 2 Trigger		**11402**	**46**

Site	Month	Date sampled	Flow (description)	Field pH	Field EC (uS/cm)	TSS (mg/L)
SW04	Jul-21	26 and 27/07/2021	Still	7.91	8920	<5
	Aug-21	23, 24 and 30/08/2021	Still	8	11970	<5
	Sep-21	20 and 21/09/2021	Still	8.08	7210	10
	Oct-21	18 and 19/10/2021	Still	8.34	2317	15
	Nov-21	15 and 16/11/2021	Still	7.4	2532	14
	Dec-21	13 and 14/12/2021	Still	7.5	4250	<5
	Jan-22	10 and 11/01/2022	Still	7.39	6380	10
	Feb-22	14 and 15/02/2022	Still	7.89	8290	6
	Mar-22	14 and 15/03/2022	Still	7.71	5340	12
	Apr-22	11 and 12/04/2022	Still	7.73	7840	12
	May-22	16 and 17/05/2022	Still	7.78	8110	<5
	Jun-22	14, 15 and 16/06/2022	Trickle	7.73	7850	<5
	Impact Assessment Criteria Trigger Values		**Stage 1 Trigger**	**6.5< >9.0**	**13959**	**82**
			Stage 2 Trigger		**15509**	**104**
SW12	Jul-21	26 and 27/07/2021	Still	8.02	7440	<5
	Aug-21	23, 24 and 30/08/2021	Still	8.2	8360	8
	Sep-21	20 and 21/09/2021	Still	8.14	7210	12
	Oct-21	18 and 19/10/2021	Still	8.39	4730	15
	Nov-21	15 and 16/11/2021	Trickle	7.42	4190	<5
	Dec-21	13 and 14/12/2021	Trickle	7.89	3690	<5
	Jan-22	10 and 11/01/2022	Still	7.55	502	<5
	Feb-22	14 and 15/02/2022	Dry			
	Mar-22	14 and 15/03/2022	Trickle	8.3	4850	11
	Apr-22	11 and 12/04/2022	Trickle	7.85	5110	9
	May-22	16 and 17/05/2022	Still	7.99	5670	<5
	Jun-22	14, 15 and 16/06/2022	Trickle	7.88	5100	42
	Impact Assessment Criteria Trigger Values		**Stage 1 Trigger**	**6.5< >9.0**	**6659**	**555**
			Stage 2 Trigger		**7153**	**708**
SW15	Jul-21	26 and 27/07/2021	Dam	7.52	1057	6
	Aug-21	23, 24 and 30/08/2021	Dam	7.33	1016	114
	Sep-21	20 and 21/09/2021	Dam	7.59	1168	18
	Oct-21	18 and 19/10/2021	Dam	7.74	990.9	145
	Nov-21	15 and 16/11/2021	Dam	7.49	397	<5
	Dec-21	13 and 14/12/2021	Dam	7.67	45.1	<5
	Jan-22	10 and 11/01/2022	Dam	7.61	697	<5
	Feb-22	14 and 15/02/2022	Dry			
	Mar-22	14 and 15/03/2022	Dam	7.47	459	18
	Apr-22	11 and 12/04/2022	Dam	7.55	1034	10
	May-22	16 and 17/05/2022	Dam	7.42	1006	<5
	Jun-22	14, 15 and 16/06/2022	Dam	7.63	1083	25
	Impact Assessment Criteria Trigger Values		**Stage 1 Trigger**	**6.5< >9.0**	**7128**	**103**
			Stage 2 Trigger		**8262**	**130**

Appendix 2 Ground Water Monitoring Results and Groundwater Level Drawdown Analysis

umwelt
Environmental & Social Consultants

BHP

MT ARTHUR COAL

Groundwater Annual Review – 2021/2022

FINAL

September 2022

MT ARTHUR COAL

Groundwater Annual Review – 2021/2022

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
BHP

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Technical Manager:	Claire Stephenson
Report No.	21576/R09
Date:	September 2022

Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Prepared By		Approved for Issue	
	Name	Date	Name	Date
Draft V1	K Cooksey	26/08/2022	C Stephenson	26/08/2022
Draft V2	K Cooksey	12/09/2022	C Stephenson	12/09/2022
Final V3	K Cooksey	13/09/2022	C Stephenson	13/09/2022

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1.0 Introduction

1.1 Overview

The Mt Arthur Coal (MAC) mine is located approximately 5 km southwest of Muswellbrook within the Muswellbrook Shire Local Government Area (LGA) in the Upper Hunter Valley of NSW and sits within 15 mining leases. MAC consists of open cut pits, a coal handling preparation plant, a rail loop and associated rail loading facilities, in addition to an approved underground operation. Over 2021 and 2022 open cut mining continued at MAC, progressing down-dip to the southwest. Mining occurred in the Windmill, Huon, Calool, Roburgh Pits (collectively known as North Pit) and Ayredale Pit (BHP, 2021a).

Water Management Plan (WMP) (MAC-ENC-MTP-034 v2.1) (BHP, 2021b) dated 6 October 2021 covers approval commitments in Project Approval 09_0062 MOD1 and conditions of Environment Protection Licence 11457. This includes requirements for the monitoring of groundwater, assessment of potential impacts and reporting.

Umwelt (Australia) Pty Limited (Umwelt) has been engaged to undertake a review of the groundwater monitoring data collected from 1 July 2021 to 30 June 2022 (reporting period). This report has been prepared to address conditions of approval relating to groundwater, and as a requirement of MAC's 2021/2022 Annual Environmental Management Review (AEMR).

1.2 Groundwater Management Plan

The WMP includes a Groundwater Monitoring Program, in accordance with Schedule 3 Condition 29 and 33 of Development Consent 09_0062. The Groundwater Monitoring Program outlined in Section 9.3 of the WMP details the monitoring methodology, monitoring locations, frequency impact assessment criteria (water levels and quality), mine inflows/licensing, impacts to private bores and groundwater dependent ecosystems (GDEs), cut-off wall and flood levee monitoring and monitoring records.

The WMP was updated 10 December 2020 and approved by the Department of Planning and Environment (DPE) on 6 October 2021. Updates to the WMP were made based on additional work conducted on site and numerical modelling. This included fieldwork by Carbon Based Environmental Ltd (CBE) in September 2020 to check the condition and construction of the bore network, and a subsequent desktop network review conducted by SLR (2020a). The findings from the network review were used to inform the current compliance monitoring network details in the WMP, discussed in **Section 3.1**.

In 2020 an updated numerical groundwater model was developed by SLR (2020b), which was calibrated with observation data to June 2020. The predictions for approved operations from the updated numerical model were used to inform the proposed water level triggers. The groundwater monitoring locations, schedule and triggers from the WMP are presented in **Appendix A** and discussion on the network included in **Section 3.1**. Over the reporting period groundwater monitoring and reporting was conducted at MAC in accordance with the WMP (MAC-ENC-MTP-034, V2.1) (BHP, 2021b). Discussion on data recovery over the reporting period is included in **Section 3.2**. The threshold criteria as outlined in Section 10 Response Plan of the WMP is included in **Table 1.1**.

Table 1.1 Groundwater Exceedance Protocol

Analyte	WMP Trigger Level	Exceedance Protocol
pH	pH values recorded outside the 5th and 95th percentile for three consecutive monitoring periods shall trigger the groundwater quality exceedance response.	Step 1: Notify the DPE of an 'interim exceedance' as soon as practicable after becoming aware of the exceedance and relevant information required for the notification is confirmed (including preliminary quality assurance of information). Step 2: If quality assurance check of the sampling procedure and analytical data acquired, reported and entered, the trigger value is still exceeded, then an investigation of the exceedance should be carried out and reasons for the exceedance identified. Step 3: Consult with the DPE to determine if a written report on the exceedance will be required and implement identified corrective/preventative actions.
Electrical Conductivity (EC)	Stage 1 – measured values that are above the 95th percentile level for one monitoring period.	Step 1: Quality assurance check of the sampling procedure and analytical data acquired, reported and entered. Step 2: For a single exceedance of a 1st stage trigger value, no further action is required other than to record the exceedance. If the 1st stage trigger value of the same parameter is exceeded at the same location for three consecutive sampling events, then the actions required for exceedance of the 2nd stage trigger values should be carried out.
	Stage 2 – measured values above historic maximum values for two consecutive monitoring periods shall trigger the groundwater quality exceedance response.	Step 1: Notify the DPE of an 'interim exceedance' as soon as practicable after becoming aware of the exceedance and relevant information required for the notification is confirmed (including preliminary quality assurance of information). Step 2: If quality assurance check of the sampling procedure and analytical data acquired, reported and entered, the trigger value is still exceeded, then an investigation of the exceedance should be carried out and reasons for the exceedance identified. Step 3: Consult with the DPE to determine if a written report on the exceedance will be required and implement identified corrective/preventative actions.
Water Level	Any monitoring bore groundwater level or vibrating wire piezometer groundwater head pressure record below the trigger level for three consecutive monitoring periods shall trigger the groundwater level exceedance response.	Step 1: Notify the DPE of an 'interim exceedance' as soon as practicable after becoming aware of the exceedance and relevant information required for the notification is confirmed (including preliminary quality assurance information). Step 2: If quality assurance check of the sampling procedure and analytical data acquired, reported and entered, the trigger value is still exceeded, then an investigation of the exceedance should be carried out and reasons for the exceedance identified. Step 3: Consult with the DPE to determine if a written report on the exceedance will be required and implement identified corrective/preventative actions.

2.0 Hydrogeological Setting

2.1 Climate

The climate within the MAC area is sub-tropical, with temperatures, rainfall and evaporation highest over the summer months of December to February. Climate data was obtained from the Scientific Information for Land Owners (SILO) database of historical climate records for Australia hosted by the Department of Environment and Science (DES). This service interpolates raw rainfall and evaporation records obtained from the Bureau of Meteorology (BOM), with data gaps addressed through data processing in order to provide a spatially and temporally complete climate dataset.

Climate data was obtained for a SILO grid point (Latitude -32.35, Longitude 150.85) at MAC between 01/01/1900 to 30/06/2022. A summary of rainfall data for SILO is presented in **Table 2.1**. The rainfall data indicates slightly higher rainfall over the summer months, from December to February. Based on the SILO dataset, the historical average annual rainfall is 609.16 mm.

Table 2.1 Monthly Rainfall (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Historical Average	72.57	65.40	57.06	42.44	36.65	46.01	42.63	36.73	41.71	48.68	57.16	62.11	**609.16**
2021	82.40	106.60	162.10	13.50	18.60	71.30	31.00	35.10	28.40	62.40	225.30	71.20	**907.90**
2022	76.10	57.50	209.30	23.80	49.90	7.10	-	-	-	-	-	-	-

Note: Based on SILO dataset date range January 1900 to June 2022

The SILO database provides the most complete long-term dataset and is therefore the most useful for assessing long term rainfall trends in the vicinity of MAC. Monthly records from the SILO dataset were used to calculate the Cumulative Rainfall Departure (CRD). The CRD shows graphically trends in recorded rainfall compared to long-term averages and provides a historical record of relatively wet and dry periods. A rising trend in slope in the CRD graph indicates periods of above average rainfall, whilst a declining slope indicates periods when rainfall is below average. A level slope indicates average rainfall conditions.

Figure 2.1 shows the CRD and total monthly rainfall. The graph indicates the area has generally experienced a period of relatively average rainfall from 2000 to 2007. Above average rainfall was experienced from 2007 to 2017. From 2017 to 2020 the area experienced below average rainfall and since the start of 2020 the area has experienced above average rainfall.

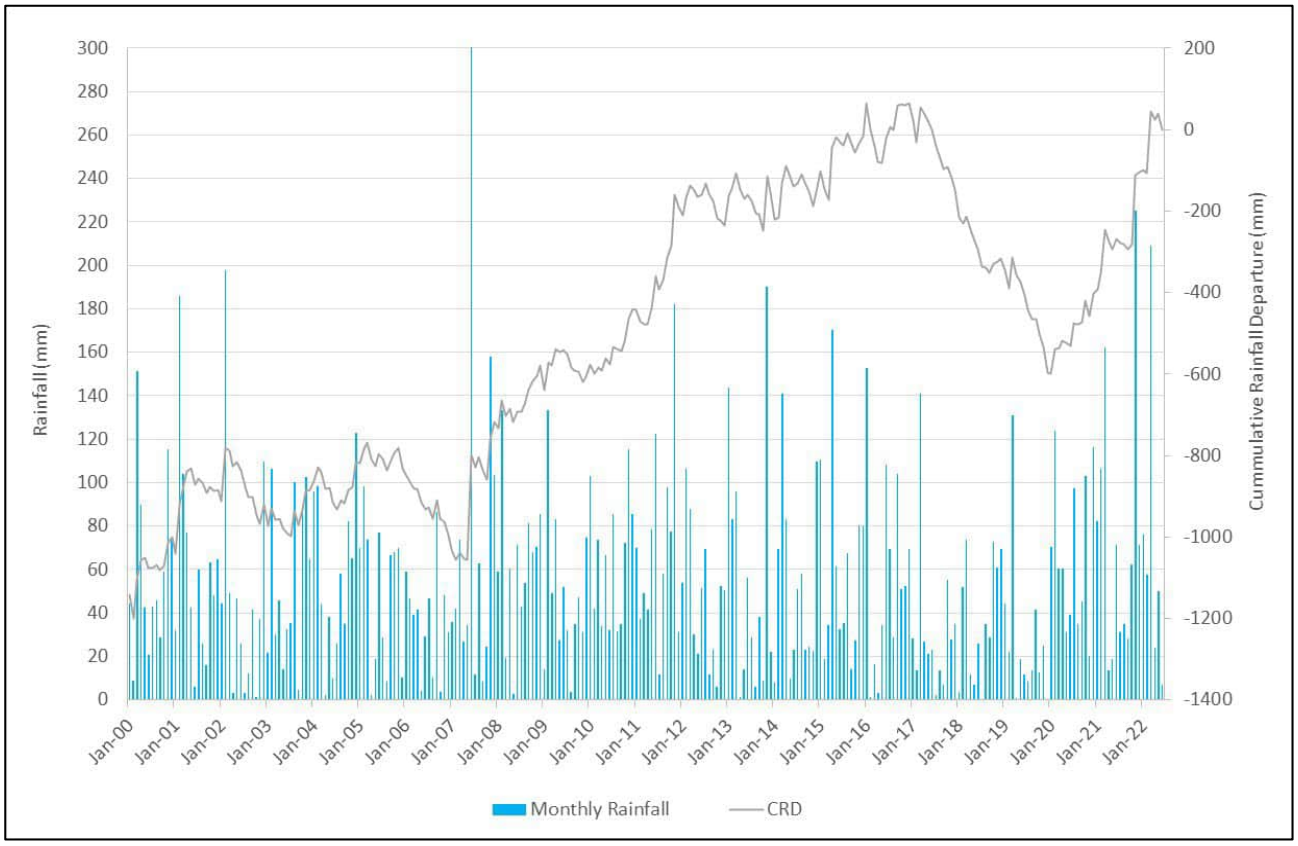


Figure 2.1 SILO Monthly Rainfall and CRD

2.2 Terrain and Drainage

The surface topography at MAC varies between approximately 127 metres (m) Australian Height Datum (AHD) to the northwest of the site along Whites Creek and rises up to a maximum of approximately 465 mAHD on the top of Mt Arthur to the south of the site. Within MAC, the surface areas are drained by Saddlers Creek and its tributaries to the southeast, as well as Quarry Creek, Whites Creek and Ramrod Creek that all flow towards the Hunter River.

Saddlers Creek is an ephemeral creek that is around 5 to 10 m wide and consists of sand, silt and scattered woody debris (EcoLogical, 2019). Historically, high flow events occurred in response to rainfall events, with available data indicating the majority of stream flow occurred in the summer months, from January to March, with negligible flows from July to December. Over the reporting period Saddlers Creek was recorded as still with no perceptible flow.

Within the region, the Hunter River is around 20 to 50 m wide, and the river flows in a south to south-easterly direction. Flows within the Hunter River are monitored at gauging stations under the Hunter Integrated Telemetry System (HITS) operated by WaterNSW. The Hunter River has perennial flows, generally ranging between 100 ML/day and 1,000 ML/day. Recent high flow/flood events, with flows over 2,000 ML/day, were recorded along the Hunter River at gauging site 210002 in March and June 2021, November to December 2021 and March 2022 as shown in **Figure 2.2**.

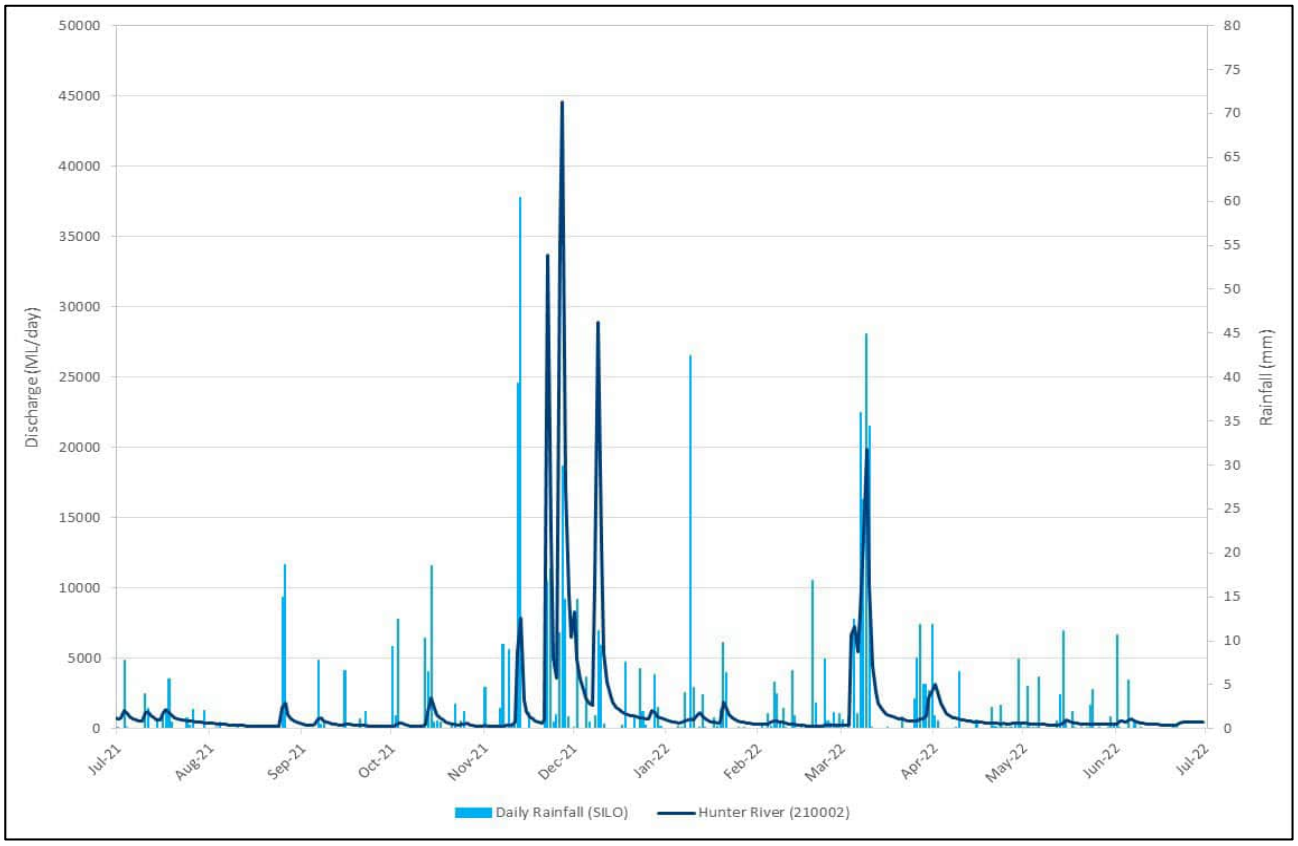


Figure 2.2 Hunter River Flow and Daily Rainfall Over Monitoring Period

2.3 Hydrogeology

2.3.1 Hunter River Alluvium

The Hunter River alluvium generally comprises surficial clays underlain by sands and gravels. The alluvium can be variably saturated spatially and temporally, with unconfined groundwater conditions and fresh to brackish water quality. The alluvium is recharged from rainfall and streamflow. The water levels in the alluvium are generally 5 to 10 m below surface and approximately 2 m below the base of the Hunter River, indicating variable losing conditions depending on peak flood events. There is also potential for upward seepage from the underlying Permian coal measures where gradients enable this.

Groundwater flow in the alluvium generally follows the Hunter River flow direction and topography.

2.3.2 Saddlers Creek Alluvium

The Saddlers Creek alluvium is unconfined and recharged from occasional streamflow and rainfall, with potential recharge from water storage in localised areas. The alluvium also potentially receives upward seepage from the underlying coal measures, with coal seams occurring at subcrop beneath the alluvium.

The water levels in the alluvium have been recorded around 3 to 10 m below surface, indicating losing conditions. However, gaining conditions can occur downstream near the confluence with the Hunter River. The water quality in the alluvium along Saddlers Creek has been characterised as moderately saline (SLR, 2020a).

2.3.3 Permian Coal Measures

The Permian coal measures include the hydraulically 'tight' interburden sequences of siltstone and sandstone, and the coal seams that exhibit secondary porosity associated with the fractures and cleats in the coal. The coal measures occur at subcrop in the north and east of MAC where groundwater conditions are semi-confined, becoming confined with depth. The coal measures are recharged by rainfall and downward seepage from overlying alluvium, regolith and spoil. Groundwater flow in the coal measures is locally influenced by mining at MAC, Drayton and Bengalla, but is generally towards the south. The water quality is moderately saline (SLR, 2020a).

3.0 Groundwater Monitoring Program

3.1 Groundwater Monitoring Network

The groundwater monitoring network at MAC is comprised of a series of monitoring bores and vibrating wire piezometers (VWPs), as shown in **Figure 3.1** and detailed in **Appendix A**. The groundwater monitoring network outlined within the WMP includes:

- 22 monitoring bores, including:
    - four bores along Saddlers Creek alluvium, one of which intersects both alluvium and regolith
    - five bores within Hunter River alluvium
    - one bore in the regolith near Saddlers Creek
    - twelve monitoring bores predominantly targeting coal seams down to the Ramrod Creek Seam.
- Six VWPs with sensors in the interburden and coal seams, including:
    - two sites (VWP2 and VWP3) around the mapped F4 fault with a sensor in the fault zone at 216.5 mbgl (VWP2), a sensor in the Edinglassie Seam at 227 mbgl (VWP3 P1) and a sensor in the Ramrod Creek Seam at 241 mbgl (VWP3 PL2)
    - four sites (VWP04 to VWP07) southwest of MAC open cut with sensors in the different coal seams.

Monitoring of groundwater levels and groundwater quality is undertaken at the bores detailed in the WMP, and defined below:

- Groundwater Level (22 bores):
    - Manual groundwater elevation/depth to groundwater every three months.
    - Timeseries groundwater level data is recorded with data loggers installed in selected alluvial bores, as indicated in **Appendix A**.
    - VWP data logger download, and verification and validation of instrument drift and correction.
- Groundwater Quality Analysis (20 bores):
    - Standard – quarterly: Field readings of water temperature, pH and EC, as well as laboratory analysis of pH, EC, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), dissolved iron, sulphate, chloride, calcium, magnesium, potassium, sodium, carbonate and bicarbonate.
    - Comprehensive – annually: the standard analyses with the addition of total phosphorus, aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc. All metals and metalloids required as dissolved analytes.

Groundwater quality sampling is undertaken quarterly in accordance with AS 5667.1-1998, *Guidance on the Sampling of Groundwater's,* by Carbon Based Environmental (CBE). Field sheets, detailing the sample location, date, time, field EC, field pH and water level below top of casing are completed by CBE during each monitoring round. The field sheets and database compiled by CBE have been reviewed by Umwelt for this report.

3.2 Data Recovery

The WMP specifies the monitoring frequency and trigger levels for groundwater level and groundwater quality for the monitoring network. This includes water quality monitoring at 20 bores and water level monitoring at 28 sites, which includes 22 bores and six VWPs.

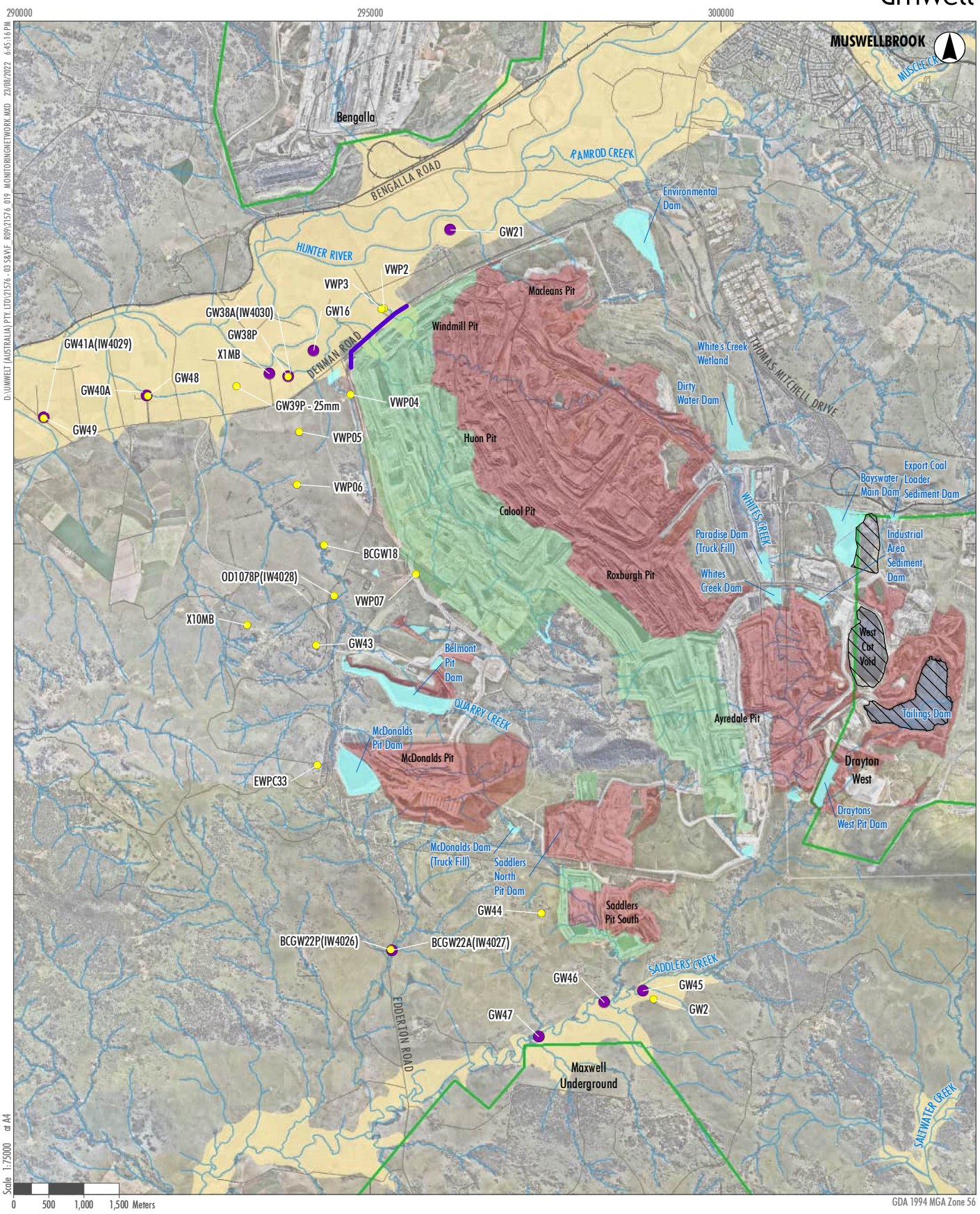
Groundwater levels in all of the 22 monitoring bores specified in the WMP were monitored over the reporting period. All VWP sites were operational over the reporting period. The individual sensors within each VWP site sit vertically above each other at different elevations within a sealed hole. When individual sensors fail it is not possible to replace them. The VWP site still provides valuable information from the other functioning sensors, therefore there has been no recommendations historically to replace individual sensors that have failed. Six sensors in the deeper seams failed prior to the reporting period at VWP3 PL2 (Ramrod Creek), VWP05 (Edinglassie), VWP05 (Ramrod Creek), VWP06 (Vaux), VWP06 (Ramrod Creek) and VWP07 (Ramrod Creek) and are no longer used. Data is still being collected by the shallower sensors at each of these VWP sites. It is recommended the VWPs are maintained in the WMP, but the individual sensors that have failed be removed from ongoing monitoring and reporting requirements.

Of the 20 bores included for water quality monitoring schedule, 19 were sampled; bore BCGW18 was dry over the reporting period.

Sites with a data capture rate less than 100 per cent are outlined in **Table 3.1**.

Table 3.1 Groundwater Monitoring Data Recovery

Bore/VWP ID	Type	Data Recovery	Comment
BCGW18	WL/WQ	0 %	Bore dry



Legend

- Surrounding Mines
- Active Mining Area
- Overburden Emplacement Area
- Tailings Storage Facility
- Water Management Dam
- Cut-off Wall
- Alluvium Extent
- Alluvium Monitoring Bore
- Permian Coal Measure Monitoring Bore
- Railway
- Roads
- Watercourse

FIGURE 3.1

Groundwater Compliance Monitoring Network

Image Source: Nearmap (May 2022) Data source: Qspatial (2021)

4.0 Groundwater Levels

Groundwater levels for the WMP compliance bore network, as shown in **Figure 3.1**, are summarised in **Table 4.1**. Details of the compliance bore network presented in **Appendix B** summarises:

- bore details including surveyed location, elevation, depth and target formation
- groundwater levels measured in each bore (initial measurement, July 2021 and June 2022)
- change in groundwater levels since records commenced and for the period July 2021 to June 2022
- groundwater levels predicted by the numerical model for July 2021 to June 2022
- difference in groundwater levels predicted by the numerical model and measured in the monitoring network.

Groundwater level graphs are presented in **Appendix C**. The graphs show instrument drift in the installed dataloggers, and it is recommended that the loggers in GW39P-25mm and GW45 be replaced to assist in correlating groundwater trends with rainfall and streamflow trends. The logger data collected for X1MB, via Ontoto, requires conversion to water level (mbgl).

Table 4.1 Groundwater Level Monitoring Results – July 2021 to June 2022

Aquifer	Bore ID	Trigger Level (mAHD)	Depth to Water (mAHD)			
			Q1	Q2	Q3	Q4
Hunter River Alluvium	GW16	120.90	122.40	123.55	122.96	122.88
	GW21	125.00	126.72	128.16	127.12	126.95
	GW38A (IW4030)	120.70	122.10	123.21	123.38	122.78
	GW40A	117.80	119.34	120.31	120.33	120.55
	GW41A (IW4029)	117.90	119.20	119.45	119.48	119.58
	X1MB	119.70	121.07	123.07	121.21	121.18
Saddlers Creek Alluvium	GW45	138.90	140.47	143.29	144.31	143.19
	GW46	129.00	135.20	136.62	136.93	137.12
	GW47	127.30	129.47	130.15	130.28	130.41
Saddlers Creek Shallow Permian	BCGW22A (IW4027)	137.60	139.20	140.26	139.92	140.40
Permian Coal Measures	BCGW18	147.30	Dry			
	BCGW22P (IW4026)	133.70	136.51	138.56	139.18	139.68
	EWPC33	194.30	198.14	198.08	199.02	203.72
	GW2	133.20	142.63	142.99	143.51	144.40
	GW38P	120.90	121.51	122.35	122.76	121.93
	GW39P	116.00	120.32	121.13	120.49	120.67
	GW43	165.40	167.99	168.80	169.28	169.54
	GW44	99.90	**98.40**	**98.24**	**97.99**	**97.93**
	GW48	117.70	119.23	120.22	120.24	120.41
	GW49	117.60	118.86	118.84	119.24	119.40
	OD1078P (IW4028)	134.60	136.63	134.86	134.89	134.99
	X10MB	174.90	183.02	183.20	183.70	183.79

4.1 Drawdown

Figure 4.1 shows the change in groundwater levels in the alluvium and **Figure 4.2** shows the change in groundwater levels the Permian coal measures. The calculated total drawdown is based on the difference between the first recorded groundwater level measured at each bore as shown in the table in **Appendix B** compared to levels recorded in June 2022. A negative value represents a decline in water levels, while a positive value represents a rise in water levels over the reporting period.

Figure 4.1 shows there has generally been a negligible change in water levels within the Hunter River alluvium. However, the change in total drawdown did vary spatially, with bores closer to mining (GW16, GW21, X1MB) recording a minor decline in levels, while bores further to the west (GW38A (IW4030), GW40A, GW41A (IW4029)) recorded a slight increase in water levels.

Groundwater levels in the bores along Saddlers Creek have fluctuated over time, potentially in response to rainfall trends, with an overall increasing trend in groundwater levels since the end of 2020. However, since monitoring began in 2016 there has been an overall minor decline in water levels (increased drawdown) within the Saddlers Creek alluvium (**Figure 4.1**). The change in total drawdown varied spatially, with bore GW45, located in the upper reaches of Saddlers Creek, recording the most drawdown.

Figure 4.2 shows a general decline in groundwater levels within the Permian coal measures to the southwest of open cut operations, showing a response to the progression of mining to the southwest. However, in-pit water storage (Belmont, MacDonald and Saddlers pits) potentially buffers the extent of drawdown in localised areas.

4.2 Trigger Exceedances

Groundwater level data collected over the reporting period have been compared to the trigger values outlined in the WMP. Bores BCGW18 and GW44 and VWPs VWP3 (P1), VWP04 (all seams), and VWP07 (Piercefield Seam) recorded groundwater level exceedances. A summary of the exceedances is presented in **Table 4.2**.

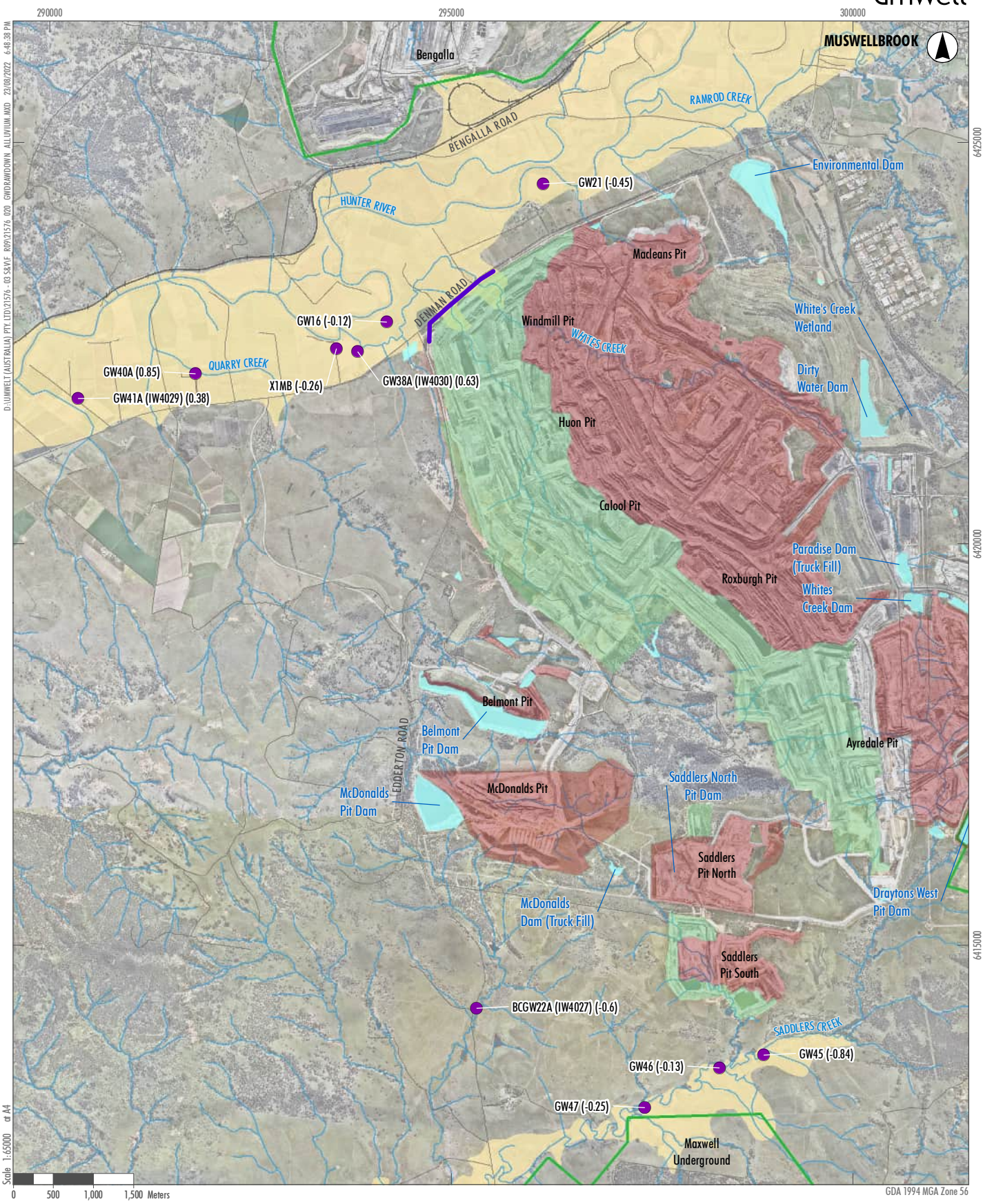
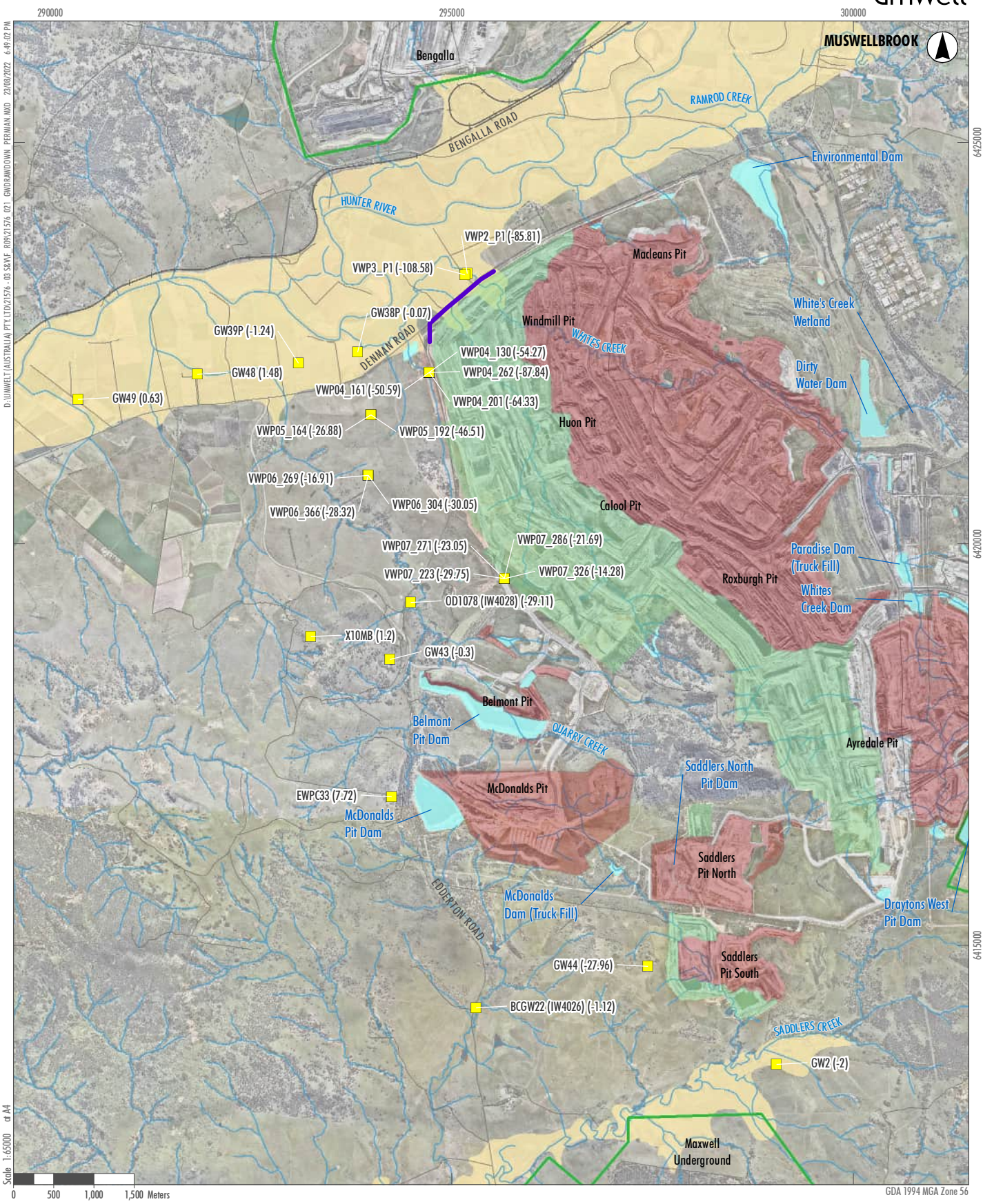


FIGURE 4.1

Total Groundwater Drawdown to June 2022
Alluvium

Image Source: Nearmap (May 2022) Data source: NSW DFSI (2021)



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Scale 1:65000 at A4

FIGURE 4.2

Total Groundwater Drawdown to June 2022
Permian Coal Measures

Image Source: Nearmap (May 2022) Data source: Qspatial (2021)

Table 4.2 Groundwater Level Trigger Exceedances

Bore ID	Exceedance	Screened Lithology	Location	Comment	Action
BCGW18	Six water level readings below trigger level of 147.30 mAHD since March 2021	Arrowfield Seam	On site – west of MAC	The purpose of bore BCGW18 is monitoring of the Arrowfield Seam, close to an old channel of Quarry Creek, and to monitor the impact of mining activities adjacent to mining areas to the west of MAC. The bore is located within 1 km of the open cut pit and close to an old channel of Quarry Creek and west of MAC open cut (Huon Pit). Groundwater levels in bore BCGW18 have gradually declined since October 2012 and has been recorded as dry and below the trigger level of 147.3 mAHD, since March 2021. Comparison between modelled and observed water levels (refer **Figure 4.3**) indicates that depressurisation of the coal seam was predicted at BCGW18.	Initial review indicates no adverse impacts beyond those predicted for the approved operations. The trigger exceedances were reported to DPE in June 2022. It is recommended that the bore be removed from the WMP as a compliance bore but continue monitoring water levels for future closure planning.
GW44	Seven water level readings below trigger level of 99.9 mAHD since December 2020	Woodlands Hill Seam	On site – west of Saddlers Pit South	The purpose of bore GW44 is monitoring of groundwater response in the Woodlands Hill Seam to mining. The bore is located 200 m west of Saddlers Pit. The field sheets indicate that a total depth check on the bore is not conducted during field monitoring. The depth should be checked and any sediment in the base of the bore should be cleaned out, if required. The 2020 network review (Umwelt, 2021a) recommended that GW44 be used for water level monitoring only as sampling is difficult due to the depth of the bore (133 m). Groundwater levels in GW44 have gradually declined since July 2018, declining below the water level trigger of 99.9 mAHD from December 2020 onwards. Comparison between modelled and observed water levels (refer **Figure 4.4**) indicates that depressurisation of the coal seam was predicted at GW44. However, the model shows a delay in the timing compared to the observed data. This may relate to timing within the model drain package.	Initial review indicates depressurisation of the coal seam was predicted in this area; however, there is a difference in the timing that may relate to how the model drain package represents actual mine progression at site. The trigger exceedances were reported to DPE in June 2022. It is recommended the water level trigger be updated in the WMP review which is currently in progress.

Bore ID	Exceedance	Screened Lithology	Location	Comment	Action
VWP04	Pressure levels below trigger levels of: 42.2 mAHD (Vaux) 37.3 mAHD (Bayswater) 22.0 mAHD (Edderton) -7.5 mAHD (Edinglassie) -12.6 mAHD (Ramrod) in all coal seams monitored since October 2020	Vaux Seam Bayswater Seam Edderton Seam Edinglassie Seam Ramrod Creek Seam	On site - immediately west of MAC open pit (Windmill Pit)	Levels in the Vaux, Bayswater, Edderton, Edinglassie, and Ramrod Creek seams have exceeded the trigger levels since October 2020 (refer **Figure 4.5).** The continuing declining groundwater level trend represents mining induced depressurisation as predicted for the approved operations by SLR (2020b). The VWP is located approximately 90 m from active mining. SLR (2020b) predicted continued drawdown in this area with simulated water levels ranging between -35.4 mAHD (Vaux) and -158.8 mAHD (Ramrod Creek) in June 2022 (refer **Figure 4.6**). The measured water levels ranged from 22.8 mAHD (Vaux) to -26.8 mAHD (Ramrod Creek) in June 2022. The SLR (2020b) model predicted greater drawdown than observed and the trigger levels should be reviewed to align with levels in the latest model predictions in the next review of the WMP.	Initial review indicates no adverse impacts beyond those predicted for the approved operations. The trigger exceedances were reported to DPE in June 2022. Review trigger levels to align with levels in the latest model predictions in the WMP review currently in progress.
VWP07 (Sensor 1)	Pressure levels below trigger level of 94.5 mAHD since October 2021	Piercefield Seam	On site - west of MAC open pit (Windmill Pit)	Levels in the Piercefield Seam have exceeded the trigger level since October 2021 (refer **Figure 4.7**). The continuing declining groundwater level trend represents mining induced depressurisation as predicted for the approved operations by SLR (2020b). SLR (2020b) predicted continued drawdown in this area with simulated water levels in all seams ranging between 113.2 mAHD (Piercefield) and 9.8 mAHD (Edderton) in June 2022 (refer **Figure 4.8**). The measured water levels ranged from 93.8 mAHD (Piercefield) to 80.5 mAHD (Edderton) in June 2022. The SLR (2020b) model predicted slightly lower starting heads in this location but does capture the trend of declining groundwater head over time consistent with the observed data.	Water level readings have exceeded the trigger threshold and should be notified. The exceedance was not notified previously as data was not downloaded due to access issues because of flooding in the area. Initial review indicates no adverse impacts beyond those predicted for the approved operations and triggers should be reviewed in consideration of the model limitations.

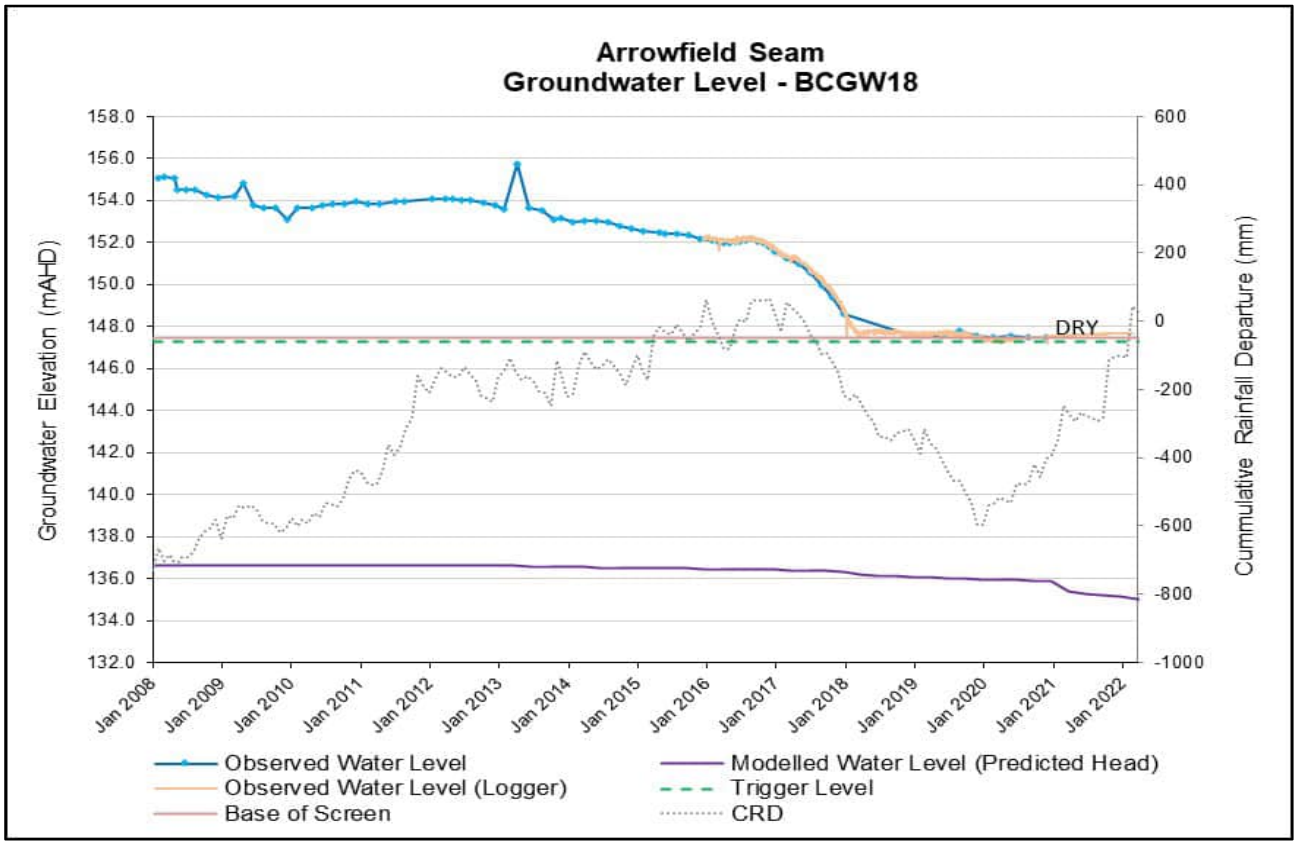


Figure 4.3 BCGW18 – Modelled and Observed Water Levels

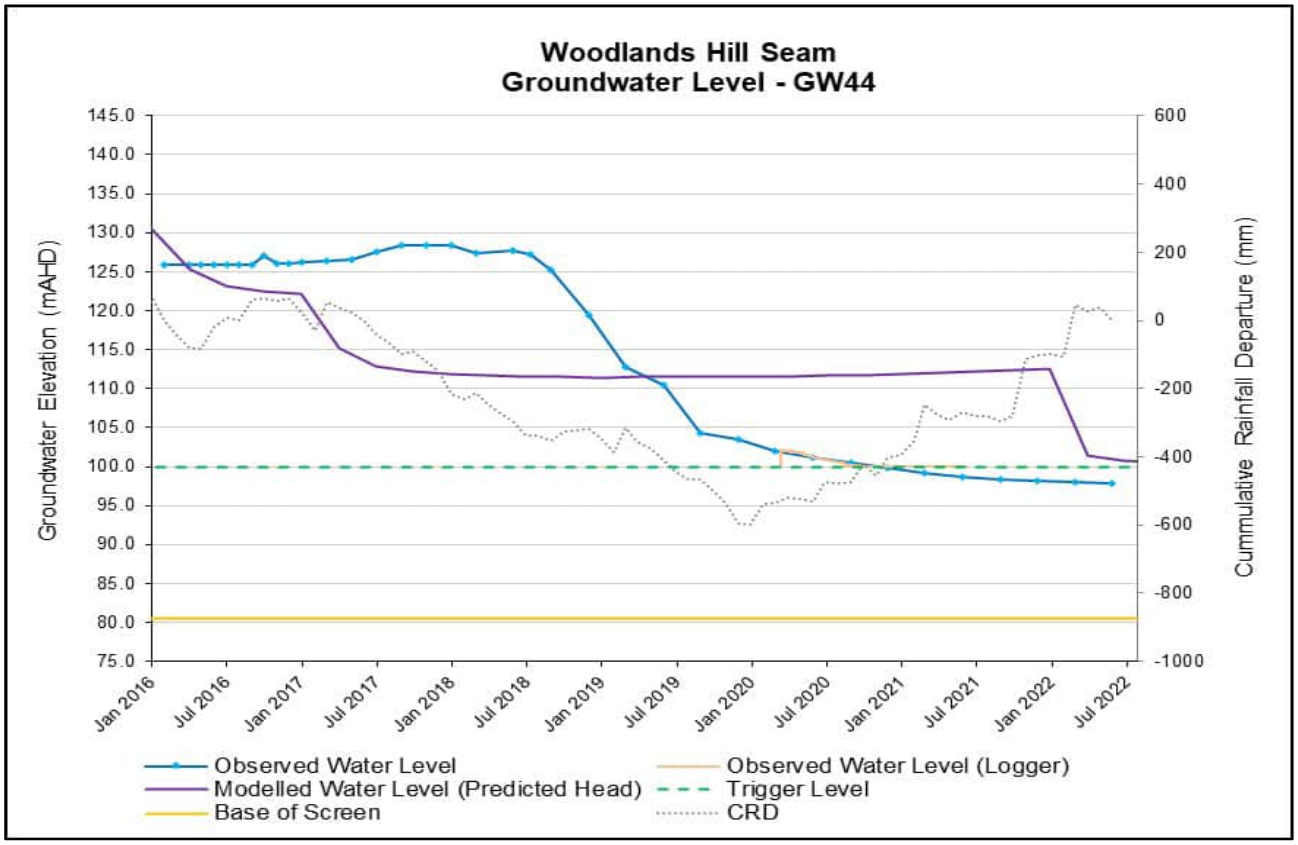


Figure 4.4 GW44 – Modelled and Observed Water Levels

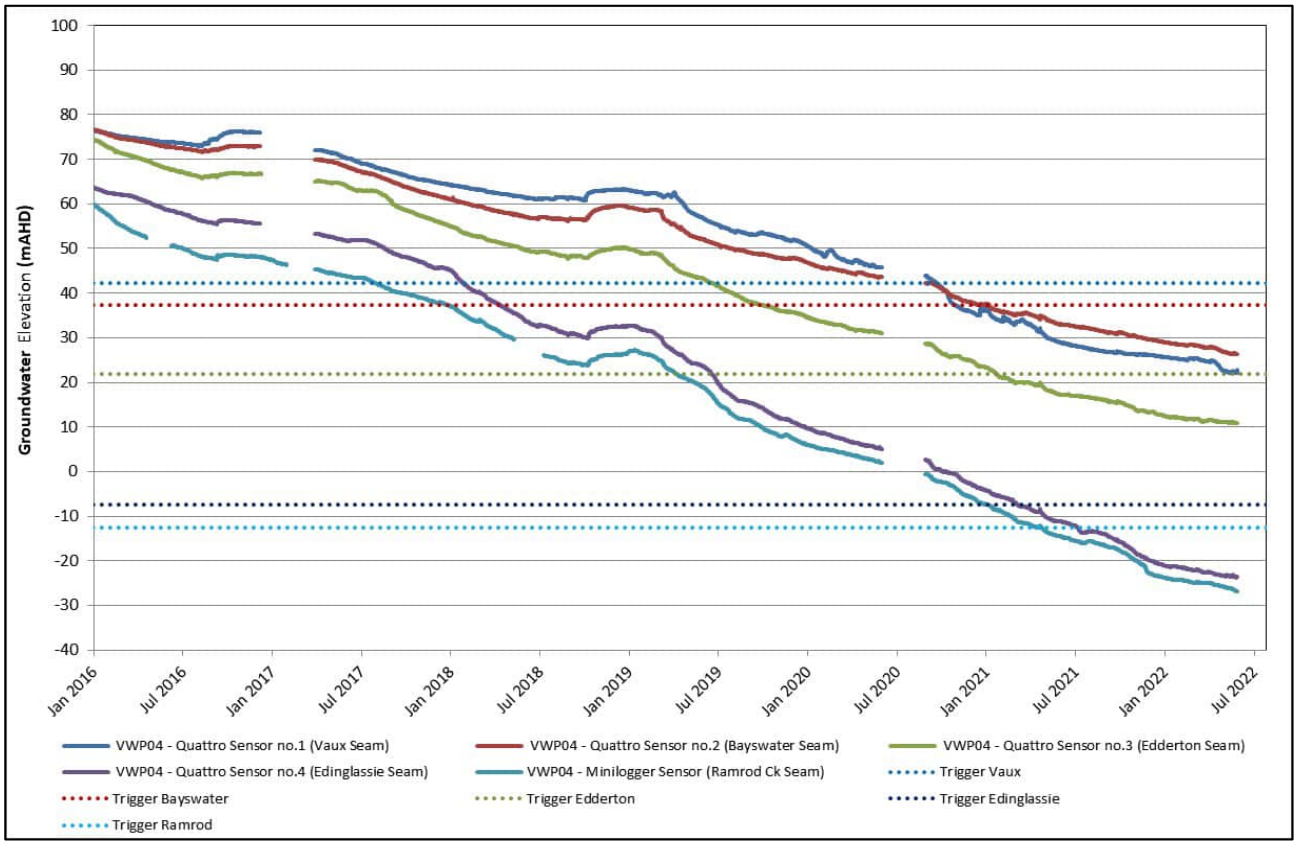


Figure 4.5 VWP04 – Trigger Levels

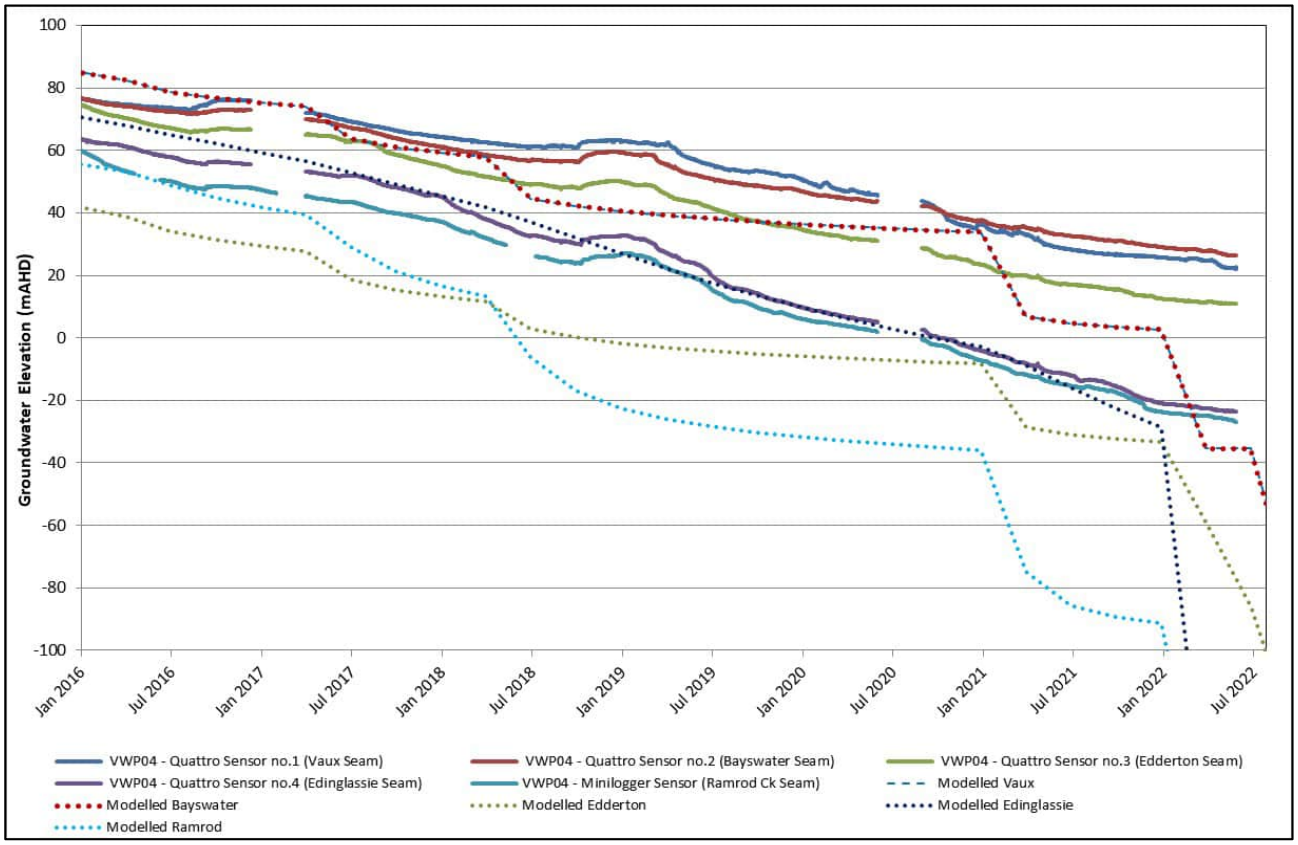


Figure 4.6 VWP04 – Modelled and Observed Water Levels

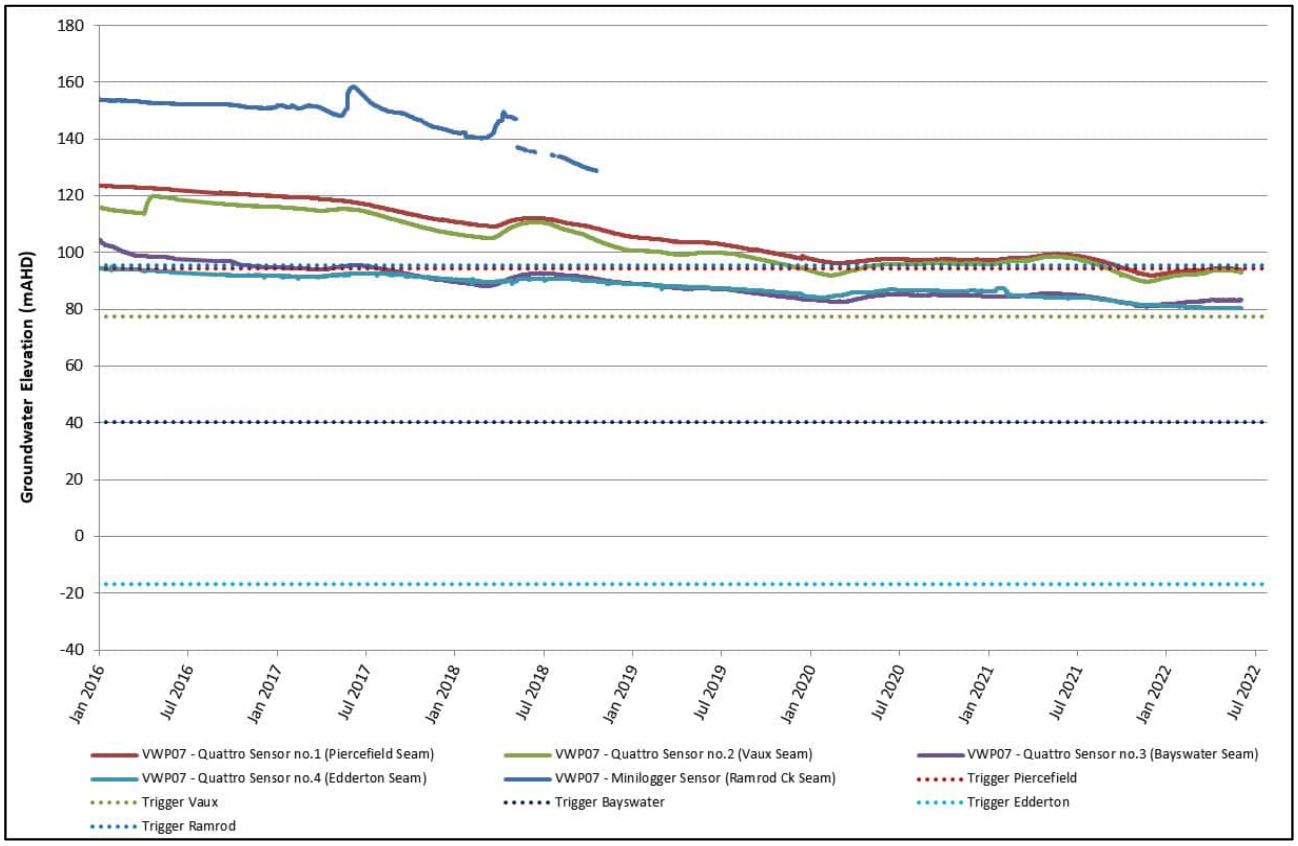


Figure 4.7 VWP07 – Trigger Levels

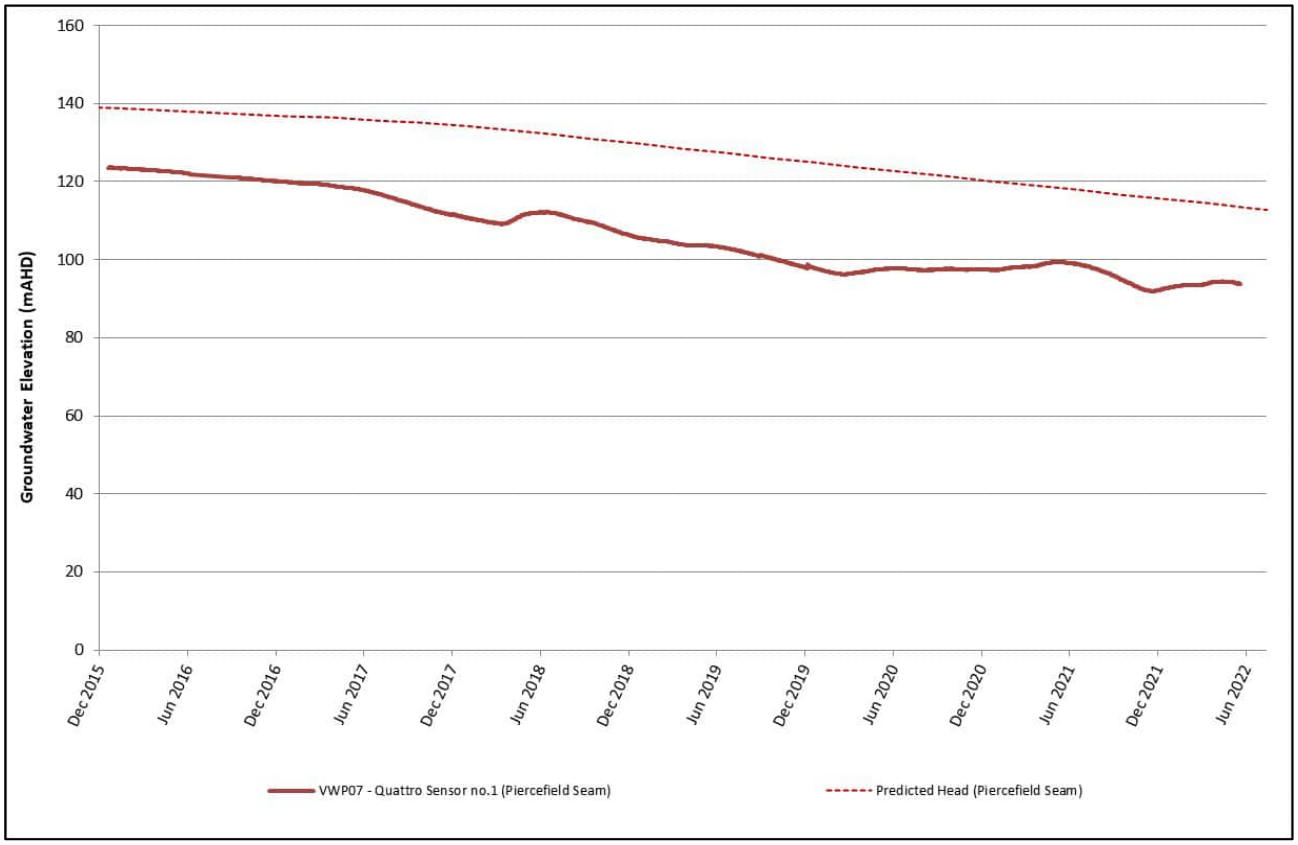


Figure 4.8 VWP07 – Modelled and Observed Water Levels

5.0 Groundwater Quality

Groundwater quality monitoring is conducted to identify any impacts from mining of coal measures to alluvial aquifers. Under the WMP, standard groundwater quality monitoring is required quarterly, and a comprehensive water quality analysis is required annually for 20 of the monitoring bores within the network, as outlined in **Appendix A**. A summary of groundwater quality (field pH and field EC) for the review period is presented in **Table 5.1** and a detailed summary of groundwater quality results for the review period are summarised in **Appendix D** with water quality graphs presented in **Appendix E**.

5.1 Laboratory Water Quality Results

Groundwater quality samples are submitted quarterly to ALS for laboratory analysis of TDS, TSS, iron, sulphate, chloride, calcium, magnesium, potassium, sodium, carbonate and bicarbonate and annually for total phosphorus, aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc. Review of the data indicates that over the reporting period most bores have recorded relatively consistent concentrations of TDS, TSS, iron and major ions (sulphate, chloride, calcium, magnesium, potassium, sodium, carbonate and bicarbonate). However, it is noted that there was:

- an increase in TSS in GW38A, GW38P, GW47, X1MB
- an increase in chloride in GW2
- an increase in sulphate, chloride, calcium, magnesium in GW21
- a decrease in chloride, calcium, magnesium in GW38A
- an increase in chloride in GW39P
- an increase in sulphate, chloride, calcium, magnesium, potassium, bicarbonate in GW41A
- a decrease in chloride, calcium, magnesium, potassium, sodium in GW45.

There are also elevated concentrations of calcium, chloride and sodium in bore BCGW22P (IW4026). The bore was recently included in a trigger investigation by Umwelt (2022), which identified the bore is likely screened within low permeability interburden and recommended that BCGW22P (IW4026) be maintained for monitoring water levels but removed from the WMP as a compliance bore. Groundwater quality monitoring results from bores X11 and X13 located up-slope, closer to the mine site, can be used as a replacement in the WMP as compliance bores

5.2 Trigger Exceedances

Water quality data collected over the reporting period have been compared to the trigger values outlined in the WMP. Nine bores recorded water quality levels (pH or EC) outside of the trigger levels. As specified in the WMP, bores that recorded EC levels above the Stage 1 trigger over the reporting period are highlighted in **Table 5.1**. Only BCGW22P (IW4026) recorded three consecutive readings for EC constituting a reportable exceedance. An analysis of the trigger exceedance for BCGW22P (IW4026) is summarised in **Table 5.2**. BCGW22P (IW4026) recorded a fourth trigger exceedance in the June 2022 monitoring round which has subsequently been reported to DPE. Trigger exceedances have been reviewed by comparing groundwater levels and climate indicated by the cumulative rainfall departure plot (refer **Figure 2.1**). Graphs of pH and EC for all monitoring bores are presented in **Appendix E**.

Table 5.1 Groundwater Quality Monitoring Results – July 2021 to June 2022

Aquifer	Bore ID	Field pH						Field EC (µS/cm)					
		Lower Trigger (5th Percentile)	Upper Trigger (95th Percentile)	Q1	Q2	Q3	Q4	1st Stage Trigger (95th Percentile) (µS/cm)	2nd Stage Trigger Maximum Value (µS/cm)	Q1	Q2	Q3	Q4
Hunter River Alluvium	GW16	7.0	7.7	7.21	**6.90**	7.20	7.52	4210	4690	4190	3400	3340	3350
	GW21	6.8	7.8	7.05	6.86	7.00	7.25	1197	2000	919	1161	1113	1110
	GW38A (IW4030)	6.5	7.7	7.25	7.46	7.50	7.37	4900	5560	3520	2730	2104	1803
	GW40A	6.9	8.0	7.27	7.25	7.33	7.58	5290	5650	**5590**	4270	4540	4360
	GW41A (IW4029)	6.6	7.7	7.39	7.42	7.42	7.40	9090	10600	8510	6730	6400	3100
	X1MB	No Trigger		7.47	7.28	7.21	7.14	No Trigger		4650	5390	4040	3600
Saddlers Creek Alluvium	GW45	6.6	7.1	7.03	6.78	**7.20**	**7.32**	11810	14500	5910	1960	1877	1831
	GW46	6.3	8.0	7.16	6.51	7.01	7.04	8050	11380	6900	6140	5720	5910
	GW47	6.5	7.6	7.15	6.79	7.03	7.11	7320	8220	5290	5200	5210	5110
Saddlers Creek Shallow Permian	BCGW22A (IW4027)	6.6	7.1	6.80	6.93	6.73	7.09	11810	14500	**14800**	11600	10800	11100
Permian Coal Seams	BCGW18	7.0	9.1	DRY				8030	8510	DRY			
	BCGW22P (IW4026)	7.1	9.9	7.36	7.67	7.75	**11.85**	14100	16270	**16240**	**14900**	**14320**	**14500**
	EWPC33	6.5	7.5	6.94	7.03	6.60	6.89	4592	16270	2940	3010	2361	2091
	GW2	6.5	8.0	7.72	7.19	7.66	7.73	4266	6280	**4400**	3610	4180	4160
	GW38P	7.2	8.1	7.59	7.68	7.68	7.54	3224	3830	2836	2560	2574	2437
	GW39P	No Trigger		7.66	7.56	7.46	7.43	No Trigger		6000	5110	5070	4780
	GW43	6.7	7.4	7.02	6.94	7.05	7.02	4400	4470	**5210**	**4460**	4120	**4420**
	GW44	No Trigger		Not Required				No Trigger		Not Required			
	GW48	6.8	8.2	7.57	7.46	7.57	7.72	4090	4750	**4290**	3610	3760	3640
	GW49	6.1	7.5	6.91	6.93	6.94	6.88	6170	7530	**6770**	5520	5860	**6350**
	OD1078P (IW4028)	No Trigger		Not Required				No Trigger		Not Required			
	X10MB	No Trigger		7.33	8.53	7.55	8.39	No Trigger		5140	5380	4770	3900

Note: ***Exceeded pH trigger level*** ***Exceeded Stage 1 EC trigger level (less than three consecutive readings)*** ***Exceeded Stage 1 EC trigger level (three consecutive readings)***

Table 5.2 Groundwater Quality Trigger Exceedances

Bore ID	Exceedance	Screened Lithology	Location	Comment	Action
BCGW22P (IW4026)	Eleven EC readings above the Stage 1 trigger level of 14320 µS/cm since December 2019	Glen Munro Seam/Interburden	On site – southwest of McDonalds Pit and north of Saddlers Creek	EC has an increasing trend, ranging from 8960 µS/cm in November 2017 to 17350 µS/cm in September 2020. An exceedance was identified in the 2021 Annual Review (Umwelt, 2021b), which recommended further investigation. The EC continued to exceed the Stage 1 trigger level throughout the 2022 reporting period. The consecutive exceedances were reported to DPE on 27 April 2022. Following the recommendations in the 2021 Annual Review, an investigation was undertaken during the 2022 reporting period determined that the slow recovery of groundwater and unique water quality results indicate the bore is not screened within the coal seam but within a low permeability interburden unit. The investigation recommended that BCGW22P (IW4026) be maintained for monitoring groundwater levels but removed from the WMP as a compliance bore and replaced with existing bores X11 and X13, which are screened within the Woodlands Hill and Glen Munro seams, respectively. The replacement bores are located up-slope of BCGW22P (IW4026), closer to the mine site. The WMP is currently being reviewed and these changes will be included in the review.	A trigger investigation has already been undertaken in March, and the response from the DPE received 19 May 2022 (DPE, 2022). A trigger exceedance was also recorded in the June 2022 monitoring round which has subsequently been reported to DPE. Remove as a compliance monitoring bore in WMP but continue to monitor water levels. Further to this, as part of the recommendations for nearby bore BCGW22A, an additional shallow bore will be installed up slope and closer to the mine area.

6.0 Trigger Investigations

As specified in the WMP, MAC are required to report on the effectiveness of the WMP in the MAC Annual Groundwater Review, which includes a summary of management/mitigation measures undertaken in the event of a confirmed exceedance of the impact assessment criteria and the effectiveness of the management/mitigation measures. The 2021 Annual Groundwater Review undertaken by Umwelt (2021) reviewed exceedances for groundwater quality. In addition, a number of exceedances have been identified during routine monitoring, which have already been reported to DPE over the reporting period. A range of investigations were conducted at MAC over 2021/2022 to address recommendations for bores with trigger threshold exceedances. Details of trigger investigations undertaken during the reporting period are summarised in **Table 6.1**.

Table 6.1 Summary of Investigations Undertaken Over Reporting Period

Bore ID	2021 Annual Review and December 2021 Network Review Recommendation	Investigations Completed	Action Being Undertaken
BCGW22A (IW4027)	The bore is screened within the shallow Permian near a tributary of Saddlers Creek. The 2021 annual review identified an EC exceedance and recommended further review of water quality and potential water sources in the area including the backfilled pit and water storage within McDonalds and Belmont Pits. An initial investigation, submitted to DPE in October 2021, was undertaken which identified that trends were likely due to surrounding land use and bore condition and recommended further investigation.	Following the initial investigation in October 2021, a field investigation was undertaken, with results reviewed and submitted to DPE in March 2022. The investigation found that the water quality results are unique to the bore and not observed at other sites or mine water storage facilities in the area. It was recommended the trigger be revised to be representative of baseline data for the site, and an additional shallow bore be installed up-slope closer to the mine area to verify the results are not related to mine activities.	The trigger level is currently being reviewed as part of the WMP update. The installation of an additional bore to be undertaken.
BCGW22P (IW4026)	The bore is screened within the Glen Munro Seam near a tributary of Saddlers Creek. The 2021 annual review identified an EC exceedance and recommended that further review of water quality and potential water sources in the area including the backfilled pit and water storage within McDonalds and Belmont Pits be undertaken. An initial investigation, submitted to DPE in October 2021, was undertaken which identified that trends were likely due to surrounding land use and bore condition and recommended further investigation.	Following the initial investigation in October 2021, a field investigation was undertaken, with results reviewed and submitted to DPE in March 2022. The investigation found that the groundwater data and groundwater level responses indicate the bore is screened within a low permeability interburden unit and not coal. It was recommended that this bore be used for water level monitoring only.	The bore will be removed from the WMP as a compliance monitoring bore but continued to be monitored for closure planning.
GW2	The bore is screened within the Woodlands Hill Seam near Saddlers Creek. There was an increasing EC trend observed in GW2 over 2020/2021 and was therefore included in the trigger investigation undertaken for nearby bores BCGW22A and BCGW22P. An initial investigation, submitted to DPE in October 2021, was undertaken which identified that trends were likely due to surrounding land use and bore condition and recommended further investigation.	Following the initial desktop investigation in October 2021, a field investigation was undertaken, with results reviewed and submitted to DPE in March 2022. The investigation found that the general rise in EC at GW2 was unlikely related to nearby Saddlers Pit. It was recommended that a trigger representative of the Woodlands Hill Seam be applied for this bore with ongoing monitoring of water quality trends.	The water quality trends have continued to be monitored and the trigger level will be updated in the WMP review which is currently in progress.

Bore ID	2021 Annual Review and December 2021 Network Review Recommendation	Investigations Completed	Action Being Undertaken
GW40A	The bore is screened within the Hunter River alluvium. The 2021 annual review identified an EC exceedance and recommended that a replacement bore be installed with a smaller screened interval to prevent water from the surface infiltrating the bore. An initial investigation, submitted to DPE in October 2021, was undertaken which identified that trends were likely due to surrounding land use and bore condition and recommended further investigation.	Following the initial investigation in October 2021, a field investigation was undertaken, with results reviewed and submitted to DPE in March 2022. The investigation found that there were no adverse impacts due to mining. Construction of the bore and irrigation in the area are influencing results. It was recommended the bore be replaced with nearby bore X2 which is 780 m to the west of GW40A and also monitors the Hunter River alluvium.	The bore will be removed from the WMP and replaced with existing bore X2 in the WMP review which is currently in progress.
GW45	The bore is screened within the Saddlers Creek alluvium. The bore did not record a trigger exceedance, but it was noted in the 2021 network review that EC and sulphate concentrations historically increased in the bore, and saturated groundwater conditions are observed despite modelling predicting unsaturated conditions. This may indicate a separate source of recharge to the alluvium in this upgradient area. Further investigation and review against recently installed nearby bores and surface water quality data was recommended.	Review of the changes in water quality in GW45 identified that an investigation be undertaken to determine the source of the water.	Investigation into water quality changes in the bore currently in progress.
GW46	The bore is screened within the Saddlers Creek alluvium. The bore did not record a trigger exceedance, but it was noted in the 2021 network review that EC and sulphate concentrations historically increased in the bore, and saturated groundwater conditions are observed despite modelling predicting unsaturated conditions. This may indicate a separate source of recharge to the alluvium in this upgradient area. Further investigation and review against recently installed nearby bores and surface water quality data was recommended. An initial investigation, submitted to DPE in October 2021, was undertaken which identified that trends were likely due to surrounding land use and bore condition and recommended further investigation.	Review of the changes in water quality in GW46 identified that an investigation be undertaken to determine the source of the water.	Investigation into water quality changes in the bore currently in progress.

Bore ID	2021 Annual Review and December 2021 Network Review Recommendation	Investigations Completed	Action Being Undertaken
GW48	The bore is screened within the Bowfield Seam near the Hunter River. The 2021 annual review identified an EC exceedance and recommended that the condition of the bore was checked using a downhole camera and verification of the surrounding surface activities to determine the cause of the rising EC trend. An initial investigation, submitted to DPE in October 2021, was undertaken which identified that trends were likely due to surrounding land use and bore condition and recommended further investigation.	Following the initial investigation in October 2021, a field investigation was undertaken, with results reviewed and submitted to DPE in March 2022. The investigation found that there were no adverse impacts due to mining. The construction of bore GW48 with a large bentonite seal has the potential to influence water quality but results are generally consistent with water quality for the coal seams. It was recommended that a trigger representative of the Bowfield Seam be applied for this bore.	Trigger level currently being reviewed as part of the WMP review.
GW49	The bore is screened within the Arrowfield Seam near the Hunter River. The 2021 annual review identified an EC exceedance and recommended that the condition of the bore was checked using a downhole camera and verify what water supply use is in the area. An initial investigation, submitted to DPE in October 2021, was undertaken which identified that trends were likely due to surrounding land use and bore condition and recommended further investigation.	Following the initial investigation in October 2021, a field investigation was undertaken, with results reviewed and submitted to DPE in March 2022. The investigation found that no adverse impacts due to mining. Evidence of potential iron bacteria in the bore was identified, and work should be undertaken to remediate the bore. It was recommended that a trigger representative of the Arrowfield Seam be applied for this bore.	Remediation of the bore to remove bacteria build up will be undertaken and the trigger level will be updated in the WMP review which is currently in progress.

7.0 Quality Assurance Review

An assessment of the quality assurance measures implemented by Carbon Based Environmental Pty Ltd (CBE) for the quarterly groundwater sampling is required as part of the WMP to identify potential errors with either the sampling methodology or laboratory techniques. This review includes:

- Comparison of duplicate samples and calculation of Relative Percentage Difference (RPD) for the laboratory analysis results for each sampling round.
- Review of the CBE groundwater sampling field sheets for assessment of field parameter stabilisation and purging volume for collection for a representative water sample. Review of equipment calibration records by CBE was not undertaken.
- Review of sample holding times prior to being dispatched to the Australian Laboratory Services Pty Ltd (ALS).

The quality assurance review results are summarised in **Table 7.1** and detailed in **Appendix D**. The results of the quality assurance review, with recommendations, are summarised below:

- CBE provided sample stabilisation data for all sampling events with the acceptable deviations for temperature set at (±0.2°C), pH (±0.1 pH units) and EC (±5 %). On average, three bore volumes were purged for each bore before sampling. Where less than three volumes were purged, the field sheets note that it was due to dry bores or when hand bailing was implemented. The purge volume in bore BCGW22P (IW4026) was approximately one third of the required volume before going dry in every sampling round. BCGW18 was unable to be sampled at all as there was insufficient water.
- Ten of the thirty-two sample batches received by ALS were above the recommended temperature of 4°C. It is recommended that all samples should be chilled sufficiently to reach the lab below 4°C.In each monitoring round the bores were monitored in a consistent manner and the samples are considered representative of the aquifer at each monitoring location.
- All samples were within the specified holding times for the parameters analysed. The exception to this is laboratory pH where holdings time breaches ranged from one to five days. However, the samples were all analysed for field pH, which is considered a more reliable source of data and has been used for the trigger level review in this report.
- Duplicate samples were collected and field parameters for pH, EC, and temperature were recorded for each duplicate sample. RPDs greater than 20 % were identified for Total Suspended Solids, Carbonate Alkalinity and Iron in January 2022, and Copper and Nickel in June 2022. The results indicate variation in the laboratory analysis between the primary and duplicate samples. This is potentially influenced by sampling methodology and timing between the samples, which can influence results for TSS and total metals. The RPDs do not correlate to any reported trigger exceedances for the reporting period.

Table 7.1 Summary of Quality Assurance Review

Monitoring Round	Field Data	Field Parameter Stabilisation	Analyses Frequency	Analysis Parameters	Holding Time (days)	Duplicate Sample	Relative Percentage Difference	Comments
Sep-21	WL, T (°C), pH, EC	All samples within parameters.	Quarterly	All samples: pH, EC, TSS, TDS, Cl, Ca, Mg, K, Na, SO4, Alkalinity, Dissolved Fe.	Lab Quality Control Report not provided.	GW43	No RPDs greater than 20 %	All bores purged 3 x bore volumes prior to sampling except BCGW18 (dry), BCGW22P (IW4026) (pumped dry), GW38A (IW4030) (hand bailed), GW39P (hand bailed, bore diameter too small for pump), GW41A (IW4029) (hand bailed), X1MB (pumped dry), X10MB (hand bailed, screws in way of pump). With the exception of one submission, all samples reached the lab below specified temperature of 4°C.
Jan-22	WL, T (°C), pH, EC	All samples within parameters.	Quarterly	All samples: pH, EC, TSS, TDS, Cl, Ca, Mg, K, Na, SO4, Alkalinity, Dissolved Fe.	Lab Quality Control Report indicates samples were within the specified holding times for the parameters analysed with the exception of pH where holdings time breaches ranged from one to five days.	GW39P	Total Suspended Solids 30 % Carbonate Alkalinity 183 % Iron 23 %	All bores purged 3 x bore volumes prior to sampling except BCGW22P (IW4026) (partially hand bailed), BCGW18 (dry), GW38A (IW4030) (hand bailed), GW39P (hand bailed, bore diameter too small for pump), GW41A (IW4029) (hand bailed), X10MB (hand bailed, screws in way of pump). Five out of eight sample submissions reached the lab below specified temperature of 4°C.
Mar-22	WL, T (°C), pH, EC	All samples within parameters.	Quarterly	All samples: pH, EC, TSS, TDS, Cl, Ca, Mg, K, Na, SO4, Alkalinity, Dissolved Fe.	Lab Quality Control Report indicates samples were within the specified holding times for the parameters analysed with the exception of pH where holdings time breaches ranged from one to five days.	EPWC33	No RPDs greater than 20 %	All bores purged 3 x bore volumes prior to sampling except BCGW18 (dry), BCGW22P (IW4026) (pumped dry), GW38A (IW4030), GW39P (hand bailed, bore diameter too small for pump), X1MB (pumped dry), X10MB (hand bailed, screws in way of pump). Four out of eight sample submissions reached the lab below specified temperature of 4°C.

Monitoring Round	Field Data	Field Parameter Stabilisation	Analyses Frequency	Analysis Parameters	Holding Time (days)	Duplicate Sample	Relative Percentage Difference	Comments
Jun-22	WL, T (°C), pH, EC	All samples within parameters.	Quarterly/ Annually	All samples: pH, EC, TSS, TDS, Cl, Ca, Mg, K, Na, SO4, Alkalinity, Dissolved Al, Sb, As, Ba, Ca, Cr, Cu, Ni, Pb, Zn, Mo, Se, B, Fe, Hg, Total P.	Lab Quality Control Report indicates samples were within the specified holding times for the parameters analysed with the exception of pH where holdings time breaches ranged from one to three days.	EPWC33	Copper 164% Nickel 67%	All bores purged 3 x bore volumes prior to sampling except BCGW18 (dry), BCGW22P (IW4026) (pumped dry), GW38A (IW4030) (hand bailed), GW39P (hand bailed, bore diameter too small for pump), BCGW18 (dry), GW41A (IW4029) (hand bailed), X10MB (hand bailed, screws in way of pump). Six out of eight sample submissions reached the lab below specified temperature of 4 °C.

8.0 Cut-off Wall Performance

The alluvial cut-off wall is a bentonite barrier wall constructed between the Hunter River and the Windmill Open Cut pit, close to the F4 fault. The cut-off wall was extended to the west in November 2020 ahead of the progression of active mining towards the west. The purpose of the cut-off wall is to minimise drawdown within the Hunter River alluvium.

To monitor drawdown within the Hunter River alluvium, VWPs were installed near the cut-off wall to monitor the Permian coal measures underlying the Hunter River alluvium. The location of the VWPs is shown on **Figure 3.1**. The VWP sensors monitor:

- VWP1 – Edinglassie Seam (footwall) at 204.5 m depth (-69.0 mAHD) (decommissioned in 2020).
- VWP2 – F4 fault at 216.5 m depth (-81.1 mAHD).
- VWP3 – Sensor 1 – Edinglassie Seam (hanging wall) at 227.0 m depth (-91.6 mAHD).
- VWP3 – Sensor 2 – Ramrod Creek Seam at 241 m depth (-105.6 mAHD).

Continuous data has been captured by the VWPs since December 2013. However, the footwall of the Edinglassie Seam is no longer monitored as VWP1 has been decommissioned due to sensor failure. VWP3 Sensor 2 (Ramrod Creek) also failed in June 2020. The sensors should be replaced to continue monitoring in this area.

Figure 8.1 shows groundwater levels have declined 87 m in the F4 fault, 107 m in the Edinglassie Seam and 103 m in the Ramrod Creek Seam, since installation. The Hunter River alluvium and shallow weathered sandstone (regolith) was previously monitored by bore GW42 which is located adjacent to the VWPs. However, monitoring of GW42 ceased in June 2021 due to the intermittent nature of groundwater within the bore. Although not as proximal to the cut-off wall as GW42, bore GW16 also monitor the Hunter River alluvium, located approximately 400 m to the northwest of the cut-off wall. Bore GW16 has been used to compare trends in the coal seams and alluvium, as a substitute for GW42 in the interim until a replacement bore for GW42 is installed.

Groundwater levels at GW16 have fluctuated over time but have remained relatively stable, with a slight increase of 0.57 m between March 2008 and June 2022, as shown in **Figure 8.2**. Depressurisation observed in the Permian coal measures has not impacted on the Hunter River alluvium and regolith groundwater levels observed in bore GW16.

Groundwater level data is available in the area at bores close to the Hunter River (GW21, GW38A and X1MB) and close to the cut-off wall (GW16). All of the bores recorded a similar stable to slightly rising trend over the monitoring period. Groundwater levels in the Hunter River alluvium bores fluctuate in response to rainfall and streamflow trends.

The relatively stable groundwater level trends shown in the alluvial bores indicate that the depressurisation observed in the Permian coal measures does not appear to have impacted on the Hunter River alluvium groundwater levels. Monitoring of the Hunter River alluvium shows no adverse impact from mining activities on alluvial groundwater conditions and beneficial use of groundwater.

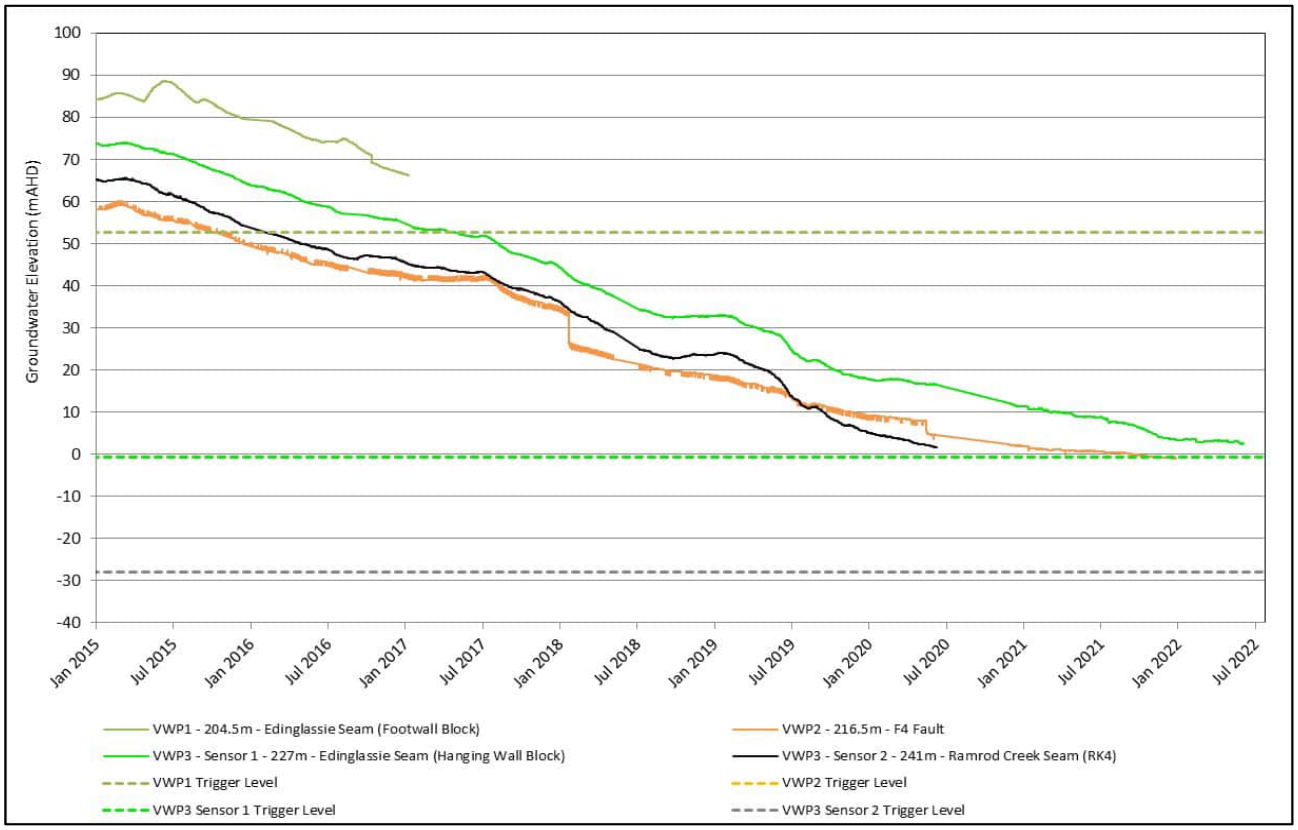


Figure 8.1 Groundwater Levels in Permian Coal Measures Adjacent to the Cut-off Wall

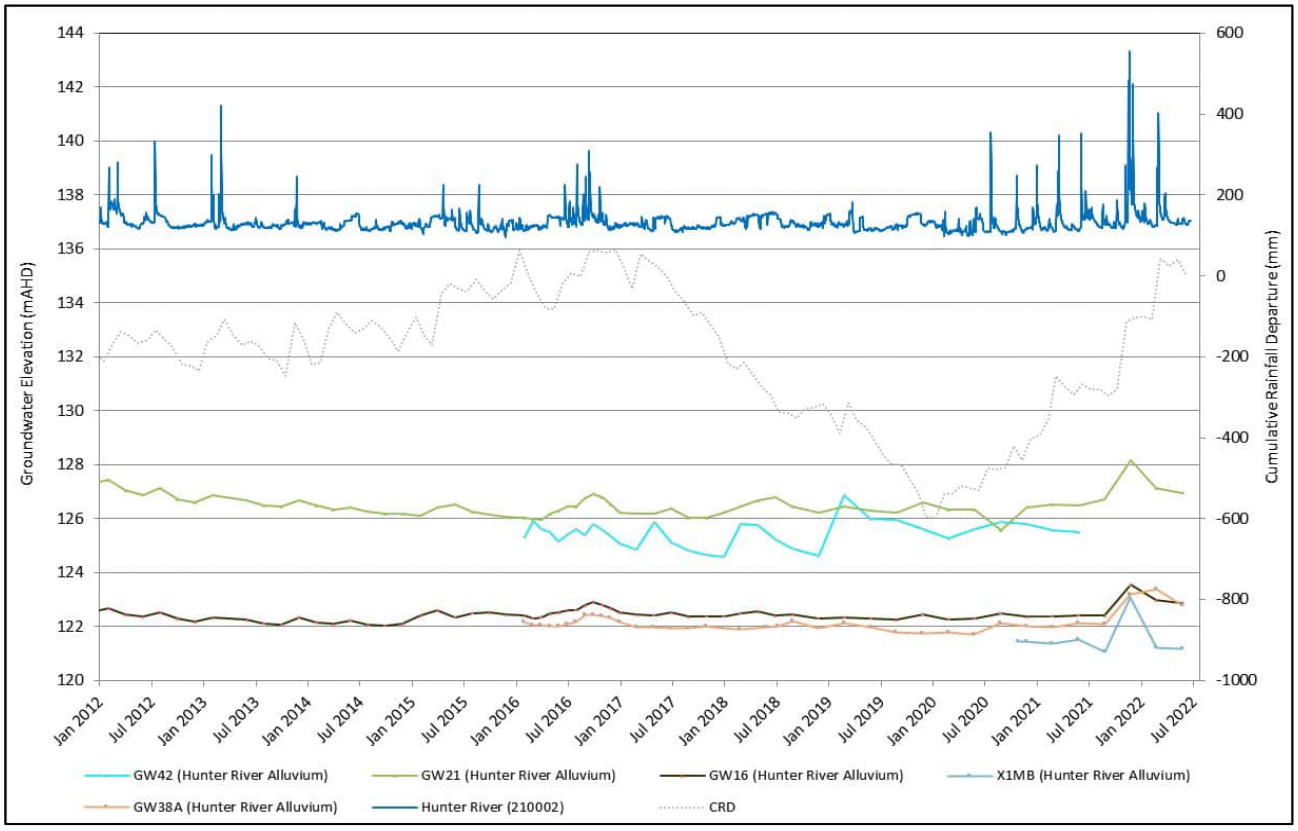


Figure 8.2 Groundwater Levels in the Hunter River Alluvium Adjacent to the Cut-off Wall

9.0 Numerical Model Predictions Review

The WMP requires a review of groundwater level predictions, which are calculated using a groundwater model to support current mining. To validate the model, the predictions are compared on an annual basis to the measured groundwater level data obtained from the monitoring program.

As summarised in SLR (2020a), the groundwater assessment was conducted by AGE (2013) concluded that approved operations at MAC would drawdown groundwater levels within 2 km of active mining operations. AGE (2013) also found that drawdown associated with operations at Bengalla Mine, to the north of MAC, would not interact with drawdown at MAC. There were no reported potential impacts on GDEs as a result of MAC (AGE, 2013). Less than 1 m drawdown was predicted at all privately owned bores intersecting alluvium and used for stock water supply and irrigation, due to mining at MAC, as shown in **Figure 9.1**. Drawdown of more than 2 m was predicted at some privately owned bores intersecting the Permian coal measures used for stock water supply as shown in **Figure 9.2**.

A review of the groundwater model was conducted by AGE (2020) and found that improvements could be made. BHP engaged SLR (2020b) to develop a numerical groundwater model for MAC that included calibration of measured groundwater levels to June 2020. The model was developed in MODFLOW-USG with steady state and transient calibration with a good fit to historical water level and mine inflow data. The updated model predicted:

- Negligible groundwater drawdown in the Saddlers Creek alluvium consistent with previous predictions. However, it is noted that the model generally predicts unsaturated conditions in the regolith and alluvium in the upper reach of Saddlers Creek.
- Localised drawdown of up to 5 m within the alluvium along Hunter River. The extent of predicted water table drawdown is consistent compared to the previous predictions for approved operations by AGE (2013).
- No impacts predicted on landholder bores intersecting alluvium.
- Predicted reduction in groundwater levels at three BHP owned bores that intersect the Permian coal measures.
- Negligible reductions in surface water flows/balance resulting from changes in groundwater baseflows to surface stream systems in Saddlers Creek.
- Up to 13.2 ML/year leakage (indirect take) from the Hunter River as a result of depressurisation due to mining, which is lower than previously predicted.
- Reduction in upward leakage from the Permian coal measures to the overlying alluvium of the Hunter River by a maximum of 82 ML/year (0.22 ML/day) which is lower than previously predicted by AGE (2013) which predicted between 0.63 ML/day to 0.72 ML/day leakage from Hunter River.
- Total groundwater inflows to the MAC open cut of approximately 657.5 ML/year on average (between 2020 to 2027) and ranging up to a peak in the order of 1,114 ML/year in 2026. The predicted inflow is largely consistent with the previously predicted average inflows by AGE (2013), which ranged between 711 ML/year to 912 ML/year from 2020 to 2026.

The updated model predictions by SLR (2020b) are consistent or slightly lower than previously predicted impacts on groundwater by AGE (2013). Further details on the up-to-date groundwater model are included in the model report by SLR (2020b).

Measured groundwater level elevations for June 2022 were compared to groundwater levels predicted in the current SLR (2020b) site model from July 2021 to June 2022. The difference between the model prediction and measured levels (residuals) are shown in **Figure 9.3**. Positive values indicate the model predicted higher groundwater levels (i.e., less drawdown) than is observed (measured). Negative values indicate the model predicted lower groundwater levels (i.e., more drawdown) than was observed (measured).

The groundwater model predictions in the Hunter River alluvium compare well to the measured levels as shown in **Figure 9.3**. Overall, the residual in the Hunter River alluvium is less than 5 m as shown in bores GW16, GW21, GW38A (IW4030), GW40A, GW41A (IW4029) and X1MB.

The model also showed a fairly good fit (i.e., less than 5 m difference) between measured and modelled groundwater levels for bore GW16 that intersects alluvium and regolith on the north side of the alluvium barrier wall that separates MAC from the Hunter River alluvium. At the same location (i.e., VWP2 and VWP3) modelled groundwater levels in underlying coal seams show a fairly good fit with measured depressurisation. This indicates the model can replicate the vertical gradient and interaction between the depressurisation from mining and the Hunter River alluvium in the area of the barrier wall.

The model also shows a fairly good fit for the bores within the Saddler Creek alluvium to the southwest of active mining. The modelled heads for bores GW45 and GW47 are within 5 m of measured levels. The modelled head for GW46 was greater than 5 m of measured levels (-7.44 m residual) indicating the area was more saturated than predicted. It is noted that the model generally predicts unsaturated conditions in the regolith and alluvium in the upper reach of Saddlers Creek. This is likely influenced by the assumption of average streamflow and rainfall and could be improved in future iterations of the model.

The response to mining is well represented in the Permian coal measure monitoring bores located along the Hunter River and show a fairly good fit with modelled heads within 5 m of measured levels. However, to the west of active mining, the model did not fully capture groundwater levels at GW43 (Woodlands Hill Seam) and X10MB (Glen Munro Seam), near Belmont Pit and to the southwest of mining at GW2 (Woodlands Hill Seam), near Saddlers Pit, where the model predicted levels more than 5 m below measured levels. This likely relates to influence of modelled in-pit water storage in the area, which may not accurately replicate actual dam water storage levels.

The model under predicted drawdown west of the open cut (Huon Pit and Calool Pit) in some layers at VWP04 (all seams), VWP05 (Vaux and Bayswater seams), VWP06 (Edinglassie Seam) and VWP07 (Piercefield and Vaux seams) and over predicted drawdown in VWP06 (Edderton Seam) and VWP07 (Bayswater and Edderton seams). However, this response is variable and likely reflects the simplified vertical discretisation in the model layers compared to the VWP sensor intervals.

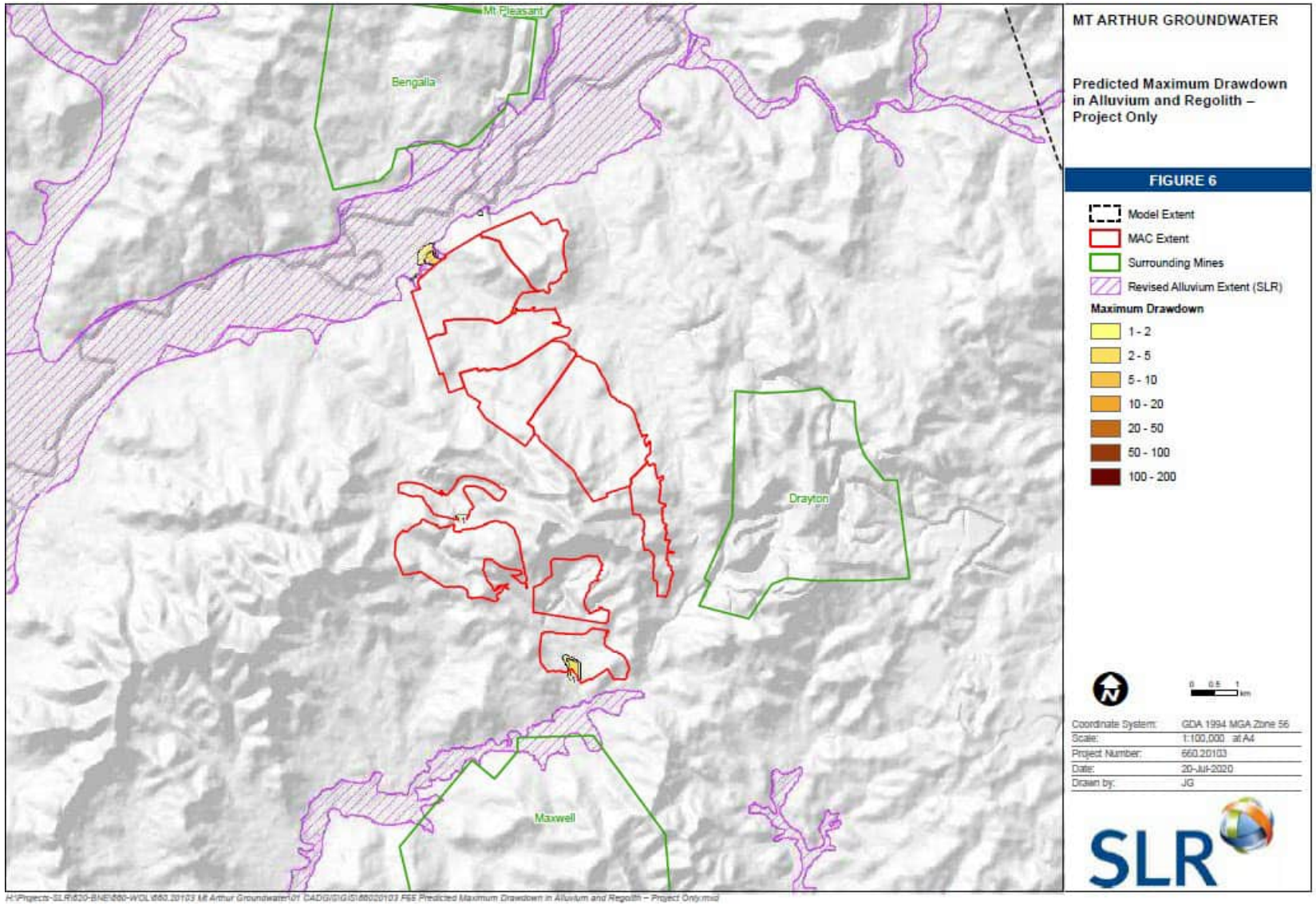


Figure 9.1 Predicted Maximum Drawdown in Unconsolidated (Layer 1 and 2) – Approved Operations (Source: SLR, 2020b)

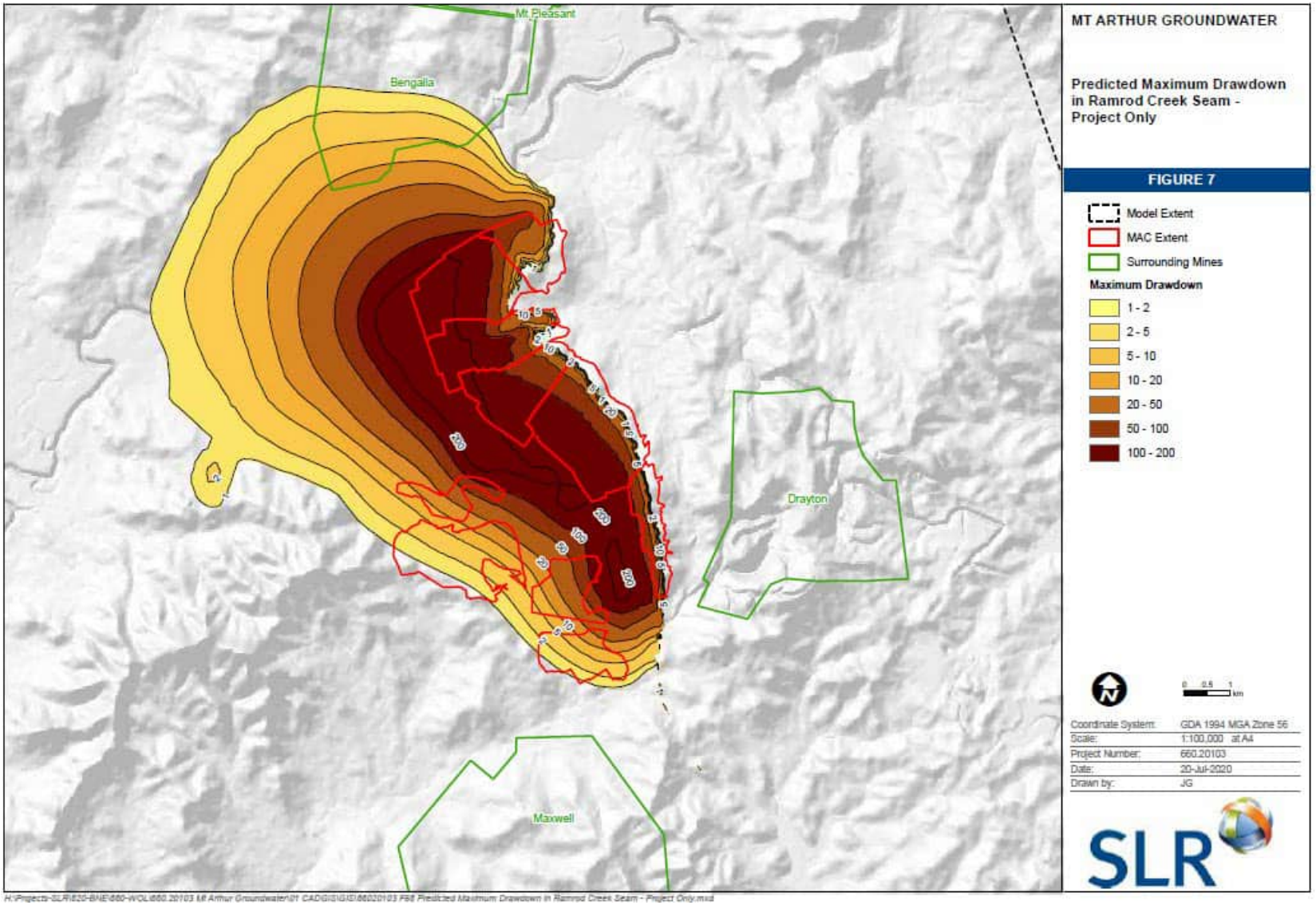
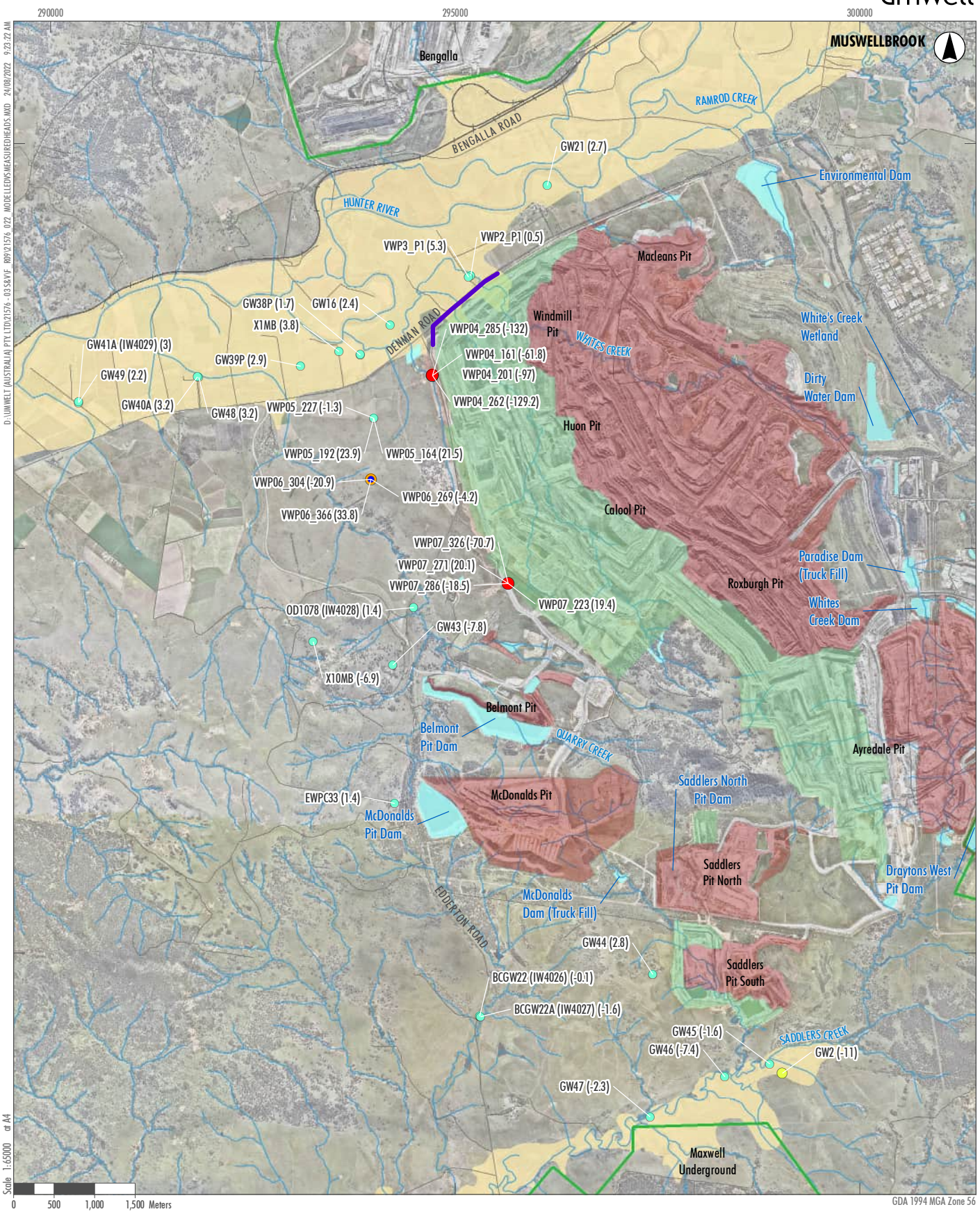


Figure 9.2 Predicted Maximum Drawdown in Ramrod Creek Seam (Layer 26) – Approved Operations (Source: SLR, 2020b)



Legend

- Surrounding Mines
- Active Mining Area
- Overburden Emplacement Area
- Water Management Dam
- Cut-off Wall
- Alluvium Extent
- Railway
- Roads
- Watercourse

Modelled vs Measured Heads (Residuals)(m)

- -75 to -50
- -50 to -20
- -20 to -10
- -10 to 10
- 10 to 20
- 20 to 40

FIGURE 9.3

Modelled vs Measured Heads June 2022

Image Source: Nearmap (May 2022) Data source: NSW DFSI (2021)

10.0 Recommendations

The following improvements to the groundwater monitoring program are recommended:

- BCGW18 – recorded as dry since March 2021. Initial review indicates no adverse impacts beyond those predicted for the approved operations. The trigger exceedances were reported to DPE in June 2022. It is recommended that the bore is removed from the WMP as a compliance bore but continue monitoring water levels for future closure planning.
- BCGW22A (IW4027) – as part of the trigger investigation undertaken in March 2022, it was recommended that the trigger level be reviewed as part of the WMP update which is currently in progress. Further to this, an additional shallow bore will be installed up slope and closer to the mine area.
- BCGW22P (IW4026) – four consecutive EC readings above the trigger level recorded over the reporting period. A trigger investigation has already been undertaken, and the response from the DPE was received 19 May 2022. It is recommended the bore be removed from WMP as a compliance bore but continue monitoring water levels. Further to this, as part of the recommendations for nearby bore BCGW22A, an additional shallow bore will be installed up slope and closer to the mine area.
- GW2 – as part of the investigation into water quality trends undertaken in March 2022, it was recommended that water quality monitoring continue, and the trigger level reviewed as part of the WMP review which is currently in progress.
- GW25 – the bore has already been removed from the WMP as a compliance monitoring bore as it was blocked. However, Section 9.3.2 of the WMP still notes that is used a background monitoring bore. Reference to the bore should be removed in the next update to the WMP.
- GW39P – shows instrument drift in the installed datalogger. It is recommended that the datalogger be replaced to assist in correlating groundwater trends with rainfall and streamflow trends.
- GW40A – due to the construction of the bore, water infiltrating from the surface is impacting the water quality readings. As part of the investigation conducted during the reporting period it was recommended that the bore be removed from the monitoring network and replaced with nearby bore X2. This recommendation was accepted by DEP on 19 May 2022. Bore GW40A will be removed from the WMP.
- GW41P – the bore has already been removed from the WMP as a compliance monitoring bore and has already been decommissioned. However, section 9.3.2 of the WMP still notes that it is used as a background monitoring bore. Reference to the bore should be removed in the next update to the WMP.
- GW42 – as per the 2021 network review, the bore should be replaced with a new bore and removed from the WMP. GW42 should continue to be monitored until the replacement bore is installed.

- GW44 – initial review indicates depressurisation of the coal seam was predicted in this area; however, there is a difference in the timing that may relate to how the model drain package represents actual mine progression at site. The trigger exceedances were reported to DPE in June 2022. It is recommended the water level trigger be updated in the WMP review which is currently in progress
- GW45 – shows instrument drift in the installed datalogger. It is recommended that the datalogger be replaced to assist in correlating groundwater trends with rainfall and streamflow trends. A review of water quality trends identified an investigation should be undertaken which is currently in progress.
- GW46 – a review of water quality trends identified an investigation should be undertaken which is currently in progress.
- GW48 – as part of the trigger investigation undertaken in March 2022, it was recommended the trigger level be reviewed as part of the WMP review which is currently in progress.
- GW49 – as part of the trigger investigation undertaken in March 2022, it was recommended that the bore is remediated to remove bacteria build up will be undertaken and the trigger level will be updated in the WMP review which is currently in progress.
- VWP1 – the sensor failed and the VWP site was decommissioned in 2020. It is recommended that VWP1 be removed from the WMP but be maintained for VWP2 and VWP3 to continue monitoring of the cut-off wall performance.
- VWP04 – water levels in all seams monitored by VWP04 have declined below the trigger levels. The initial review indicates no adverse impacts beyond those predicted for the approved operations. The trigger exceedances were reported to DPE in June 2022. It is recommended that the water level trigger be reviewed to align with levels in the latest model predictions in the WMP review which is currently in progress.
- VWP07 (Piercefield Seam) – water level readings have exceeded the trigger threshold and should be notified. The exceedance was not notified previously as data was not downloaded due to access issues because of flooding in the area. Initial review indicates no adverse impacts beyond those predicted for the approved operations and triggers should be reviewed in consideration of the model limitations, in the WMP review which is currently in progress.
- VWP3 (P2) (Ramrod Ck), VWP04 (Ramrod Ck), VWP05 (Edinglassie), VWP05 (Ramrod Ck), VWP06 (Vaux), VWP06 (Ramrod Ck) – sensors have failed in these deeper sensors and should be removed from the WMP monitoring and reporting requirements.
- X1MB – update Ontoto settings to convert data to mbgl.

The following improvements to the field monitoring and sampling programme by CBE are recommended:

- Chilled groundwater lab samples – ten of the thirty two sample batches received by ALS were above the recommended temperature of 4°C. It is recommended that all samples should be chilled sufficiently to reach the lab below 4°C.
- Supply all field calibration sheets and lab QA/QC sheets for quality review.
- Set logger frequency to 6 am/12 pm/6 pm/12 am, on the hour, in all water level loggers to ensure consistency of logger data.

11.0 References

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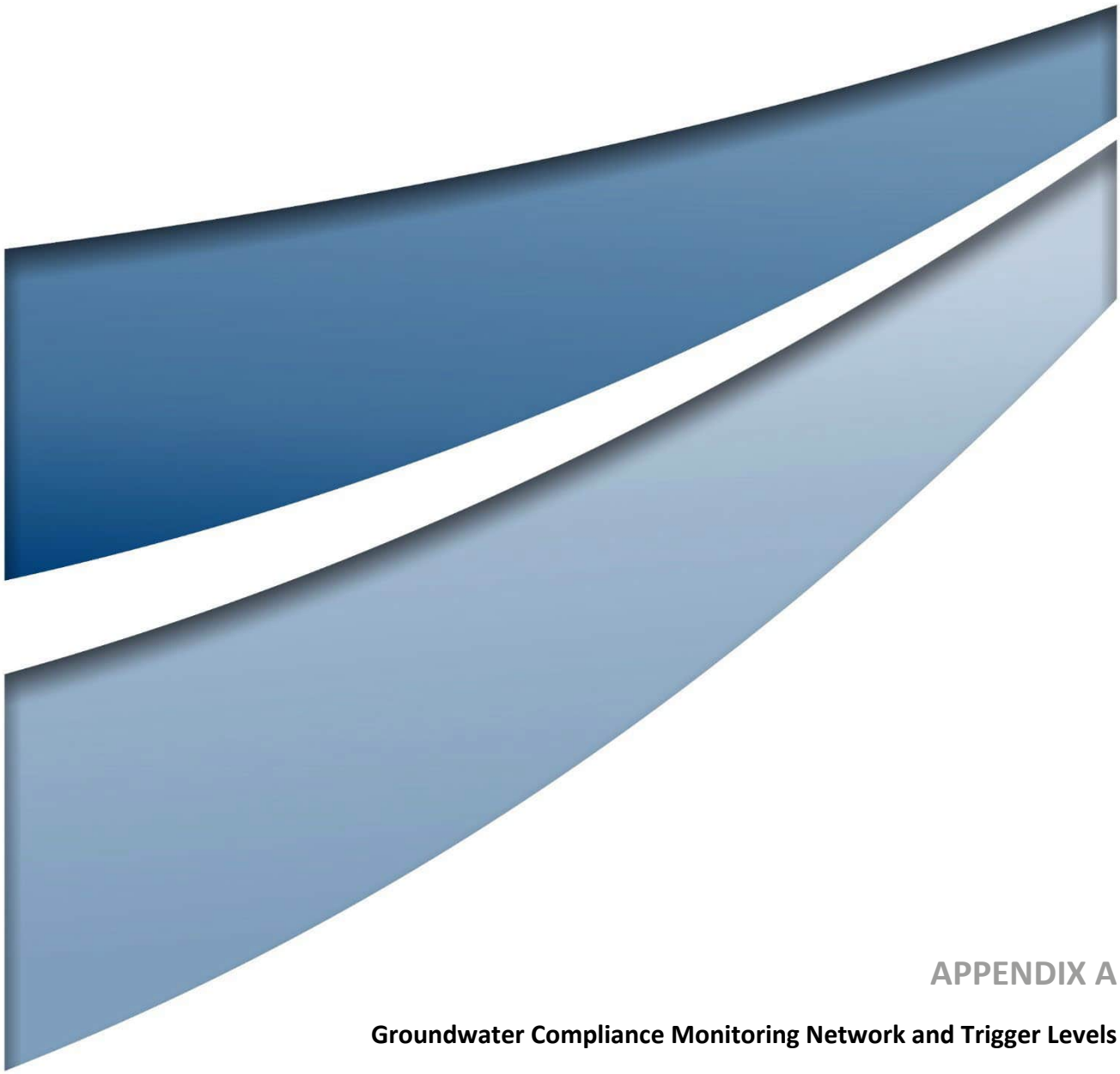


APPENDIX A

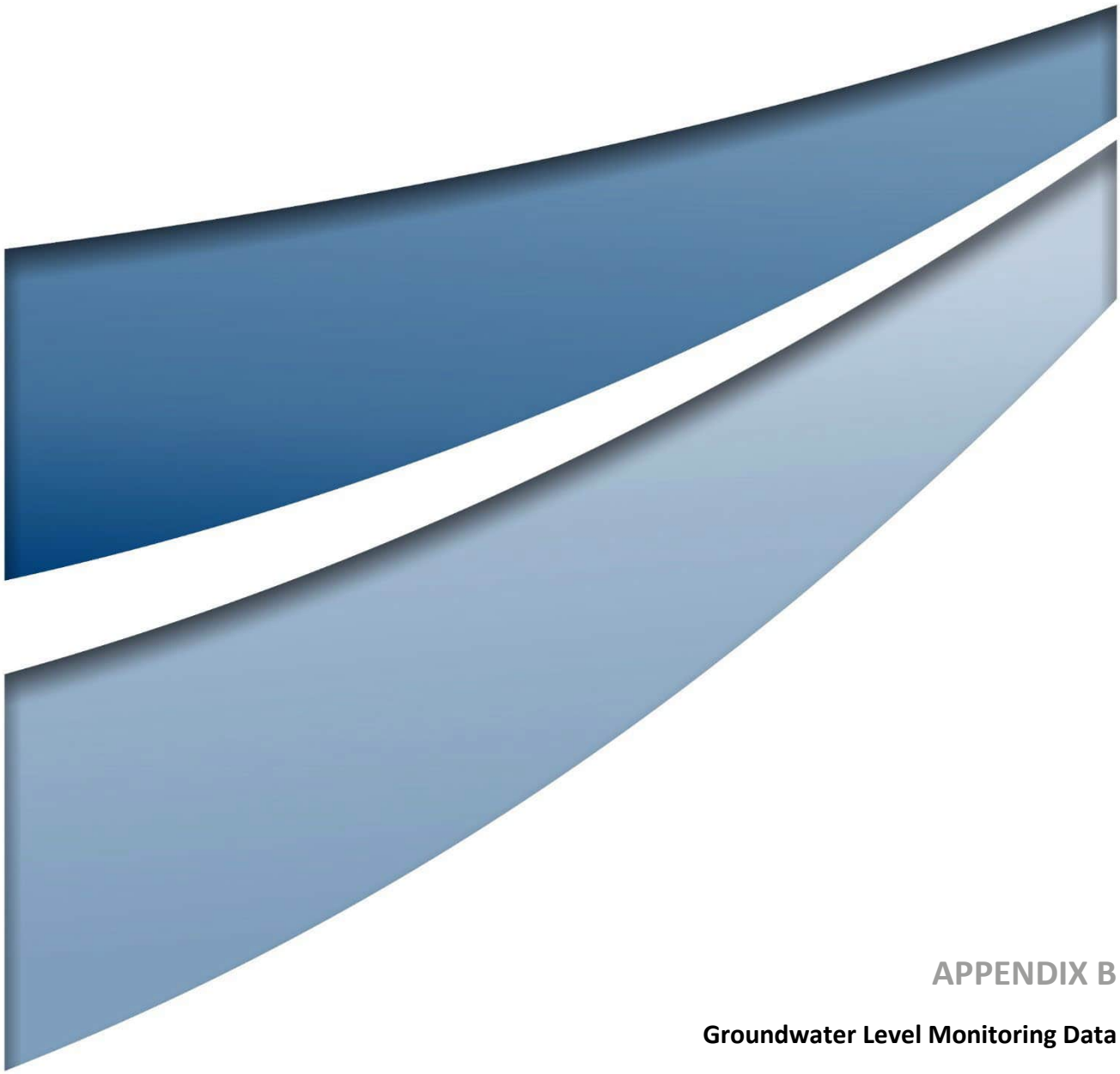
Groundwater Compliance Monitoring Network and Trigger Levels

Bore ID	Easting (m)	Northing (m)	Type	TOC Elevation (mAHD)	Surface Elevation (mAHD)	Bore/ Sensor Depth (mbTOC)	Screen/Sensor (mAHD)	Stratigraphy	Logger/ Sensor Installed	Purpose of Bore	SWL Frequency	WQ Frequency	Water Level Trigger Derivation Method	Water Level Trigger (mAHD)	Water Level Trigger (mbTOC)	pH Trigger Range	EC Trigger Stage 1 (µS/cm)	EC Trigger Stage 2 (µS/cm)
BCGW18	294345	6419985	MB	158.76	158.3	11.60	147.5 - 150.5	Arrowfield Seam	Y	Monitoring of Arrowfield seam, close to old channel of Quarry Creek, and to monitor the impact of mining activities adjacent to mining areas to the west of MAC.	D/Q	Q/A	3	147.3	11.46	7.0-9.1	8030	8510
BCGW22A (IW4027)	295314	6414210	MB	143.8	143.45	15.00	129.3 - 135.3	Saddlers Shallow Permian	Y	Monitoring of alluvium in unnamed tributary of Saddlers Creek, between McDonalds Pit/Void and Saddlers Creek. A paired bore with BCGW22(IW4026) to assess vertical hydraulic gradient between Permian Coal measures (Glen Munro seam) and alluvium, as well as any impact of mining activities adjacent to mining areas to the north of MAC.	D/Q	Q/A	1	137.6	6.20	6.6-7.1	11810	14500
BCGW22P (IW4026)	295301	6414215	MB	143.74	143.39	33.00	113.0 - 116.0	Glen Munro Seam	Y	Monitoring of Glen Munro seam in unnamed tributary of Saddlers Creek, between McDonalds Pit/Void (mined to Blakefield seam) and Saddlers Creek. A paired bore with BCGW22A(IW4027) to assess vertical hydraulic gradient between Permian Coal measures (Glen Munro seam) and alluvium, and the impact of mining activities adjacent to mining areas to the south-west of MAC.	D/Q	Q/A	3	133.7	10.04	7.1-9.9	14100	16270
EWPC33	294253	6416847	MB	230.32	229.32	57.38	175.6 - 178.6	Blakefield Seam	Y	Monitoring of Blakefield Seam to the west of McDonalds Pit/Void (mined to Blakefield seam) and monitor the impact of mining activities adjacent to mining areas in the area west of MAC.	D/Q	Q/A	1	194.3	36.02	6.5-7.5	4592	6290
GW16	294197	6422759	MB	131.71	131.57	12.91	120.5 - 126.5	Hunter River Alluvium	Y	Monitoring of Hunter River alluvium between the Hunter River and north-west end of MAC to identify any leakage from the Hunter River alluvium due to adjacent mining activities at MAC.	D/Q	Q/A	1	120.9	10.82	7.0-7.7	4210	4690
GW2	299045	6413511	MB	153.84	153.47	113.00	40.8 - 43.8	Woodlands Hill Seam	Y	Monitoring of Woodlands Hill Seam in the Saddlers Creek area. A paired bore with GW3, GW45 and GW46 to assess vertical hydraulic gradient between Permian Coal measures (Woodlands Hill seam) and alluvium, and the impact of mining activities adjacent to mining areas in the Saddlers Creek area.	D/Q	Q/A	2	133.2	20.64	6.5-8.0	4266	4770
GW21	296141	6424483	MB	136.96	136.96	16.00	122.4 - 128.4	Hunter River Alluvium	Y	Monitoring of Hunter River alluvium between the Hunter River and north end of MAC to identify any leakage from the Hunter River alluvium due to adjacent mining activities at MAC.	D/Q	Q/A	1	125	11.96	6.8-7.8	1197	2000
GW38A (IW4030)	293831	6422393	MB	131.71	131.1	11.37	108.7 - 131.7	Hunter River Alluvium	Y	Monitoring of Hunter River alluvium close to the Hunter River and NW end of main pit. A paired bore with GW38P to assess vertical hydraulic gradient between Permian Coal measures (Warkworth seam) and alluvium, as well as any impact of mining activities adjacent to mining areas to the north of MAC.	D/Q	Q/A	1	120.7	11.01	6.5-7.7	4900	5560
GW38P	293832	6422384	MB	131.16	131.16	23.00	98.6 - 131.6	Warkworth Seam	Y	Monitoring of Warkworth seam close to the Hunter River and NW end of main pit. A paired bore with GW38A(IW4030) to assess vertical hydraulic gradient between Permian Coal measures (Warkworth seam) and alluvium, and the impact of mining activities adjacent to mining areas to the north of MAC.	D/Q	Q/A	2	120.9	10.74	7.2-8.1	3224	3830

Bore ID	Easting (m)	Northing (m)	Type	TOC Elevation (mAHD)	Surface Elevation (mAHD)	Bore/ Sensor Depth (mbTOC)	Screen/Sensor (mAHD)	Stratigraphy	Logger/ Sensor Installed	Purpose of Bore	SWL Frequency	WQ Frequency	Water Level Trigger Derivation Method	Water Level Trigger (mAHD)	Water Level Trigger (mbTOC)	pH Trigger Range	EC Trigger Stage 1 (µS/cm)	EC Trigger Stage 2 (µS/cm)
GW39P	293094	6422251	MB	130.72	130.3	42.16	88.1 - 91.1	Warkworth Seam	Y	Monitoring of Hunter River alluvium close to the Hunter River and NW end of the main pit. A paired bore with GW39A to assess vertical hydraulic gradient between Permian Coal measures (Warkworth seam) and alluvium, as well as any impact of mining activities adjacent to mining areas to the north of MAC.	D/Q	-	3	116	14.72	-	-	-
GW40A	291816	6422119	MB	129.27	128.9	13.18	114.3 - 128.3	Hunter River Alluvium	Y	Monitoring of Hunter River alluvium. A paired bore with GW48 to assess vertical hydraulic gradient between Permian Coal measures (Bowfield seam) and alluvium, and the impact of mining activities adjacent to mining areas to the north of MAC.	D/Q	Q/A	1	117.8	11.48	6.9-8.0	5290	5650
GW41A (IW4029)	290348	6421810	MB	126.48	125.91	8.00	112.5 - 126.5	Hunter River alluvium and coal measures	Y	Monitoring of Hunter River alluvium. A paired bore with GW49 to assess vertical hydraulic gradient between Permian Coal measures (Arrowfield seam) and alluvium, as well as any impact of mining activities adjacent to mining areas to the north of MAC.	D/Q	Q/A	1	117.9	8.57	6.6-7.7	9090	10600
GW43	294233	6418560	MB	197.33	196.83	69.00	133.8 - 139.8	Woodlands Hill Seam	Y	Monitoring of Woodlands Hill Seam, northwest of Belmont Pit/Void (mined to Glen Munro seam). A paired bore with GW6 to assess vertical hydraulic gradient of Permian Coal measures (Woodlands Hill seam), and the impact of mining activities adjacent to mining areas to the west of MAC.	D/Q	Q/A	1	165.4	31.93	6.7-7.4	4400	4470
GW44	297445	6414733	MB	211.03	210.5	133.00	80.5 - 86.5	Woodlands Hill Seam	Y	Monitoring of Woodlands Hill Seam to the west of Saddlers Central Pit and to monitor the impact of mining activities adjacent to mining areas in the Saddlers Creek area.	D/Q	-	2	99.9	111.13	-	-	-
GW45	298890	6413630	MB	152.41	151.89	15.00	138.9 - 141.9	Saddlers Creek alluvium	Y	Monitoring of Saddlers Creek alluvium in the Saddlers Creek area. A paired bore with GW2, GW3 and GW46 to assess vertical hydraulic gradient between Permian Coal measures (Woodlands Hill seam) and alluvium, and the impact of mining activities adjacent to mining areas in the Saddlers Creek area.	D/Q	Q/A	1	138.9	13.51	6.6-7.1	11810	14500
GW46	298337	6413469	MB	144.14	143.63	21.00	126.1 - 129.1	Saddlers Shallow Permian	Y	Monitoring of Saddlers Creek alluvium in the Saddlers Creek area. A paired bore with GW2, GW3 and GW45 to assess vertical hydraulic gradient between Permian Coal measures (Woodlands Hill seam) and alluvium, as well as any impact of mining activities adjacent to mining areas to the north of MAC.	D/Q	Q/A	2	129	15.15	6.3-8.0	8050	11380
GW47	297409	6412974	MB	137	136.51	18.00	120.5 - 123.5	Saddlers Creek alluvium	Y	Monitoring Saddlers Creek alluvium to the south of Saddlers Creek and monitor the impact of mining activities adjacent to mining areas in the Saddlers Creek area.	D/Q	Q/A	2	127.3	9.70	6.5-7.6	7320	8220
GW48	291830	6422111	MB	129.62	129.07	36.15	95.0 - 98.0	Bowfield Seam	Y	Monitoring of Bowfield seam. A paired bore with GW40A to assess vertical hydraulic gradient between Permian Coal measures (Bowfield seam) and alluvium, and the impact of mining activities adjacent to mining areas to the north of MAC.	D/Q	Q/A	1	117.7	11.93	6.8-8.2	4090	4750
GW49	290346	6421798	MB	126.62	126.02	36.00	92.1 - 95.1	Arrowfield Seam	Y	Monitoring of Arrowfield Seam. A paired bore with GW41A(IW4029) to assess vertical hydraulic gradient between Permian Coal measures (Arrowfield seam) and alluvium, and the impact of mining activities adjacent to mining areas to the north of MAC.	D/Q	Q/A	1	117.6	8.95	6.1-7.5	6170	7530

Bore ID	Easting (m)	Northing (m)	Type	TOC Elevation (mAHD)	Surface Elevation (mAHD)	Bore/ Sensor Depth (mbTOC)	Screen/Sensor (mAHD)	Stratigraphy	Logger/ Sensor Installed	Purpose of Bore	SWL Frequency	WQ Frequency	Water Level Trigger Derivation Method	Water Level Trigger (mAHD)	Water Level Trigger (mbTOC)	pH Trigger Range	EC Trigger Stage 1 (µS/cm)	EC Trigger Stage 2 (µS/cm)
OD1078P (IW4028)	294491	6419265	MB	171.26	171.26	65.00	107.3 - 110.3	Arrowfield Seam	Y	Monitoring of Arrowfield Seam close to an old channel of Quarry Creek, to the north-west of Belmont Pit/Void (mined to Glen Munro seam).	D/Q	-	2	134.6	36.84	-	-	-
X1MB	293566	6422429	MB	131.47	131.47	13.96	65.0 - 118.2	Hunter River Alluvium	Y	Monitoring of Hunter River alluvium.	D	-	3	119.7	11.77	-	-	-
X10MB	293247	6418841	MB	248.19	248.19	81.26	166.9 - 169.9	Glen Munro Seam	Y	Monitoring of Glen Munro Seam.	D	-	2	176.9	71.95	-	-	-
VWP2_P1	295195	6423364	VWP	135.41	135.41	216.5	-81.1	F4 Fault	Y	Targeting F4 Fault zone to monitor any variations in water levels within the fault and coals seams either side of, and displaced by, fault movement. Also, to monitor the effectiveness of cut off wall located between the Hunter River and the northern end of MAC. A paired bore with GW42, VWP1, and VWP3 to assess vertical hydraulic gradient between Permian Coal measures and alluvium, and the impact of mining activities adjacent to mining areas to the north of MAC.	D	-	2	-0.6	-	-	-	-
VWP3_P1	295166	6423349	VWP	135.38	135.38	227	-91.6	Edinglassie Seam	No longer functioning	Targeting Edinglassie seam, above F4 fault on footwall, to monitor any variations in water levels within the fault and coals seams either side of, and displaced by, fault movement. Also, to monitor the effectiveness of cut off wall located between the Hunter River and the northern end of MAC. A paired bore with GW42, VWP1, and VWP2 to assess vertical hydraulic gradient between Permian Coal measures and alluvium, and the impact of mining activities adjacent to mining areas to the north of MAC.	D	-	2	-0.6	-	-	-	-
VWP3_P2						241	-105.6	Ramrod Creek Seam	Y	Targeting Ramrod Creek seam (RK4) on the footwall of the F4 Fault to provide detail on the maximum potential pore water pressures within the highwall and to provide detail on the maximum potential pore water pressures within the highwall. Monitoring of Ramrod Creek seam and effectiveness of cut off wall located between the Hunter River and the northern end of MAC. A paired bore with GW42, VWP1, and VWP2 to assess vertical hydraulic gradient between Permian Coal measures and alluvium, and the impact of mining activities adjacent to mining areas to the north of MAC.	D	-	2	-27.9	-	-	-	-
VWP04_130	294719	6422132	VWP	140.8	140.8	130	10.8	Vaux Seam	Y	Monitoring any depressurisation in Vaux Seam due to mining activities at MAC.	D	-	3	42.2	-	-	-	-
VWP04_161						161	-20.2	Bayswater Seam	Y	Monitoring any depressurisation in Bayswater Seam due to mining activities at MAC.	D	-	3	37.3	-	-	-	-
VWP04_201						201	-60.2	Edderton Seam	Y	Monitoring any depressurisation in Edderton Seam due to mining activities at MAC.	D	-	3	22	-	-	-	-
VWP04_262						262	-121.2	Edinglassie Seam	Y	Monitoring any depressurisation in Edinglassie Seam due to mining activities at MAC.	D	-	3	-7.5	-	-	-	-
VWP04_285						285	-144.2	Ramrod Creek Seam	Y	Monitoring any depressurisation in Ramrod Creek Seam due to mining activities at MAC.	D	-	3	-12.6	-	-	-	-

Bore ID	Easting (m)	Northing (m)	Type	TOC Elevation (mAHD)	Surface Elevation (mAHD)	Bore/ Sensor Depth (mbTOC)	Screen/Sensor (mAHD)	Stratigraphy	Logger/ Sensor Installed	Purpose of Bore	SWL Frequency	WQ Frequency	Water Level Trigger Derivation Method	Water Level Trigger (mAHD)	Water Level Trigger (mbTOC)	pH Trigger Range	EC Trigger Stage 1 (µS/cm)	EC Trigger Stage 2 (µS/cm)
VWP05_164	293993	6421605	VWP	161.4	161.4	164	-2.6	Vaux Seam	Y	Monitoring any depressurisation in Vaux Seam due to mining activities at MAC.	D	-	2	32.4	-	-	-	-
VWP05_192						192	-30.6	Bayswater Seam	Y	Monitoring any depressurisation in Bayswater Seam due to mining activities at MAC.	D	-	2	32.4	-	-	-	-
VWP05_227						227	-65.6	Edderton Seam	Y	Monitoring any depressurisation in Edderton Seam due to mining activities at MAC.	D	-	2	-6.2	-	-	-	-
VWP05_288						288	-126.6	Edinglassie Seam	Y	Monitoring any depressurisation in Edinglassie Seam due to mining activities at MAC.	D	-	2	28.2	-	-	-	-
VWP05_311						311	-149.6	Ramrod Creek Seam	Y	Monitoring any depressurisation in Ramrod Creek Seam due to mining activities at MAC.	D	-	2	6.6	-	-	-	-
VWP06_237	293960	6420850	VWP	179.64	179.64	237	-57.4	Vaux Seam	Y	Monitoring any depressurisation in Vaux Seam due to mining activities at MAC.	D	-	2	43.1	-	-	-	-
VWP06_269						269	-89.4	Broonie Seam	Y	Monitoring any depressurisation in Broonie Seam due to mining activities at MAC.	D	-	2	43.1	-	-	-	-
VWP06_304						304	-124.4	Edderton Seam	Y	Monitoring any depressurisation in Edderton Seam due to mining activities at MAC.	D	-	2	4.1	-	-	-	-
VWP06_366						366	-186.4	Edinglassie Seam	Y	Monitoring any depressurisation in Edinglassie Seam due to mining activities at MAC.	D	-	2	58.1	-	-	-	-
VWP06_388						388	-208.4	Ramrod Creek Seam	Y	Monitoring any depressurisation in Ramrod Creek Seam due to mining activities at MAC.	D	-	2	53.7	-	-	-	-
VWP07_223	295656	6419565	VWP	215.95	215.95	223	-70.6	Piercefield Seam	Y	Monitoring any depressurisation in Piercefield Seam due to mining activities at MAC.	D	-	2	94.5	-	-	-	-
VWP07_271						271	-70.6	Vaux Seam	Y	Monitoring of Vaux Seam. A paired bore with GW7 to assess vertical hydraulic gradient between Permian Coal measures (Woodlands Hill, Piercefield, Vaux, Bayswater, Edderton and Ramrod Creek seams), and the impact of mining activities adjacent to mining areas to the north-west of MAC.	D	-	3	77.5	-	-	-	-
VWP07_286						286	-70.6	Bayswater Seam	Y	Monitoring of Vaux Seam. A paired bore with GW7 to assess vertical hydraulic gradient between Permian Coal measures (Woodlands Hill, Piercefield, Vaux, Bayswater, Edderton and Ramrod Creek seams), and the impact of mining activities adjacent to mining areas to the north-west of MAC.	D	-	2	40.4	-	-	-	-
VWP07_326						326	-110.1	Edderton Seam	Y	Monitoring of Vaux Seam. A paired bore with GW7 to assess vertical hydraulic gradient between Permian Coal measures (Woodlands Hill, Piercefield, Vaux, Bayswater, Edderton and Ramrod Creek seams), and the impact of mining activities adjacent to mining areas to the north-west of MAC.	D	-	2	-16.7	-	-	-	-
VWP07_418						418	-202.1	Ramrod Creek Seam	Y	Monitoring of Vaux Seam. A paired bore with GW7 to assess vertical hydraulic gradient between Permian Coal measures (Woodlands Hill, Piercefield, Vaux, Bayswater, Edderton and Ramrod Creek seams), and the impact of mining activities adjacent to mining areas to the north-west of MAC.	D	-	3	95.7	-	-	-	-



APPENDIX B

Groundwater Level Monitoring Data

Construction								Triggers	Modelled Levels	Measured Groundwater Levels							Drawdown		
Bore ID	Easting (m)	Northing (m)	TOC Elevation (mAHD)	Bore/Sensor Depth (mbTOC)	Target Formation	Type	Classification	WMP Trigger (2020) (mAHD)	MAC Consolidation Project June 2022 Modelled Head (mAHD)	First Record			June 2021		June 2022		Head Difference Modelled vs Measured (m) June 2022[2] (Residual)	Measured Drawdown First Record vs Measured (m) June 2022[3]	Expected Drawdown First Record vs Modelled (m) June 2022[3]
										WL Date	Depth to Water (mBTOC)	WL Elevation (mAHD)	Depth to Water (mBTOC)	WL Elevation (mAHD)	Depth to Water (mBTOC)	WL Elevation (mAHD)			
BCGW18	294345.2	6419985.4	158.76	11.60	Arrowfield Seam	MB	Compliance	-	134.96	Jan-08	3.90	154.90	Dry	Dry	Dry	Dry	-	-	-
BCGW22A (IW4027)	295313.6	6414209.8	143.80	15.00	Saddlers Shallow Permian	MB	Compliance	137.6	138.80	Feb-16	3.02	141.00	4.57	139.23	3.4	140.403	-1.61	-0.60	-2.20
BCGW22 (IW4026)	295301.5	6414214.7	143.74	33.00	Glen Munro Seam	MB	Compliance	133.7	139.55	Feb-16	3.22	140.80	5.95	137.79	4.06	139.679	-0.13	-1.12	-1.25
EWPC33	294252.7	6416847.0	230.32	57.38	Blakefield Seam	MB	Compliance	194.3	205.15	Jan-08	34.30	196.00	32.04	198.28	26.6	203.723	1.42	7.72	9.15
GW16	294197.3	6422759.3	131.71	12.91	Hunter River Alluvium	MB	Compliance	120.9	125.30	Feb-99	9.20	123.00	9.46	122.25	8.83	122.884	2.42	-0.12	2.30
GW2	299044.8	6413510.7	153.84	113.00	Woodlands Hill Seam	MB	Compliance	133.2	133.40	Jun-01	7.50	146.40	11.34	142.50	9.44	144.403	-11.00	-2.00	-13.00
GW21	296141.4	6424483.0	135.96	16.00	Hunter River Alluvium	MB	Compliance	125.0	129.66	Feb-99	8.60	127.40	9.46	126.50	9.01	126.953	2.71	-0.45	2.26
GW38A (IW4030)	293831.3	6422393.1	131.71	11.37	Hunter River alluvium and coal measures	MB	Compliance	120.7	125.05	Feb-16	9.60	122.15	9.64	122.07	8.93	122.78	2.27	0.63	2.90
GW38P	293831.7	6422384.0	131.64	23.00	Warkworth Seam	MB	Compliance	120.9	123.61	Jan-08	9.50	122.00	10.26	121.38	9.71	121.93	1.68	-0.07	1.61
GW39P	293094.4	6422251.0	130.72	42.16	Warkworth Seam	MB	Compliance	116.0	123.61	Jan-08	8.50	121.90	10.45	120.27	10.05	120.665	2.94	-1.24	1.71
GW40A	291815.5	6422119.3	129.27	13.18	Hunter River Alluvium	MB	Compliance	117.8	123.76	Jan-08	9.60	119.70	9.90	119.37	8.72	120.551	3.21	0.85	4.06
GW41A (IW4029)	290347.8	6421809.9	126.48	8.00	Hunter River alluvium and coal measures	MB	Compliance	117.9	122.60	Feb-16	7.36	119.20	7.26	119.22	6.9	119.576	3.03	0.38	3.40
GW43	294233.0	6418560.1	197.33	69.00	Woodlands Hill Seam	MB	Compliance	165.4	161.76	Feb-16	27.49	169.84	29.05	168.28	27.79	169.54	-7.78	-0.30	-8.08
GW44	297444.5	6414732.6	211.03	133.00	Woodlands Hill Seam	MB	Compliance	99.9	100.72	Feb-16	85.14	125.89	112.42	98.61	113.1	97.931	2.79	-27.96	-25.17
GW45	298889.8	6413629.5	152.41	15.00	Saddlers Creek alluvium	MB	Compliance	138.9	141.61	Feb-16	8.43	144.03	11.45	140.96	9.22	143.189	-1.58	-0.84	-2.42
GW46	298336.8	6413469.3	144.14	21.00	Saddlers Shallow Permian	MB	Compliance	129.0	129.68	Feb-16	6.91	137.25	9.00	135.14	7.02	137.124	-7.44	-0.13	-7.57
GW47	297408.8	6412974.1	137.00	18.00	Saddlers Creek alluvium	MB	Compliance	127.3	128.10	Feb-16	6.41	130.66	7.47	129.53	6.59	130.412	-2.31	-0.25	-2.56
GW48	291829.6	6422110.7	129.62	36.15	Bowfield Seam	MB	Compliance	117.7	123.65	Feb-16	10.77	118.93	10.41	119.21	9.21	120.412	3.24	1.48	4.72
GW49	290345.7	6421797.6	126.55	36.00	Arrowfield Seam	MB	Compliance	117.6	121.62	Feb-16	7.78	118.77	7.62	118.93	7.15	119.4	2.22	0.63	2.85
OD1078P (IW4028)	294490.6	6419265.2	171.26	65.00	Arrowfield Seam	MB	Compliance	134.6	136.41	Jan-08	7.3	164.1	36.06	135.20	36.27	134.987	1.42	-29.11	-27.69
VWP2_P1	295194.8	6423364.1	135.41	216.50	F4 Fault	VWP	Compliance	-0.6	2.35	Aug-11	47.7	87.7	-	0.80	-	1.89	0.46	-85.81	-85.35
VWP3_P1	295165.9	6423349.4	135.38	227.00	Edinglassie Seam	VWP	Compliance	-0.6	2.35	Sep-11	29.8	105.6	-	3.46	-	2.52	-0.17	-103.08	-103.25
VWP3_P2				241.00	Ramrod Creek Seam	VWP	Compliance	-27.9	-24.90		33.3	102.1	-	Faulty	-	Faulty	-	-	-
VWP04_130	294719.2	6422131.7	140.84	130.00	Vaux Seam	VWP	Compliance	42.2	-35.44	Dec-15	66.28	77.04	-	29.00	-	22.77	-58.21	-54.27	-112.48
VWP04_161				161.00	Bayswater Seam	VWP	Compliance	37.3	-35.44		97.15	76.98	-	33.10	-	26.39	-61.83	-50.59	-112.42
VWP04_201				201.00	Edderton Seam	VWP	Compliance	22	-86.05		135.41	75.24	-	17.30	-	10.91	-96.96	-64.33	-161.29
VWP04_262				262.00	Edinglassie Seam	VWP	Compliance	-7.5	-152.82		185.92	64.2	-	-11.20	-	-23.64	-129.18	-87.84	-217.02
VWP04_285				285.00	Ramrod Creek Seam	VWP	Compliance	-12.6	-158.82		205.46	61.17	-	-14.40	-	-26.78	-132.04	-87.95	-219.99
VWP05_164	293993.3	6421605.1	161.4	164.00	Vaux Seam	VWP	Compliance	32.4	63.52	Dec-15	89.55	68.95	-	49.20	-	42.07	21.45	-26.88	-5.43
VWP05_192				192.00	Bayswater Seam	VWP	Compliance	32.4	63.52		116.78	86.13	-	46.60	-	39.62	23.90	-46.51	-22.61
VWP05_227				227.00	Edderton Seam	VWP	Compliance	-6.2	35.33		151.13	85.47	-	45.00	-	36.62	-1.29	-48.85	-50.14
VWP05_288				288.00	Edinglassie Seam	VWP	Compliance	28.2	76.84		196.38	69.67	-	Faulty	-	Faulty	-	-	-
VWP05_311				311.00	Ramrod Creek Seam	VWP	Compliance	6.6	71.81		212.85	63.04	-	Faulty	-	Faulty	-	-	-
VWP06_237	293960.3	6420850.4	179.64	237.00	Vaux Seam	VWP	Compliance	43.1	68.91	Dec-15	149.66	92.3	-	Faulty	-	Faulty	-	-	-
VWP06_269				269.00	Broonie Seam	VWP	Compliance	43.1	68.91		179.49	89.99	-	80.10	-	73.08	-4.17	-16.91	-21.08
VWP06_304				304.00	Edderton Seam	VWP	Compliance	4.1	39.11		214.63	90.08	-	67.70	-	60.03	-20.92	-30.05	-50.97

Bore ID	Easting (m)	Northing (m)	TOC Elevation (mAHD)	Bore/Sensor Depth (mbTOC)	Target Formation	Type	Classification	WMP Trigger (2020) (mAHD)	MAC Consolidation Project June 2022 Modelled Head (mAHD)	First Record			June 2021		June 2022		Head Difference Modelled vs Measured (m) June 2022[2] (Residual)	Measured Drawdown First Record vs Measured (m) June 2022[3]	Expected Drawdown First Record vs Modelled (m) June 2022[3]
										WL Date	Depth to Water (mBTOC)	WL Elevation (mAHD)	Depth to Water (mBTOC)	WL Elevation (mAHD)	Depth to Water (mBTOC)	WL Elevation (mAHD)			
VWP06_366				366.00	Edinglassie Seam	VWP	Compliance	58.1	91.80		272.85	86.33	-	66.40	-	58.01	33.79	-28.32	5.47
VWP06_388				388.00	Ramrod Creek Seam	VWP	Compliance	53.7	92.20		290.91	82.04	-	Faulty	-	Faulty	-	-	-
VWP07_223				223.00	Piercefield Seam	VWP	Compliance	94.5	113.24		130.65	123.55	-	99	-	93.8	19.44	-29.75	-10.31
VWP07_271				271.00	Vaux Seam	VWP	Compliance	77.5	113.24		171.33	116.15	-	97.9	-	93.1	20.14	-23.05	-2.91
VWP07_286	295656.1	6419564.9	215.95	286.00	Bayswater Seam	VWP	Compliance	40.4	64.74	Dec-15	175.42	104.89	-	85.1	-	83.2	-18.46	-21.69	-40.15
VWP07_326				326.00	Edderton Seam	VWP	Compliance	-16.7	9.85		204.93	94.78	-	84.2	-	80.5	-70.65	-14.28	-84.93
VWP07_418				418.00	Ramrod Creek Seam	VWP	Compliance	95.7	145.38		264.50	154.32	-	Faulty	-	Faulty	-	-	-
X1MB	293566.0	6422429.0	132.11	13.96	Hunter River Alluvium	MB	Compliance	119.7	125.00	Nov-20	10.67	121.44	10.61	121.50	10.29	121.18	3.82	-0.26	3.56
X10MB	293247.0	6418841.0	248.19	81.26	Glen Munro Seam	MB	Compliance	176.9	176.90	Nov-20	65.60	182.59	65.36	182.83	64.4	183.79	-6.89	1.20	-5.69

Notes: *1 TOC Elev – Top of Casing elevation; mAHD metres above Australian Height Datum; WL – water level; mBTOC – metres below top of casing.*

2 Negative values indicate the measured piezometric level is higher than modelled – this means the model is over-predicting effects at this site for FY21.

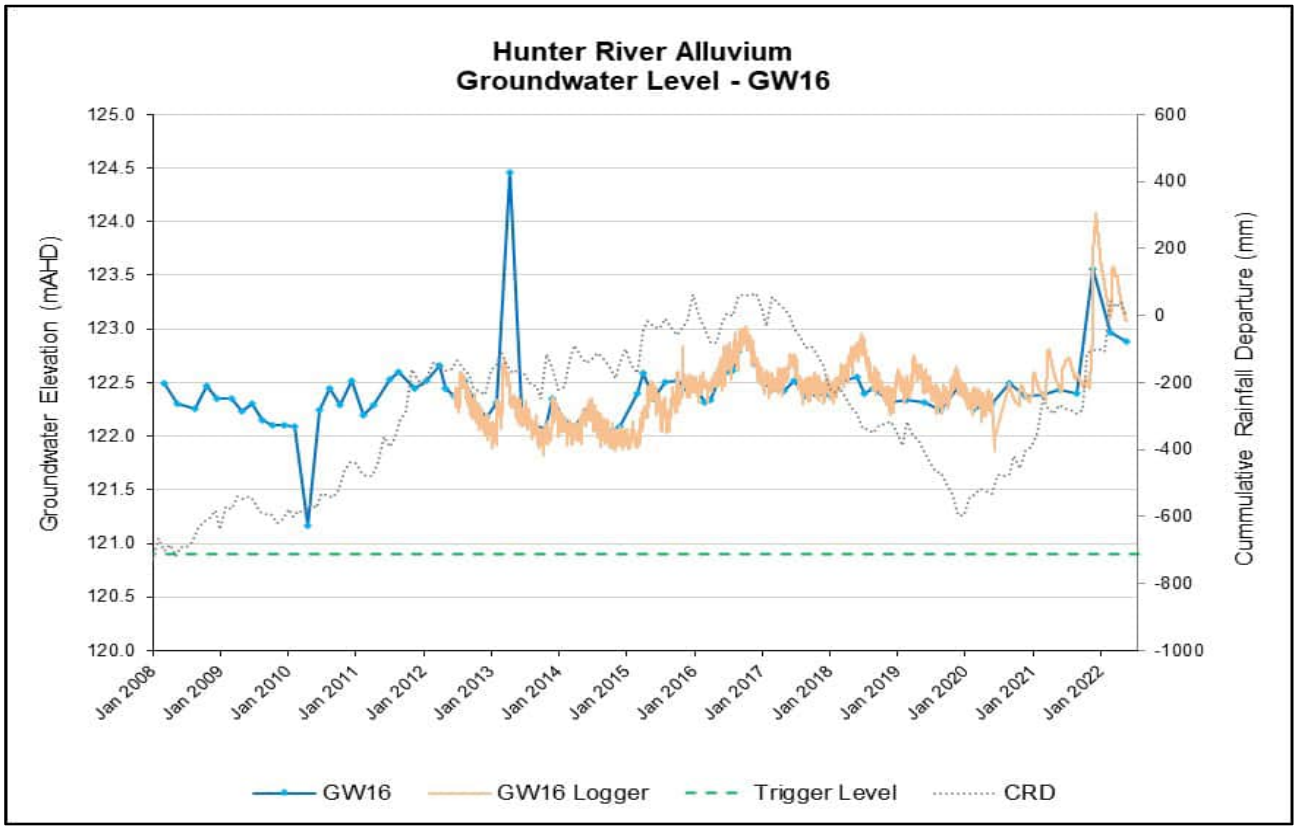
3 Negative values indicate drawdown.

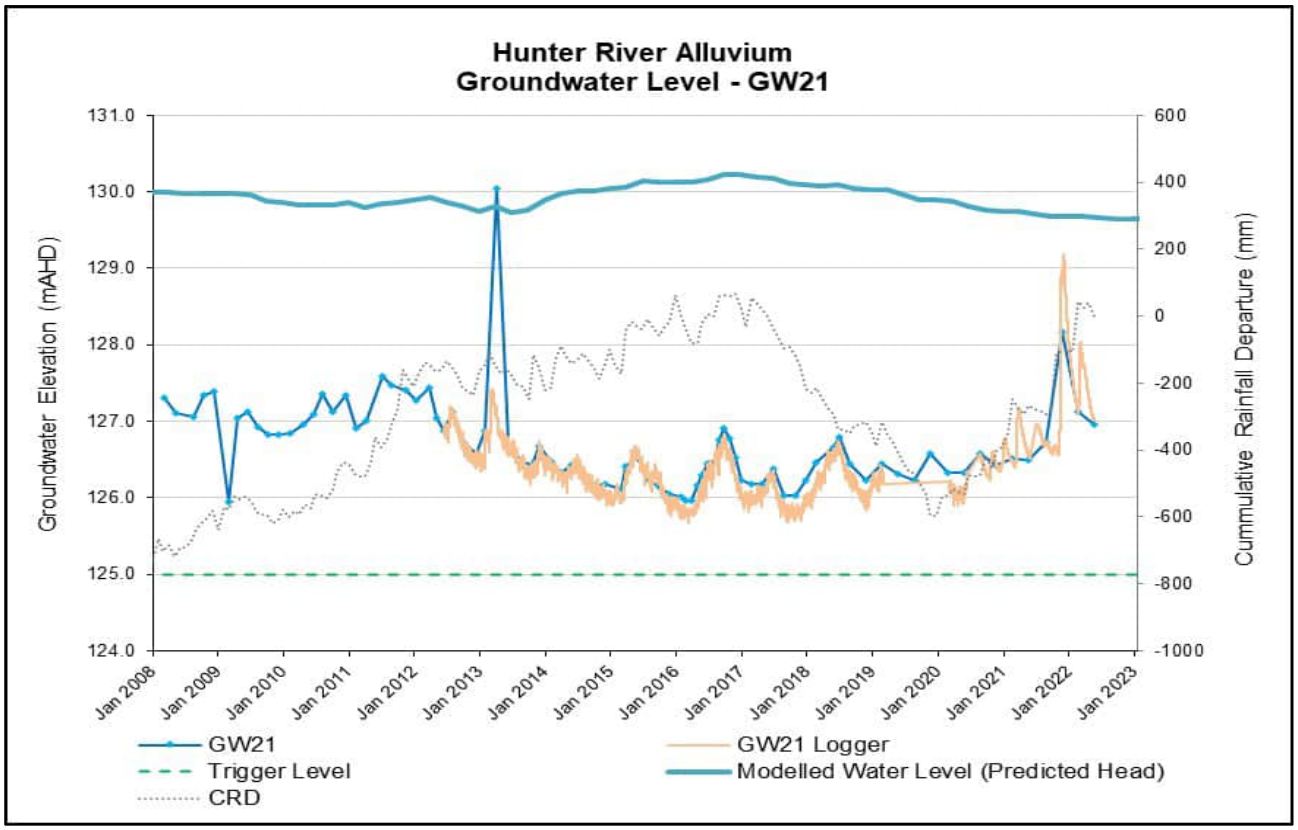
4 Negative values indicate drawdown over the last year.

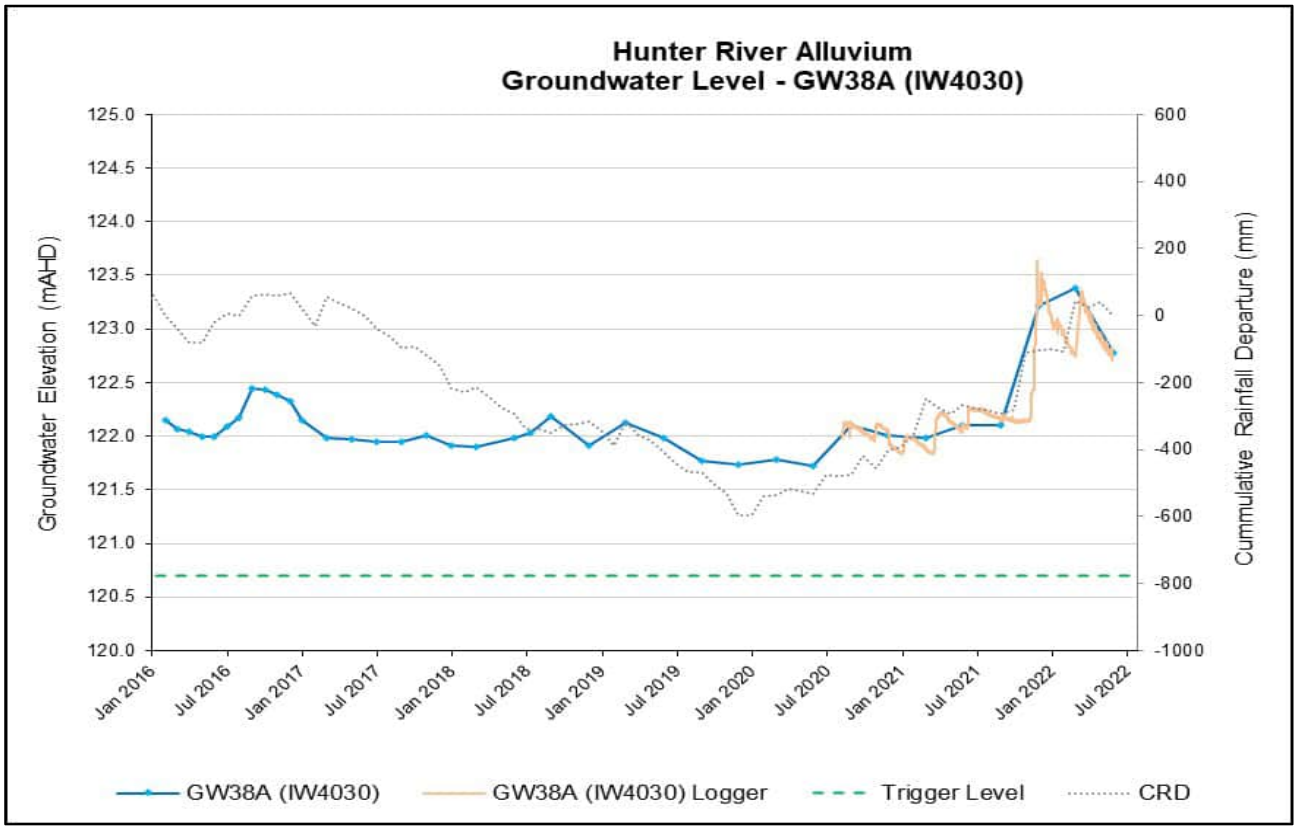
NM – Not monitored / data not available.

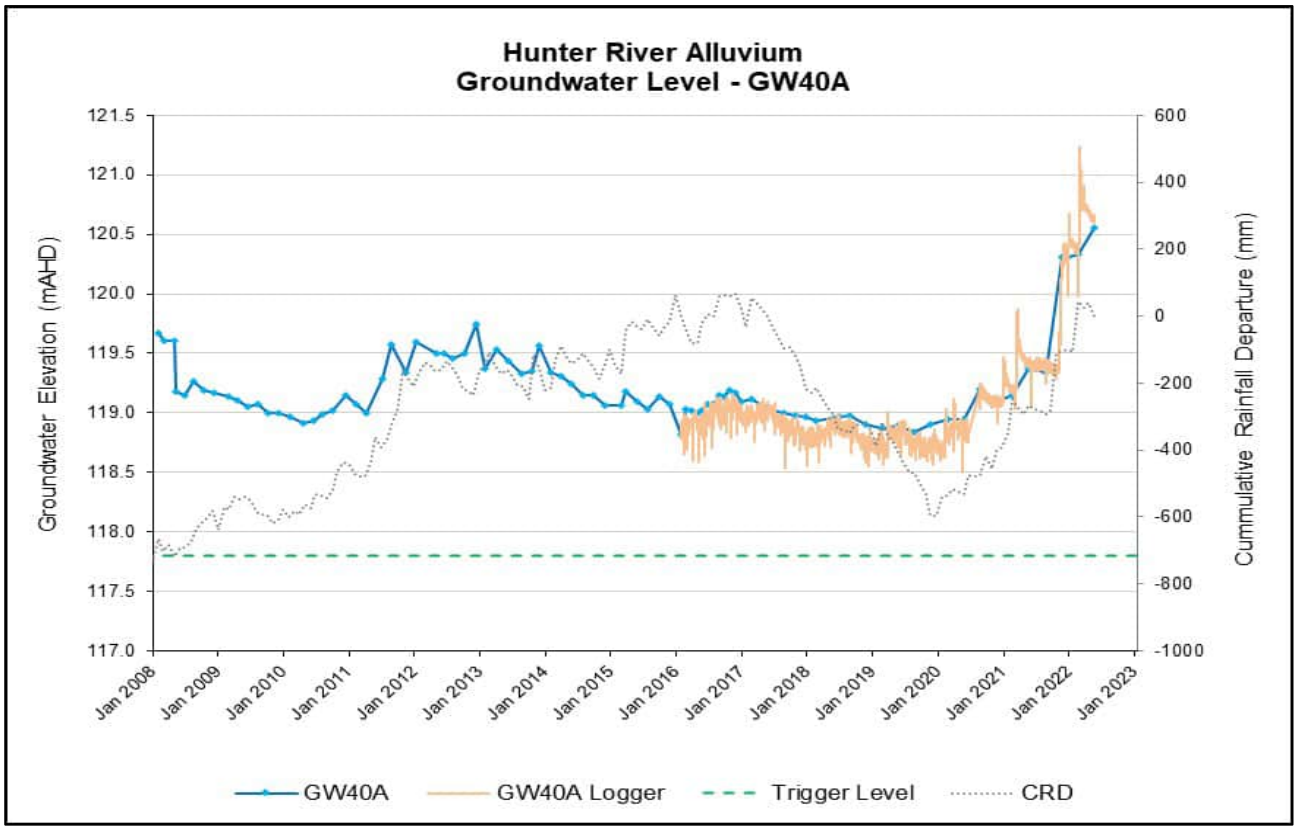
APPENDIX C

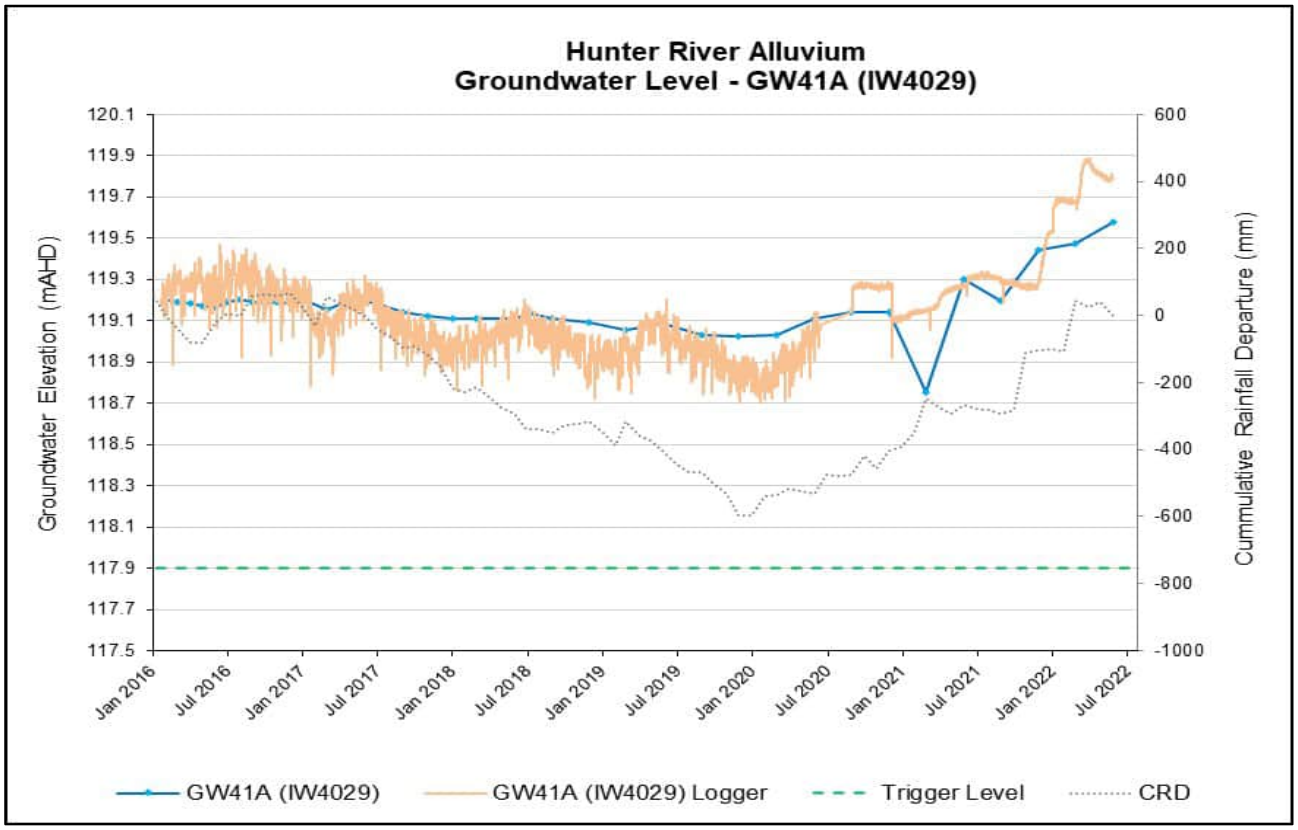
Groundwater Level Graphs

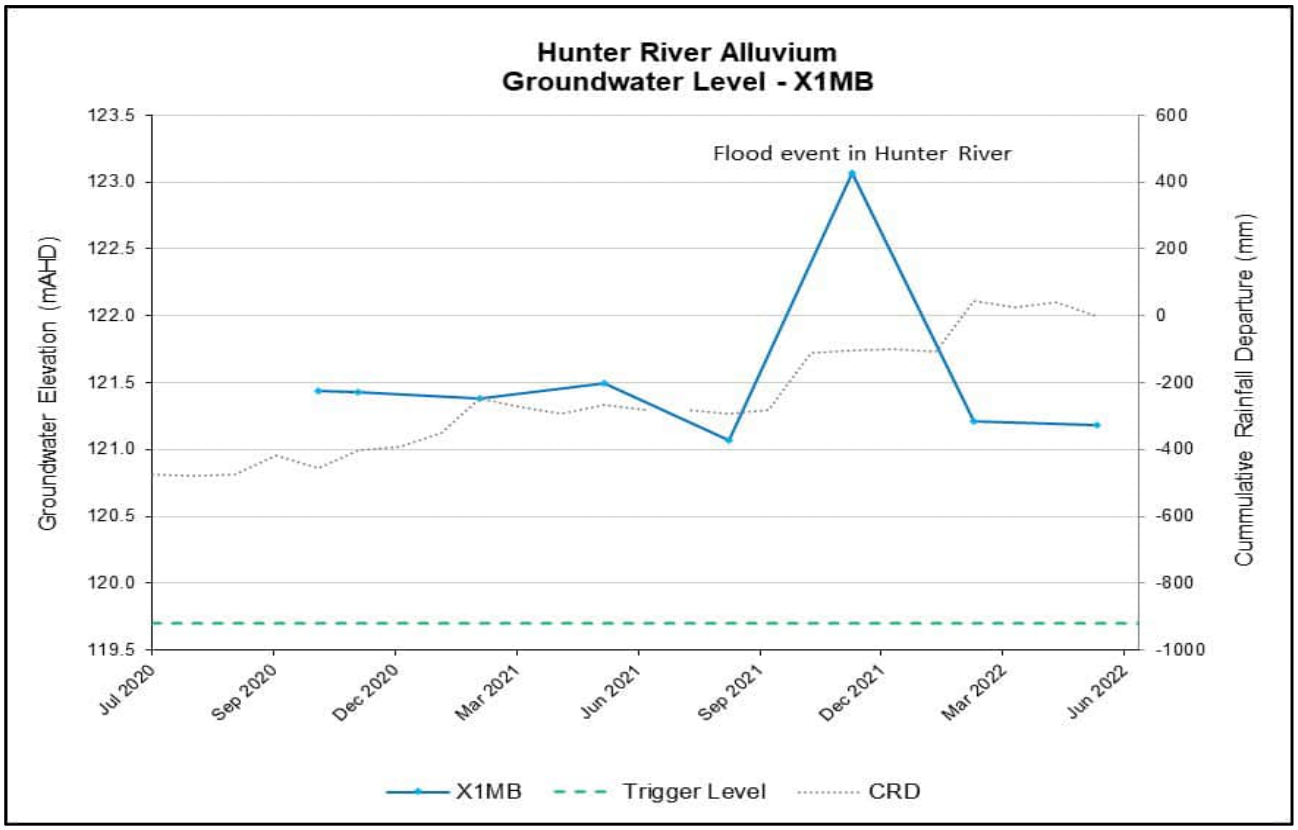

Hunter River Alluvium
Groundwater Level - GW16
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
125.0
124.5
124.0
123.5
123.0
122.5
122.0
121.5
121.0
120.5
120.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
GW16
GW16 Logger
Trigger Level
CRD

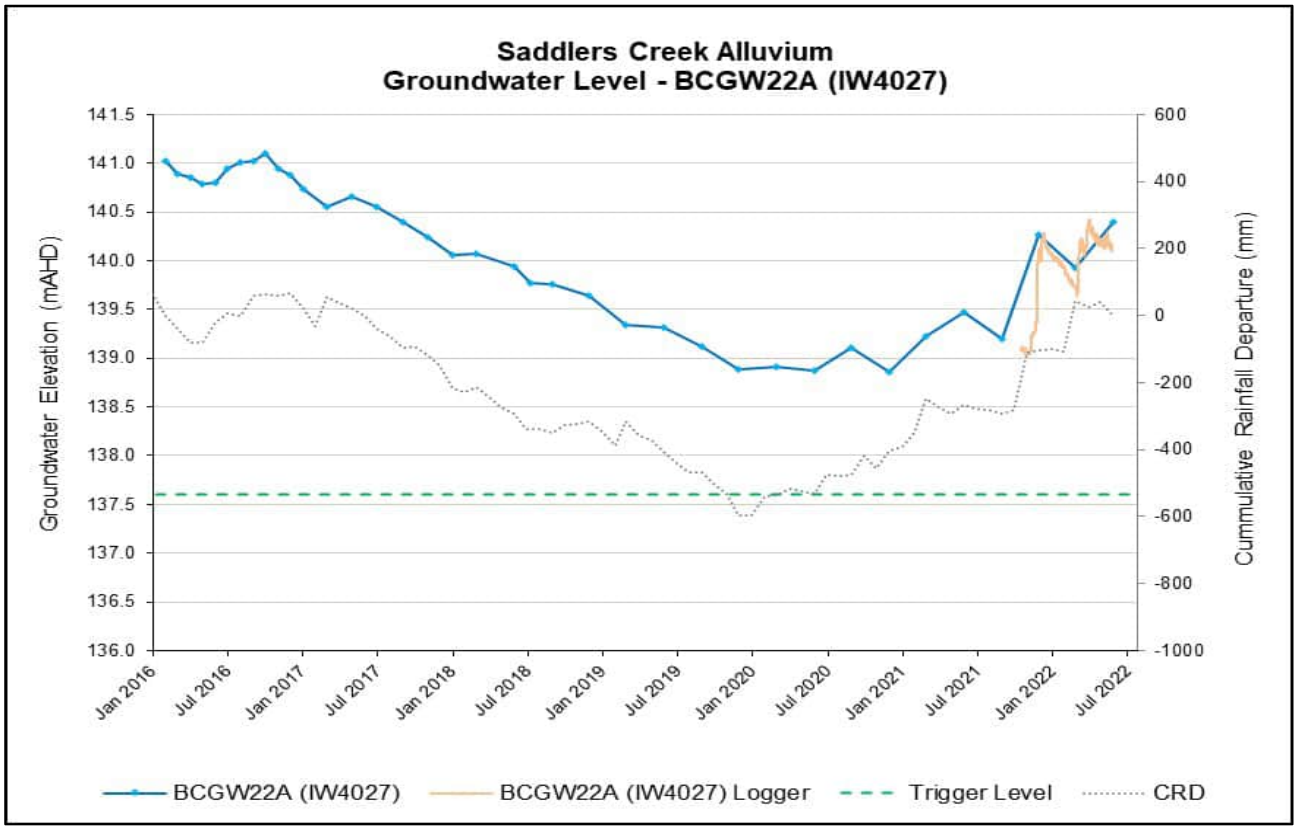

Hunter River Alluvium
Groundwater Level - GW21
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
131.0
130.0
129.0
128.0
127.0
126.0
125.0
124.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
GW21
GW21 Logger
Trigger Level
Modelled Water Level (Predicted Head)
CRD

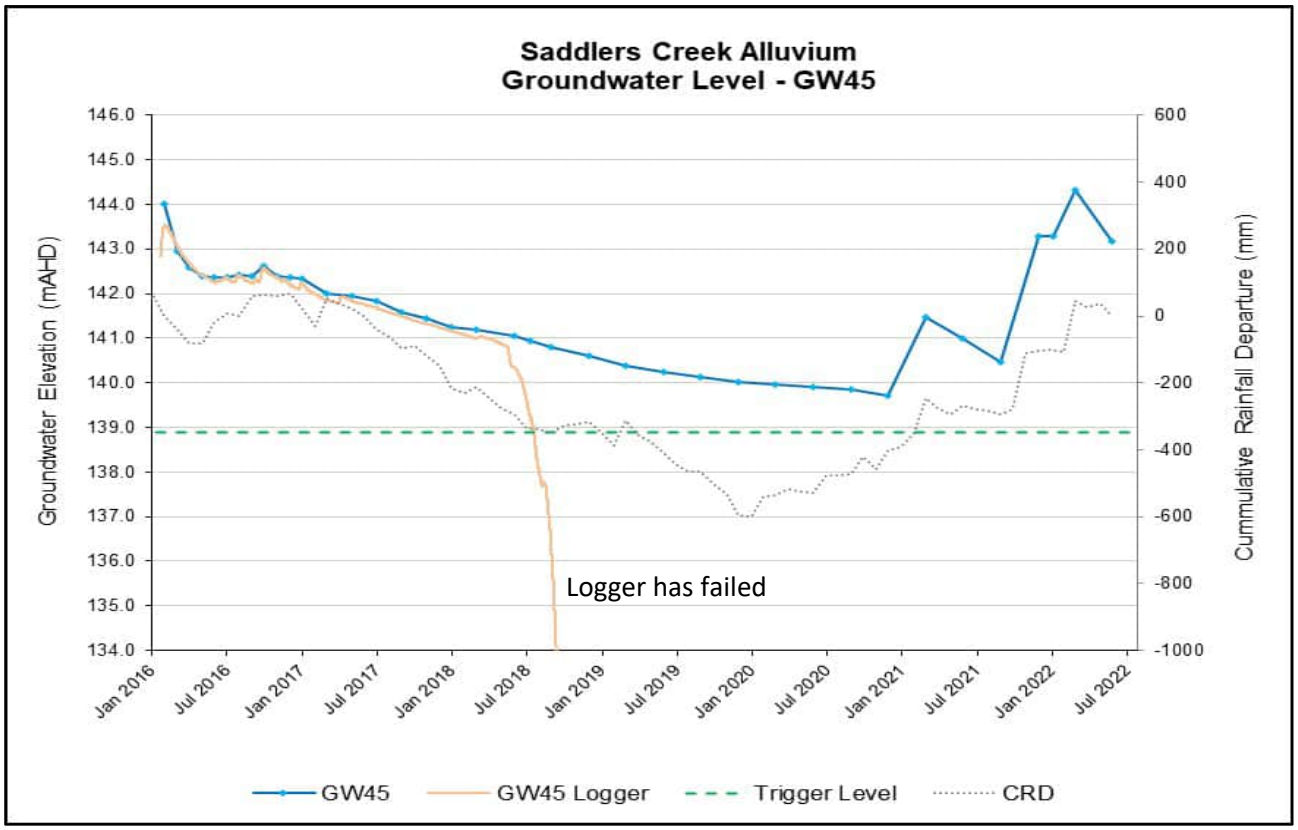

Hunter River Alluvium
Groundwater Level - GW38A (IW4030)
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
125.0
124.5
124.0
123.5
123.0
122.5
122.0
121.5
121.0
120.5
120.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW38A (IW4030)
GW38A (IW4030) Logger
Trigger Level
CRD

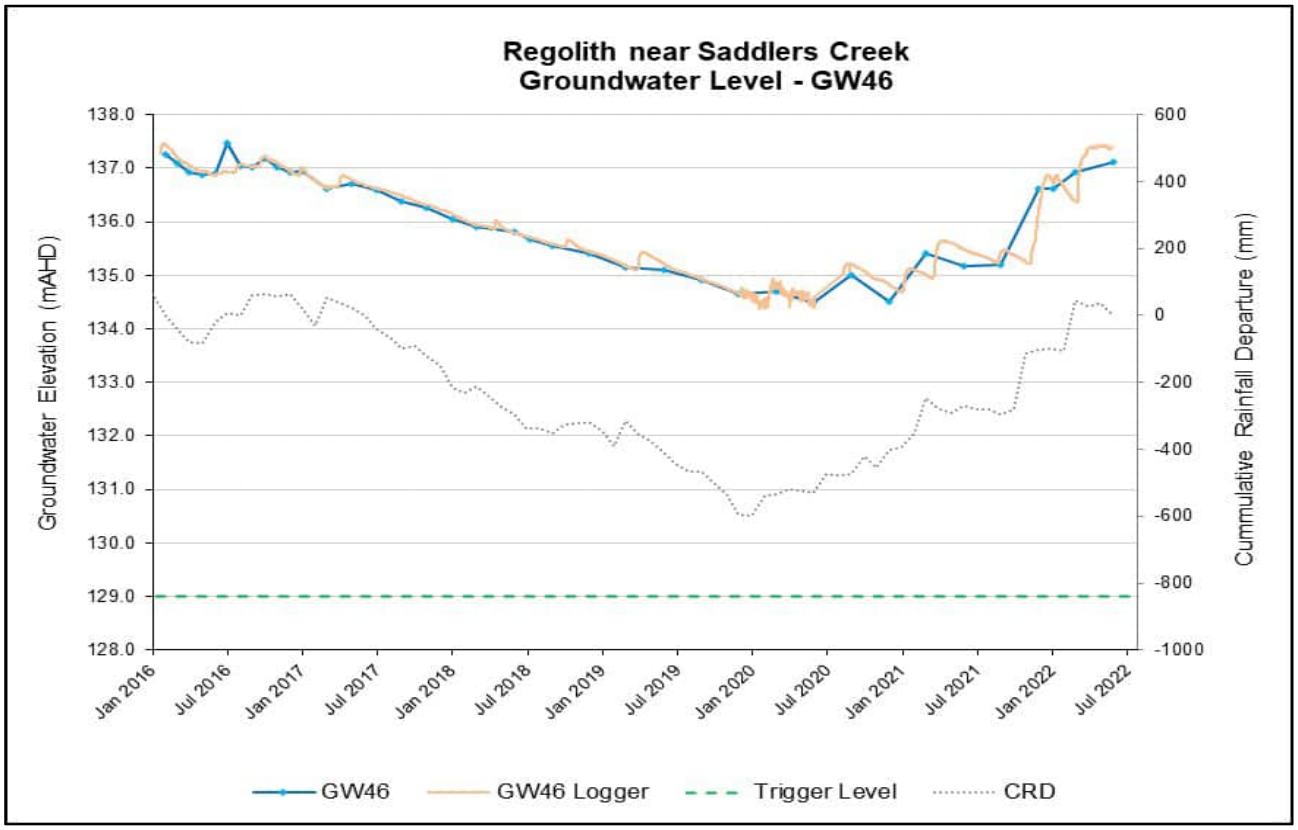

Hunter River Alluvium
Groundwater Level - GW40A
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
121.5
121.0
120.5
120.0
119.5
119.0
118.5
118.0
117.5
117.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
GW40A
GW40A Logger
Trigger Level
CRD

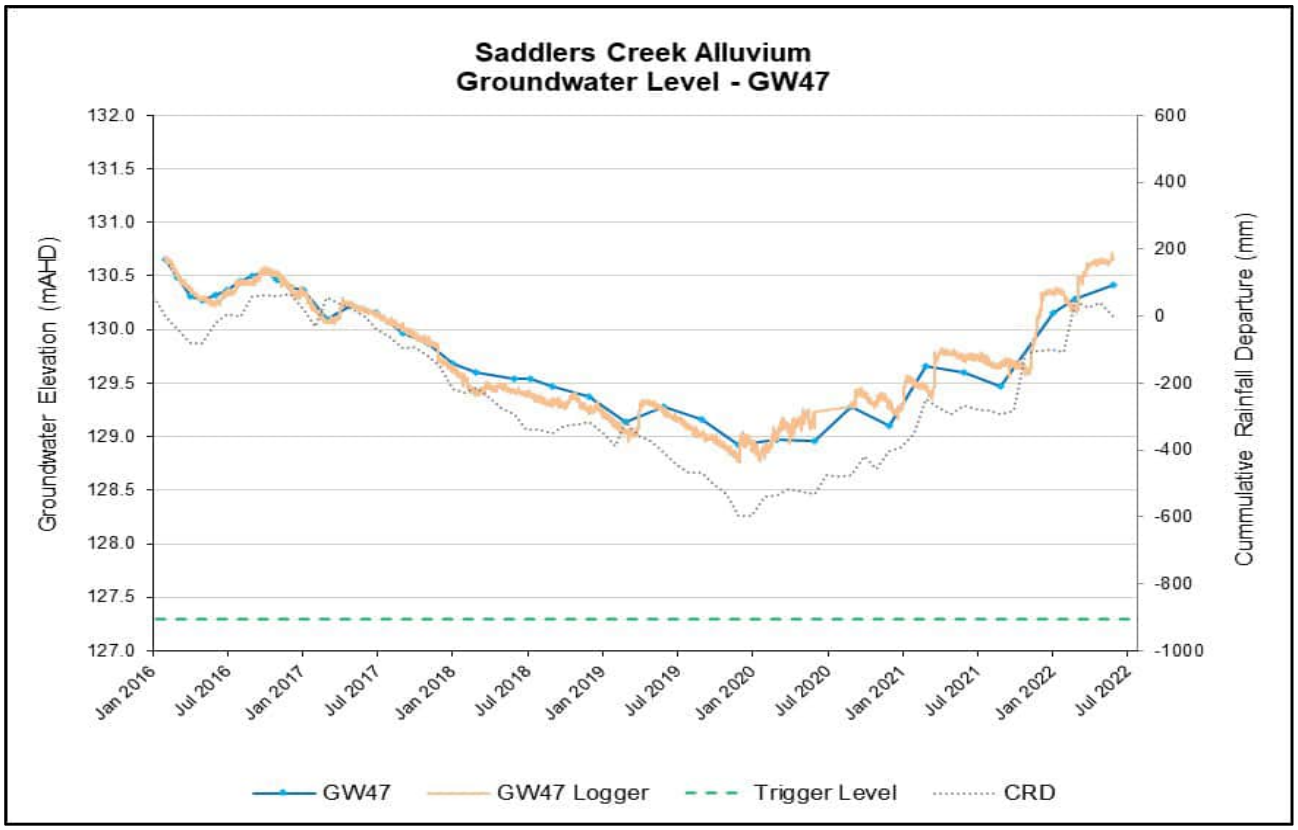

Hunter River Alluvium
Groundwater Level - GW41A (IW4029)
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
120.1
119.9
119.7
119.5
119.3
119.1
118.9
118.7
118.5
118.3
118.1
117.9
117.7
117.5
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW41A (IW4029)
GW41A (IW4029) Logger
Trigger Level
CRD

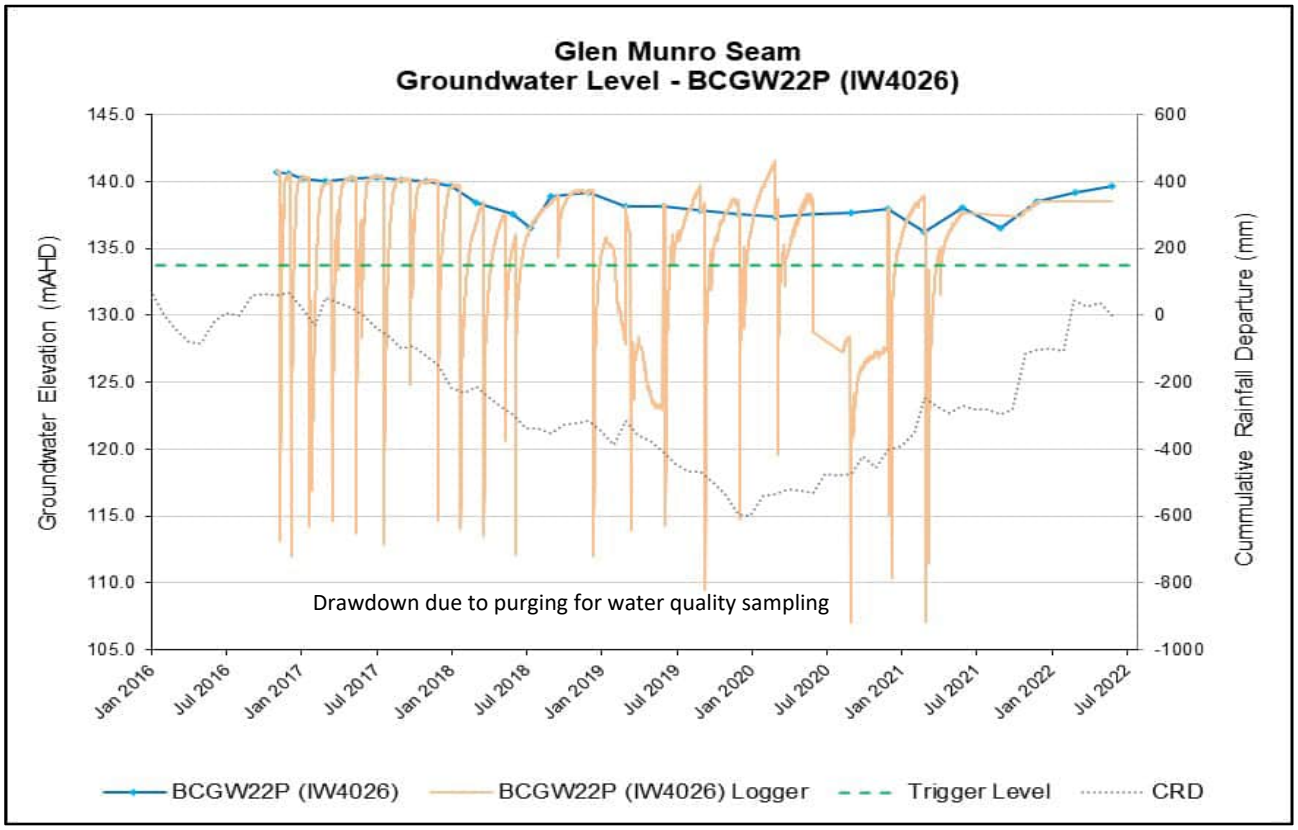

Hunter River Alluvium
Groundwater Level - X1MB
Flood event in Hunter River
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
123.5
123.0
122.5
122.0
121.5
121.0
120.5
120.0
119.5
600
400
200
0
-200
-400
-600
-800
-1000
Jul 2020
Sep 2020
Dec 2020
Mar 2021
Jun 2021
Sep 2021
Dec 2021
Mar 2022
Jun 2022
X1MB
Trigger Level
CRD

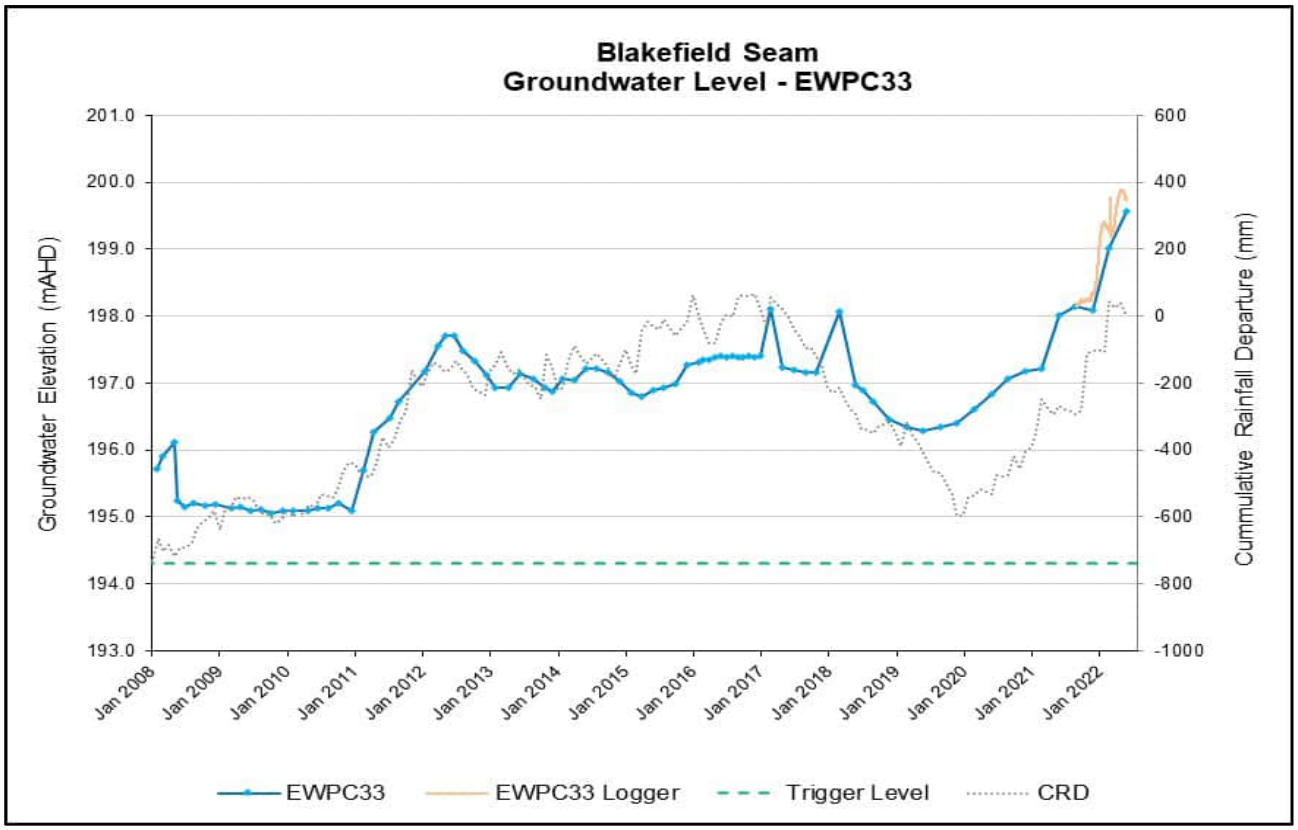

Saddlers Creek Alluvium
Groundwater Level - BCGW22A (IW4027)
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
141.5
141.0
140.5
140.0
139.5
139.0
138.5
138.0
137.5
137.0
136.5
136.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
BCGW22A (IW4027)
BCGW22A (IW4027) Logger
Trigger Level
CRD

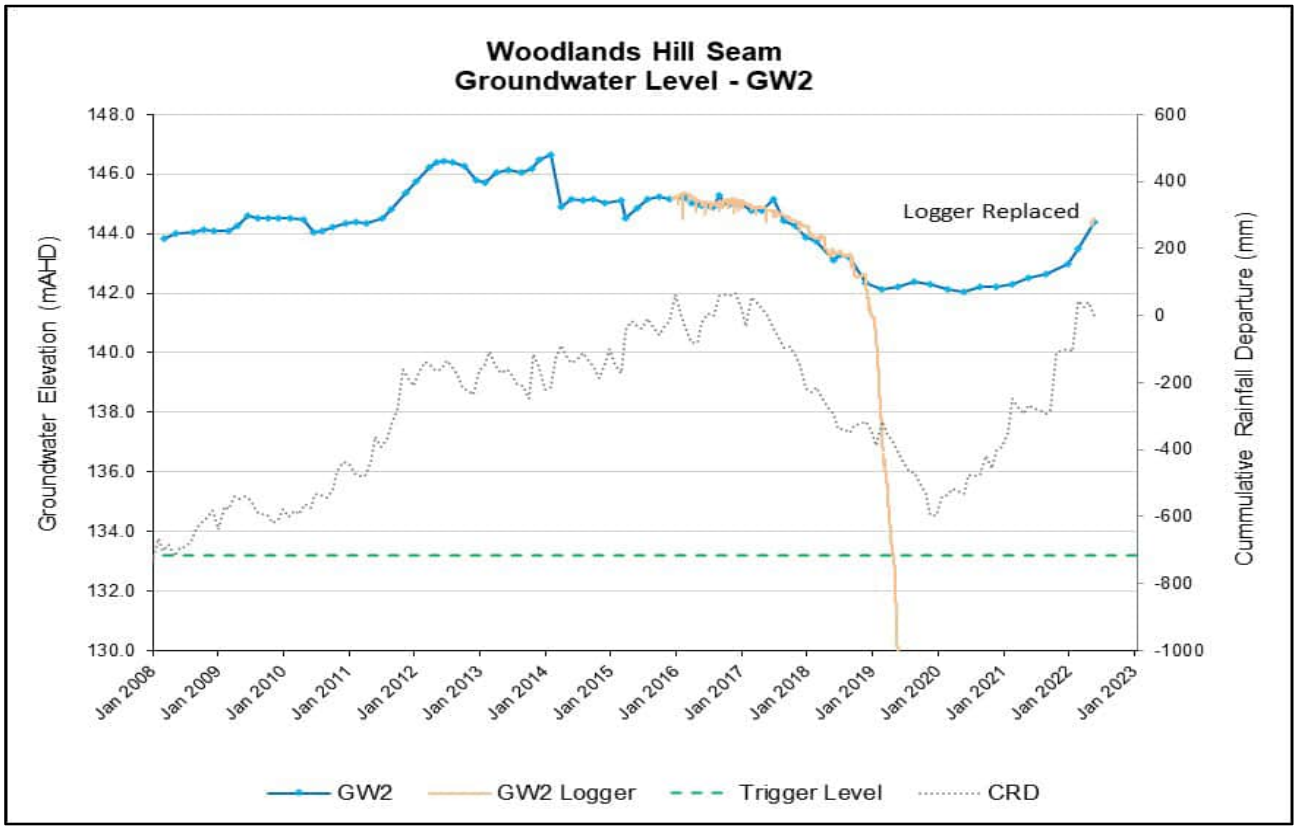

Saddlers Creek Alluvium
Groundwater Level - GW45
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
146.0
145.0
144.0
143.0
142.0
141.0
140.0
139.0
138.0
137.0
136.0
135.0
134.0
600
400
200
0
-200
-400
-600
-800
-1000
Logger has failed
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW45
GW45 Logger
Trigger Level
CRD

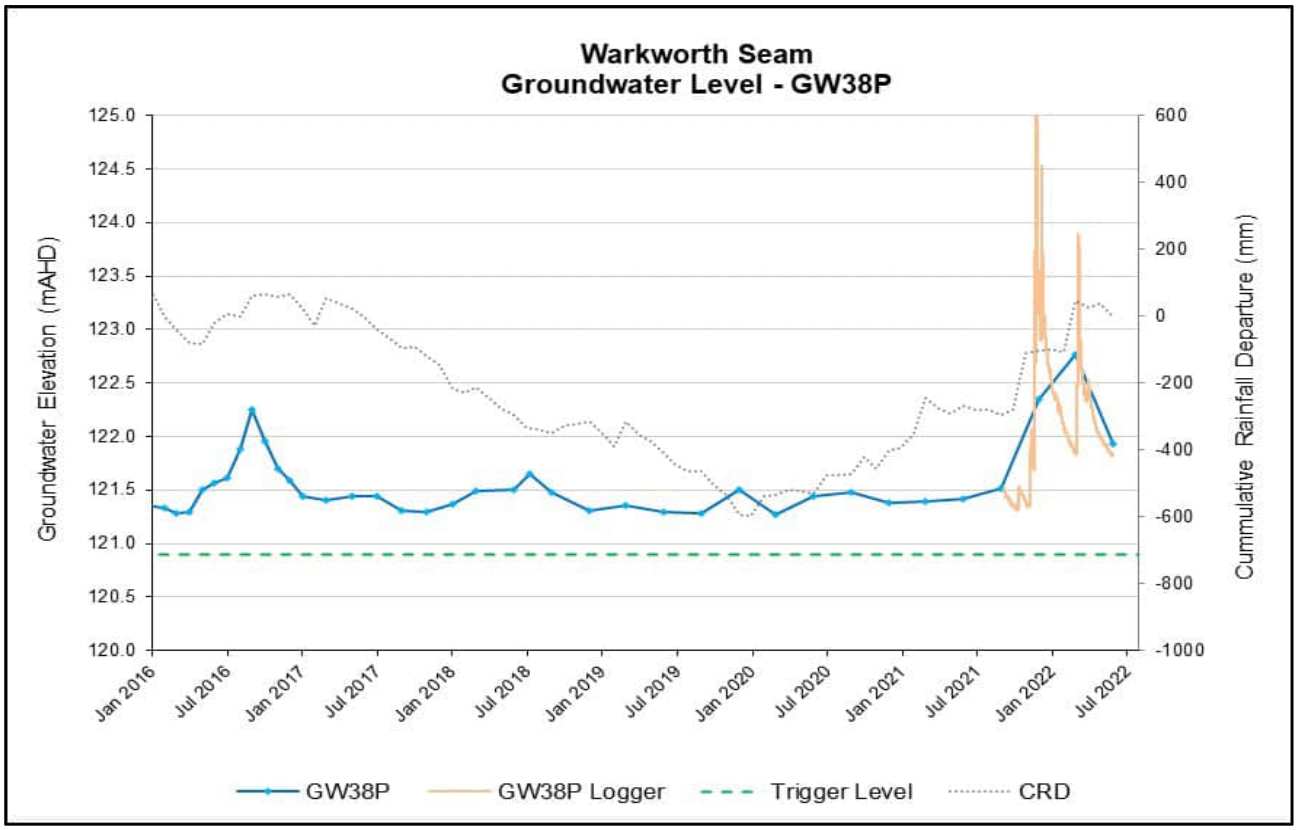

Regolith near Saddlers Creek
Groundwater Level - GW46
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
138.0
137.0
136.0
135.0
134.0
133.0
132.0
131.0
130.0
129.0
128.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW46
GW46 Logger
Trigger Level
CRD

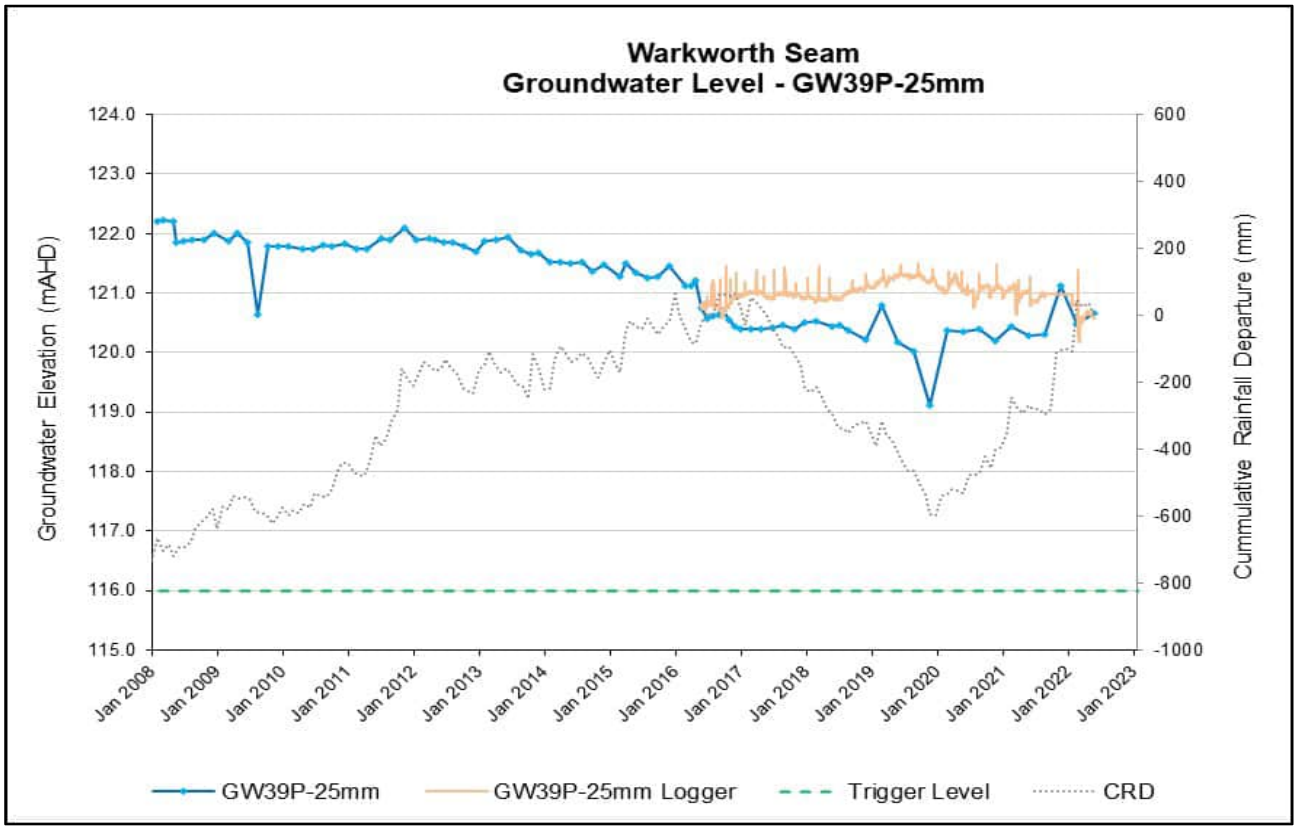

Saddlers Creek Alluvium
Groundwater Level - GW47
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
132.0
131.5
131.0
130.5
130.0
129.5
129.0
128.5
128.0
127.5
127.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW47
GW47 Logger
Trigger Level
CRD

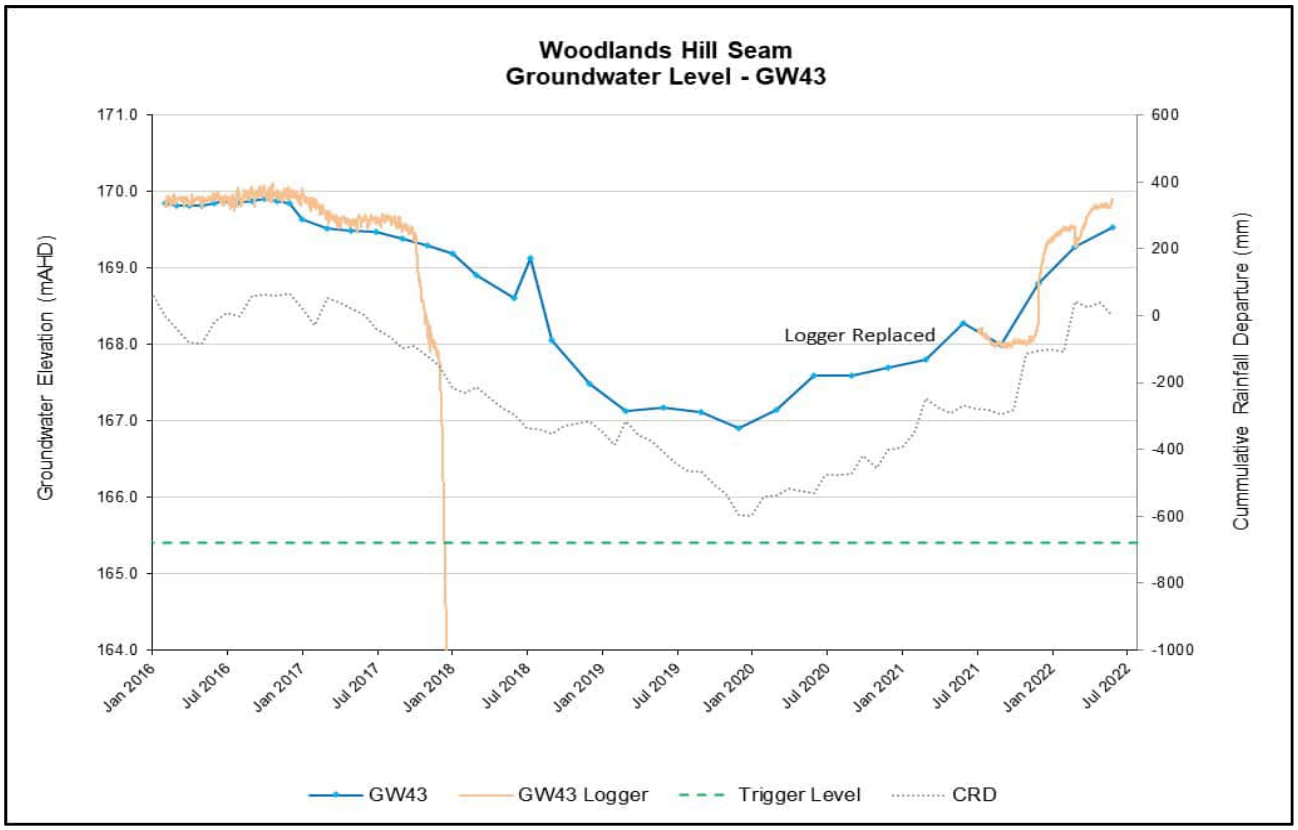

Glen Munro Seam
Groundwater Level - BCGW22P (IW4026)
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
145.0
140.0
135.0
130.0
125.0
120.0
115.0
110.0
105.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
Drawdown due to purging for water quality sampling
BCGW22P (IW4026)
BCGW22P (IW4026) Logger
Trigger Level
CRD

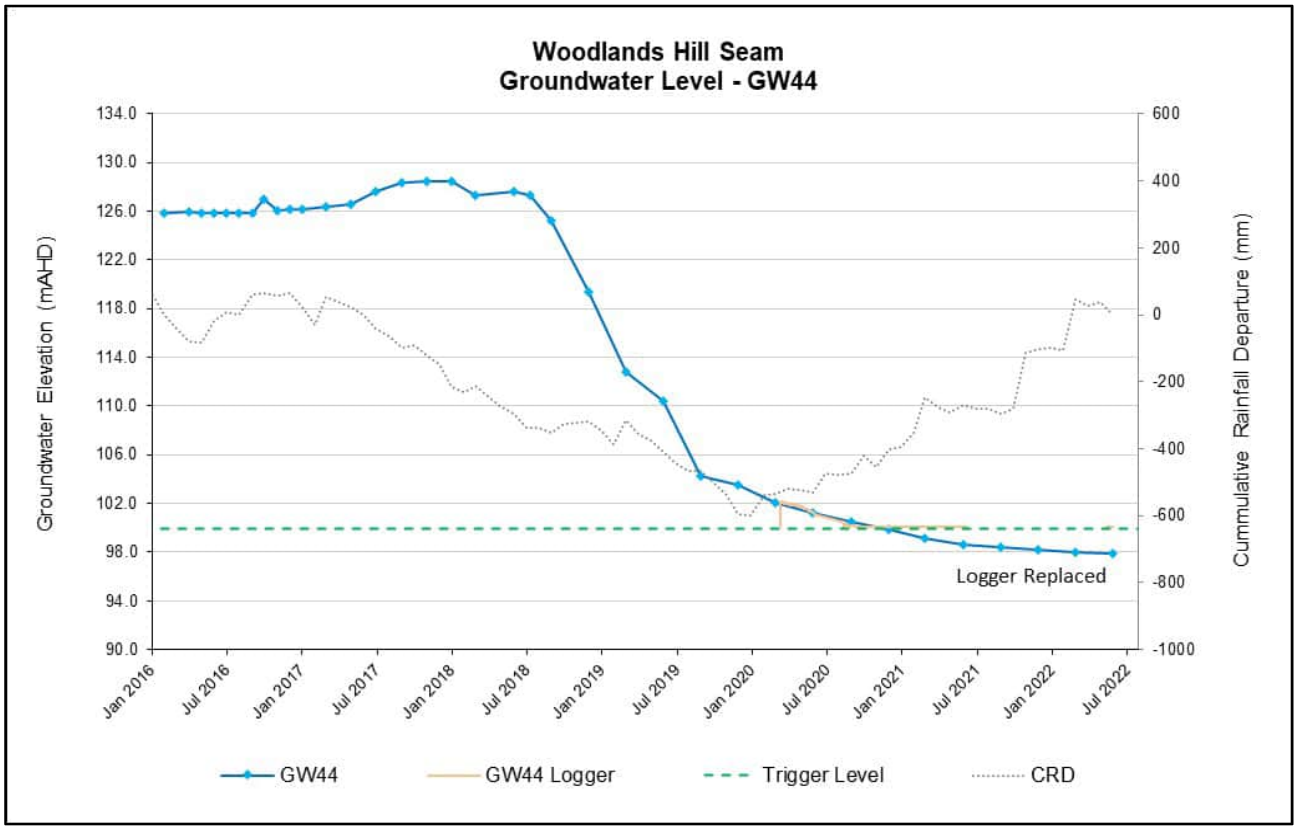

Blakefield Seam
Groundwater Level - EWPC33
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
201.0
200.0
199.0
198.0
197.0
196.0
195.0
194.0
193.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
EWPC33
EWPC33 Logger
Trigger Level
CRD

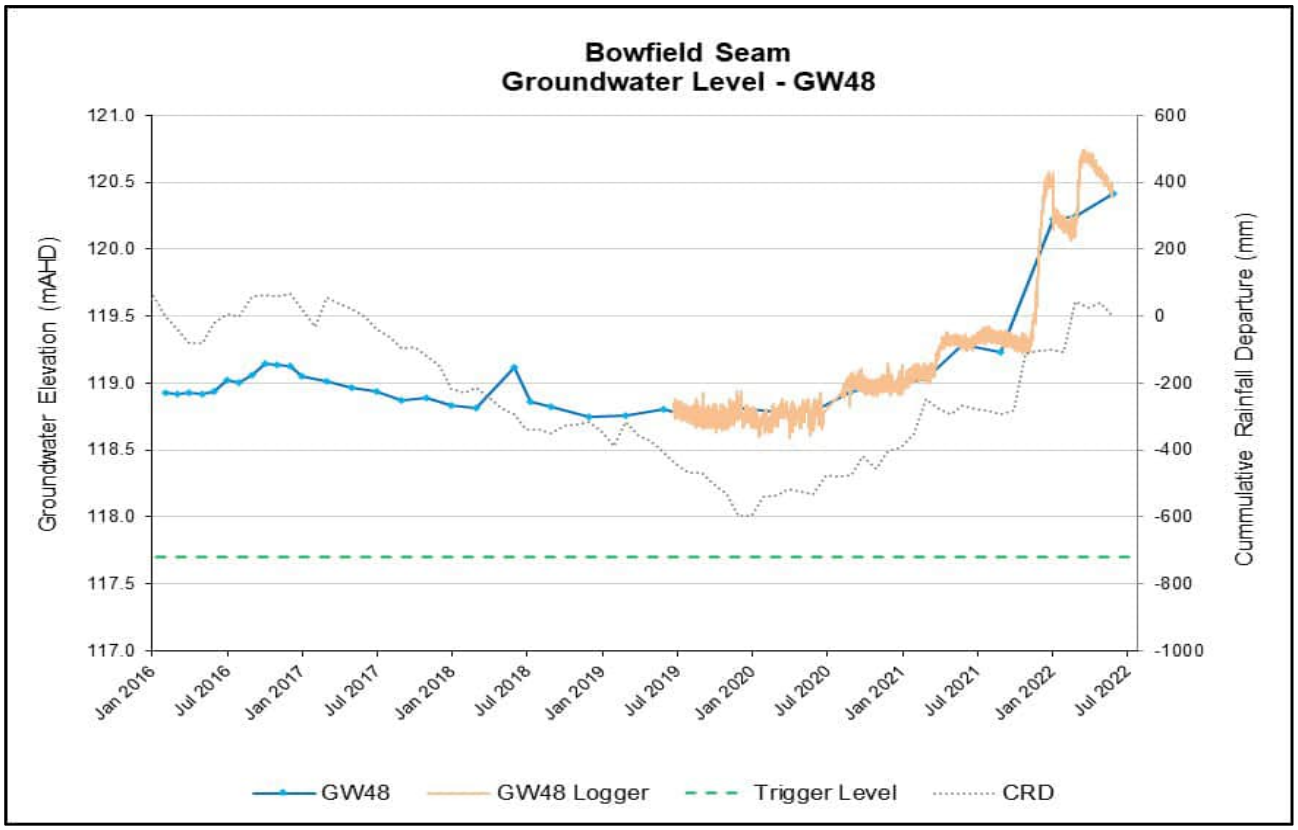

Woodlands Hill Seam
Groundwater Level - GW2
Logger Replaced
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
148.0
146.0
144.0
142.0
140.0
138.0
136.0
134.0
132.0
130.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
GW2
GW2 Logger
Trigger Level
CRD

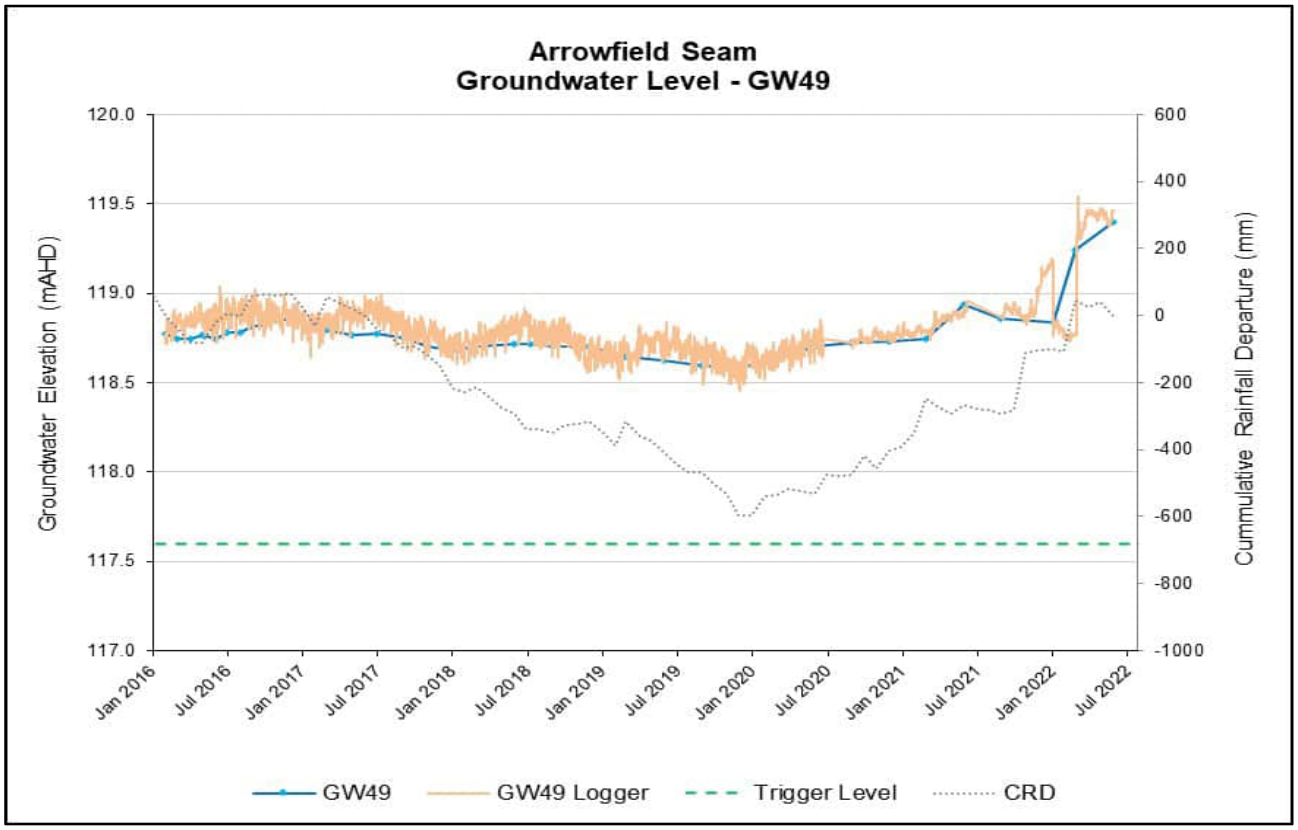

Warkworth Seam
Groundwater Level - GW38P
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
125.0
124.5
124.0
123.5
123.0
122.5
122.0
121.5
121.0
120.5
120.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW38P
GW38P Logger
Trigger Level
CRD

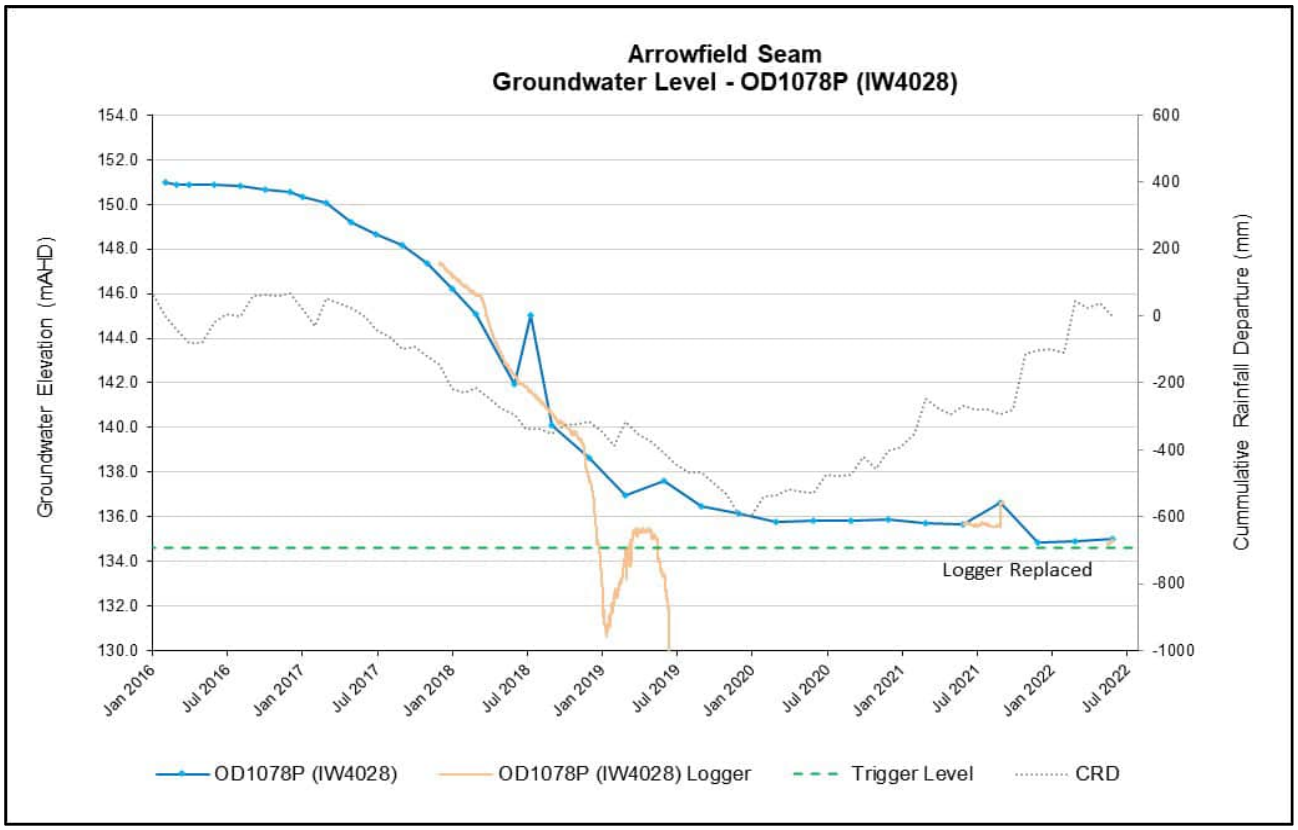

Warkworth Seam
Groundwater Level - GW39P-25mm
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
124.0
123.0
122.0
121.0
120.0
119.0
118.0
117.0
116.0
115.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
GW39P-25mm
GW39P-25mm Logger
Trigger Level
CRD

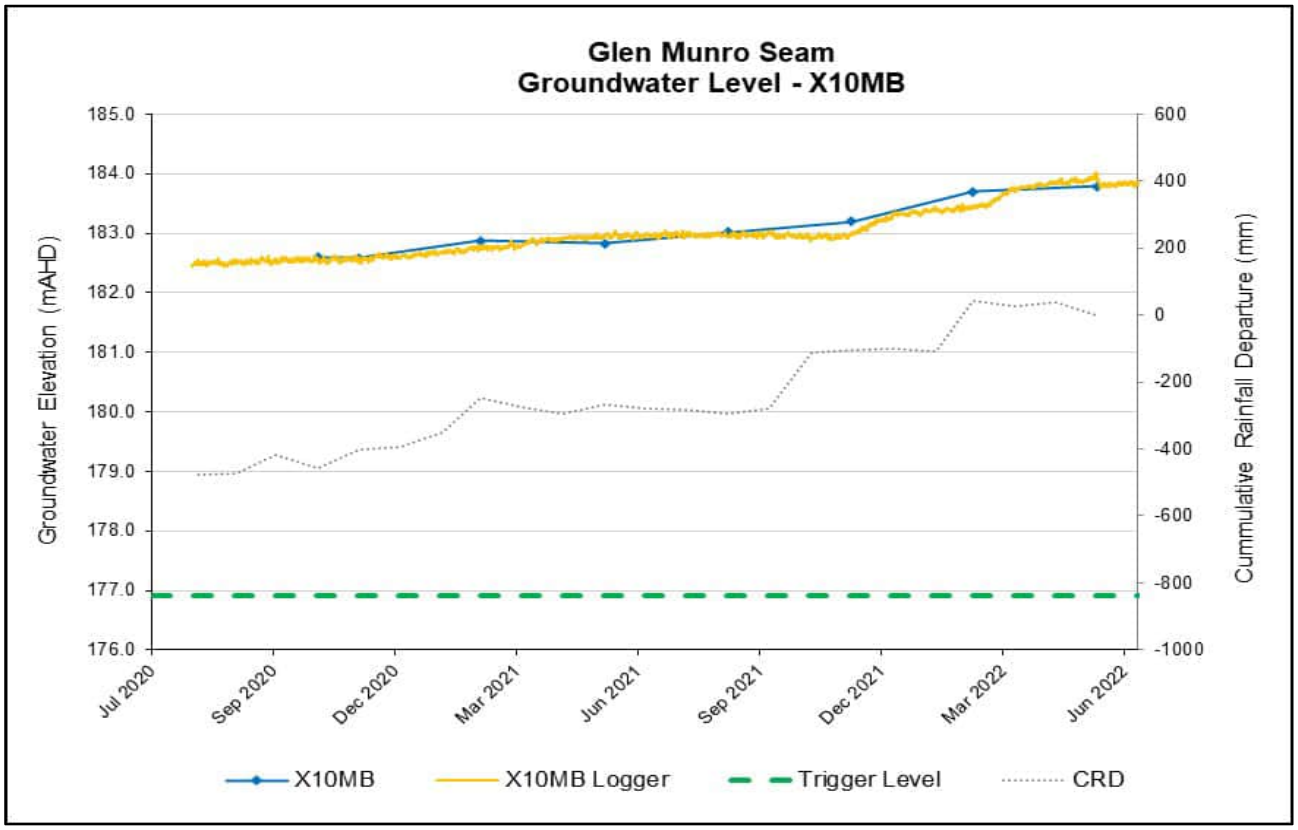

Woodlands Hill Seam
Groundwater Level - GW43
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
171.0
170.0
169.0
168.0
167.0
166.0
165.0
164.0
600
400
200
0
-200
-400
-600
-800
-1000
Logger Replaced
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW43
GW43 Logger
Trigger Level
CRD

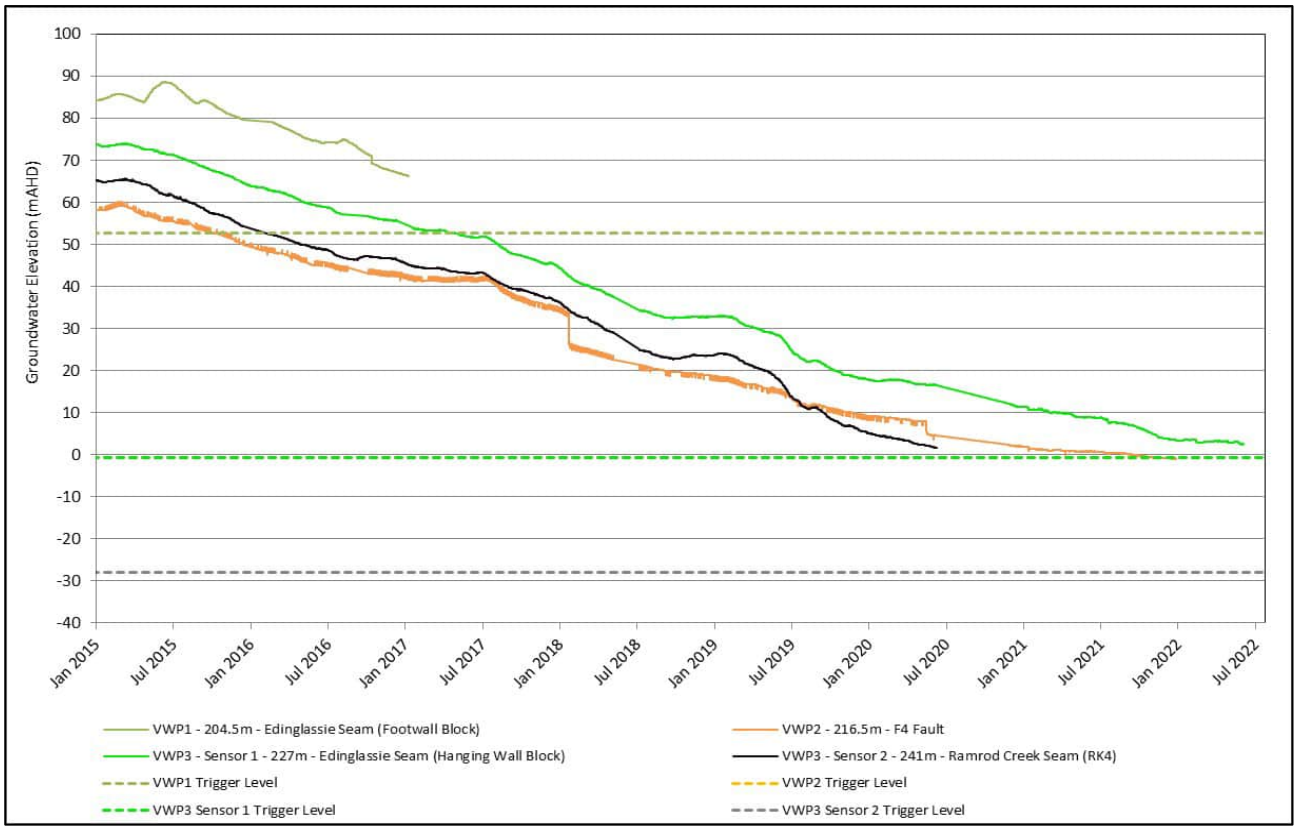

Woodlands Hill Seam
Groundwater Level - GW44
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
134.0
130.0
126.0
122.0
118.0
114.0
110.0
106.0
102.0
98.0
94.0
90.0
600
400
200
0
-200
-400
-600
-800
-1000
Logger Replaced
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW44
GW44 Logger
Trigger Level
CRD

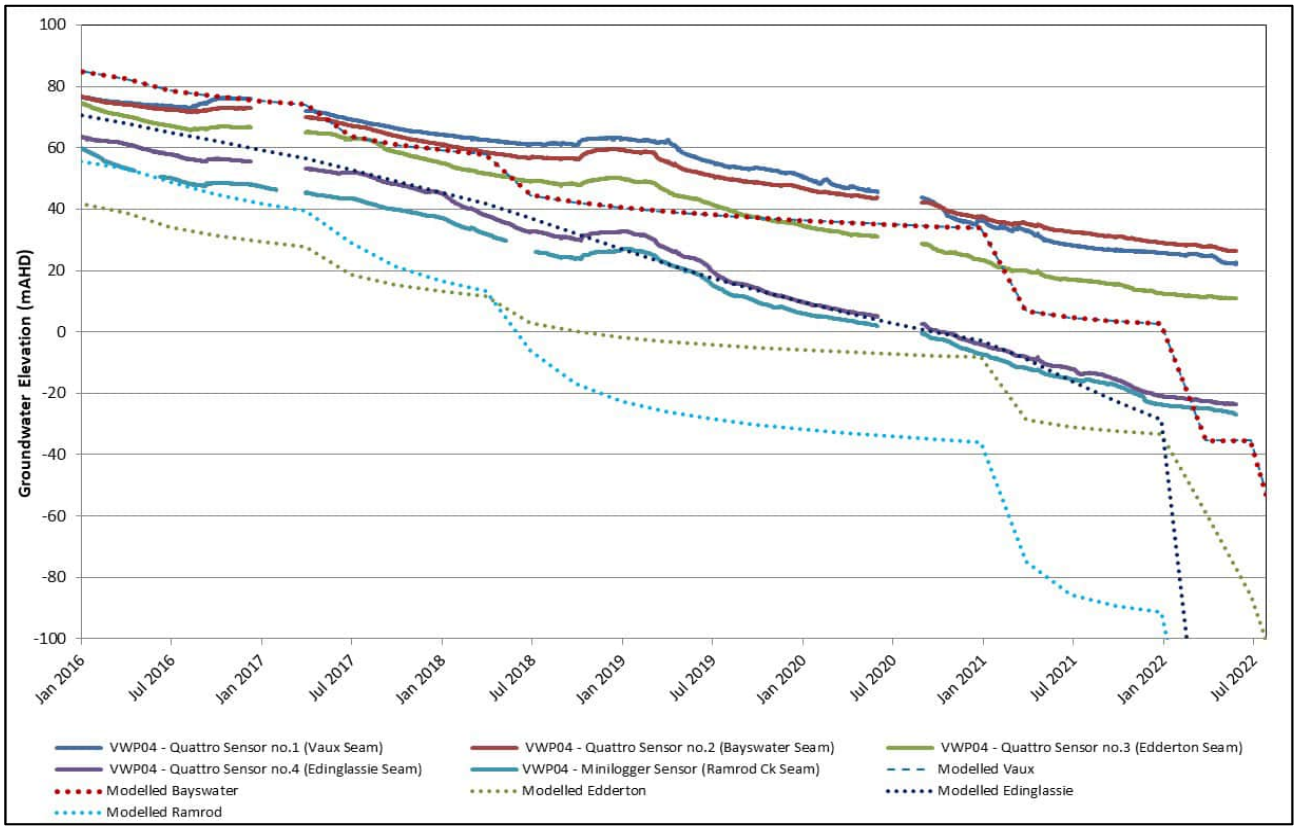

Bowfield Seam
Groundwater Level - GW48
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
121.0
120.5
120.0
119.5
119.0
118.5
118.0
117.5
117.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW48
GW48 Logger
Trigger Level
CRD

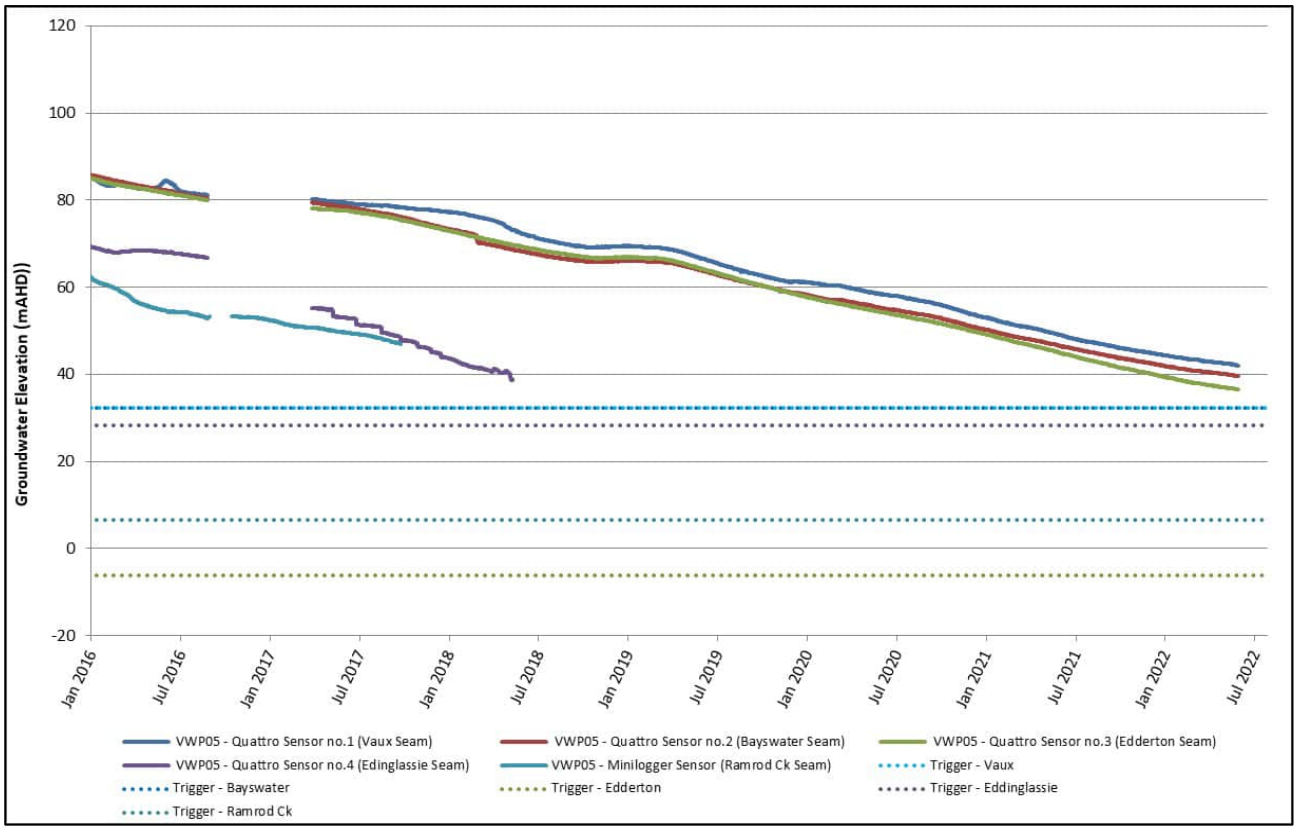

Arrowfield Seam
Groundwater Level - GW49
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
120.0
119.5
119.0
118.5
118.0
117.5
117.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
GW49
GW49 Logger
Trigger Level
CRD

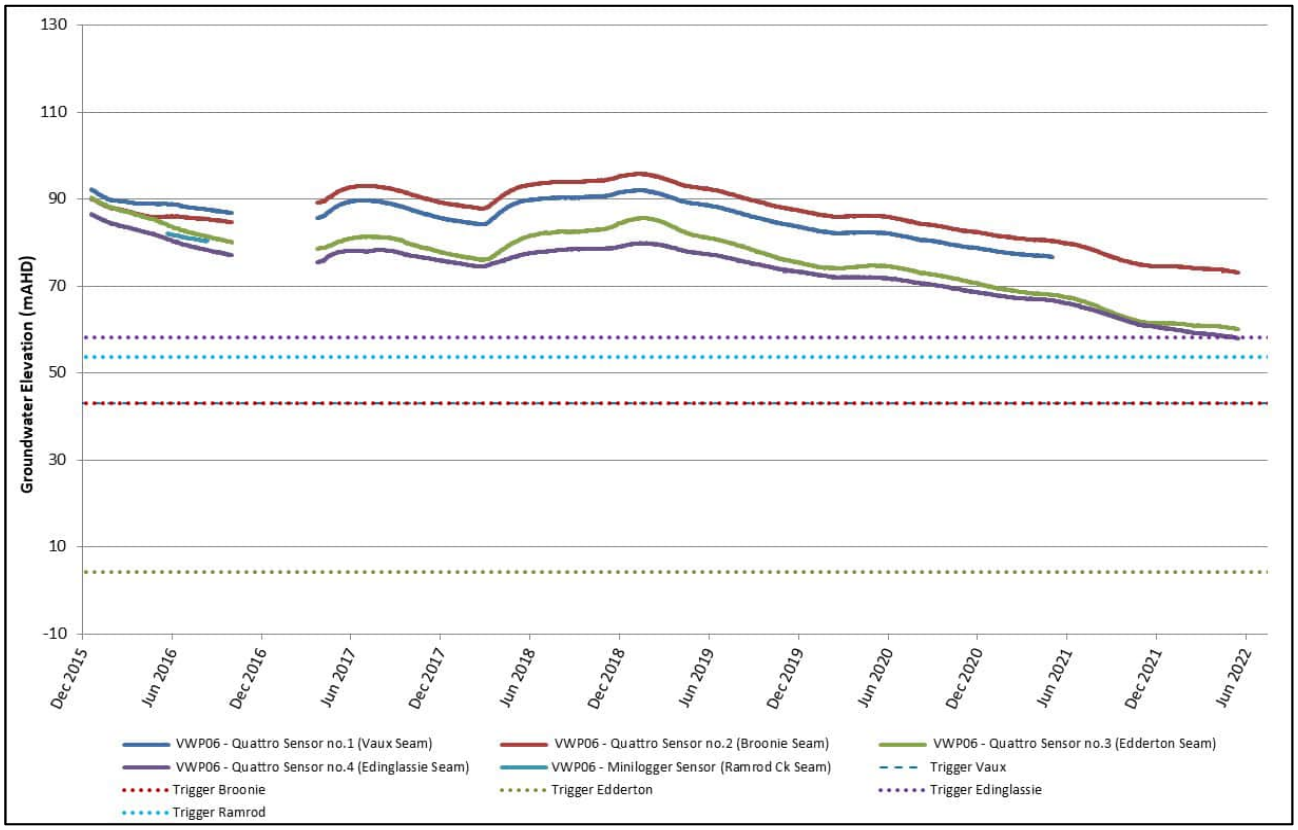

Arrowfield Seam
Groundwater Level - OD1078P (IW4028)
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
154.0
152.0
150.0
148.0
146.0
144.0
142.0
140.0
138.0
136.0
134.0
132.0
130.0
600
400
200
0
-200
-400
-600
-800
-1000
Logger Replaced
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
OD1078P (IW4028)
OD1078P (IW4028) Logger
Trigger Level
CRD

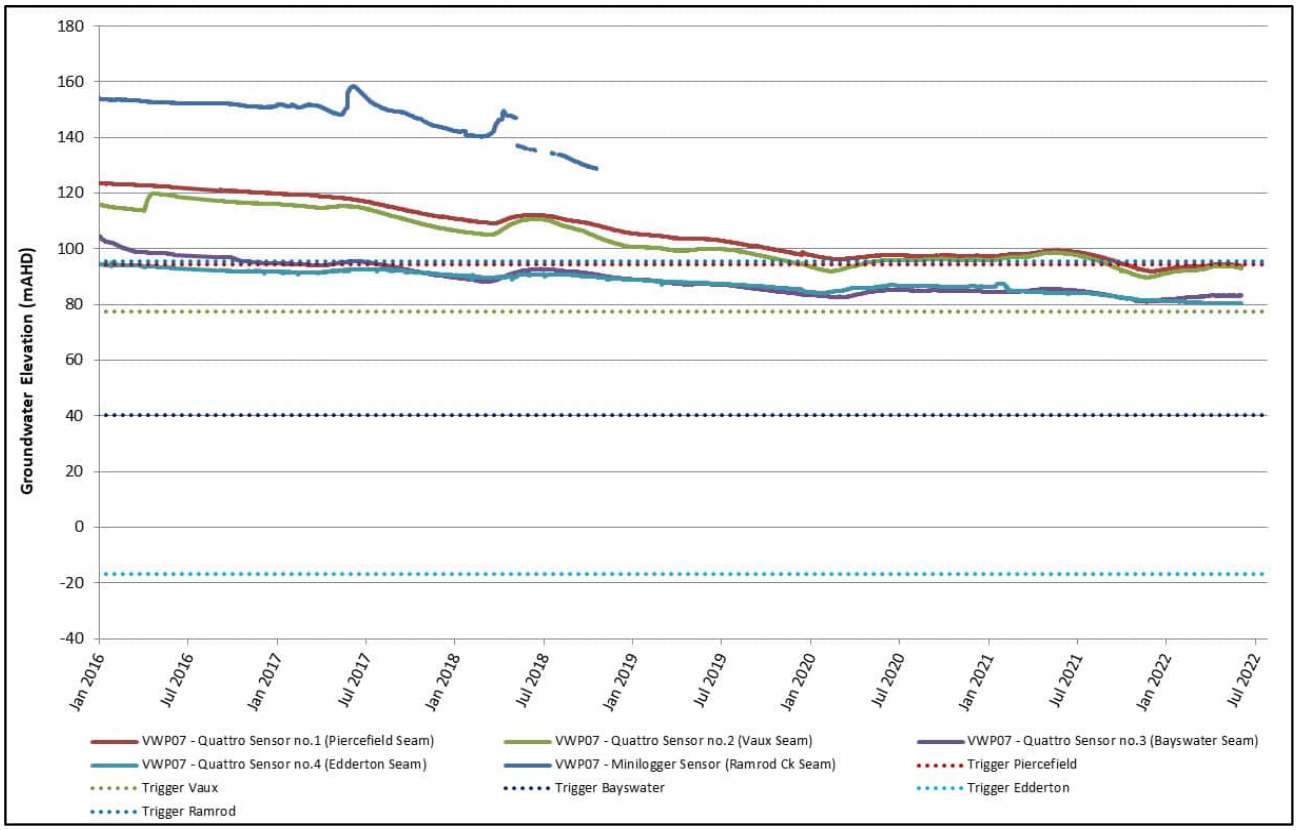

Glen Munro Seam
Groundwater Level - X10MB
Groundwater Elevation (mAHD)
Cummulative Rainfall Departure (mm)
185.0
184.0
183.0
182.0
181.0
180.0
179.0
178.0
177.0
176.0
600
400
200
0
-200
-400
-600
-800
-1000
Jul 2020
Sep 2020
Dec 2020
Mar 2021
Jun 2021
Sep 2021
Dec 2021
Mar 2022
Jun 2022
X10MB
X10MB Logger
Trigger Level
CRD

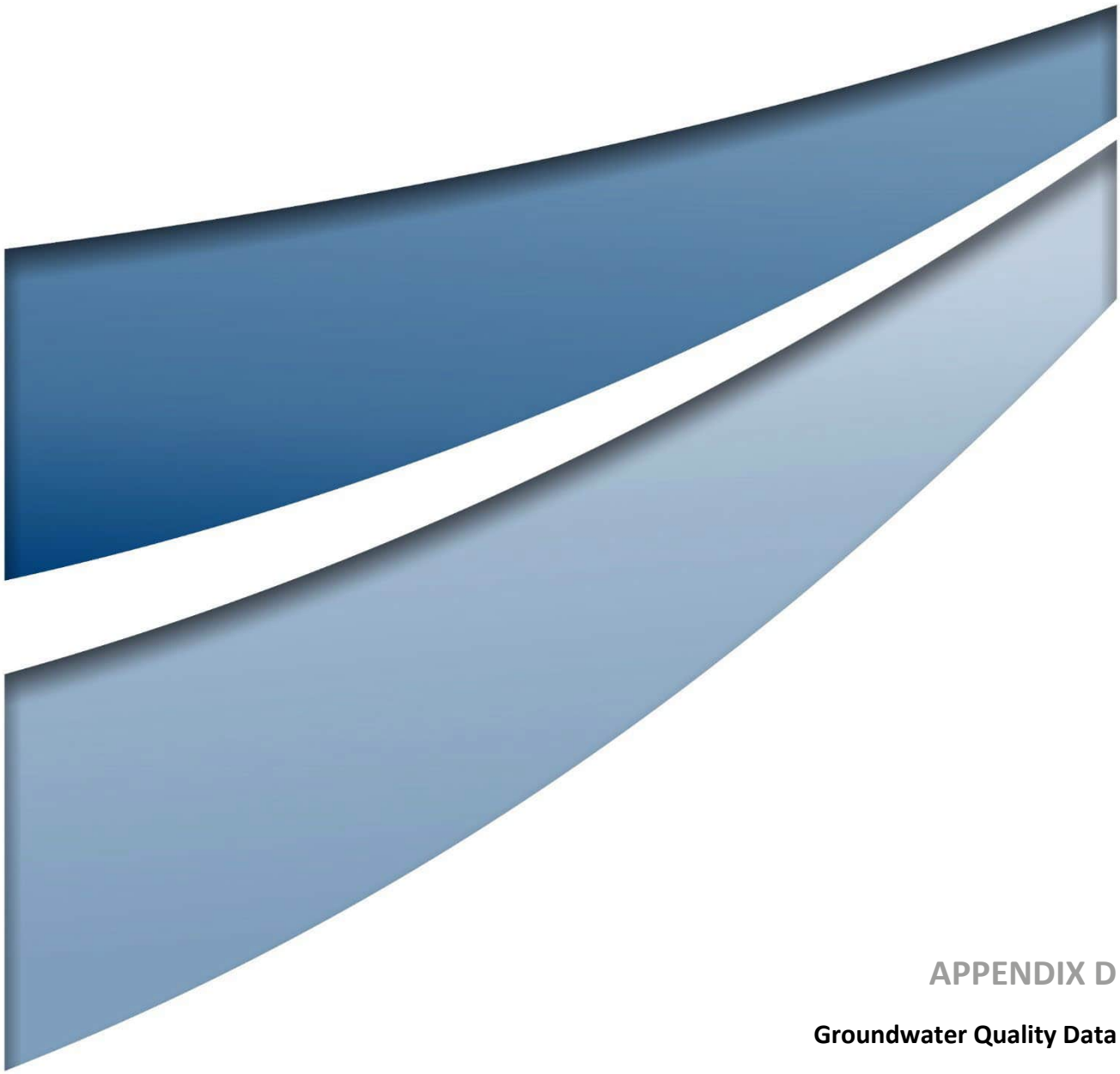

Groundwater Elevation (mAHD)
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
Jan 2015
Jul 2015
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
VWP1 - 204.5m - Edinglassie Seam (Footwall Block)
VWP2 - 216.5m - F4 Fault
VWP3 - Sensor 1 - 227m - Edinglassie Seam (Hanging Wall Block)
VWP3 - Sensor 2 - 241m - Ramrod Creek Seam (RK4)
VWP1 Trigger Level
VWP2 Trigger Level
VWP3 Sensor 1 Trigger Level
VWP3 Sensor 2 Trigger Level


Groundwater Elevation (mAHD)
100
80
60
40
20
0
-20
-40
-60
-80
-100
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
VWP04 - Quattro Sensor no.1 (Vaux Seam)
VWP04 - Quattro Sensor no.2 (Bayswater Seam)
VWP04 - Quattro Sensor no.3 (Edderton Seam)
VWP04 - Quattro Sensor no.4 (Edinglassie Seam)
VWP04 - Minilogger Sensor (Ramrod Ck Seam)
Modelled Vaux
Modelled Bayswater
Modelled Edderton
Modelled Edinglassie
Modelled Ramrod


Groundwater Elevation (mAHD))
120
100
80
60
40
20
0
-20
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
VWP05 - Quattro Sensor no.1 (Vaux Seam)
VWP05 - Quattro Sensor no.2 (Bayswater Seam)
VWP05 - Quattro Sensor no.3 (Edderton Seam)
VWP05 - Quattro Sensor no.4 (Edinglassie Seam)
VWP05 - Minilogger Sensor (Ramrod Ck Seam)
Trigger - Vaux
Trigger - Bayswater
Trigger - Edderton
Trigger - Eddinglassie
Trigger - Ramrod Ck


Groundwater Elevation (mAHD)
130
110
90
70
50
30
10
-10
Dec 2015
Jun 2016
Dec 2016
Jun 2017
Dec 2017
Jun 2018
Dec 2018
Jun 2019
Dec 2019
Jun 2020
Dec 2020
Jun 2021
Dec 2021
Jun 2022
VWP06 - Quattro Sensor no.1 (Vaux Seam)
VWP06 - Quattro Sensor no.2 (Broonie Seam)
VWP06 - Quattro Sensor no.3 (Edderton Seam)
VWP06 - Quattro Sensor no.4 (Edinglassie Seam)
VWP06 - Minilogger Sensor (Ramrod Ck Seam)
Trigger Vaux
Trigger Broonie
Trigger Edderton
Trigger Edinglassie
Trigger Ramrod


Groundwater Elevation (mAHD)
180
160
140
120
100
80
60
40
20
0
-20
-40
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Jul 2022
VWP07 - Quattro Sensor no.1 (Piercefield Seam)
VWP07 - Quattro Sensor no.2 (Vaux Seam)
VWP07 - Quattro Sensor no.3 (Bayswater Seam)
VWP07 - Quattro Sensor no.4 (Edderton Seam)
VWP07 - Minilogger Sensor (Ramrod Ck Seam)
Trigger Piercefield
Trigger Vaux
Trigger Bayswater
Trigger Edderton
Trigger Ramrod



APPENDIX D

Groundwater Quality Data

Water Quality Data

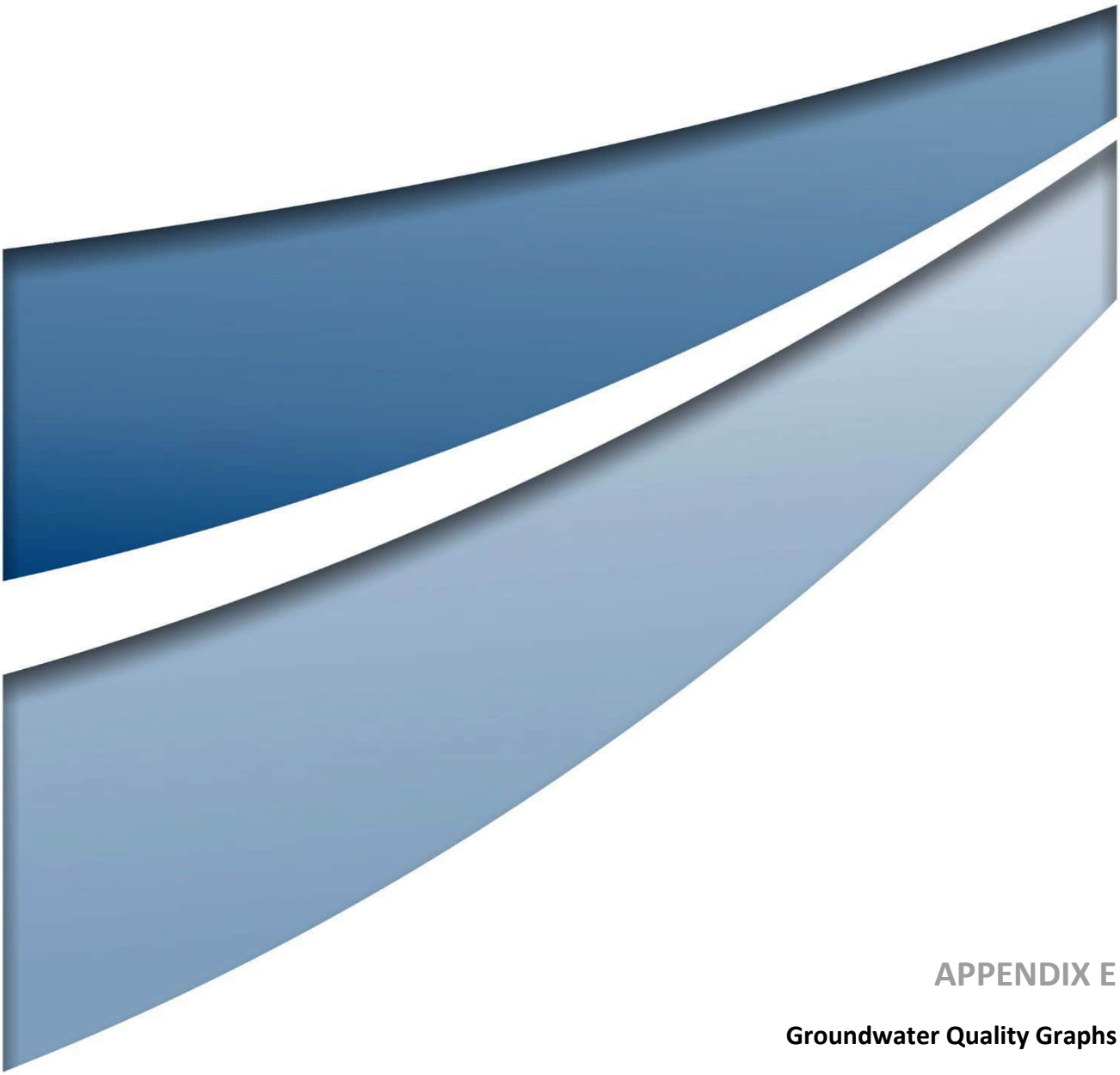
	BCGW18							BCGW22P (IW4026)							BCGW22A (IW4027 (BCGW22A))						
Parameter	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average
Field pH					5.5	9.3	8.1	7.4	7.7	7.8	11.9	7.1	12.5	10.2	6.8	6.9	6.7	7.1	6.6	7.1	6.9
Field EC (µS/cm)					3100.0	8210.0	5798.5	16240.0	14900.0	14320.0	14500.0	8470.0	17350.0	12465.8	14800.0	11600.0	10800.0	11100.0	9200.0	15690.0	11580.8
TDS (mg/L)					1980.0	4900.0	3124.4	8650.0	7840.0	10100.0	9310.0	3100.0	10100.0	6480.6	7860.0	5980.0	6870.0	6220.0	4580.0	8930.0	7118.9
TSS (mg/L)					6.0	116.0	25.7	27.0	34.0	**nm**	19.0	7.0	611.0	81.8	20.0	18.0	9.0	<5	6.0	410.0	58.5
Dissolved Fe (mg/L)					0.1	32.8	2.7	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	20.0	18.0	9.0	<0.05	0.1	0.1	0.1
Sulphate (mg/L)					2.0	39.0	10.8	17.0	10.0	20.0	24.0	2.0	172.0	46.8	274.0	271.0	286.0	278.0	188.0	305.0	248.8
Chloride (mg/L)			Dry		739.0	2600.0	1806.1	5120.0	4730.0	4800.0	5160.0	1640.0	5160.0	3510.3	4090.0	3670.0	3330.0	3470.0	2720.0	4140.0	3509.7
Calcium (mg/L)					1.0	43.0	22.9	213.0	138.0	265.0	384.0	4.0	384.0	171.6	243.0	192.0	186.0	214.0	175.0	276.0	230.6
Magnesium (mg/L)					25.0	253.0	192.9	24.0	36.0	23.0	6.0	1.0	38.0	19.0	376.0	308.0	305.0	322.0	274.0	399.0	333.8
Potassium (mg/L)					21.0	38.0	24.8	29.0	26.0	34.0	29.0	26.0	290.0	119.1	7.0	6.0	6.0	7.0	4.0	9.0	5.9
Sodium (mg/L)					738.0	1420.0	1204.7	2540.0	2680.0	2690.0	2480.0	1420.0	2930.0	2075.3	1780.0	1590.0	1540.0	1650.0	1360.0	1920.0	1743.3
Carbonate (mg/L)					76.0	76.0	76.0	<1	<1	<1	<1	4.0	244.0	73.3	<1	<1	<1	<1	<1	<1	<1
Bicarbonate (mg/L)					298.0	1160.0	889.4	220.0	436.0	77.0	36.0	18.0	436.0	182.4	918.0	742.0	684.0	794.0	536.0	1030.0	857.0
	EWPC33							GW16							GW2						
Parameter	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average
Field pH	6.9	7.0	6.6	6.9	6.5	8.0	7.1	7.2	6.9	7.2	7.5	6.4	8.0	7.3	7.7	7.2	7.7	7.7	6.5	8.5	7.7
Field EC (µS/cm)	2940.0	3010.0	2361.0	2091.0	290.0	6280.0	2269.7	4190.0	3400.0	3340.0	3350.0	2139.0	4690.0	3353.7	4400.0	3610.0	4180.0	4160.0	3030.0	5030.0	3853.7
TDS (mg/L)	1450.0	1360.0	1610.0	1480.0	149.0	2060.0	1260.6	2000.0	2360.0	1860.0	1910.0	1350.0	2860.0	2005.9	2250.0	2270.0	2480.0	2610.0	1670.0	2610.0	2198.5
TSS (mg/L)	<5	<5	**nm**	<5	5.0	108.0	22.4	<5	<5	<5	<5	5.0	492.0	60.1	<5	<5	<5	<5	2.0	432.0	24.5
Dissolved Fe (mg/L)	0.1	0.1	0.2	0.1	0.1	1.5	0.3	<0.05	<0.05	<0.05	<0.05	0.0	0.3	0.1	0.1	<0.05	<0.05	<0.05	0.1	0.2	0.1
Sulphate (mg/L)	27.0	26.0	22.0	24.0	12.0	39.0	23.4	248.0	270.0	249.0	257.0	191.0	313.0	247.4	110.0	116.0	119.0	110.0	85.0	152.0	117.4
Chloride (mg/L)	220.0	205.0	194.0	209.0	161.0	257.0	201.8	776.0	825.0	665.0	731.0	458.0	869.0	662.8	591.0	582.0	765.0	786.0	442.0	846.0	623.9
Calcium (mg/L)	19.0	18.0	20.0	18.0	13.0	22.0	17.7	136.0	128.0	114.0	129.0	76.0	160.0	116.6	16.0	11.0	17.0	15.0	6.0	20.0	14.1
Magnesium (mg/L)	85.0	82.0	86.0	85.0	63.0	100.0	82.5	117.0	120.0	103.0	109.0	62.0	130.0	103.5	12.0	10.0	15.0	12.0	9.0	17.0	12.1
Potassium (mg/L)	14.0	14.0	15.0	12.0	12.0	17.0	14.1	2.0	2.0	2.0	2.0	1.0	2.0	1.8	3.0	3.0	4.0	3.0	2.0	5.0	3.5
Sodium (mg/L)	429.0	421.0	426.0	436.0	379.0	538.0	462.9	428.0	433.0	378.0	411.0	305.0	469.0	399.3	810.0	800.0	933.0	923.0	736.0	1070.0	900.1
Carbonate (mg/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	23.0	<1	<1	20.0	99.0	53.2
Bicarbonate (mg/L)	1200.0	1090.0	1200.0	1170.0	1060.0	1290.0	1171.6	544.0	535.0	454.0	441.0	404.0	598.0	483.4	1230.0	1130.0	1100.0	1050.0	963.0	1240.0	1108.6
	GW21							GW38A (IW4030)							GW38P						
Parameter	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average
Field pH	7.1	6.9	7.0	7.3	6.4	8.0	7.2	7.3	7.5	7.5	7.4	6.5	8.3	7.3	7.6	7.7	7.7	7.5	7.1	8.6	7.7
Field EC (µS/cm)	918.6	1161.0	1113.0	1110.0	636.0	2000.0	935.4	3520.0	2730.0	2104.0	1803.0	1803.0	5560.0	4015.6	2836.0	2560.0	2574.0	2437.0	1811.0	3830.0	2335.9
TDS (mg/L)	488.0	870.0	637.0	668.0	370.0	992.0	528.6	1680.0	1510.0	1130.0	1220.0	1130.0	3200.0	2241.4	1350.0	1440.0	1290.0	1380.0	1000.0	3650.0	1288.6
TSS (mg/L)	<5	<5	<5	<5	5.0	280.0	58.0	52.0	73.0	100.0	110.0	6.0	138.0	58.3	<5	14.0	<5	8.0	2.0	87.0	14.8
Dissolved Fe (mg/L)	0.2	0.1	0.1	0.1	0.0	10.7	0.6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	0.1	0.1	0.1	0.1	0.5	0.1
Sulphate (mg/L)	14.0	101.0	72.0	83.0	4.0	102.0	28.3	145.0	150.0	121.0	110.0	110.0	247.0	180.4	44.0	38.0	54.0	44.0	35.0	69.0	42.6
Chloride (mg/L)	55.0	117.0	93.0	102.0	39.0	147.0	65.8	560.0	528.0	376.0	350.0	350.0	1130.0	828.7	464.0	537.0	515.0	549.0	397.0	597.0	474.6
Calcium (mg/L)	59.0	95.0	81.0	96.0	50.0	133.0	68.5	89.0	65.0	39.0	36.0	36.0	144.0	104.4	12.0	12.0	12.0	12.0	8.0	14.0	11.5
Magnesium (mg/L)	36.0	63.0	52.0	58.0	29.0	81.0	42.3	91.0	64.0	47.0	39.0	39.0	157.0	115.4	16.0	17.0	17.0	16.0	12.0	17.0	15.3
Potassium (mg/L)	<1	<1	<1	<1	1.0	3.0	2.0	2.0	2.0	2.0	1.0	1.0	3.0	2.7	6.0	7.0	7.0	6.0	5.0	8.0	6.2
Sodium (mg/L)	51.0	65.0	58.0	62.0	51.0	81.0	62.2	449.0	364.0	336.0	291.0	291.0	800.0	584.4	473.0	478.0	478.0	460.0	414.0	599.0	479.7
Carbonate (mg/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	12.0	12.0	12.0	<1	<1	<1	<1	4.0	59.0	20.3
Bicarbonate (mg/L)	367.0	398.0	311.0	341.0	288.0	442.0	355.8	639.0	487.0	436.0	390.0	390.0	845.0	684.3	509.0	538.0	515.0	476.0	464.0	607.0	515.2
	GW39P							GW40A							GW41A (IW4029)						
Parameter	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average
Field pH	7.7	7.6	7.5	7.4	6.7	8.5	7.6	7.3	7.3	7.3	7.6	6.5	8.9	7.4	7.4	7.4	7.4	7.4	6.6	8.0	7.4
Field EC (µS/cm)	6000.0	5110.0	5070.0	4780.0	500.0	9170.0	5209.2	5590.0	4270.0	4540.0	4360.0	3250.0	5680.0	4398.5	8510.0	6730.0	6400.0	3100.0	815.0	10600.0	4685.1
TDS (mg/L)	3230.0	2870.0	3250.0	3140.0	230.0	4140.0	3010.3	2560.0	2840.0	2720.0	2500.0	2080.0	3410.0	2642.0	4560.0	4360.0	3810.0	2110.0	505.0	6030.0	2598.6
TSS (mg/L)	237.0	92.0	220.0	316.0	12.0	5100.0	175.3	8.0	22.0	8.0	<5	8.0	1580.0	248.5	220.0	43.0	76.0	35.0	35.0	3340.0	692.1
Dissolved Fe (mg/L)	0.1	0.6	0.5	<0.05	0.1	3.2	0.8	<0.05	<0.05	<0.05	<0.05	0.1	0.7	0.1	<0.05	<0.05	<0.05	<0.05	0.1	0.1	0.1
Sulphate (mg/L)	<1	<1	<1	<1	2.0	55.0	19.7	212.0	276.0	255.0	256.0	193.0	387.0	295.7	272.0	284.0	250.0	118.0	26.0	368.0	160.3
Chloride (mg/L)	798.0	767.0	784.0	913.0	725.0	1080.0	829.4	1090.0	1070.0	936.0	1020.0	746.0	1260.0	945.8	1930.0	1850.0	1520.0	943.0	69.0	2330.0	1026.9
Calcium (mg/L)	18.0	16.0	15.0	16.0	14.0	21.0	16.6	126.0	112.0	111.0	122.0	100.0	157.0	120.3	183.0	176.0	153.0	86.0	19.0	260.0	121.6
Magnesium (mg/L)	18.0	16.0	15.0	14.0	14.0	20.0	16.6	208.0	192.0	190.0	198.0	60.0	242.0	199.1	243.0	233.0	191.0	115.0	16.0	339.0	146.4
Potassium (mg/L)	11.0	10.0	9.0	9.0	9.0	12.0	10.0	7.0	7.0	6.0	7.0	6.0	9.0	7.3	9.0	10.0	8.0	6.0	4.0	12.0	7.6
Sodium (mg/L)	1130.0	1060.0	1130.0	1150.0	1060.0	1390.0	1202.2	525.0	503.0	493.0	513.0	467.0	578.0	514.5	925.0	881.0	723.0	541.0	134.0	1210.0	604.4
Carbonate (mg/L)	<1	<1	<1	<1	26.0	405.0	169.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	7.0	7.0	7.0
Bicarbonate (mg/L)	1750.0	1480.0	1530.0	1530.0	1260.0	1850.0	1596.9	689.0	676.0	600.0	634.0	30.0	776.0	612.8	710.0	743.0	532.0	558.0	251.0	1660.0	628.7

	GW43							GW45							GW46						
Parameter	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average
Field pH	7.0	6.9	7.1	7.0	6.7	7.4	7.1	7.0	6.8	7.2	7.3	6.3	8.0	7.2	7.2	6.5	7.0	7.0	6.5	7.6	7.0
Field EC (µS/cm)	5210.0	4460.0	4120.0	4420.0	3900.0	5210.0	4298.4	5910.0	1960.0	1877.0	1831.0	638.0	11380.0	3352.9	6900.0	6140.0	5720.0	5910.0	4840.0	8220.0	6464.7
TDS (mg/L)	2450.0	2470.0	2770.0	2250.0	2120.0	3010.0	2416.4	3540.0	1220.0	1110.0	1140.0	302.0	7580.0	2190.3	4220.0	4480.0	3990.0	3990.0	3290.0	4590.0	3985.8
TSS (mg/L)	<5	<5	<5	<5	6.0	14.0	9.5	8.0	8.0	<5	<5	6.0	1680.0	95.3	<5	<5	<5	<5	5.0	76.0	14.3
Dissolved Fe (mg/L)	0.2	0.2	0.2	0.3	0.1	0.3	0.2	<0.05	<0.05	<0.05	<0.05	0.1	2.2	0.7	<0.05	<0.05	<0.05	<0.05	0.1	0.1	0.1
Sulphate (mg/L)	56.0	58.0	57.0	50.0	27.0	58.0	35.2	881.0	187.0	199.0	217.0	16.0	2410.0	567.8	1290.0	1360.0	1380.0	876.0	213.0	1380.0	604.7
Chloride (mg/L)	711.0	826.0	775.0	829.0	633.0	829.0	695.0	1060.0	385.0	359.0	321.0	22.0	2240.0	584.7	1040.0	1140.0	899.0	1260.0	899.0	1570.0	1360.0
Calcium (mg/L)	8.0	8.0	8.0	9.0	6.0	10.0	8.5	264.0	84.0	103.0	98.0	30.0	550.0	186.6	208.0	203.0	191.0	173.0	167.0	228.0	193.6
Magnesium (mg/L)	156.0	175.0	174.0	160.0	130.0	175.0	158.0	250.0	95.0	105.0	104.0	30.0	520.0	175.3	248.0	270.0	238.0	247.0	208.0	295.0	254.9
Potassium (mg/L)	23.0	24.0	24.0	23.0	21.0	27.0	24.4	4.0	2.0	2.0	1.0	1.0	9.0	3.6	5.0	5.0	5.0	5.0	5.0	10.0	5.7
Sodium (mg/L)	658.0	729.0	739.0	682.0	658.0	834.0	752.0	444.0	154.0	139.0	133.0	71.0	917.0	260.0	782.0	828.0	800.0	795.0	699.0	957.0	814.9
Carbonate (mg/L)	<1	<1	<1	<1	244.0	244.0	244.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate (mg/L)	1370.0	1400.0	1370.0	1320.0	1070.0	1540.0	1394.0	393.0	392.0	380.0	398.0	304.0	556.0	370.6	672.0	737.0	724.0	679.0	545.0	766.0	662.9
	GW47							GW48							GW49						
Parameter	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average
Field pH	7.2	6.8	7.0	7.1	6.8	7.5	7.1	7.6	7.5	7.6	7.7	6.8	8.2	7.6	6.9	6.9	6.9	6.9	6.1	7.5	6.9
Field EC (µS/cm)	5290.0	5200.0	5210.0	5110.0	3540.0	6100.0	4965.8	4290.0	3610.0	3760.0	3640.0	3090.0	4750.0	3758.9	6770.0	5520.0	5860.0	6350.0	5020.0	7530.0	5928.9
TDS (mg/L)	3130.0	3680.0	2980.0	3150.0	2130.0	3840.0	2862.2	2100.0	2410.0	2430.0	2240.0	1920.0	2520.0	2218.3	3580.0	3400.0	3640.0	3610.0	2850.0	3790.0	3451.1
TSS (mg/L)	<5	43.0	9.0	28.0	8.0	1080.0	152.2	<5	<5	<5	<5	5.0	30.0	10.8	14.0	6.0	16.0	5.0	5.0	54.0	16.6
Dissolved Fe (mg/L)	<0.05	<0.05	<0.05	<0.05	0.1	0.1	0.1	0.3	0.3	0.2	0.3	0.2	0.6	0.4	0.4	0.3	0.2	0.5	0.1	0.6	0.4
Sulphate (mg/L)	168.0	163.0	187.0	183.0	101.0	246.0	178.0	<1	<1	<1	<1	2.0	152.0	77.0	<1	<1	<1	<1	1.0	1.0	1.0
Chloride (mg/L)	1040.0	1330.0	1240.0	1280.0	733.0	1340.0	1029.7	243.0	256.0	231.0	247.0	214.0	284.0	239.5	827.0	905.0	778.0	860.0	725.0	997.0	822.0
Calcium (mg/L)	95.0	95.0	104.0	99.0	68.0	118.0	91.7	14.0	12.0	13.0	14.0	10.0	15.0	13.5	46.0	44.0	43.0	50.0	41.0	68.0	48.4
Magnesium (mg/L)	246.0	315.0	291.0	302.0	188.0	363.0	272.8	14.0	13.0	14.0	15.0	11.0	17.0	14.1	43.0	42.0	45.0	47.0	37.0	61.0	46.6
Potassium (mg/L)	7.0	7.0	8.0	6.0	5.0	8.0	6.8	8.0	8.0	8.0	9.0	6.0	11.0	8.1	31.0	29.0	29.0	36.0	25.0	42.0	31.9
Sodium (mg/L)	492.0	541.0	555.0	551.0	462.0	622.0	541.0	889.0	868.0	898.0	915.0	756.0	1030.0	928.9	1240.0	1200.0	1280.0	1300.0	1100.0	1460.0	1316.9
Carbonate (mg/L)	<1	<1	<1	<1	7.0	7.0	7.0	<1	<1	<1	<1	47.0	422.0	139.4	<1	<1	<1	<1	<1	<1	<1
Bicarbonate (mg/L)	916.0	866.0	857.0	773.0	769.0	991.0	881.6	2120.0	1830.0	1730.0	1720.0	1380.0	2120.0	1784.7	2000.0	2100.0	2010.0	2030.0	1530.0	2460.0	2073.9
	X1MB							X10MB													
Parameter	Q1	Q2	Q3	Q4	Minimum	Maximum	Average	Q1	Q2	Q3	Q4	Minimum	Maximum	Average							
Field pH	7.5	7.3	7.2	7.1	7.1	7.6	7.3	7.3	8.5	7.6	8.4	7.3	10.0	8.7							
Field EC (µS/cm)	4650.0	5390.0	4040.0	3600.0	3600.0	5390.0	4627.5	5140.0	5380.0	4770.0	3900.0	3900.0	6570.0	5456.3							
TDS (mg/L)	2700.0	2420.0	2410.0	2430.0	2370.0	2700.0	2448.8	2620.0	2860.0	3000.0	2640.0	2620.0	3300.0	2890.0							
TSS (mg/L)	743.0	<5	574.0	530.0	248.0	1800.0	839.6	57.0	24.0	42.0	13.0	13.0	308.0	87.5							
Dissolved Fe (mg/L)	<0.05	<0.05	<0.05	<0.05	0.2	0.2	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05							
Sulphate (mg/L)	187.0	198.0	209.0	198.0	160.0	209.0	190.1	<1	51.0	38.0	44.0	7.4	95.4	45.4							
Chloride (mg/L)	834.0	975.0	801.0	912.0	801.0	975.0	875.5	594.0	766.0	714.0	757.0	594.0	776.0	719.9							
Calcium (mg/L)	128.0	144.0	137.0	121.0	121.0	144.0	132.5	19.0	36.0	37.0	40.0	4.0	40.0	20.6							
Magnesium (mg/L)	120.0	125.0	120.0	113.0	113.0	134.0	124.0	67.0	103.0	135.0	123.0	18.0	135.0	78.0							
Potassium (mg/L)	5.0	4.0	4.0	3.0	3.0	8.0	5.4	269.0	187.0	185.0	168.0	168.0	471.0	286.6							
Sodium (mg/L)	558.0	576.0	602.0	574.0	544.0	602.0	569.5	744.0	660.0	703.0	653.0	653.0	882.0	757.4							
Carbonate (mg/L)	<1	<1	<1	<1	<1	<1	<1	1250.0	<1	<1	<1	375.0	1250.0	826.0							
Bicarbonate (mg/L)	666.0	705.0	661.0	641.0	641.0	790.0	696.8	625.0	1340.0	1510.0	1470.0	590.0	1510.0	1136.9							

Note: The minimum, maximum and average values are based on all datat since monitoring began

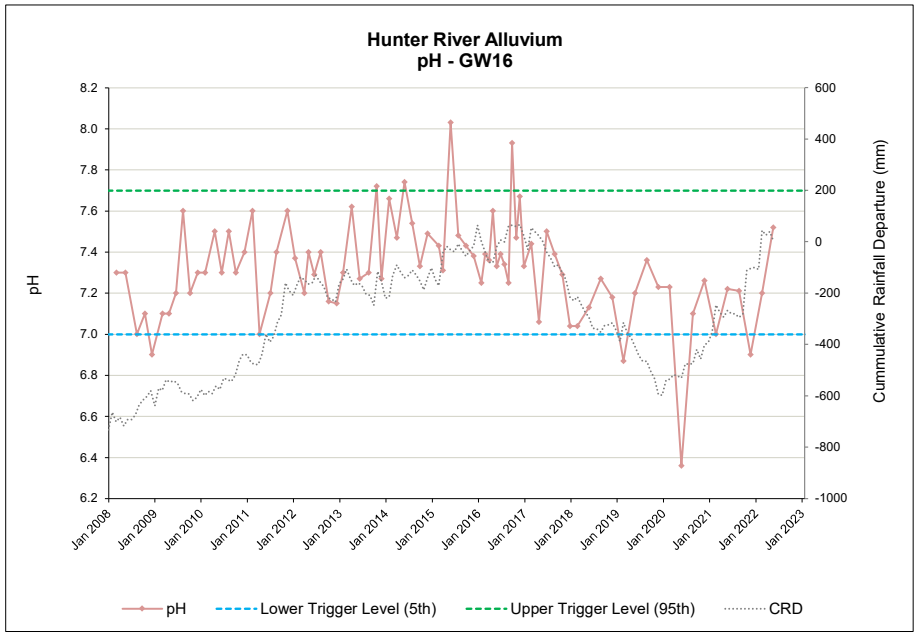
Groundwater Quality Assurance Review

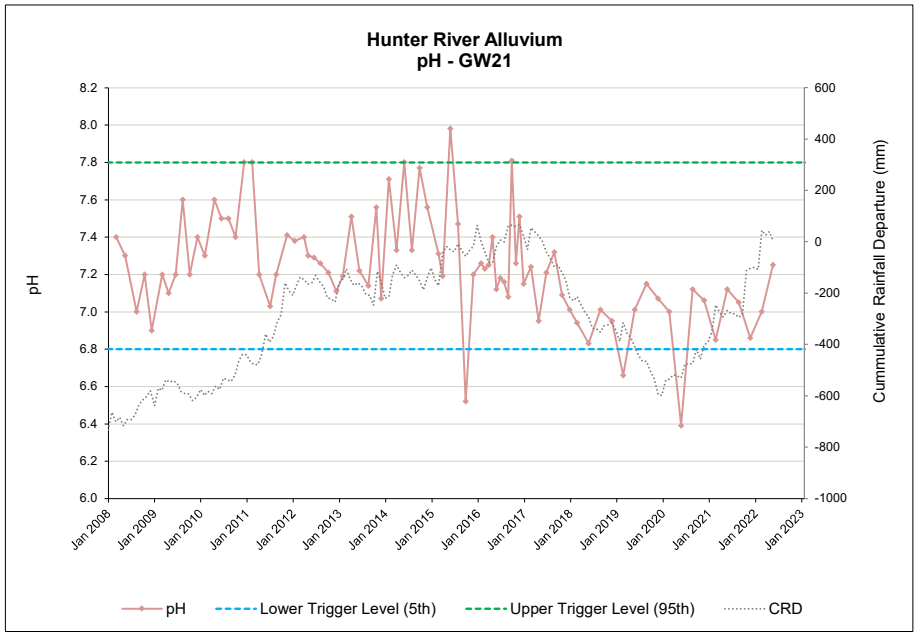
Sample Date:			16/09/2021		Relative Percentage Difference	31/01/2022		Relative Percentage Difference	10/03/2021		Relative Percentage Difference	2/06/2021		Relative Percentage Difference
ALS Batch Number:			WN2110737			ES2203296			ES2208932			ES2219572		
Client sample ID (1st):			GW43	DUPLICATE		GW39P	DUPLICATE		EPWC33	DUPLICATE		EPWC33	DUPLICATE	
Analyte grouping/Analyte	Unit	LOR												
Physical parameters														
pH Value	pH Unit	0.01	7.23	7.16	1 %	7.56	7.6	1%	7.15	7.12	0%	7.16	7.16	0%
Electrical Conductivity @ 25°C	µS/cm	1	4450	4450	0 %	4690	5290	12%	2420	2450	1%	2450	2460	0%
Total Dissolved Solids @ 180°C	mg/L	10	2450	2460	0 %	2870	2880	0%	1610	1600	1%	1480	1520	3%
Total Suspended Solids (TSS)	mg/L	5	<5	<5	0 %	92	68	30%	1570	1590	1%	<5	<5	0%
Major ions														
Hydroxide Alkalinity as CaCO3	mg/L	1	<1	<1	0 %	<1	<1	0%	<1	<1	0%	<1	<1	0%
Carbonate Alkalinity as CaCO3	mg/L	1	<1	<1	0 %	<1	22	**183%**	<1	<1	0%	<1	<1	0%
Bicarbonate Alkalinity as CaCO3	mg/L	1	1370	1520	10 %	1480	1700	14%	1200	1170	3%	1170	1150	2%
Total Alkalinity as CaCO3	mg/L	1	1370	1520	10 %	1480	1720	15%	1200	1170	3%	1170	1150	2%
Sulfate as SO4 - Turbidimetric	mg/L	1	56	56	0 %	<1	<1	0%	22	22	0%	24	22	9%
Chloride by Discrete Analyser	mg/L	1	711	714	0 %	767	831	8%	194	196	1%	209	209	0%
Calcium	mg/L	1	8	8	0 %	16	16	0%	20	20	0%	18	18	0%
Magnesium	mg/L	1	156	160	3 %	16	17	6%	86	85	1%	85	84	1%
Sodium	mg/L	1	658	680	3 %	1060	1170	10%	426	426	0%	436	432	1%
Potassium	mg/L	1	23	23	0 %	10	11	10%	15	15	0%	12	11	9%
Total Phosphorus as P	mg/L	0.01	-	-	-	-	-	-	-	-	-	<0.01	<0.01	0%
Total Anions	meq/L	0.01	48.6	51.7	6 %	51.2	57.8	12%	29.9	29.4	2%	29.8	29.3	2%
Total Cations	meq/L	0.01	42.4	43.7	3 %	48.5	53.4	10%	27	26.9	0%	27.2	26.9	1%
Dissolved Metals														
Aluminium	mg/L	0.01	-	-	-	-	-	-	-	-	0%	<0.01	<0.01	0%
Antimony	mg/L	0.001	-	-	-	-	-	-	-	-	0%	<0.001	<0.001	0%
Arsenic	mg/L	0.001	-	-	-	-	-	-	-	-	0%	<0.001	<0.001	0%
Barium	mg/L	0.001	-	-	-	-	-	-	-	-	0%	0.181	0.185	2%
Boron	mg/L	0.05	-	-	-	-	-	-	-	-	0%	0.16	0.16	0%
Cadmium	mg/L	0.0001	-	-	-	-	-	-	-	-	0%	<0.0001	<0.0001	0%
Chromium	mg/L	0.001	-	-	-	-	-	-	-	-	0%	<0.001	<0.001	0%
Copper	mg/L	0.001	-	-	-	-	-	-	-	-	0%	<0.01	0.001	**164%**
Iron	mg/L	0.05	0.18	0.19	5 %	0.62	0.78	23 %	0.15	0.15	0%	0.08	0.08	0%
Lead	mg/L	0.001	-	-	-	-	-	-	-	-	0%	<0.001	<0.001	0%
Mercury	mg/L	0.0001	-	-	-	-	-	-	-	-	0%	<0.0001	<0.0001	0%
Molybdenum	mg/L	0.001	-	-	-	-	-	-	-	-	0%	<0.001	<0.001	0%
Nickel	mg/L	0.001	-	-	-	-	-	-	-	-	0%	<0.001	0.002	**67%**
Selenium	mg/L	0.01	-	-	-	-	-	-	-	-	0%	<0.01	<0.01	0%
Zinc	mg/L	0.005	-	-	-	-	-	-	-	-	0%	0.013	0.014	7%

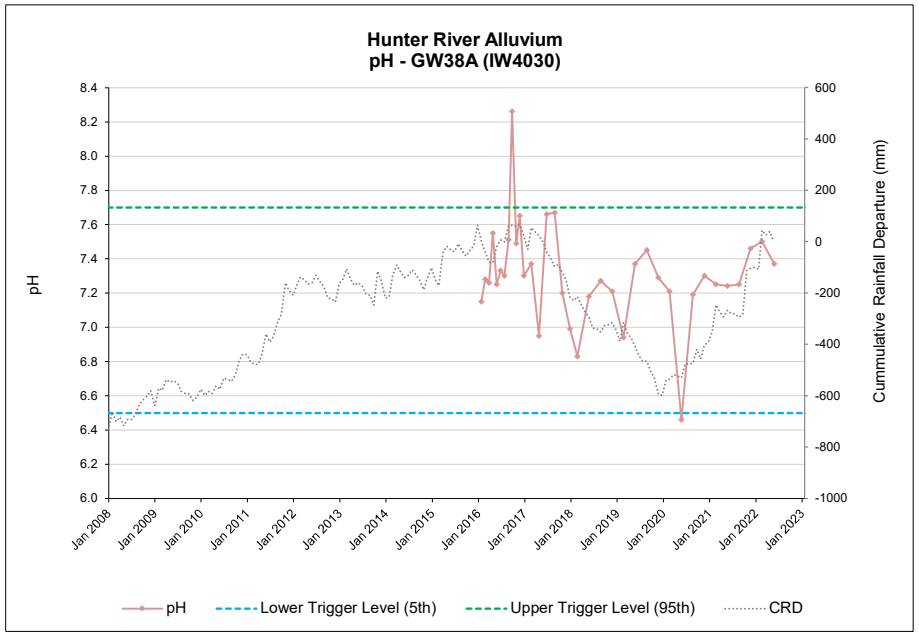


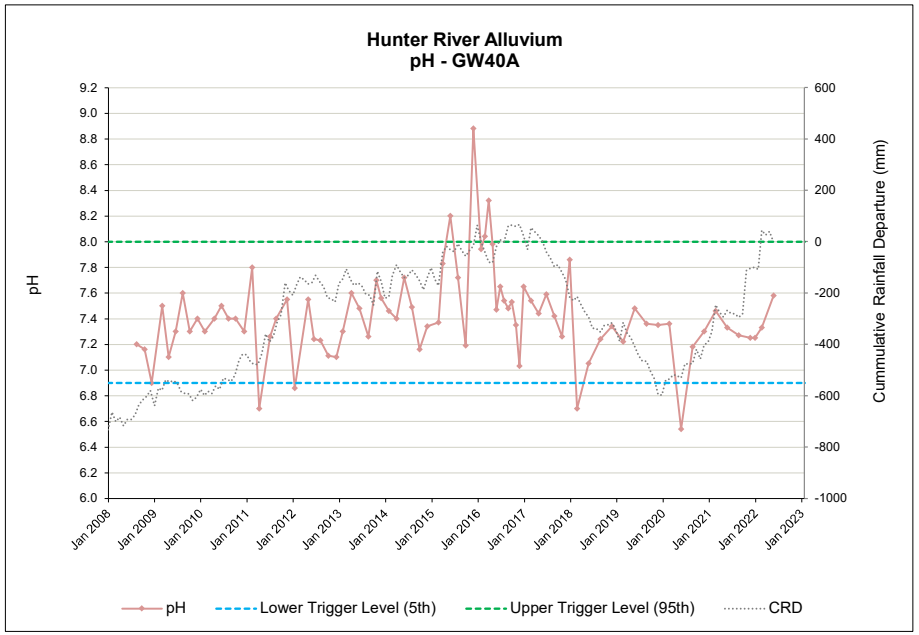
APPENDIX E

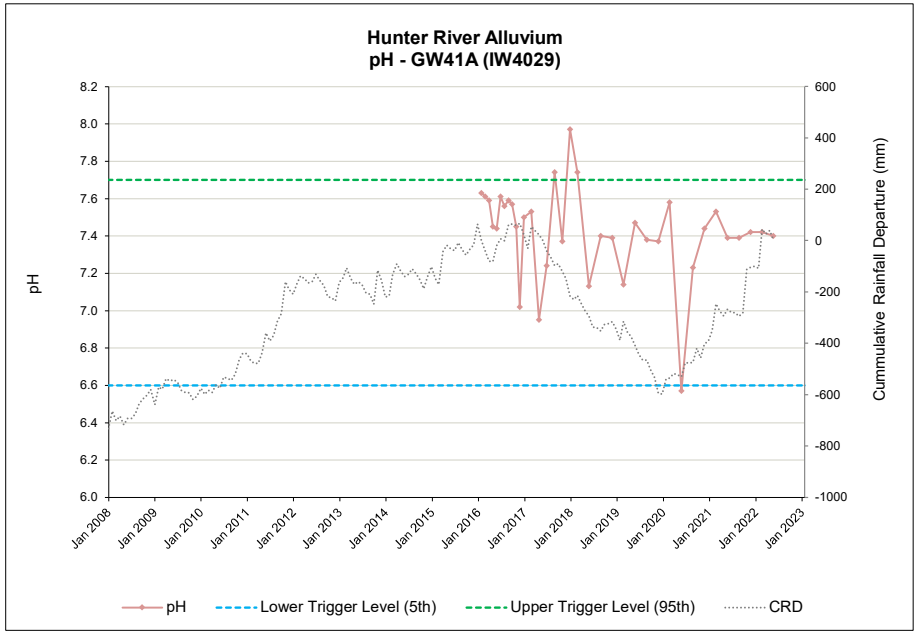
Groundwater Quality Graphs

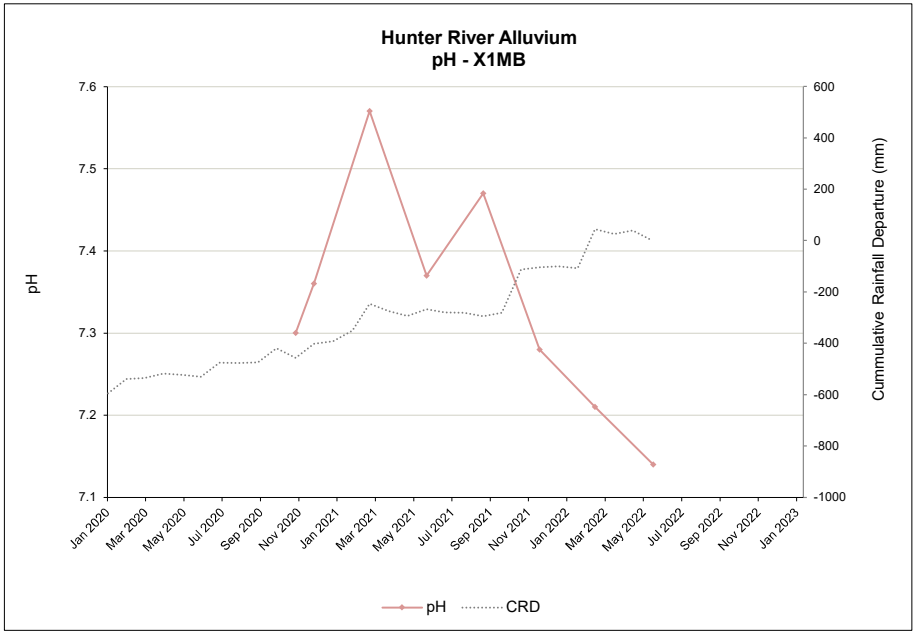

Hunter River Alluvium
pH - GW16
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

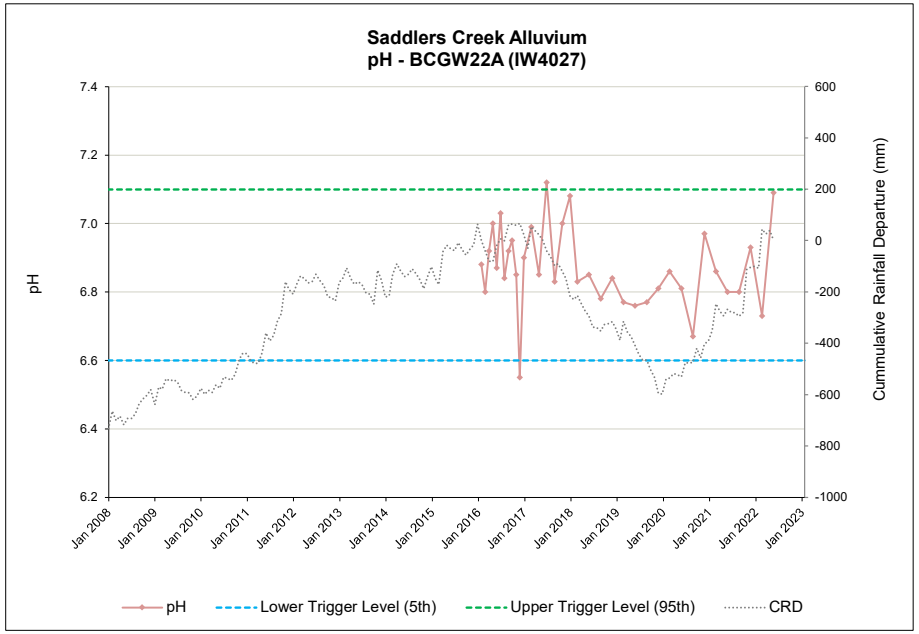

Hunter River Alluvium
pH - GW21
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

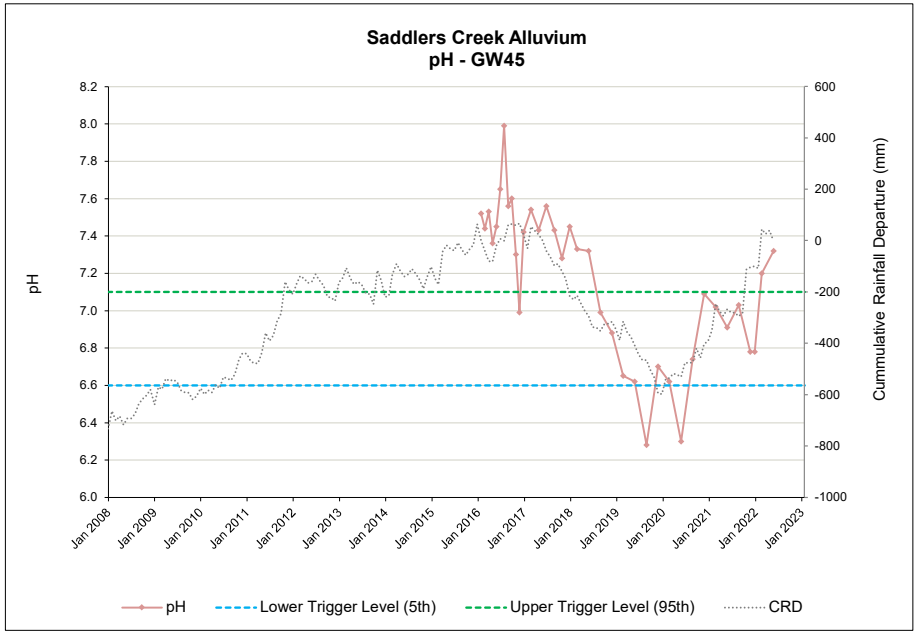

Hunter River Alluvium
pH - GW38A (IW4030)
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

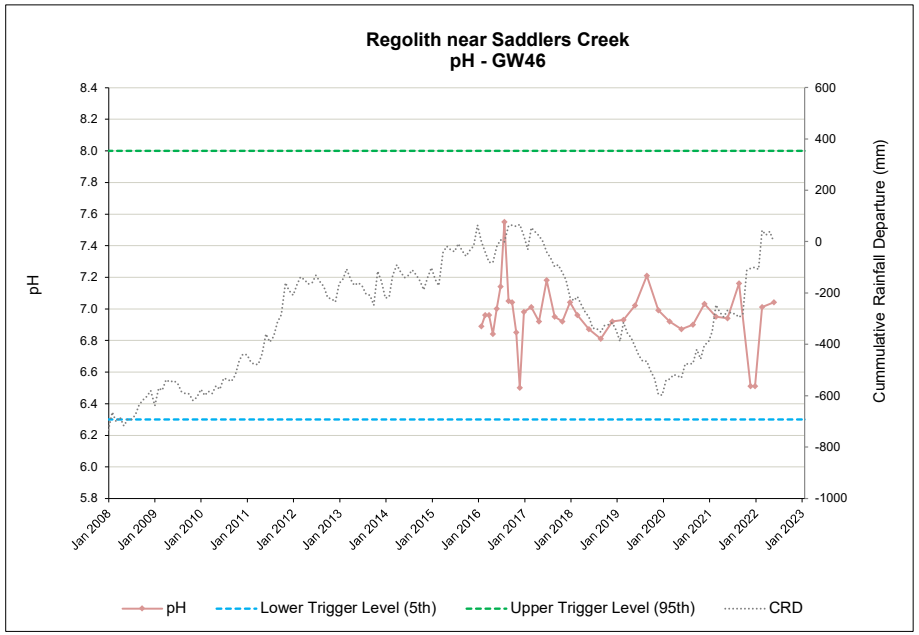

Hunter River Alluvium
pH - GW40A
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

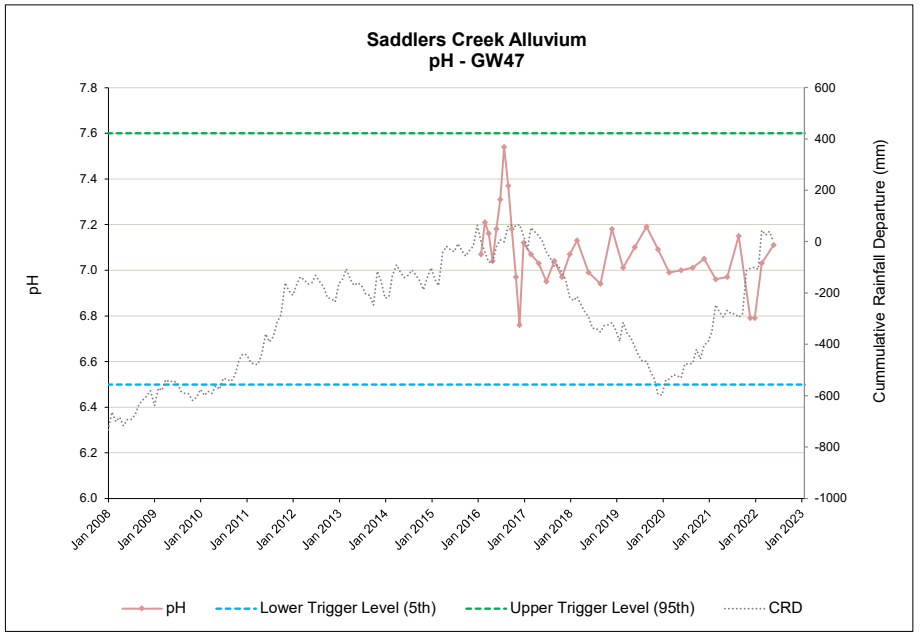

Hunter River Alluvium
pH - GW41A (IW4029)
pH
Cummulative Rainfall Departure (mm)
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

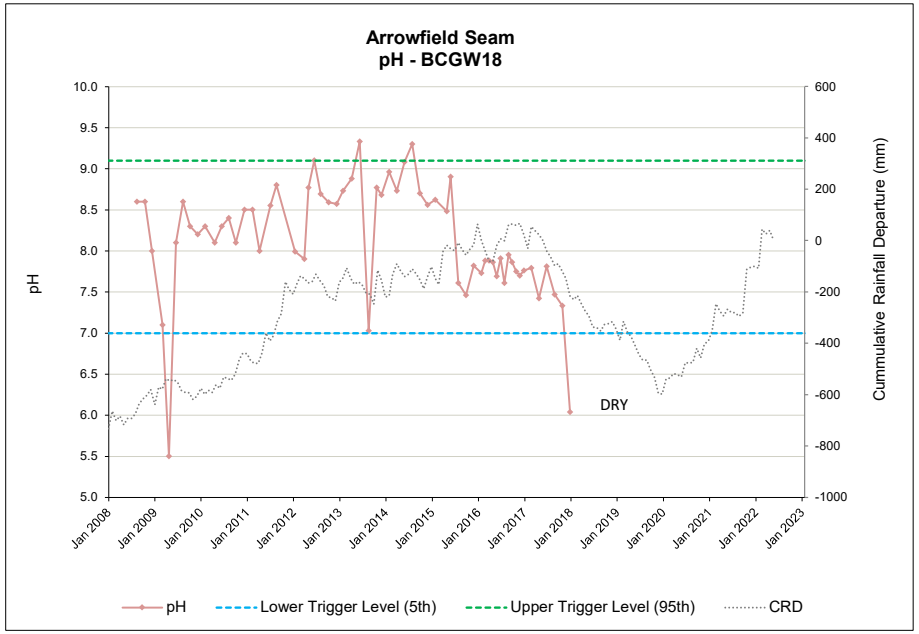

Hunter River Alluvium
pH - X1MB
pH
Cummulative Rainfall Departure (mm)
7.6
7.5
7.4
7.3
7.2
7.1
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2020
Mar 2020
May 2020
Jul 2020
Sep 2020
Nov 2020
Jan 2021
Mar 2021
May 2021
Jul 2021
Sep 2021
Nov 2021
Jan 2022
Mar 2022
May 2022
Jul 2022
Sep 2022
Nov 2022
Jan 2023
pH
CRD

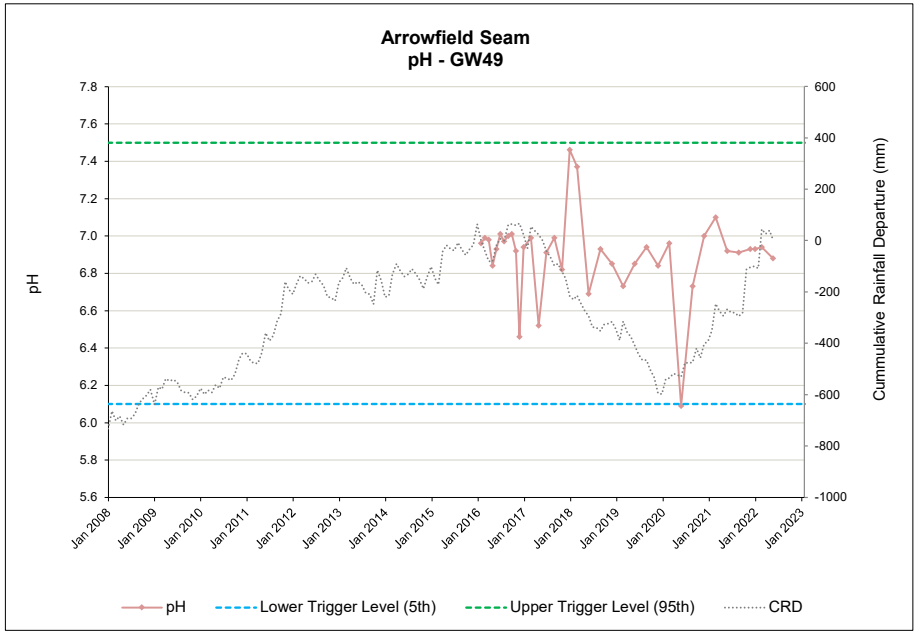

Saddlers Creek Alluvium
pH - BCGW22A (IW4027)
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

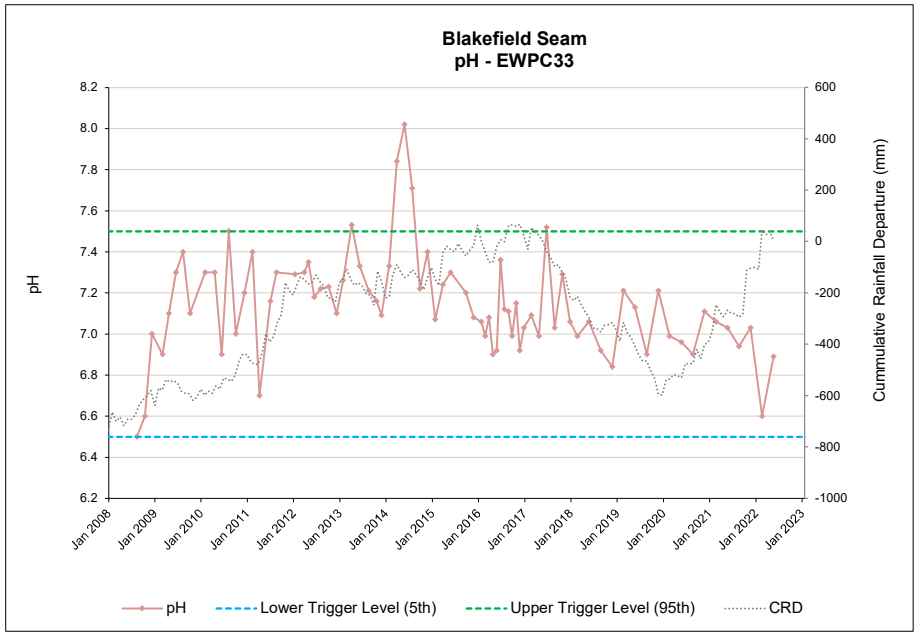

Saddlers Creek Alluvium
pH - GW45
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

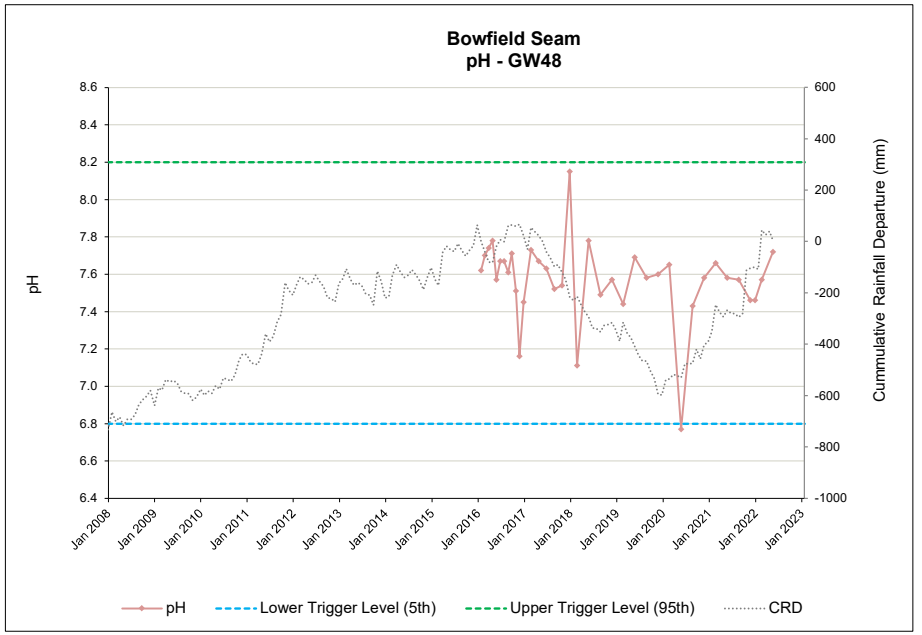

Regolith near Saddlers Creek
pH - GW46
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

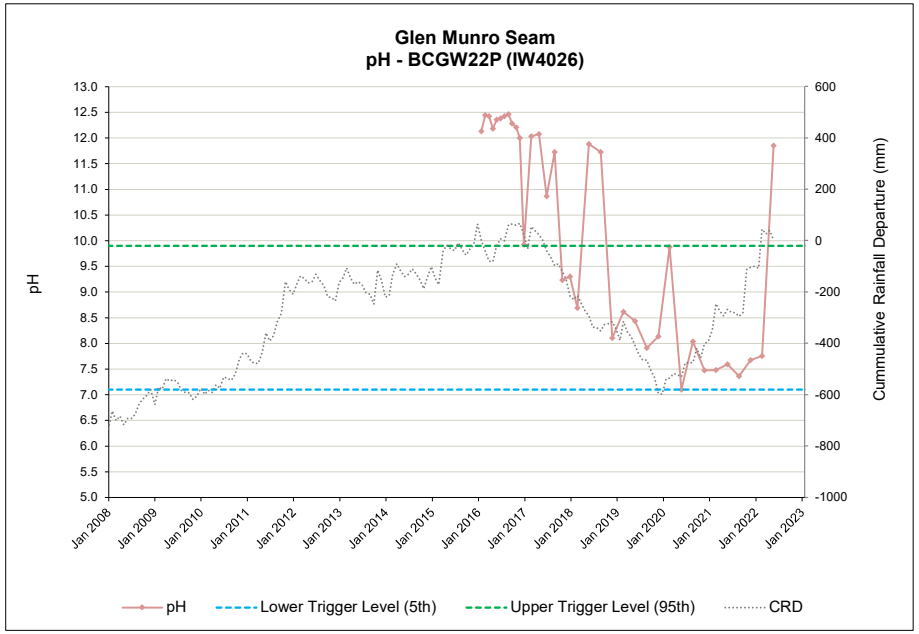

Saddlers Creek Alluvium
pH - GW47
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

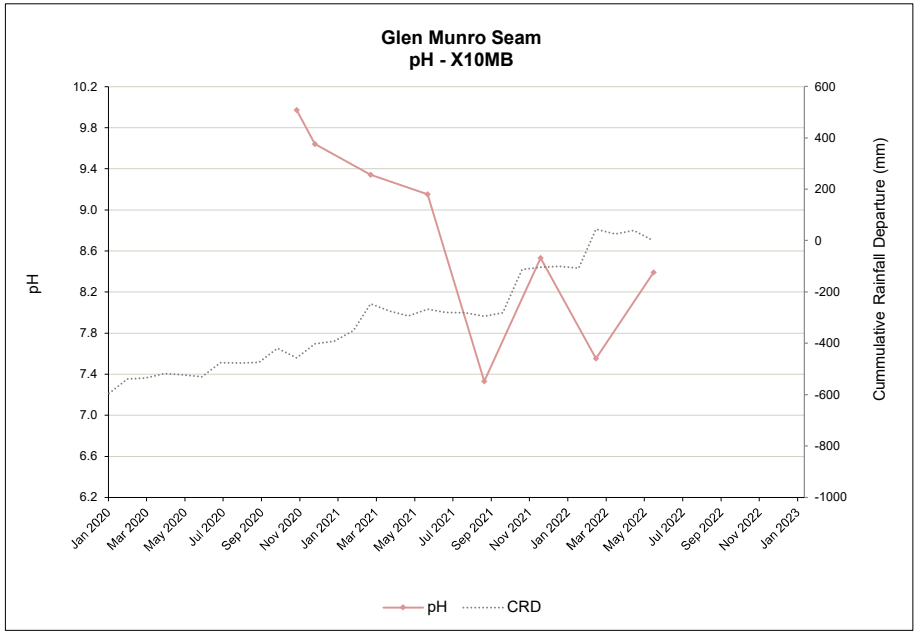

Arrowfield Seam
pH - BCGW18
pH
Cummulative Rainfall Departure (mm)
DRY
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

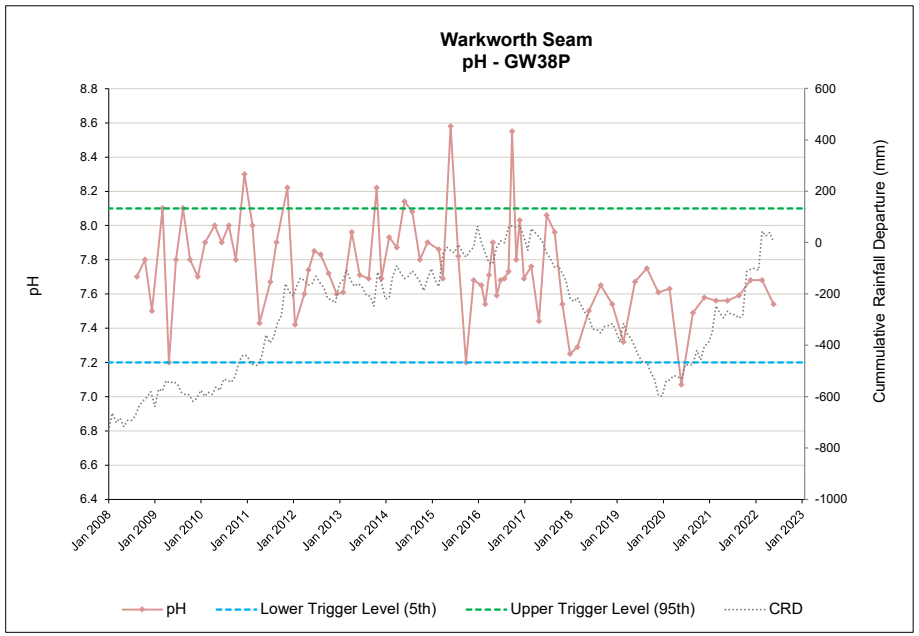

Arrowfield Seam
pH - GW49
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

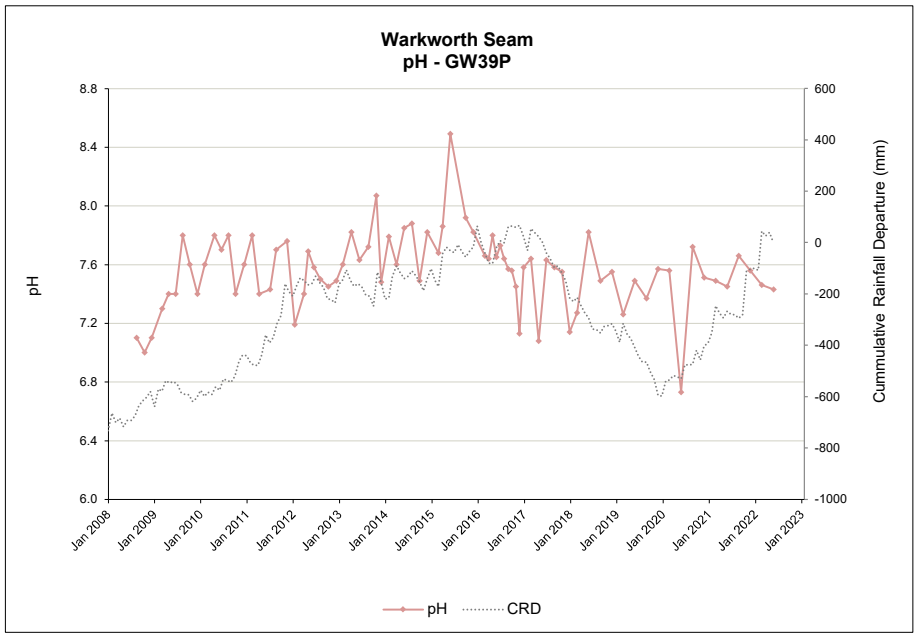

Blakefield Seam
pH - EWPC33
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

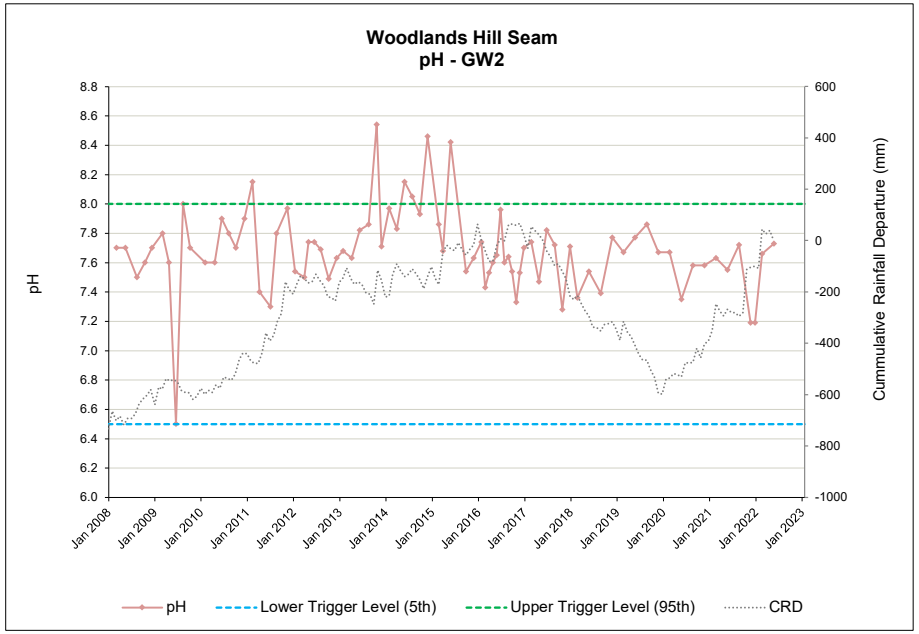

Bowfield Seam
pH - GW48
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

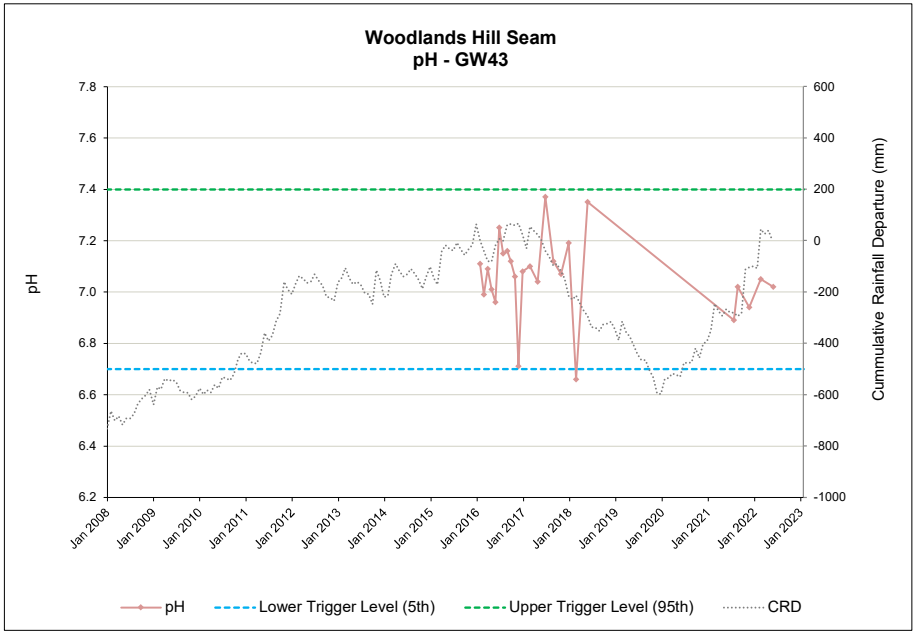

Glen Munro Seam
pH - BCGW22P (IW4026)
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

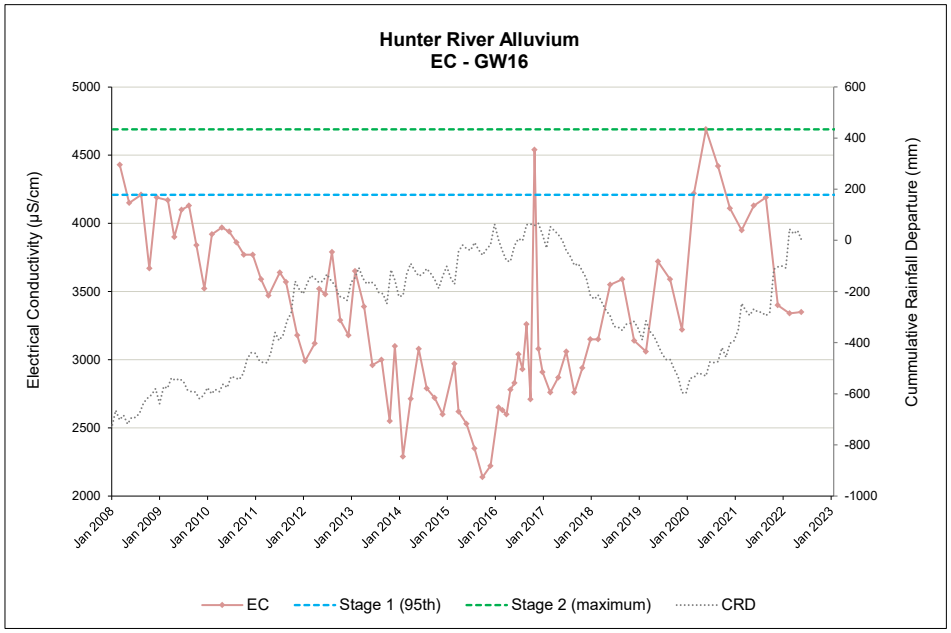

Glen Munro Seam
pH - X10MB
pH
Cummulative Rainfall Departure (mm)
pH
CRD

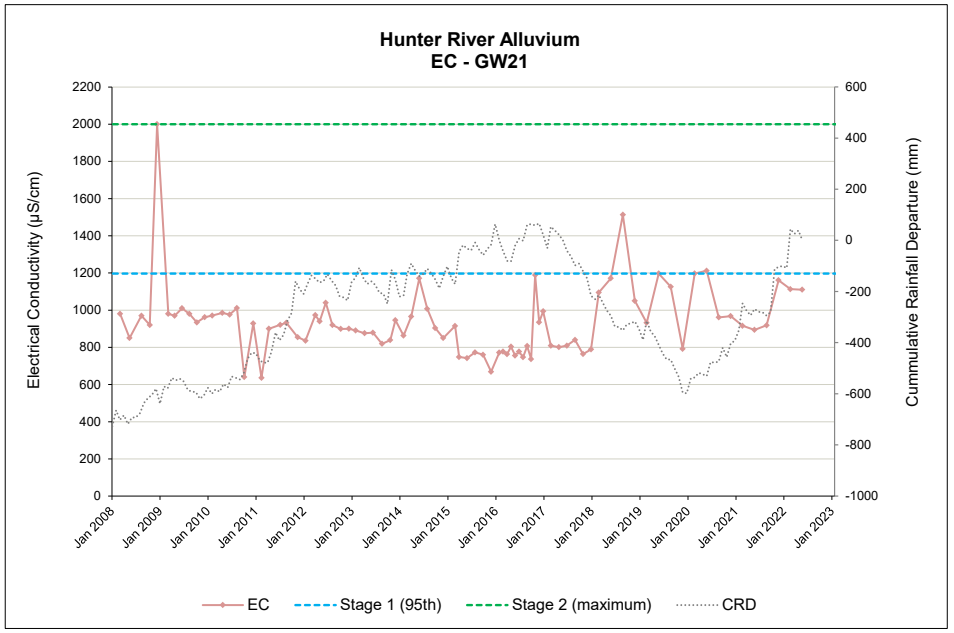

Warkworth Seam
pH - GW38P
pH
Cummulative Rainfall Departure (mm)
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

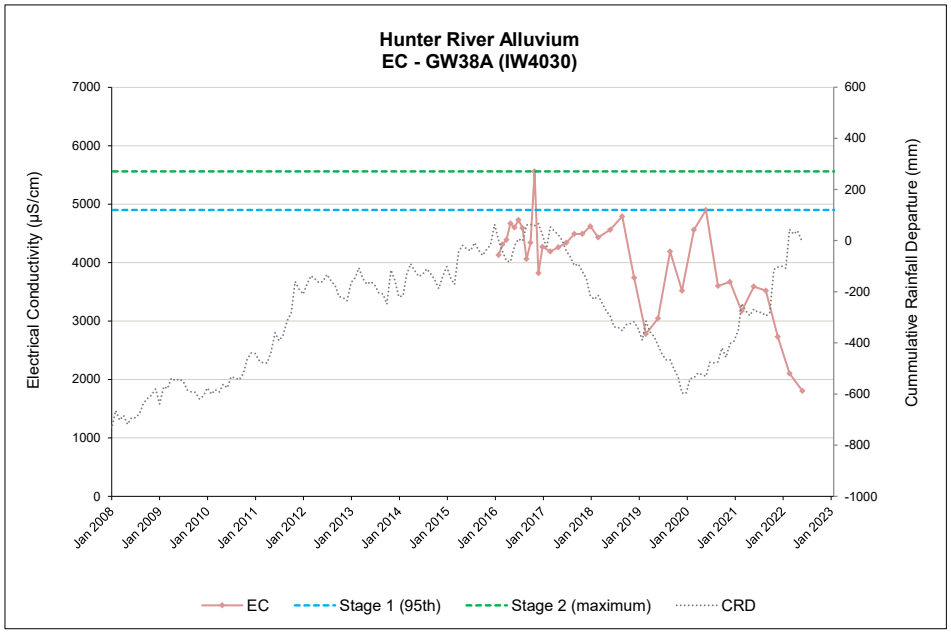

Warkworth Seam
pH - GW39P
pH
Cummulative Rainfall Departure (mm)
pH
CRD

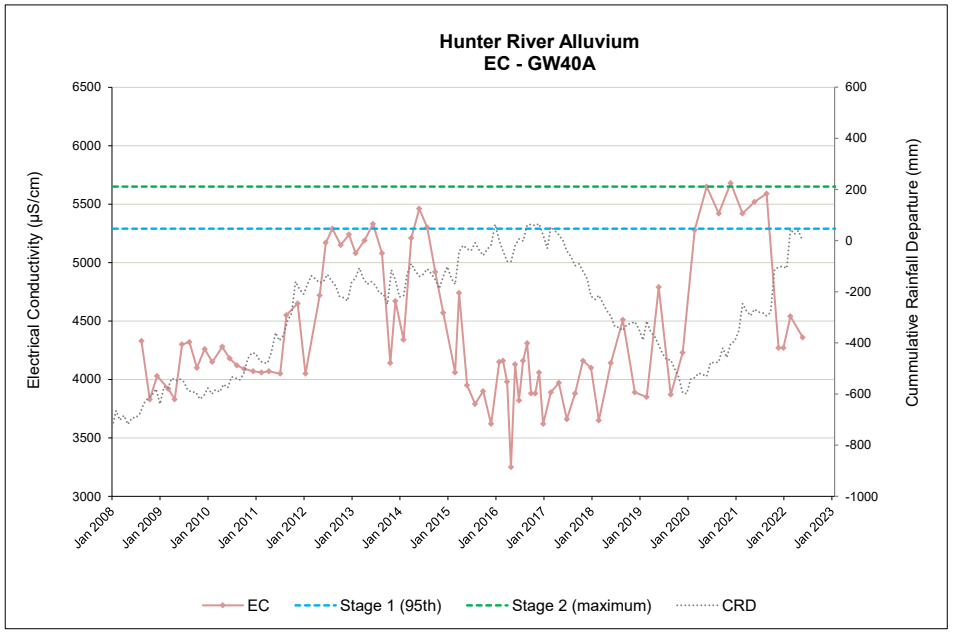

Woodlands Hill Seam
pH - GW2
pH
Cummulative Rainfall Departure (mm)
8.8
8.6
8.4
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

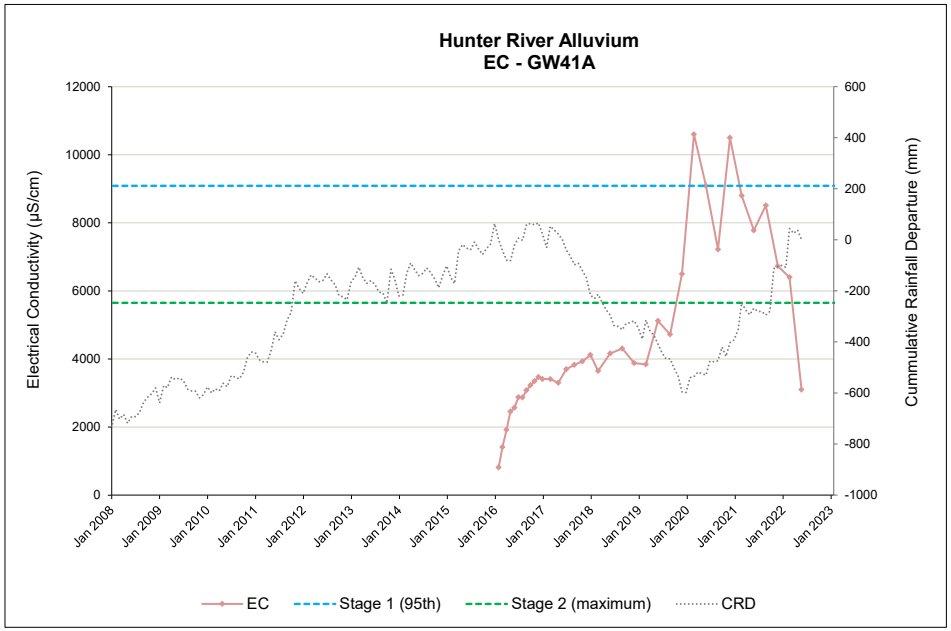

Woodlands Hill Seam
pH - GW43
pH
Cummulative Rainfall Departure (mm)
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
pH
Lower Trigger Level (5th)
Upper Trigger Level (95th)
CRD

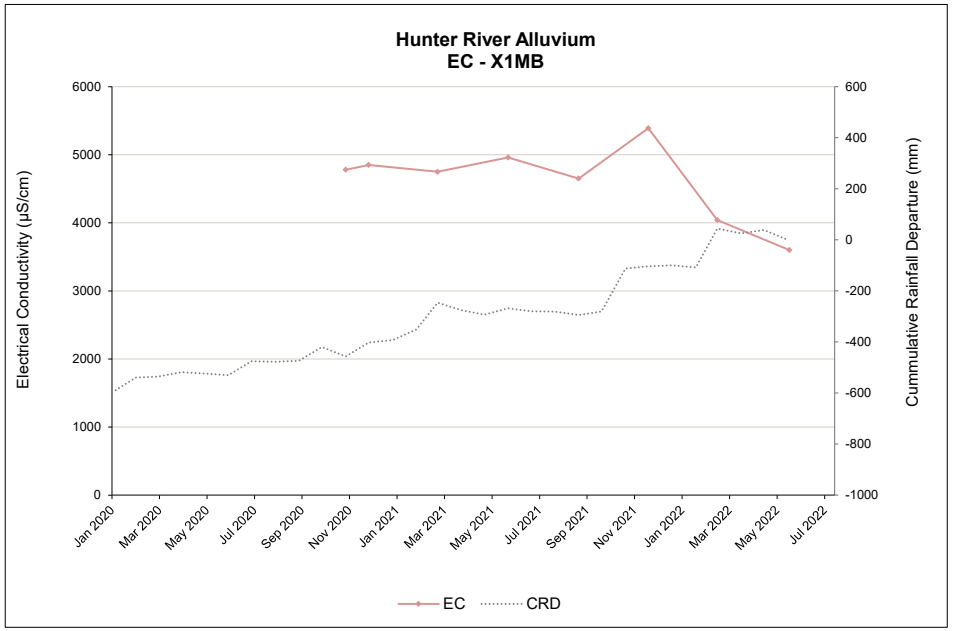

Hunter River Alluvium
EC - GW16
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

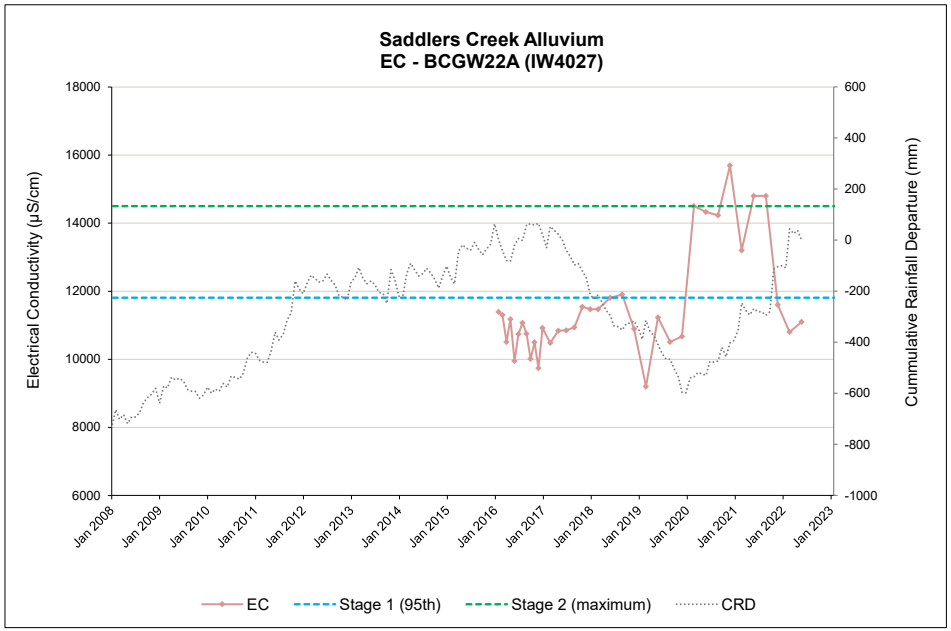

Hunter River Alluvium
EC - GW21
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

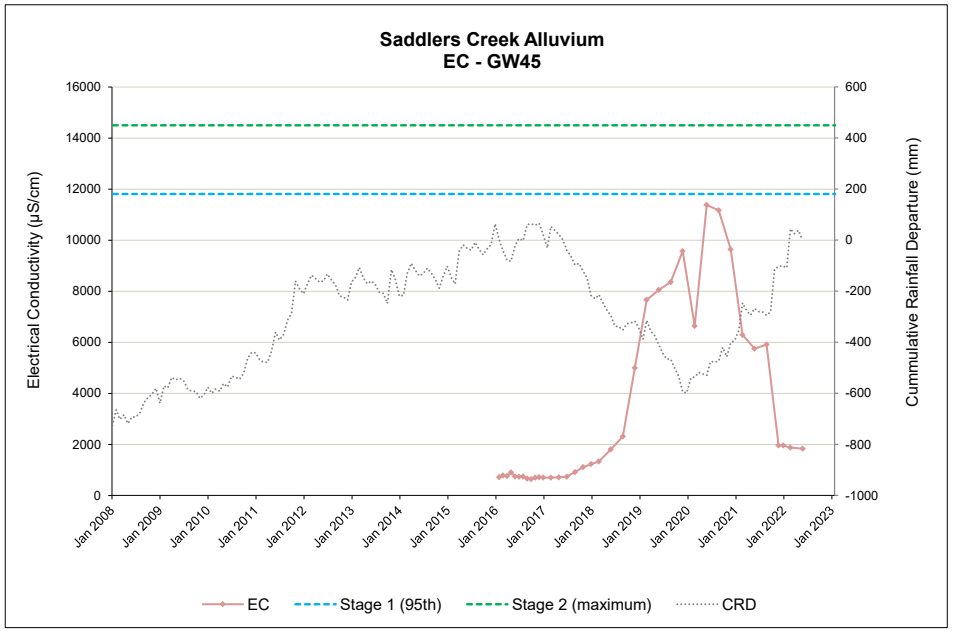

Hunter River Alluvium
EC - GW38A (IW4030)
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

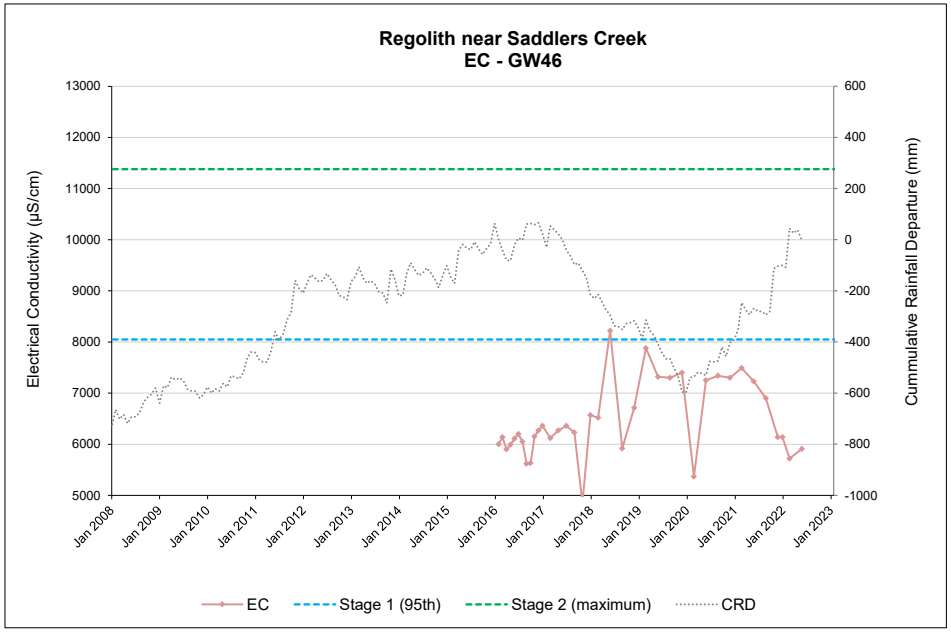

Hunter River Alluvium
EC - GW40A
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

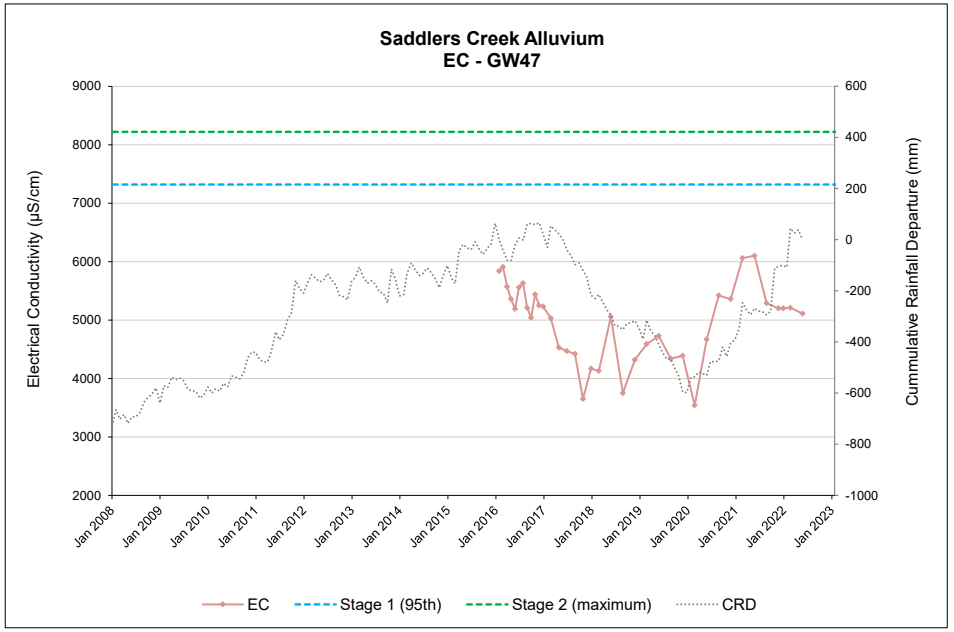

Hunter River Alluvium
EC - GW41A
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
12000
10000
8000
6000
4000
2000
0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

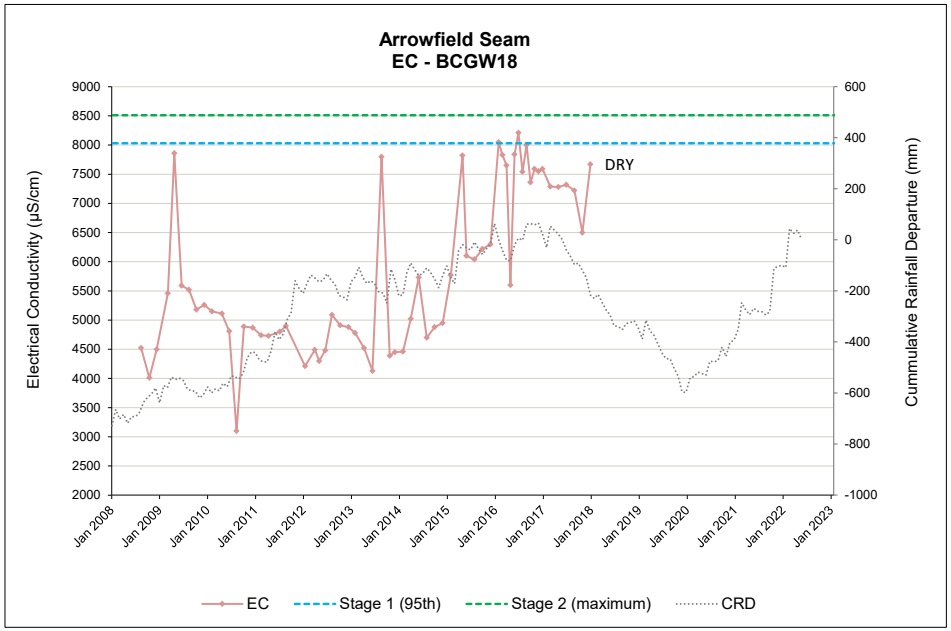

Hunter River Alluvium
EC - X1MB
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
6000
5000
4000
3000
2000
1000
0
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2020
Mar 2020
May 2020
Jul 2020
Sep 2020
Nov 2020
Jan 2021
Mar 2021
May 2021
Jul 2021
Sep 2021
Nov 2021
Jan 2022
Mar 2022
May 2022
Jul 2022
EC
CRD

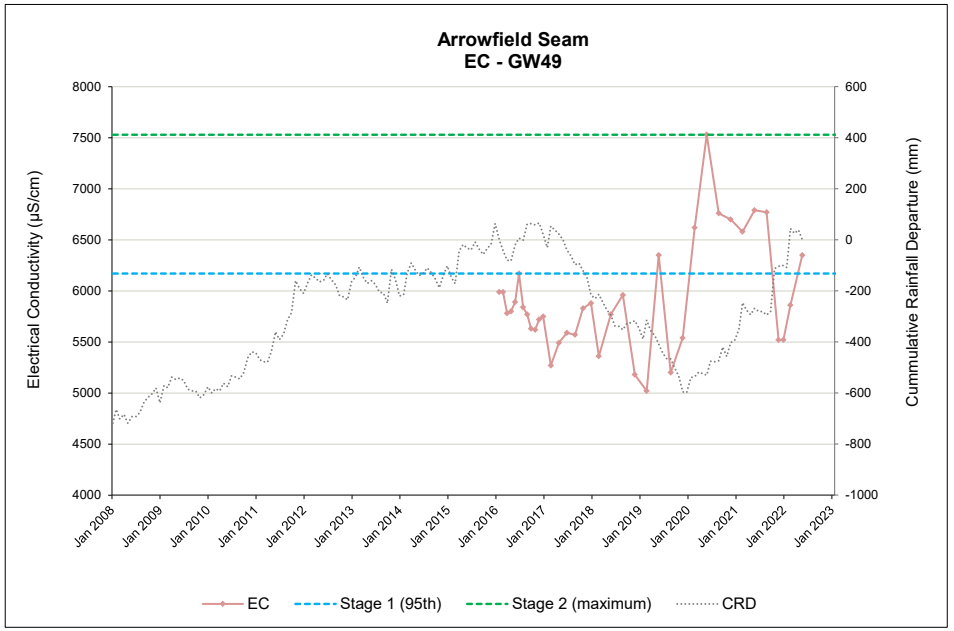

Saddlers Creek Alluvium
EC - BCGW22A (IW4027)
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

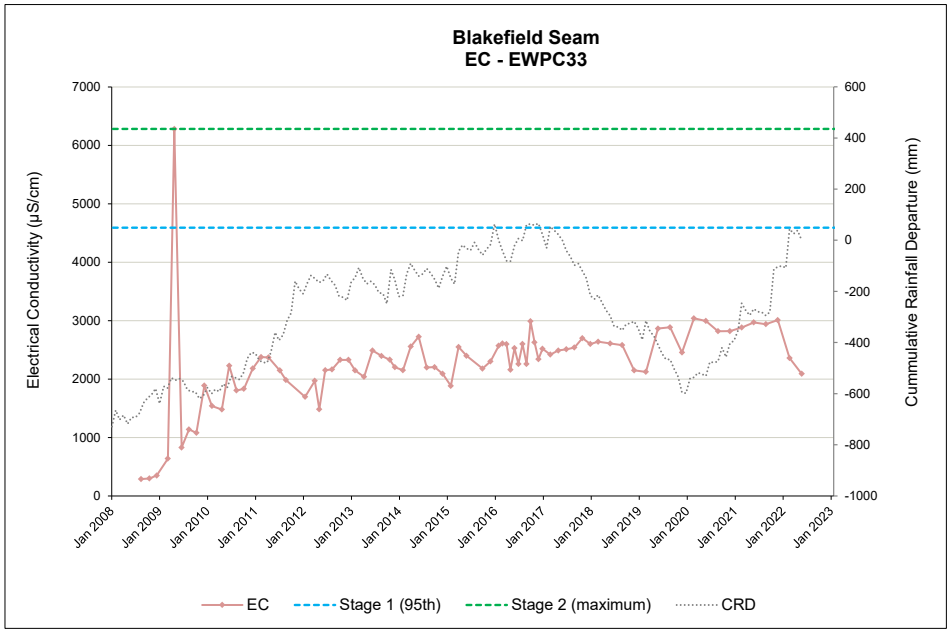

Saddlers Creek Alluvium
EC - GW45
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

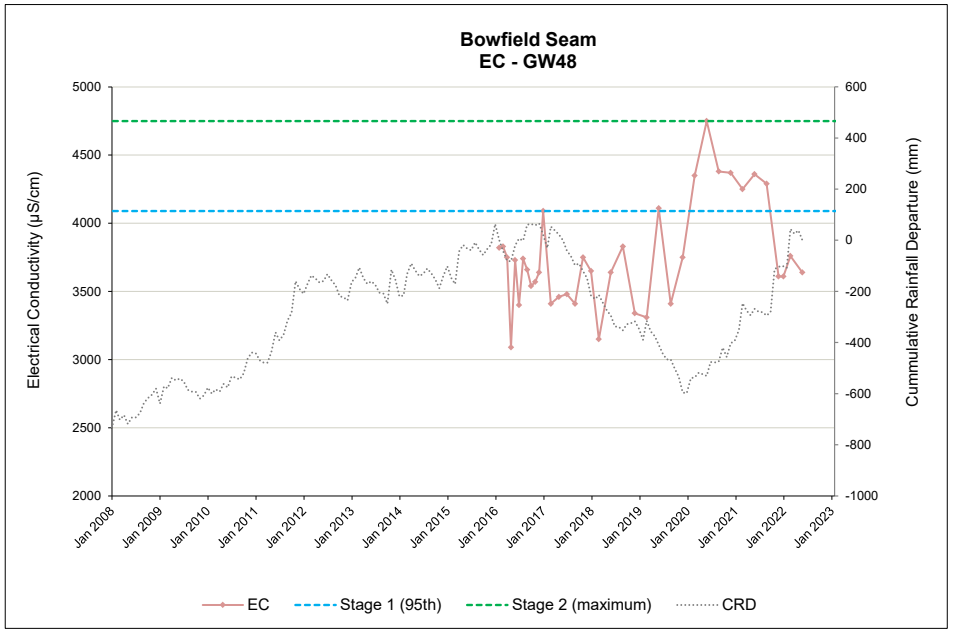

Regolith near Saddlers Creek
EC - GW46
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

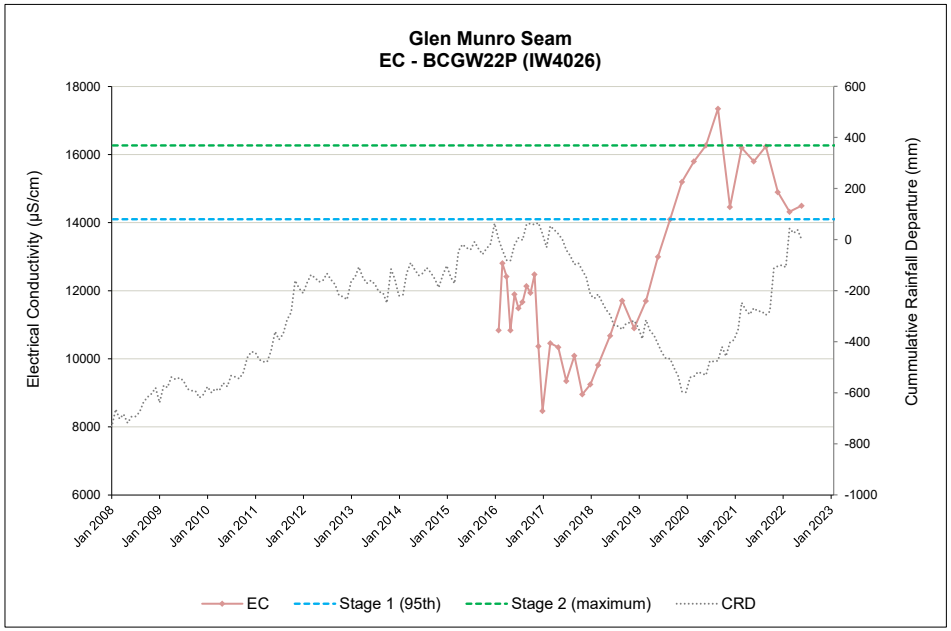

Saddlers Creek Alluvium
EC - GW47
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

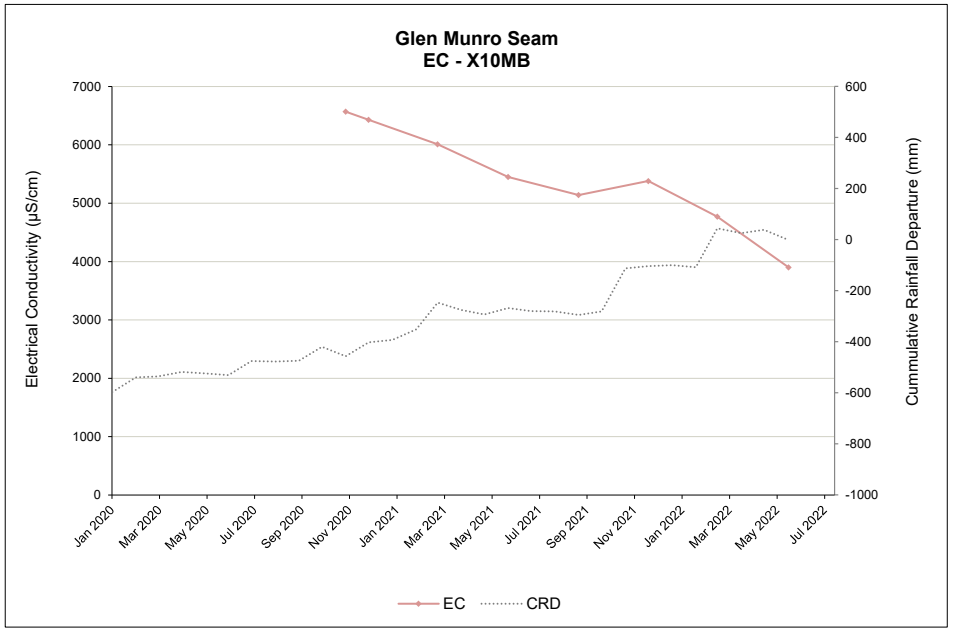

Arrowfield Seam
EC - BCGW18
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
DRY
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

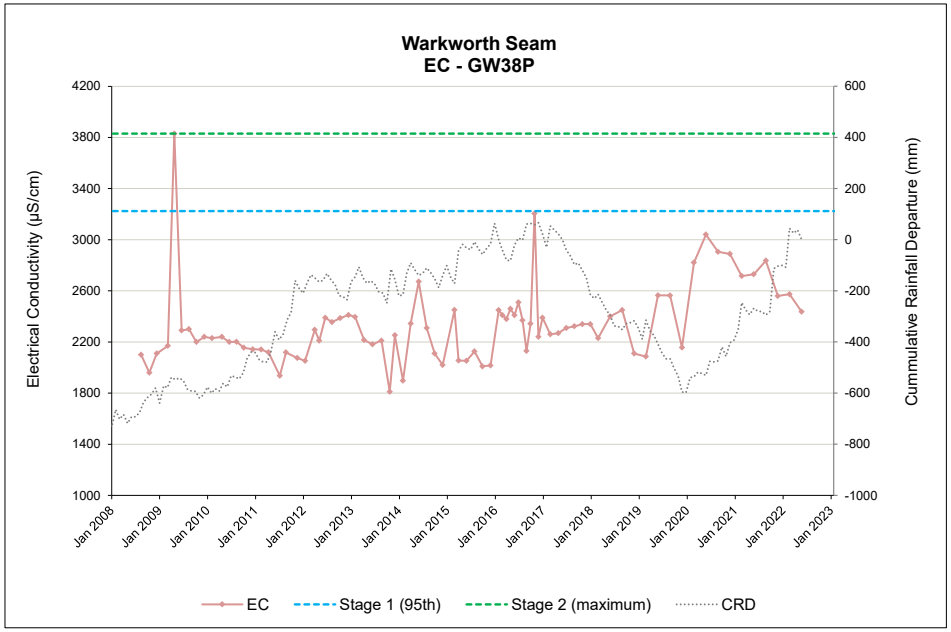

Arrowfield Seam
EC - GW49
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

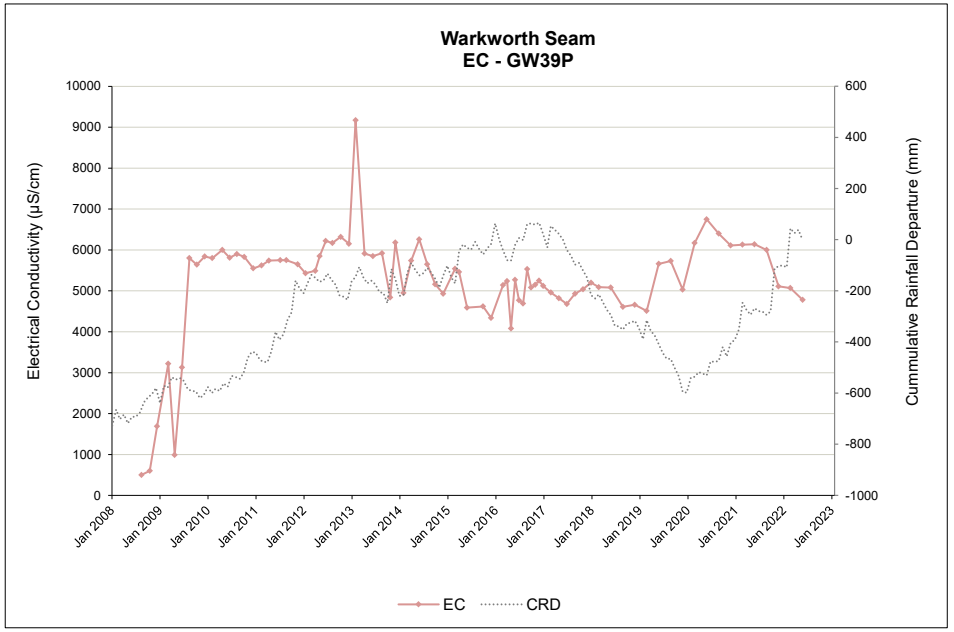

Blakefield Seam
EC - EWPC33
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

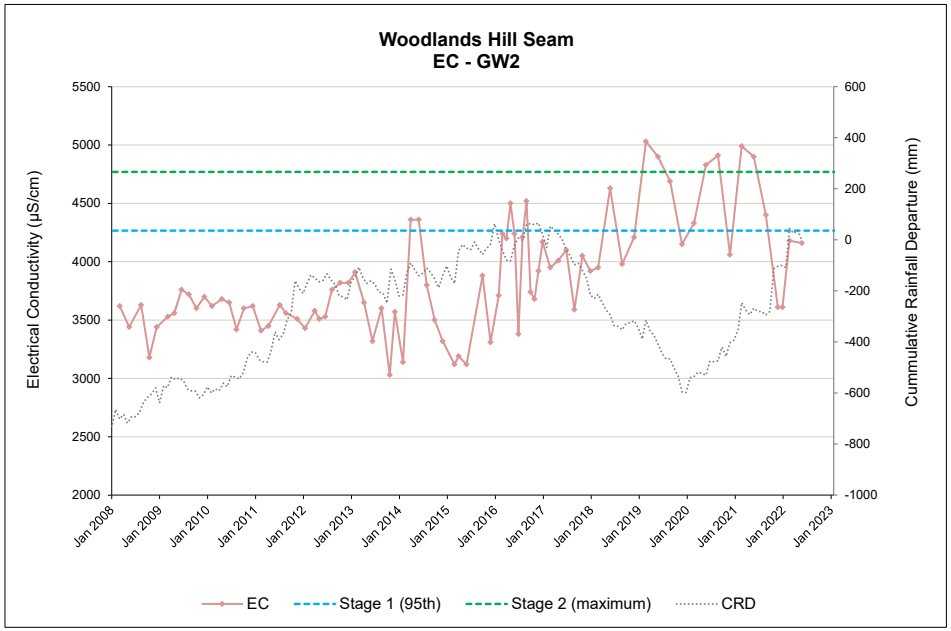

Bowfield Seam
EC - GW48
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

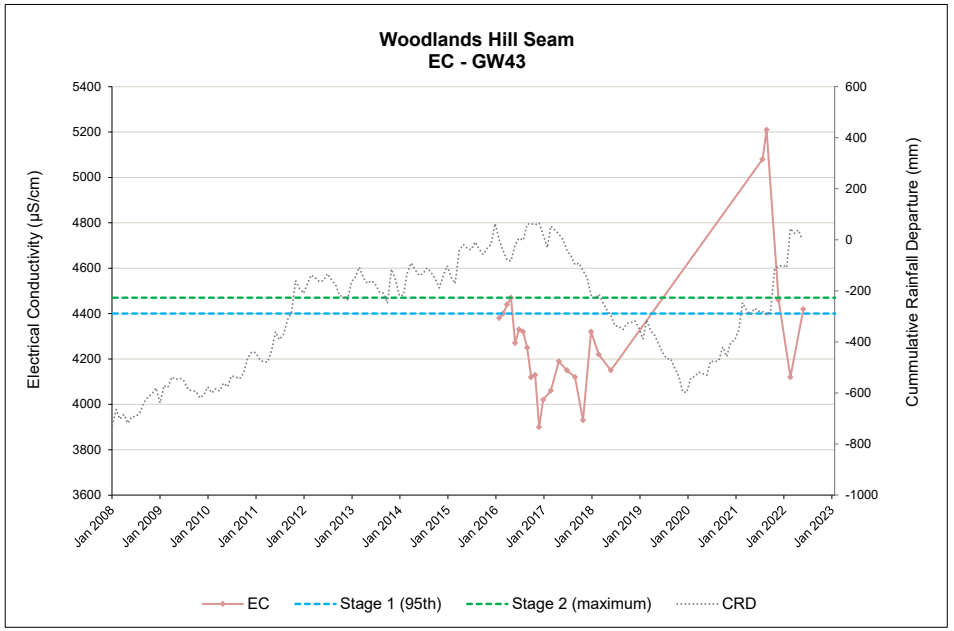

Glen Munro Seam
EC - BCGW22P (IW4026)
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD


Glen Munro Seam
EC - X10MB
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
CRD


Warkworth Seam
EC - GW38P
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD


Warkworth Seam
EC - GW39P
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
EC
CRD


Woodlands Hill Seam
EC - GW2
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
5500
5000
4500
4000
3500
3000
2500
2000
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD


Woodlands Hill Seam
EC - GW43
Electrical Conductivity (µS/cm)
Cummulative Rainfall Departure (mm)
5400
5200
5000
4800
4600
4400
4200
4000
3800
3600
600
400
200
0
-200
-400
-600
-800
-1000
Jan 2008
Jan 2009
Jan 2010
Jan 2011
Jan 2012
Jan 2013
Jan 2014
Jan 2015
Jan 2016
Jan 2017
Jan 2018
Jan 2019
Jan 2020
Jan 2021
Jan 2022
Jan 2023
EC
Stage 1 (95th)
Stage 2 (maximum)
CRD

umwelt
Environmental & Social
Consultants

Umwelt (Australia) Pty Limited

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au

Appendix 3 Community Complaints

Number	Month	Date	Time	From	Issue	Lodgement type	Investigation and response to caller
1	July	06/07/2021	9:45pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of stationary lights, which were switched off.
2		07/07/2021	10:59am	Roxburgh Road	Other	Community Response Line	Investigation revealed that lighting complaint reported to Community Response Phone Line was only communicated to MAC team via email and not the usual text message. As a result, the MAC team did not receive an alert via mobile phone and therefore could not immediately respond to the complaint.
3		23/07/2021	4:23pm	Racecourse Road	Blast	Community Response Line	Vibration results from the blast exceeded the approval limit of 10mm/s at one blast monitor on Denman Road west. All other blast monitors recorded results well below this level. Caller was advised of investigation.
4		26/07/2021 (23/07/2021)	8:01am (4:18pm)	Roxburgh Road	Blast	Community Response Line	Vibration results from the blast exceeded the approval limit of 10mm/s at one blast monitor on Denman Road west. All other blast monitors recorded results well below this level. Caller was advised of investigation.
5		30/07/2021	11:15am	Bureen Road	Blast	Community Response Line	Overpressure and vibration results from the blast were within approval limits. Caller was advised of investigation.
6	August	03/08/2021	7:03pm	Roxburgh Road	Lighting	Community Response Line	Several lights were altered to mitigate impacts to the complainant's satisfaction.

Number	Month	Date	Time	From	Issue	Lodgement type	Investigation and response to caller
7		05/08/2021	11.22am	Ridgelands Road	Blast	Community Response Line	Overpressure and vibration results from the blast were within approval limits. Caller was advised of investigation.
8		12/08/2021	10:39pm	Roxburgh Road	Noise	Community Response Line	Nearest real-time monitor did not record any exceedances or distribute any alerts. Caller was advised of investigation and monitoring results.
9		27/08/2021	7:35pm	Roxburgh Road	Lighting	Community Response Line	Investigation did not reveal any offending lights. Complainant was contacted shortly after and no longer had a concern with lights.
10	September	01/09/2021	9:16pm	Bureen Road	Lighting	Community Response Line	Investigation revealed location of stationary lights, which were adjusted to the resident's satisfaction.
11		01/09/2021	9:48pm	Bureen Road	Lighting	Community Response Line	Investigation revealed location of stationary lights, which were adjusted to the resident's satisfaction.
12		02/09/2021	9:23pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of stationary lights, which were adjusted to the resident's satisfaction.
13		03/09/2021	7:51pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of stationary lights, which were adjusted to the resident's satisfaction.
14		05/09/2021	7:18pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of one stationary light, which was adjusted to the resident's satisfaction.
15		06/09/2021	10:32am	Roxburgh Road	Other	Community Response Line	Community Response Line was alleged to be unattended. Investigation with Vodafone phone service provider found that line was staffed at this time.
16		09/09/2021	2:28pm	Racecourse Road	Blast	Community Response Line	Monitoring results indicated overpressure and vibration levels were within regulatory criteria. Caller was advised of investigation and monitoring results.

Number	Month	Date	Time	From	Issue	Lodgement type	Investigation and response to caller
17		11/09/2021	7:45pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of one stationary light, which was adjusted to the resident's satisfaction.
18		16/09/2021	2:57pm	Skelletar Stock Rte	Other	NSW Department of Planning, Industry & Environment (DPIE)	Investigation revealed the BHP website had recently been rebuilt and relaunched on 7/09/2021 and not all MAC CCC minutes had successfully migrated across to the new site. CCC minutes were uploaded to BHP's website on 17/09/2021.
19		17/09/2021	8:05pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of stationary light, which was adjusted to the resident's satisfaction.
20		19/09/2021	9:32pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of stationary lights, which were adjusted to the resident's satisfaction.
21		24/09/2021	7:35pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of stationary light, which were adjusted to the resident's satisfaction.
22		27/09/2021	7:57pm	Bureen Road	Lighting	Community Response Line	Investigation revealed location of stationary lights, which were adjusted. Further light positioning adjustments made on following day to ensure continued mitigation of impacts.
23		30/09/2021	9:38pm	Roxburgh Road	Noise	Community Response Line	Nearest real-time monitor did not record any exceedances or distribute any alerts. Caller was advised of investigation and monitoring results.
24	October	02/10/2021	7:04pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of one stationary light, which was adjusted to the resident's satisfaction.
25		04/10/2021	5:08am	Roxburgh Road	Noise	Community Response Line	Nearest real-time monitor did not record any exceedances or distribute any alerts. Caller was advised of investigation and monitoring results.

Number	Month	Date	Time	From	Issue	Lodgement type	Investigation and response to caller
26		13/10/2021	8:32pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of stationary lights, which was switched off to the resident's satisfaction.
27		21/10/2021	8:00pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of stationary light, which was adjusted to the resident's satisfaction.
28		22/10/2021	12pm	Thomas Mitchell Drive	Other	Other	Immediate installation of a dedicated traffic controller to direct truck movements entering and exiting BHP property.
29		30/10/2021	5:22pm	Shephard Avenue	Dust	Community Response Line	Operations were modified to lower levels in response to airborne dust evident due to strong southerly winds. No dust monitor exceedances were recorded for the period. Caller was advised of result.
30	November	02/11/2021	7:50pm	Hassell Road	Lighting	Community Response Line	Investigation revealed location of stationary light, which was modified to the resident's satisfaction.
31	December	17/12/2021	6:56pm	New England Highway	Blast	Community Response Line	Investigation revealed MAC didn't blast at the time. The impact was due to magnitude 3 earthquake as recorded by Geoscience Australia.
32		23/12/2021	2:03pm	Muswellbrook	Other	Community Response Line	Investigation revealed, MAC South (Thiess) vehicles use the LV wash bay facility at MAC North or manual cleaning of vehicles as required. As a result of complaint, Thiess reminded teams of the requirement to ensure any vehicles leaving site to be adequately cleaned.

Number	Month	Date	Time	From	Issue	Lodgement type	Investigation and response to caller
33	January	02/01/2022	8:58pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed that due to a fault from the Response Line carrier, notifications were not received about this complaint. BHP has put in place a remediation with carrier and will receive a detailed usage report every week to ensure response line is active and all complaints captured. Unfortunately, due to the error of the carrier, this complaint was not actioned in line with our processes. We have shared this information with the resident.
34		17/1/22	12.30pm	Racecourse Road	Blast Vibration	Community Response Line	Investigation revealed that BHP Mt Arthur Coal did not blast on this date and there was no noise exceedances or vibration exceedances recorded on monitoring.
35		31/01/2022	9:30pm	Roxburgh Road	Noise	Community Response Line	Nearest real-time monitor did not record any exceedances or distribute any alerts. Caller was advised of investigation and monitoring results.
36	March	21/03/2022	9.16am	Roxburgh Road	Blast	Community Response Line	Investigation revealed that BHP Mt Arthur Coal blasted at this time but there were no exceedances for noise.
37		30/03/2022	2:00am	Roxburgh Road	Noise	Community Response Line	Investigation revealed one noise monitor alert during the period which was inspected and revealed not to be attributed to mine related noise as the mine was halted due to wet weather. There were no exceedances.
38	April	21/04/2022	10:50am	Crossing at Sydney Road	Other	Community Response Line	Investigation revealed road closure signs for blast were incorrectly marked. This was due to a slight delay to blasting to ensure weather and safety during and after blast. Road was closed from 10.29am to 10.55am. Sign said road would reopen at 10.20am.

Number	Month	Date	Time	From	Issue	Lodgement type	Investigation and response to caller
39	June	18/06/2022	3:30pm	Denman Road	Blast	Community Response Line	Investigation revealed overpressure results (noise) were elevated but within our approval and license.
40		27/06/2022	10:43pm	Roxburgh Road	Noise	Community Response Line	Investigation and inspection revealed minimal noise evident. Both manual and electronic noise samples were taken and all below the threshold, within our approval and license.

Appendix 4 Annual Coal Transport Report FY22

Mt Arthur Coal

Annual Coal Transport Report FY22

This report has been prepared in accordance with Schedule 3 Condition 46 of Project Approval 09_0062 MOD 1:

Monitoring of Coal Transport

46. The Proponent shall keep records of the:
    (a) amount of coal transported from the site in each financial year;
    (b) number of coal haulage train movements generated by the Mt Arthur mine complex (on a daily basis); and
    (c) make these records available on its website at the end of each financial year.

For the 12 month period ending 30 June 2022:

- 13.873 million tonnes of export product coal was transported by rail to the Port of Newcastle. This is compliant with Schedule 2 Condition 7(a) of Project Approval 09_0062 MOD 1, which restricts Mt Arthur Coal's coal transport on the Antiene rail spur to a maximum of 27 million tonnes of product coal in a financial year;
- The total number of train movements was 3,158; and
- The maximum number of train movements in a single day was 20. This is compliant with Schedule 2 Condition 7(b) of Project Approval 09_0062 MOD 1, which restricts Mt Arthur Coal's coal transport on the Antiene rail spur to a maximum of 30 train movements a day.

Note: Each train entering and exiting the site is classified as two train movements and a day refers to the 24 hours from midnight to midnight the next day.

Table 40. Daily train movements FY22

Date	No. of train movements
1/07/2021	12
2/07/2021	14
3/07/2021	8
4/07/2021	12
5/07/2021	6
6/07/2021	8
7/07/2021	2
8/07/2021	4
9/07/2021	0
10/07/2021	8
11/07/2021	6
12/07/2021	4
13/07/2021	10
14/07/2021	16
15/07/2021	10
16/07/2021	16
17/07/2021	6
18/07/2021	16
19/07/2021	8
20/07/2021	10
21/07/2021	4
22/07/2021	8
23/07/2021	10
24/07/2021	10
25/07/2021	16
26/07/2021	12
27/07/2021	14
28/07/2021	10
29/07/2021	8
30/07/2021	8
31/07/2021	8
1/08/2021	10
2/08/2021	4
3/08/2021	10
4/08/2021	2
5/08/2021	8
6/08/2021	8
7/08/2021	8
8/08/2021	4
9/08/2021	4
10/08/2021	4
11/08/2021	0
12/08/2021	0
13/08/2021	4
14/08/2021	14
15/08/2021	14
16/08/2021	14
17/08/2021	8
18/08/2021	12
19/08/2021	12
20/08/2021	6
21/08/2021	12
22/08/2021	14

Date	No. of train movements
23/08/2021	14
24/08/2021	14
25/08/2021	10
26/08/2021	12
27/08/2021	18
28/08/2021	8
29/08/2021	18
30/08/2021	12
31/08/2021	4
1/09/2021	8
2/09/2021	16
3/09/2021	10
4/09/2021	10
5/09/2021	10
6/09/2021	4
7/09/2021	12
8/09/2021	6
9/09/2021	8
10/09/2021	10
11/09/2021	12
12/09/2021	12
13/09/2021	12
14/09/2021	4
15/09/2021	0
16/09/2021	0
17/09/2021	10
18/09/2021	14

Date	No. of train movements
19/09/2021	18
20/09/2021	10
21/09/2021	10
22/09/2021	10
23/09/2021	14
24/09/2021	4
25/09/2021	6
26/09/2021	8
27/09/2021	14
28/09/2021	14
29/09/2021	10
30/09/2021	8
1/10/2021	4
2/10/2021	14
3/10/2021	12
4/10/2021	2
5/10/2021	0
6/10/2021	0
7/10/2021	6
8/10/2021	8
9/10/2021	12
10/10/2021	4
11/10/2021	10
12/10/2021	6
13/10/2021	10
14/10/2021	8
15/10/2021	12

Date	No. of train movements
16/10/2021	12
17/10/2021	14
18/10/2021	8
19/10/2021	10
20/10/2021	12
21/10/2021	16
22/10/2021	10
23/10/2021	8
24/10/2021	10
25/10/2021	0
26/10/2021	0
27/10/2021	2
28/10/2021	6
29/10/2021	8
30/10/2021	2
31/10/2021	8
1/11/2021	8
2/11/2021	12
3/11/2021	12
4/11/2021	14
5/11/2021	10
6/11/2021	14
7/11/2021	8
8/11/2021	10
9/11/2021	10
10/11/2021	10
11/11/2021	2

Date	No. of train movements
12/11/2021	4
13/11/2021	12
14/11/2021	12
15/11/2021	8
16/11/2021	8
17/11/2021	10
18/11/2021	12
19/11/2021	6
20/11/2021	10
21/11/2021	6
22/11/2021	2
23/11/2021	0
24/11/2021	0
25/11/2021	0
26/11/2021	10
27/11/2021	8
28/11/2021	4
29/11/2021	6
30/11/2021	14
1/12/2021	8
2/12/2021	14
3/12/2021	12
4/12/2021	14
5/12/2021	12
6/12/2021	10
7/12/2021	14
8/12/2021	10

Date	No. of train movements
9/12/2021	10
10/12/2021	12
11/12/2021	10
12/12/2021	20
13/12/2021	14
14/12/2021	16
15/12/2021	8
16/12/2021	0
17/12/2021	4
18/12/2021	8
19/12/2021	4
20/12/2021	2
21/12/2021	10
22/12/2021	4
23/12/2021	6
24/12/2021	8
25/12/2021	12
26/12/2021	6
27/12/2021	14
28/12/2021	8
29/12/2021	4
30/12/2021	6
31/12/2021	8
1/01/2022	0
2/01/2022	0
3/01/2022	0
4/01/2022	6

Date	No. of train movements
5/01/2022	12
6/01/2022	14
7/01/2022	12
8/01/2022	12
9/01/2022	12
10/01/2022	12
11/01/2022	18
12/01/2022	12
13/01/2022	0
14/01/2022	4
15/01/2022	8
16/01/2022	4
17/01/2022	2
18/01/2022	10
19/01/2022	4
20/01/2022	6
21/01/2022	8
22/01/2022	12
23/01/2022	6
24/01/2022	14
25/01/2022	8
26/01/2022	4
27/01/2022	6
28/01/2022	8
29/01/2022	12
30/01/2022	14
31/01/2022	12

Date	No. of train movements
1/02/2022	10
2/02/2022	12
3/02/2022	8
4/02/2022	10
5/02/2022	10
6/02/2022	10
7/02/2022	4
8/02/2022	4
9/02/2022	0
10/02/2022	0
11/02/2022	2
12/02/2022	8
13/02/2022	12
14/02/2022	10
15/02/2022	8
16/02/2022	8
17/02/2022	10
18/02/2022	10
19/02/2022	12
20/02/2022	16
21/02/2022	14
22/02/2022	10
23/02/2022	14
24/02/2022	0
25/02/2022	12
26/02/2022	8
27/02/2022	0

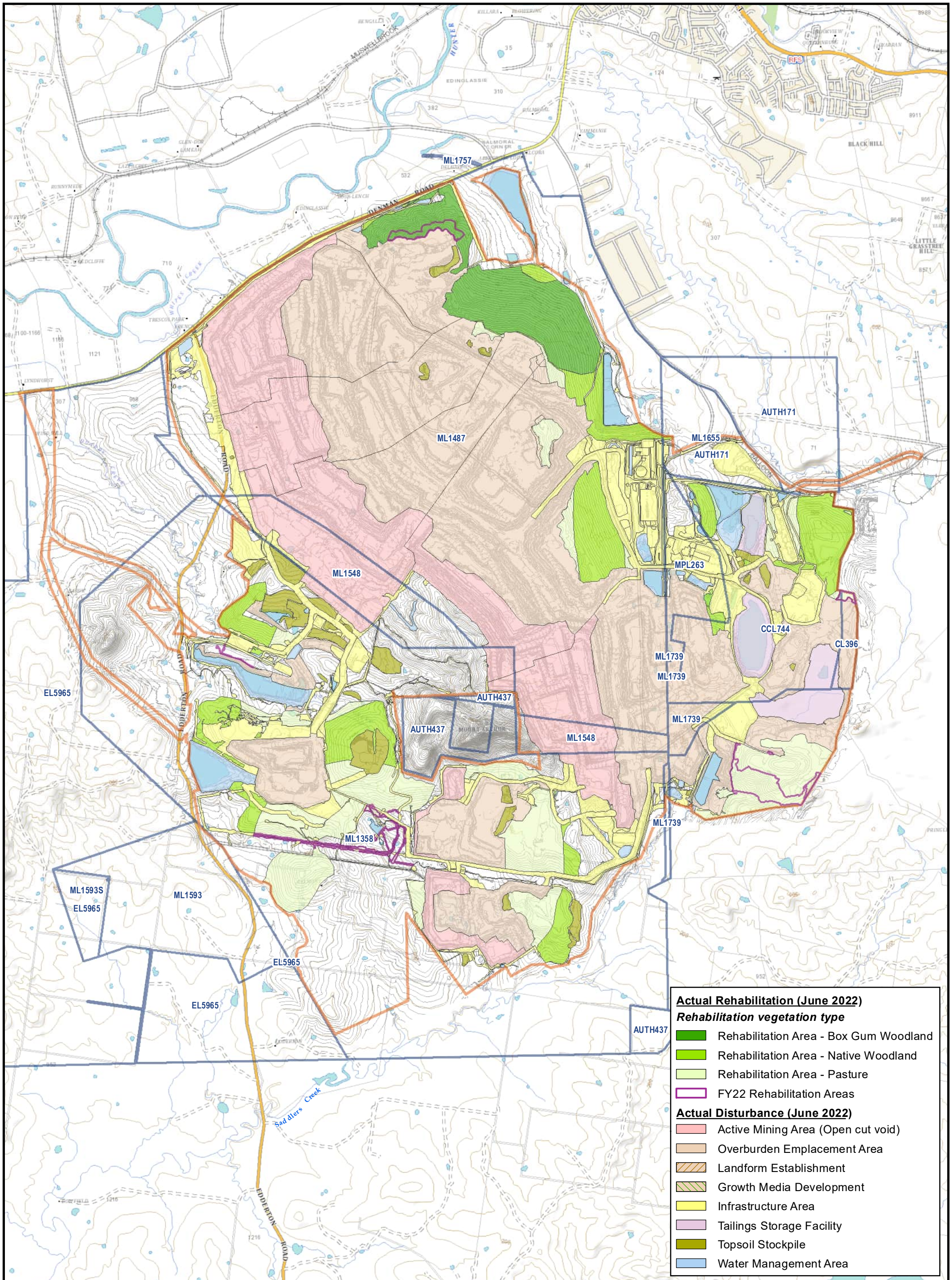
Date	No. of train movements
28/02/2022	0
1/03/2022	0
2/03/2022	6
3/03/2022	6
4/03/2022	6
5/03/2022	8
6/03/2022	12
7/03/2022	8
8/03/2022	2
9/03/2022	0
10/03/2022	0
11/03/2022	0
12/03/2022	0
13/03/2022	0
14/03/2022	4
15/03/2022	8
16/03/2022	4
17/03/2022	8
18/03/2022	8
19/03/2022	4
20/03/2022	4
21/03/2022	4
22/03/2022	0
23/03/2022	0
24/03/2022	0
25/03/2022	4
26/03/2022	8

Date	No. of train movements
27/03/2022	4
28/03/2022	2
29/03/2022	2
30/03/2022	2
31/03/2022	6
1/04/2022	2
2/04/2022	8
3/04/2022	6
4/04/2022	2
5/04/2022	0
6/04/2022	0
7/04/2022	4
8/04/2022	4
9/04/2022	10
10/04/2022	10
11/04/2022	6
12/04/2022	6
13/04/2022	6
14/04/2022	14
15/04/2022	12
16/04/2022	16
17/04/2022	8
18/04/2022	12
19/04/2022	10
20/04/2022	8
21/04/2022	12
22/04/2022	6

Date	No. of train movements
23/04/2022	10
24/04/2022	10
25/04/2022	4
26/04/2022	4
27/04/2022	4
28/04/2022	8
29/04/2022	6
30/04/2022	8
1/05/2022	10
2/05/2022	14
3/05/2022	10
4/05/2022	14
5/05/2022	14
6/05/2022	14
7/05/2022	10
8/05/2022	14
9/05/2022	18
10/05/2022	16
11/05/2022	14
12/05/2022	12
13/05/2022	16
14/05/2022	8
15/05/2022	8
16/05/2022	12
17/05/2022	14
18/05/2022	8
19/05/2022	6

Date	No. of train movements
20/05/2022	8
21/05/2022	12
22/05/2022	10
23/05/2022	8
24/05/2022	4
25/05/2022	0
26/05/2022	0
27/05/2022	8
28/05/2022	4
29/05/2022	12
30/05/2022	10
31/05/2022	14
1/06/2022	12
2/06/2022	6
3/06/2022	0
4/06/2022	14
5/06/2022	10
6/06/2022	16
7/06/2022	14
8/06/2022	14
9/06/2022	12
10/06/2022	12
11/06/2022	14
12/06/2022	12
13/06/2022	10
14/06/2022	14
15/06/2022	16
16/06/2022	14
17/06/2022	14
18/06/2022	16
19/06/2022	12
20/06/2022	10
21/06/2022	12
22/06/2022	18
23/06/2022	16
24/06/2022	14
25/06/2022	16
26/06/2022	16
27/06/2022	16
28/06/2022	10
29/06/2022	12
30/06/2022	2
Total	**3158**
Maximum daily train movements	**20**

Appendix 5 Rehabilitation Plan & and Monitoring Results



BHP

Mapping Services Brisbane

0 500 1,000 1,500 2,000 m

Transverse Mercator Projection.
MGA Zone 56. GDA2020 Datum.

MOUNT ARTHUR COAL

Annual Review - Rehabilitation Plan

Drawn: B. Kleinschmidt	Checked: J. Deacon	Date: 17/08/2022	Revision: 0	Filename: MAC_AR_RehabPlan	Appen. 5

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY22 Response	FY21 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
1. All areas	1.1	Improve and increase monitoring	N/A	N/A	Review the ecological monitoring program (REMP) to align with the preferred rehabilitation objectives and completion criteria derived from the project approvals. Update the REMP to include updated monitoring practices (soil sampling, remote sensing, weed assessments etc.) Scope: 1. Transition to BAM monitoring 2. Add additional monitoring locations 3. Review of Analogue sites 4. Introduce remote sensing (e.g. erosion, vegetation health, tree count) 5. Formalise revegetation inspections 6. Investigate Landform Function monitoring 7. Develop topsoil validation process 8. Update 1SAP strategies 9. Review REMP following Rehabilitation Objective update 10. Formalise weed monitoring in REMP 11. Capture all monitoring programs in a 1SAP strategy (IEMA FY21 Rehab Risk Assessment Update Action Plan, 2021)	Reviewed the project approval history to ensure all target ecological communities are targeted during mine rehabilitation. Updated all ecological comunities referenced in current approvals to align with Plant Community Types (PCT) Updated reference sites based on recommendations from FY22 ecological monitoring program to align with the PCTs (see section 8.5 for more details)	BAM monitoring completed in FY20 and carried over to FY21. Additional monitoring sites (MD1 and SDc) completed in FY21. Remote sensing monitoring trialled in FY19-20 for weed assessment was discontinued in FY21 due to limited return on investment. Remote sensing was also used to assess vegetation health, tree count and erosion.	~~**FY22**:~~ ~~1. Analogue site review to commence using Conservation Agreement monitoring sites~~ **FY23** 1. Development standards for resolution of ecological development monitoring focussing on revegetation inspections and ecological development monitoring 2. Development of a formalised materials sampling and validation process	See Section 6.5 Future TARP responses to be reported in Section 8.5 of future Annual reviews	Annual ecological development monitoring, aerial imagery and LiDAR scans	N/A
	1.2	Improvement to Rehabilitation Phase Objectives and Completion Criteria	N/A	1. Major storm event resulting in flooding, geotechnical instability, major erosion and/or widespread damage to rehabilitation areas. 2. Sodicity and/or salinity of spoils/soils leading to accelerated erosion and preventing successful vegetation establishment. 3. Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution. 4. Surface (wind or water) erosion leading to degradation of growth medium and rehabilitation/offset quality.	1. Landform establishment: - topofactor to determine controls to manage erosion risk - Drain design parameters - Frequency of maintenance tracks - Growth medium parameters to manage erosion risk 2. Growth medium development: - Target parameter range of growth medium for each final land use 3. Ecological and Land Use Establishment - Weed infestation triggers - Species list to establish wider variety of Plant Community Types 4. Ecological and Land Use Development - Evidence of trajectory to self sustaining native ecosystems - Evidence of productivity of pasture areas (NSW Resources Regulator rehabilitation reforms)	Landform Establishment Objectives to manage erosion risk have been drafted and work will continue to be refined in FY23 See 1.1 for more details on Review of PCTs listed in the project approval to define achievable species and structure for the establishment of native woodlands.	FY21 saw the submission of updated Rehabilitation Strategy and Rehabilitation Management Plans with updated Completion Criteria and a review of Rehabilitation objectives. A detailed review of Landform Establishment was commenced in FY21 and will continue into FY22	**FY22** 1 . ~~Finalise Landform Establishment Objectives to manage erosion risk~~ 2. Commence review of Growth Medium parameters to manage erosion risk 3. Review of PCTs listed in the project approval to define achievable species and structure for the establishment of native woodlands **FY23** 1. Finalise Growth Medium Development Objectives 2. Finalise Landform Establishment Objectives to manage erosion risk 3. Finalise Ecological and Land Use Establishment Objectives regarding species composition and structure for native woodlands. 4. Review of pasture species lists to assess viability of establishing derived native grasslands and still produce productive pasture **FY24** 1. Review of existing rehabilitation areas against Finalise Ecological and Land Use Establishment Objectives 2. Drafting of Ecological and Land Use Development objectives	As reported in the RMP and Rehabilitation Strategy	As reported in the RMP and Rehabilitation Strategy	N/A
	1.3	QA/QC procedures	As required	Poor systems implementation, leading to inadequate rehabilitation monitoring and maintenance.	Scope: 1. Rehab tracking database 2. Improved Rehab ARP tracking 3. Development of Inspection Test Plans and Stop/Hold points in line with civil construction projects; 4. Utilising weather forecasting in rehab execution; 5. Developing Rehabilitation Phase Objectives; and 6. Update of Rehab TARP based on updated Rehab Objectives 7. Document mine planning process relating to rehab 8. Review BHP rehab Manual and make site specific (IEMA FY21 Rehab Risk Assessment Update Action Plan, 2021)		FY21 focussed on the development of Rehab Objectives and TARP responses relating to the Landform Establishment Phase with a draft report being prepared.	**FY22:** 1. Finalise Landform Establishment TARP and monitoring accordingly in line with Objectives updates 2. Development of Inspection Test Plans and Stop/Hold points in line with civil construction projects **FY23** 1. Draft Ecological and Land Use Establishment TARP 2. Update TARP and monitoring according to updates of any Phase Objectives coimpleted in the FY 3. Document mine planning process relating to rehab 4. Review of available weather foerceasting tools and models to assess aplicability	TARP responses provided in future Annual Reviews in Section 8.5	Updated management plans and procedures	As required

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY22 Response	FY21 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
	1.4	Materials Handling, Selection, Characterisation and Development	Materials sampling based on rehab project	1. Poor quality/ insufficient topsoil impeding vegetation establishment for ecological communities or grazing. 2. Sodicity and/or salinity of spoils/soils leading to accelerated erosion and preventing successful vegetation establishment. 3. Surface (wind or water) erosion leading to degradation of growth medium and rehabilitation/offset quality.	1. Sample rehabilitation materials. 2. Create a Topsoil Management Plan 3. Create a Topsoil database 4. Investigate Materials tracking and improve selective handling practices (carbonaceous materials, potentially acid forming, CAT1 and sub CAT1 material) (IEMA FY21 Rehab Risk Assessment Update Action Plan, 2021)	An updated topsoil balance and topsoil management plan was completed in FY22: 1. Topsoil database has been captured in a GIS layer 2. Review topsoil stripping depths provided in EIS 3. Initial trials into establishing rehab on waste rock were carried out Field work to review stripping depths and update topsoil balance was delayed due to ongoing impacts of covid.	FY21 all materials used in rehabilitation were analysed to determined appropriate amelioration. Topsoil management plan details sampling requirements was submitted with the FY21 update to the RMP. Topsoil stockpile database has been developed and included in the Topsoil Management Plan Action captured from the FY21 review of the rehabilitation risk assessment. Highest priority is: 1. Capture all carbonaceous potentially acid forming materials in site procedures for materials handling 2. Determine appropriate materials for rehab surfaces	**FY22** 1. Capture topsoil database in a GIS layer 2. Complete review of site documents to capture all hazardous (carbonaceous and PAF) material handling requirements 2. Review topsoil stripping depths provided in EIS 3. Initial trials into establishing rehab on waste rock 4. ~~Field work to review stripping depths and update topsoil balance~~ **FY23** 1. Complete review of site documents to capture all hazardous (carbonaceous and PAF) material handling requirements 2. Complete desktop review of rehab surface materials to better understand parameters, qualities and balance ~~4. Scoping of research trials into the viability of recreating topsoil profiles at analogue sites~~ 3. Field work to review stripping depths and update topsoil balance **FY24** 1. Field work to assess soil parameters at analogue sites 2. Continue trials into using waste rock as growth medium 3. Scoping of research trials into the viability of recreating topsoil profiles at analogue sites	Soil sampling results	Ongoing sampling of stockpiles and directly placed topsoil. Materials sampling based on rehab project	As required
	1.5	Pest animal control	All	Inadequate vertebrate pest animal control leading to predation of juvenile vegetation and poor biodiversity (habitat) outcomes.	The following key activities have been undertaken as part of the rabbit management program: 1. Rabbit baiting using Pindone poison was conducted across site; 2. Wild dog baiting; and 3. Opportunistic shooting of pest species was conducted as part of the kangaroo harvesting program. 4. Kangaroo Harvesting Program (Cumberland, FY21 Ecological Development Monitoring)		Operational changes limited the animal control carried out in FY21. Dog baiting and 2 night shoots were carried out in FY21. FY21 on site kangaroo management was suspended due to safety concerns that resulted from operational changes.	On going	See Section 6.5	Annual ecological development monitoring. Recording of animals taken and as part of the annual ecological development monitoring and observations during RAW.	Annual
	1.6	Replace hand sowing	N/A	N/A	Work to date has included: 1. Trialling of UAV seeding; 2. Aerial seeding from a plane; and 3. Tractor seed spreading (Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018)		FY21 seed spreading was completed using	Complete	See Section 8	Annual revegetation inspections and Rapid Assessment Walkover (RAW).	N/A
	1.7	Weed treatment	All	Inadequate weed control, leading to extreme weed competition preventing establishment of desired species.	1. Weed control of any Priority Weeds listed under the Biosecurity Act 2015 as well as HTE weeds. 2. General weed species should be managed. 3. Spot-spraying (or other suitable control methods) followed by follow-up monitoring and additional control if required. (Cumberland, FY21 Ecological Development Monitoring)	FY22 weed treatment focused on priority weeds	FY21 weed treatment focused on priority weeds and exotic perennial grasses	On going	See Section 6.5 and Appendix 6.	Annual ecological development monitoring and annual weed assessment.	Annually
	~~1.8~~	~~Mulching~~	~~As required~~	~~1. Major storm event resulting in flooding, geotechnical instability, major erosion and/or widespread damage to rehabilitation areas.~~ ~~2. Sodicity and/or salinity of spoils/soils leading to accelerated erosion and preventing successful vegetation establishment.~~ ~~3. Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.~~ ~~4. Surface (wind or water) erosion leading to degradation of growth medium and rehabilitation/offset quality.~~	~~Consider closing the window of erosion risk on new rehabilitation~~ ~~(Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018)~~	See 1.2 above. Action will be removed	~~FY21 maintenance scope of VD5 imported~~	~~**FY22:**~~ ~~Develop design triggers to allow for targeted use of temporary stabilisation~~	~~To be provided in future Annual Reviews in Section 8.5~~	~~RAW and Revegetation Inspections~~	~~Annually~~

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY22 Response	FY21 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
2. VD1	1.8	Contour drain removal	As required	Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.	1. Removal of contour banks to recover topsoil 2. Construction of dendritic drainage (Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018)	See 2.1 for more detail	Initial design work has been completed for VD1. Follow up design work will be completed to allow for greater retention of high value areas and staging of works to individual project areas. Additional works involving Landscape Evolution Modelling are required before large scale works are entered into.	**FY22:** ~~Trial area to be completed on a section of VD1 "Native grasslands with emergent Box - Gum canopy and mid-storey"~~ **FY23**: Engage contractor and commence work	Follow up materials sampling, RAW, revegetation inspections, Ecological Development Modelling	To be confirmed	N/A
	2.1	Contour drain removal	As required	1. Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution. 2. Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.	1. Removal of contour banks to recover topsoil 2. Construction of dendritic drainage 3. Stem density reduction where required 4. Treatment of exotic grasses – slashing and spraying of exotic grass. Scalping and removal of contour drains 5. Diversify ground and mid-storey (Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018) (Future Harvest Ecological Development Strategy, 2019)	FY22 design work was continued following the identification of impact to surrounding water management structures and staging issues. Work has been included in a larger project and has been handed to the Projects Engineering team for commencement in FY23. This scope has also been expanded to include revegatation work to reduce exotic grasses and increase diversity in midstory and groundcover.	Initial design work has been completed for VD1. Follow up design work will be completed to allow for greater retention of high value areas and staging of works to individual project areas. Additional works involving Landscape Evolution Modelling are required before large scale works are entered into.	**FY22:** ~~Trial area to be completed on a section of VD1 "Native grasslands with emergent Box - Gum canopy and mid-storey"~~ **FY23**: Engage contractor and commence work	Follow up materials sampling, RAW, revegetation inspections, Ecological Development Modelling	To be confirmed	N/A
	2.2	Installation of habitat features such as stag trees	To be determined	Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.	1. Stockpile habitat trees 2. Stockpile nest boxes 3. Develop alternative nest box installation process (Cumberland, FY21 Ecological Development Monitoring)	Habitat trees and structures stockpiles have increased in FY22. A stockpile of powerpoles was also established to create alternaitves for habbitat to hang nest boxes on.	FY21 significantly increased the supply of habitat trees and the re-stocking of nest boxes. FY21 also sourced discarded power poles from power line realignment on site. These will be used to hang nest boxes allowing the habitat trees to be used for fallen logs. Moving forward this action will be part of individual rehab projects.	**FY23**: Define Rehab Objectives for amount/frequency of habitat structures	To be provided in future Annual Reviews in Section 8.5	Annual ecological development monitoring	Annually
	~~Weed treatment trials~~	~~To be determined~~	~~Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.~~	~~Area 1 scope includes: 1. Slashing 2. Rip contours 3. Spray emergent weeds early Spring 4. Re-seed 5. Spot treatment for weeds Area 2 scope includes: 1. Secure area and conduct burn in early Spring 2019 2. Rip contours 3. Spray emergent weeds early Spring 4. Re-seed 5. Spot treatment for weeds (Autumn 2020) 6. Tube stock planting (Future Harvest Ecological Development Strategy, 2019)~~	Recent revegetation planning work has determined that burning will not aid ecological development. Addtionallly, revegatation work will be included in the contour bank removal work (see 2.1). This action will be removed	~~Work completed in FY21 was trialling controlled burns on rehab areas to determine the safety requirements for larger scale execution. These areas are considered lower value, prioritise emergent box gum woodland areas.~~	~~**FY23:** Conduct trial burn in winter to allow greater curing of exotic grasses. **FY24**: Commence broader weed treatment trials~~	~~Section 8.5 of Annual Review~~	~~Annual ecological development monitoring, RAW and Revegetation Inspections~~	~~Annually~~
	~~Spotted Gum / Box forest~~	~~VB2~~	~~1. Inadequate weed control, leading to extreme weed competition preventing establishment of desired species. 2. Continued dominance of exotic tropical grass species, preventing successful establishment of native grass groundcover. 3. Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value. 4. Insufficient, poor quality or incorrect species seed/seedlings leading to poor vegetation establishment.~~	~~Future Harvest scope: 1. Stem density reduction 2. Treatment of exotic grasses – slashing and spraying of exotic grass. Scalping and removal of contour drains 3. Tube stock planting (Cumberland, Ecological Monitoring Program FY19, 2019) (Future Harvest Ecological Development Strategy, 2019)~~	Routine weed treatment continued on VD1 in FY22. Revegatation work will be included in the contour bank removal work (see 2.1). This action will be removed	~~FY21 works will include continued spot weed treatment.~~	~~**FY22**: Routine weed treatment to continue in FY22 as resources allow **FY23**: Finalise design work for water management to remove contour drains and irrigation. **FY24**: Commence contour drain removal, tube stock planting~~	~~To be provided in future Annual Reviews in Section 8.5~~	~~Annual ecological development monitoring, RAW and Revegetation Inspections~~	~~Annually~~
	~~Exotic and depleted grasslands~~	~~To be determined~~	~~1. Inadequate weed control, leading to extreme weed competition preventing establishment of desired species. 2. Continued dominance of exotic tropical grass species, preventing successful establishment of native grass groundcover.~~	~~Future Harvest scope: 1. Segmenting areas into projects of between 5 to 10 ha. 2. Project areas will be slashed, ripped and sprayed to reduce exotic grasses 3.Appropriate ameliorants will be applied with temporary surface stabilisation of a composted mulch being applied 4. Box Gum woodland species mix will be seeded in the areas 5. Follow up spot weed treatment 6. Tube stock planting as required (Future Harvest Ecological Development Strategy, 2019)~~	Routine weed treatment continued on VD1 in FY22. Revegatation work will be included in the contour bank removal work (see 2.1). This action will be removed	~~FY20 focused on drought impacted rehab on VD4 and VD5. The depleted grass lands deprioritised due as it was determined that spraying and seeding were not deemed effective. This limited work due to equipment availability.~~	~~**FY24**: Finalise design work for water management to remove contour drains and irrigation. **FY25**: Commence contour drain removal, tube stock planting~~	~~To be provided in future Annual Reviews in Section 8.5~~	~~Annual ecological development monitoring, RAW and Revegetation Inspections~~	~~Annually~~

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY22 Response	FY21 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
		Native grasslands with emergent Box – Gum canopy and mid-storey	1. VB3 2. FY21 Revegetation monitoring site 1	1. Inadequate weed control, leading to extreme weed competition preventing establishment of desired species. 2. Continued dominance of exotic tropical grass species, preventing successful establishment of native grass groundcover. 3. Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value. 4. Insufficient, poor quality or incorrect species seed/seedlings leading to poor vegetation establishment. 5. Inadequate vertebrate pest animal control leading to predation of juvenile vegetation and poor biodiversity (habitat) outcomes.	1. Treatment of perennial weeds (Future Harvest Ecological Development Strategy, 2019) 3. (Cumberland, FY21 Ecological Development Monitoring) Scope updated to be included: 4. Contour drain removal and scalping of exotic perennial grasses 5. Ground cover seeding and tube stock planting	Routine weed treatment continued on VD1 in FY22. Revegatation work will be included in the contour bank removal work (see 2.1). This action will be removed	FY20 focused on drought impacted rehab on VD4 and VD5. It was determined that treatment of exotic perennial grasses via spraying and seeding were not deemed effective and that scalping to reduce the weed seed bank was required. This limited work due to equipment availability.	**FY22**: 1. Design of drainage control works 2. Design irrigation 3. Weed treatment 4. Order tube stock for FY23 planting **FY23** 1. Construction of water management 2. Contour drain removal and scalping of high perennial grassed areas 3. Groundcover diversity seeding 4. Construction of irrigation lines and tanks Area of maintenance to be determined based on equipment availability.	To be provided in future Annual Reviews in Section 8.5	Annual ecological development monitoring, RAW and Revegetation Inspections	Annually
		Emergent Box – Gum woodland	FY21 Revegetation monitoring site 4 - 8	1. Inadequate weed control, leading to extreme weed competition preventing establishment of desired species. 2. Continued dominance of exotic tropical grass species, preventing successful establishment of native grass groundcover. 3. Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value. 4. Insufficient, poor quality or incorrect species seed/seedlings leading to poor vegetation establishment.	Future Harvest scope: 1. Targeted weed treatment program commenced in the reporting period 2. Monitor for need for stem thinning 3. Consider cool burns 4. Water availability (Future Harvest Ecological Development Strategy, 2019) (Cumberland, Ecological Monitoring Program FY21, 2021)	Routine weed treatment continued on VD1 in FY22. Revegatation work will be included in the contour bank removal work (see 2.1). This action will be removed	FY20 focused on drought impacted rehab on VD4 and VD5. It was determined that treatment of exotic perennial grasses via spraying and seeding were not deemed effective and that scalping to reduce the weed seed bank was required. This limited work due to equipment availability.	**FY22**: 1. Design of drainage control works 2. Design irrigation 3. Weed treatment 4. Order tube stock for FY23 planting **FY23** 1. Construction of water management 2. Contour drain removal and scalping of high perennial grassed areas 3. Groundcover diversity seeding 4. Construction of irrigation lines and tanks Area of maintenance to be determined based on equipment availability.	Spot weed treatment results presented in section 6.5. Revegetation Inspections completed in FY20. To be provided in future Annual Reviews in Section 8.5	Annual ecological development monitoring, RAW and Revegetation Inspections	Annually
		Mixed eucalypt forest with exotic canopy and mid storey	To be determined	1. Inadequate weed control, leading to extreme weed competition preventing establishment of desired species. 2. Continued dominance of exotic tropical grass species, preventing successful establishment of native grass groundcover. 3. Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value. 4. Insufficient, poor quality or incorrect species seed/seedlings leading to poor vegetation establishment.	Future Harvest scope 1. Targeted stem thinning of inappropriate species 2. Monitor for need for stem thinning 3. Consider cool burns 4. Water availability (Future Harvest Ecological Development Strategy, 2019)	Routine weed treatment continued on VD1 in FY22. Revegatation work will be included in the contour bank removal work (see 2.1). This action will be removed	FY20 focused on drought impacted rehab on VD4 and VD5. It was determined that treatment of exotic perennial grasses via spraying and seeding were not deemed effective and that scalping to reduce the weed seed bank was required. This limited work due to equipment availability.	**FY23**: 1. Design of drainage control works 2. Design irrigation 3. Weed treatment 4. Order tube stock for FY24 planting **FY24** 1. Construction of water management 2. Contour drain removal and scalping of high perennial grassed areas 3. Groundcover diversity seeding 4. Construction of irrigation lines and tanks Area of maintenance to be determined based on equipment availability.	Spot weed treatment results presented in section 6.5. To be provided in future Annual Reviews in Section 8.5	Annual ecological development monitoring, RAW and Revegetation Inspections	Annually
3. VD4 and VD5	3.1	Construct additional rock lined drains	To be determined	1. Major storm event resulting in flooding, geotechnical instability, major erosion and/or widespread damage to rehabilitation areas. 2. Sodicity and/or salinity of spoils/soils leading to accelerated erosion and preventing successful vegetation establishment. 3. Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.	Settling of the constructed landform has resulted in concentration of flow to unarmoured drainage lines. (RAW inspections)	Works delayed due to covid impacts and rescheduled to align with the contour bank removal project (see 2.1)	Erosion monitoring and RAW inspections identified significant erosion on VD5 south area following initial repair works had been completed. Design work was commissioned to assess the likely hood of these gullies worsening and it was determined that rock armouring is required	FY22 FY23: Complete construction of 2 new rock armoured drains FY23		RAW and Revegetation Inspections	Annually

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY22 Response	FY21 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
4. CD1	4.1	Application of ameliorants	1. CD1 2. FY21 Revegetation monitoring site 12-16	Sodicity and/or salinity of spoils/soils leading to accelerated erosion and preventing successful vegetation establishment.	Application of fertiliser and gypsum. (Highlands Environmental, Focussed Annual Rapid Assessment of Rehabilitation Mount Arthur Mine, 2019)	VD1, VD4 and VD5 works are priorities.	VD1, VD4 and VD5 works are priorities.	Subject to works on VD1-5 **FY2526**: 1. Design of drainage control works 2. Design irrigation 3. Weed treatment 4. Order tube stock for FY24 planting **FY2627**: 1. Construction of water management 2. Contour drain removal and scalping of high perennial grassed areas 3. Groundcover diversity seeding 4. Construction of irrigation lines and tanks 5. Tube stock planting Area of maintenance to be determined based on equipment availability.	N/A	RAW and Revegetation Inspections	Annually
	4.2	Stem density reduction	1. CD1 2. FY21 Revegetation monitoring site 12-16	Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.	N/A	VD1, VD4 and VD5 works are priorities.	VD1, VD4 and VD5 works are priorities.		N/A	Annual ecological development monitoring.	Annually
	4.3	Habitat and water availability	1. CD1 2. FY21 Revegetation monitoring site 12-16	Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.	Increase habitat availability (Cumberland, Ecological Monitoring Program FY19, 2019)	VD1, VD4 and VD5 works are priorities.	VD1, VD4 and VD5 works are priorities.		N/A	N/A	
	4.4	Understory planting	1. CD1 2. FY21 Revegetation monitoring sites 12-16	Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.	Species to include Notelaea microcarpa var. microcarpa (Native Olive), Bursaria spinosa (Blackthorn), Acacia falcata (Hickory Wattle) and Acacia paradoxa (Kangaroo Thorn). Note that tube stock planting in recent years has had a low success rate due to drought and predation. (Cumberland, Ecological Monitoring Program FY19, 2019) (Cumberland, Ecological Monitoring Program FY21, 2021)	VD1, VD4 and VD5 works are priorities.	VD1, VD4 and VD5 works are priorities.		N/A	Annual ecological development monitoring and Revegetation Inspections.	Annually
	4.5	Contour drain removal and erosion repair	As required	1. Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution. 2. Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.	1. Removal of contour banks to recover topsoil 2. Construction of dendritic drainage 3. Stem density reduction where required 4. Treatment of exotic grasses – slashing and spraying of exotic grass. Scalping and removal of contour drains 5. Diversify ground and mid-storey (Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018) (Future Harvest Ecological Development Strategy, 2019)	Works will be designed and scheduled following landform redesign and VD1 contour bank removal. Temporary stabilisation adjacent to drop structure to be scheduled for FY23 if practicable with work schedule.	N/A	FY23: 1. Temporary patch up of failed conoutrs FY25 1. Complete design work on removal of contour banks	Follow up materials sampling, RAW, revegetation inspections, Ecological Development Modelling	To be confirmed	N/A
5. EME Pad	5.1	Rip, seed and fertilise FY17 rehabilitation	To be determined	Inadequate weed control, leading to extreme weed competition preventing establishment of desired species.	Rip, seed and fertilise FY17 rehabilitation (Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018)	Area rehabbed as part of the FY21 target	Area rehabbed as part of the FY21 target	FY21	To be provided in future Annual Reviews in Section 8.5	Annual ecological development monitoring and Revegetation Inspections.	Annually
6. Macdonalds and Belmont area	6.1	Fill erosion gullies at MacDonald's to the landform design surface	N/A	1. Sodicity and/or salinity of spoils/soils leading to accelerated erosion and preventing successful vegetation establishment. 2. Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.	Fill erosion gullies at MacDonald's to the landform design surface (Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018)	VD1, VD4 and VD5 works are priorities.	VD1, VD4 and VD5 works are priorities.	N/A	N/A	N/A	N/A
	6.2	Remove contour drains	N/A	1. Sodicity and/or salinity of spoils/soils leading to accelerated erosion and preventing successful vegetation establishment. 2. Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.	Remove contour drains (Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018)	VD1, VD4 and VD5 works are priorities.	VD1, VD4 and VD5 works are priorities.	N/A	N/A	N/A	N/A

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY22 Response	FY21 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
7. Dump 11 (Export)	7.1	Revegetation Works	1. Dump 11 2. FY21 Revegetation monitoring site 17	1. Continued dominance of exotic tropical grass species, preventing successful establishment of native grass groundcover. 2. Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.	1. Weed control of perennial grasses 2. Supplementary planting 3. Increased habitat (nest boxes and stag trees) (Cumberland, Ecological Monitoring Program FY20, 2020) (Cumberland, Ecological Monitoring Program FY21, 2021)	VD1, VD4 and VD5 works are priorities.	VD1, VD4 and VD5 works are priorities.	**FY26**: 1. Design of drainage control works 2. Design irrigation 3. Treatment of priority weeds 4. Order of tube stock **FY27**: 1. Construction of water management 2. Contour drain removal and scalping of high perennial grassed areas 3. Groundcover diversity seeding 4. Construction of irrigation lines and tanks 5. Tube stock planting Area of maintenance to be determined based on equipment availability.	To be provided in future Annual Reviews in Section 8.5	Annual ecological development monitoring and RAW and Revegetation Inspections.	Annually
8.Drayton Void	8.1	Weed treatment	Drayton North	Inadequate weed control, leading to extreme weed competition preventing establishment of desired species.	1. Broadleaf weed control early spring & early autumn 2 .Broadleaf weed control early spring (SLR, Mt Arthur Coal Ground Pasture Assessment, 2020)	VD1, VD4 and VD5 works are priorities. Topsoil stockpile maintenance	VD1, VD4 and VD5 works are priorities. Topsoil stockpile maintenance	**FY23**: Broadleaf weed treatment	To be provided in future Annual Reviews in Section 8.5	GPA, RAW and Revegetation Inspections.	Annually
	8.2			1. Sodicity and/or salinity of spoils/soils leading to accelerated erosion and preventing successful vegetation establishment. 2. Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.	Re-rip FY22 rehab and install water diversion	Include re-rip and additioanl water management infrastructure to allow for water diversion away from site stirage	N/A	**FY23**: 1. Re-rip FY22 rehab and add additional ameliorants where appropriate	To be provided in future Annual Reviews in Section 8.5	GPA, RAW and Revegetation Inspections.	Annually
9. Saddlers Central (SDc)	9.1	Initial monitoring	1. SDc 2. FY21 Revegetation monitoring sites 9 - 11	Poor systems implementation, leading to inadequate rehabilitation monitoring and maintenance.	N/A	VD1, VD4 and VD5 works are priorities. Topsoil stockpile maintenance	VD1, VD4 and VD5 works are priorities. Topsoil stockpile maintenance	N/A	N/A	Annual ecological development monitoring and RAW and Revegetation Inspections.	Annually
	9.2	Weed treatment	1. SDc 2. FY21 Revegetation monitoring sites 9 - 11	Inadequate weed control, leading to extreme weed competition preventing establishment of desired species.	Weed treatment (Cumberland, Ecological Monitoring Program FY21, 2021)	CD2 access is blocked due to dumping in the areaVD1, VD4 and VD5 works are priorities.	CD2 access is blocked due to dumping in the areaVD1, VD4 and VD5 works are priorities.	**FY23**: 1. Design irrigation 2. Weed treatment 3. Order tube stock for FY24 planting	N/A	Annual ecological development monitoring and RAW and Revegetation Inspections.	Annually
	9.3	Increase diversity	1. SDc 2. FY21 Revegetation monitoring sites 9 - 11	Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.	Characteristic canopy, shrub and groundcover species according to appropriate species lists identified in Tables 11 and 12 of the MOP be planted. Prioritise planting species not currently present within the site to improve species diversity. (Cumberland, Ecological Monitoring Program FY21, 2021)	Planning work commenced in FY20	Planning work commenced in FY21	**FY24**: 1. Diversity seeding 2. Tube stock	N/A	Annual ecological development monitoring and RAW and Revegetation Inspections.	Annually
	9.4	Increase habitat	1. SDc 2. FY21 Revegetation monitoring sites 9 - 11	Poor vegetation development leading to simplified, non-stratified community structure of poor habitat value.	1. Installation of nest boxes. 2. Installation of nest boxes.	Planning work commenced in FY21	Planning work commenced in FY21	**FY24**: Placement of habitat structures	N/A	Annual ecological development monitoring and RAW and Revegetation Inspections.	Annually
10. CD2	10.1	Weed treatment	To be determined	Inadequate weed control, leading to extreme weed competition preventing establishment of desired species.	1. Broadleaf weed control early spring & early autumn 2 .Broadleaf weed control early spring RAW monitoring	Planning work commenced in FY21	Planning work commenced in FY21	Dependent on access **FY23**: Broadleaf weed treatment	N/A	GPA, RAW and Revegetation Inspections.	Annually

Appendix 6 Baiting & Weed Management Reports

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Mt Arthur Dog Control Program FY22 Report

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1 - INTRODUCTION:

The 2022 Wild Dog trapping program has been completed as of 28/5/2022. This report details the methods used, results and subsequent recommendations to ensure further control of wild dog populations at Mt. Arthur Mine. During the month of May soft jaw trapping techniques have been employed to control the wild dog population at Mt Arthur operations. The program was conducted in three main phases: Initial site exploration, monitoring to direct trapping locations and finally active trapping. The trapping program was then followed by a round of dog baiting utilising kangaroo meat treated with sodium fluroacetate 1080. Over the monitoring period game trail cameras were deployed to observe and quantify the population size and the habitat wild dogs utilise at Mt Arthur mine. Following the monitoring period high quality soft jaws traps were deployed into the identified active areas targeting the wild dogs.

Wild dogs (which by definition include all wild-living dogs, such as dingoes, feral dogs and their hybrids) prey on a variety of animals including mammals, birds and reptiles of all sizes from insects to water buffalo. However, they prefer to eat small and medium-sized mammals when available, including native mice, dunnarts, bandicoots and wallabies. Wild dogs have been implicated in the decline of several species, both historically and in the recent past. Wild dogs also have a large impact on the livestock industry in Australia, this costs farmers millions in lost production through killing and injuring livestock. They are also carriers of diseases that can affect humans and domestic animals such hydatids.

The trapping has occurred at Mt Arthur with advice and assistance from the Hunter LLS, Denman and District Wild Dog Association and the DPI. The Feral Scan app has also been utilised which has been developed to build a database of information on wild dog populations and biology. All dogs taken were uploaded into feral scan and samples taken for DNA testing.

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2 – SITE INVESTIGATION

To identify locations that cameras should be installed to commence monitoring the wild dog population input was sought from a variety of parties. The Mt. Arthur Coal Environmental team provided guidance on areas we could expect to find wild dogs ranging. Anecdotal reports were also provided from site personnel such as production 11, the mining engineering manager and operators. Previous reports relating to wild dog control activities were also consulted, chiefly the 2021 Autumn 1080 baiting report to gain insight to where the dogs were likely to be most active. The efficacy of trapping is largely based on trapping proximity to the dogs preferred den as they frequent this area daily. Due to the size of wild dog's home range the entire perimeter is not visited daily so trapping locations closer to the den are preferred rather than parts of their outer range.

Ground truthing of the compiled evidence was then conducted to verify the currency of dog sightings and dog sign such as mauled carcases, faeces and prints. Prints were the main source of evidence occurring on many of the light vehicle roads around the outside of active mining areas. It is widely known that wild dogs will utilise cleared access paths where available. This is thought to be the case as roadways and dry water courses provide dogs with an easier terrain to cross as well as improved visibility when compared to traversing the tall grasses that populate many areas on site.

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3 – MONITORING

The monitoring program was conducted with the use of 7 game trail cameras mounted at various locations identified by the pervious site investigation for dog sign. The cameras were active on Mt Arthur mine site between the 25/3/22 – 12/4/22. Cameras yielding little footage of the target species were repositioned throughout the observation period. There were various challenges finding suitable locations due to the nature of the environment being an active mine site. Fundamental to trap positioning was that proposed locations were accessible in all weather conditions. This was critical to ensure traps could be visited every 24 hour period so any trapped animals could be addressed without undue suffering.

Camera locations:

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Results: There were approximately 11 different Wild Dogs identified during the monitoring program.

CAMERA	25-Mar	26-Mar	27-Mar	28-Mar	29-Mar	30-Mar	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr	7-Apr	8-Apr	9-Apr	10-Apr	11-Apr	12-Apr
1.1																			2X WD
2.1										2X WD				2x WD		2X WD			
3									1X WD										1X WD
4			1X WD																
4.1																			
5																			
5.1									2X WD								1X WD		
6																			
7	4X WD	2X WD	2X WD	2X WD	1X WD	1X WD		2X WD			1X WD	2X WD						2X WD	

WD= WILD DOG

Camera 2.1 – Light vehicle road near base of Mt. Arthur

Observation location selected due to high traffic through area indicated by prints.

Camera 3 – Light vehicle road near base of Mt. Arthur

Observation location selected to cover alternate route out of Mt. Arthur conservation area, also had prints during initial site investigation.

Camera 5.1 – Light vehicle road running through Roxburgh Hill

Observation location selected as the site had prints and was another possible route for wild dogs moving between wooded areas at the base of Mt. Arthur and Roxburgh Hill.

Camera 7 – Light vehicle road VD1

Observation location selected as the site had prints and gave a view to the habits of wild dogs traversing VD1.

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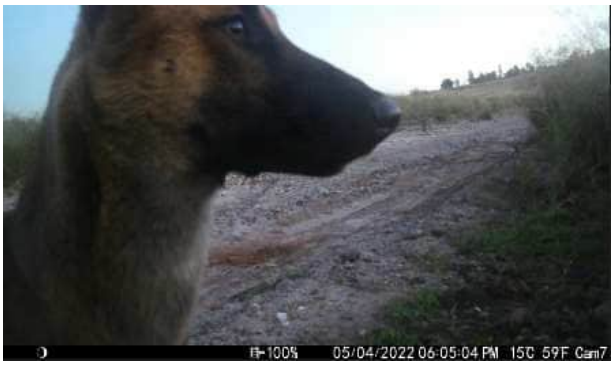

The greatest frequency of wild dog sighting via trail camera took place at camera 7 located on the light vehicle access road southeast of VD1 rehabilitation area. This aligned with multiple reported of sightings wild dogs around the dirty water dam in the lead up to the trapping program. Heavy grass cover over VD1 made further investigation into the specific location of a possible dog den here difficult. Dog sign could only be located around the perimeter of the rehab but the high attendance of wild dogs around this area indicates a den is likely to exist on VD1. Lack of vehicle access through the VD1 area also played a role in the decision to place traps just next to the light vehicle road close to where prints were originally found.

Prior to commencing trapping local police were notified of the intent to conduct a legal firearms activity on site. A Need to Know alert was also created for distribution on site to ensure mine workers were aware of the activity and the controls in place around the trapping locations. See Appendix for Need to Know utilised.

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4: TRAPPING

The 6 trapping locations were selected from the data received in the monitoring period. The traps used were of the rubber jawed variety; these prevent the dog from suffering injuries upon capture. The traps were installed on the 15/5/22 and removed on the 28/5/22. Trail cameras were utilised at 4 of the trapping locations to monitor the dog's activity during this period. There were 15 traps installed across the 6 locations for the duration of the program. To identify the specific location in areas of activity that traps should be placed the trappers scent dog was taken to the sites and observed. The scent dog marked locations with urine that would serve as a lure to wild dogs and traps were placed near these points. In other cases the scent dog highlighted areas of wild dog activity that were not evidenced previously by prints on the soil. Lures were used on multiple traps to guide wild dogs onto the trap's pressure plates. To assist in directing dogs to the pressure plate the use of "trip sticks" was employed. This involves arranging vegetation such as thistles or logs in a way that they limit where a dog has access to place their paws. This can create a bottle neck terminating in an area where the wild dog must step into a trap.

Special consideration was also given to avoid placing traps onto trails formed by native wild life and as such no native bycatch was encountered. Trails were identified as depressed areas of grass leading through the scrub on the edges of light vehicle roads.

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5: RESULTS

Overall, the results of the trapping program were a success with the destruction of 3 dogs in total. The Wild dog's activity had greatly decreased due to the end of breeding season around 2 weeks prior to the trapping commencing. There were multiple near misses which could have produced a higher success rate. Near misses were identified where cameras left at trapping locations witnessed dogs enter trapping locations and fail to engage the trap by a few centimetres. These are also evidenced by paw prints left on either side of the traps pressure plates in a few instances. All wild dogs captured were euthanized in accordance with site policy (Use of Firearms for Humane Destruction MAC-STE-REG-059) and the controls identified in the risk assessment for the activity. There were samples taken from each animal for the DPI to conduct DNA testing and an event for each animal was uploaded into the Feral Scan app.

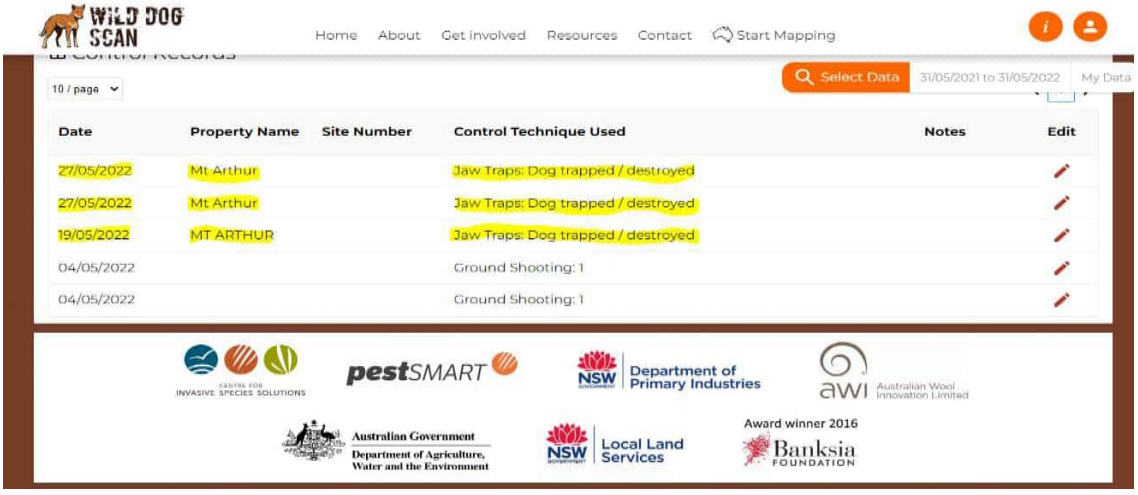
There were 6 different wild dogs identified during the trapping period using trail cameras at the trapping locations. This camera footage showed nearly 50% decrease in wild dog activity from the monitoring phase.

Note: There was 1 Fox captured during trapping, there were no other non-target animals trapped. This is due to the design of the trap and the trap locations selected.

Trap Location	15-May	16-May	17-May	18-May	19-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	27-May	28-May
1														
2					1		1	1	1	1			1	
3												1	1	
4														
5														
6						1	1							

	WILD DOG PRESENT
	WILD DOG CAPTURE
	NEAR MISS

Total animals destroyed		
WILD DOG	FOX	BY-CATCH
3	1	0



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Fox – 17/5/22 Location 6

Wild Dog – 19/5/22 Location 2 VD1

Wild Dog – 27/5/22 Location 2 VD1

Wild Dog – 27/5/22 Location 3 Rox Hill

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Example of Near Miss:

Image shows the trap to be well hidden in highlighted area. Screwdriver for reference pointing to extent of traps jaw.

Dog investigating trapped area.

Dog prints evident either side pressure plate the next morning.

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6: RECOMMEDATIONS

During the entire program there was a significant number of other feral animals observed including: Feral Pigs, Foxs and Feral Cats.

Feral Cats being the standout with approximately 13 different cats observed during the program. The use of cage traps or soft jaw traps would be a useful measure to bring the cat population under control.

In relation to the Wild Dogs that inhabit Mt Arthur:

It is recommended further trapping be undertaken in conjunction with trail cameras capable of 4G cellular communication ideally from September to October. This would remove the need for the trapper to routinely attend site to collect information from the cameras. Remote notification would allow collection of data with minimised disturbance to the wild dogs and less time lost driving around site, which would account for roughly 4 hours travel each time data is collected. This could allow for the dogs roaming habits to be better understood by observing them over a longer time period. When the wild dog activity increases, or a regular pattern has formed with the dogs frequenting an area a more targeted trapping program could be implemented. Having data collected over a longer time span may allow for using less traps at once, but increasing their efficacy.

Having improved longer term monitoring will also contribute information about other pest species on site. The wild dog program captured the cost of initialising pest control on site with Mineco. Costs such as time spent having the trapper's equipment and firearms approved for use on site or obtaining signage will benefit future pest control programs. The result of which is that future pest control programs will be more cost effective.

Examples of other pest species witnessed by monitoring equipment below:

Fox near MacDonald's Fill Point

Cat on Rox hill near conservation area

Wild pig near base of Mt. Arthur

7: CONCLUSION

This is the first contact pest control project Mineco has had with BHP Mt Arthur, learning the Wild Dogs habits and home range is the key to obtaining results. Wild Dogs are extremely smart animals with home ranges and territories than span many kilometres. The information gathered and the knowledge learnt from the past 2 months is invaluable to control the Wild Dogs moving forward.

It was a pleasure to have the opportunity to conduct the Wild Dog Trapping Program. Special thanks is owed to the staff at the SAC office and Production 11 who were extremely helpful in the execution of the program. There were no safety concerns raised or incidents over the course of the program. All relevant risk assessments were adhered to which resulted in a successful and safe program.

The controls implemented for conducting the trapping on site relied heavily on notification to the wider mine community that a trapping activity was occurring. An example of the signage used to designate an actively trapped area is below. This system made the hazard in the area abundantly clear and provided multiple avenues for anyone requiring egress through an area to obtain further information or permission to enter. The effectiveness was verified by cameras monitoring the traps that showed no unannounced entries to the trap locations.

8.1 Dog Baiting

Based on the observations of the dog trapping program locations were selected for distributing baits in the hopes of continuing to reduce the wild dog and fox population. Timing was selected to coincide with the neighbouring properties efforts to control wild dogs with 1080 baits. This is to ensure that dogs who range over large areas would have the opportunity to be exposed to baits at a wider local level.

Baits were placed in strategic positions to reduce the risk of being taken by non-target species such as crows and goannas. The time of year was also ideal for avoiding non-target species interaction particularly with lizards as they are likely to be sluggish with lowered metabolism through colder months. In some cases this involved burying the baits at shallow depth or placing the bait under bark covers and inserting into hollow logs. To minimise bait shyness there was an effort made to avoid disturbing natural surroundings. This contrasted with previous years baiting programs which utilised flagging of baited locations to make recollection easier. This plan was formulated in discussion with the wild dog association, who commented that the dogs may begin to recognise bait markers and shyness will arise. The feral scan app was again utilised to track the usage of baits in line with LLS policy.

Signage was erected prior to commencement of baiting, notifying of the activity dates in accordance with the LLS Vertebrate Pesticide Induction Training. Baits were installed and left for 1 week then removed. Fresh baits were placed in the same places as the initial round of baiting to try and interact with dogs as they moved through their range. The spread of baited locations was though to be appropriate given the areas of the mine permitted the be accessed for the program.

It is unlikely that accurate conclusions can be drawn about the exact number of baits taken by wild dogs. However, we can see that there was a high level of interaction with the baits at a similar rate to previous years. At the midpoint and conclusion of the program the remaining baits were buried to a depth of 500mm in accordance with the LLS guidelines.

Example of baiting sign placed at Entry to CHPP to alert mine workers

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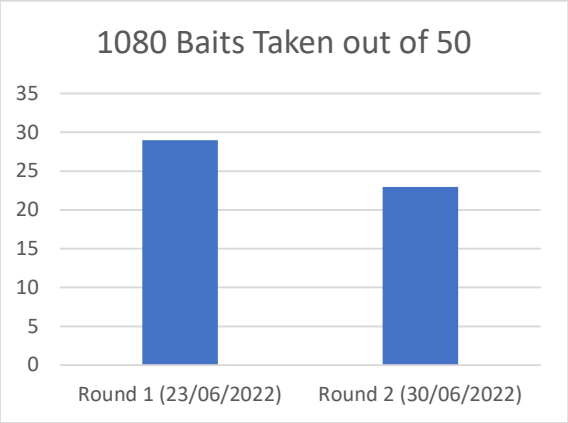
8.2 Results



Graph 1 shows the number of baits removed

Graph 1

Total number of baits removed was 52 out of 100 baits laid over the two week period. The decrease in baits removed suggests a decrease in target animals in the habitat available to remove them. A 52% interaction rate overall would signify a successful program.

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Mt. Arthur 1080 Baiting locations FY22

Distribution of baiting locations, see waypoints listed in appendix for all locations and identifications

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9: REFERENCES

- NSW Department of Primary Industries and NSW EPA Websites
- PestSmart Code of practice for the humane control of wild dogs
- MAC-STE-REG-059 Firearms for Humane Destruction of Pest Species or Injured Animals
- MAC-ENC-PRO-012 - Land Management
- NEC-STE-MTP-028 Firearms Management Plan
- Feralscan app

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10: APPENDIX

Need to know information

Wild Dog trapping commencing at Mt. Arthur

Soft jaw trapping of wild dogs will be commencing at Mt. Arthur Coal mine in non active mining areas. Signage will begin to be emplaced this week to demarcate locations containing traps. Traps will be emplaced after signage is installed from Thursday 12th May 2022. See example below. If you require access past the barricades you must first contact Prod 11 or Mineco Land Management supervisor (2 way # 21571) Trap locations have been selected to minimize worker interruption to frequently used access. Wild Dogs are targeted as part of Mt Arthur Coal's ongoing commitment to controlling feral animals on site. Programs used to control feral animal populations on site, assist Mt Arthur Coal in meeting its regulatory obligations as well as its obligations to the neighbouring community in the Muswellbrook Area.

- You must not approach trapped dogs
- Obey all signage regarding trapping locations
- Trappers Vehicle LV223 will be operating on site under a conditional exemption until 9/6/22
- If shooting is in progress "Animal Trapping" sign will be replaced by "Do Not Enter Shooting In Progress", do not enter area and contact number on sign.

Dave Rae, Mineco Land Management Supervisor
10th May 2022

BHP

Need to know information

Wild Dog trapping commencing at Mt. Arthur

Expected locations of soft jaw dog traps

Dave Rae, Mineco Land Management Supervisor
10th May 2022

BHP

BHP NEED TO KNOW INFO – FY22 Baiting Program

FY22 Baiting Program begins – 16 June to 1 July

- The FY22 Baiting Program will begin on the 16th June and include the use of 1080 baits 2 weeks across site, near biodiversity offset properties and our nearby leased properties .
- Wild Dogs and Foxes are targeted through an annual 1080 baiting program as part of Mt Arthur Coal's ongoing commitment to controlling feral animals on site. This is in line with the Local Land Services Baiting Program
- Programs used to control feral animal populations on site, assist Mt Arthur Coal in meeting its regulatory obligations as well as its obligations to the neighbouring community in the Muswellbrook Area.
- Please see map for areas of baiting. Roughly 50 baits will be used across non active mining areas and offset country
- Please note **IF ENCOUNTERED – DO NOT TOUCH BAITS**
- Standard controls for dog control:
  - Ensure no food is left lying around
  - Bins are secured and regularly empty
  - Above all **NO ONE** is to feed wild dogs or foxes

For any questions or concerns please contact:
Drae@mineco.net.au

15/6/22

BHP NEED TO KNOW INFO – FY22 Baiting Program

15/6/22

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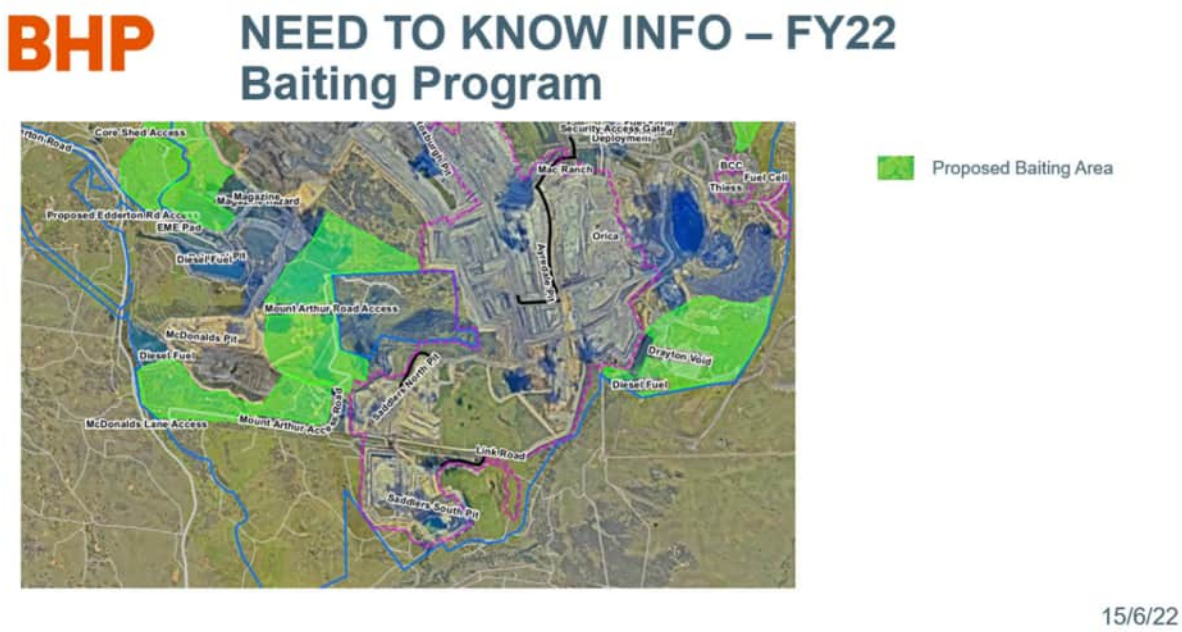

Location data for dog baiting program

Id	SiteNumber	DateEntered	Latitude	Longitude	1080 Bait activity
DO-CO-124562	1	16/06/2022 7:39	-32.32608869	150.8918437	Bait laid
DO-CO-124563	2	16/06/2022 7:50	-32.32927204	150.8898653	Bait laid
DO-CO-124564	3	16/06/2022 7:57	-32.32665728	150.8850982	Bait laid
DO-CO-124565	4	16/06/2022 8:05	-32.32807872	150.876042	Bait laid
DO-CO-124567	5	16/06/2022 8:27	-32.31977137	150.8755439	Bait laid
DO-CO-124568	6	16/06/2022 8:31	-32.32445777	150.8736286	Bait laid
DO-CO-124570	7	16/06/2022 8:56	-32.32159948	150.8690332	Bait laid
DO-CO-124571	8	16/06/2022 9:08	-32.30783255	150.8610901	Bait laid
DO-CO-124572	9	16/06/2022 9:17	-32.3104912	150.8548055	Bait laid
DO-CO-124573	10	16/06/2022 9:22	-32.31551816	150.8619399	Bait laid
DO-CO-124574	11	16/06/2022 9:43	-32.33505668	150.8217648	Bait laid
DO-CO-124580	12	16/06/2022 9:46	-32.3429625	150.8168286	Bait laid
DO-CO-124583	13	16/06/2022 9:55	-32.34736429	150.822411	Bait laid
DO-CO-124585	14	16/06/2022 10:02	-32.35849076	150.8362064	Bait laid
DO-CO-124586	15	16/06/2022 10:12	-32.35551803	150.8203828	Bait laid
DO-CO-124587	16	16/06/2022 10:16	-32.36203301	150.8171754	Bait laid
DO-CO-124588	17	16/06/2022 10:32	-32.36051086	150.8302179	Bait laid
DO-CO-124589	18	16/06/2022 10:46	-32.37023269	150.8363726	Bait laid
DO-CO-124590	19	16/06/2022 10:54	-32.36946333	150.8239385	Bait laid

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DO-CO-124591	20	16/06/2022 11:07	-32.37453023	150.8178052	Bait laid
DO-CO-124593	21	16/06/2022 11:19	-32.37290212	150.8407639	Bait laid
DO-CO-124594	22	16/06/2022 11:22	-32.37596733	150.8379383	Bait laid
DO-CO-124596	23	16/06/2022 11:30	-32.37459219	150.8432836	Bait laid
DO-CO-124598	24	16/06/2022 11:41	-32.36584923	150.845515	Bait laid
DO-CO-124599	25	16/06/2022 11:45	-32.3589206	150.8441592	Bait laid
DO-CO-124600	26	16/06/2022 12:04	-32.35463095	150.8497189	Bait laid
DO-CO-124602	27	16/06/2022 12:10	-32.35391824	150.8566235	Bait laid
DO-CO-124603	28	16/06/2022 12:14	-32.36030594	150.8578964	Bait laid
DO-CO-124605	29	16/06/2022 12:20	-32.36160054	150.8555266	Bait laid
DO-CO-124606	30	16/06/2022 12:28	-32.36025944	150.8518582	Bait laid
DO-CO-124617	32	16/06/2022 13:34	-32.377829	150.842217	Bait laid
DO-CO-124618	33	16/06/2022 13:34	-32.397493	150.856132	Bait laid
DO-CO-124619	34	16/06/2022 13:35	-32.399259	150.859999	Bait laid
DO-CO-124620	35	16/06/2022 13:35	-32.396265	150.861789	Bait laid
DO-CO-124623	31	16/06/2022 13:39	-32.359753	150.847413	Bait laid
DO-CO-124626	36	16/06/2022 13:44	-32.39645578	150.8688353	Bait laid
DO-CO-124627	37	16/06/2022 13:49	-32.39629779	150.8772746	Bait laid
DO-CO-124628	38	16/06/2022 13:51	-32.39481987	150.8764056	Bait laid
DO-CO-124629	39	16/06/2022 13:55	-32.39103469	150.8764268	Bait laid
DO-CO-124633	40	16/06/2022 14:00	-32.38706802	150.8751397	Bait laid
DO-CO-124634	41	16/06/2022 14:05	-32.38687598	150.8812426	Bait laid
DO-CO-124635	42	16/06/2022 14:10	-32.38491959	150.8778918	Bait laid
DO-CO-124636	43	16/06/2022 14:14	-32.38624115	150.8836125	Bait laid
DO-CO-124637	44	16/06/2022 14:26	-32.37521154	150.884047	Bait laid
DO-CO-124638	45	16/06/2022 14:29	-32.37081146	150.8840998	Bait laid
DO-CO-124639	46	16/06/2022 14:36	-32.37269406	150.8874846	Bait laid
DO-CO-124642	48	16/06/2022 14:54	-32.34290789	150.9054208	Bait laid
DO-CO-124643	49	16/06/2022 14:58	-32.34041761	150.9094592	Bait laid
DO-CO-124644	50	16/06/2022 15:04	-32.33782649	150.9112164	Bait laid
DO-CO-124844	47	20/06/2022 13:50	-32.361902	150.891163	Bait laid
DO-CO-124973	1	23/06/2022 7:39	-32.32612989	150.8918058	Bait taken and replaced
DO-CO-124974	2	23/06/2022 7:48	-32.32931834	150.8899111	Bait taken and replaced
DO-CO-124975	3	23/06/2022 7:55	-32.32664784	150.8850971	Bait taken and replaced
DO-CO-124976	4	23/06/2022 8:06	-32.32800529	150.8758427	Bait taken and replaced
DO-CO-124977	5	23/06/2022 8:17	-32.31975861	150.8755708	Bait not taken but replaced
DO-CO-124978	6	23/06/2022 8:22	-32.3244918	150.8736144	Bait not taken but replaced
DO-CO-124979	7	23/06/2022 8:31	-32.3217061	150.8689421	Bait not taken but replaced
DO-CO-124980	8	23/06/2022 8:41	-32.30783772	150.8609737	Bait taken and replaced
DO-CO-124981	9	23/06/2022 8:51	-32.31047636	150.854838	Bait taken and replaced
DO-CO-124987	10	23/06/2022 9:09	-32.31556339	150.8620492	Bait taken and replaced
DO-CO-124991	11	23/06/2022 9:40	-32.33500557	150.8218026	Bait taken and replaced
DO-CO-124992	12	23/06/2022 9:45	-32.34298557	150.8168494	Bait not taken but replaced
DO-CO-124993	13	23/06/2022 9:51	-32.3473674	150.8223597	Bait not taken but replaced
DO-CO-124996	14	23/06/2022 9:59	-32.35853505	150.8363169	Bait taken and replaced
DO-CO-125000	15	23/06/2022 10:20	-32.35553761	150.8204476	Bait taken and replaced

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DO-CO-125001	17	23/06/2022 10:24	-32.360621	150.830072	Bait taken and replaced
DO-CO-125002	16	23/06/2022 10:28	-32.36198067	150.817176	Bait not taken but replaced
DO-CO-125004	18	23/06/2022 10:42	-32.37032822	150.8363512	Bait taken and replaced
DO-CO-125007	19	23/06/2022 10:51	-32.36944171	150.8239061	Bait taken and replaced
DO-CO-125008	20	23/06/2022 11:01	-32.37451142	150.8177888	Bait taken, not replaced
DO-CO-125010	21	23/06/2022 11:16	-32.372894	150.840764	Bait not taken but replaced
DO-CO-125012	22	23/06/2022 11:20	-32.3759735	150.8379598	Bait taken and replaced
DO-CO-125013	23	23/06/2022 11:25	-32.37459486	150.8432759	Bait taken and replaced
DO-CO-125014	24	23/06/2022 11:35	-32.36585051	150.8455088	Bait not taken but replaced
DO-CO-125015	25	23/06/2022 11:41	-32.35887365	150.8441046	Bait taken and replaced
DO-CO-125018	26	23/06/2022 11:52	-32.35463965	150.8497306	Bait not taken but replaced
DO-CO-125019	27	23/06/2022 11:57	-32.35392224	150.8566216	Bait not taken but replaced
DO-CO-125020	28	23/06/2022 12:01	-32.36023945	150.8578453	Bait taken, not replaced
DO-CO-125021	29	23/06/2022 12:04	-32.36161322	150.8555498	Bait taken and replaced
DO-CO-125022	30	23/06/2022 12:09	-32.36025379	150.8518317	Bait taken and replaced
DO-CO-125023	31	23/06/2022 12:18	-32.359797	150.847419	Bait not taken but replaced
DO-CO-125024	32	23/06/2022 12:31	-32.37784122	150.8422299	Bait not taken but replaced
DO-CO-125026	33	23/06/2022 12:58	-32.39749274	150.856205	Bait taken and replaced
DO-CO-125029	34	23/06/2022 13:04	-32.39928996	150.8599798	Bait not taken but replaced
DO-CO-125030	35	23/06/2022 13:07	-32.396277	150.8617908	Bait not taken but replaced
DO-CO-125031	36	23/06/2022 13:12	-32.39644639	150.8688062	Bait not taken but replaced
DO-CO-125032	37	23/06/2022 13:17	-32.3962817	150.8772373	Bait not taken but replaced
DO-CO-125033	38	23/06/2022 13:20	-32.39484309	150.8763863	Bait not taken but replaced
DO-CO-125034	39	23/06/2022 13:24	-32.39114158	150.8763724	Bait not taken but replaced
DO-CO-125037	42	23/06/2022 13:41	-32.384931	150.877876	Bait taken and replaced
DO-CO-125038	43	23/06/2022 13:44	-32.38625988	150.883609	Bait taken and replaced
DO-CO-125039	41	23/06/2022 13:47	-32.3868744	150.8813085	Bait not taken but replaced
DO-CO-125040	40	23/06/2022 13:51	-32.38709218	150.8751942	Bait taken and replaced
DO-CO-125041	44	23/06/2022 14:01	-32.37523308	150.8841069	Bait taken and replaced
DO-CO-125042	45	23/06/2022 14:04	-32.37081659	150.8840842	Bait taken and replaced
DO-CO-125043	46	23/06/2022 14:08	-32.37273794	150.8874966	Bait taken and replaced
DO-CO-125044	48	23/06/2022 14:27	-32.342911	150.9054311	Bait taken and replaced
DO-CO-125045	47	23/06/2022 14:28	-32.36199	150.891169	Bait taken and replaced
DO-CO-125046	49	23/06/2022 14:33	-32.34046269	150.9094863	Bait not taken but replaced
DO-CO-125047	50	23/06/2022 14:37	-32.33782311	150.9112293	Bait not taken but replaced
DO-CO-125292	1	30/06/2022 7:18	-32.32614588	150.8918018	Bait taken, not replaced
DO-CO-125294	2	30/06/2022 7:25	-32.32927564	150.8898674	Bait withdrawn
DO-CO-125295	3	30/06/2022 7:32	-32.3266283	150.885098	Bait taken, not replaced
DO-CO-125296	4	30/06/2022 7:38	-32.32800723	150.8758377	Bait withdrawn
DO-CO-125297	5	30/06/2022 7:46	-32.31972424	150.8755718	Bait withdrawn
DO-CO-125298	6	30/06/2022 7:50	-32.32448369	150.8735786	Bait taken, not replaced
DO-CO-125299	7	30/06/2022 7:55	-32.32169195	150.8689812	Bait taken, not replaced
DO-CO-125300	8	30/06/2022 8:05	-32.30785952	150.860971	Bait withdrawn
DO-CO-125301	9	30/06/2022 8:12	-32.31047657	150.8548327	Bait taken, not replaced
DO-CO-125302	10	30/06/2022 8:17	-32.31554464	150.8620555	Bait taken, not replaced
DO-CO-125303	11	30/06/2022 8:57	-32.33500673	150.8217625	Bait taken, not replaced

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DO-CO-125304	12	30/06/2022 9:02	-32.34301033	150.8168249	Bait withdrawn
DO-CO-125305	13	30/06/2022 9:05	-32.34737923	150.8223717	Bait taken, not replaced
DO-CO-125306	14	30/06/2022 9:12	-32.35857131	150.8363179	Bait withdrawn
DO-CO-125307	17	30/06/2022 9:16	-32.36053313	150.8301412	Bait withdrawn
DO-CO-125309	15	30/06/2022 9:21	-32.35560683	150.8204132	Bait withdrawn
DO-CO-125310	16	30/06/2022 9:24	-32.36201677	150.8171987	Bait taken, not replaced
DO-CO-125311	18	30/06/2022 9:36	-32.37026863	150.8363661	Bait withdrawn
DO-CO-125312	19	30/06/2022 9:44	-32.36947126	150.8239053	Bait taken, not replaced
DO-CO-125313	20	30/06/2022 9:50	-32.37454027	150.8178467	Bait taken, not replaced
DO-CO-125314	21	30/06/2022 10:00	-32.37288114	150.8407954	Bait withdrawn
DO-CO-125315	22	30/06/2022 10:03	-32.37593208	150.8379786	Bait taken, not replaced
DO-CO-125316	23	30/06/2022 10:07	-32.37456743	150.8433079	Bait withdrawn
DO-CO-125318	24	30/06/2022 10:17	-32.36583639	150.8455226	Bait withdrawn
DO-CO-125319	25	30/06/2022 10:23	-32.35881095	150.8440645	Bait withdrawn
DO-CO-125320	26	30/06/2022 10:29	-32.35462762	150.8497249	Bait taken, not replaced
DO-CO-125321	27	30/06/2022 10:34	-32.35380003	150.8564828	Bait withdrawn
DO-CO-125322	28	30/06/2022 10:34	-32.36023479	150.8578322	Bait withdrawn
DO-CO-125323	29	30/06/2022 10:36	-32.36164026	150.8555924	Bait taken, not replaced
DO-CO-125324	30	30/06/2022 10:40	-32.36028201	150.8518635	Bait withdrawn
DO-CO-125325	31	30/06/2022 10:46	-32.35940334	150.8470015	Bait withdrawn
DO-CO-125326	32	30/06/2022 10:52	-32.37783782	150.8422504	Bait withdrawn
DO-CO-125328	33	30/06/2022 11:47	-32.39750063	150.8562059	Bait withdrawn
DO-CO-125329	34	30/06/2022 11:49	-32.39931001	150.86001	Bait taken, not replaced
DO-CO-125330	35	30/06/2022 11:51	-32.3962711	150.8617943	Bait taken, not replaced
DO-CO-125331	36	30/06/2022 11:55	-32.39646394	150.8687476	Bait withdrawn
DO-CO-125332	37	30/06/2022 11:59	-32.39628426	150.8772497	Bait withdrawn
DO-CO-125333	38	30/06/2022 12:02	-32.3948448	150.876419	Bait withdrawn
DO-CO-125334	39	30/06/2022 12:05	-32.39108008	150.8764216	Bait taken, not replaced
DO-CO-125335	40	30/06/2022 12:07	-32.38707245	150.8751622	Bait withdrawn
DO-CO-125336	41	30/06/2022 12:16	-32.38497024	150.8778927	Bait withdrawn
DO-CO-125337	41	30/06/2022 12:18	-32.38688563	150.8812869	Bait withdrawn
DO-CO-125339	43	30/06/2022 12:23	-32.38583429	150.8818139	Bait withdrawn
DO-CO-125340	44	30/06/2022 12:27	-32.37527505	150.8840533	Bait taken, not replaced
DO-CO-125341	45	30/06/2022 12:29	-32.3708012	150.8840558	Bait taken, not replaced
DO-CO-125342	46	30/06/2022 12:38	-32.37271931	150.8874919	Bait taken, not replaced
DO-CO-125343	47	30/06/2022 12:42	-32.3619312	150.8911547	Bait taken, not replaced
DO-CO-125344	49	30/06/2022 12:53	-32.34047456	150.9094837	Bait withdrawn
DO-CO-125345	50	30/06/2022 12:56	-32.33787564	150.911207	Bait taken, not replaced
DO-CO-125346	48	30/06/2022 13:08	-32.34293023	150.9054525	Bait taken, not replaced

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Weed

Management Report FY22

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1 Summary

Mineco were contracted to conduct weed management at Mount Arthur Coal in late 2021. This would be conducted through the use of Mineco's internal staff and the supervision of sub-contractors.

Weed treatments conducted were carried out with respect to the appropriate herbicide recommended by label instructions and the time of year that treatment should be conducted. As such not all weeds seen in particular areas could be treated either due to the off season timing or herbicide being used for higher priority weeds was not registered for their control.

Treatment areas were determined through a variety of means. Garmin GPS, mobile device and marking on daily paper maps of areas worked. This has been collated into treatment areas. As a summary of the work carried out this document has been prepared to give an overview of the treatment locations.

A summary matrix of weeds targeted in each area (Table 1) and chemicals used (Table 2) is provided in section 3 on page 13.

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2 Areas of Activity

2.1 VD5

VD5 visual dump was predominantly spot sprayed using knapsacks throughout February 2022. Priority weeds for the Upper Hunter and MAC priority weeds were targeted where the weeds were actively growing (See table 1. Treatment Matrix). The steep sloping areas of VD5 were targeted due to the difficulty in using larger equipment on that terrain. Where weeds were encountered that were not ideal for spraying at that time of year hand pulling was utilized due to the low density mainly occurring on the verge of the existing rehab and bare exposed ground (Inkweed, narrow leaf cotton bush).

Upper sections of the northern facing slope were predominantly covered in dense ground cover with light patches of galenia spread throughout. Dense patches were observed on the lower terrain in the north following the drainage channel. Density of African boxthorn was rare with isolated individuals scattered throughout treatment area which were foliar sprayed. The southern slope of the treated are has a medium density of galenia patches growing. Stinking roger is evident on the Southern side and will require follow up treatment.

Figure 1. VD5 treatment Area

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2.2 VD4

VD4 was predominantly spot sprayed utilizing knapsacks and a Quickspray unit mounted on a light vehicle. Cut stump control of boxthorn in this area was also utilised. Prickly pear was lightly distributed near the base of VD4, this was thoroughly scanned for and removed from the site by hand. The area has been seeded with native varieties of ground cover and canopy species. The canopy species are beginning to emerge since seeding in FY21. To avoid impacting these beneficial plants it was decided to omit the use of boom spray as off target herbicide damage would occur. (See table 1. Treatment Matrix)

Figure 2. VD4 Treatment Area

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2.3 Remnant Vegetation Area

Bare ground at the base of VD1 in a stand of mature canopy species had become densely populated by galenia and had prickly pear scattered throughout. Narrow leaf cotton bush was also starting to colonise the area's boundary. Use of the Quickspray unit and knapsacks occurred to manage this area. During rainy conditions while spraying was not possible prickly pear was removed with hand tools, stockpiled and later removed for deep burial. The narrow leaf cotton bush was also able to be hand pulled as spot spraying commenced in the area. (See table 1. Treatment Matrix)

Figure 3. Remnant Vegetation Treatment Area

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2.4 VD1 Treatment Area

Treatment on VD1 commenced a the south eastern edge of the rehabilitation where access was available. Control of the densest patch of African boxthorn identified was made a priority to limit the stands ability to seed in the next season. Cut and paint method was utilised in this area. Spot spraying with knapsacks and the Quickspray unit was also undertaken throughout for the isolated patches of galenia, thistle, fireweed and narrow leaf cotton bush encountered. Deployment of the spray boom was not possible due to proximity to native revegetation efforts and height of the grass. (See table 1. Treatment Matrix)

Figure 4. VD1 Treatment Area

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2.5 Site Boundary Areas

Following identification of St. John's wort in some areas of the site boundary a targeted campaign of tractor mounted spot spraying was used to eradicate the plant. All four areas where the weed was seen to be present were spot and boom sprayed. (See table 1. treatment matrix)

Figure 5. St John's Wort (Rail loop & Mt Arthur Coal South Access Road)

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Figure 6. St John's Wort (Enviro Dam area)

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2.5 Topsoil stockpiles

As part of an ongoing maintenance program to protect the mines topsoil storage areas boom spraying, spot spraying and cut and pain methods have been implemented in these areas. Rolling with a tractor drawn aerator roller was also used to inhibit weed growth. Spot spraying of bunds around the outside of the topsoil was undertaken on foot to create a buffer around the areas. This was conducted on TSS75,70,74 and 72 to further support the boom spraying. These bunds are where most of the African boxthorn was found likely due to difficulties faced controlling them in previous years with a tractor. Some areas were difficult to reach as they have been block tipped without smoothing over. These areas were attempted to be accessed with retractable reel herbicide hand guns. (See table 1. Treatment Matrix)

Figure 7. Topsoil Locations Treated

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Figure 8. Topsoil Locations Treated

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Figure 9. TSS82

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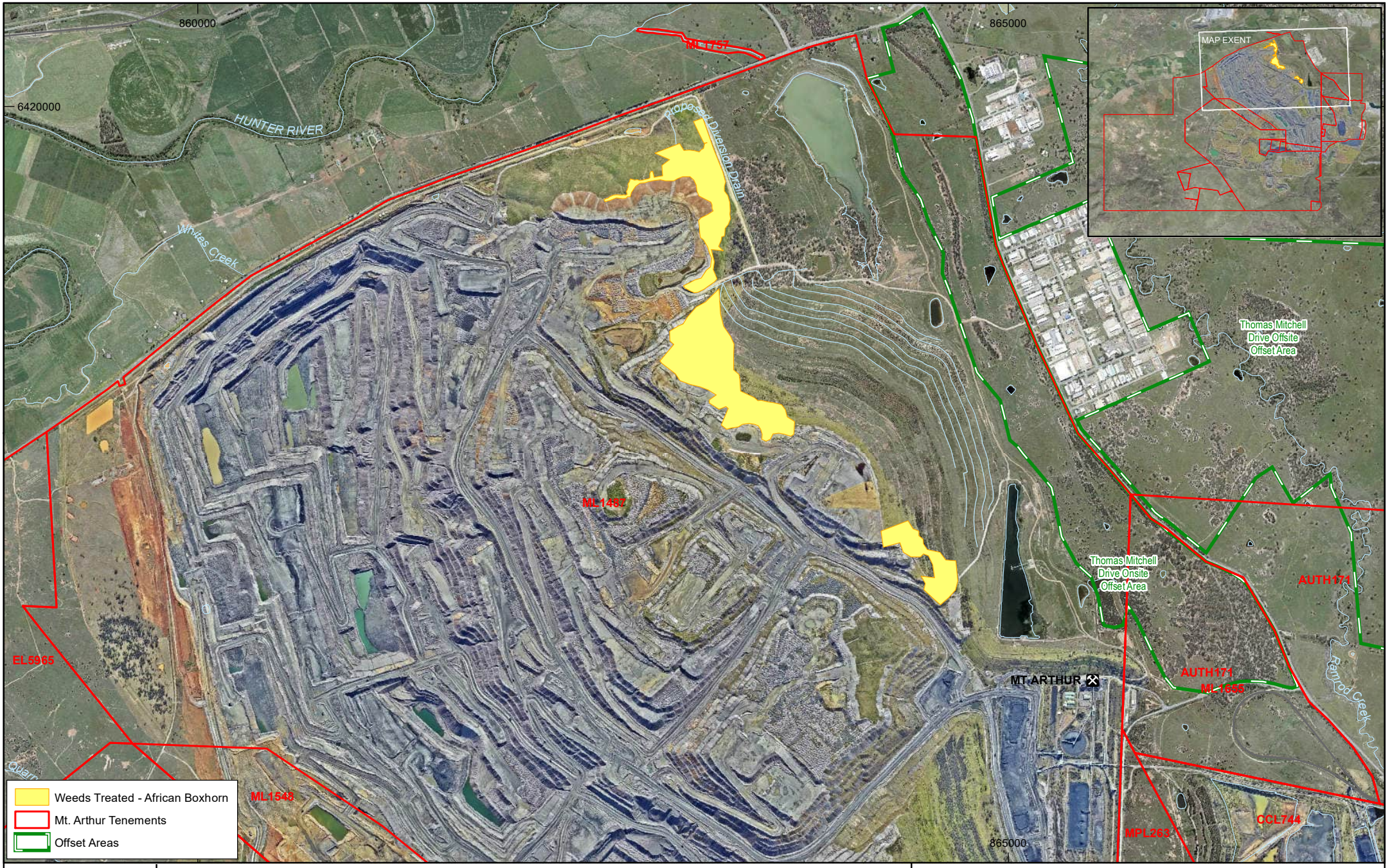
3 Matrix

Table 1. Weeds treated by area

Weeds Treated		Area					
Common Name	**Species**	**VD5**	**VD4**	**Remnant Veg**	**VD1**	**Boundary Area**	**Topsoil Areas**
African Boxthorn	***Lycium ferocissimum***	●	●		●		●
Galenia	***Galenia pubescens***	●	●	●	●		●
Thistle Sp.	***Sonchus***		●		●		●
	Carthamus	●	●				●
Prickly Pear	***Opuntioid cacti***		●	●			
Stinking Roger	***Tagetes minuta***						●
Flax Leaf Fleabane	***Conyza bonariensis***						●
St. Johns Wort	***Hypericum perforatum***					●	
Fireweed	***Senecio madagascariensis***		●		●		
Inkweed	***Phytolacca octandra***	●	●				
Onion weed	***Asphodelus fistulosus***		●				
Mustard Weed	***Brassica sp.***		●				●
Galvanised Burr	***Sclerolaena birchii***		●				●
Bathurst Burr	***Xanthium spinosum***		●				
Noogoora Burr	***Xanthium occidentale***		●				
Thorn Apple	***Datura sp.***	●	●				●
Cotton Bush	***Gomphocarpus fruticosus***	●	●	●	●		●

Table 2. Herbicide utilised by area

Herbicide Used		Area							
Name	**Function**	**VD5**	**VD4**	**Remnant Veg**	**VD1**	**Enviro Dam**	**Rail Loop**	**MTA South Rd**	**Topsoil Areas**
Grazon Extra (L)	Herbicide	7.238	25.125	3.000	1.500	2.000	1.000	1.000	14.500
Wetter 600 (L)	Surfactant	0.230	0.533	0.078	0.036	0.125	0.063	0.063	1.224
Dinky Dye (L)	Dye Marker	0.036	-	-	-	0.350	0.175	0.175	-
Triclopyr Pic (L)	Herbicide	-	-	-	-	-	-	-	36.500
Vigilant II (L)	Herbicide	-	0.025	-	0.150	-	-	-	0.200



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MT. ARTHUR MINE
WEEDS TREATED - AFRICAN BOXHORN

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
Checked: J. Deacon	Filename: 20220812-5	

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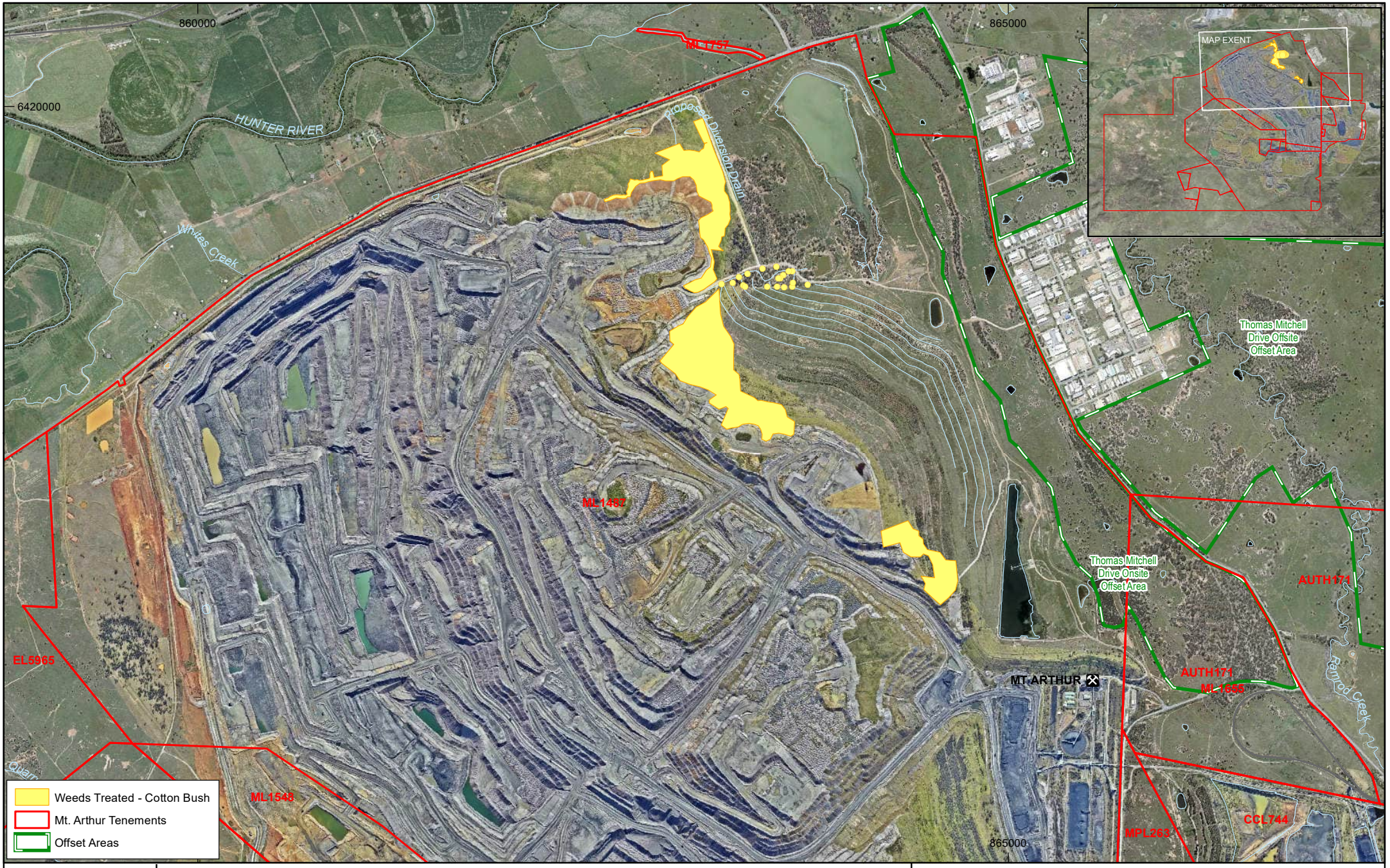
MT. ARTHUR MINE
WEEDS TREATED - BATHURST BUR

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
Checked: J. Deacon	Filename: 20220812-5a	



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MT. ARTHUR MINE
WEEDS TREATED - COTTON BUSH

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
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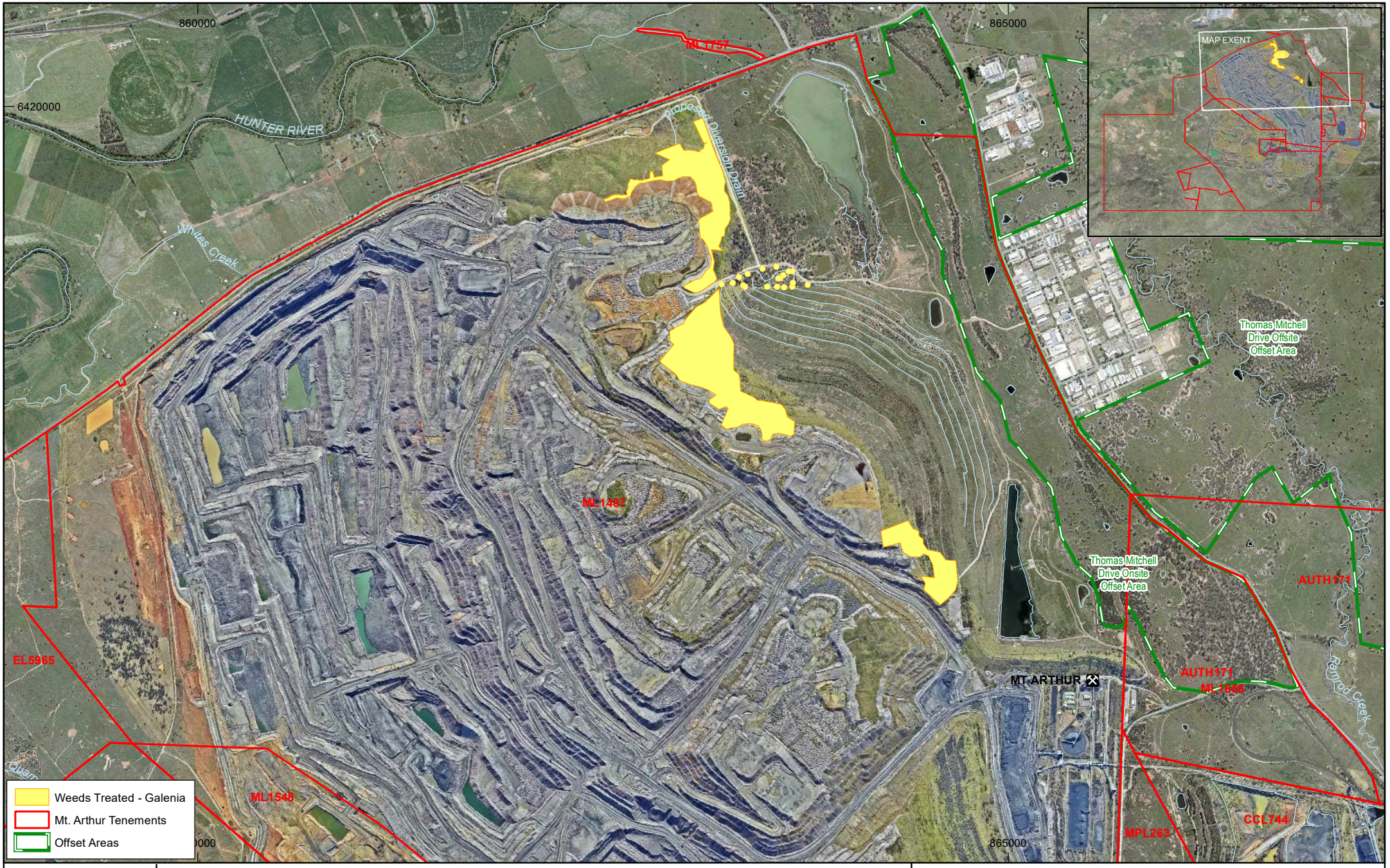
WEEDS TREATED - FIREWEED

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
Checked: J. Deacon	Filename: 20220812-5c	



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MT. ARTHUR MINE
WEEDS TREATED - GALENIA

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
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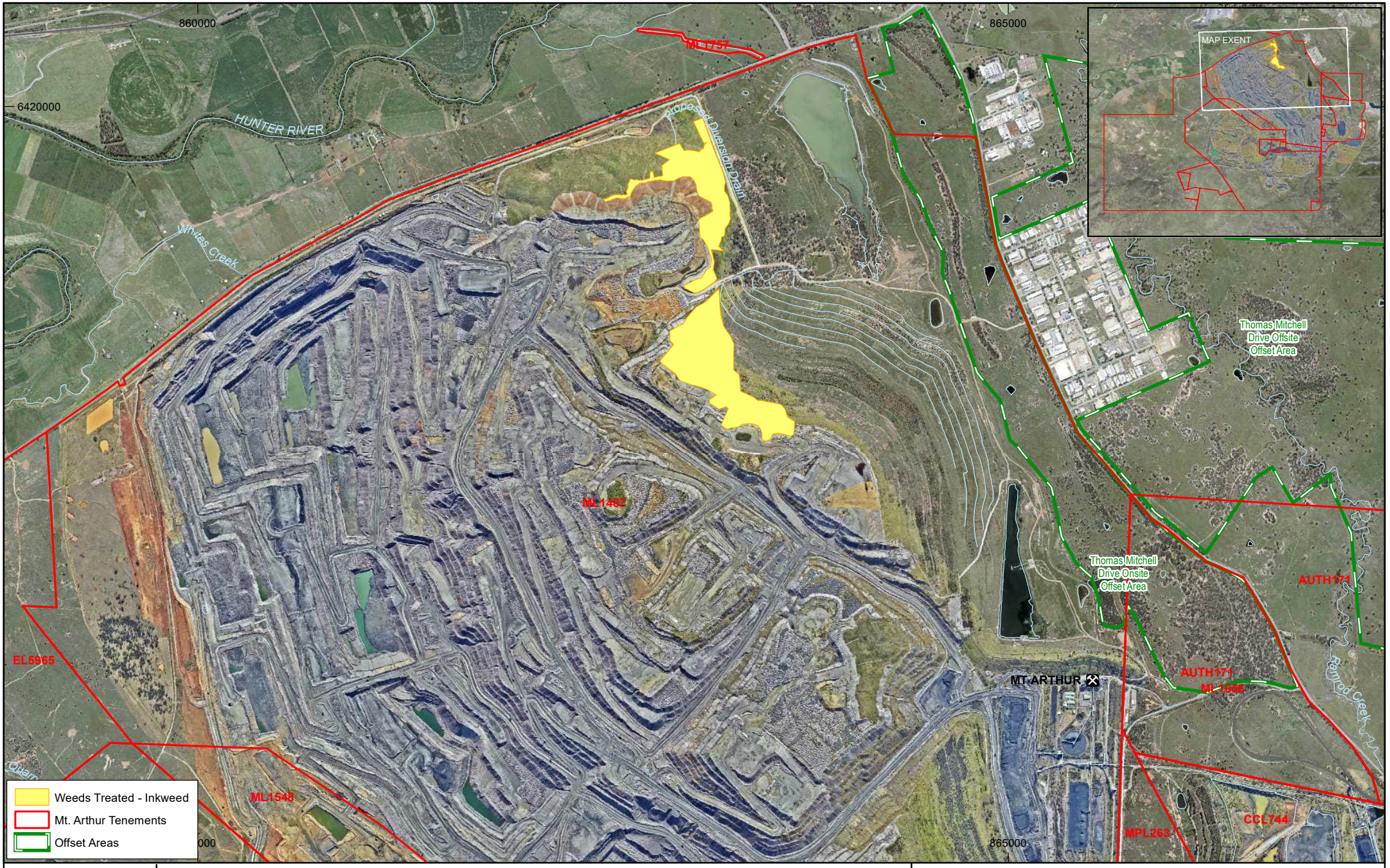
MT. ARTHUR MINE
WEEDS TREATED - GALVANISED BUR

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
Checked: J. Deacon	Filename: 20220812-5e	



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MT. ARTHUR MINE
WEEDS TREATED - INKWEED

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
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MT. ARTHUR MINE
WEEDS TREATED - MUSTARD WEED

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MT. ARTHUR MINE
WEEDS TREATED - NOOGORA BUR

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WEEDS TREATED - ONION WEED

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
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MT. ARTHUR MINE
WEEDS TREATED - PRICKLY PEAR

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
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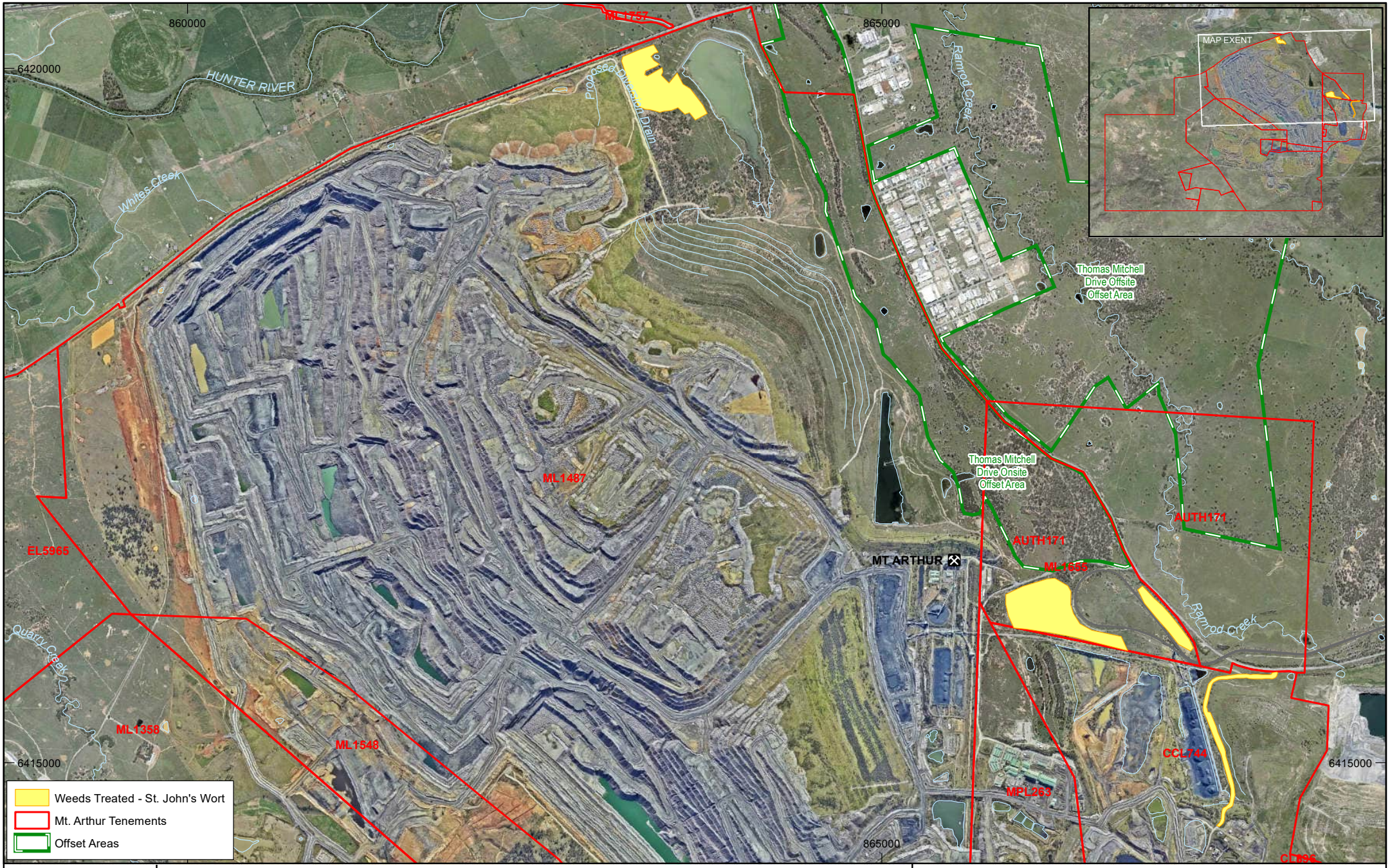

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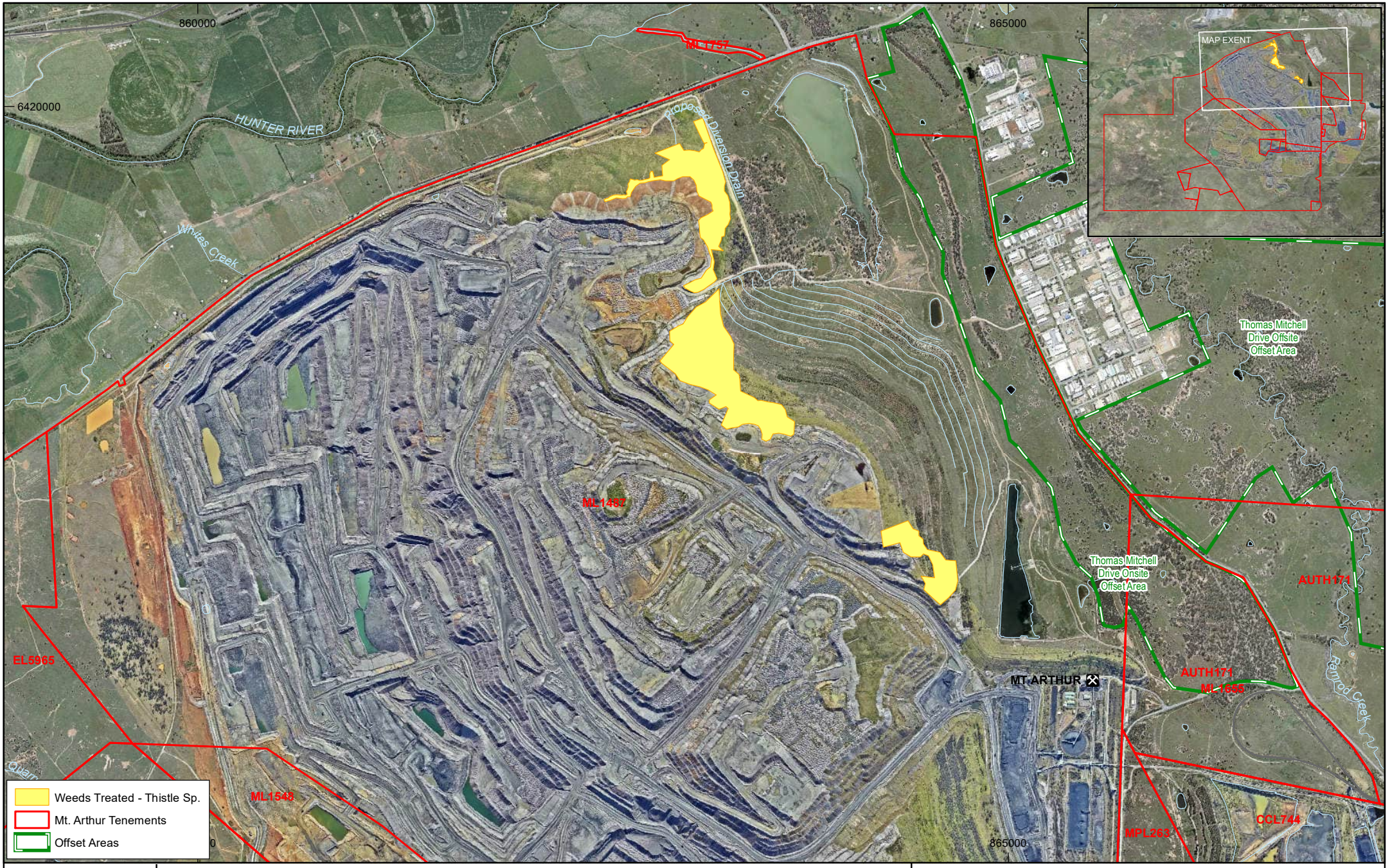
MT. ARTHUR MINE
WEEDS TREATED - ST. JOHN'S WORT

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
Checked: J. Deacon	Filename: 20220812-5k	



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MT. ARTHUR MINE
WEEDS TREATED - THISTLE SP.

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
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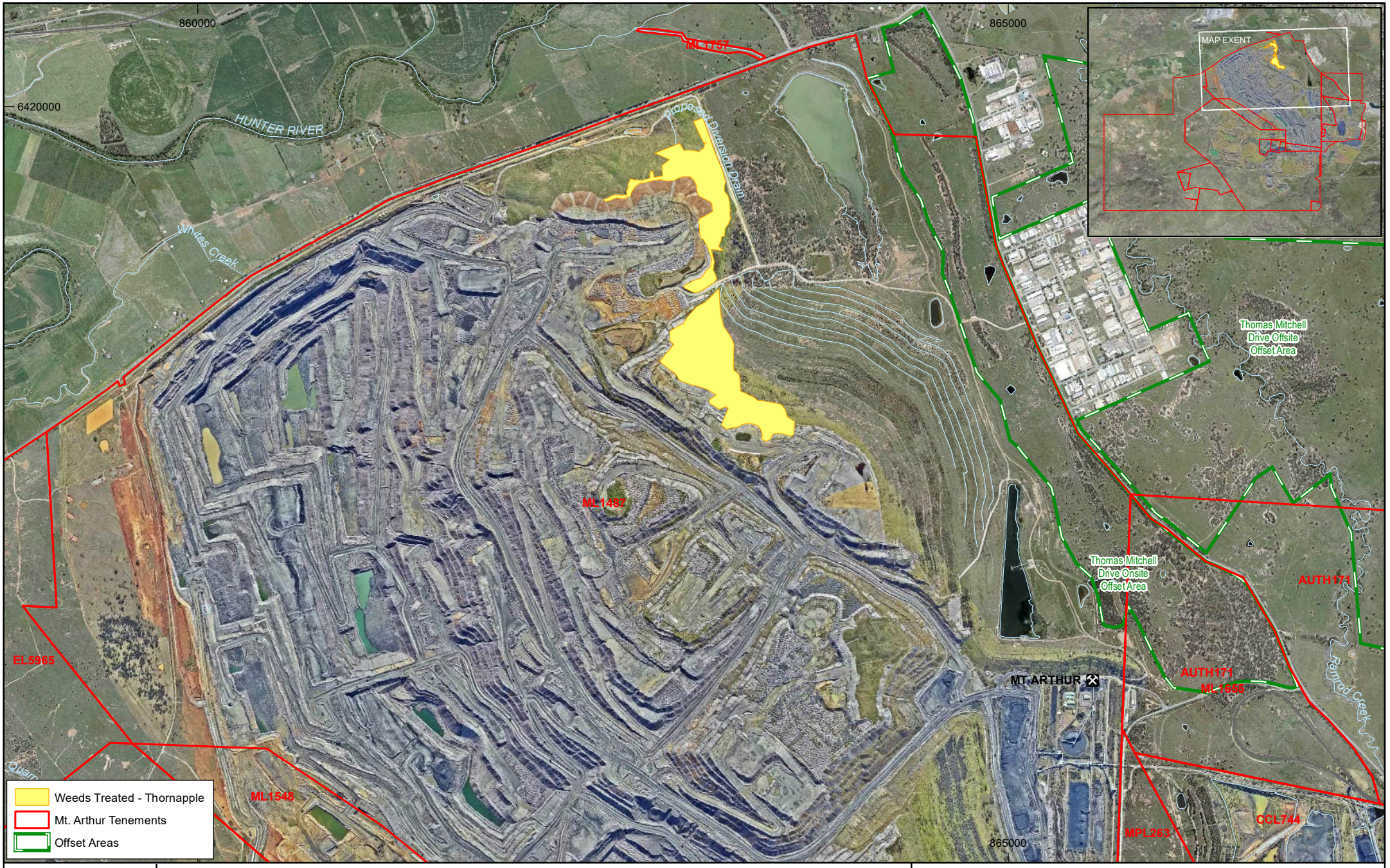

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MT. ARTHUR MINE
WEEDS TREATED - THORNAPPLE

Drawn: B. Lang	Date: 15/08/2022	Revision: 1
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