BHP

Mt Arthur Coal

Annual Review FY21

29 September 2021

Table of Contents

List of Figures

List of Tables

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
Name of holder of water licences	Hunter Valley Energy Coal Pty Ltd
Mining Operations Plan Commencement Date	1 July 2020 (as approved 26 June 2020)
Mining Operations Plan Completion Date	30 June 2023
Annual Review Commencement Date	1 July 2020
Annual Review Completion Date	30 June 2021
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 2020 to 30 June 2021 and that I am authorised to make this statement on behalf of Hunter Valley Energy Coal Pty Ltd. Note. a) 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. b) 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	27/10/2021

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	YES (note; one event from the period is still under investigation)
EPBC 2011/5866	YES
EPBC 2014/7377	YES
ML	YES

Relevant approval	Condition	Description Summary	Compliance Status	Comment	Report Reference
PA09_0062	10 (Schedule 3)	Blast Monitoring	Non-compliant (Low)	Blast overpressure exceedance of the 50mm/s public infrastructure criteria was recorded on 13 August 2020.	Section 11
PA09_0062	7 (Schedule 5)	Reporting	Non-compliant (Low)	The blast over pressure event on 13 August 2020 was not reporting immediately.	Section 11

Table 3: Non-compliance summary

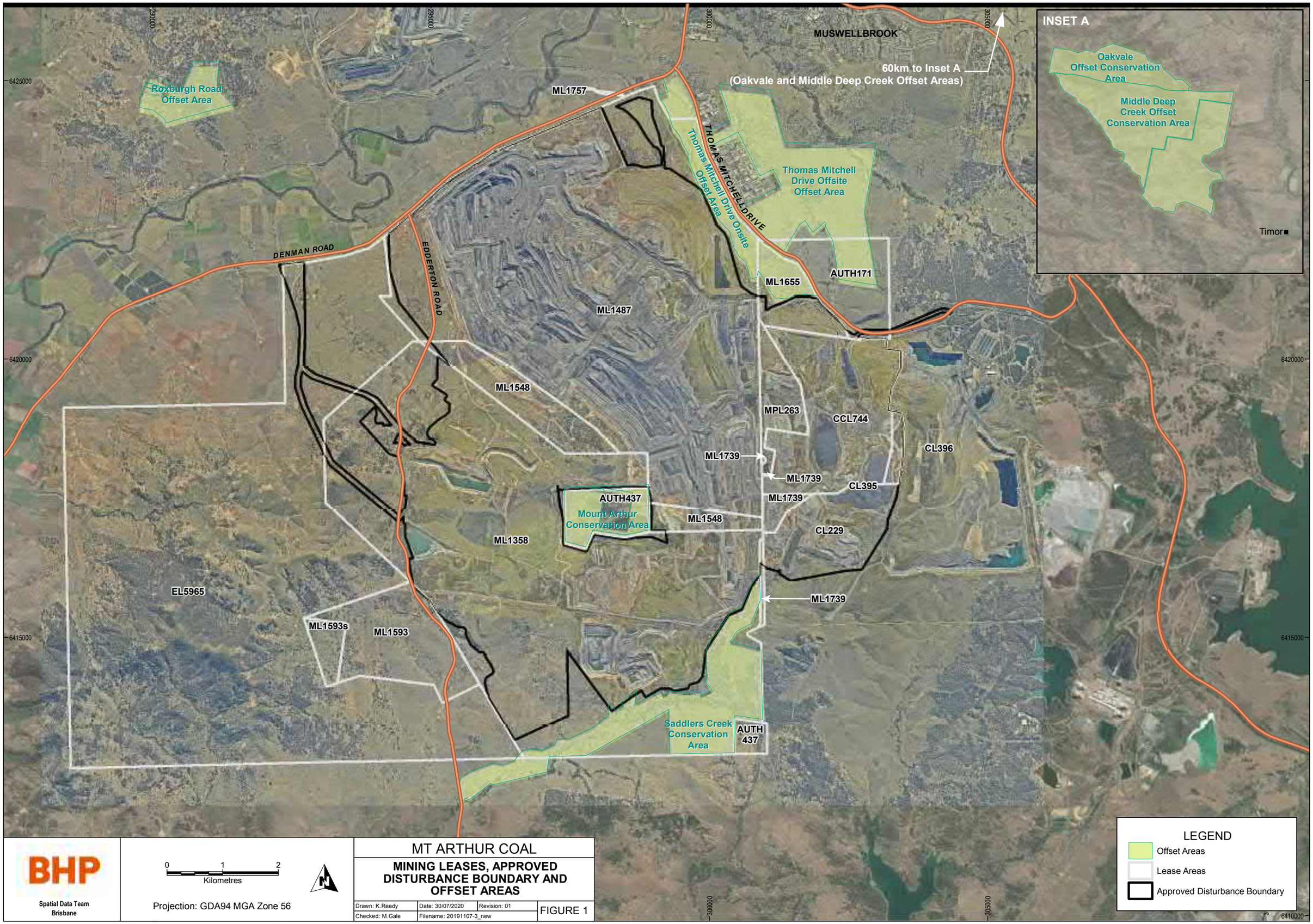
Note: Compliance Status key for Table 3

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
RBGS	Royal Botanic Gardens Sydney
ROM	Run of mine
UAV	Unmanned aerial vehicle
VPA	Voluntary Planning Agreement
VWP	Vibrating wire piezometers



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		

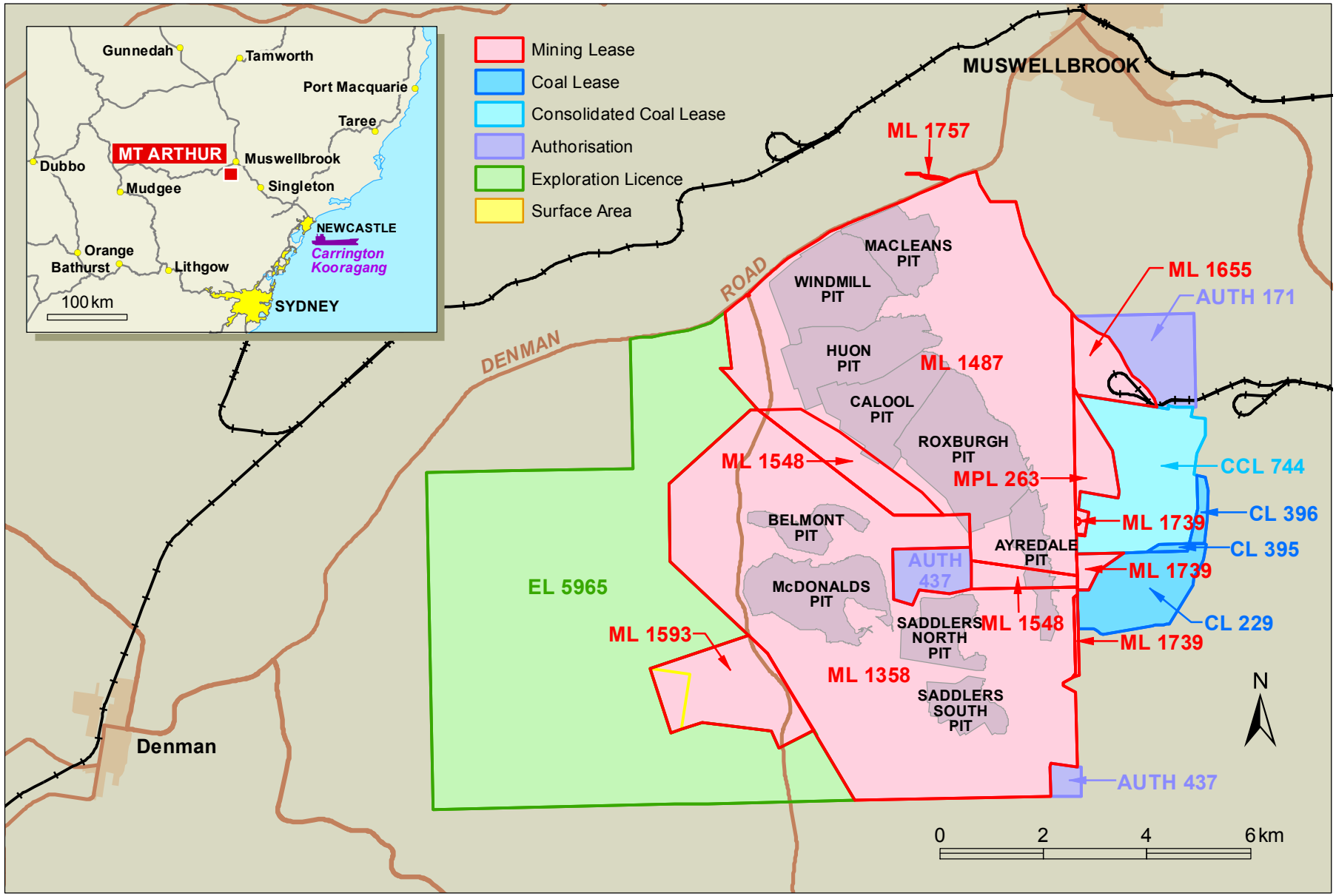


Figure 2: Mt Arthur Coal Locality Plan

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

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 2020 to 30 June 2021 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, Industry and Environment (DPIE), 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
Adam Lancey, General Manager, BHP Mt Arthur Coal	(02) 6544 5800
Hannah Farr, Manager Health, Safety and Environment, Mt Arthur Coal	(02) 6544 5800

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 approval modifications occurred:

- 30 July 2020 – Environmental Protection Licence (EPL 11457) 5 year review completed by the Environment Protection Authority (EPA) modified EPL 11457 with a number of changes to conditions.
- 1 March 2021 - A variation to the EPL 11457 Boundary approved by the EPA.
- 26 April 2021 – EPA varied EPL 11457 to include Condition U1 Review of mine water transfer pipelines.
- In January 2021, EL 5965 was renewed by NSW Department of Planning for a further term until 15 July 2026.
- 26 June 2020 - An amended Mining Operations Plan (MOP) was approved by the Resources Regulator for FY21-FY23 mining operations.
- The FY22-FY24 Forward Program, Mine Operations Plan (MOP) was submitted to the NSW Resources Regulator for the period 1 July 2019 to 30 June 2022.

Table 5 shows Mt Arthur Coal's existing statutory approvals at 30 June 2021.

Table 5: Mt Arthur Coal's existing statutory approvals at 30 June 2021

Description	Issue date	Expiry date
Project approvals issued by the DPIE		
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	12/06/2022
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 26//2021)	Not specified
EPBC approval issued by the DAWE		
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 14.9 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	135,394,000	127,753,000
Run-of-mine coal	tonnes	32,000,000	20,000,000	21,300,000	21,600,000
Coarse and fine reject	tonnes	N/A	4,200,000	6,300,000	5,300,000
Tailings	tonnes (dry)	N/A	1,622,000	2,249,000	2,000,000
Product (saleable) coal	tonnes	27,000,000 (by rail)	14,326,000	14,900,000	14,200,000

4.2 Other Operations

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

- *Exploration*: 6 boreholes (totalling 1,316 metres) were drilled in ML1358, ML 1593 and EL5965 to further define coal seam geology and geotechnical parameters of the resource. Rehabilitation and sealing of 64 boreholes was completed.
- *Land Preparation:* During the reporting period approximately 173,087 cubic metres of topsoil was recovered from 99 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 activates were commenced, progressed or completed during the reporting period:
    - Commencement of early works of the first phase of the Tailings Dam Stage 2 raise project involving the downstream raising of an existing embankment to provide ongoing tailings storage capacity;
    - Relocation of infrastructure to facilitate the approved extension of Windmill Pit, including finalisation of the realignment of Edderton Road.
    - Relocation of electrical infrastructure to facilitate the forward mine plan;

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 14.9 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	135,394,000	127,753,000
Run-of-mine coal	tonnes	32,000,000	20,000,000	21,300,000	21,600,000
Coarse and fine reject	tonnes	N/A	4,200,000	6,300,000	5,300,000
Tailings	tonnes (dry)	N/A	1,622,000	2,249,000	2,000,000
Product (saleable) coal	tonnes	27,000,000 (by rail)	14,326,000	14,900,000	14,200,000

4.2 Other Operations

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

- *Exploration*: 6 boreholes (totalling 1,316 metres) were drilled in ML1358, ML 1593 and EL5965 to further define coal seam geology and geotechnical parameters of the resource. Rehabilitation and sealing of 64 boreholes was completed.
- *Land Preparation:* During the reporting period approximately 173,087 cubic metres of topsoil was recovered from 99 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 activates were commenced, progressed or completed during the reporting period:
    - Commencement of early works of the first phase of the Tailings Dam Stage 2 raise project involving the downstream raising of an existing embankment to provide ongoing tailings storage capacity;
    - Relocation of infrastructure to facilitate the approved extension of Windmill Pit, including finalisation of the realignment of Edderton Road.
    - Relocation of electrical infrastructure to facilitate the forward mine plan;

- Construction of permanent and temporary erosion and sediment control structures for the mining operation;
- Complete relocation of water management related infrastructure to facilitate pit progression.
- Complete removal of the old conveyor up to AGL Boundary including removal of redundant coal bin and associated structures
- Drilling of underground water monitoring boreholes.
- Upgrades of fencing in high priority conservation areas.
- Demolition of the explosives storage and reload facilities and construction and commissioning a new upgraded facility.
- Relocation of the Earth Moving Equipment maintenance pad.
- Installation of 13 new boreholes – involved the installation of monitoring bores and with vibrating wire piezometers (VWP) and 14 monitoring boreholes at 13 new locations;
- Installation of 8 water monitoring boreholes (at 4 locations) for North Cut Tailings Storage Facility and 6 water monitoring boreholes at Tailings Storage Facility near Saddlers Creek;

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 971 permanent and fixed-term contract employees and approximately 1225 contractors on a full-time equivalent basis. Approximately 77 per cent of Mt Arthur Coal's employees resided in the local government areas of Muswellbrook, Upper Hunter and Singleton as at 30 June 2021.

4.4 Next Reporting Period

Forecast major infrastructure and construction activities for the next reporting period include:

- Continued relocation of in-pit infrastructure to facilitate pit progression
- Continued establishment an out of pit dump (OP1N) to cater for insufficient dump capacity on low wall over five year plan, particularly with impact of monocline;
- Modification to existing in-pit electrical infrastructure to facilitate the forward mine plan;
- Construction of permanent and temporary erosion and sediment control structures for the mining operation;
- Modifications of existing and installation of additional water pipelines and associated pumping infrastructure to support ongoing water management strategies for the operation;
- Complete the upgrade of Drayton Void pumping and pipelines infrastructure;
- Commencement of the second phase of the Tailings Dam Stage 2 raise project involving the downstream raising of an existing embankment to provide ongoing tailings storage capacity;
- Continued closure works for the Main Dam and North cut TSF;
- Fencing upgrades to conservation areas;
- Denman Rd and Thomas Mitchell Drive intersection upgrade works;
- Noise and dust monitoring equipment upgrades;
- Drilling of exploration boreholes to continue refining geotechnical parameters of the resource;
- Continue with the rehabilitation program for exploration boreholes;
- Construction of visual amenity infrastructure along the new Edderton Rd.

5 Actions Required from Previous Annual Review

The DPIE notified HVEC by letter dated 16 November 2020 that the amended FY20 Annual Review was considered by the Department to satisfy the requirements of the Project Approval and the Department's Annual Review Guideline, October 2015.

The NSW Resources Regulator acknowledged receipt of the FY20 Annual Review on 27 September 2020.

Regulator feedback following review of the FY20 Annual Review is summarised in Table 7. Regulator feedback on additional requirements to be considered during the preparation of the FY21 Annual Review is also summarised in Table 7.

Table 7: Actions required from FY20 Annual Review and additional requirements for FY21 Annual Review

Action required	Requested by	Action taken by HVEC	FY21 Annual Review section
Regulator Feedback from FY20 Annual Review			
No specific feedback from FY20 has been provided for consideration in the development of the FY21 Annual Review.	NSW Resources Regulator, DPIE	N/A	N/A
Regulator Feedback on additional requirements for FY20 Annual Review			
Provide a summary of the results analysis and further investigation associated with notified groundwater trigger level exceedances.	DPIE	Exceedance investigation has been undertaken by a groundwater specialist.	Appendix 2 – Ground Water Monitoring Results and Groundwater Level Drawdown Analysis
Include a summary of the progress of the Rehabilitation Strategy and Rehabilitation Management Plan (MOP) revisions.	DPIE	The Rehabilitation Strategy was initially submitted to DPIE in 2018. A revised version was submitted in 30 July 2020, reference MP09_0062-PA-65 The Rehabilitation Management Plan (MOP) was revised during the reporting period and submitted DPIE in July 2021. Mt Arthur Coal is awaiting DPIE feedback or approval of both Management Plans.	Section 3 Approvals

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 Monitoring Program.

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 Monitoring Program and four real-time monitoring locations utilised for internal use. Noise monitoring locations are shown in Figure 3.

A revised Noise Management Plan was submitted to the DPIE in June 2019 and approved on 17 July 2020.

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.

A comparison of FY21 noise monitoring results to previous reporting years is presented in Table 9. FY21 $L_{Aeq(15min)}$ noise levels are generally higher than historical results, with the exception of some sites remaining at the same levels. Data capture was 100 per cent at all attended noise monitoring sites.

$L_{Aeq(15min)}$ 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 below modelled predictions with the exception of NP10 and NP16.

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.

In line with the Section 4 of the Noise Management Plan, an expert third party consultant was engaged to complete the three yearly traffic noise assessment in November 2020. The purpose being to predict the current traffic noise generated by Mt Arthur Coal vehicles along Thomas Mitchell Drive and Denman Roads and compare the results from attended monitoring against the criteria. The expert assessment could not identify an appropriate methodology to accurately evaluate compliance with Project Approval criteria. This outcome was consistent with the previous assessment completed in 2015 which also identified that Mt Arthur Coal's contribution to total road traffic noise levels could not be measured directly. Mt Arthur Coal will continue to review available methodology in consultation with expert third parties on a three yearly basis to comply with this obligation.

6.1.3 Complaints and Reportable Incidents

During the reporting period, 6 noise complaints were received from one complainant. This is lower than FY20 (19 noise complaints). 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.

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

6.1.4 Proposed Improvements

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.

Table 8: Monthly attended nighttime 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	20/33/38*	45	25/39/46*	No valid exceedances	Continuation of management and monitoring in accordance with Noise Management Plan
NP07	39	38	25/33/37*	45	30/37/40		
NP10	39	36	31/35/38*	45	32/40/45*		
NP12	39	39	30*/33/36*	45	30*/36/40*		
NP13	35	N/A	20/23/27*	45	20/26/30*		
NP14	35	35	25/28/32*	45	25/32/37*		
NP15	35	36	25*/30/34*	45	25*/33/39*		
NP16	37	36	30/34/37*	45	33/38/41*		

^ 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

Monitoring Site	FY21		FY20		FY19	
	Min	Max	Min	Max	Min	Max
$L_{Aeq(15\ min)}$ dB						
NP04	IA	38*	IA	35*	IA	37*
NP07	IA	37*	IA	34*	IA	33
NP10	IA	38*	IA	37*	IA	<30*
NP12	IA	36*	IA	34*	IA	35*
NP13	IA	27*	IA	27	IA	<30*
NP14	IA	32*	IA	34*	IA	32*
NP15	IA	34*	IA	32*	IA	31*
NP16	IA	37*	IA	37*	IA	32*
$L_{Aeq(1\ min)}$ dB						
NP04	IA	46*	IA	40*	IA	47*

NP07	IA	40*	IA	37	IA	37*
NP10	IA	45*	IA	39*	IA	35*
NP12	IA	40*	IA	35*	IA	42*
NP13	IA	30*	IA	34	IA	31
NP14	IA	37*	IA	43	IA	34*
NP15	IA	39*	IA	43	IA	34*
NP16	IA	41*	IA	41*	IA	35

* 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.
NM – Mt Arthur Coal's operations were audible but not measurable.

MT ARTHUR MINE

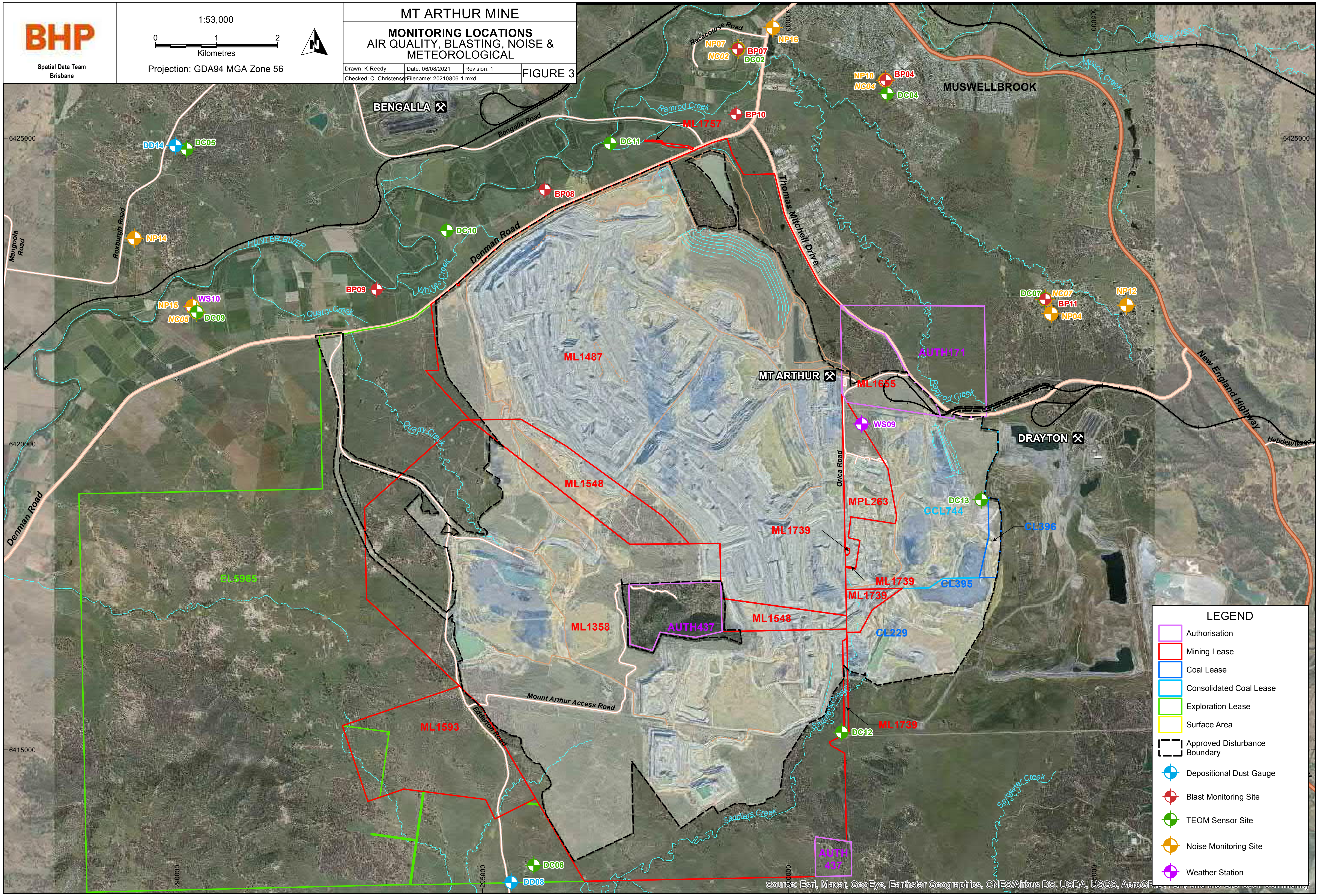
MONITORING LOCATIONS AIR QUALITY, BLASTING, NOISE & METEOROLOGICAL

FIGURE 3

BHP
Spatial Data Team
Brisbane

1:53,000
0 1 2
Kilometres
Projection: GDA94 MGA Zone 56

Drawn: K.Reedy | Date: 06/08/2021 | Revision: 1
Checked: C. Christensen | Filename: 20210806-1.mxd



BENGALLA
MUSWELLBROOK
MT ARTHUR
DRAYTON
DD14
DC05
NP14
NP15
WS10
NC05
DC09
BP09
DC10
BP08
DC11
ML1757
BP10
NP07
BP07
NC02
DC02
NP16
NP10
BP04
NC04
DC04
DC07
NC07
BP11
NP04
NP12
AUTH171
ML1655
WS09
ML1487
ML1548
MPL263
CCL744
DC13
CL396
ML1739
CL395
CL229
AUTH437
ML1358
EL5965
ML1593
DC12
DC06
DD08
AUTH 437
Denman Road
Hunter River
Quarry Creek
Wybong Creek
Ramrod Creek
Racecourse Road
Bengalla Road
Thomas Mitchell Drive
Roxburgh Road
Mangoola Road
Orica Road
Mount Arthur Access Road
Edderton Road
Saddlers Creek
Saltwater Creek
Muscle Creek
New England Highway
Hebden Road
6425000
6420000
6415000
290000
295000
300000
305000
LEGEND
Authorisation
Mining Lease
Coal Lease
Consolidated Coal Lease
Exploration Lease
Surface Area
Approved Disturbance Boundary
Depositional Dust Gauge
Blast Monitoring Site
TEOM Sensor Site
Noise Monitoring Site
Weather Station
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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);
- BP09 (Denman Road West);
- BP10 (Yammanie North); and
- BP11 (Balmoral Road).

Blast monitoring locations are 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 204 blasts were undertaken. Blast data capture rates for the reporting period were 100% at all statutory sites with the exception of BP09 Denman Rd West which was 99.5% as one blast event was not recorded at this logger due to memory card corruption. The cause of the card corruption has been identified, a data block got corrupted and interrupted downloading process. The memory card has been thoroughly checked and will be replaced if any further data gap found. There have been no other issues with the card identified

Blasting was undertaken between 8 am and 5 pm Monday to Saturday, with no blasts being undertaken on Sundays or public holidays. No blast ground vibration monitoring results above the maximum 10 mm/s limit were recorded at any of the statutory blast monitors during the reporting period. No blast recorded an airblast overpressure result above the maximum 120 dBL limit.

Of the 204 blast events fired during the reporting period, four (2%) exceeded the airblast overpressure criteria of 115 dBL and six (2.9%) exceeded the ground vibration criteria of 5 mm/s, 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. A comparison of FY21 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, Roxburgh and Saddlers pits. One Blast in Saddlers Pit on 13 August 2020 exceeded the 50mm/s Public Infrastructure criteria at Transgrid 2 and Transgrid 3 locations. The exceedance event was reported to DPIE, following investigation a warning was issued by DPIE.

Table 10: Summary of statutory blast monitoring results

Parameter	Statistic	FY21	FY20	FY19
Ground vibration (mm/s)	Average	0.24	0.21	0.27
	Maximum valid result	8.55 (at BP09)	5.96 (at BP09)	5.51 (at BP09)
	Valid blasts above 5 mm/s threshold	4	1	2
Airblast overpressure (dBL)	Average	94.6	95.3	95.1
	Maximum valid result	119.6 (at BP09)	117.7(at BP10)	120.6 (at BP09)
	Valid blasts above 115 dBL threshold	6	4	5

6.2.3 Complaints and Reportable Incidents

During the reporting period, 9 blast complaints were recorded. 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 and improvements to the predictive model, which is periodically audited externally, will be undertaken in FY22, allowing for increased accuracy in determining the vibration and overpressure at the design stage.

Review relocation options for BP09 to improve blast monitoring accuracy at neighbouring privately owned residences. If deemed appropriate relocate BP09.

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 99.85 per cent at WS09 and 98.87 percent at WS10.

Total rainfall (WS09) for the reporting period was 858 mm, which is approximately 39 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 (Winter/Spring) and south-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 generally lower than previous years, which can primarily be attributed to the increased rainfall in FY21 which was 39% above the long-term average, see Section 6.3.

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
		FY21	FY20	FY19		
Edderton Homestead (DD08)	4 g/m^2/ month	1.7	2.0	2.0	No exceedances	Continue dust management in accordance with AQMP
Roxburgh Road (DD14)		2.7	3.0	2.6		

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 all monitors remained above the 90 percent target, as shown below:

- DC02 – 97%
- DC04 – 97%
- DC05 – 96%
- DC06 – 97%
- DC07 – 91%
- DC08 – 95%
- DC09 – 98%
- DC10 – 98%
- DC11 – 94%
- DC12 – 92%
- DC13 – 99%

During the reporting period, the short term 24-hour cumulative impact assessment criteria was exceeded 10 times at statutory TEOM monitoring sites over a total of 7 days. All exceedances of the cumulative criteria were reported to the DPIE, 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 from FY20 through to FY21. This trend may be attributed to higher rainfall in FY21 which was 39% above the long-term average, see Section 6.3.

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
			FY21		FY20		FY19			
			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	63	20	217#	27	223#	30	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	79	19	194#	20	163*	25		
Roxburgh Road (DC05)		19	43	11	213#	13	124*	21		
Edderton Homestead (DC06)		N/A	36	11	215#	14	107*	19		
Antiene (DC07)		18	52	15	209#	20	146#	20		
Wellbrook (DC09)		17	53	15	194#	23	168*	25		

* This result, which includes air emissions from all sources, was investigated as it exceeded the short term 24-hour impact assessment criterion of 50 µg/m3. Investigations found the incremental increase in concentrations due to the Mt Arthur Coal project was less than the criterion.
# 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 ($\mu g/m^3$)	Mt Arthur Coal contribution ($\mu g/m^3$) (incremental impact)	Declared extraordinary event by Secretary *
19/08/2020	DC02	55.9	0.0	No
16/10/2020	DC02	51.3	1.6	No
21/11/2020	DC04	78.5	0.5	No
22/11/2020	DC04	53.2	2.0	No
29/11/2020	DC02	58.8	0.9	No
	DC04	50.5	3.7	
	DC07	52.6	5.9	
	DC09	53.3	0.8	
16/01/2021	DC04	50.1	15.1	No
15/04/2021	DC02	52.8	12.8	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.

There were no days where the mine contribution was found to have caused an exceedance of the criteria. On the specified dates in Table 13, Mt Arthur Coal implemented reasonable and feasible mitigation measures in line with Table 2 of the Mt Arthur Coal Air Quality Management Plan.

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 FY20 and FY19, which may be attributed to the increased rainfall in FY21 which was 39% 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 ($\mu g/m^3$)			Trend / key management implications	Implemented / proposed management actions
		FY21	FY20	FY19		
Sheppard Avenue (DC02)	Long term annual average: 90 $\mu g/m^3$	50	68	75	No exceedances	Continue dust management in accordance with AQMP
South Muswellbrook (DC04)		47	50	61		
Roxburgh Road (DC05)		27	33	53		
Edderton Homestead (DC06)		27	35	46		
Antiene (DC07)		38	50	51		
Wellbrook (DC09)		38	58	61		

Complaints and Reportable Incidents

Four dust-related complaints were received from 3 sources (2 residents and 1 via the regulator) during the reporting period. This is a decrease from 6 complaints from 5 complainants in FY21. Investigations indicated that real-time dust levels and 24-hour averages remained within regulatory limits at the monitoring location nearest to the complainants.

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

6.4.3 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.

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 (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 (99 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) (495 hectares);
- Roxburgh Road 'Constable' Offset Area (109 hectares); and
- Middle Deep Creek Offset Area (1245.5 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 24 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.

40ha of planting was completed in FY21 split between the Thomas Mitchell Drive Offset Area off-site and on-site offset areas.

Weed Assessment and Treatment

Mt Arthur Coal conducted an annual weed assessment in FY21. This included:

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

The above work was combined into a site weed action plan to be 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*). Additional programs introduced and conducted in FY20 included:

- A shooting program targeting wild dogs (*Canis lupus familiaris*), foxes (*Vulpes vulpes*), feral cats (*Felis catus*), rabbits (*Oryctolagus cuniculu*) and hares (*Leporidae lepus*); and
- A baiting program targeting wild dogs (*Canis lupus familiaris*), foxes (*Vulpes vulpes*), feral cats (*Felis catus*).

6.5.2 Environmental Performance

The annual ecological development monitoring program, consisting of vegetation community assessment and fauna surveys, was undertaken in October - December 2020 by independent consultants. The REMP monitoring schedule identifies a total of 12 monitoring sites scheduled to be monitored in FY21; however, two of the monitoring sites (OAK3 and MDC5) were not monitored as they did not meet minimum vegetation height thresholds (i.e. minimum height of 3 m) identified in the REMP to trigger commencement of monitoring. Those sites are listed in Table 15.

Table 15: FY21 ecological development monitoring sites

Site Name	Site Location	Vegetation Type (PCT No.)	Treatment Type	Easting (MGA56)	Northing (MGA56)	First Year of Monitoring
VB3	Visual Bund - Box Gum Woodland Establishment Area	Box Gum Woodland (1606)	Rehabilitation	298529	6423293	2008 (FY09)
Dump 11	Dump 11 - Eastern Woodland Corridor	Woodland (1604)	Rehabilitation	302822	6420201	2019 (FY20)
MD1	Main Dam - Eastern Woodland Corridor	Woodland (1604)	Rehabilitation	301408	6420437	2020 (FY21)
SDC1	Saddlers Creek Central - Southern Woodland Corridor	Woodland (1604)	Rehabilitation	299548	6414655	2020 (FY21)
MA8	Mt Arthur - Conservation Area	Red Gum Grassy Forest (1608)	Reference	297538	6417357	2014 (FY15)
SC9	Saddlers Creek - Southern Woodland Corridor	Hunter Floodplain Red Gum Complex (42)	Reference	299272	6413895	2021 (FY21)
TMOF2	Thomas Mitchell Drive - Offsite Offset Area	Central Hunter Box – Ironbark Woodland - Ironbark Dominated (1691)	Reference	301903	6423266	2004 (FY05) - Flora, 2007 (FY08) - Fauna
MDC1	Middle Deep Creek West - Offset Area	Blakely's Red Gum – Yellow Box Grassy Woodland (281)	Reference	314749	6487148	2014 (FY15)
MDC2	Middle Deep Creek West - Offset Area	White Box – Blakely's Red Gum Grassy Woodland (618)	Reference	313727	6487320	2014 (FY15)
MDC3	Middle Deep Creek West - Offset Area	Blakely's Red Gum – Yellow Box Grassy Woodland - DNG (1684)	Reference (Natural Regeneration)	312029	6487948	2016 (FY17)

Four nest box monitoring locations were also monitored (MACT, TMD Onsite, Saddlers Creek and Mt Arthur).

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: Flora and fauna species recorded and condition assessment scores

Item	Rehabilitation Site				Reference Site					Reference Site (Natural Regeneration)
	VB3	Dump 11	MD1	SDC1	MA8	SC9	TMOF2	MDC1	MDC2	MDC3
Native species (No.)	13	10	18	19	60	58	48	36	36	49
Native species (% of total)	48%	38%	55%	54%	88%	85%	86%	73%	65%	78%
Introduced species (No.)	14	16	15	16	8	10	8	13	19	14
Introduced species (% of total)	52%	62%	45%	46%	12%	15%	14%	27%	35%	22%
Total species	27	26	33	35	68	68	56	49	55	63
Total condition score out of 32	**22 (69%)**	**18 (56%)**	**22 (69%)**	**23 (72%)**	**29 (91%)**	**21 (66%)**	**27 (84%)**	**29 (91%)**	**29 (91%)**	**24 (75%)**

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 FY21 represents the second monitoring event for this site (first monitoring event utilising the BAM for the collection of floristic data).

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* individuals. A small open shrub layer is present that includes the natives *Solanum cinereum* (Narrawa Burr), *Dodonaea viscosa* subsp. *angustifolia* (Sticky Hop-bush) and *Enchylaena tomentosa* (Ruby Saltbush). The ground stratum is dominated by the exotic grass *Megathyrsus maximus* (80% cover) as well as *Paspalum dilatatum* (Paspalum) and *Galenia pubescens* (Galenia).

The total fauna species richness recorded at VB3 in FY21 was 15 species. Species richness increased by five species from FY18 to FY21, likely as a result of the continued growth of rehabilitated vegetation providing better habitat for fauna. The low species richness is attributed to the area being on an exposed slope with limited foraging resources, few refugia sites and minimal connectivity to larger areas of habitat.

No threatened fauna species were recorded at VB3.

Two introduced species were recorded and included the European Rabbit (*Oryctolagus cuniculus*) and House Mouse (*Mus musculus*). High numbers (estimated to be over 100) of the European Rabbit were observed. Species richness increased by five from FY18 to FY21, likely as a result of the continued growth of rehabilitated vegetation providing better habitat for fauna.

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 FY21 represents the second monitoring event for this site.

The vegetation canopy is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus blakelyi* (Blakely's Red Gum) with few small regrowth trees present. The shrub layer is sparse and includes regrowth canopy trees as well as the exotic shrubs *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* (30% cover), *Melinis repens* (Red Natal Grass) and *Asphodelus fistulosus* (Onion Weed). Native groundcovers are present in low numbers and include *Aristida ramosa* (Purple Wire Grass), *Vittadinia muelleri* and *Sida corrugata* (Corrugated Sida).

The total fauna species richness recorded at Dump 11 in FY21 was 10 species. The low species richness is attributed to the area being on an exposed slope with limited foraging resources, few refugia sites and minimal connectivity to larger areas of habitat. No threatened fauna species or introduced species were recorded at Dump 11.

Species richness decreased by two from FY20 to FY21, but this decrease includes the introduced European Rabbit, which was recorded in FY20, but not in FY21 (i.e. reduction in one native species from FY20 to FY21).

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 FY21 represents the first monitoring event for this site.

A tree canopy is yet to develop at this site with only small trees/shrubs present (5-19 cm DBH) comprised of *Corymbia maculata* (Spotted Gum) and *Acacia salicina* (Cooba) individuals. The ground stratum is dominated by the exotic grass *Megathyrsus maximus* (20% cover) as well as *Galenia pubescens* (Galenia). Native groundcovers are present in low numbers and coverage, and include the grasses *Eriochloa pseudoacrotricha* (Early Spring Grass) and *Microlaena stipoides* var. *stipoides* (Weeping Grass).

The total fauna species richness recorded at MD1 in FY21 was 16 species. The low species richness is attributed to the area being isolated and surrounded by previously cleared areas and having limited refugia sites with no tree hollows.

Two threatened fauna species were recorded at MD1 which included the Grey-headed Flying-fox (*Pteropus poliocephalus*) and the Eastern Bentwing-bat (*Miniopterus orianae oceansis*), which are both listed as vulnerable under the BC Act, and the Grey-headed Flying-fox also listed as vulnerable under the EPBC Act. No introduced species were recorded at MD1.

As this site has not been previously monitored for fauna, no comparison can be made to previous years of monitoring.

SDC1

This monitoring site is a rehabilitation site located in the southern rehabilitation woodland corridor near Saddlers Creek. Rehabilitation of the site finished in FY16, 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 therefore FY21 represents the first monitoring event for this site.

A tree canopy is yet to develop at this site with only small trees/shrubs present (5-9 cm DBH) dominated by *Acacia falciformis* (Broad-leaved Hickory) (40% cover). Additional small trees shrubs include *Corymbia maculata* (Spotted Gum), *Acacia salicina* (Cooba) and *Acacia parvipinnula* (Silver-stemmed Wattle) individuals. The ground stratum is dominated by the exotic grass *Cenchrus clandestinus* (Kikuyu Grass) (50% cover) as well as *Bidens pilosa* (Cobbler's Pegs) and *Carthamus lanatus* (Saffron Thistle). Native groundcovers are present in low numbers and coverage, and include the grasses *Eriochloa pseudoacrotricha* (Early Spring Grass) and *Panic effusum* (Hairy Panic).

The total fauna species richness recorded at SDC1 in FY21 was 17 species. The relatively low species richness is attributed to the area being isolated and surrounded by previously cleared areas and having limited refugia sites with no tree hollows.

No threatened fauna species were recorded at SDC1 and one introduced species, the Brown Hare (*Lepus capensis*), was recorded.

MA8

This monitoring site is a reference site located within the Mt. Arthur Conservation Area. The monitoring site was established in FY15 (formerly referred to in the REMP as MTA1) with the vegetation present considered to be 'best-fit' to PCT 1608 Grey Box – Grey Gum – Rough-barked Apple – Blakely's Red Gum grassy open forest of the central Hunter. The monitoring site was established in FY15; however, FY21 represents the first monitoring event as part of the REMP, and second time floristic data was collected utilising the BAM (BAM data also collected in FY20 as part of separate Conservation Agreement monitoring).

The vegetation canopy is dominated by *Eucalyptus blakelyi* (Blakely's Red Gum) (35% cover). The shrub layer is sparse and includes regrowth canopy trees as well as the native shrubs *Notelaea microcarpa* (Native Olive) and *Spartothamnella juncea* (Bead Bush). The ground layer is dominated by native grasses and forbs including *Aristida ramosa* (Purple Wiregrass) (60% cover), *Austrostipa scabra* (Speargrass) and *Desmodium brachypodum* (Large Tick-trefoil). Exotic groundcovers occur in low numbers/cover and include *Sonchus oleraceus* (Common Sowthistle) and *Senecio madagascariensis* (Fireweed). A significant increase in groundcovers' richness and cover was recorded between monitoring years. This is attributed to the break in drought conditions that occurred between monitoring years.

The total fauna species richness recorded at MA8 in FY21 was 25 species. The relatively moderate species richness is attributed to the presences of foraging resources and refugia sites due to the presence of logs, woody debris and hollow-bearing trees in surrounding areas. The area also has connectivity to larger areas of habitat.

Two threatened fauna species were recorded at MA8 which included the Large-eared Pied Bat (*Chalinolobus dwyeri*) and the Eastern Bentwing-bat (*Miniopterus orianae oceansis*), which are both listed as vulnerable under the BC Act, and the Large-eared Pied Bat also listed as vulnerable under the EPBC Act.

Two introduced species were recorded which included the Dog (*Canis lupus familiaris*) and Brown Hare (*Lepus capensis*).

SC9

This monitoring site is a reference site located within the Saddlers Creek Conservation Area. The monitoring site was established in FY20 as part of separate Conservation Agreement monitoring and FY21 marks the first year of monitoring under the REMP. The vegetation present considered to be 'best-fit' to PCT 42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley.

The vegetation canopy is co-dominated by *Eucalyptus blakelyi* (Blakely's Red Gum) (20% cover) and *Eucalyptus albens x moluccana* (20% cover). The shrub layer is sparse and includes regrowth canopy trees as well as the native shrubs *Bursaria spinosa* (Native Blackthorn) and *Solanum cinereum* (Narrawa Burr). The ground layer is dominated by native grasses and forbs including *Themeda triandra* (30% cover), *Poa sieberiana* (Snowgrass) and *Dianella revoluta* (Blueberry Lily). Exotic groundcovers are in low numbers/cover and include *Bryophyllum delagoense* (Mother of millions) and *Senecio madagascariensis* (Fireweed).

The total fauna species richness recorded at SC9 in FY21 was 31 species. The relatively high l species richness is attributed to the presence of foraging resources and refugia sites due to the presence of logs, woody debris and hollow-bearing trees in surrounding areas. The area also has connectivity to larger areas of habitat.

One threatened fauna species was recorded at SC9 which included the Eastern Bentwing-bat (*Miniopterus orianae oceansis*) listed as vulnerable under the EPBC Act. No introduced species were recorded at this site. As this site has not been previously monitored for fauna, no comparison can be made to previous years of monitoring.

TMOF2

This monitoring site is a reference site within the Thomas Mitchell Drive Offsite Conservation Area. The monitoring site was established in FY20 as part of separate Conservation Agreement monitoring and FY21 marks the first year of monitoring under the REMP. The vegetation present considered to be 'best-fit' to PCT 1691 Narrow-leaved Ironbark – Grey Box grassy woodland of the central and upper Hunter. The vegetation canopy is dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark) (30% cover) and a sparce shrub layer that includes regrowth canopy trees as well as the native shrubs *Acacia decora* (Western Silver Wattle) and *Eremophila debilis* (Amulla). The ground layer is dominated by native grasses and forbs including *Microlaena stipoides* var. *stipoides* (Weeping Grass) (30% cover), *Aristida ramosa* (Purple Wiregrass) and *Dianella longifolia* (Blueberry Lily). Exotic groundcovers are in low numbers/cover and include *Opuntia stricta* (Common Prickly Pear) and *Galenia pubescens* (Galenia).

The total fauna species richness recorded at TMOF2 in FY21 was 31 species. The relatively high species richness is attributed to the presence of foraging resources and refugia sites due to the presence of logs, woody debris and hollow-bearing trees in surrounding areas. The area also has connectivity to larger areas of habitat. No threatened fauna species were recorded at TMOF2. Two introduced species were recorded at TMOF2 which included European Rabbit (*Oryctolagus cuniculus*) and Brown Hare (*Lepus capensis*).

As this site has not been previously monitored for fauna, no comparison can be made to previous years of monitoring.

MDC1

This monitoring site is a reference site within the Middle Deep Creek Conservation Area. The monitoring site was established in FY15 with the vegetation present considered to be 'best-fit' to PCT 281 Rough-barked Apple – Red Gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion. The monitoring site was established in FY15; however, FY21 represents the first monitoring event as part of the REMP, and second time floristic data was collected utilising the BAM (BAM data also collected in FY20 as part of separate Conservation Agreement monitoring).

The vegetation canopy is dominated by *Eucalyptus blakelyi* (Blakely's Red Gum) (25% cover) with *Eucalyptus albens x moluccana* less common. The shrub layer is sparce and includes regrowth canopy trees as well as the native shrubs *Olearia elliptica* (Sticky Daisy-bush) and *Solanum cinereum* (Narrawa Burr). The ground layer is dominated by native grasses and forbs including *Aristida ramosa* (Purple Wiregrass) (30% cover) and *Sigesbeckia orientalis* (Indian Weed). Exotic groundcovers are in low numbers/cover and include *Trifolium arvense* (Haresfoot Clover) and *Lolium perenne* (Perennial Ryegrass).

The total fauna species richness at MDC1 in FY21 was 38 species. The relatively high species richness is attributed to the presence of foraging resources and refugia sites due to the presence of logs, woody debris and hollow-bearing trees in surrounding areas. The area also has connectivity to larger areas of habitat.

Three threatened fauna species were recorded at MDC1 which included the Little Bentwing-bat (*Miniopterus australis*), Little Lorikeet (*Glossopsitta pusilla*) and Diamond Firetail (*Stagonopleura guttata*), which are all listed as vulnerable under the BC Act. No introduced species were recorded.

Species richness decreased by 11 from FY20 to FY21, but this decrease includes two introduced species, which were recorded in FY20, but not in FY21 (i.e. reduction in nine native species from FY20 to FY21).

MDC2

This monitoring site is a reference site within the Middle Deep Creek Conservation Area. The monitoring site was established in FY15 with the vegetation present considered to be 'best-fit' to PCT 618 White Box x Grey Box - Red Gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley. The monitoring site was established in FY15; however, FY21 represents the first monitoring event as part of the REMP, and second time floristic data was collected utilising the BAM (BAM data also collected in FY20 as part of separate Conservation Agreement monitoring).

The vegetation canopy is dominated by *Eucalyptus albens x moluccana* (20% cover) with *Eucalyptus blakelyi* (Blakely's Red Gum) less common. The shrub layer is sparce and includes regrowth canopy trees as well as the

native shrubs *Bursaria spinosa* (Native Blackthorn), *Olearia elliptica* (Sticky Daisy-bush) and *Cassinia quinquefaria.* The ground layer is dominated by native grasses and forbs including *Poa sieberiana* (Snowgrass) (30% cover), *Aristida ramosa* (Purple Wiregrass) and *Sigesbeckia orientalis* (Indian Weed). Exotic groundcovers are in low numbers/cover and include *Trifolium arvense* (Haresfoot Clover) and *Lolium perenne* (Perennial Ryegrass).

The total fauna species richness recorded at MDC2 in FY21 was 43 species. The relatively high l species richness is attributed to the presence of foraging resources and refugia sites due to the presence of logs, woody debris and hollow-bearing trees in surrounding areas. The area also has connectivity to larger areas of habitat.

Two threatened fauna species were recorded at MDC2 which included the Little Lorikeet (*Glossopsitta pusilla*) and Dusky Woodswallow (*Artamus cyanopterus*), which are both listed as vulnerable under the BC Act. One introduced species was recorded which included the Dog (*Canis lupus familiaris*).

Species richness decreased by seven from FY20 to FY21. This includes one introduced species recorded in FY21 that was not recorded in FY20 (i.e. reduction in six native species from FY20 to FY21).

MDC3

This monitoring site is a reference site (natural regeneration of derived native grassland) within the Middle Deep Creek Conservation Area. The monitoring site was established in FY17 with the vegetation present considered to be 'best-fit' to PCT 1684 Silvertop Stringybark - Rough-barked Apple - Bundy open forest of the Liverpool Ranges and Northern Tablelands escarpment. The monitoring site was established in FY17 and FY21 represents the third monitoring event for this site (first monitoring event utilising the BAM for the collection of floristic data).

The vegetation lacks a canopy or shrub layer. The ground layer is dominated by native grasses including *Microlaena stipoides* (Weeping Grass) (60% cover), *Cynodon dactylon* (Common Couch) and *Aristida ramosa* (Purple Wiregrass). Exotic groundcovers are in low numbers/cover and include *Carthamus lanatus* (Saffron Thistle), *Cirsium vulgare* (Spear Thistle) and *Trifolium arvense* (Haresfoot Clover).

The total fauna species richness recorded at MDC3 in FY21 was 18 species. The relatively low species richness is attributed to the area being a grassland area with limited foraging resources, few refugia sites and minimal connectivity to larger areas of habitat. No threatened fauna species or introduced species were recorded at MDC3.

Species richness decreased by six from FY20 to FY21.

Nest Box Monitoring Results

Nest box monitoring was conducted at MACT, TMD Onsite, Saddlers Creek and Mt Arthur in FY21. The results of the FY21 nest box monitoring were broadly comparable with the previous year of monitoring (Table 17.). Fluctuations in fauna richness and abundance as observed through monitoring are considered to be natural variations and/or a result of the current condition of the nest boxes, and not attributable to mining-related activities.

Overall, the condition of the nest boxes monitored in FY21 was considered to be low with 16 nest boxes or approximately 31% of boxes requiring replacement or repair. This is an increase of nest boxes requiring replacement or repair identified in FY18, FY19 and FY20, noting that no nest boxes previously identified as requiring replacement/repair were replaced or repaired in previous years.

A summary of the next box monitoring for each site is provided in Table 17.

Table 17: Nest box occupancy rates and species

Nest Box Site	Number of Nest Boxes	Number of Nest Boxes Occupied	Occupancy Rate (%)
MACT	14	2	14
TMD Onsite	6	1	17
Saddlers Creek	7	1	14
Mt Arthur	24	10	42

6.5.3 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. An assessment of the rehabilitation site VB3 against specific performance and completion criteria for rehabilitated vegetation is shown in Table 18 and is taken from the MOP.

Table 18: VB3 assessment against MOP completion criteria

Relinquishment Criteria	Relinquishment Criteria
Phase – 4. Ecosystem and Land use Establishment	
The Box-Gum reestablishment area based on the north-eastern slope of Visual Dump 1, and shown on Plan 4, will be established with a species mix (seed or tubestock) drawn from the species list presented in Section 7 for Central Hunter Box - Ironbark Woodland or Central Hunter Ironbark - Spotted Gum – Grey Box Forest.	Partially compliant for isolated stand of woodland at this monitoring site. On a whole site basis, this criterion will not be fully compliant until all rehabilitation has been undertaken in the woodland corridor.
All structural dominant species represented compared with analogue site.	Partially compliant. No current analogue site currently monitored, however all layers contain species characteristic of Box Gum Woodland as identified in the community's planting list in Table 12 of the MOP. Ground layer is currently dominated by the exotic species *Megathyrsus maximus* (80% cover).
The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm is comparable to that of the local remnant vegetation.	Unlikely to be compliant. The diversity, percentage and density of shrubs and juvenile trees with a stem diameter of <5cm are below benchmark values. Once an appropriate reference site is monitored, better comparisons can be made to local remnant vegetation.
The total number of live native plant species is comparable to the local remnant vegetation.	Unlikely to be compliant. The total number of live native plant species is likely less than local remnant vegetation. Once an appropriate reference site is monitored, better comparisons can be made to local remnant vegetation.
The number of tree, shrub and sub-shrub species is comparable to that of the local remnant vegetation.	Unlikely to be compliant. The total number of tree, shrub and sub-shrub species is likely less than local remnant vegetation. Once an appropriate reference site is monitored, better comparisons can be made to local remnant vegetation.
Establishment of groundcover, understory and canopy according to Table 7 of the MOP.	Not compliant. Established covers for groundcovers, understorey and canopy are well below covers identified in Table 7 of the MOP.
Fauna monitoring of natural and introduced habitat indicates colonisation by native species.	Compliant. Fauna monitoring indicates colonisation of small woodland bird species they do not require hollows.
Number of weed species and surface area comparable to reference sites.	Not compliant. Number of weed species and surface area is high (92% cover). Once an appropriate reference site is monitored, comparisons to a reference site can be made.
Program implemented for fuel load assessment and reduction, with advice from NSW Rural Fire Service.	Unknown
Pest animal infestation comparable to reference sites.	Not compliant. Site has high numbers of the European Rabbit.
Erosion comparable to surrounding non-mined landforms of similar topography.	Compliant. No significant areas of erosion recorded.

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.

An assessment of the rehabilitation site Dump 11 against specific performance and completion criteria for rehabilitated vegetation is shown in Table 19 and is taken from the MOP.

Table 19 Dump 11 assessment against MOP completion criteria

Relinquishment Criteria	Dump 11 (Domain D)
Phase – 4. Ecosystem and Landuse Establishment	
All areas shown as Native Woodland vegetation community in Plan 4, planted with a native species mix (seed or tubestock) targeted at establishing an open grassy woodland vegetation community.	Partially compliant for isolated stand of woodland at this monitoring site. On a whole of site basis, this criterion will not be fully compliant until all rehabilitation has been undertaken in the woodland corridor.
Rehabilitation species composition (seedmix or tubestock) drawn from the species list in Section 7 of the MOP.	Compliant. Species composition includes species listed in Section 7 (Table 11 of the MOP).
All structural dominant species represented compared with analogue site.	Not compliant. No current analogue site currently monitored, however the site lacks a native shrub layer and low species diversity for all other structural layers.
The diversity, percentage and density of shrubs and juvenile trees with a stem diameter <5cm is comparable to that of the local remnant vegetation.	Unlikely to be compliant. No shrubs or juvenile trees with a stem diameter of <5cm are present.
The total number of native plant species is comparable to the local remnant vegetation.	Unlikely to be compliant. The total number of live native plant species is likely less than local remnant vegetation. Once an appropriate reference site is monitored, better comparisons can be made to local remnant vegetation.
The number of tree, shrub and sub-shrub species is comparable to that of the local remnant vegetation	Unlikely to be compliant. The total number of tree, shrub and sub-shrub species is likely less than local remnant vegetation. Once an appropriate reference site is monitored, better comparisons can be made to local remnant vegetation.
Species composition for revegetation will be aimed at establishing a complex community structure consisting of groundcover, understory and canopy according to Table 7 of the MOP.	Partially compliant. Revegetation was aimed at establishing community structure, however, established covers for groundcovers, understorey and canopy are well below covers identified in Table 7 of the MOP.
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.	Not compliant. No nesting boxes/natural habitat features are present.
Number of weed species and surface area comparable to local remnant vegetation.	Not compliant. Number of weed species and cover (37%) is higher than total native cover (26% cover). Once an appropriate reference site is monitored, comparisons to a reference site can be made.
Program implemented for fuel load assessment and reduction, with advice from NSW Rural Fire Service	Unknown
Pest animal infestation comparable to reference sites.	Compliant. No feral animals recorded.
Where adjacent to selected grazing or operational mining land, adequate fencing and signage is installed and maintained to prevent unintentional vehicle and livestock access.	Compliant. Access is restricted through fencing and signage.
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 Resources Regulator Synoptic Plan.	Compliant. Rehabilitated areas will link areas of onsite and near-site vegetation.
Erosion comparable to surrounding non-mined landforms of similar topography.	Compliant. No significant areas of erosion recorded.

6.5.4 Weed Control

FY21 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.

All this work was combined into a Weed Management Action Plan. This represents a focus on independent advice and an increased effort in the assessment process to obtain measurable data.

The following weed species were targeted during the reporting period:

- *Acacia saligna*;
- 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*)
- Thornapple (*Datura stramonium*)
- Marshmallow weed (*Malva parviflora*)
- Artichoke thistle (*Cynara cardunculus L*.)
- Sweet briar (*Rosa rubiginosa*)
- Cobblers pegs (*Bidens pilosa*)
- Cotton bush (*Gomphocarpus sp.*);
- Galenia (*Galenia pubescens*)
- St Johns Wort (Hypericum perforatum)
- Stinking Roger (*Tagetes minuta*); and
- African Turnip weed (*Sisymbrium thellungii*).

The treatment focused in the north eastern portion of the site, including the VD1 and CD1 rehabilitation areas, operational area surrounding the Environmental Dam and western areas of the site off of Edderton Rd. Weed treatment for Biodiversity Offset Areas treated for included:

- Thomas Mitchell Drive Onsite Offset Area
- Thomas Mitchell Drive Offsite Offset Areas
- Saddlers Creek Offset Area
- Middle Deep Creek Offset Area

Refer to Appendix 6 for figures showing weed treatment locations.

Pest Animal Control

During May 2021 a 1080 baiting campaign with the intent of targeting wild dog and fox baiting was completed across the Mt Arthur Coal mine site and adjacent conservation areas. During the campaign 162 baits were laid across 51 locations, with 70 baits taken.

Table 20 shows the breakdown of species and baits taken.

Table 20: 1080 Baiting control program results for FY21

Species	Count
Fox	20
Wild Dog	20
Unknown takes	16
Crow	5

Kangaroo harvesting program is on hold due to operational changes requiring a review into how to complete the work safely.

6.5.5 Complaints and Reportable Incidents

There were no biodiversity complaints received in FY21. 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.

6.5.6 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 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.

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 July of 2020. 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.

6.6.3 Complaints and Reportable Incidents

During the reporting period, 14 lighting complaints were received from four complainants, which is lower than FY20 (18 from three complainants). On notification of the complaints, immediate action was taken to locate and redirect the offending light/s, in response to addressing the complainants' 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 cultural heritage management plan was completed and has been provided to the Registered Aboriginal Parties for consultation.

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:

- Exploration Drill Site Rehabilitation
- Minor changes to roads, access tracks and powerlines
- Offset Planting Areas
- Hazard reduction burn site at Thomas Mitchell Drive Offsite Offset.

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

The reviewed Aboriginal Heritage Management Plan will be submitted to DPIE and implemented during the 2022 reporting year. HVEC 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.

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, conserve and manage 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

During the reporting period, Mt Arthur Coal inspected all of its historic homesteads and related buildings located on freehold land to ensure properties were maintained to an acceptable standard.

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 owned by Mt Arthur Coal.

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-028 Storage of Fuels and Chemicals;
- 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.

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.
- The explosives reload and explosives magazine compound areas were relocated to facilitate dump progressions with the old facilities decommissioned. Site inspection and desk-based review of previous historical records indicated the explosives magazine compound presented a negligible risk to the environment and the area was discounted from further assessment. Further investigation was undertaken at the Reload Facility and comprised
    - the drilling of 8 borehole locations;
    - collection of surface and subsurface soil samples;
    - collection of surface water and sediment samples;
    - analysis of samples by National Association of Testing Authority (NATA) accredited laboratories and data evaluation and reporting.

  The available data indicated that widespread contamination was not present, the identified contamination that was identified presents a low risk to human health and the environment both on and off-site.

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 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 6833m² of land was treated for spontaneous combustion in the reporting period. A summary of spontaneous combustion in the reporting period is shown in Table 21.

Table 21: Summary of spontaneous combustion at Mt Arthur Coal in FY21

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	10201	0	3098	3497	10600
August	10600	0	1016	365	9948
September	9948	0	853	73	9168
October	9168	0	983	310	8494
November	8494	0	0	169	8663
December	8663	0	284	67	8447
January	8447	0	427	0	8020
February	8020	0	0	0	8020
March	8020	0	0	0	8020
April	8020	0	64	39	7995
May	7995	81	108	1087	8892
June	8892	0	0	0	8910
Total		0	6834	5606	

6.10.3 Complaints and Reportable Incidents

During the reporting period, there were no complaints regarding odour from 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.

In accordance with the approved mine operations plan, overburden material will continue to be emplaced over current emplacement areas at Bayswater No. 2. This will be carried out in alignment with the design of the extension of the existing tailings storage facility, which is planned to encompass most of this area, and will ultimately treat a significant portion of identified spontaneous combustion 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 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 GHG emissions were 631 kt CO_2-e in the FY21 reporting period, of which direct (scope 1) emissions accounted for 87 per cent, and scope 2 emissions from the use of grid-based electricity accounted for the remaining 13 per cent. As in the previous reporting period, Mt Arthur Coal used NGER Method 2 measurement of its open cut fugitive emissions, which increased in absolute terms (to 55 kt CO_2-e) and as a proportion of total scope 1 emissions (ten per cent). Fugitive emissions are expected to continue increasing over time as mining progresses into areas with higher *insitu* methane contents.

Fuel combustion will continue to constitute the bulk of emissions from Mt Arthur Coal, accounting for 90 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 (94 per cent), with other fuels accounting for one 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 and has established a company-wide short-term target to maintain FY2022 emissions at or below FY2017 levels while it continues to grow its business. The company also has set medium and longer term goals of achieving at least 30% emissions reduction below 2020 levels by 2030 and net-zero operational emissions by 2050. In 2019, BHP announced a five–year US$400M Climate Investment Program to support funding of initiatives to reduce the company's operational emissions and those related to its value chain.

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 7645 tonnes of both recycled and non-recycled waste sent off site for management. This an increase of approximately 104% per cent on the FY20 total of 3,977 tonnes. Approximately 6,450 tonnes (84 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 an increase of the FY20 percentage recycled off site total of 2,962 tonnes (74 per cent).

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.

Figure 4: Waste disposal from Mt Arthur Coal

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. 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 volunteer 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.

7 Water Management

Water at Mt Arthur Coal is managed in accordance with:

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

The MAC-ENC-MTP-034 Site Water Management Plan was revised during the reporting period, submitted to DPIE in April 2020 the WMP was approved by DPIE in February 2021.

The revised WMP incorporates each of the site water management documents

- MAC-ENC-PRO-059 Site Water Balance;
- MAC-ENC-PRO-061 Surface Water Monitoring Program;
- MAC-ENC-PRO-062 Ground Water Monitoring Program (GWMP); and
- MAC-ENC-PRO-063 Surface and Ground Water Response Plan.

7.1 Water Balance

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 did not discharge water into the Hunter River from its licensed discharge point under the Hunter River Salinity Trading Scheme (HRSTS) during the reporting period.

Water use totaled 8,205 ML during the reporting period. The use is a total of model outputs including evaporation, product entrainment and task loss. This is comparable to the 8,100 ML used in FY20.

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

Mt Arthur Coal extracted 2526.6 ML from the Hunter River under water extraction licence, shown in Table 22.

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 22: Water take for FY21

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	-	0	0
WAL 918 20AL201127	Hunter Regulated River Water Source (General Security), Zone 1A Management Zone	3,564	-	2526.6	2526.6
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.

7.1.1 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 (WMP);

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 23, with further results presented in 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.

Riparian vegetation monitoring program was not able to be undertaken during the report period due to Covid controls restricting travel and access to site by external subject matter experts based in Sydney,. Monitoring will commence as soon as practicable pending the easing of NSW travel restrictions.

Improvements that occurred during the reporting period include:

- The amelioration of dispersive soils were made as part of the FY21 rehabilitation program;
- New sediment controls including sediment control ponds; and
- New Sediment Control Dam for expanded overburden emplacements in the conveyor corridor and upper Saddlers Creek catchment, was 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).
- Erosion and sediment controls were implemented as part of the Permit to Disturb process and inspected on an as needed basis.

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

New sediment dams and drainage for expanded overburden emplacements in 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).

Areas prone to erosion with exposed dispersive soils are focused in freshly established rehabilitation areas. These areas undergo annual landform stability assessments as per MAC-ENC-PRO-080 Rehabilitation and Ecological Monitoring Procedure.

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);

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

Mt Arthur Coal's Site Water Management Plan outlines measures for managing water on site, 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.

During the reporting period Mt Arthur Coal received an Official Caution from the EPA in relation to two pipeline discharge events that occurred in the previous reporting period. The EPA also added a Pollution Reduction Study to the EPL see below;

Environment Protection Licence (L11457).

U1.1

The Licensee must undertake a review of mine water transfer pipelines at the premises to assess the risk of pollution of waters and identify any actions or works that can be reasonably and feasibly implemented to reduce the risk. A report detailing the findings and recommending upgrades must be provided to the EPA by 24 September 2021 via email to: EPA.DeliveryHub@epa.nsw.gov.au

The review and report must:

a) Be undertaken by an appropriately qualified and experienced person.

b) Assess existing mine water transfer pipelines against relevant guideline design criteria.

c) Provide a risk assessment and ranking of findings to justify recommendations.

d) Include recommendations for upgrades and improvements.

e) Include a timeline for implementation of any recommended upgrades and improvements, based on highest risk and approximate costing.

The study was commenced in this reporting period with the report due to the EPA in the following reporting period. Significant pipeline improvement work were also commenced during the reporting period to reduce the risk of pollution of waters from pipeline breaks.

7.3.2 Environmental Performance

A summary of the surface water quality data for statutory sites during the reporting period is provided in Table 23, with further results provided in Surface Water Quality Monitoring Results Appendix 1.

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 (Ramrod Creek), which recorded an elevated result in October 2020 and December 2020, the results were determined to be not as a result of Mt Arthur Coals activities, there was no flow in the creek and the pool was close

to empty at the time of sampling. Investigations have identified that the Balmoral Seam which is part of the Greta formation, subcrops through Ramrod Creek and the associated catchment areas. It is believed that this coal seam subcrop is contributing to the elevated EC levels in this area. Surface water TSS measured at individual statutory sites remained below impact assessment trigger levels during the reporting period at all statutory sites. Results are summarised in Table 23.

SW02 was dry for all standard monthly monitoring event and inaccessible during rainfall event sampling for the reporting period. SW03 was too low to sample for two months. SW04 was too low to sample for one month.

Additional rainfall event monitoring is undertaken when 24hr rainfall levels are >25mm. There were eight rainfall monitoring events during the reporting period. All parameters monitored were below impact assessment trigger levels, with the exception of SW12 which recorded an elevated result in October 2020, the level did not trigger and immediate report to the regulator. The cause of the elevated EC results is considered to be the same as detailed above.

Surface water monitoring locations are shown in Figure 5.

North

GW21
SW28
SW15
ML 1757
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 1358
X10MB
GW43
ML 1548
VWP7 1-5
EWPC33
ML 1487
SW12
A171
ML1655
MPL 263
CCL 744
CL396
ML1739
SUBLEASE CL395
SUBLEASE CL229
SW2
EL 5965
ML1593
BCGW22P
BCGW22A
GW44
GW45
GW46
GW2
SW3
GW47
A437

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 23: 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	Revised Water Management Plan approved in February 2021
	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		7.15	7.5	7.8	No assessment criteria triggered	
	EC (µS/cm)	Stage 1	10,133	485	3852	7780	No assessment criteria triggered	
		Stage 2	11,402					
	TSS (mg/L)	Stage 1	37	<5	13.3	25	No assessment criteria triggered	
		Stage 2	46					
SW04	pH	6.5 – 9.0		7.3	7.9	8.4	No assessment criteria triggered	
	EC (µS/cm)	Stage 1	13,959	422	3385	9700	No assessment criteria triggered	
		Stage 2	15,509					
	TSS (mg/L)	Stage 1	82	<5	9.3	29	No assessment criteria triggered	
		Stage 2	104					
SW12	pH	6.5 – 9.0		7.0	7.4	7.7	No assessment criteria triggered	
	EC (µS/cm)	Stage 1	6,659	2455	5273	9240	Stage 2 criteria exceeded on two non consecutive occasion 19/10/2020 and 14/12/2020 both samples were collected from pools i.e. no flow. (not a reportable exceedance). Investigations determined the levels were not as a result of mine activities	
		Stage 2	7,153					
	TSS (mg/L)	Stage 1	555	6	17	65	No assessment criteria triggered	
		Stage 2	708					
SW15	pH	6.5 – 9.0		7.4	7.7	8.1	No assessment criteria triggered	
	EC (µS/cm)	Stage 1	7,128	513	1383	8140	No assessment criteria triggered	
		Stage 2	8,262					
	TSS (mg/L)	Stage 1	103	6	31	122	Stage 1 criteria exceeded on one occasion (not a reportable exceedance)	
		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 two reportable incidents relating to surface water. Both relating to a discharge from site due to a break in a mine water pipe. Both incidents were reported to the EPA and DPIE. These incidents are discussed further in Section 11.

7.3.4 Proposed Improvements

The revised site water management plan was approved in February 2021, Mt Arthur will continue to review surface water monitoring results and performance against the revised.

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.

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 (WMP).

Mt Arthur Coal's 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 Ground Water Monitoring Program included in the WMP outlines program requirements for monitoring of potential groundwater impacts from mining operations. The WMP was revised and approved in February 2021 .This included revision of the groundwater monitoring program and groundwater trigger levels.

The Surface and Ground Water Response Plan included in the WMP outlines the response actions to be implemented, should ground water monitoring trigger values be exceeded. Management measures associated with the alluvial ground water cut-off wall and flood levee constructed parallel to Denman Road along the northern boundary of the site to prevent both surface and subsurface migration from the Hunter River to the active pit, have also been incorporated into the Surface and Ground Water Response Plan.

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 2021;
- 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.

There has been no trigger to require compensation to be provided to landowners of privately owned land whose water supply is adversely affected by the project. There have been no known groundwater impacts to landowners on privately owned land identified during the reporting period and no complaints received from landholders on privately owned land relating to groundwater impacts.

Drawdown and cut off wall performance

Groundwater level data collected from July 2020 to June 2021 have been compared to the trigger values outlined in the WMP. Only VWP04 recorded a groundwater level exceedance over the reporting period. A summary of the exceedance is presented in. An analysis of the trigger exceedance is included in Table 24.

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 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 the end of December 2013. However, the footwall of the Edinglassie Seam is no longer monitored as VWP1 has been decommissioned due to sensor failure. The VWP3 – Sensor 2 also failed in December 2020. The sensors should be replaced to continue monitoring in this area.

Groundwater levels have declined 87 m in the F4 fault, 105 m in the Edinglassie Seam and 103 m in the Ramrod Creek Seam, since installation in 2011. The Hunter River alluvium and shallow weathered sandstone (regolith) is monitored by bore GW42 which is located adjacent to the VWPs. Groundwater levels at GW42 have fluctuated over time but have remained relatively stable, with a minor increase of 0.18 m between February 2016 and June 2021. As noted in previous annual reviews (AGE, 2019; SLR, 2020a), bore GW42 fluctuates in response to rainfall and streamflow trends. Depressurisation observed in the Permian coal measures has not impacted on the Hunter River alluvium and regolith groundwater levels observed in bore GW42.

Groundwater level data is available in the area at bores close to the Hunter River (GW16, GW21, GW38A and X1MB) and close to the cut-off wall (GW42). All of the bores recorded a similar stable to slightly rising trend over the monitoring period.

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.

Table 24: Groundwater Level Trigger Exceedances

Bore ID	Screened Lithology	Location	Comment
VWP04	Vaux Seam Bayswater Seam Edderton Seam Edinglassie Seam Ramrod Creek Seam	On site - north of MAC open pit	Levels in the Vaux, Bayswater, Edderton, Edinglassie, and Ramrod Creek Seams exceeded the 2020 trigger levels between October 2020 and June 2021. The continuing declining groundwater level trend represents mining induced depressurisation as predicted for the approved operations by SLR as shown in Figure 4.1 of the Groundwater Assessment Report in Appendix 2. SLR (2020b) predicted continued drawdown in this area with simulated water levels ranging between 4.72 and -85.5 mAHD. The measured water levels ranged from 29 to -14.4 mAHD. 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.

Groundwater Quality

Water quality data collected from July 2020 to June 2021 have been compared to the trigger values outlined in the WMP. Five bores recorded a water quality exceedance over the reporting period including BCGW22A (IW4027), BCGW22P (IW4026), GW40A, GW48 and GW49.

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 the Groundwater Assessment Report in Appendix 2. An analysis of the trigger exceedances is summarised in Table 25

Table 25: Groundwater Level Trigger Exceedances

Bore ID	Screened Lithology	Location	Comment
GW40A	Hunter River Alluvium	Off site – off Denman Road, west of MAC	EC has fluctuated seasonally since monitoring began. Since September 2019 EC has increased and exceeded the 1st stage trigger level of 5290 µS/cm for the entire monitoring period. Groundwater levels have declined since 2013, despite periods of above average rainfall from 2013 to 2017. The bore is located over 3 km from active mining and the decline in levels is unique compared to bores closer to the mine area such as GW16. The bore is located on private property surrounded by houses and farm sheds and located 20 m northwest of GW48 which is screened in the Bowfield Seam. The EC levels recorded in GW40A are higher than those in GW48. Review of groundwater levels indicates similar trend for both bores, with levels in the alluvium only slightly (0.1 m) higher than levels in the coal seam. However, the logger data also indicates a sharp 0.4 to 0.6 m rise in alluvial water levels in January and March 2021 followed by a gradual decline between months. The sharp rise in groundwater levels in January and March correspond to high rainfall, with 58.2 mm falling over two days at the start of January and 131 mm falling over ten days in the middle of March. This indicates that the rise in EC is likely sourced from surface activities or potentially soil stored salts, as opposed to upward seepage from the shallow coal seam. The condition of the surface casing and depth of the bore was checked in September 2020 by CBE; no issues were identified. However, bore construction information indicates the bore is screened from around 0.5 m depth to 14.63 mbgl. The construction of the bore may be influencing the results, with the large screened interval facilitating capture of water infiltrating from surface (i.e. irrigation). The elevated EC is unlikely due to mining, and it is recommended that a replacement bore is installed with a smaller screened interval to prevent surface water infiltrating the bore
GW48	Bowfield Seam	Off site – off Denman Road, west of MAC	EC has fluctuated seasonally since monitoring began ranging from 3090 µS/cm in May 2016 to 4750 µS/cm in June 2020, with an increasing trend between September 2019 and June 2020. Between June 2020 and June 2021 levels have declined ranging between 4250 µS/cm and 4380 µS/cm. Groundwater levels have increased over the same period, with the exception of one reading in December 2020 of 115.95 mAHD, but it is likely due to a field reading error. EC exceeded the 1st stage trigger level of 4090 µS/cm for the entire monitoring period. The bore is located over 3 km from active mining on private property surrounded by houses and farm sheds and located 20 m southeast of GW40A which is screened in the Hunter River alluvium. The EC levels recorded in GW40A are higher than those in GW48. This indicates the trends for GW48 are likely influenced by local ground conditions and activities and not due to mining activities.

			The condition of the surface casing and depth of the bore was checked in September 2020 by CBE; no issues were identified. It is recommended that the condition of the bore using a downhole camera and verification of the surrounding surface activities be undertaken to determine the cause of the rising EC trend.
BCGW22A (IW4027)	Saddlers Creek Tributary/ Shallow Permian	On site - southwest of Bayswater No. 3	EC has fluctuated seasonally since monitoring began. EC has an increasing trend, ranging from 9200 µS/cm in March 2019 to 15690 µS/cm in December 2020. The 1st stage trigger level of 14100 µS/cm was exceeded for the entire monitoring period, and levels ranged between 14460 µS/cm to 17350 µS/cm over Q1 to Q4. The bore is over 2 km from active mining and 1 km from a historical rehabilitated pit. The condition of the surface casing and depth of the bore was checked in September 2020 by CBE; no issues were identified. Further review of water quality and potential water sources in the area is recommended, including the backfilled pit and water storage within McDonalds and Belmont Pits.
BCGW22P (IW4026)	Glen Munro Seam	On site - southwest of Bayswater No. 3	EC has an increasing trend, ranging from 8960 µS/cm in November 2017 to 17350 µS/cm in September 2020. The 1st stage trigger level of 14100 µS/cm was exceeded for the entire monitoring period, and levels ranged between 14460 µS/cm to 17350 µS/cm over Q1 to Q4. The bore is over 2 km from active mining and 1 km from a historical rehabilitated pit. The condition of the surface casing and the depth of the bore was checked in September 2020 by CBE; no issues were identified. Further review of water quality and potential water sources in the area is recommended, including the backfilled pit and water storage within McDonalds and Belmont Pits.
GW49	Arrowfield Seam	Off site – off Denman Road, west of Mt Arthur Open Cut	EC has fluctuated seasonally since monitoring began ranging from 5020 µS/cm in March 2019 to 7530 µS/cm in June 2020, with an increasing trend between September 2019 and June 2020. Between June 2020 and June 2021 levels have declined ranging between 6580 µS/cm and 6790 µS/cm. Groundwater levels have an increasing trend since December 2019. EC exceeded the 1st stage trigger level of 6170 µS/cm for the entire monitoring period. The bore is located over 5 km from active mining on private property in open farmland and located 15 m south of GW41A which is screened in the Hunter River alluvium. The EC levels recorded in GW49 are lower than those in GW41A. The condition of the surface casing and depth of the bore was checked in September 2020 by CBE; no issues were identified. It is recommended that the condition of the bore using a downhole camera and verification of water supply use is undertaken.

7.4.3 Proposed Improvements

Undertake a review of the groundwater monitoring program be rationalised based on recent findings and additional newly installed bores.

Review the condition and instrumentation of groundwater bores based on the recommendations the of the annual review assessment report.

8 Rehabilitation

8.1 Buildings and Infrastructure

The bins associated with the former Bayswater conveyor were decommissioned this reporting period. The area now forms part of the Conveyor Corridor overburden dump.

The magazine and reload facilities we decommissioned during the reporting period. The area now forms part of the overburden dump.

The Earth Moving Equipment (EME) pad was decommissioned during the period. The area now forms part of the pit.

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:

- Restricting stockpile height to generally three metres or less, to minimise compaction and anaerobic conditions within topsoil stockpiles;
- Locating stockpiles so as to reduce the requirement for re-handling
- Establishing cover crops; and
- Weed treatment by slashing and scalping.

Topsoil was placed and spread to an approximate depth of 200 to 300 millimetres on rehabilitation areas. 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 TSS011, TSS059, TSS072, TSS074 and TSS075. The scope included:

- Scalping;
- Broad leaf weed treatment;
- Ripping to aerate; and
- Spreading of pasture seed mix as per the Mining Operations Plan.

Approximately 44 ha of topsoil stockpiles were maintained during the reporting period.

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 utlises geomorphic design and incorporates natural micro-relief and natural 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. Importantly, the approach does not replicate existing landforms, but rather uses the key characteristics that make these landforms stable in a new design. Natural landforms in in the local environment are characterised by an integrated network of drainage channel, typically with slopes initially convex close to ridge lines, becoming concave and progressively flattening with increasing catchment area. The aim is to establish landforms consistent with the erosion rate of natural features in the area.

Future use of areas disturbed by active mining is closely linked to landform design and general vegetation strategies found in the Synoptic Plan. The Environmental Assessment states 'the conceptual final landform provides an integrated landscape that is consistent with the Synoptic Plan and aims to link existing vegetation communities with mine rehabilitation areas to provide fauna movement corridors for the movement of fauna'. These proposed corridors are consistent with, and will further complement, both the Synoptic Plan and the final landforms of surrounding areas.

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;
- The retention of the eastern flank of MacLean's Hill to assist in creating landscape diversity at the foot of overburden emplacements;
- Modifying final void high walls and low wall slopes to minimise final disturbance;
- 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.

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 land use, 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.

The MAC-ENC-MTP-047 Rehabilitation Strategy with updated designs was submitted to the former DPIE in 2018 with updated information in relation to the design use and void management. A revised version of the Rehabilitation Strategy was re-submitted in July 2020.

Figure 6: Topsoil spreading at Drayton Void emplacement

Figure 7 Geomorphic design of FY21 rehabilitation integrated with rehabilitation completed in FY20

8.4 Disturbed Land

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) 76.85 hectares of rehabilitation across three areas (VD5, VD4 and Drayton Void). This exceeded the MOP target of 72.80 hectares to Phase 4 – Ecosystem and Land use Establishment, as shown in Table 26. Areas of rehabilitation undertaken during the reporting period are shown in Appendix 5.

Both woodland and pasture seed mixes and rates have been revised in consultation with an independent specialist, as specified in the MOP.

Table 27 provides the Mt Arthur Coal rehabilitation summary for the operation.

Table 26: Mt Arthur Coal rehabilitation claimed for FY21

Rehabilitation phase	FY21 MOP rehabilitation commitments (hectares)	FY21 areas in active rehabilitation phases (hectares)
Phase 2 – Landform Establishment	0	0
Phase 3 – Growing Media Development	0	0
Phase 4 – Ecosystem and Landuse Establishment	72.80	76.85
Total	72.80	76.85

Note: All areas calculated using GDA1994 Zone 56 coordinate system

Table 27: Mt Arthur Coal rehabilitation summary

Mine area type	Previous reporting period (FY20 actual)	This reporting period (FY21 actual)	Next reporting period (FY22 forecast)
A. Total mine footprint[1]	5,333	5,450	5,590
B. Total active disturbance[2]	4,152	4,266	4,625
C. Land being prepared for rehabilitation[3]	31.3	55	0
D. Land under active rehabilitation[4]	1181*	1,184	964**
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 FY20
** FY20 actuals, minus FY22 forecast dehab plus FY22 rehabilitation target
[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. From the end of FY19 to the end of FY21 a significant amount of area in active rehabilitation has been cleared for dump space.
[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.

8.5 Other Activities

During the reporting period other rehabilitation related activities undertaken included weed spraying, soil management and pest animal control.

Major repair and maintenance project occurred in the VD5 and VD4 emplacement areas. These areas had previously been established during drought conditions. As presented in the FY20 Annual review, weed cover dramatically increased in the VD4 and VD5 emplacement areas due to rainfall breaking seed dormancy of the weed seed bank. With increased rainfall forecast to over the reporting period the decision was made to focus on re-working and repairing these areas.

The scope of work has included:

- Scalping of areas dominated by perennial grasses;
- Repair of erosion gullies;

- Levelling of dump;
- Application of gypsum;
- Application of compost;
- Chisel ploughing in compost and gypsum;
- Re-seeding with box gum woodland mix as per the Mining Operations Plan;
- Application hay mulch as a temporary stabilisation; and
- Construction of approximately 565 m of maintenance track

The project completed 65 hectares of rework and maintenance of heavily drought impacted rehabilitation. The above scope included trials in the use of compost and temporary stabilisation. These represent a material change to how rehabilitation is carried out at Mt Arthur. Areas maintained are shown in Figure 8 and Figure 9.

A trial into temporary stabilisation via the spreading of hay mulch was also conducted in the VD5 northern area. The trail was initially delayed due to the drought impacting availability of hay, however, rain damaged hay was sourced in the reporting period which allowed for initial trials to commence. The trial was focussed in determining the optimal method for spreading hay to gain appropriate coverage.

Figure 8 VD5 following maintenance work looking north

Figure 9 VD4 following maintenance work looking east

A trial into a controlled burn was carried out during the reporting period.

Work completed in the reporting period was trialling controlled burns on rehab areas to determine the safety requirements and feasibility of larger scale execution. Then trial was conducted on a 2 ha area on 28th to 30th April 2021 on VD1 Within Exotic and depleted grasslands (see Appendix 5). The trial is presented in Figure 10.

The results indicate that the grass in the area had not cured sufficiently to burn hot enough adequately treat exotic grasses. MAC plans follow up trials will take place in winter 2022 to determine potential of controlled burns in weed management. This will be in conjunction with other weed management practices to determine the most cost effective method for treatment of exotic grasses.

Figure 10 Controlled burn on VD1 in exotic and depleted grasslands

Mt Arthur carried out an initial trial into the use of remote sensing to assess the following:

- Erosion;
- Vegetation health; and
- Tree count and tree height.

The erosion analysis is focused upon both the detection of gullies, and quantifying characteristics of their structure. The detection of gullies is dependent upon developing a relationship between hydrological flows across a landscape, and fine-scale, local topographic structure. Central to the formation and balancing of this relationship is the incorporation of error propagation to model environmental stochasticity. Once identified, region growing algorithms are then implemented to map the extents of individual gullies. With individual gullies clearly delineated, an approximate pre-erosion surface can be regenerated.

Erosion metrics are derived from the gully extents and regenerated pre-erosion surface. The combined extents of identified gullies within a predefined area provide a measure of the overall surface erosion. Surface erosion cover is calculated for each quadrat.

The extents of individual gullies can be further broken down into their structural components, providing an estimation of gully width and length. Gully and volumetric statistics were calculated for both individual gully extents as well as for quadrats. Results of the erosion monitoring are presented in Table 28.

Table 28: Summary table of landform metrices in MAC

Site	Angle rise		Height rise		Slope length		Width	
	Max (Deg)	Min (Deg)	Max (m)	Min (m)	Max (m)	Min (m)	Max (m)	Min (m)
Belmont	11.85	1.05	57.36	4.40	396.23	158.75	393.50	157.39
CD 1	9.84	8.37	115.15	51.08	752.03	322.67	743.91	318.61
CD 2	10.71	0.01	46.55	0.04	382.62	129.14	380.23	129.10
Drayton 1	-	-	-	-	-	-	514.82	96.47
Drayton 2	19.32	0.01	41.02	0.06	389.56	17.68	389.56	16.92
Main Dam	14.51	1.58	24.09	0.31	267.21	6.69	266.14	6.57
Saddlers 1	4.63	0.02	49.66	0.35	980.13	202.58	978.88	202.43
Saddlers 2	11.12	0.01	29.76	0.01	245.95	17.16	244.29	17.14
Saddlers 3	5.16	0.01	31.94	0.15	720.95	270.92	720.94	270.31
Saddlers 4	10.70	1.86	21.59	5.25	251.98	69.78	251.62	68.60
Dump 11	2.36	0.01	15.30	0.05	819.06	45.09	818.98	45.07
VD 1	10.50	7.53	161.16	12.79	1,160.53	75.99	1,149.47	74.92
VD 5	18.06	4.56	66.68	11.38	484.00	57.45	482.18	55.14

Vegetation condition is measured using the Normalized Difference Vegetation Index (NDVI). The NDVI is strongly correlated with the condition and abundance of vegetative biomass. The NDVI provides a quantitative measure of relative plant condition. As biophysical properties of vegetation may differ between species (e.g. glaucousness), so too is there variation within the measured response of vegetation indices, and what denotes good or poor health. NDVI measurements are therefore relative to the species under observation. An example of the analysis is presented in Figure 11. The VD1 sequence in Figure 11 shows the impact of drought and increased rainfall from 2019 to 2021.

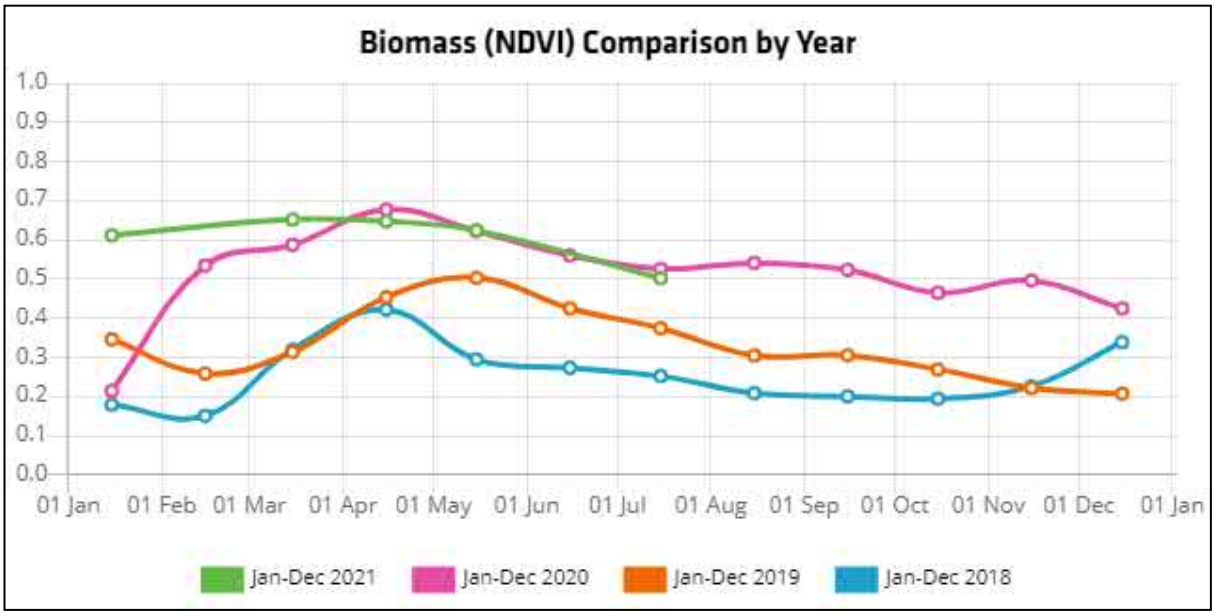


Figure 11 Biomass (NDVI) time series of VD1

The tree counting was performed using an AI-based tree-counting algorithm based on Mt Arthur's March 2021 flyover. was geo-processed into 512x512 tiles and used for detection of tree within each rehabilitation area. The tiles were the raw input for the tree-count algorithm and the outputs were identified trees as point locations within each tile. For tree-height metrix calculation, an unclassified high-density LiDAR point cloud was used to classify as ground and above-ground classes. The above-ground filtered point cloud was then used to generate a Canopy Height Model (CHM). Then, the CHM was used as inputs in the tree-height classification algorithm for Tree-height classification metrix classifying into suitable height categories (over 1 m, over 2 m and over 3 m).

Table 29: Summary table of Tree Count

Site Name	No. of Trees
Belmont	604
CD1	2,325
Dayton2	83
Main Dam	902
Saddlers2	844
Saddlers3	547
Dump 11	671
VD1	2,628
Total	8,604

Example figures generated via remote sensing are presented in Appendix 5.

8.6 Rehabilitation Activities for Next Reporting Period

The FY22-FY24 Forward Program was submitted to the NSW Resources Regulator for the period 1 July 2019 to 30 June 2022. Performance indicators and completion criteria were developed for the MOP 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 FY21 reporting period include the continuation of natural landform design rehabilitation techniques and the inclusion of habitat in new areas as they become available. FY21 has an annual rehabilitation area target of 73 hectares.

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

- Mt Arthur Coal's FY20-FY22 Forward Program;
- Mt Arthur Coal's Rehabilitation Management Plan;
- MAC-ENC-MTP-047 Rehabilitation Strategy;
- MAC-ENC-MTP-050 Biodiversity Management Plan; and
- MAC-ENC-PRO-012 Land Management Procedure.

Additional focus on improving the quality of rehabilitation of VD1 will continue in FY21 with the aim of establishing self-sustaining Box Gum woodland based vegetation community as described in the MOP.

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

Mt Arthur Coal will investigate the further 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.

During the next reporting period Mt Arthur Coal will continue to utilise the Rehabilitation Specialist role, which is responsible for collaborating with and influencing mine planning to achieve MOP rehabilitation targets using industry best practice methods, as well as implementing the rehabilitation maintenance and improvement program of works presented in Appendix 5.

9 Community

9.1 Community Engagement

Mt Arthur Coal continues to actively engage and build relationships with key stakeholders and support the local community through its program of community consultation. Mt Arthur Coal's community 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 an Singleton 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
- Coal Community Connect bi-monthly newsletter, distributed to key community stakeholders (including surrounding landholders), providing an update on business activities
- The CSIRO Local Voices program (launched in 2019) to provide the local community ways to provide feedback to Mt Arthur Coal on its business activities via quarterly surveys
- 24-hour BHP Mt Arthur Coal Community Response Line: 1800 882 044
- Comprehensive engagement for the Mt Arthur Coal Continuation Project (2026 Project Approval) involving consultation with more than 40 stakeholders, ranging from neighbouring landholders and property licences to community groups and Muswellbrook Shire Council.

Community Response Line

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/

During the reporting period, Mt Arthur Coal received 36 complaints from community members and near neighbours. A comparison of complaints received during the reporting period against previous financial years is shown in

Figure 12 and a complete register of complaints is presented in Appendix 3.

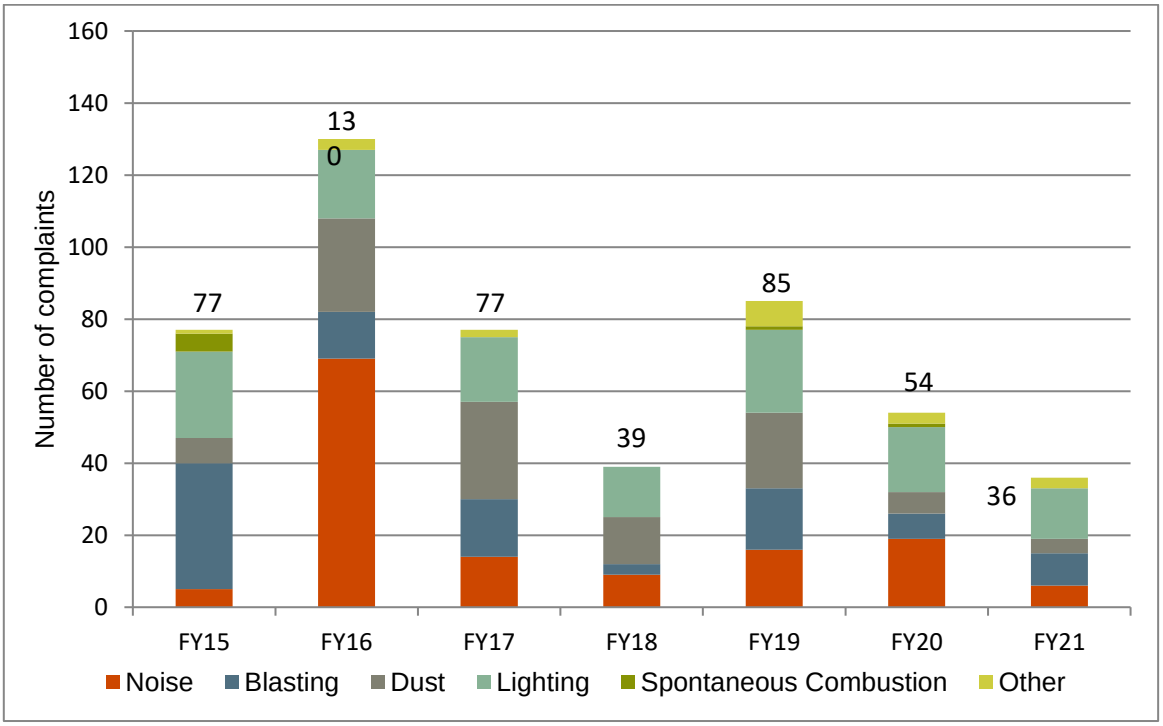


Figure 12: Comparison of complaints received during current and previous financial years

Noise Complaints

During the reporting period, 6 noise complaints were received from one complainant. This is lower than FY20 (19 noise complaints). All complaints were investigated, with noise levels generated by Mt Arthur Coal being measured within internal management benchmarks at the nearest real-time monitor.

Blasting Complaints

During the reporting period, 9 blast complaints from 7 sources (7 residents and 2 via the regulator) were recorded. This is an increase from 7 complaints in FY20. All investigations revealed weather conditions were suitable for blasting at the time and results indicated overpressure noise and ground vibration levels were within regulatory criteria on dates when the complaints were received. There was no exceedance of our Project Approval or Environmental Protection Licence limits.

One complaint, made on 9 June was made to Mt Arthur Coal via the Community Response Line and also received by the Department. The complaint was primarily in relation to blasting conducted by Mt Arthur Coal on 8 June but also made reference to lighting and the Community Response Line itself. A thorough investigation and response was provided to the DPIE on 11 June which addressed the complainant's and Department's concerns.

Air Quality Complaints

Four dust-related complaints were received from 3 sources (2 residents and 1 via the regulator) during the reporting period. This is a decrease from 6 complaints from 5 complainants in FY21. Investigations indicated that real-time dust levels and 24-hour averages remained within regulatory limits at the monitoring location nearest to the complainants.

In 2019, Mt Arthur Coal implemented a new real time dust monitoring system, which 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.

Lighting Complaints

During the reporting period, 14 lighting complaints were received from four complainants, a decrease from FY20 (18 from three complainants). On notification of the complaints, immediate action was taken to locate and redirect the offending light/s, in response to addressing the complainants' concerns.

Spontaneous Combustion Complaints

No complaints were received during the reporting period.

Other Complaints

During the reporting period, three complaints were received from three complainants in relation to non-operational activities.

One of these complaints was an allegation of a mine worker using offensive using language over the open airway 2-way CB channel. This complaint was not substantiated as the conversation could not be identified as one being held by employees of Mt Arthur Coal. Nonetheless, in response to the complaint, Mt Arthur Coal issued communications to remind the workforce of BHP's Code of Conduct and the behavioural expectations of employees.

One of these complaints was in relation to Mt Arthur Coal employees and contractors accessing Crown Land across from the entrance to its operation to smoke cigarettes. The workers were littering their cigarette butts and the complainant was concerned that unextinguished butts presented a fire risk. In response, the business worked with the complainant to install water filled bollards to prevent vehicle access to the land.

One of these complaints was regarding an Indigenous social inclusion matter. The manager of a local Aboriginal business alleged that BHP was failing to engage with local Indigenous businesses and as a result, excluding these businesses from tendering for work at Mt Arthur Coal. This matter was investigated and a response provided to inform the complainant of Mt Arthur Coal's tendering process, which is open to local Indigenous businesses and provides equal opportunity to tender for work.

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.

Community Consultative Committee

During the reporting period, Mt Arthur Coal coordinated four CCC meetings in accordance with the Community Consultative Committee Guidelines (DPIE, 2016) on:

- 8 August 2020
- 11 November 2020
- 17 February 2021
- 12 May 2021

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

- 8 December 2020
- 9 June 2021

9.1 Community Investment

During the reporting period Mt Arthur Coal voluntary contributed $486,027 to the local community.

Central to Mt Arthur Coal's commitment to the local community is its Voluntary Planning Agreement (VPA) with MSC, of which an additional $660,946 was provided in FY21 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.

BHP Vital Resources Fund

In response to COVID-19, BHP established the Vital Resources Fund in 2020 to support regional communities in areas in which it operates which are facing the challenges of the COVID-19 pandemic. Through the Fund, BHP contributed $850,000 to the Hunter Region in the reporting period to support a major community project to address the ongoing impacts of the COVID-19 pandemic.

Local Buying Program

Through the Local Buying Program, Mt Arthur Coal continues to engage and support small eligible local businesses through procuring goods and services, with $6,229,820 in FY21 across the three shires of Muswellbrook, Upper Hunter and Singleton.

Matched Giving Program

Through the Matched Giving Program (MGP), Mt Arthur Coal supports a small number of community groups through matching employee donations at a rate of 2:1. In FY21, Mt Arthur Coal's contribution to the MGP community groups was $251,140.

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 30 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 30: 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**

The site visit concluded that Mt Arthur Coal is generally compliant and well maintained, with highlights including:

- There has been a recent increase in rehabilitation and closure targets;
- Additional funding has been provided for biodiversity management;
- Sophisticated real time air quality and noise management system;
- The site has generally been compliant with key monitoring criteria;
- There has been a continuity of environmental staff during the IEA period. The IEA team is satisfied the site

is sufficiently resourced in regard to environmental management;

- There was a very high degree of participation from the Mt Arthur Coal team and contractors during this IEA which illustrates the importance of environment and community compliance management at the site;
- The annual reporting (Annual Reviews) have generally been to a high standard; and
- The field performance of the site was excellent. This included no major dust issues in the field as well as excellent erosion and sediment control management.

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 FY22.

Table 31 and Table 32 detail the findings of the IEA and Mt Arthur Coal response and agreed actions.

Table 31: 2020 Independent Environmental Audit Non-compliance Recommendations and Actions

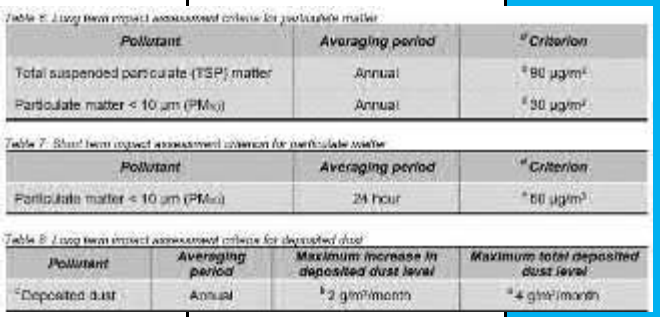
Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
Project Approval (PA09-0062)					
S3 C20	**Impact Assessment Criteria** The Proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so 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	[a] Criterion
Total suspended particulate (TSP) matter	Annual	[b] 90 µg/m³
Particulate matter < 10 µm (PM_{10})	Annual	[b] 30 µg/m³

Table 7: Short term impact assessment criterion for particulate matter

Pollutant	Averaging period	[a] Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	[b] 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
[a] Deposited dust	Annual	[b] 2 g/m²/month	[c] 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 6.4.2 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: • groundwater inflows to the mining operations; • impacts on regional aquifers;	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: 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.	**ACTION** NC REC 2: **Complete** New Scope of works issued, monitoring undertaken in accordance with the WMP.

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
	• 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. 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.	**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: 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.**	**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: No further action is proposed.

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
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; (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.	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 7.4.2 of this report.

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
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: 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;	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 lodged with DPIE in August 2021

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
	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.				
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	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	**ACTION** NC REC 9: **Complete** Reviews of management plans completed during the reporting period.

Schedule and Condition Number	Condition	Compliance Status	Recommendations	Mt Arthur Coal Response/ Agreed Action	Status
	(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.			Revisions completed (where triggered): 20 May 2021	A review of the Blast management plan was triggered as part of these revisions. A revised Blast Management Plan was submitted to DPIE in July 2021.

<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 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:	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
	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).				
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	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
	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 regarding the installation of a lower permeability barrier along the point of connections of mining and the alluvium or other appropriate safeguards.				

Table 32: 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 6.1.2 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.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
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 6.4.2 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 in the Rehabilitation Management Plan currently with DPIE for approval.

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 in the Rehabilitation Management plan currently with DPIE for approval.

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 in the Rehabilitation Management plan currently with DPIE for approval.
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: Not yet scheduled for completion.

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: Not yet scheduled for completion.
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.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
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
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.

Aspect	Condition Reference	Improvement REC Number	Recommendation	Mt Arthur Coal Response	Status
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.
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 submitted to DPIE for approval in July 2021
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**

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 Exceedance & Failure to immediately notify the Secretary of any incident

13 August 2020 Hunter Valley Energy Coal (HVEC) recorded a minor exceedance of the ground vibration Peak Particle Velocity (ppv) limit (50mm/s) for Public Infrastructure. Project approval 09_0062 Schedule 3 Condition 10. The ppv recorded at two of the towers marginally exceeded the MAC project approval limits. Specifically, 54.5mm/s and 51.3mm/s was recorded at TransGrid 2 and TransGrid 3 respectively.

An investigation was undertaken which identified that there was an error made by the expert third party consultant, when assessing the modelled vibration impacts against the public infrastructure criteria. It was identified that a potential cause of the drift within the consultants process may have been that many Transgrid and Ausgrid power poles in the area for other mining operations for which they perform similar work have limits of 100mm/s (for example, the usual expectation is that poles of this type ordinarily have a limit of 100mm/s not 50mm/s, and this has potentially lead to the consultant not identifying the drift in criterion throughout the HVEC model assessment). The exceedance was report to the DPIE and the infrastructure owner. DPIE have undertaken an investigation and issued a warning.

As a results of the above event on 13 August 2020 and the delay in identifying the exceedance event until 1 October 2020, due to the consultants erroneous reference to the 100 mm/s limit. The immediate reporting of any potential exceedances to Mt Arthur Coal did not occur on or shortly within the date of occurrence as the result was initially considered compliant with the Approval limits. As such the event was not reported to DPIE until 1 October 2020. DPIE have undertaken an investigation and issued a warning for Failure to immediately notify the Secretary of any incident.

Uncontrolled Discharge of Water

On 5 June 2021, it was identified that a pipeline failure had occurred which led to water and sediment travelling off-site to an adjoining property owned by Mt Arthur Coal. There were indications that some water entered the Hunter River. The majority of the water discharged from the line was contained on site or within Mt Arthur Coal owned land where it was cleaned up and removed.

Water sampling and monitoring was undertaken immediately after the event was identified and continued until all clean up actions had been completed. The results showed that the pH and EC levels for the locations within the Hunter River, upstream and downstream of the entry point were substantially similar. All clean-up actions have been completed. The incident was reported to the EPA and DPIE, and investigations have been commenced by the EPA and DPIE.

Groundwater Trigger Exceedances

During the reporting period there were Groundwater Quality and Level trigger events. All trigger events reported to DPIE and are detailed in Section 7.4.2 and Appendix 2. 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 Exceedances

During the reporting period there were 10 cumulative 24-hour PM10 trigger events during the period (Cumulative 24-hour PM10 >50$\mu g/m^3$). All trigger events were reported DPIE and are detailed in Section 6.4.2. Investigations, in accordance with the Mt Arthur Coal Air Quality Management plan, determined that the trigger events were 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.
- Review relocation options for BP09 to improve blast monitoring accuracy at neighbouring privately owned residences. If deemed appropriate relocate BP09.
- 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.
- 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 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.
- 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.
- 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.
- 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).
- 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.
- Undertake a review of the groundwater monitoring program be rationalised based on recent findings and additional newly installed bores.
- Review the condition and instrumentation of groundwater bores based on the recommendations the of the annual review assessment report.
- Engage an air quality specialist to complete a quality check and review of the real time air quality management system.
- Mt Arthur Coal will undertake a lighting audit of high risk fixed lighting.

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

Table 33 outlines a progress summary of Mt Arthur Coal's performance against targets set for the FY20 period.

Table 33: Mt Arthur Coal's performance against targets for FY20

Target	Status	Performance
Undertake update to the Site Law database and predictive blast model, allowing for increased accuracy in determining the vibration and overpressure at the design stage;	Completed	Site Law Database has been reviewed by Orica during the reporting period.
Undertake review of the Blast Matrices, Pre Blast Approval procedure and Approval to Blast Form which 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 the blasting improvements to the sites current predictive meteorological model; and	Completed	The Blast Matrices, Pre Blast Approval procedure and Approval to Blast Form has been reviewed during the period and implemented across site.
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.	Completed	Details of these assessments are detailed in Section 8
Undertake a review of the groundwater monitoring program be rationalised based on recent findings and additional newly installed bores	Completed	Review completed and recommended changes incorporated into the 2020 review of the Water Management Plan.
Review the WMP to ensure consistency between the field program and management plan.	Completed	Revised Water Management Plan approved in February 2021
Review the condition and instrumentation of groundwater bores based on the recommendations the of the annual review assessment report.	Completed	A number of instruments were replaced during the reporting period and operations of the bores were reviewed in detail during the groundwater monitoring program rationalisation review.
Relocate one of the environment dam to Belmont mine water lines to the toe of VD5	Partially Completed	A new pipeline road was installed during the reporting period and three replacement lines rather than one installed during the period. All lines are scheduled to be fully commissioned in September 2021.
Embed Licence to Operate risk control effectiveness testing	Completed	Control effectiveness testing environmental risks has been implemented.
Fit for purpose monitoring systems within the Environment Data Monitoring System Project	Completed	The Environmental Data Management System project was completed in FY21. The system is now in use at Mt Arthur Coal and has improved our ability to manage environmental data.

Appendix 1. Surface Water Quality Monitoring Results

Surface Water Quality Results

Site	Month	Date sampled	Flow (description)	Field pH	Field EC (uS/cm)	TDS (mg/L)	TSS (mg/L)	Turbidity (NTU)	Sulfate (mg/L)	Dissolved Fe (mg/L)	Total Fe (mg/L)	Nitrate (mg/L)	O&G (mg/L)
SW02	Jul-20	13 and 14/07/2020											
	Aug-20	24 and 25/08/2020											
	Sep-20	15 and 16/09/2020											
	Oct-20	19 and 20/10/2020											
	Nov-20	16 and 17/11/2020											
	Dec-20	14, 15, 16 and 21/12/2020											
	Jan-21	11, 12 and 18/01/2021											
	Feb-21	15, 16, 22 and 23/02/2021											
	Mar-21	15 and 16/03/2021											
	Apr-21	19 and 20/04/2021											
	May-21	24 and 25/05/2021											
	Jun-21	21 and 22/06/2021											
	Impact Assessment Criteria Trigger Values		**Stage 1 Trigger**	**6.5< >9.0**	**12365**		**219**						
			Stage 2 Trigger		**13900**		**277**						
SW03	Jul-20	13 and 14/07/2020	Still	7.25	7020	4580	18	4.8	1480	0.2	0.4	0.01	<5
	Aug-20	24 and 25/08/2020	Still	7.36	1621	1170	25	8.3	441	0.74	1.55	<0.01	<5
	Sep-20	15 and 16/09/2020	Still	7.7	4120	2770	16	8.2	1100	0.19	1.05	<0.01	<5
	Oct-20	19 and 20/10/2020	Still	7.44	6060	4250	25	21.1	1740	0.15	1.55	<0.01	<5
	Nov-20	16 and 17/11/2020	Still	7.65	5500	3630	5	2.1	1430	0.07	0.44	<0.01	<5
	Dec-20	14, 15, 16 and 21/12/2020	Still	7.79	7780	5290	14	10.2	1910	0.17	0.81	<0.01	<5
	Jan-21	11, 12 and 18/01/2021	Still	7.15	485	341	24	22.3	108	0.36	1.5	<0.01	<5
	Feb-21	15, 16, 22 and 23/02/2021											
	Mar-21	15 and 16/03/2021											
	Apr-21	19 and 20/04/2021	Still	7.44	1461	912	6	2.5	408	0.3	0.72	0.01	<5
	May-21	24 and 25/05/2021	Still	7.59	2138	1430	0	1.5	690	0.05	0.19	0.04	<5
	Jun-21	21 and 22/06/2021	Still	7.86	2337	1590	0	1.3	573	<0.05	0.08	<0.01	<5
	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)	TDS (mg/L)	TSS (mg/L)	Turbidity (NTU)	Sulfate (mg/L)	Dissolved Fe (mg/L)	Total Fe (mg/L)	Nitrate (mg/L)	O&G (mg/L)
SW04	Jul-20	13 and 14/07/2020	Still	8.22	967	616	12	34.8	193	<0.05	1.22	0.07	5
	Aug-20	24 and 25/08/2020	Still	7.81	6810	614	12	38.3	103	0.18	1.7	<0.01	<5
	Sep-20	15 and 16/09/2020	Still	8.21	1978	1010	9	12.9	257	0.14	0.73	<0.01	<5
	Oct-20	19 and 20/10/2020	Still	8.16	6850	3890	29	18.9	902	0.06	1.33	<0.01	<5
	Nov-20	16 and 17/11/2020	Still	7.29	969	510	6	6.8	80	0.12	0.32	<0.01	<5
	Dec-20	14, 15, 16 and 21/12/2020											
	Jan-21	11, 12 and 18/01/2021	Still	7.43	1495	632	8	9	158	0.31	0.77	<0.01	<5
	Feb-21	15, 16, 22 and 23/02/2021	Still	7.8	1761	946	0	2.2	154	0.15	0.28	<0.01	<5
	Mar-21	15 and 16/03/2021	Still	7.49	422	266	15	18.2	34	0.08	0.65	1.24	<5
	Apr-21	19 and 20/04/2021	Still	8	5050	2770	0	1.6	430	<0.05	0.07	<0.01	<5
	May-21	24 and 25/05/2021	Still	7.85	9700	5400	0	1.1	814	<0.05	0.11	<0.01	<5
	Jun-21	21 and 22/06/2021	Still	8.43	1237	579	11	18.3	88	0.07	0.8	0.42	<5
	Impact Assessment Criteria Trigger Values		**Stage 1 Trigger**	**6.5< >9.0**	**13959**		**82**						
			Stage 2 Trigger		**15509**		**104**						
SW12	Jul-20	13 and 14/07/2020	Still	7.37	2455	1600	<5	1.5	577	<0.05	0.08	<0.01	<5
	Aug-20	24 and 25/08/2020	Still	7.59	2461	3020	65	4.9	822	<0.05	0.56	<0.01	<5
	Sep-20	15 and 16/09/2020	Still	7.38	6630	4080	8	2.1	1310	0.08	0.24	0.01	<5
	Oct-20	19 and 20/10/2020	Still	7.27	9240	4790	12	2.6	1570	0.07	0.43	<0.01	<5
	Nov-20	16 and 17/11/2020	Still	7.31	6540	4060	<5	1.2	889	0.06	0.16	<0.01	<5
	Dec-20	14, 15, 16 and 21/12/2020	Still	7.74	9130	5710	10	1.7	1610	<0.05	0.17	0.01	<5
	Jan-21	11, 12 and 18/01/2021	Still	7.38	2998	1620	<5	2.3	528	<0.05	0.18	<0.01	<5
	Feb-21	15, 16, 22 and 23/02/2021	Still	7.37	3168	1820	6	3.8	492	<0.05	0.19	0.02	<5
	Mar-21	15 and 16/03/2021	Still	7.73	2558	1400	14	11.7	368	0.13	0.63	0.08	<5
	Apr-21	19 and 20/04/2021	Still	7.68	5810	3770	<5	1	957	<0.05	<0.05	<0.01	<5
	May-21	24 and 25/05/2021	Still	7.03	5900	3740	7	8	1300	0.28	1.65	0.01	<5
	Jun-21	21 and 22/06/2021	Still	6.76	6390	3830	10	9.7	1090	0.15	2.24	0.03	<5
	Impact Assessment Criteria Trigger Values		**Stage 1 Trigger**	**6.5< >9.0**	**6659**		**555**						
			Stage 2 Trigger		**7153**		**708**						

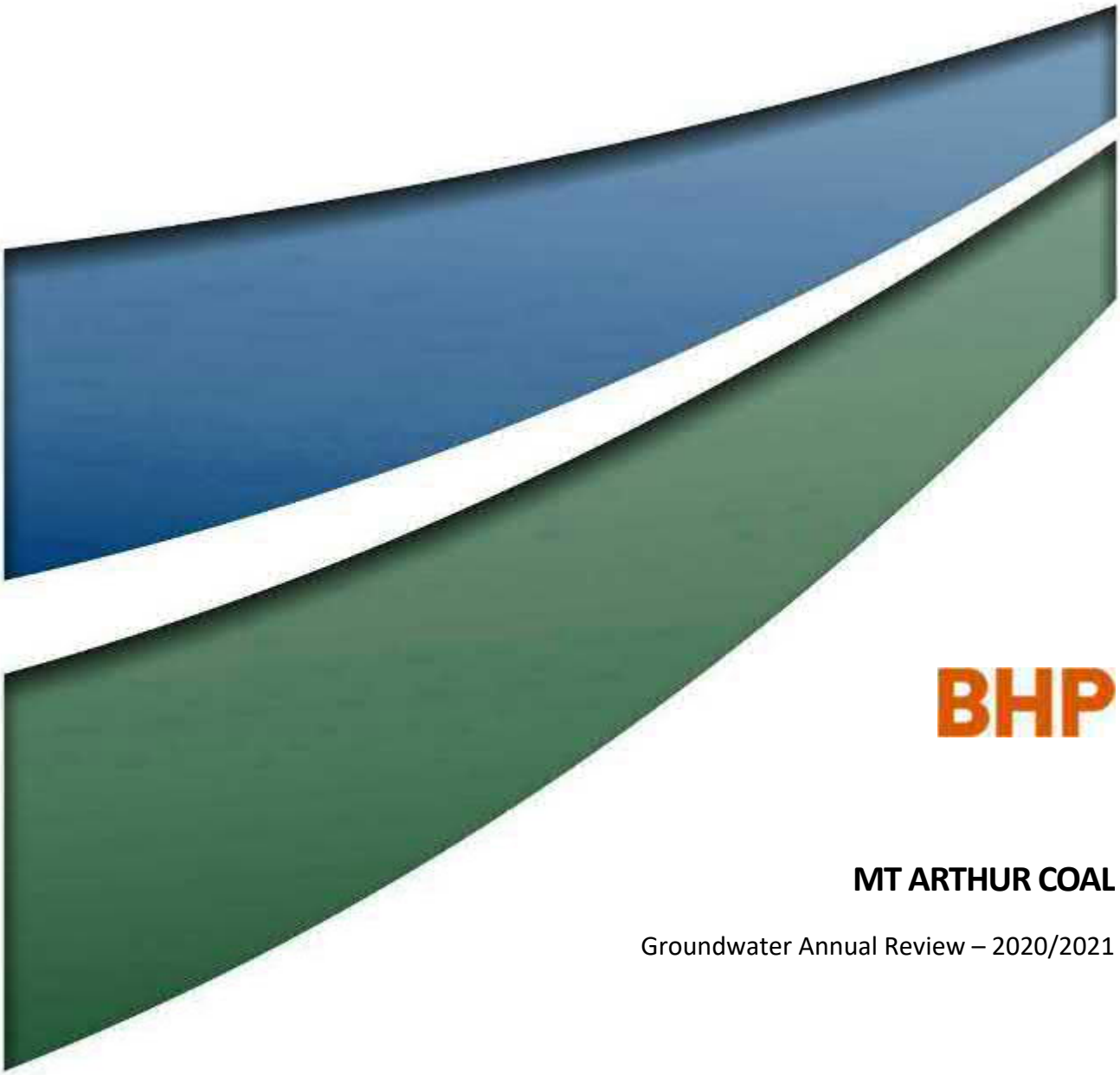
Site	Month	Date sampled	Flow (description)	Field pH	Field EC (uS/cm)	TDS (mg/L)	TSS (mg/L)	Turbidity (NTU)	Sulfate (mg/L)	Dissolved Fe (mg/L)	Total Fe (mg/L)	Nitrate (mg/L)	O&G (mg/L)
SW15	Jul-20	13 and 14/07/2020	Dam	7.54	723	394	<5	1.7	71	0.17	0.29	<0.01	6
	Aug-20	24 and 25/08/2020	Dam	7.61	513	292	<5	1.9	60	0.14	0.32	0.01	<5
	Sep-20	15 and 16/09/2020	Dam	7.57	617	328	6	1.3	47	0.25	0.6	<0.01	<5
	Oct-20	19 and 20/10/2020	Dam	7.53	947	400	<5	2.4	34	0.36	0.61	<0.01	<5
	Nov-20	16 and 17/11/2020	Dam	7.61	944	482	<5	1.2	96	0.07	0.16	<0.01	7
	Dec-20	14, 15, 16 and 21/12/2020	Dam	7.96	1069	536	13	3.4	71	0.12	0.58	0.01	<5
	Jan-21	11, 12 and 18/01/2021	Dam	8.14	596	356	6	1.9	71	<0.05	0.15	<0.01	<5
	Feb-21	15, 16, 22 and 23/02/2021	Dam	7.82	733	366	6	4.5	122	<0.05	0.18	<0.01	<5
	Mar-21	15 and 16/03/2021	Dam	8.14	8140	428	<5	5	171	0.08	0.34	<0.01	<5
	Apr-21	19 and 20/04/2021	Dam	7.73	559.6	348	<5	1.1	50	<0.05	0.05	<0.01	<5
	May-21	24 and 25/05/2021	Dam	7.38	656.3	348	122	25.3	53	<0.05	0.1	<0.01	<5
	Jun-21	21 and 22/06/2021	Dam	7.58	1094	578	<5	0.7	213	<0.05	<0.05	0.04	<5
	Impact Assessment Criteria Trigger Values		**Stage 1 Trigger**	**6.5< >9.0**	**7128**		**103**						
			Stage 2 Trigger		**8262**		**130**						

Unable to sample due to dry or low water level

* invalid due to level.

Appendix 2. Ground Water Monitoring Results and Groundwater Level Drawdown Analysis

umwelt
Environmental & Social Consultants



BHP

MT ARTHUR COAL

Groundwater Annual Review – 2020/2021

FINAL

September 2021

MT ARTHUR COAL

Groundwater Annual Review – 2020/2021

FINAL

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

Project Director: Claire Stephenson
Project Manager: Kirsty Cooksey
Report No. 21576/R01
Date: September 2021

Disclaimer

This document has been prepared for the sole use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by Umwelt (Australia) Pty Ltd (Umwelt). No other party should rely on this document without the prior written consent of Umwelt.

Umwelt undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. Umwelt assumes no liability to a third party for any inaccuracies in or omissions to that information. Where this document indicates that information has been provided by third parties, Umwelt has made no independent verification of this information except as expressly stated.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
1	Claire Stephenson	15/09/21	Claire Stephenson	15/09/21
2	Claire Stephenson	17/09/21	Claire Stephenson	17/09/21

Table of Contents

Figures

Tables

Appendices

1.0 Introduction

1.1 Overview

The Mt Arthur Coal (MAC) mine is located approximately 5 km south-west 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 2020 to 2021 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, 2020a).

Water Management Plan (WMP) (MAC-ENC-MTP-034 v2) dated 10 December 2020 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) have been engaged to undertake a review of the groundwater monitoring data collected from 1 July 2020 to 30 June 2021. This report has been prepared to address conditions of approval relating to groundwater, and as a requirement of MACs 2020/2021 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 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 MAC WMP was updated on the 10th of December 2020 and approved by DPIE on the 3rd of February 2021. Updates to the WMP were made based on additional work conducted on site and numerical modelling. This included a 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 modelling 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 review period groundwater monitoring and reporting was conducted at MAC in accordance with the WMP (MAC-ENC-MTP-034) (BHP, 2020b). 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 DPIE 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 DPIE 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 DPIE 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 DPIE 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 DPIE 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 DPIE 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 30/06/2021. 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, average annual rainfall is 606.5 mm.

Table 2.1 Monthly Rainfall (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Historical Average	72.5	65.5	55.8	42.6	36.5	46.3	42.37	36.7	41.8	48.6	55.8	62.0	**606.5**
2020	70.2	123.9	60.5	60.4	30.9	39.4	97.3	34.90	45.3	103.1	20.1	116.3	**802.3**
2021	82.4	106.6	162.1	13.5	18.6	71.3	-	-	-	-	-	-	**-**

Note: Based on SILO dataset date range January *1900 to June 2021*

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.

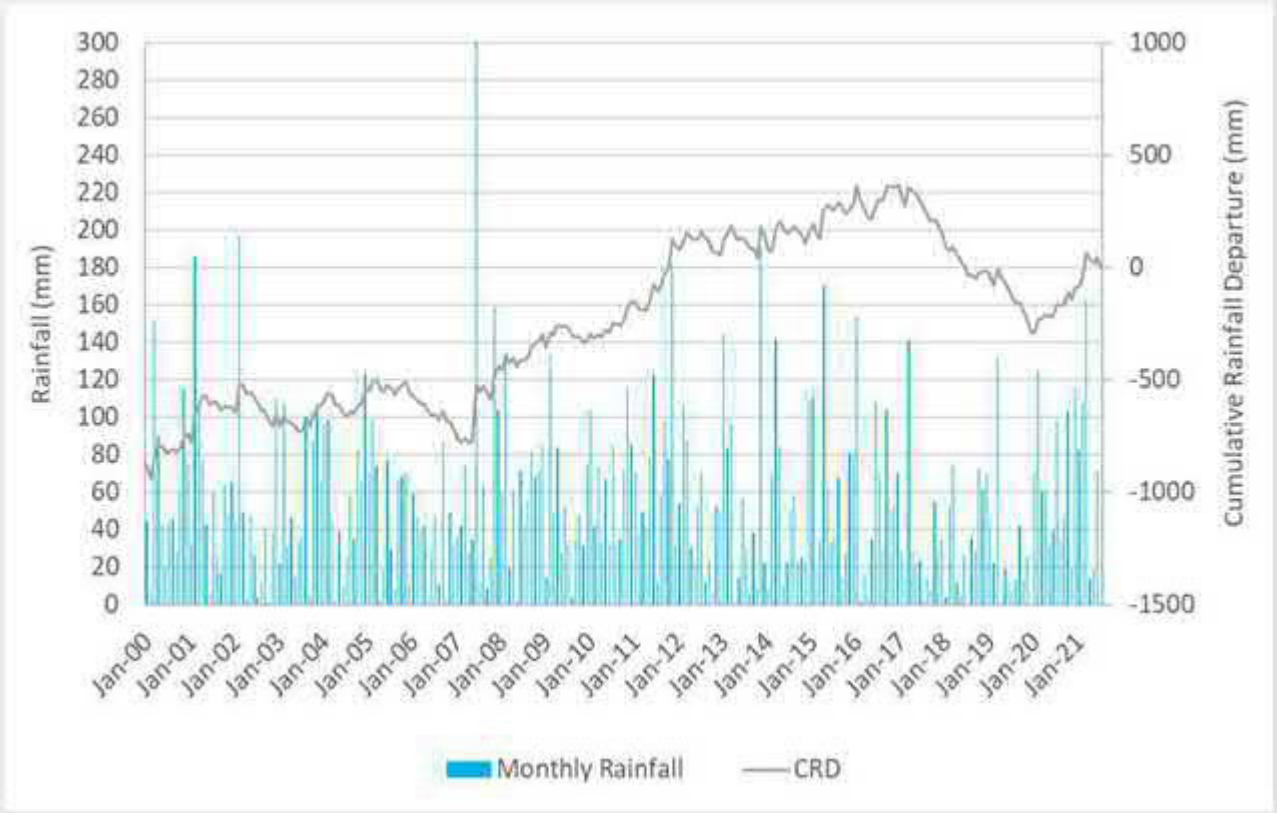


Figure 2.1 SILO Monthly Rainfall and CRD

2.2 Terrain and Drainage

As described in SLR (2020a), 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 (SLR, 2020). 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 (SLR, 2020). Recent high flow/flood events, with flows over 2,000 ML/day, were recorded along the Hunter River at gauging site 210002 in May 2001, June 2007, September 2008, June 2011, March 2013, April 2015, June to October 2016, July and October 2020, and March and June 2021 as shown in **Figure 2.2**.

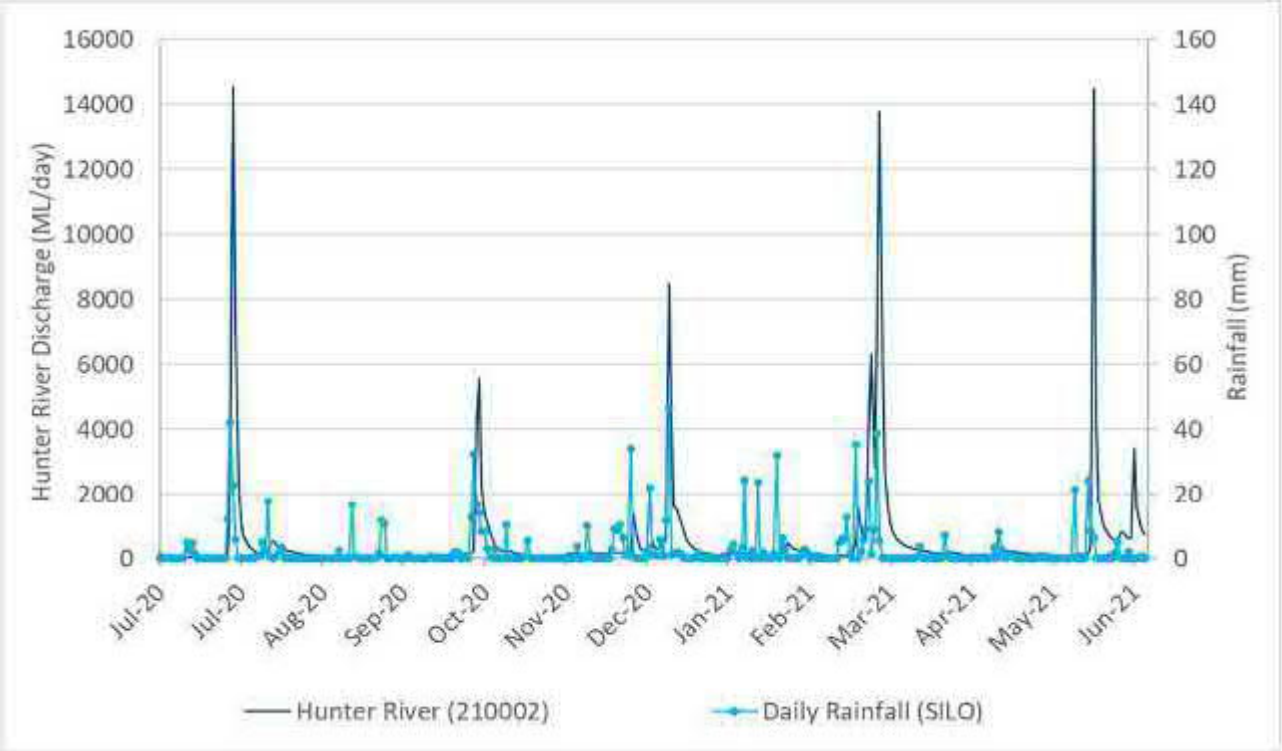


Figure 2.2 Hunter River Flow and Daily Rainfall Over Monitoring Period

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 recharge 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 (SLR, 2020). 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, 2020).

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, 2020).

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 presented in **Appendix A** and shown in **Figure 3.1**. 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 (VWP4 to VWP7) 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
    - pressure transducers continuous every six hours
    - VWP data logger download, and verification and validation of instrument drift and correction
- Groundwater Quality Analysis (20 bores):
    - Standard – Quarterly: Water temperature, pH, EC, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), iron, sulphate, chloride, calcium, magnesium, potassium, sodium, carbonate and bicarbonate
    - Comprehensive – Annually: the standard analysis 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 in accordance with AS 5667.1-1998, Guidance on the Sampling of Groundwater's quarterly by CBE.

To assess any impacts on alluvial aquifers (Hunter River and Saddlers Creek) and private bores, groundwater levels are monitored using data loggers installed in representative monitoring bores in the alluvial aquifers and Permian coal measures for continuous depth to water measurement via either a pressure transducer (with barometric pressure correction) or VWP sensor.

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 22 bores and six VWPs, as shown in **Appendix A**.

Groundwater levels in all of the 28 monitoring sites specified in the WMP were monitored over the reporting period; however, two VWP sensors failed during the reporting period (VWP3 PL2 and VWP06 Vaux). Of the 20 bores included for water quality monitoring schedule, 18 were monitored. Bore GW43 was not sampled in Q1 to Q3 as it was not required before the WMP was updated in February 2021. A water quality sample was collected in August 2021 for GW43. Bore BCGW18 was dry over the reporting period. Sites with a data capture rate of less than 100 per cent are outlined in **Table 3.1**.

Section 9.3.2 of the WMP notes regional background monitoring is to be undertaken at bores GW25 (north of MAC), GW41A and GW41P (northwest of MAC), and BCGW22 (west of MAC).. It is noted that GW41P has already been grouted to surface (decommissioned), and Section 9.3.2 of the WMP should be updated to reflect that GW41P is no longer used as a background monitoring bore.

Table 3.1 Groundwater Monitoring Data Recovery

Location	Type	Data Recovery	Comprehensive Analysis Done	Comments
BCGW18	WL/WQ	0%	No	Bore dry
GW43	WL/WQ	0%	No	Not sampled
VWP3 PL2 (241 m)	WL	50%	-	Sensor failed in December 2020
VWP06 – Vaux Sensor	WL	95%	-	Sensor failed in May 2021

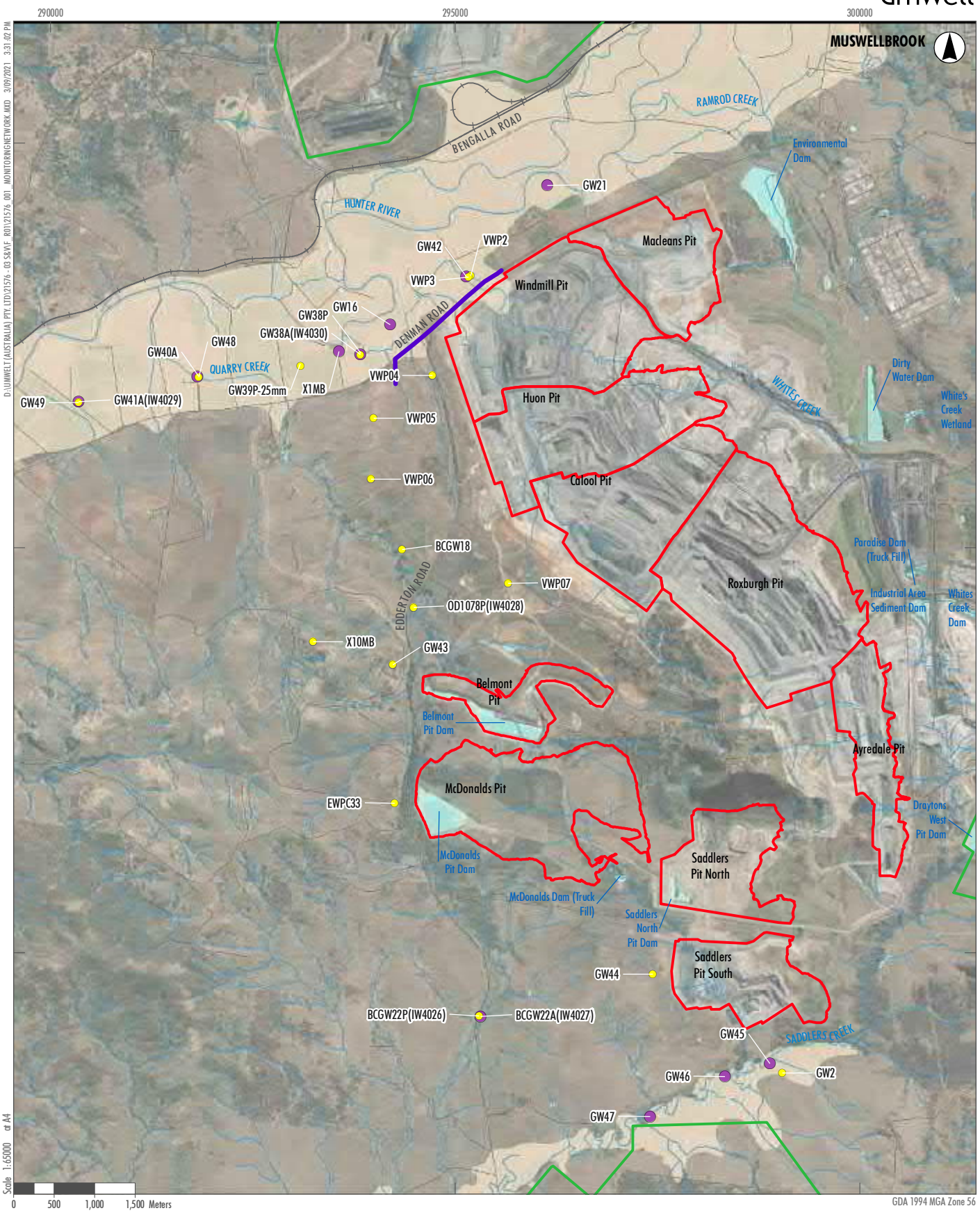


FIGURE 3.1

Groundwater Monitoring Network

Image Source: ESRI Basemap (2021) 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 2020 and June 2021)
- change in groundwater levels since records commenced and for the period July 2020 to June 2021
- monitoring bores where triggers have been exceeded for July 2020 to June 2021
- groundwater levels predicted by the numerical model for July 2020 to June 2021
- 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 GW2, GW43, GW45 and OD1078 (IW4028) be replaced to assist in correlating groundwater trends with rainfall and streamflow trends.

Table 4.1 Groundwater Level Monitoring Results July 2020 to June 2021

Aquifer	Bore ID	Bore Depth (mbgl)	Depth to Water - Below Casing (mbToC)			Depth to Water - Below Ground (mbgl)			Groundwater Elevation (mAHD)		
			Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Hunter River Alluvium	GW16	12.91	9.4	9.52	9.47	9.08	9.20	9.15	122.37	122.49	122.42
	GW21	16.00	9.39	9.54	9.46	9.39	9.54	9.46	126.42	126.57	126.5
	GW38A (IW4030)	11.37	9.64	9.77	9.7	8.99	9.12	9.05	121.98	122.11	122.05
	GW40A	13.18	9.9	10.18	10.07	9.52	9.80	9.69	119.1	119.38	119.21
	GW41A (IW4029)	8.00	7.26	7.81	7.48	6.61	7.16	6.83	118.75	119.3	119.09
	X1MB	13.30	10.61	10.73	10.67	9.97	10.09	10.03	121.38	121.5	121.44
			7.26	**10.73**	**9.48**	**6.61**	**9.80**	**8.84**	**118.75**	**126.57**	**121.79**
Saddlers Creek Alluvium	GW45	15.00	10.99	12.75	11.95	10.43	12.19	11.38	139.71	141.47	140.51
	GW46	21.00	8.75	9.65	9.14	8.22	9.12	8.60	134.51	135.41	135.02
	GW47	18.00	7.41	7.96	7.66	6.86	7.41	7.10	129.11	129.66	129.41
			7.41	**12.75**	**9.58**	**6.86**	**12.19**	**9.03**	**129.11**	**141.47**	**134.98**
Saddlers Creek Tributary/ Shallow Permian	BCGW22A (IW4027)	15.00	4.57	5.18	4.87	3.99	4.60	4.29	138.86	139.47	139.16
			4.57	**5.18**	**4.87**	**3.99**	**4.60**	**4.29**	**138.86**	**139.47**	**139.16**

Aquifer	Bore ID	Bore Depth (mbgl)	Depth to Water - Below Casing (mbToC)			Depth to Water - Below Ground (mbgl)			Groundwater Elevation (mAHD)		
Permian coal measures	BCGW18	11.60	Dry								
	BCGW22 (IW4026)	33.00	5.95	11.11	7.81	5.32	10.48	7.18	132.91	138.07	136.21
	EWPC33	57.38	32.04	55.1	38.25	31.32	54.38	37.53	174.94	198	191.8
	GW2	113.00	11.34	11.67	11.56	10.94	11.27	11.16	142.2	142.53	142.32
	GW38P	23.00	10.2	10.3	10.26	9.68	9.78	9.74	121.38	121.48	121.42
	GW39P - 25mm	42.16	10.29	10.52	10.4	9.86	10.09	9.97	120.21	120.44	121.42
	GW43	69.00	29.05	29.74	29.49	28.55	29.24	28.99	167.59	168.28	167.84
	GW44	133.00	110.58	112.42	111.52	110.05	111.89	110.99	98.61	110.45	99.51
	GW48	36.15	10.41	13.75	11.4	9.78	13.12	10.77	115.95	119.29	118.3
	GW49	36.00	7.62	7.83	7.77	7..09	7.30	7.24	118.72	118.93	118.78
	OD1078P (IW4028)	88.00	38.9	38.82	36.69	35.25	38.17	36.04	132.88	135.8	135.01
	X10MB	80.60	65.32	65.61	65.43	64.66	64.95	64.77	182.58	182.87	182.76
			5.95	**112.42**	**29.34**	**5.32**	**111.89**	**28.77**	**98.61**	**198.00**	**140.24**

4.1 Drawdown

Figure 4.2 shows the change in groundwater levels in the alluvium and **Figure 4.3** shows the change in groundwater levels the Permian coal measures over the reporting period. 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 2021. A negative value represents a decline in water levels, while a positive value represents a rise in water levels over the reporting period.

Figure 4.2 shows over the reporting period there was generally negligible change in water levels along the Hunter River alluvium. However, the change in levels did vary spatially, with GW16 and GW40A showing higher drawdown compared to bores closer to the mine.

Bores along Saddlers Creek fluctuated over the monitoring period in response to rainfall trends with changes in levels ranging between 0.55 m (GW47) and 1.60 m (GW45), with an overall increasing trend with the highest increase observed in the upper reaches at bore GW45.

Figure 4.3 shows a general decline in groundwater levels to the southwest of open cut operations, showing a response to the progression of mining to the southwest. However, in-pit water storage (Belmont and MacDonald pits) potentially buffers the extent of drawdown in localised areas.

4.1.1 Trigger Exceedances

Groundwater level data collected from July 2020 to June 2021 have been compared to the trigger values outlined in the WMP. Only VWP04 recorded a groundwater level exceedance over the reporting period. A summary of the exceedance is presented in **Table 4.2**.

Table 4.2 Groundwater Level Trigger Exceedances

Bore ID	Screened Lithology	Location	Comment
VWP04	Vaux Seam Bayswater Seam Edderton Seam Edinglassie Seam Ramrod Creek Seam	On site - north of MAC open pit	Levels in the Vaux, Bayswater, Edderton, Edinglassie, and Ramrod Creek Seams exceeded the 2020 trigger levels between October 2020 and June 2021. The continuing declining groundwater level trend represents mining induced depressurisation as predicted for the approved operations by SLR as shown in **Figure 4.1**. SLR (2020b) predicted continued drawdown in this area with simulated water levels ranging between 4.72 and -85.5 mAHD. The measured water levels ranged from 29 to -14.4 mAHD. 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.

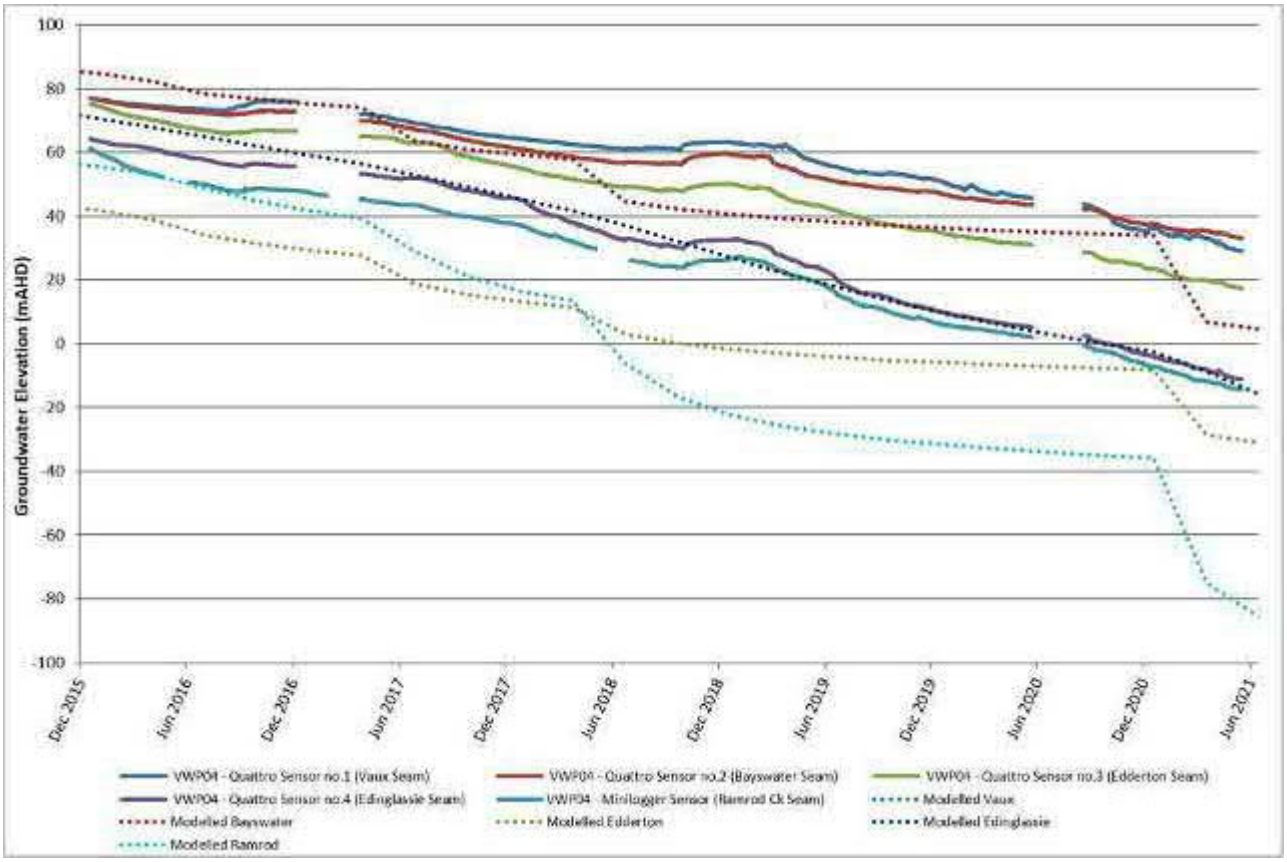
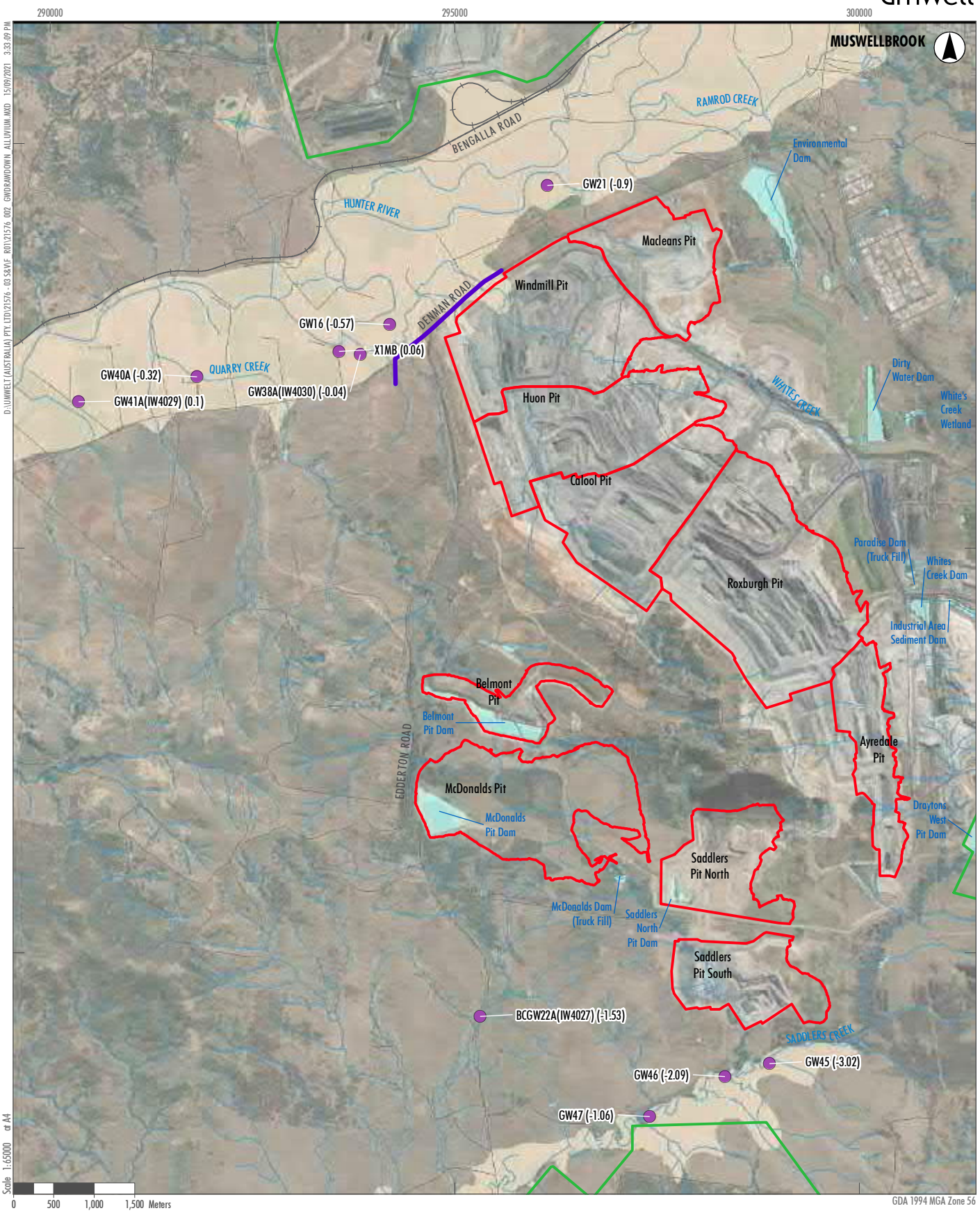


Figure 4.1 VWP04 Modelled versus Observed Levels



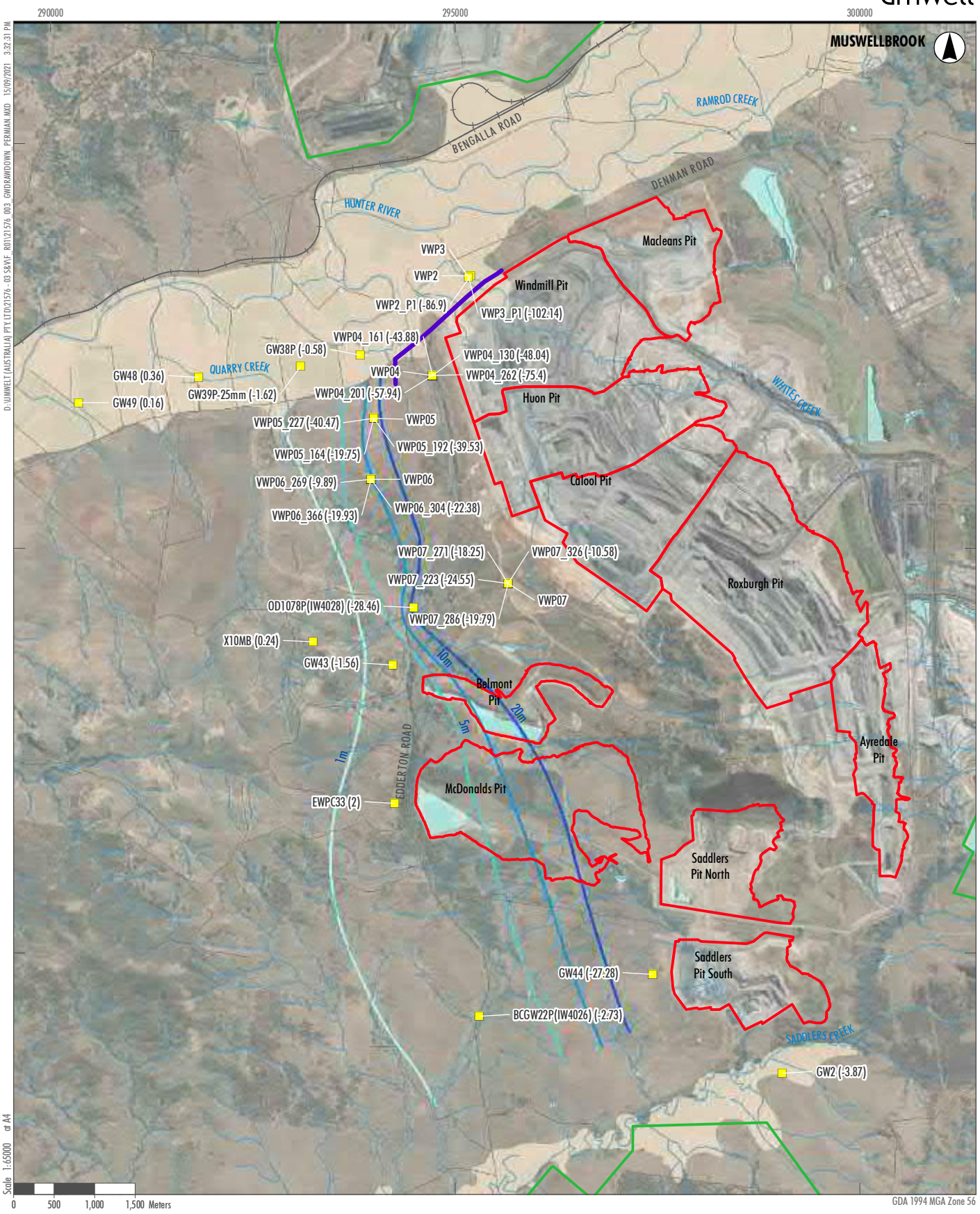
Legend

- MAC Extent
- Surrounding Mines
- Alluvium Monitoring Locations
- Cut-off Wall
- Alluvium Extent
- Railway
- Roads
- Watercourse
- Waterbodies

FIGURE 4.2

Total Groundwater Drawdown to June 2021
Alluvium

Image Source: ESRI Basemap (2021) Data source: Qspatial (2021)



Legend

- MAC Extent
- Surrounding Mines
- Permian Coal Measures Monitoring Locations
- Cut-off Wall
- Alluvium Extent
- Railway
- Roads
- Watercourse
- Waterbodies

Permian Coal Measures Drawdown (m)

- 1
- 5
- 10
- 20

FIGURE 4.3

Total Groundwater Drawdown to June 2021 Permian Coal Measures

Image Source: ESRI Basemap (2021) Data source: Qspatial (2021)

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**.

Table 5.1 Groundwater Quality Monitoring Results July 2021 to June 2020

Aquifer	Bore ID	pH			EC (µS/cm)		
		Min	Max	Avg	Min	Max	Avg
Hunter River Alluvium	GW16	7.0	7.6	7.2	3950	4420	4152
	GW21	6.9	7.1	7.0	894	968	935
	GW38A (IW4030)	7.2	7.3	7.3	3170	3670	3508
	GW40A	7.2	7.5	7.3	5420	5680	5510
	GW41A (IW4029)	7.2	7.5	7.4	7220	10500	8575
	X1MB	7.3	7.6	7.4	4750	4960	4835
		6.9	**7.6**	**7.2**	**894**	**10500**	**4536**
Saddlers Creek Alluvium	GW45	6.7	7.1	6.9	5750	11170	8213
	GW46	6.9	7.0	7.0	7230	7490	7340
	GW47	7.0	7.1	7.0	5360	6100	5735
		6.7	**7.1**	**7.0**	**5360**	**11170**	**7096**
Saddlers Creek Tributary/ Shallow Permian	BCGW22A (IW4027)	6.7	7.0	6.8	13200	15690	14480
		6.7	**7.0**	**6.8**	**13200**	**15690**	**14480**
Permian coal measures	BCGW18	Dry					
	BCGW22 (IW4026)	7.5	8.0	7.6	14460	17350	15953
	EWPC33	6.9	7.1	7.0	2820	2970	2874
	GW2	7.6	7.6	7.6	4060	4990	4715
	GW38P	7.5	7.6	7.6	2716	2906	2811
	GW39P - 25mm	7.5	7.7	7.5	6110	6400	6195
	GW43	NM					
	GW44	NR					
	GW48	7.4	7.7	7.6	4250	4380	4340
	GW49	6.7	7.1	6.9	6580	6790	6708
	OD1078P (IW4028)	NR					
	X10MB	9.2	10.0	9.5	5450	6570	6115
		6.7	**10.0**	**7.7**	**2716**	**17350**	**6214**

Note: NM = not measured NR = not required

5.1 Trigger Exceedances

Water quality data collected from July 2020 to June 2021 have been compared to the trigger values outlined in the WMP. Five bores recorded a water quality exceedance over the reporting period including BCGW22A (IW4027), BCGW22P (IW4026), GW40A, GW48 and GW49.

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**. An analysis of the trigger exceedances is summarised in **Table 5.2**.

Table 5.2 Groundwater Level Trigger Exceedances

Bore ID	Screened Lithology	Location	Comment
GW40A	Hunter River Alluvium	Off site – off Denman Road, west of MAC	EC has fluctuated seasonally since monitoring began. Since September 2019 EC has increased and exceeded the 1st stage trigger level of 5290 µS/cm for the entire monitoring period. Groundwater levels have declined since 2013, despite periods of above average rainfall from 2013 to 2017. The bore is located over 3 km from active mining and the decline in levels is unique compared to bores closer to the mine area such as GW16. The bore is located on private property surrounded by houses and farm sheds and located 20 m northwest of GW48 which is screened in the Bowfield Seam. The EC levels recorded in GW40A are higher than those in GW48. Review of groundwater levels indicates similar trend for both bores, with levels in the alluvium only slightly (0.1 m) higher than levels in the coal seam. However, the logger data also indicates a sharp 0.4 to 0.6 m rise in alluvial water levels in January and March 2021 followed by a gradual decline between months. The sharp rise in groundwater levels in January and March correspond to high rainfall, with 58.2 mm falling over two days at the start of January and 131 mm falling over ten days in the middle of March. This indicates that the rise in EC is likely sourced from surface activities or potentially soil stored salts, as opposed to upward seepage from the shallow coal seam. The condition of the surface casing and depth of the bore was checked in September 2020 by CBE; no issues were identified. However, bore construction information indicates the bore is screened from around 0.5 m depth to 14.63 mbgl. The construction of the bore may be influencing the results, with the large screened interval facilitating capture of water infiltrating from surface (i.e. irrigation). The elevated EC is unlikely due to mining, and it is recommended that a replacement bore is installed with a smaller screened interval to prevent surface water infiltrating the bore

Bore ID	Screened Lithology	Location	Comment
GW48	Bowfield Seam	Off site – off Denman Road, west of MAC	EC has fluctuated seasonally since monitoring began ranging from 3090 µS/cm in May 2016 to 4750 µS/cm in June 2020, with an increasing trend between September 2019 and June 2020. Between June 2020 and June 2021 levels have declined ranging between 4250 µS/cm and 4380 µS/cm. Groundwater levels have increased over the same period, with the exception of one reading in December 2020 of 115.95 mAHD, but it is likely due to a field reading error. EC exceeded the 1st stage trigger level of 4090 µS/cm for the entire monitoring period. The bore is located over 3 km from active mining on private property surrounded by houses and farm sheds and located 20 m southeast of GW40A which is screened in the Hunter River alluvium. The EC levels recorded in GW40A are higher than those in GW48. This indicates the trends for GW48 are likely influenced by local ground conditions and activities and not due to mining activities. The condition of the surface casing and depth of the bore was checked in September 2020 by CBE; no issues were identified. It is recommended that the condition of the bore using a downhole camera and verification of the surrounding surface activities be undertaken to determine the cause of the rising EC trend.
BCGW22A (IW4027)	Saddlers Creek Tributary/ Shallow Permian	On site - southwest of Bayswater No. 3	EC has fluctuated seasonally since monitoring began. EC has an increasing trend, ranging from 9200 µS/cm in March 2019 to 15690 µS/cm in December 2020. The 1st stage trigger level of 14100 µS/cm was exceeded for the entire monitoring period, and levels ranged between 14460 µS/cm to 17350 µS/cm over Q1 to Q4. The bore is over 2 km from active mining and 1 km from a historical rehabilitated pit. The condition of the surface casing and depth of the bore was checked in September 2020 by CBE; no issues were identified. Further review of water quality and potential water sources in the area is recommended, including the backfilled pit and water storage within McDonalds and Belmont Pits.
BCGW22P (IW4026)	Glen Munro Seam	On site - southwest of Bayswater No. 3	EC has an increasing trend, ranging from 8960 µS/cm in November 2017 to 17350 µS/cm in September 2020. The 1st stage trigger level of 14100 µS/cm was exceeded for the entire monitoring period, and levels ranged between 14460 µS/cm to 17350 µS/cm over Q1 to Q4. The bore is over 2 km from active mining and 1 km from a historical rehabilitated pit. The condition of the surface casing and the depth of the bore was checked in September 2020 by CBE; no issues were identified. Further review of water quality and potential water sources in the area is recommended, including the backfilled pit and water storage within McDonalds and Belmont Pits.

Bore ID	Screened Lithology	Location	Comment
GW49	Arrowfield Seam	Off site – off Denman Road, west of Mt Arthur Open Cut	EC has fluctuated seasonally since monitoring began ranging from 5020 µS/cm in March 2019 to 7530 µS/cm in June 2020, with an increasing trend between September 2019 and June 2020. Between June 2020 and June 2021 levels have declined ranging between 6580 µS/cm and 6790 µS/cm. Groundwater levels have an increasing trend since December 2019. EC exceeded the 1st stage trigger level of 6170 µS/cm for the entire monitoring period. The bore is located over 5 km from active mining on private property in open farmland and located 15 m south of GW41A which is screened in the Hunter River alluvium. The EC levels recorded in GW49 are lower than those in GW41A. The condition of the surface casing and depth of the bore was checked in September 2020 by CBE; no issues were identified. It is recommended that the condition of the bore using a downhole camera and verification of water supply use is undertaken.

6.0 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 sample holding times prior to being dispatched to the Australian Laboratory Services Pty Ltd (ALS).

The quality assurance review results are summarised in **Table 6.1** 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.
- 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.
- BCGW18 was unable to be sampled at all as there was insufficient water.
- 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 six 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. Exceedances of RPD greater than 20% were identified for Total Phosphorus and Iron in September 2020, Total Suspended Solids in December 2020 and Iron in March 2021. 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. No exceedances for dissolved metals were observed, and the RPD exceedances do not correlate to any reported trigger exceedances for the monitoring period.

Table 6.1 Summary of Quality Assurance Review

Monitoring Round	Field Data	Field Parameter Stabilisation	Frequency of Analyses	Analysis Parameters	Holding Time (days)	Duplicate Sample	Relative Percentage Difference (RPD)	Comments
Sep-20	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.	Samples received within holding time with the exception of pH	EPWC33	Total Phosphorus 120% Iron 93%	All bores purged 3 x bore volumes prior to sampling except GW25 (hand bailed - tree roots in bore blocking pump), GW39A and GW39P (hand bailed - bore diameter too small for pump), BCGW18 (dry), GW41A (IW4029) (hand bailed), BCGW22P (pumped dry). All sample submissions reached the lab below specified temperature of 4 °C. Field calibration sheets were not available for review.
Dec-20	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.	Samples received within holding time with the exception of pH	GW47	Total Suspended Solids 79%	All bores purged 3 x bore volumes prior to sampling except GW25 (hand bailed - tree roots blocking bore), BCGW22P (pumped dry), BCGW18 (dry), GW45 (hand bailed), GW39P (hand bailed - bore diameter too small for pump), X1MB (pumped dry, then hand bailed, very silty), X10MB (hand bailed - screws in bore screen obstructing access). Only two out of six sample submissions reached the lab below specified temperature of 4 °C. Field calibration sheets were not available for review.

Monitoring Round	Field Data	Field Parameter Stabilisation	Frequency of Analyses	Analysis Parameters	Holding Time (days)	Duplicate Sample	Relative Percentage Difference (RPD)	Comments
Mar-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.	Samples received within holding time with the exception of pH	GW48	Iron 161%	All bores purged 3 x bore volumes prior to sampling except GW25 (hand bailed - tree roots blocking bore), BCGW22P (pumped dry), BCGW18 (dry). Only two out of six sample submissions reached the lab below specified temperature of 4 °C. Field calibration sheets were not available for review.
Jun-21	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.	Samples received within holding time with the exception of pH	GW2	No RPDs greater than 20%	All bores purged 3 x bore volumes prior to sampling except GW25 (hand bailed - blocked with tree roots), GW38A (IW4030) (hand bailed), GW39A and GW39P (hand bailed - bore diameter too small for pump), BCGW18 (insufficient water to sample). Eight out of nine sample submissions reached the lab below specified temperature of 4 °C. Field calibration sheets were not available for review.

7.0 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 227.0m 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 the end of December 2013. However, the footwall of the Edinglassie Seam is no longer monitored as VWP1 has been decommissioned due to sensor failure. The VWP3 – Sensor 2 also failed in December 2020. The sensors should be replaced to continue monitoring in this area.

Figure 7.1 shows groundwater levels have declined 87 m in the F4 fault, 105 m in the Edinglassie Seam and 103 m in the Ramrod Creek Seam, since installation in 2011. The Hunter River alluvium and shallow weathered sandstone (regolith) is monitored by bore GW42 which is located adjacent to the VWPs. Groundwater levels at GW42 have fluctuated over time but have remained relatively stable, with a minor increase of 0.18 m between February 2016 and June 2021, as shown in **Figure 7.2**. As noted in previous annual reviews (AGE, 2019; SLR, 2020a), bore GW42 fluctuates in response to rainfall and streamflow trends. Depressurisation observed in the Permian coal measures has not impacted on the Hunter River alluvium and regolith groundwater levels observed in bore GW42.

Groundwater level data is available in the area at bores close to the Hunter River (GW16, GW21, GW38A and X1MB) and close to the cut-off wall (GW42). All of the bores recorded a similar stable to slightly rising trend over the monitoring period.

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.

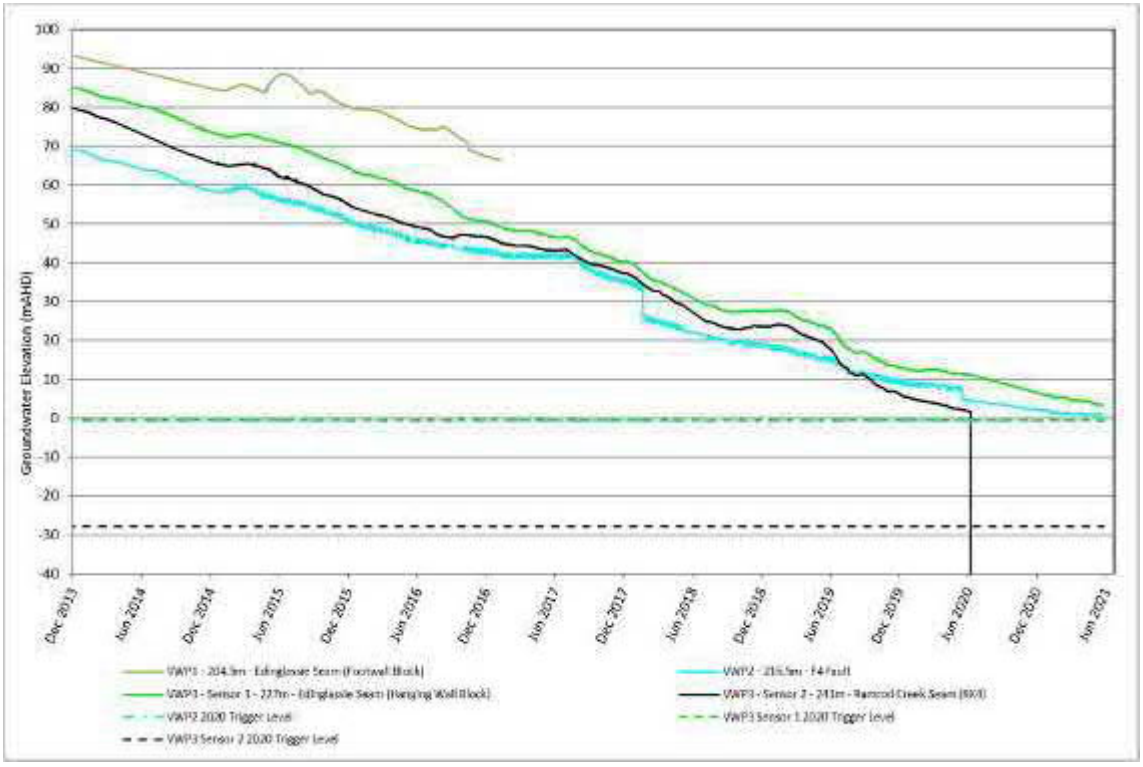


Figure 7.1 Groundwater levels in Permian Coal Measures Adjacent to the Cut-off Wall

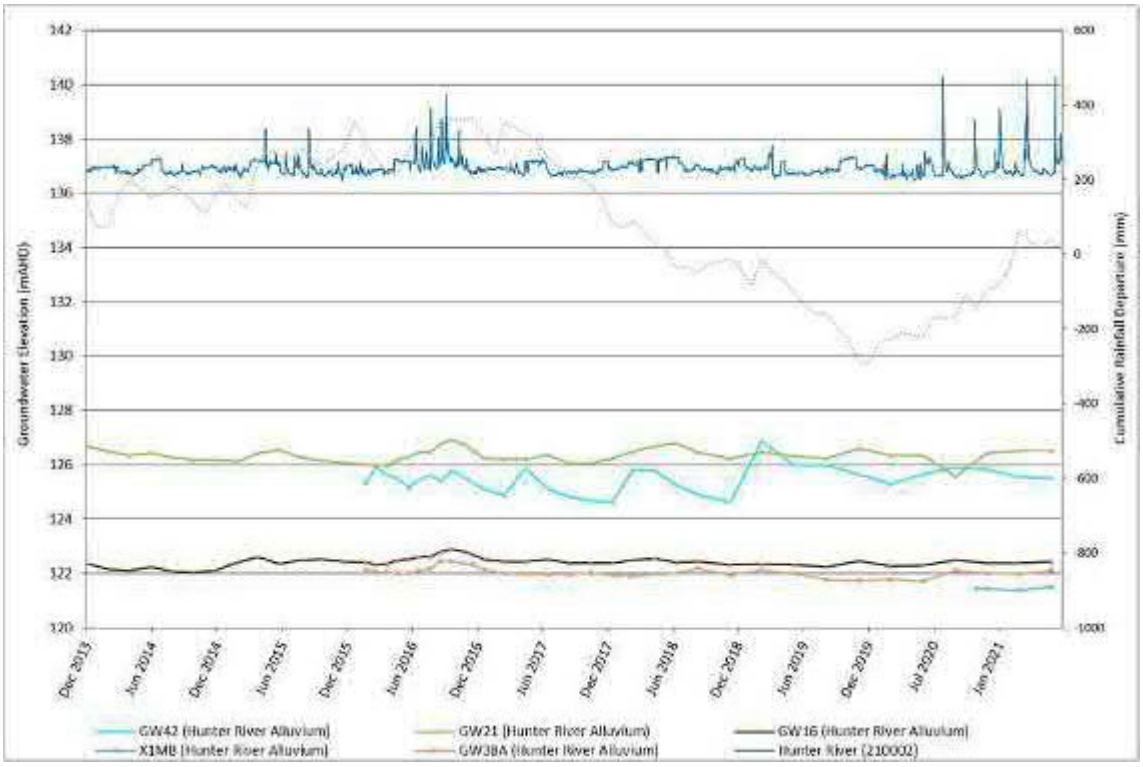


Figure 7.2 Groundwater Levels in the Hunter River Alluvium Adjacent to the Cut-off Wall

8.0 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 8.1**. 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 8.2**.

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 2021 were compared to groundwater levels predicted in the current SLR (2020b) site model from July 2020 to June 2021. The difference between the model prediction and measured levels (residuals) are shown in **Figure 8.3**. Where the model predicted higher groundwater levels (i.e. less drawdown) than is observed, the values are positive. Negative values indicate where the model predicted lower groundwater levels (i.e. more drawdown) than was observed.

New groundwater monitoring bores and VWPs were installed to the west of MAC over 2020. Two of the new bores are included in the WMP; X1MB, screened within the Hunter River alluvium and X10MB, screened within the Glen Munro Seam. However, these bores were not included in the SLR (2020b model outputs. For this annual review the modelled head was estimated for X1MB using nearby bore GW38A (IW4030) which is 300m to the southeast of X1MB and also screened within the Hunter River alluvium. Bore GW6, which is screened in the Glen Munro Seam, was used to estimate the modelled head for X10MB which is 1 km to the northeast of GW6.

The groundwater model predictions in the Hunter River alluvium compare well to the measured levels as shown in **Figure 8.3**. Overall, the residual in the Hunter River alluvium is less than 5 m as shown in bores GW16, GW21, GW38A (IW4030), GW40A and GW41A (IW4029).

The model also showed a good fit (i.e. less than 1 m difference) between measured and modelled groundwater levels for bore GW42 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, GW46 and GW47 are within 5 m of measured levels. However, 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 EWPC33 near McDonalds Pit. 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 southwest of the open cut (Huon Pit and Calool Pit) in some layers at VWP05, VWP06 (except Edderton Seam) and VWP07 (Piercefield and Vaux Seams). However, this response is variable and likely reflects the simplified vertical discretisation in the model layers compared to the VWP sensor intervals.

The difference between observed and modelled levels for X10MB is around 22 m. This difference relates to the use of results for GW6 which is 1 km closer to mine operations where the modelled and observed drawdown due to mining is greater. It is recommended that the updated network be applied in the model and results at each location extracted for future reporting.

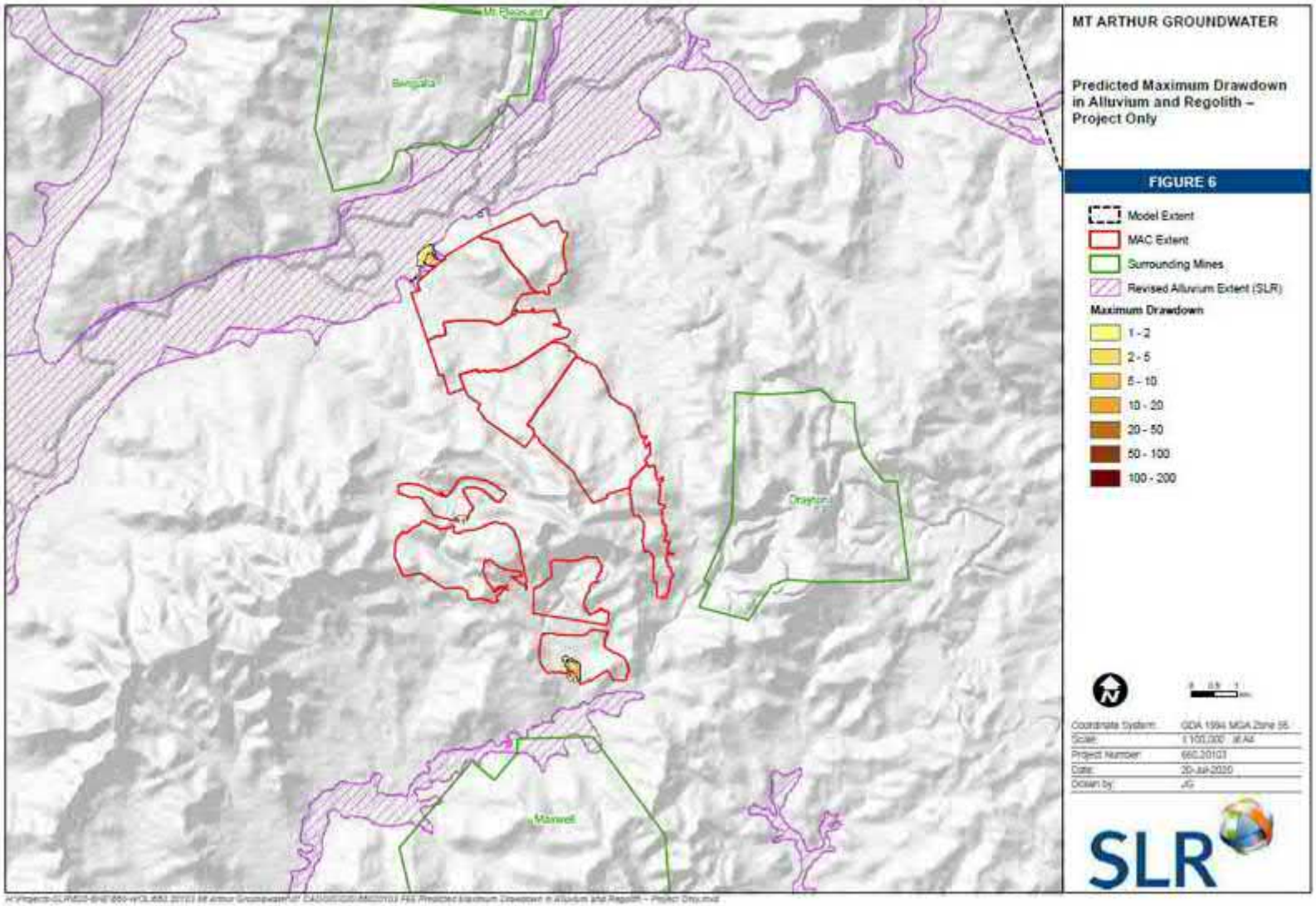


Figure 8.1 Predicted Maximum Drawdown in Unconsolidated (Layer 1 and 2) – Approved Operations

(Source: SLR, 2020)

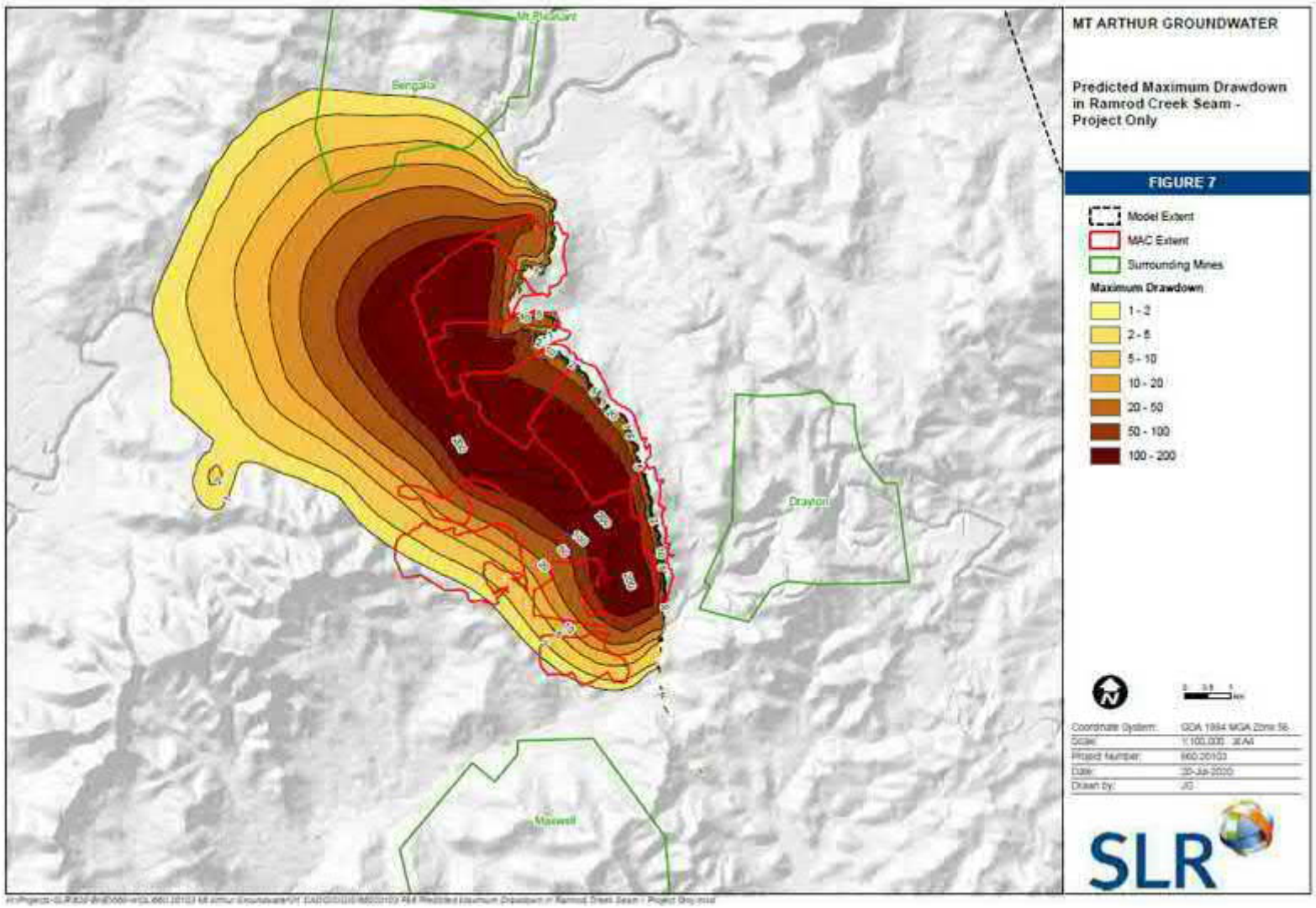
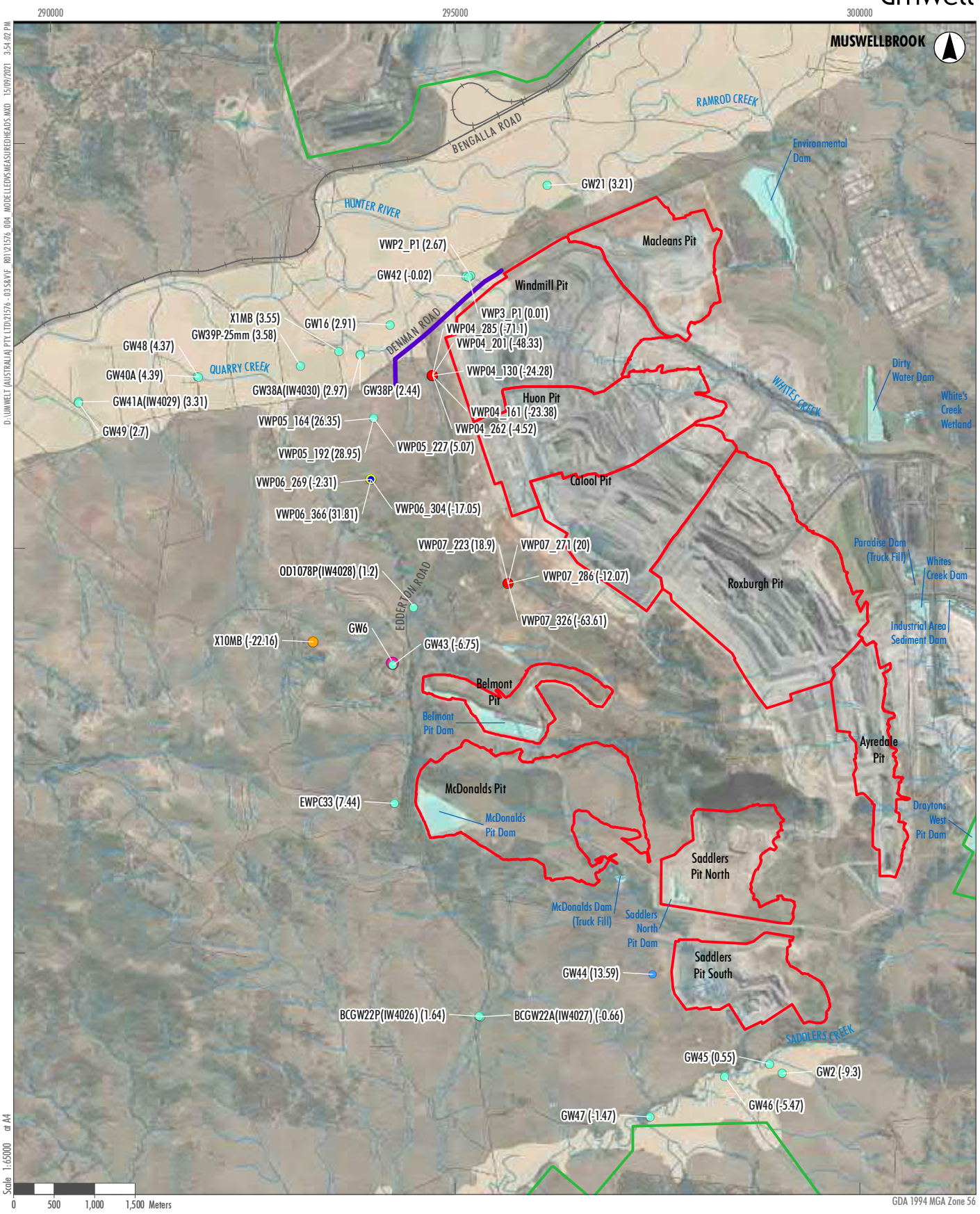


Figure 8.2 Predicted Maximum Drawdown in Ramrod Creek Seam (Layer 26) – Approved Operations

(Source: SLR, 2020)



Legend

- MAC Extent
- Surrounding Mines
- Cut-off Wall
- Alluvium Extent
- Railway
- Roads
- Watercourse
- Waterbodies

Modelled vs Observed Heads (m)

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

FIGURE 8.1

Modelled vs Observed Heads June 2021

Image Source: ESRI Basemap (2021) Data source: Qspatial (2021)

9.0 Recommendations

The following improvements to the groundwater monitoring program are recommended:

- Bore BCGW22A (IW4027) - further review of water quality and potential water sources in the area including the backfilled pit and water storage within McDonalds and Belmont Pits due to the water quality exceedance.
- Bore BCGW22P (IW4026) - further review of water quality and potential water sources in the area including the backfilled pit and water storage within McDonalds and Belmont Pits due to the water quality exceedance.
- Bore GW49 – check the condition of the bore using a downhole camera and verify what water supply use is in the area. Bore GW41P – Section 9.3.2 of the WMP should be updated to reflect that GW41P is no longer used as a background monitoring bore as it has already been decommissioned.
- GW40A - install a replacement bore with a smaller screened interval to prevent surface water infiltrating the bore.
- GW48 - check the condition of the bore using a downhole camera and verification of the surrounding surface activities to determine the cause of the rising EC trend.
- Bores GW2, GW43, GW45 and OD1078P (IW4028) - show instrument drift in the installed dataloggers. It is recommended that the dataloggers be replaced to assist in correlating groundwater trends with rainfall and streamflow trends.
- Bore BCGW22A (IW4027) – logger data was not received. The field sheets note that the logger was full of water which was cleaned out and the logger has been resealed. The logger function should be checked in Q1 of 2021/2022 to determine if the logger needs to be replaced.
- VWP3 – sensor 2 in the Ramrod Creek Seam (241 m) stopped recording in December 2020, it is recommended that the installation of the logger be checked.
- VWP04 – triggers levels in all sensors were exceeded. It is recommended that the water level trigger be reviewed to align with levels in the latest model predictions
- VWP06 – the sensor 1 in the Vaux Seam stopped recording in May 2021, it is recommended that the installation of the logger be checked.
- the updated monitoring network should be applied in the model and results at each location extracted for future reporting.
- 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 following improvements to the field monitoring and sampling programme by CBE are recommended:

- chilled groundwater lab samples – nine of the 15 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 of 4°C
- supply all field calibration sheets and lab QA/QC sheets for quality review.

10.0 References

Australasian Groundwater and Environmental Consultants Pty Ltd (AGE), 2013. Groundwater Impact Assessment, Mt Arthur Coal Open Cut Modification. Report prepared for Mt Arthur Coal. Project No. G1602. January 2013.

Australasian Groundwater and Environmental Consultants Pty Ltd (AGE), 2019. Mt Arthur Coal Groundwater Annual Review 2018/2019. Prepared for Hunter Valley Energy Coal Pty Ltd. Project No. G1936. September 2019.

Australasian Groundwater and Environmental Consultants Pty Ltd (AGE), 2020. Mt Arthur Coal Groundwater Model Update. Prepared for Hunter Valley Energy Coal Pty Ltd. Project No. G1936. January 2020.

BHP, 2020a. Mt Arthur Coal: Forward Program, MAC-ENC-MTP-052, released 14th of May 2020.

BHP, 2020b. Mt Arthur Coal Water Management Plan (WMP), MAC-ENC-MTP-034, released 10th of December 2020.

EcoLogical, 2019. Maxwell Project Aquatic Ecology and Stygofauna Assessment, prepared for Malabar Coal Ltd, January 2019.

Scientific Information for Land Owners (SILO). http://silo.longpaddock.qld.gov.au

SLR Consulting Pty Ltd (SLR), 2020a. Mount Arthur Coal Groundwater Annual Review 2019/2020. Report prepared for BHP. Project No. 660.20103.00000-R01-v2.0. September 2020.

SLR Consulting Pty Ltd (SLR), 2020b. Mount Arthur Coal Groundwater Modelling Report. Report prepared for BHP. Project No. 665.20103-R03-v1.0. July 2020.

APPENDIX A

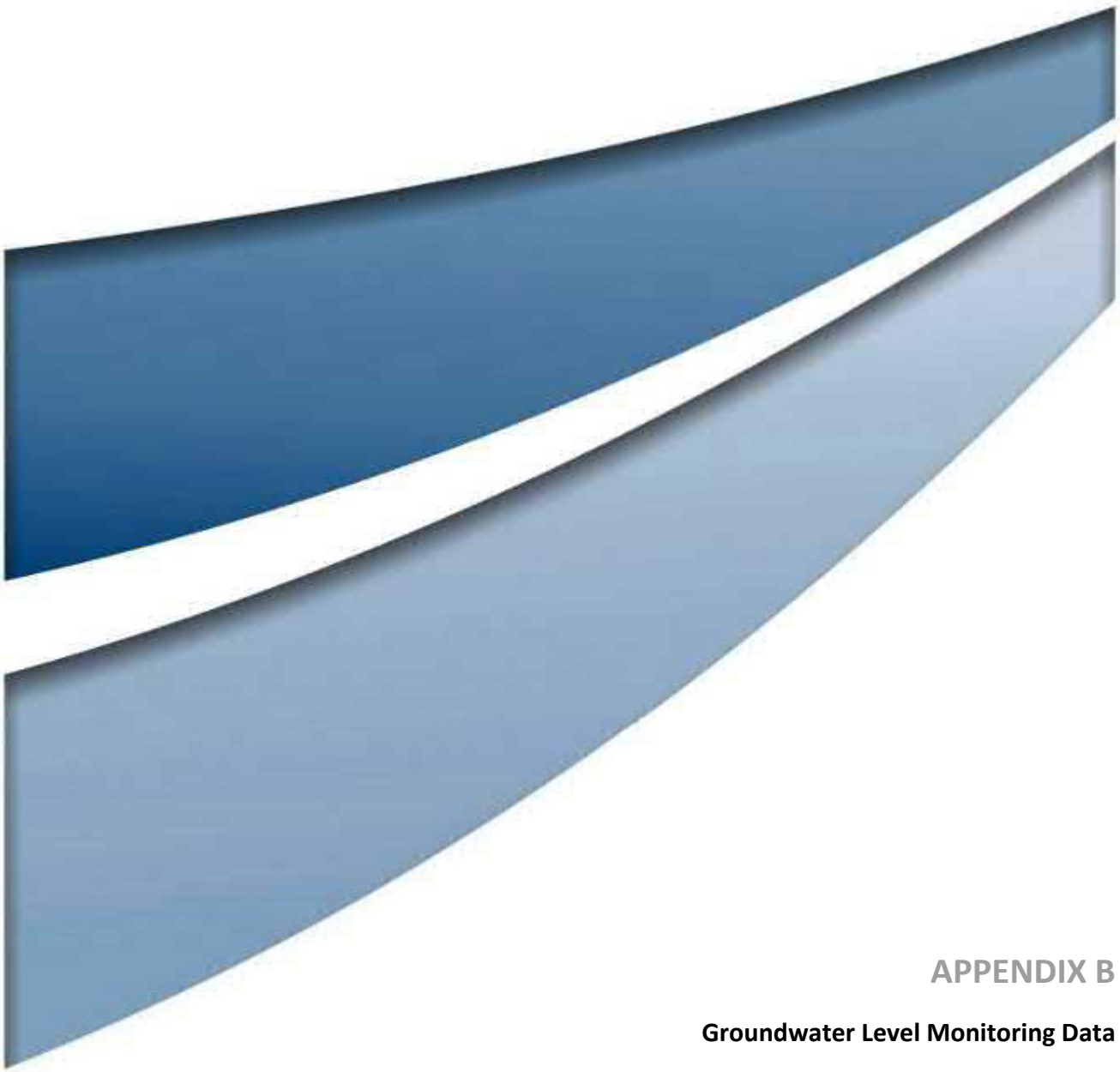
Groundwater Monitoring Network and Triggers

Bore ID	Easting	Northing	RL (mAHD)	Screen/Sensor (mAHD)	Unit	Stratigraphy	SWL Frequency	WQ Frequency	Monitored in 2021	Trigger Derivation Method	Water Level Trigger (mAHD)	pH Trigger Range	EC Trigger - Stage 1 µS/cm	EC Trigger - Stage 2 µS/cm
BCGW18	294345	6419985	158.301	147.701 - 151.701	AFS	Coal	D/Q	Q/A	Y	3	147.3	7.0-9.1	8030	8510
BCGW22P (IW4026)	295304	6414211	143.389	-	GM	Coal	D/Q	Q/A	Y	3	133.7	7.1-9.9	14100	16270
BCGW22A (IW4027)	295304	6414211	143.389	-	Saddlers Shallow Permian	Regolith	D/Q	Q/A	Y	1	137.6	6.6-7.1	11810	14500
EWPC33	294253	6416847	229.05	174.623 - 177.623	BKF	Coal	D/Q	Q/A	Y	1	194.3	6.5-7.5	4592	6290
GW2	299045	6413511	153.691	40.473 - 43.473	WDH	Coal	D/Q	Q/A	Y	2	133.2	6.5-8.0	4266	4770
GW16	294197	6422759	131.441	120.369 - 126.269	Qa - Hunter	Alluvium	D/Q	Q/A	Y	1	120.9	7.0-7.7	4210	4690
GW21	296141	6424483	135.996	124.963 - 128.963	Qa - Hunter	Alluvium	D/Q	Q/A	Y	1	125.0	6.8-7.8	1197	2000
GW38A (IW4030)	293831	6422393			Qa - Hunter	Alluvium	D/Q	Q/A		1	120.7	6.5-7.7	4900	5560
GW38P	293832	6422384	131.16	99.86 - 102.86	WW	Coal	D/Q	Q/A	Y	2	120.9	7.2-8.1	3224	3830
GW39P-25mm	293094.7	6422251	130.35	-	WW	Coal	D/Q	-	Y	3	116.0	-	-	-
GW40A	291816	6422119	128.815	116.296 - 128.896	Qa - Hunter	Alluvium	D/Q	Q/A	Y	1	117.8	6.9-8.0	5290	5650
GW41A (IW4029)	290354	6421789	125.96	-	Qa - Hunter	Alluvium	D/Q	Q/A	Y	1	117.9	6.6-7.7	9090	10600
GW43	294233	6418560	197.33	133.83 - 139.83	WDH	Coal	D/Q	Q/A	Y	1	165.4	6.7-7.4	4400	4470
GW44	297445	6414733	211.031	80.5 - 86.5	WDH	Coal	D/Q	-	Y	2	99.9	-	-	-
GW45	298890	6413630	151.886	138.394 - 141.394	Qa - Saddlers	Alluvium	D/Q	Q/A	Y	1	138.9	6.6-7.1	11810	14500
GW46	298337	6413469	143.63	126.14 - 129.14	Saddlers Shallow Permian	Regolith	D/Q	Q/A	Y	2	129.0	6.3-8.0	8050	11380

Bore ID	Easting	Northing	RL (mAHD)	Screen/Sensor (mAHD)	Unit	Stratigraphy	SWL Frequency	WQ Frequency	Monitored in 2021	Trigger Derivation Method	Water Level Trigger (mAHD)	pH Trigger Range	EC Trigger - Stage 1 µS/cm	EC Trigger - Stage 2 µS/cm
GW47	297409	6412974	136.505	120.012 - 123.012	Qa - Saddlers	Alluvium	D/Q	Q/A	Y	2	127.3	6.5-7.6	7320	8220
GW49	290346	6421798	125.553	91.52 - 94.52	AFS	Coal	D/Q	Q/A	Y	1	117.6	6.1-7.5	6170	7530
OD1078-P (IW4028)	294496	6419259	171.048	82 - 92.048	BFS	Coal	D/Q	-	Y	2	134.6	-	-	-
VWP2_P1	295195	6423364	135.412	-81.088	Fault	-	D	-	Y	2	-0.6	-	-	-
VWP3_P1	295166	6423349	135.38	-91.62	EG	Coal	D	-	Y	2	-0.6	-	-	-
VWP3_P2	295166	6423349	135.38	-105.62	RC	Coal	D	-	Y	2	-27.9	-	-	-
VWP04_130	294719	6422132	140.84	10.84	VU	Coal	D	-	Y	3	42.2	-	-	-
VWP04_161	294719	6422132	140.84	-20.16	BU	Coal	D	-	Y	3	37.3	-	-	-
VWP04_201	294719	6422132	140.84	-60.16	ED	Coal	D	-	Y	3	22.0	-	-	-
VWP04_262	294719	6422132	140.84	-121.16	EG	Coal	D	-	Y	3	-7.5	-	-	-
VWP04_285	294719	6422132	140.84	-144.16	RC	Coal	D	-	Y	3	-12.6	-	-	-
VWP05_164	293993	6421605	161.4	-2.6	VU	Coal	D	-	Y	2	32.4	-	-	-
VWP05_192	293993	6421605	161.4	-30.6	BU	Coal	D	-	Y	2	32.4	-	-	-
VWP05_227	293993	6421605	161.4	-65.6	ED	Coal	D	-	Y	2	-6.2	-	-	-
VWP05_288	293993	6421605	161.4	-126.6	ED	Coal	D	-	Y	2	28.2	-	-	-
VWP05_311	293993	6421605	161.4	-149.6	RC	Coal	D	-	Y	2	6.6	-	-	-
VWP06_237	293960	6420850	179.64	-57.36	VU	Coal	D	-	Y	2	43.1	-	-	-
VWP06_269	293960	6420850	179.64	-89.36	BR	Coal	D	-	Y	2	43.1	-	-	-
VWP06_304	293960	6420850	179.64	-124.36	ED	Coal	D	-	Y	2	4.1	-	-	-
VWP06_366	293960	6420850	179.64	-186.36	BR	Coal	D	-	Y	2	58.1	-	-	-
VWP06_388	293960	6420850	179.64	-208.36	BR	Coal	D	-	Y	2	53.7	-	-	-
VWP07_223	295656	6419565	215.95	-70.55	BU	Coal	D	-	Y	2	94.5	-	-	-
VWP07_271	295656	6419565	215.95	-70.55	BU	Coal	D	-	Y	3	77.5	-	-	-
VWP07_286	295656	6419565	215.95	-70.55	BU	Coal	D	-	Y	2	40.4	-	-	-

Bore ID	Easting	Northing	RL (mAHD)	Screen/Sensor (mAHD)	Unit	Stratigraphy	SWL Frequency	WQ Frequency	Monitored in 2021	Trigger Derivation Method	Water Level Trigger (mAHD)	pH Trigger Range	EC Trigger - Stage 1 µS/cm	EC Trigger - Stage 2 µS/cm
VWP07_326	295656	6419565	215.95	-110.05	ED	Coal	D	-	Y	2	-16.7	-	-	-
VWP07_418	295656	6419565	215.95	-202.05	RC	Coal	D	-	Y	3	95.7	-	-	-
X1MB	293566	6422429	131.47	13.30	Qa - Hunter	Alluvium	D/Q	-	Y	3	119.7	-	-	-
X10MB	293247	6418841	247.53	80.60	GM	Coal	D/Q	-	Y	2	176.9	-	-	-

Note: Coordinates in MGA94 Zone 56
Qa – Alluvium
PCM – Permian coal measures *WW – Warkworth Seam* *BKF – Blakefield Seam*
WDH – Woodland Hill Seam *AFS – Arrowfield Seam* *BFS – Bowfield Seam*
BR – Broonie Seam *VU – Vaux Seam* *BU – Bayswater Seam*
ED – Edderton Seam *RC – Ramrod Creek Seam* *EG – Edinglassie Seam*
D/Q – Daily (6 hourly) water level data from logger, downloaded quarterly and manual reading quarterly
Q/A – Quarterly standard water quality analysis and Annual comprehensive water quality analysis



APPENDIX B

Groundwater Level Monitoring Data

Construction						Triggers	Modelled Levels	Measured Levels							Drawdown		
								First Record			June 2020		June 2021				
Bore ID	Easting (m)	Northing (m)	TOC Elevation 2018 Survey (mAHD)	Bore Depth (mbgl)	Monitored Formation	WMP Trigger (2020) (mAHD)	MAC Consolidation Project June 2021 Modelled Head (mAHD)								Head Difference Modelled vs Measured (m) June 2021[2] (Residual)	Measured Drawdown First Record vs Measured (m) June 2021[3]	Expected Drawdown First Record vs Modelled (m) June 2021[3]
GW16	294197.18	6422759.34	131.9	13.3	Hunter River Alluvium	120.9	125.34	Feb-99	9.20	123.00	9.59	122.30	9.46	122.43	2.91	-0.57	2.34
GW21	296141.35	6424483.01	136.0	15.8	Hunter River Alluvium	125.0	129.71	Feb-99	8.60	127.40	9.64	126.33	9.46	126.50	3.21	-0.90	2.31
GW38A (IW4030)	293831.31	6422393.09	131.8	11.4	Hunter River Alluvium	120.7	125.08	Feb-16	9.60	122.15	10.03	121.72	9.64	122.11	2.97	-0.04	2.93
GW40A	291815.48	6422119.3	129.3	13.8	Hunter River Alluvium	117.8	123.77	Jan-08	9.60	119.70	10.33	118.95	9.90	119.38	4.39	-0.32	4.07
GW41A (IW4029)	290347.80	6421809.9	126.6	8.0	Hunter River Alluvium	117.9	122.61	Feb-16	7.36	119.20	7.45	119.11	7.26	119.30	3.31	0.10	3.41
GW42	295138.80	6423356.3	135.6	11.0	Alluvium/Regolith	-	125.47	Feb-16	9.71	125.91	9.99	125.63	10.13	125.49	-0.02	-0.42	-0.44
X1MB*	293566.0	6422429.0	-	13.3	Hunter River Alluvium	119.7	125.05	Nov-11	10.67	121.44	NM	NM	10.61	121.50	-	0.06	3.61
BCGW22A (IW4027)	295313.60	6414209.8	144.0	15.0	Saddlers Creek Shallow Permian	137.6	138.81	Feb-16	3.02	141.00	5.16	138.88	4.57	139.47	-0.66	-1.53	-2.19
GW45	298889.71	6413629.54	152.5	15.0	Saddlers Creek Alluvium	138.9	141.56	Feb-16	8.43	144.03	12.55	139.91	11.45	141.01	0.55	-3.02	-2.47
GW46	298336.76	6413469.34	144.2	21.0	Saddlers Creek Alluvium	129.0	129.69	Feb-16	6.91	137.25	9.68	134.48	9.00	135.16	-5.47	-2.09	-7.56
GW47	297408.76	6412974.11	137.1	18.0	Saddlers Creek Alluvium	127.3	128.13	Feb-16	6.41	130.66	8.11	128.96	7.47	129.60	-1.47	-1.06	-2.53
BCGW18	294345.19	6419985.43	159.0	11.3	Arrowfield	147.3	135.28	Jan-08	3.90	154.90	11.44	147.53	Dry		-	-	-19.62
BCGW22P (IW4026)	295301.50	6414214.69	144.0	-	Glen Munro	133.7	139.71	Feb-16	3.22	140.80	6.50	137.54	5.95	138.07	1.64	-2.73	-1.09
EWPC33	294252.70	6416847.05	230.0	57.4	Blakefield	194.3	205.44	Jan-08	34.30	196.00	33.21	196.83	32.04	198.00	7.44	2.00	9.44
GW2	299044.92	6413510.71	153.9	113.0	Woodlands Hill	133.2	133.23	Jun-01	7.50	146.40	11.81	142.06	11.34	142.53	-9.30	-3.87	-13.17
GW38P	293831.70	6422384.09	131.7	32.6	Warkworth	120.9	123.86	Jan-08	9.50	122.00	10.24	121.44	10.26	121.42	2.44	-0.58	1.86
GW39P-25mm	293094.70	6422250.89	130.7	42.7	Warkworth	116.0	123.86	Jan-08	8.50	121.90	10.38	120.35	10.45	120.28	3.58	-1.62	1.96
GW43	294233.00	6418560.1	197.3	69.0	Woodlands Hill	165.4	161.53	Feb-16	27.49	169.84	29.74	167.59	29.05	168.28	-6.75	-1.56	-8.31
GW44	297444.50	6414732.6	211.0	133.0	Woodlands Hill	99.9	112.20	Feb-16	85.14	125.89	109.79	101.24	112.42	98.61	13.59	-27.28	-13.69
GW48	291829.60	6422110.67	129.7	36.2	Bowfield	117.7	123.66	Feb-16	10.77	118.93	10.91	118.79	10.41	119.29	4.37	0.36	4.73
GW49	290345.74	6421797.57	126.6	36.0	Arrowfield	117.6	121.63	Feb-16	7.78	118.77	7.85	118.70	7.62	118.93	2.70	0.16	2.86
OD1078P (IW4028)	294495.47	6419259.28	171.7	63.0	Arrowfield	134.6	136.84	Jan-08	7.3	164.1	35.89	135.81	36.06	135.64	1.20	-28.46	-27.26
VWP04_130	294719.2	6422131.7	140.84	-	Vaux	42.2	4.72	Dec-15	66.28	77.04	-	45.78	-	29.00	-24.28	-48.04	-72.32
VWP04_161				-	Bayswater	37.3	4.72		97.15	76.98	-	43.64	-	33.10	-28.38	-43.88	-72.26
VWP04_201				-	Edderton	22	-31.03		135.41	75.24	-	31.09	-	17.30	-48.33	-57.94	-106.27
VWP04_262				-	Edinglassie	-7.5	-15.72		185.92	64.2	-	5.16	-	-11.20	-4.52	-75.40	-79.92
VWP04_285				-	Ramrod Creek	-12.6	-85.50		205.46	61.17	-	2.07	-	-14.40	-71.10	-75.57	-146.67
VWP05_164	293993.3	6421605.1	161.4	-	Vaux	32.4	75.55	Dec-15	89.55	68.95	-	58.43	-	49.20	26.35	-19.75	6.60
VWP05_192				-	Bayswater	32.4	75.55		116.78	86.13	-	55.26	-	46.60	28.95	-39.53	-10.58
VWP05_227				-	Edderton	-6.2	50.07		151.13	85.47	-	54.34	-	45.00	5.07	-40.47	-35.40
VWP05_288				-	Edinglassie	28.2	84.74		196.38	69.67	Faulty		Faulty		-	-	-
VWP05_311				-	Ramrod Creek	6.6	86.40		212.85	63.04	Faulty		Faulty		-	-	-

Construction						Triggers	Modelled Levels	Measured Levels						Drawdown		
VWP06_237	293960.3	6420850.4	179.64	-	Vaux	43.1	77.79	Dec-15	149.66	92.3	-	82.16	Faulty	-	-	-
VWP06_269				-	Broonie	43.1	77.79		179.49	89.99	-	85.98	- 80.10	-2.31	-9.89	-12.20
VWP06_304				-	Edderton	4.1	50.65		214.63	90.08	-	74.57	- 67.70	-17.05	-22.38	-39.43
VWP06_366				-	Edinglassie	58.1	98.21		272.85	86.33	-	71.79	- 66.40	31.81	-19.93	11.88
VWP06_388				-	Ramrod Creek	53.7	101.42		-	-	-	-	- -	-	-	-
VWP07_223	295656.1	6419564.9	215.95	-	Piercefield	94.5	117.90	Dec-15	130.65	123.55	-	NM	- 99	18.90	-24.55	-5.65
VWP07_271				-	Vaux	77.5	117.90		171.33	116.15	-	NM	- 97.9	20.00	-18.25	1.75
VWP07_286				-	Bayswater	40.4	73.03		175.42	104.89	-	NM	- 85.1	-12.07	-19.79	-31.86
VWP07_326				-	Edderton	-16.7	20.59		204.93	94.78	-	NM	- 84.2	-63.61	-10.58	-74.19
VWP07_418				-	Ramrod Creek	95.7	146.22		264.50	154.32	-	NM	Faulty	-	-	-
VWP2_P1	295194.8	6423364.1	135.41	216.5	F4 Fault	-0.6	3.47	Aug-11	47.7	87.7	-	4.61	- 0.80	2.67	-86.90	-84.23
VWP3_P1	295165.9	6423349.4	135.38	227.0	Edinglassie	-0.6	3.47	Sep-11	29.8	105.6	-	11.15	- 3.46	0.01	-102.14	-102.13
VWP3_P2				241.0	Ramrod Creek	-27.9	-23.62	Sep-11	33.3	102.1	-	1.83	Faulty	-	-	-
X10MB**	293247.0	6418841.0	-	80.6	Glen Munro	176.9	160.67	Nov-11	65.60	182.59	NM	NM	65.36 182.83	-	0.24	-21.92

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

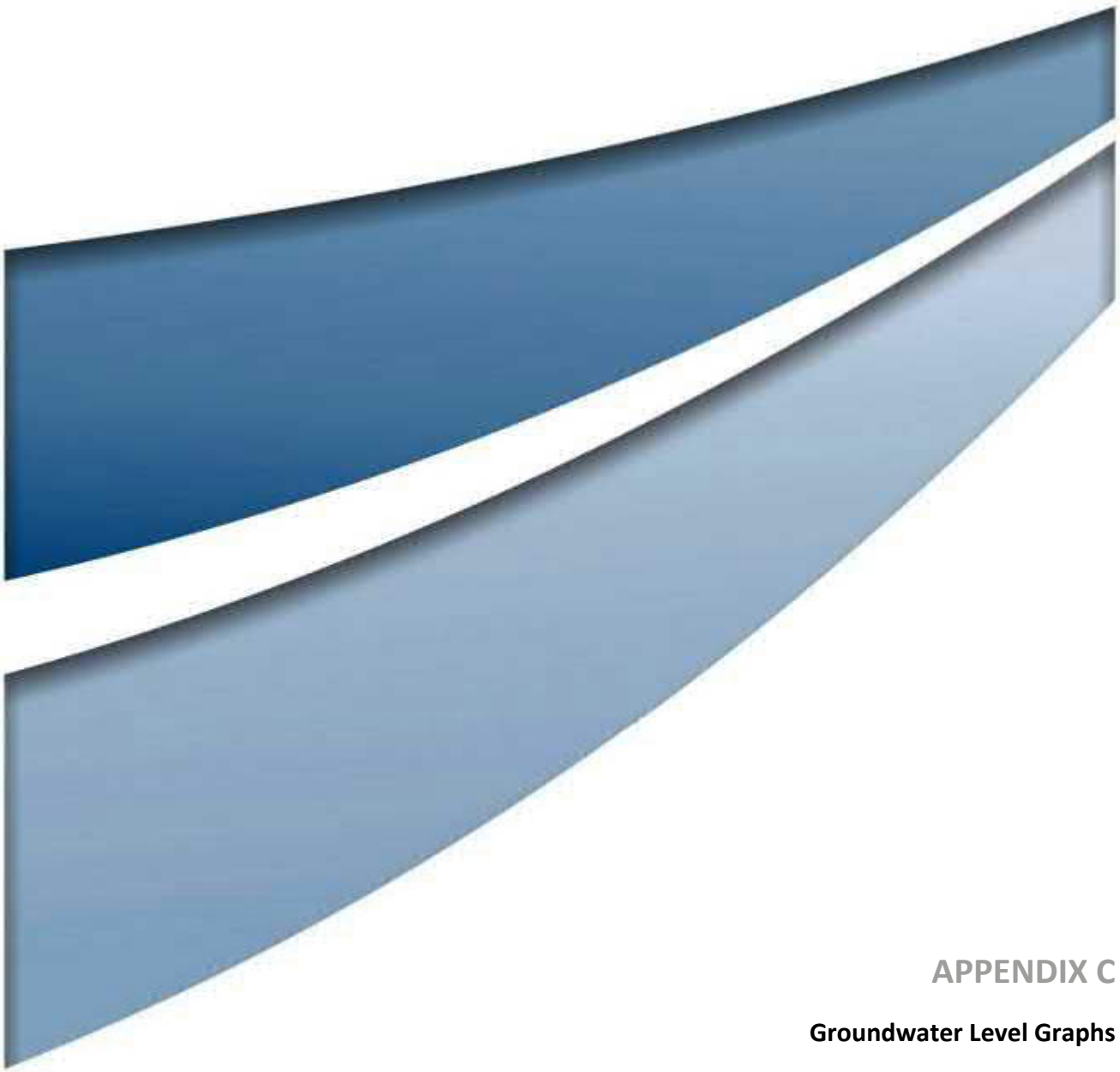
2 Negative values indicate the measured piezometric level is higher than modelled – this means the model is over-predicting effects at this site for FY21.

3 Negative values indicate drawdown.

4 Negative values indicate drawdown over the last year. NM – Not monitored / data not available.

** Estimated using modelling result from nearby bore GW38A (IW4030)*

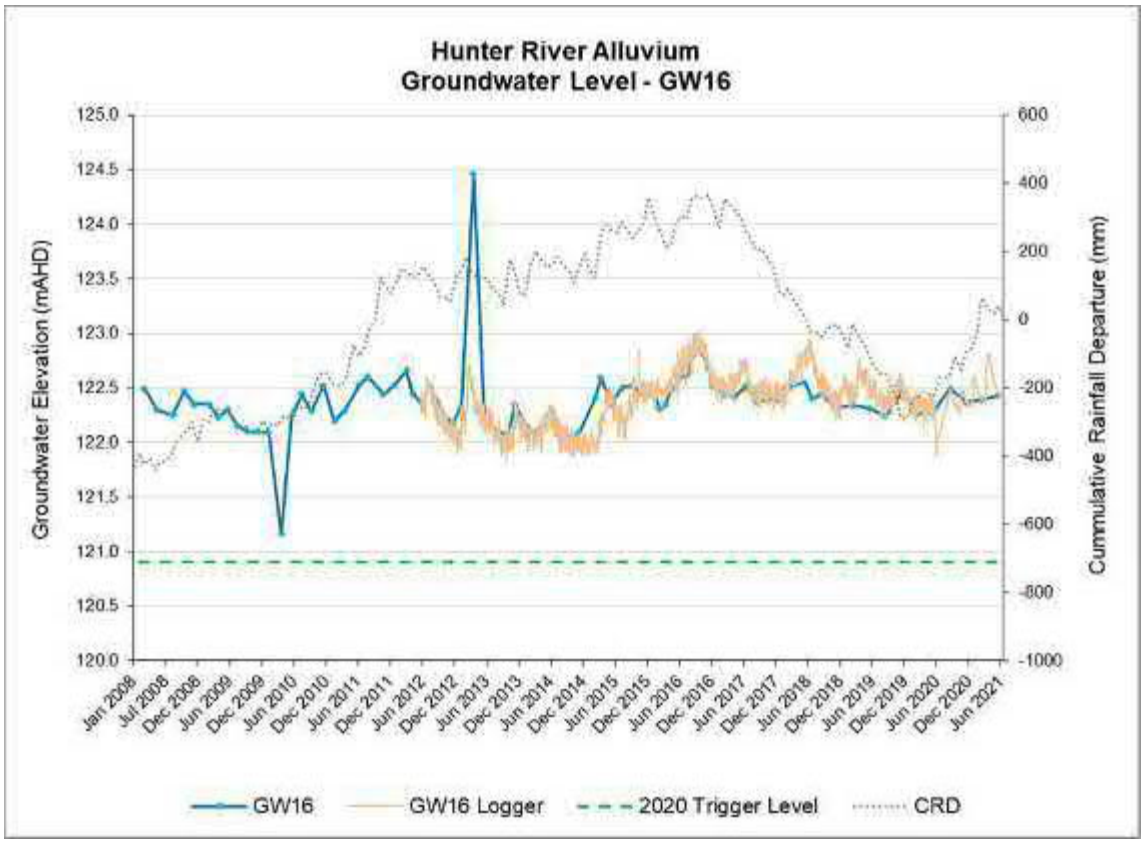
*** Estimated using modelling result from nearby bore GW6*



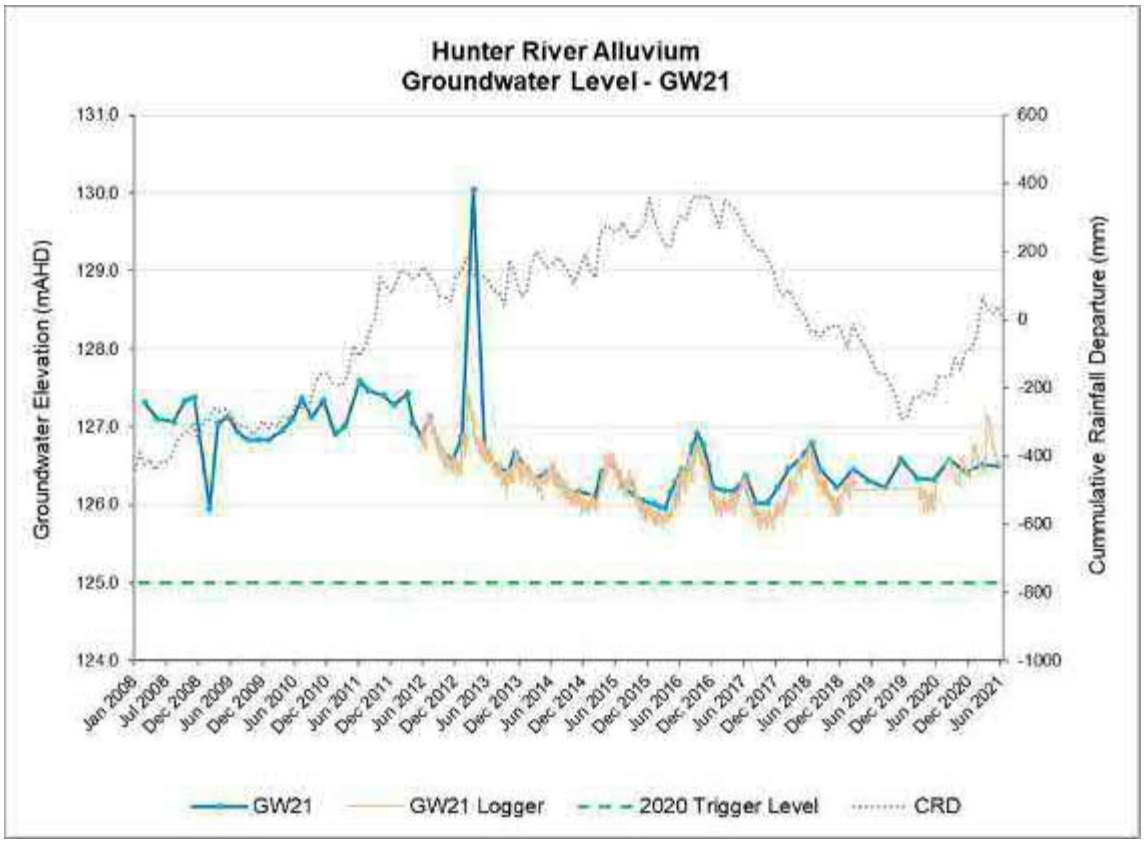
APPENDIX C

Groundwater Level Graphs

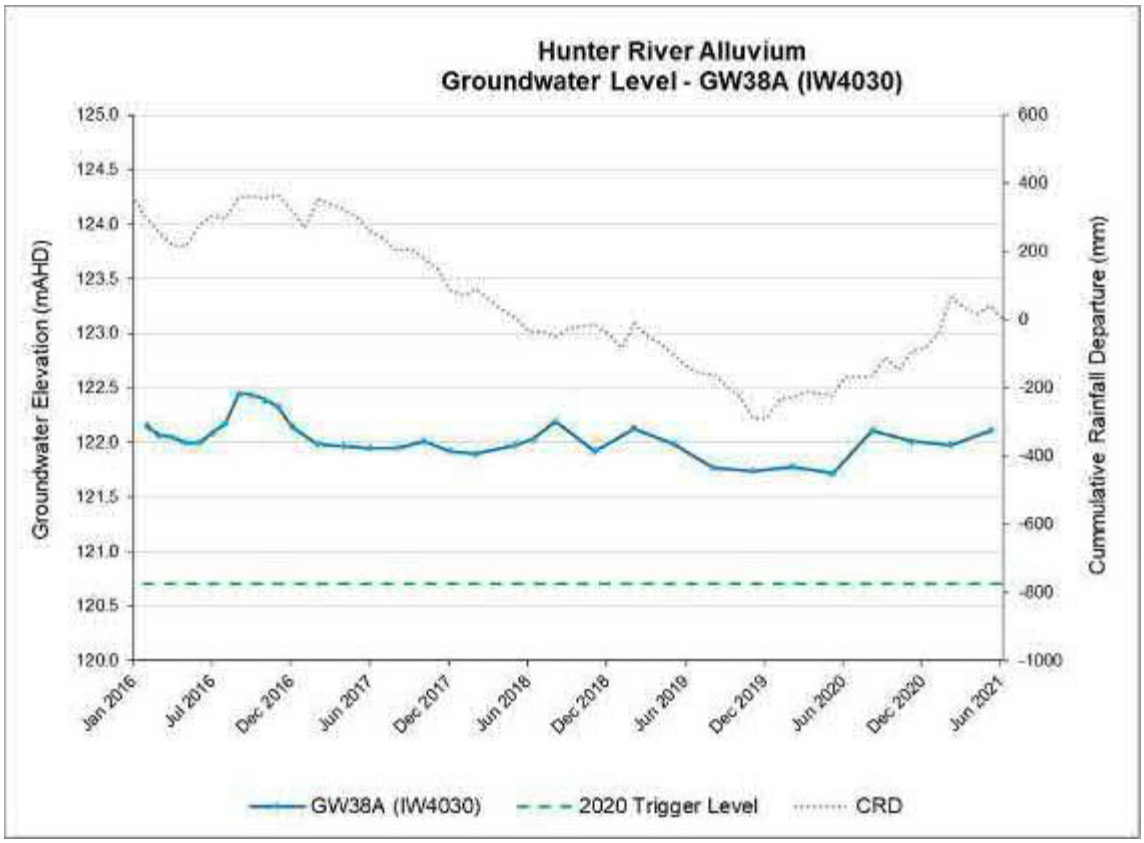
SWL – GW16



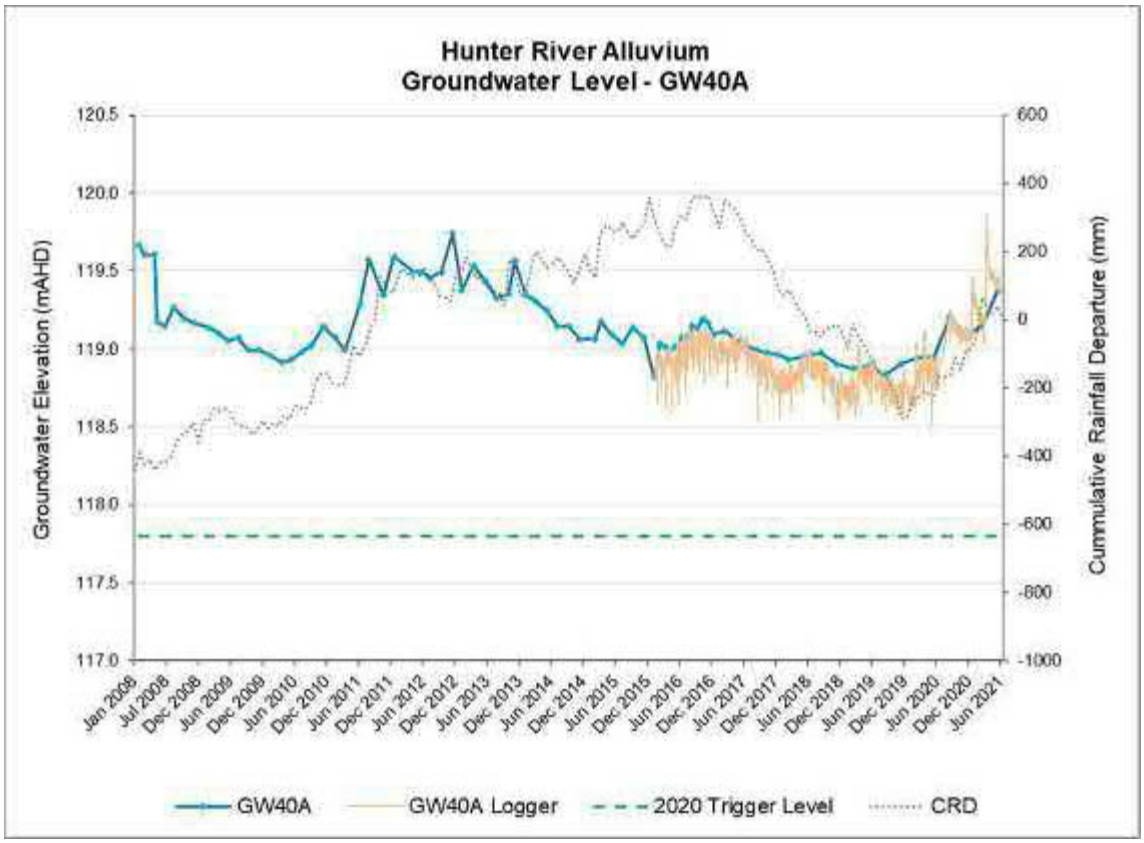
SWL – GW21



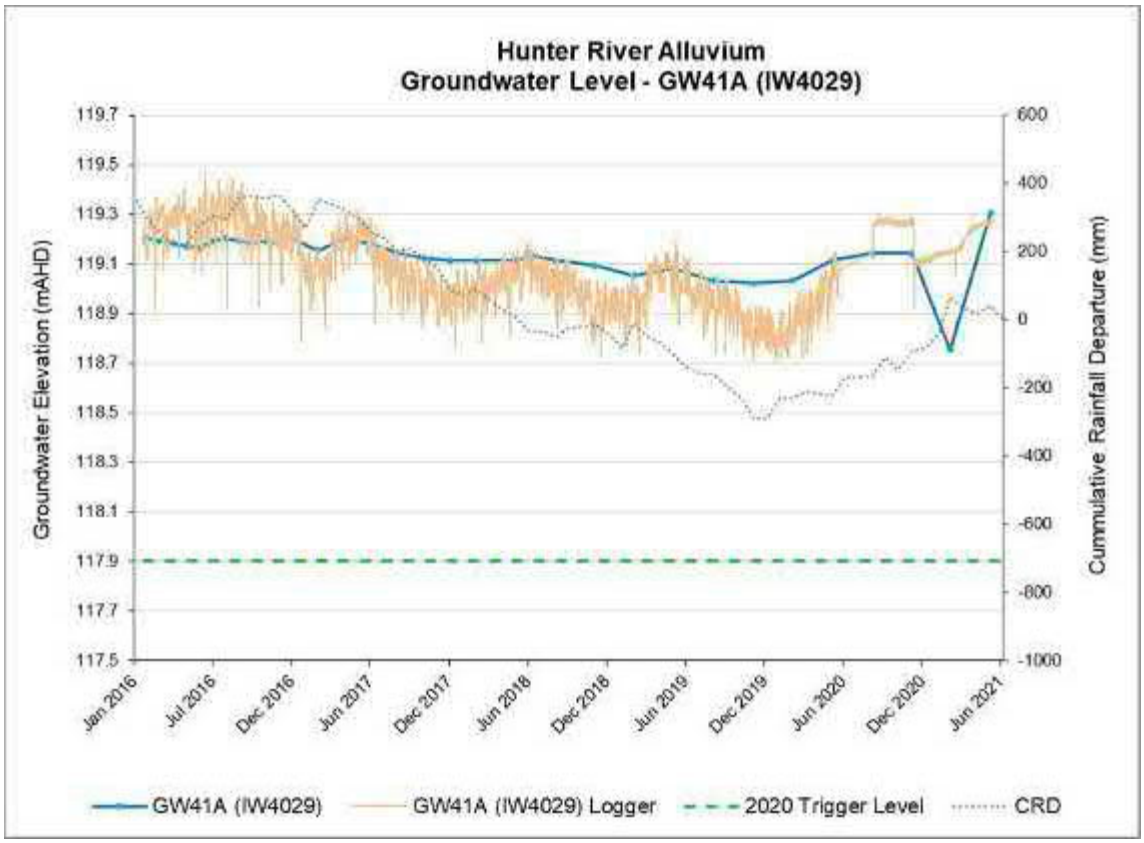
SWL – GW38A (IW4030)



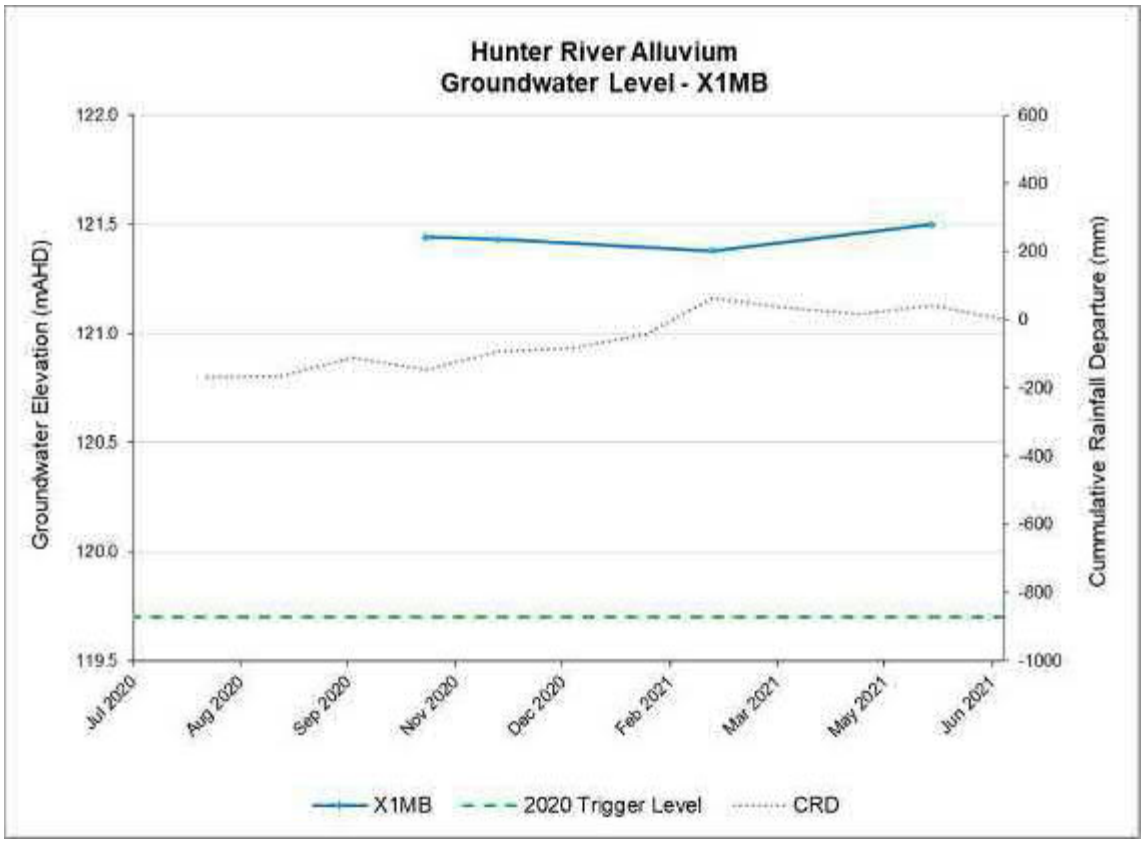
SWL – GW40A



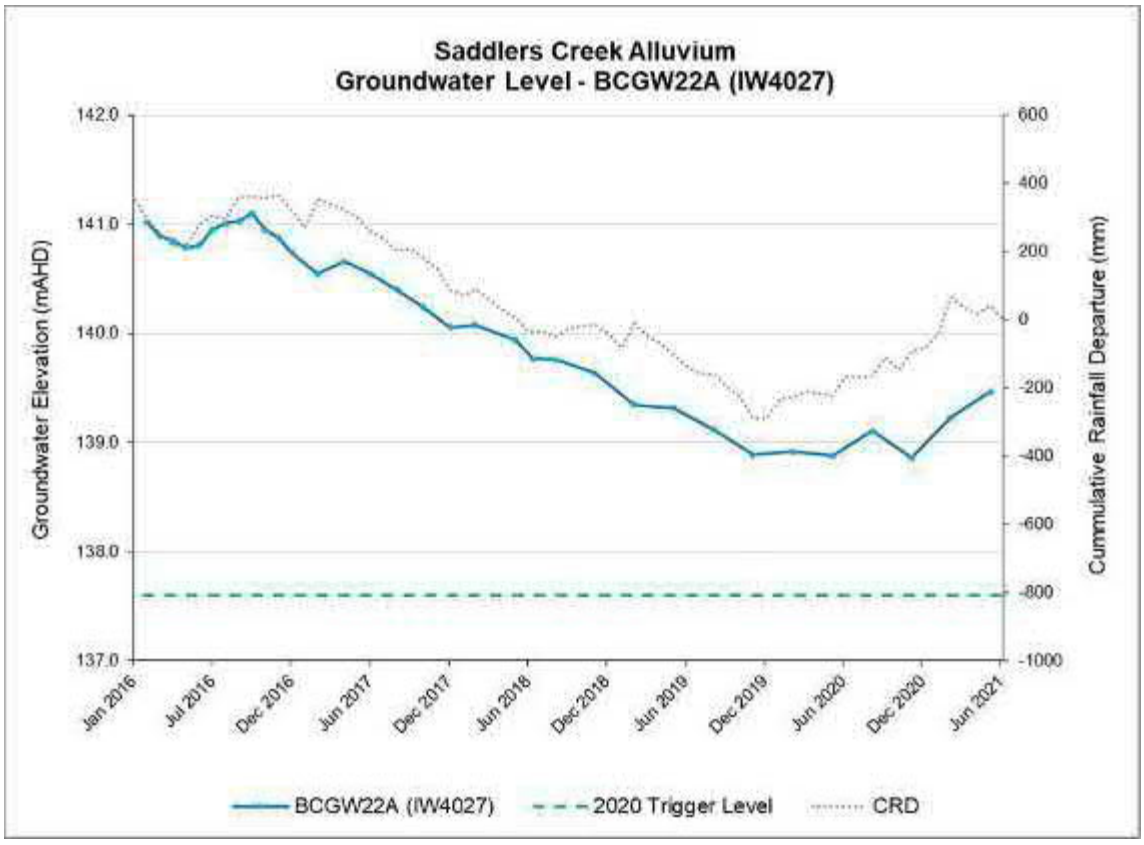
SWL – GW41A (IW4029)



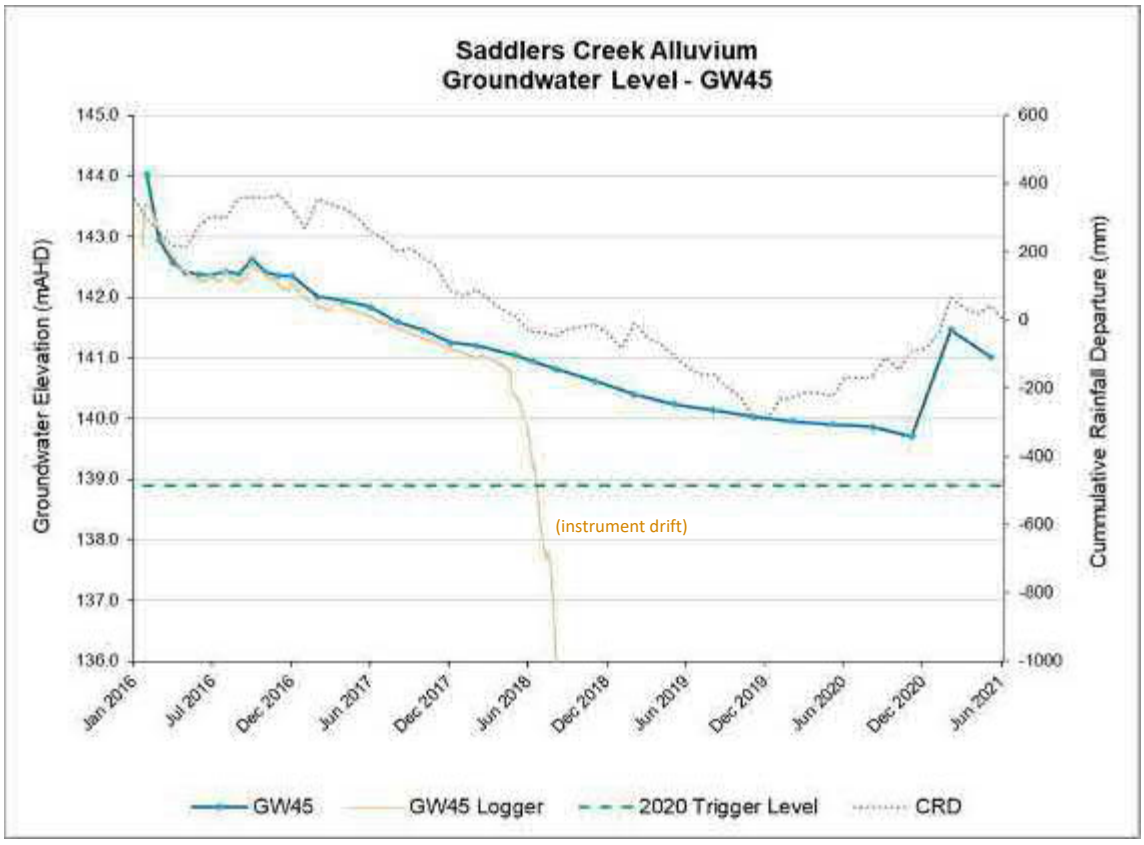
SWL – X1MB



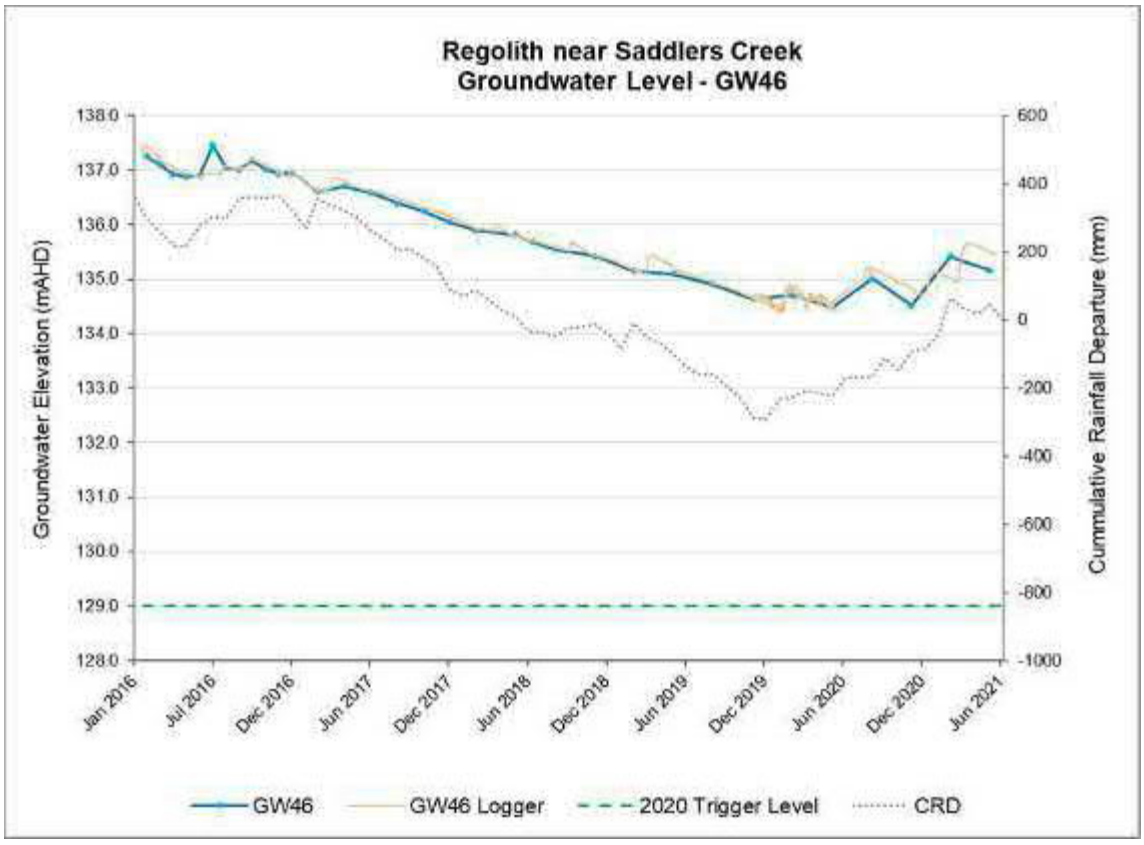
SWL – BCGW22A (IW4027)



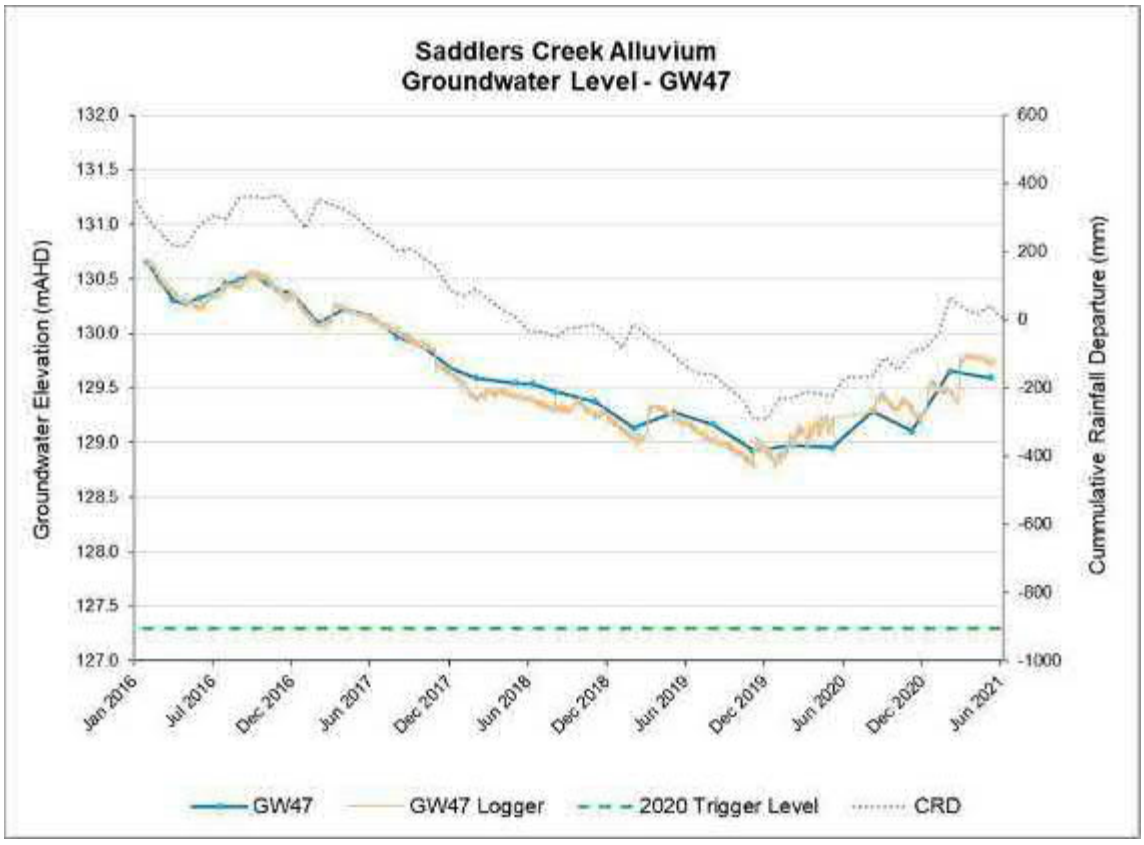
SWL – GW45



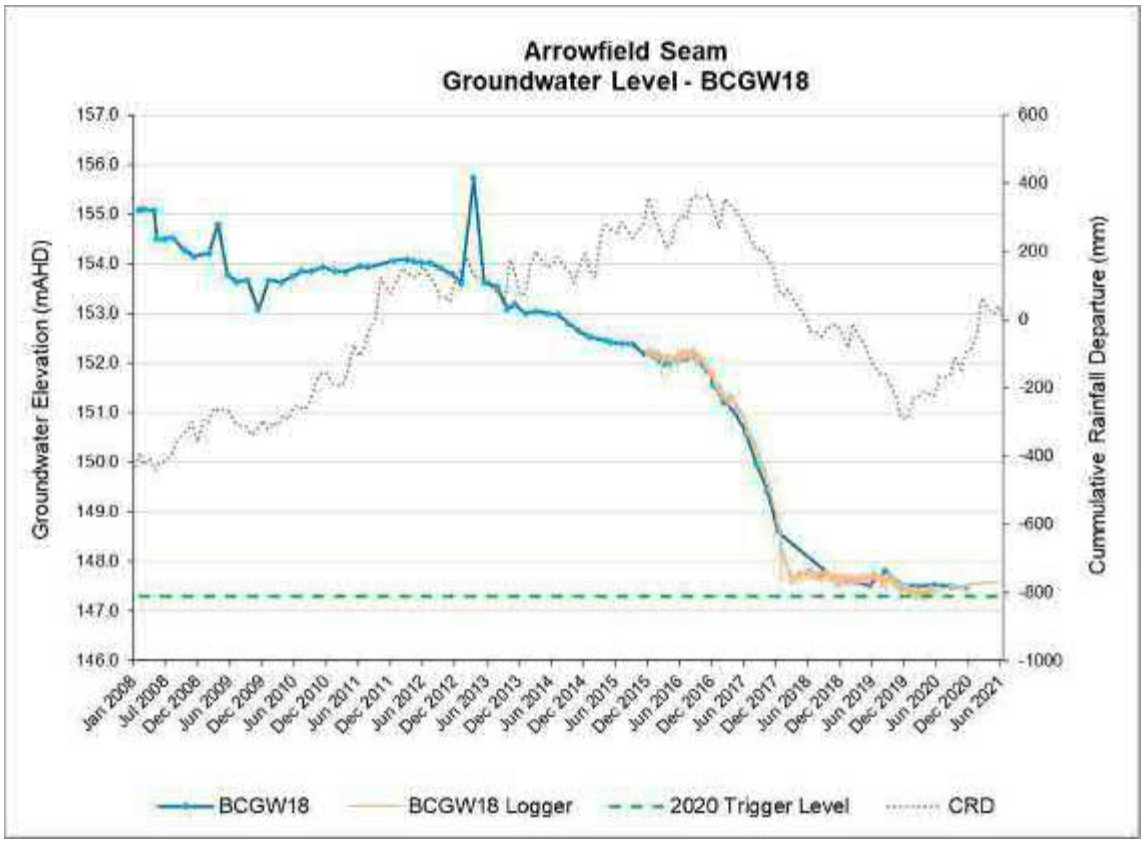
SWL – GW46



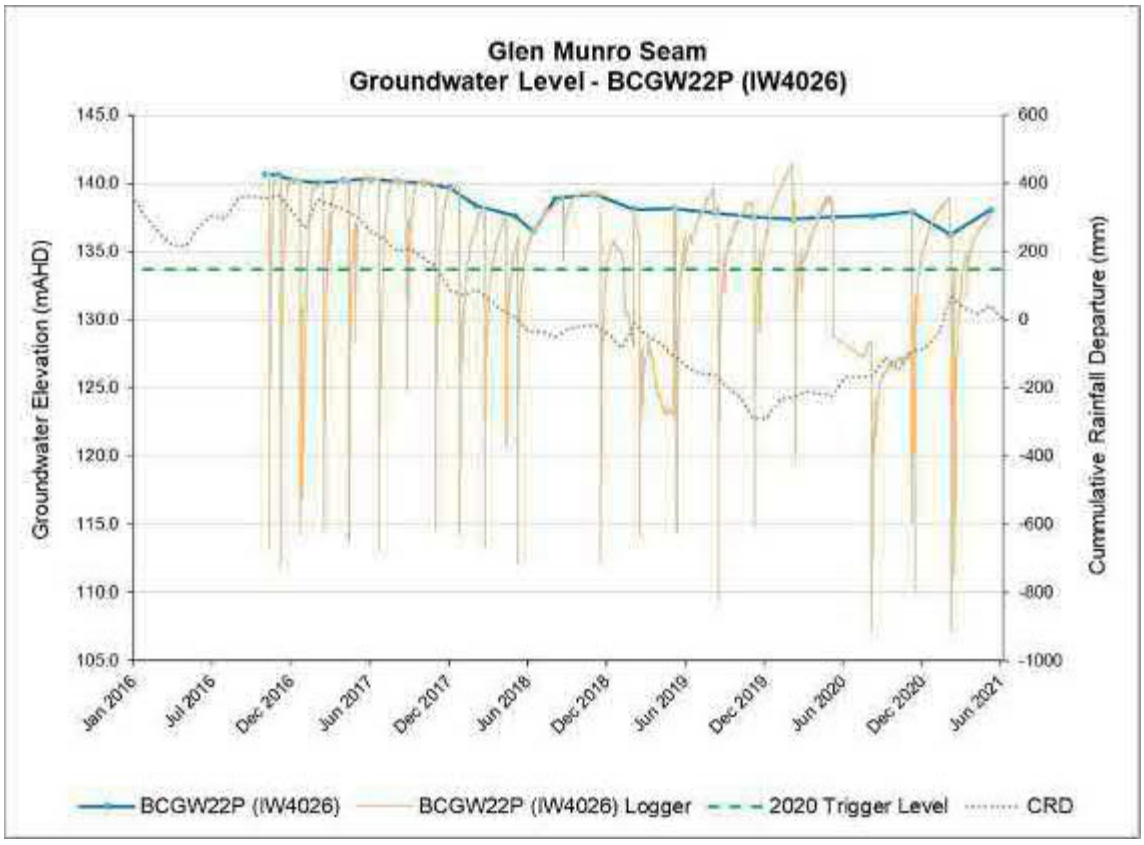
SWL – GW47



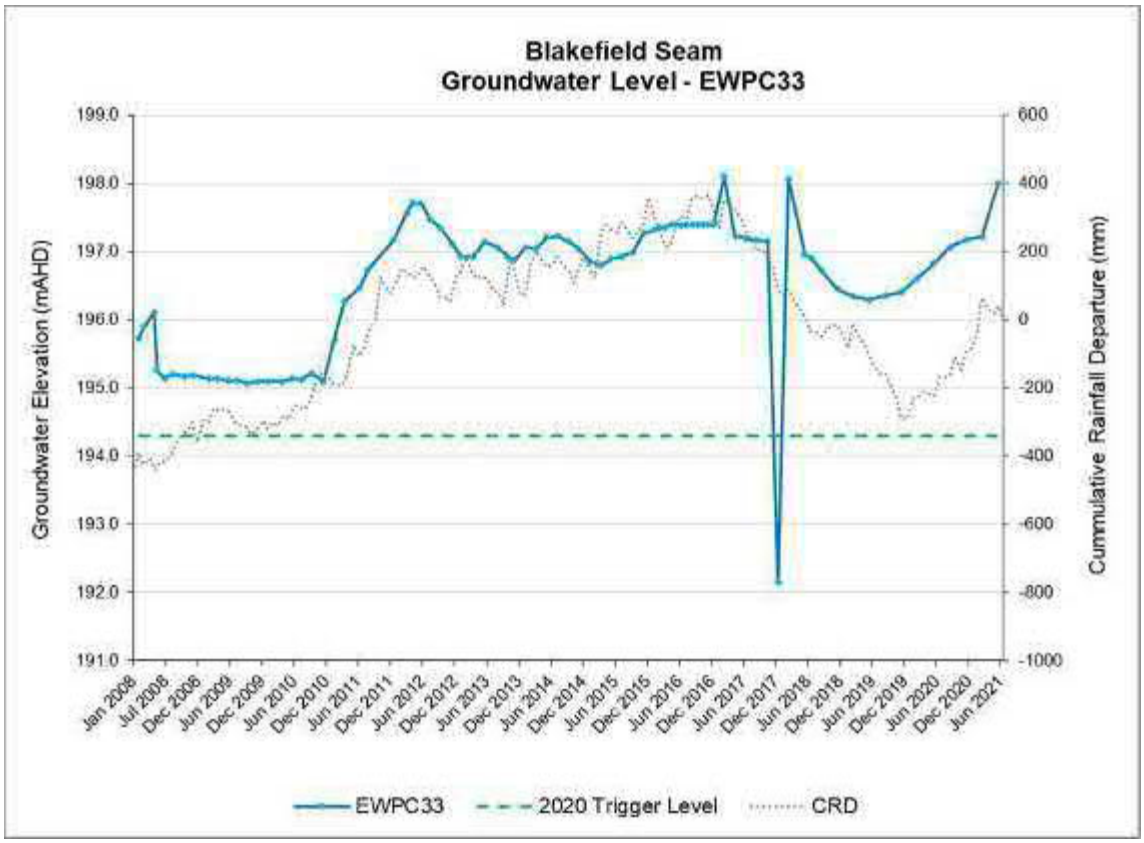
SWL – BCGW18



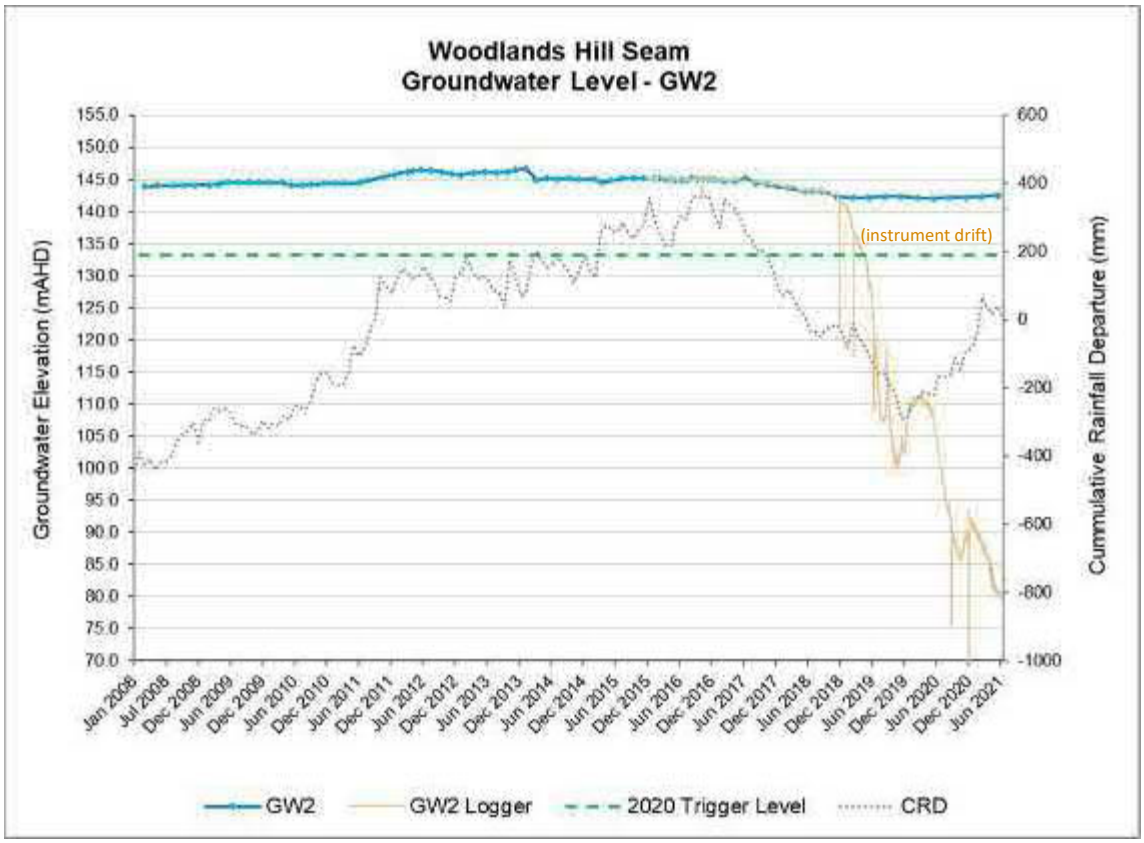
SWL – BCGW22P (IW4026)



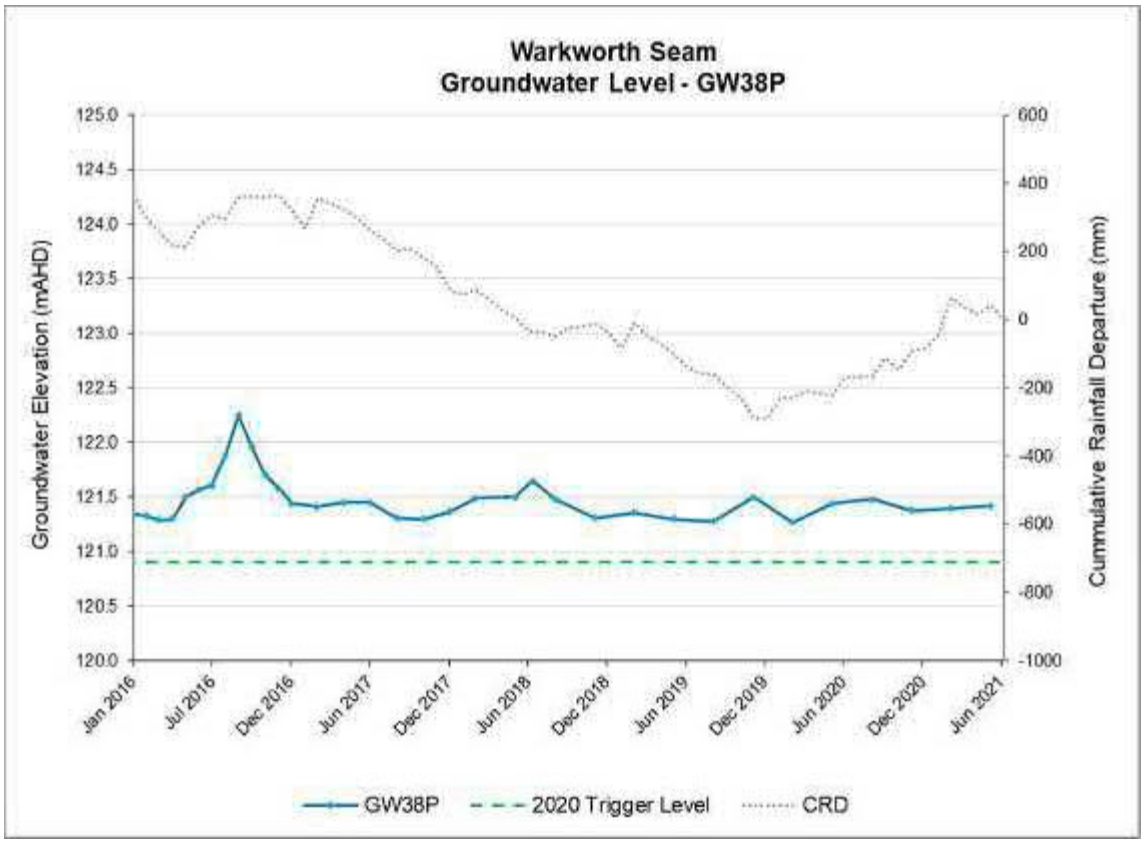
SWL – EWPC33



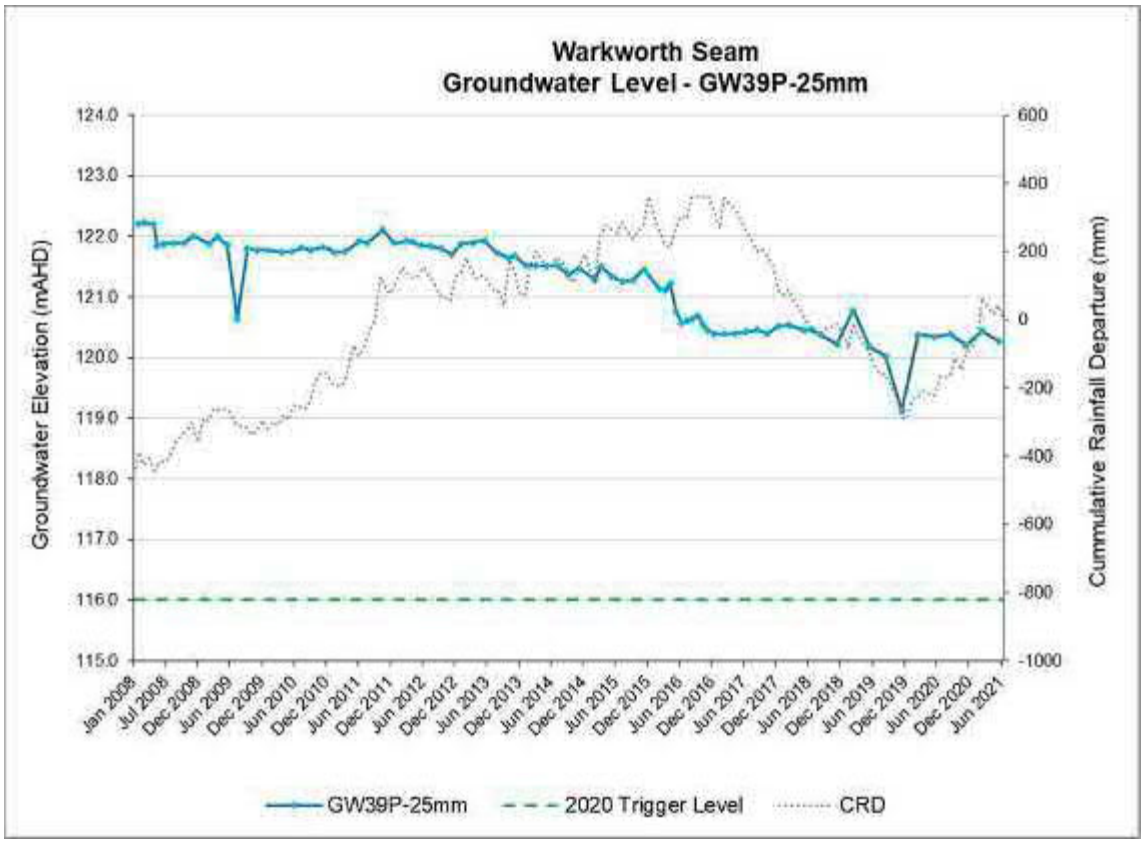
SWL – GW2



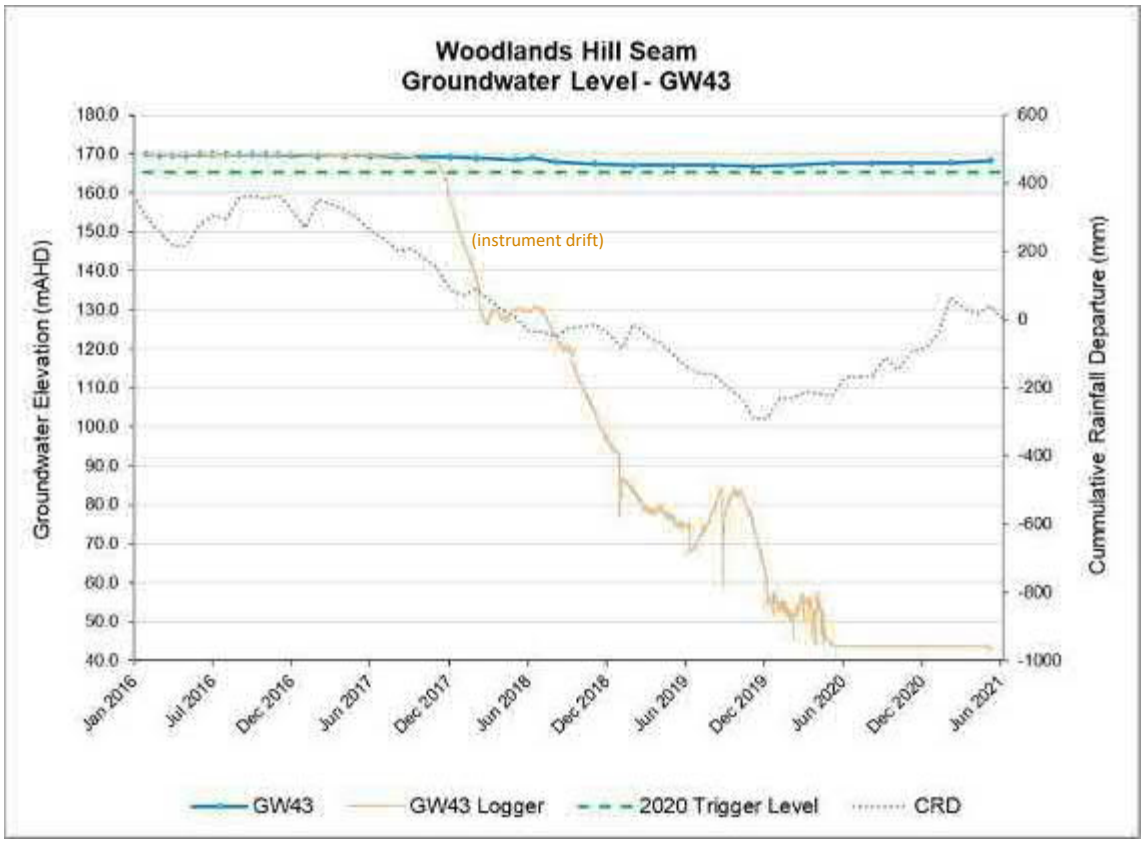
SWL – GW38P



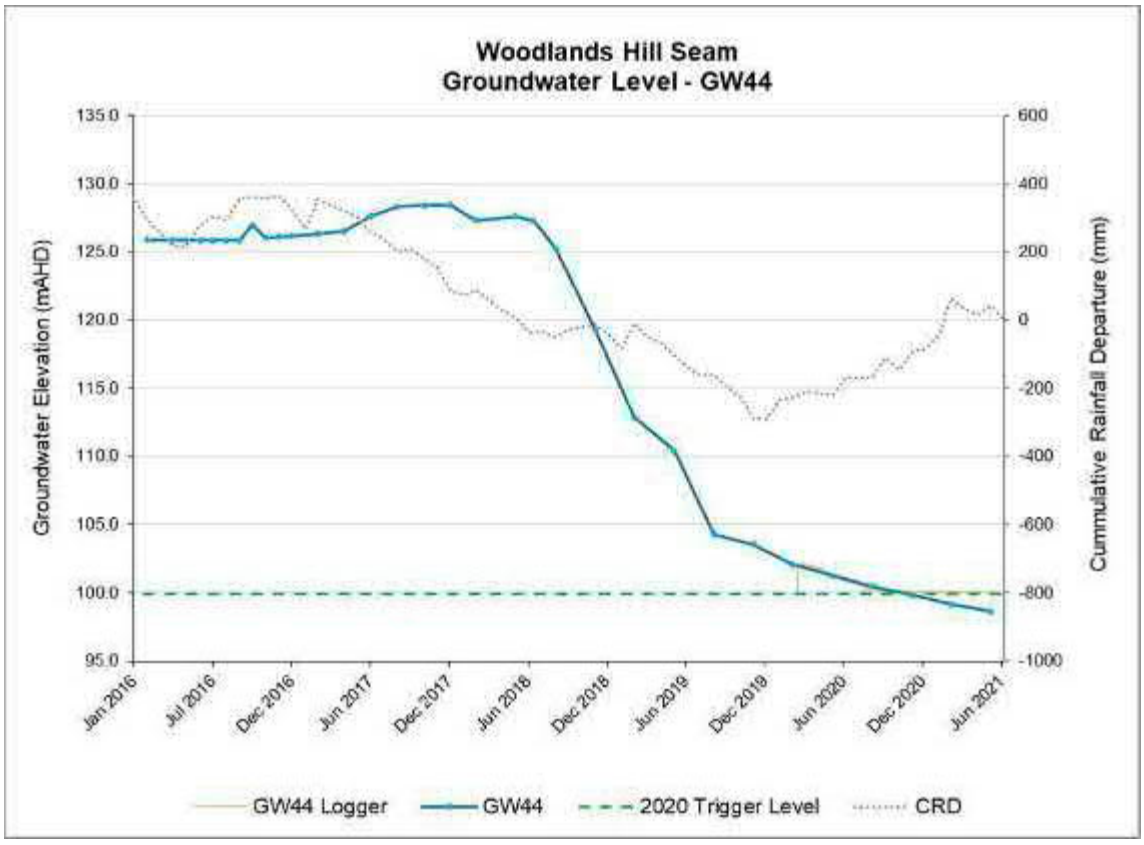
SWL – GW39P-25mm



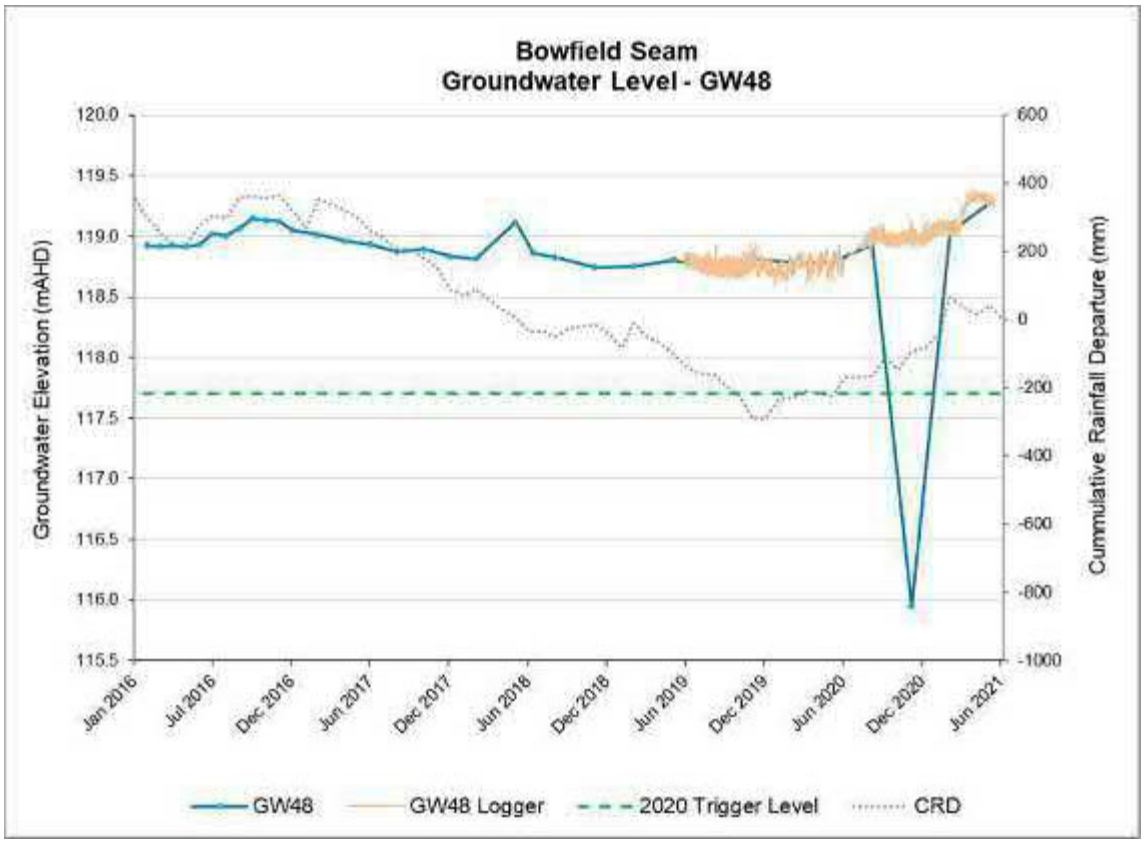
SWL – GW43



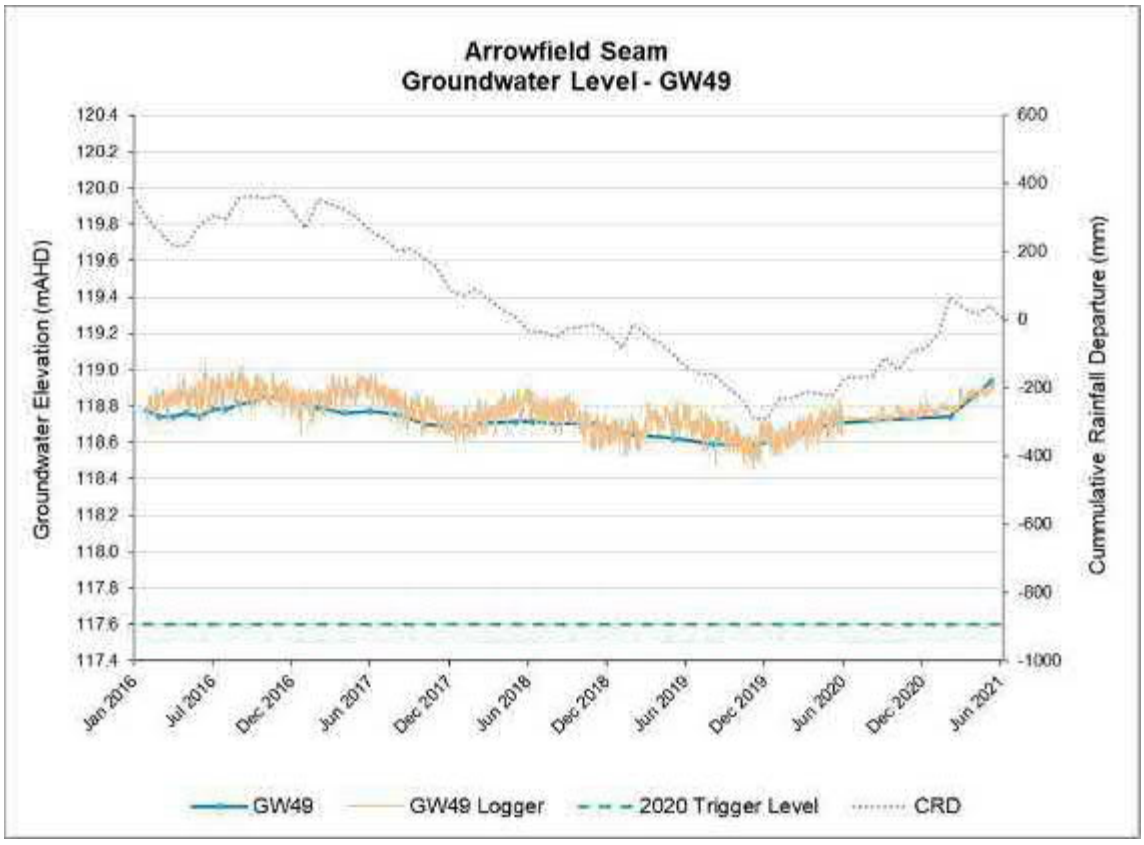
SWL – GW44



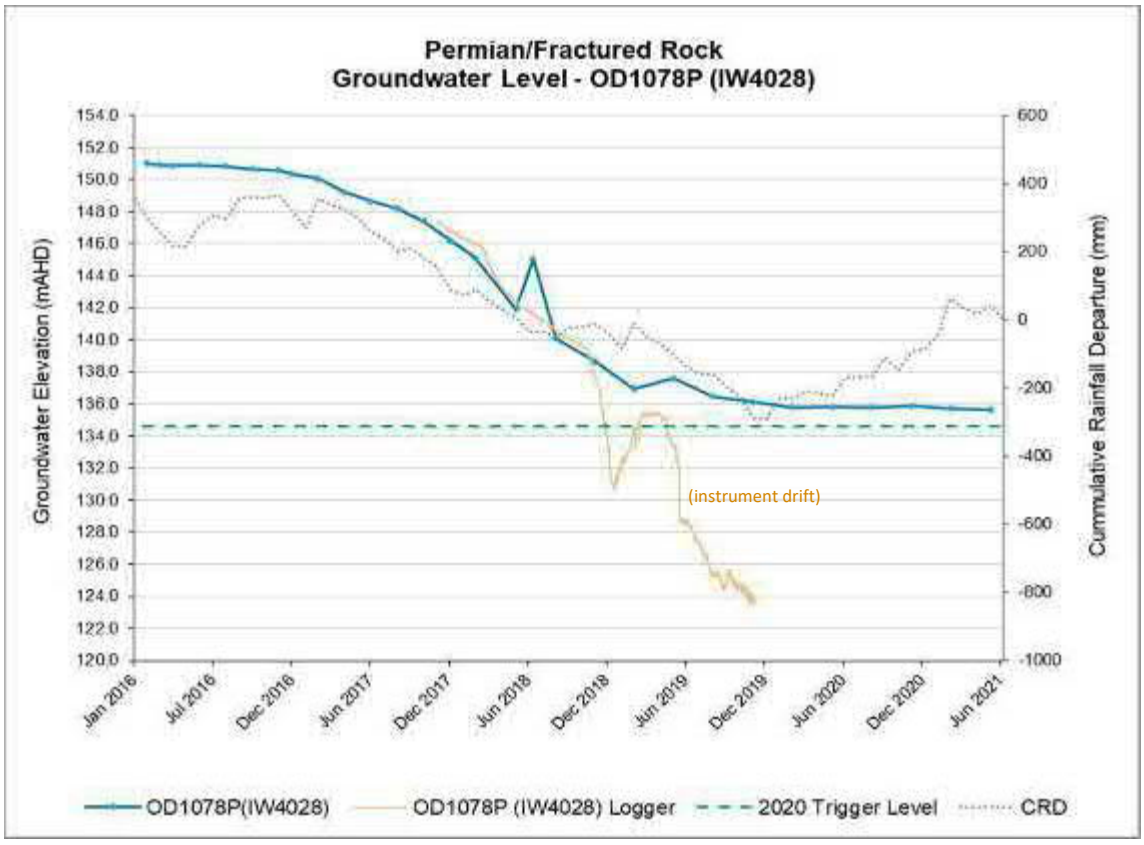
SWL – GW48



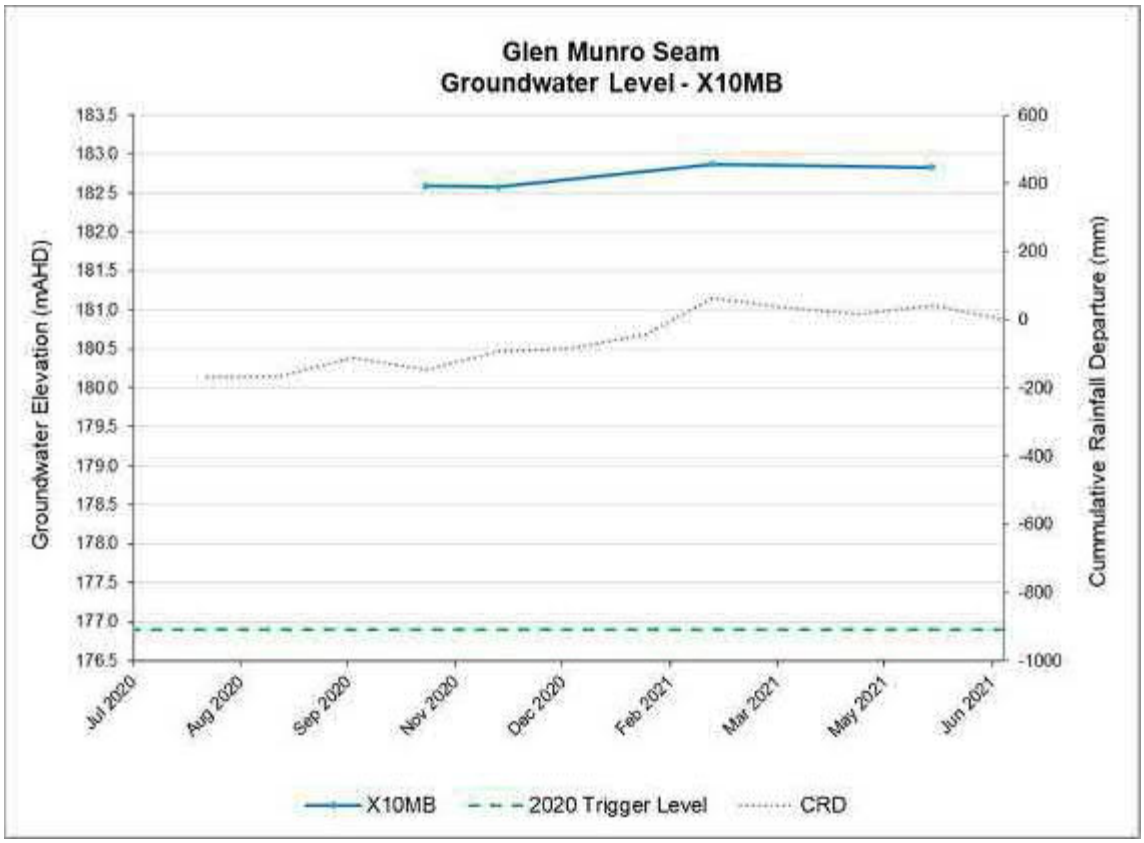
SWL - GW49



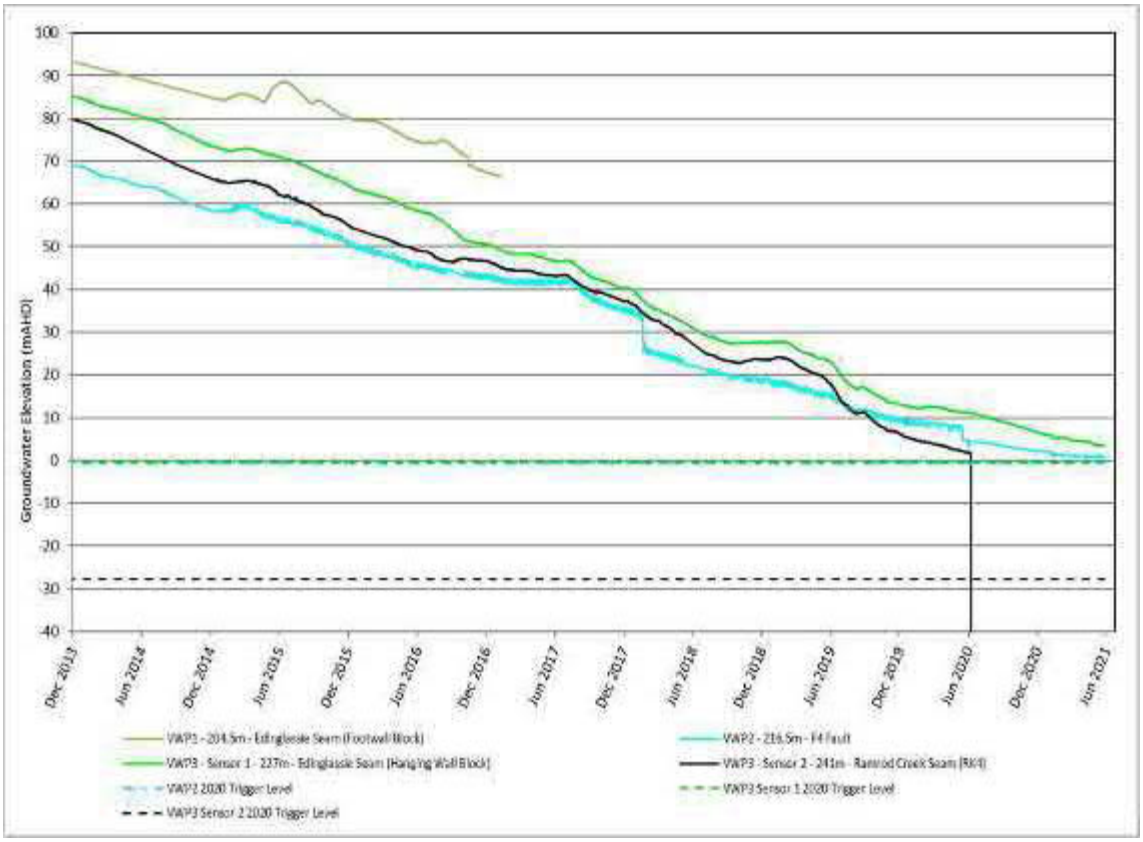
SWL – OD1078P (IW408)



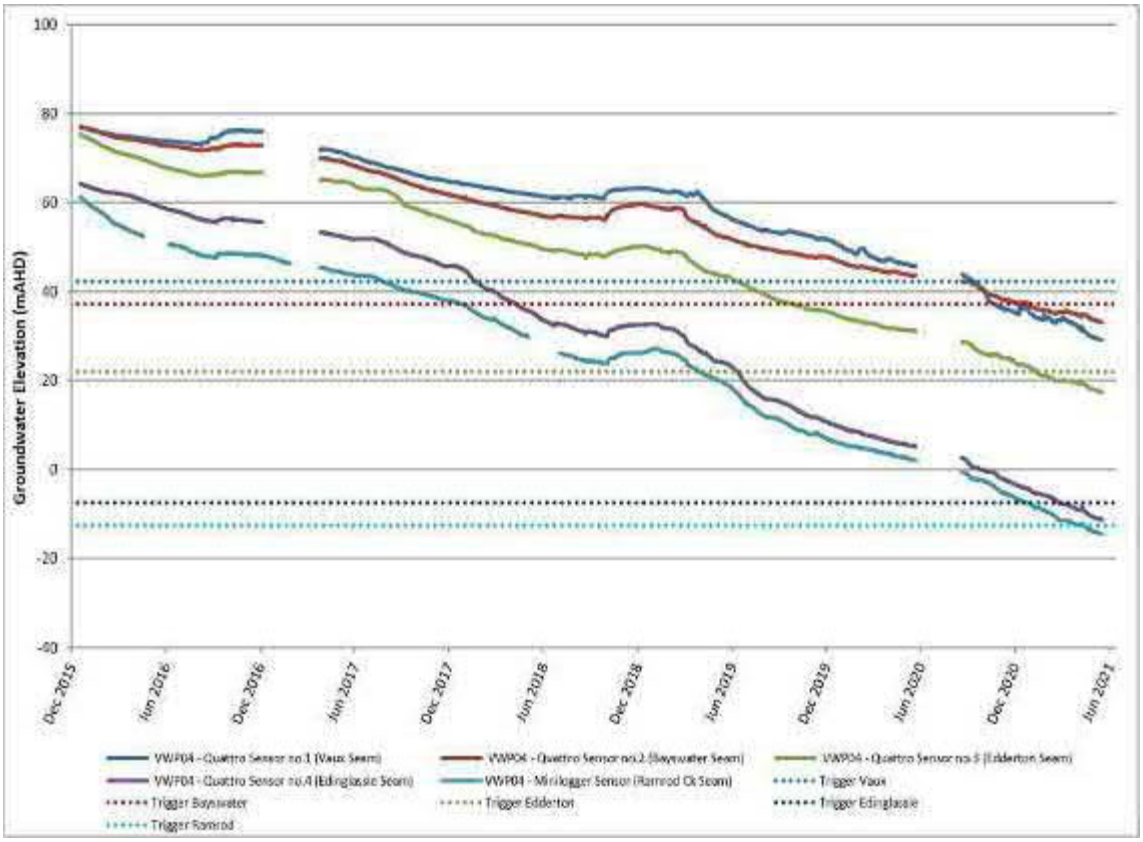
SWL – X10MB



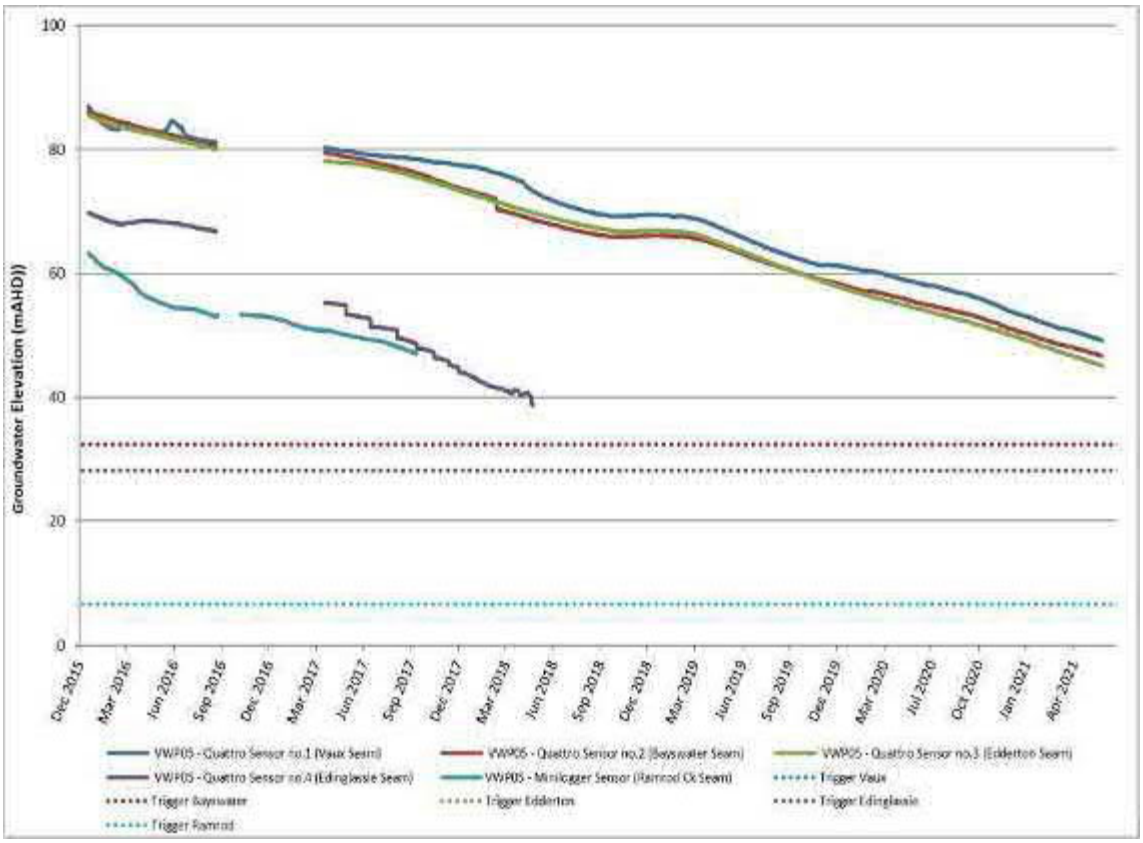
SWL – VWP2 and VWP3



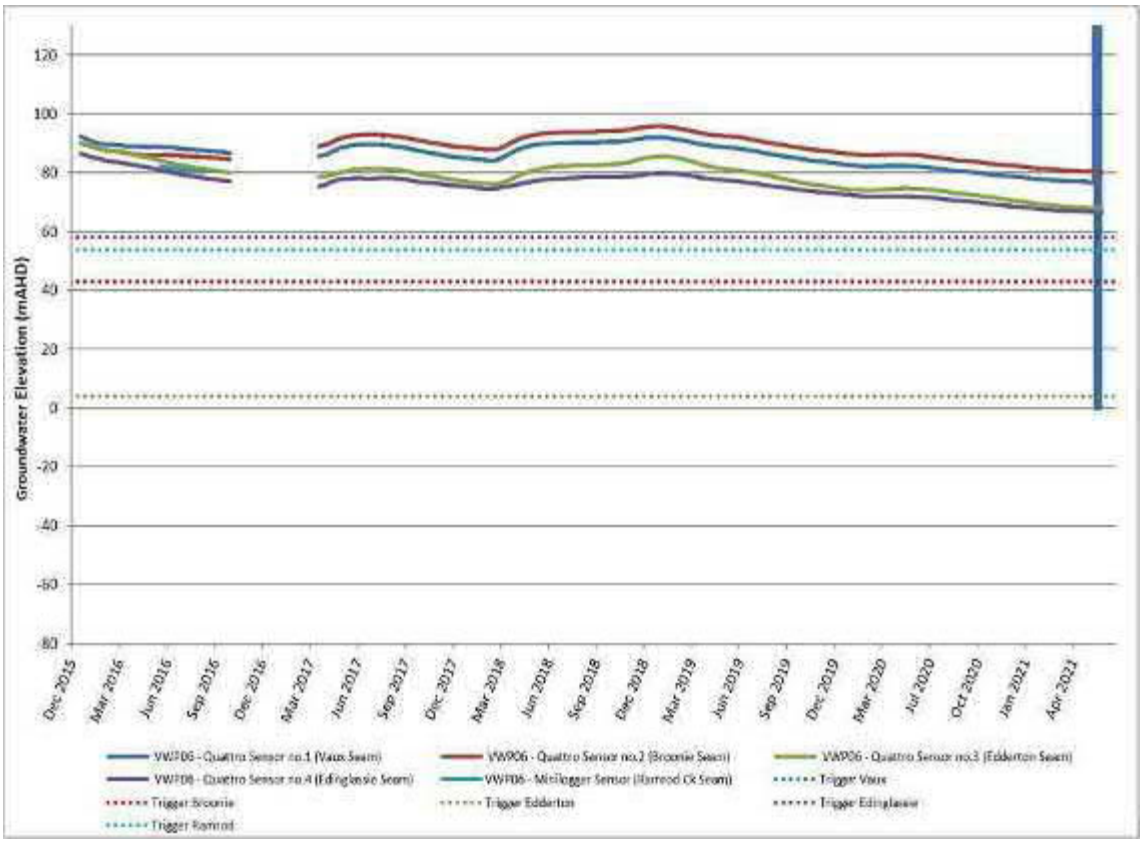
SWL – VWP04



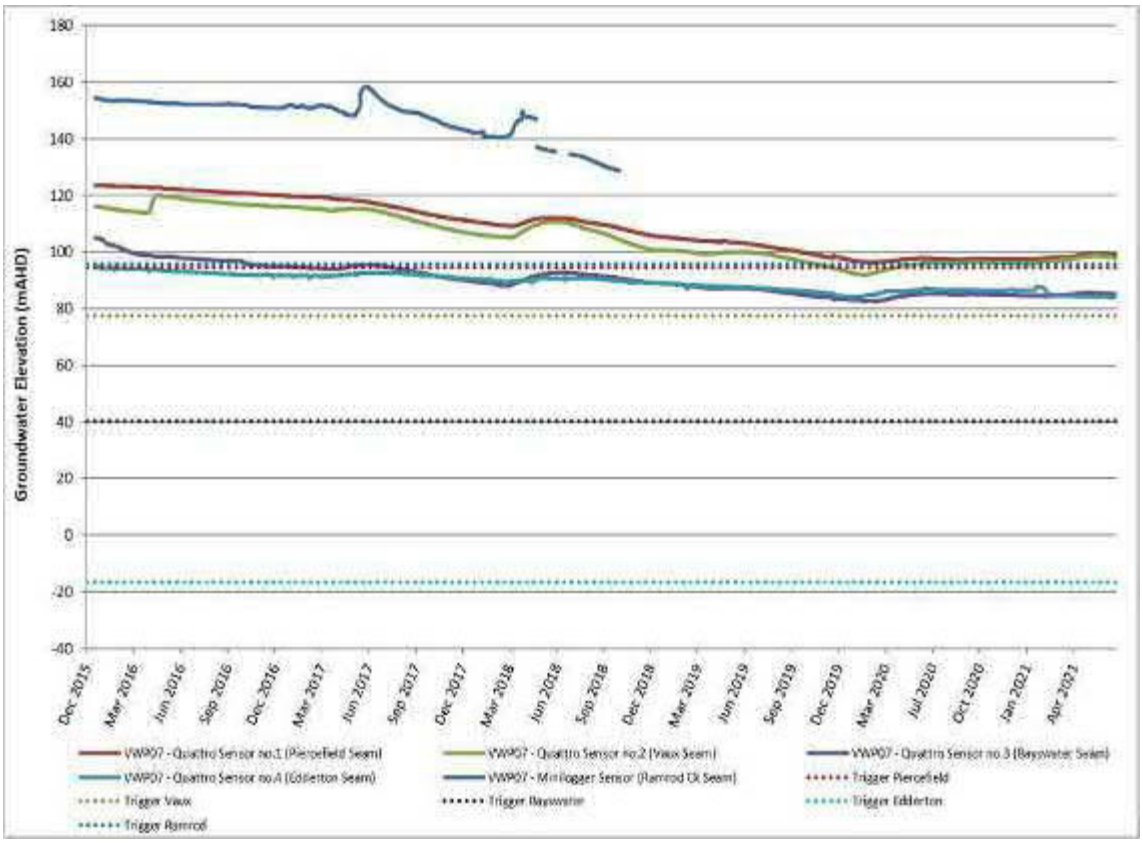
SWL – VWP05



SWL – VWP06



SWL – VWP07


Groundwater Elevation (mAHD)
180
160
140
120
100
80
60
40
20
0
-20
-40
Dec 2015
Mar 2016
Jun 2016
Sep 2016
Dec 2016
Mar 2017
Jun 2017
Sep 2017
Dec 2017
Mar 2018
Jun 2018
Sep 2018
Dec 2018
Mar 2019
Jun 2019
Sep 2019
Dec 2019
Mar 2020
Jul 2020
Oct 2020
Jan 2021
Apr 2021
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 Monitoring Data

Groundwater Monitoring Data with 2020 WMP Trigger Levels

Site	Target Formation	Depth to Water (mAHD)					Field pH						Field EC (µS/cm)					
		Trigger Level 2020	Q1	Q2	Q3	Q4	Lower Trigger Level 5th Percentile 2020	Upper Trigger Level 95th Percentile 2020	Q1	Q2	Q3	Q4	1st Stage EC Trigger 95th Percentile (µS/cm) 2020	2nd Stage EC Trigger Maximum Value (µS/cm) 2020	Q1	Q2	Q3	Q4
GW16	Alluvium (Hunter River)	*120.9*	122.49	122.37	122.39	122.43	*7.0*	*7.7*	7.1	7.3	7.0	7.2	*4210*	*4690*	4420	4110	3950	4130
GW21		*125*	126.57	126.42	126.51	126.50	*6.8*	*7.8*	7.1	7.1	6.9	7.1	*1197*	*2000*	961	968	916	894
GW38A (IW4030)		*120.7*	122.11	122.01	121.98	122.11	*6.5*	*7.7*	7.2	7.3	7.3	7.2	*4900*	*5560*	3600	3670	3170	3590
GW40A		*117.8*	119.21	119.10	119.15	119.38	*6.9*	*8.0*	7.2	7.3	7.5	7.3	*5290*	*5650*	5420	5680	5420	5520
GW41A (IW4029)		*117.9*	119.14	119.14	118.75	119.30	*6.6*	*7.7*	7.2	7.4	7.5	7.4	*9090*	*10600*	7220	10500	8800	7780
X1MB		*119.7*	121.44	121.43	121.38	121.50	*No Trigger*		7.30	7.36	7.57	7.37	*No Trigger*		4780	4850	4750	4960
BCGW22A (IW4027)	Alluvium (Saddlers Creek)	*137.6*	139.11	138.86	139.23	139.47	*6.6*	*7.1*	6.7	7.0	6.9	6.8	*11810*	*14500*	14230	15690	13200	14800
GW45		*138.9*	139.87	139.71	141.47	141.01	*6.6*	*7.1*	6.7	7.1	7.0	6.9	*11810*	*14500*	11170	9640	6290	5750
GW46		*129*	135.01	134.51	135.41	135.16	*6.3*	*8.0*	6.9	7.0	7.0	6.9	*8050*	*11380*	7340	7300	7490	7230
GW47		*127.3*	129.29	129.11	129.66	129.60	*6.5*	*7.6*	7.0	7.1	7.0	7.0	*7320*	*8220*	5420	5360	6060	6100
BCGW18	Permian Coal Seam	*147.3*	Dry				*7.0*	*9.1*	Dry				*8030*	*8510*	Dry			
BCGW22P (IW4026)		*133.7*	137.62	137.91	136.24	138.07	*7.1*	*9.9*	8.0	7.5	7.5	7.6	*14100*	*16270*	17350	14460	16200	15800
EWPC33		*194.3*	197.06	197.17	197.22	198.00	*6.5*	*7.5*	6.9	7.1	7.1	7.0	*4592*	*16270*	2820	2821	2883	2970
GW2		*133.2*	142.20	142.21	142.32	142.53	*6.5*	*8.0*	7.6	7.6	7.6	7.6	*4266*	*6280*	4910	4060	4990	4900
GW38P		*120.9*	121.48	121.38	121.40	121.42	*7.2*	*8.1*	7.5	7.6	7.6	7.6	*3224*	*3830*	2906	2889	2716	2730

Site	Target Formation	Depth to Water (mAHD)					Field pH						Field EC (µS/cm)					
		Trigger Level 2020	Q1	Q2	Q3	Q4	Lower Trigger Level 5th Percentile 2020	Upper Trigger Level 95th Percentile 2020	Q1	Q2	Q3	Q4	1st Stage EC Trigger 95th Percentile (µS/cm) 2020	2nd Stage EC Trigger Maximum Value (µS/cm) 2020	Q1	Q2	Q3	Q4
GW39P		*116*	120.39	120.21	120.44	120.28	*No Trigger*		7.7	7.5	7.5	7.5	*No Trigger*		6400	6110	6130	6140
GW43		*165.4*	167.59	167.69	167.80	168.28	*6.7*	*7.4*	NM	NM	NM	NM	*4400*	*4470*	NM	NM	NM	NM
GW44		*99.9*	100.45	99.83	99.14	98.61	*No Trigger*		NM	NM	NM	NM	*No Trigger*		NM	NM	NM	NM
GW48		*117.7*	118.94	115.95	119.04	119.29	*6.8*	*8.2*	7.4	7.6	7.7	7.6	*4090*	*4750*	4380	4370	4250	4360
GW49		*117.6*	118.72	118.73	118.74	118.93	*6.1*	*7.5*	6.7	7.0	7.1	6.9	*6170*	*7530*	6760	6700	6580	6790
OD1078P (IW4028)		*134.6*	135.80	135.88	135.71	135.64	*No Trigger*		NM	NM	NM	NM	*No Trigger*		NM	NM	NM	NM
X10MB		*174.9*	182.59	182.58	182.87	182.83	*No Trigger*		9.97	9.64	9.34	9.15	*No Trigger*		6570	6430	6010	5450

** RED text indicates single trigger exceedance*

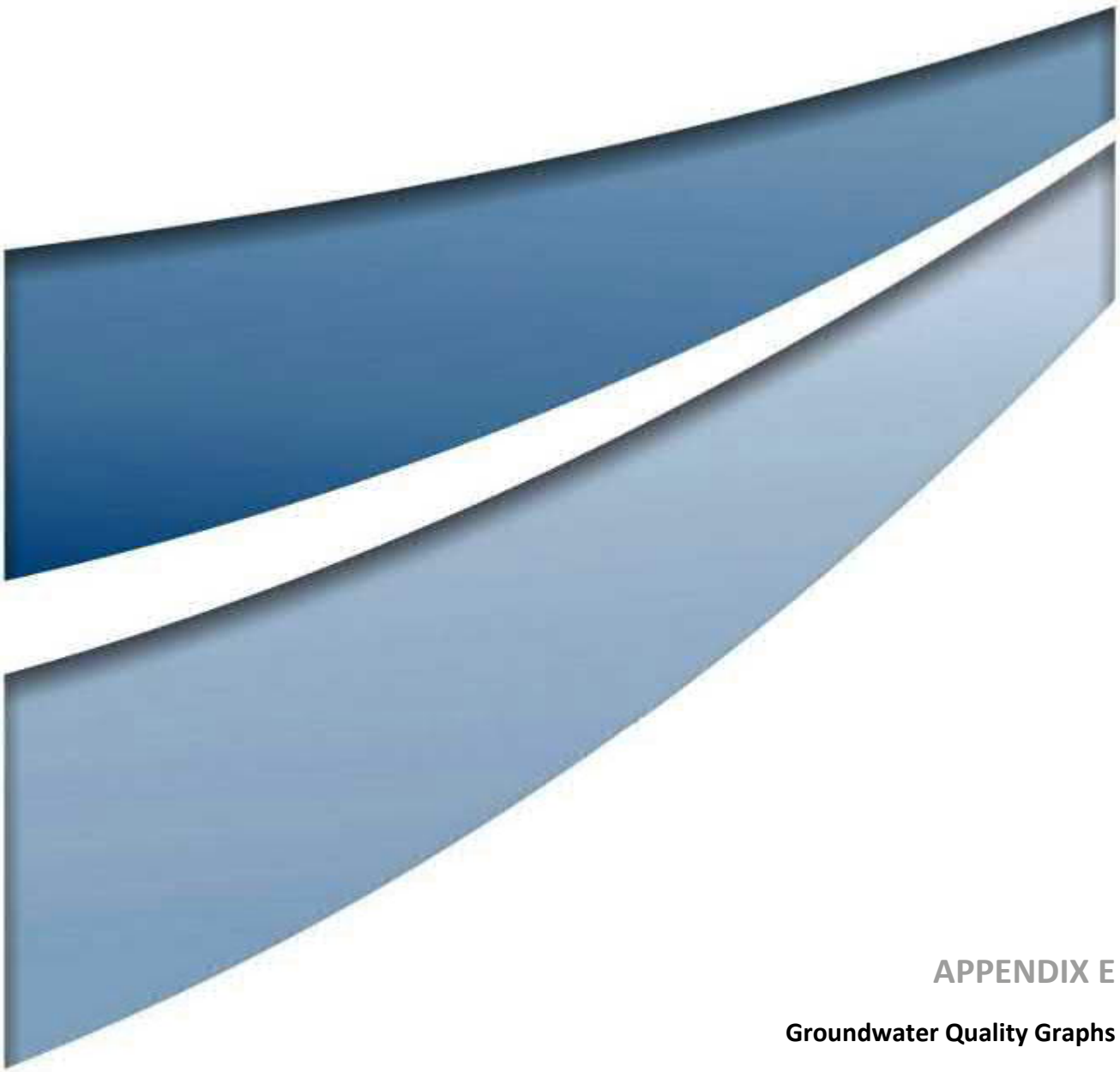
** Red text indicates exceedance based on 2020 Impact Assessment Criteria (3 consecutive readings, 1st stage for EC)*

** Red text indicates EC exceedance based on 2020 Impact Assessment Criteria – 2nd Stage (1 reading)*

** NM = not measured*

Groundwater Quality Assurance Review

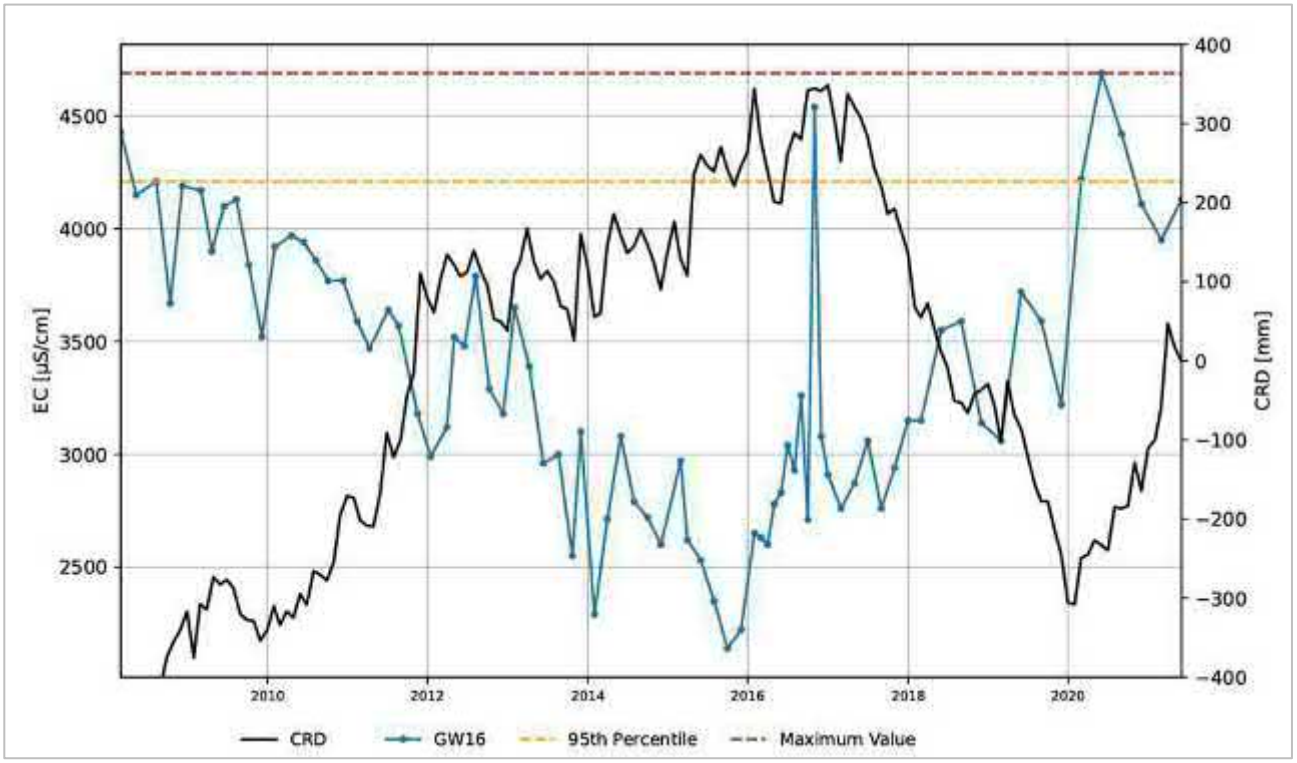
Sample Date:			3/09/2019		Relative Percentage Difference	24/12/2020		Relative Percentage Difference	12/03/2021		Relative Percentage Difference	30/06/2021		Relative Percentage Difference
ALS Batch Number:			ES2031319			ES2046027			ES2109031			ES2124386		
Client sample ID (1st):			EPWC33	DUPLICATE		GW47	DUPLICATE		GW48	DUPLICATE		GW2	DUPLICATE	
Analyte grouping/Analyte	**Unit**	**LOR**												
Physical parameters														
pH Value	pH Unit	0.01	7.08	7.1	0%	7.27	7.27	0%	7.76	7.76	0%	7.76	7.73	0%
Electrical Conductivity @ 25°C	µS/cm	1	2430	2410	1%	4520	4450	2%	3710	3720	0%	4160	4120	1%
Total Dissolved Solids @ 180°C	mg/L	10	1480	1550	5%	2620	2550	3%	2350	2340	0%	2520	2530	0%
Total Suspended Solids (TSS)	mg/L	5	<5	<5	0%	30	13	79%	<5	<5	0%	11	12	9%
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	<1	0%	<1	<1	0%	48	58	19%
Bicarbonate Alkalinity as CaCO3	mg/L	1	1290	1270	2%	977	964	1%	1900	1930	2%	1110	1100	1%
Total Alkalinity as CaCO3	mg/L	1	1290	1270	2%	977	964	1%	1900	1930	2%	1160	1160	0%
Sulfate as SO4 - Turbidimetric	mg/L	1	26	27	4%	223	184	19%	<1	<1	0%	108	108	0%
Chloride by Discrete Analyser	mg/L	1	215	220	2%	1000	1020	2%	256	252	2%	705	709	1%
Calcium	mg/L	1	22	22	0%	93	90	3%	15	15	0%	14	15	7%
Magnesium	mg/L	1	94	96	2%	247	233	6%	15	15	0%	13	14	7%
Sodium	mg/L	1	441	457	4%	512	506	1%	908	908	0%	955	1000	5%
Potassium	mg/L	1	16	16	0%	7	7	0%	9	10	11%	4	4	0%
Total Phosphorus as P	mg/L	0.01	<0.01	0.04	120%	-	<0.0001	-	-	-	-	0.04	0.04	0%
Total Anions	meq/L	0.01	32.4	32.1	1%	52.4	51.9	1%	45.2	45.7	1%	45.3	45.4	0%
Total Cations	meq/L	0.01	28.4	29.3	3%	47.4	45.8	3%	41.7	41.7	0%	43.4	45.5	5%
Dissolved Metals														
Aluminium	mg/L	0.01	<0.01	<0.01	0%	-	<0.01	-	-	-	0%	<0.01	<0.01	0%
Antimony	mg/L	0.001	<0.001	<0.001	0%	-	<0.001	-	-	-	0%	<0.001	<0.001	0%
Arsenic	mg/L	0.001	<0.001	<0.001	0%	-	<0.001	-	-	-	0%	<0.001	<0.001	0%
Barium	mg/L	0.001	0.19	0.196	3%	-	0.061	-	-	-	0%	0.057	0.057	0%
Boron	mg/L	0.05	0.18	0.16	12%	-	0.12	-	-	-	0%	0.24	0.24	0%
Cadmium	mg/L	0.0001	<0.0001	<0.0001	0%	-	<0.0001	-	-	-	0%	<0.0001	<0.001	0%
Chromium	mg/L	0.001	<0.001	<0.001	0%	-	<0.001	-	-	-	0%	<0.001	<0.001	0%
Copper	mg/L	0.001	<0.001	<0.001	0%	-	0.002	-	-	-	0%	<0.001	<0.001	0%
Iron	mg/L	0.05	0.22	0.08	93%	<0.05	<0.05	0%	<0.05	0.46	161%	<0.05	0.06	18%
Lead	mg/L	0.001	<0.001	<0.001	0%	-	<0.001	-	-	-	0%	<0.001	<0.001	0%
Mercury	mg/L	0.0001	<0.0001	<0.0001	0%	-	<0.0001	-	-	-	0%	<0.0001	<0.0001	0%
Molybdenum	mg/L	0.001	<0.001	<0.001	0%	-	0.001	-	-	-	0%	<0.001	<0.001	0%
Nickel	mg/L	0.001	<0.001	<0.001	0%	-	0.003	-	-	-	0%	<0.001	<0.001	0%
Selenium	mg/L	0.01	<0.01	<0.01	0%	-	<0.01	-	-	-	0%	<0.01	<0.01	0%
Zinc	mg/L	0.005	0.011	0.01	10%	-	0.018	-	-	-	0%	<0.005	<0.005	0%



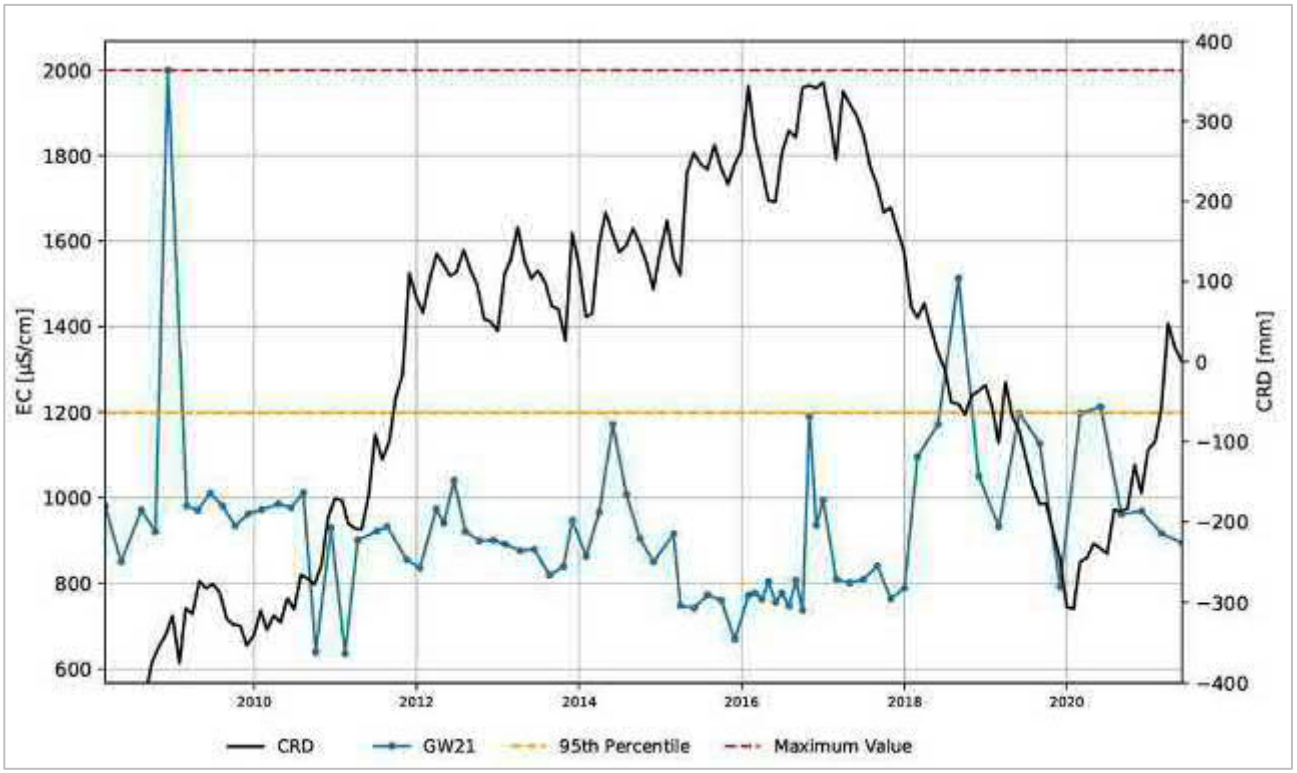
APPENDIX E

Groundwater Quality Graphs

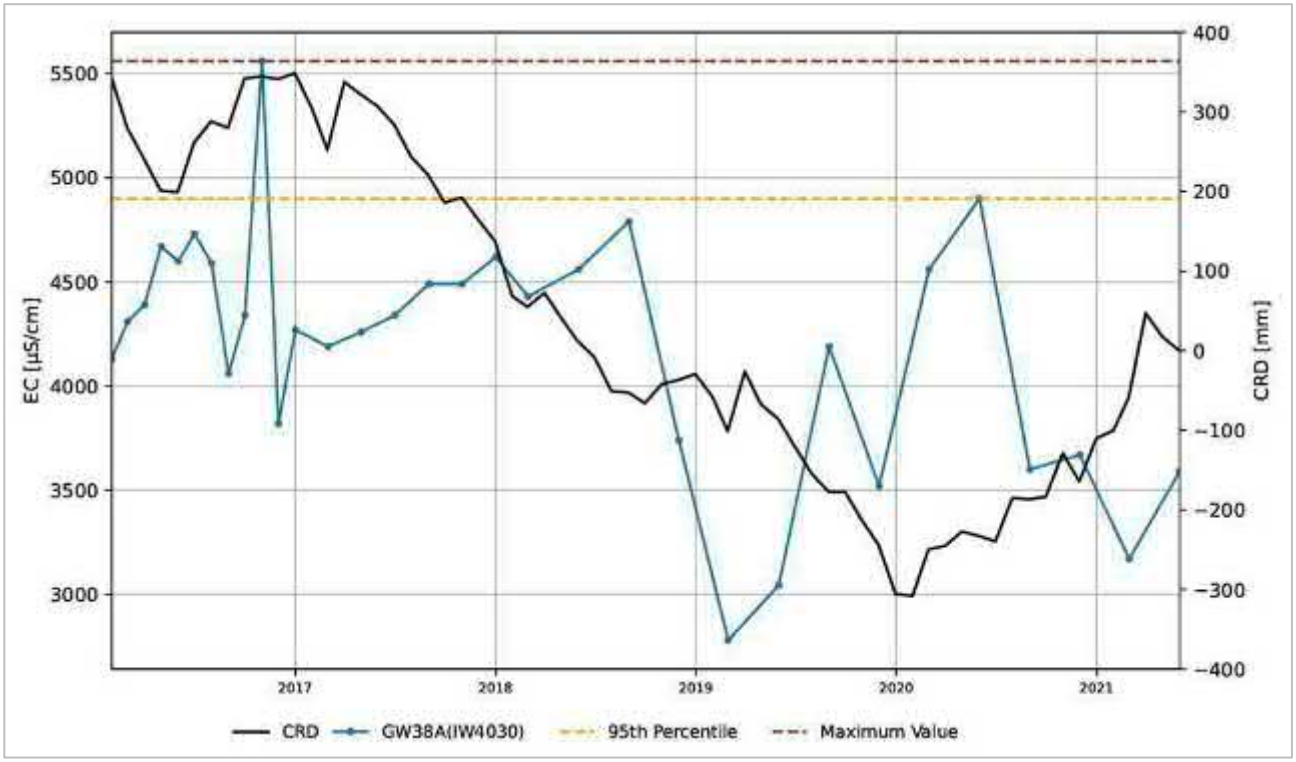
EC – GW16 – Hunter River Alluvium



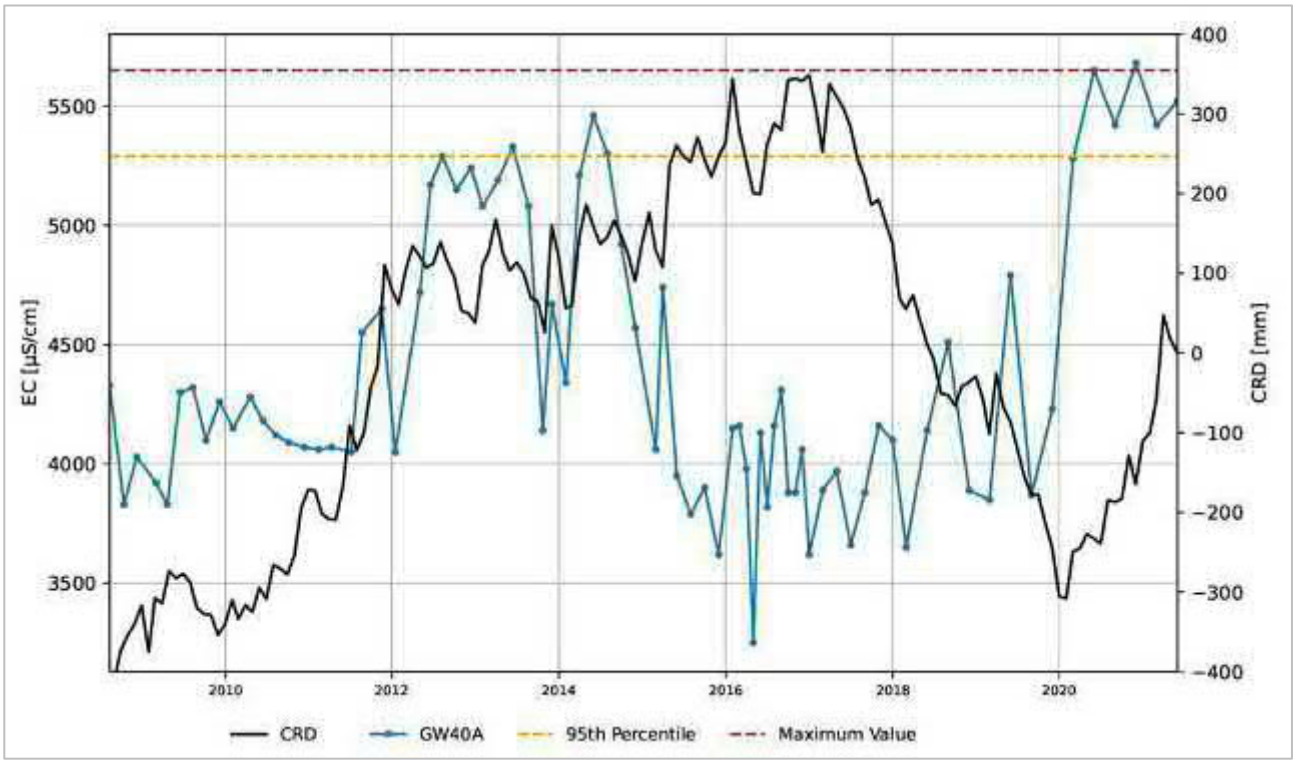
EC – GW21 – Hunter River Alluvium



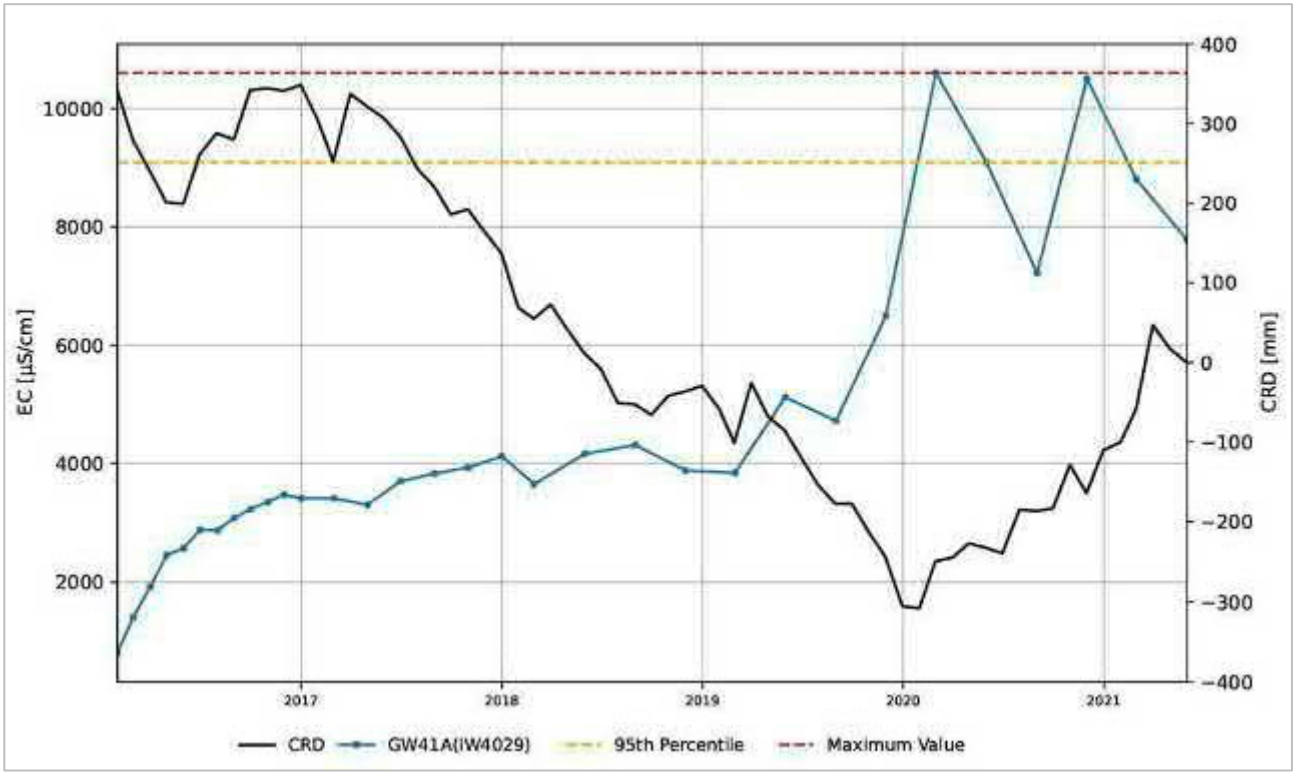
EC – GW38A (IW4030) – Hunter River Alluvium



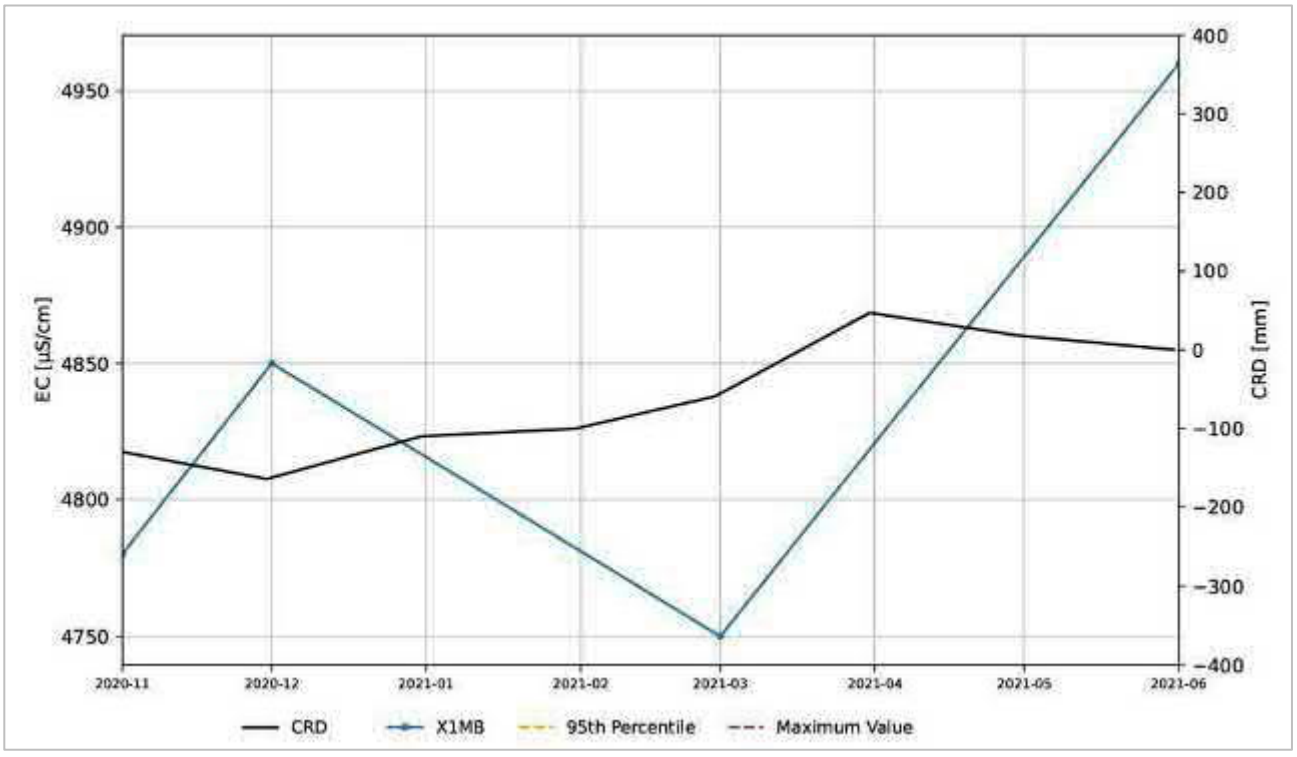
EC – GW40A – Hunter River Alluvium



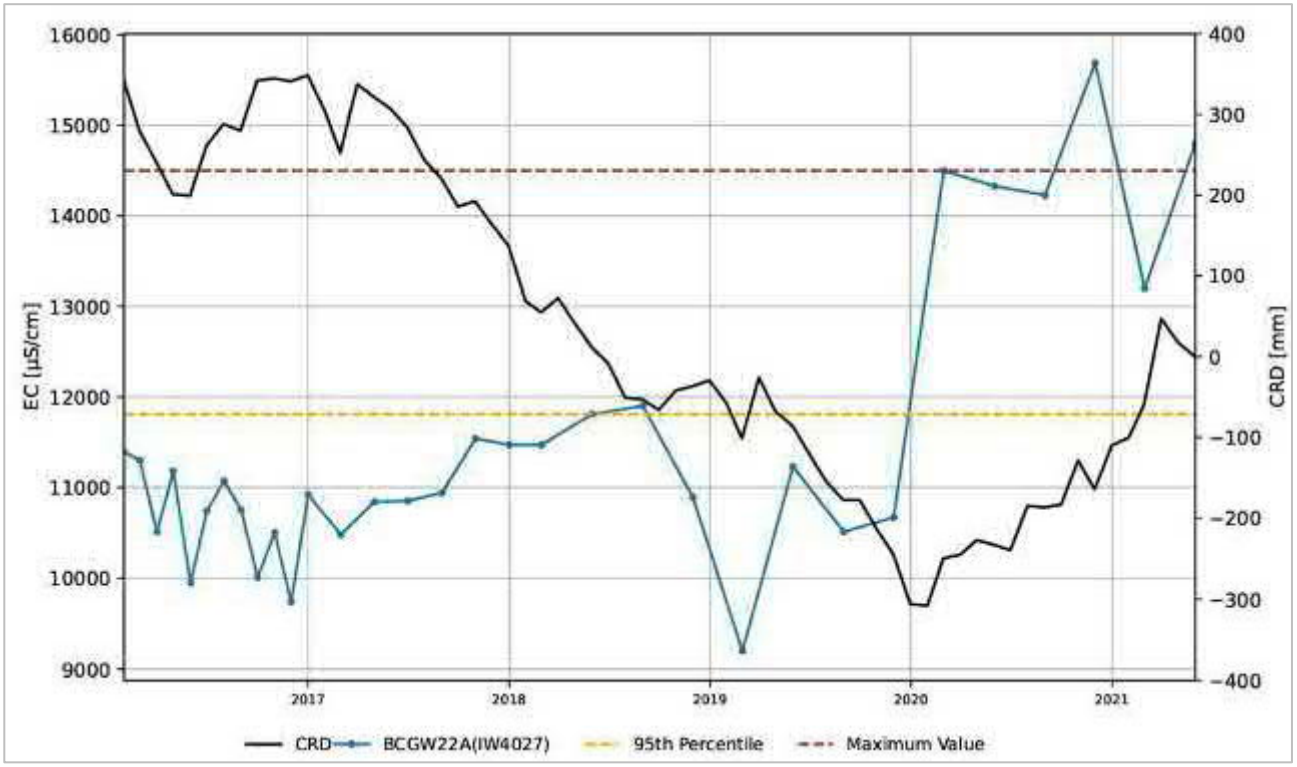
EC – GW41A (IW4029) – Hunter River Alluvium



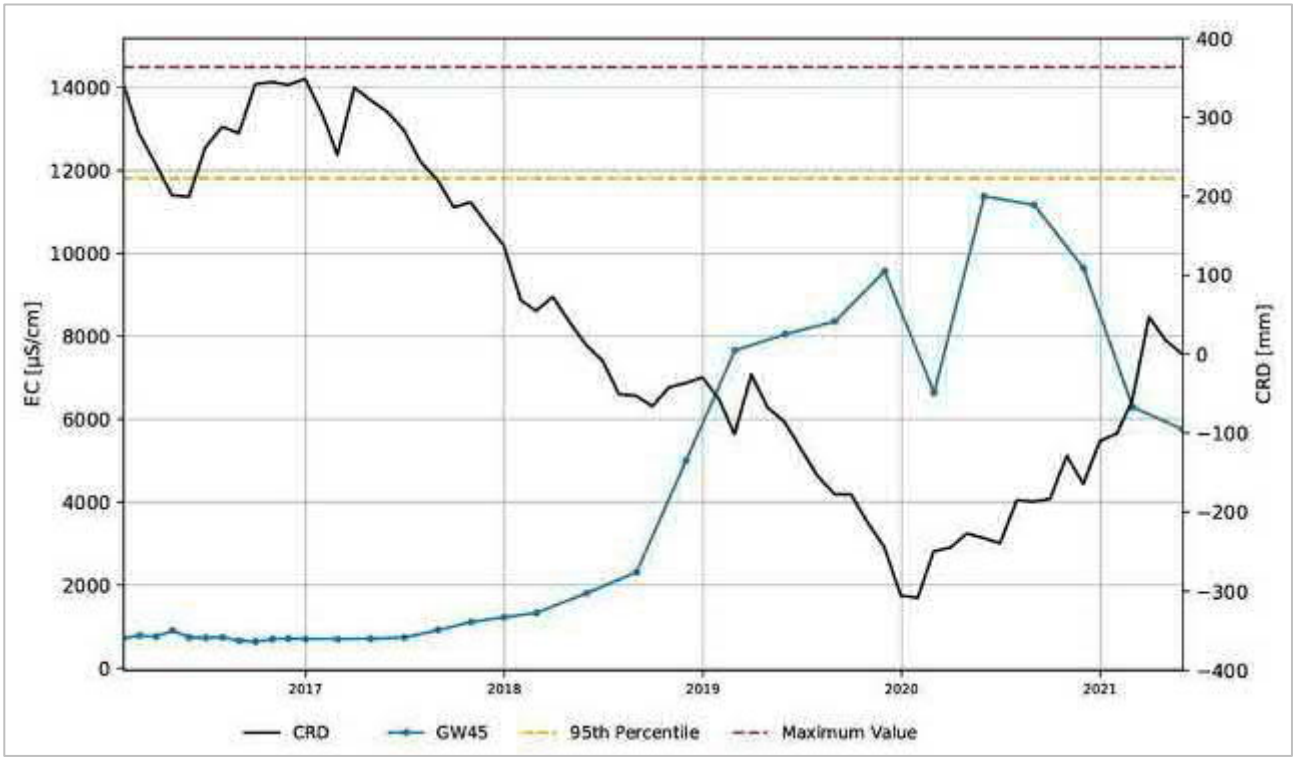
EC – X1MB – Hunter River Alluvium



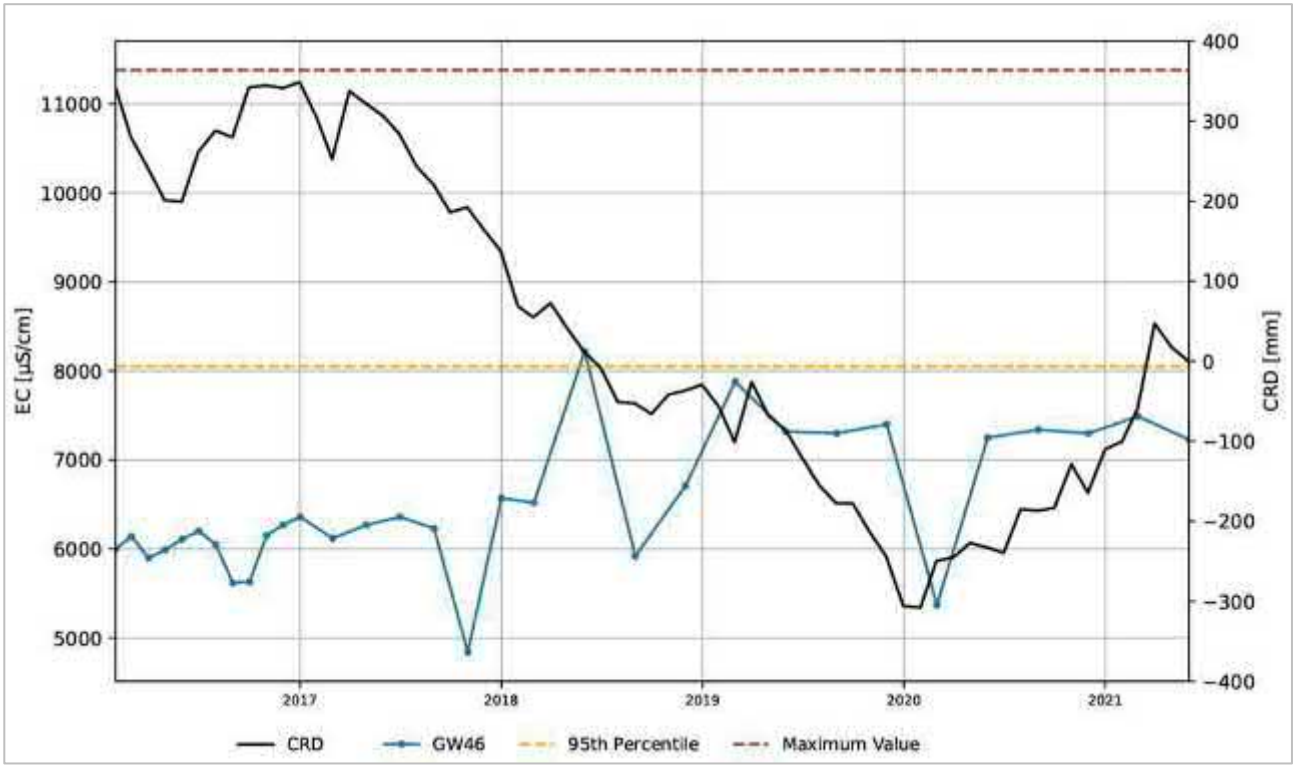
EC – BCGW22A (IW4027) – Saddlers Creek Alluvium



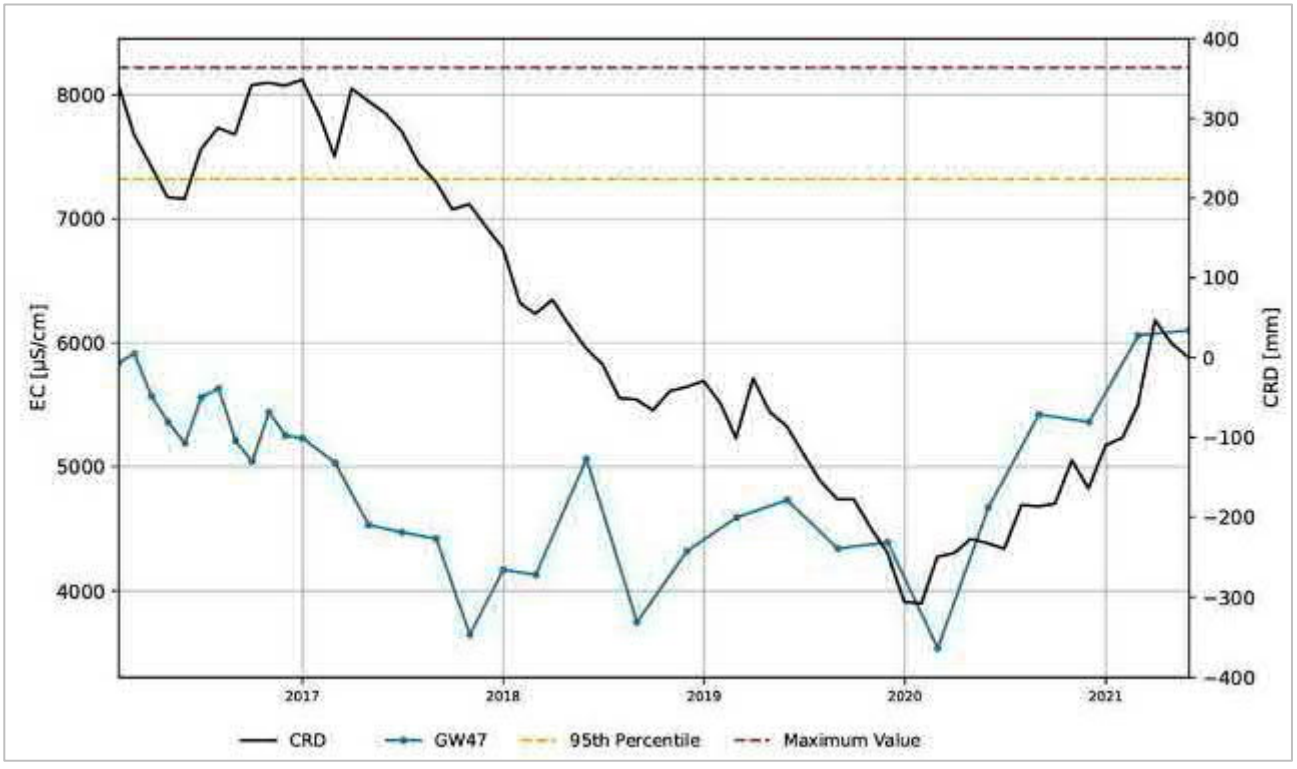
EC – GW45 – Saddlers Creek Alluvium



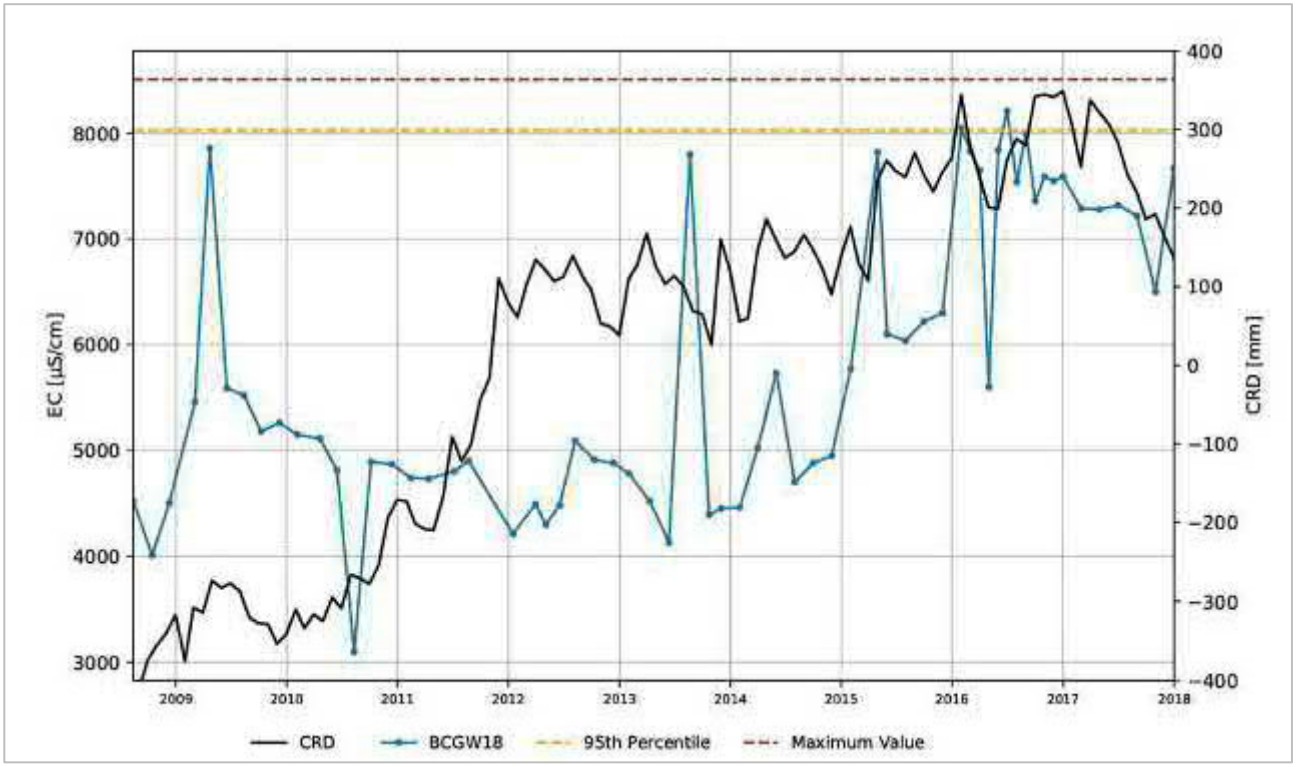
EC – GW46 – Saddlers Creek Alluvium



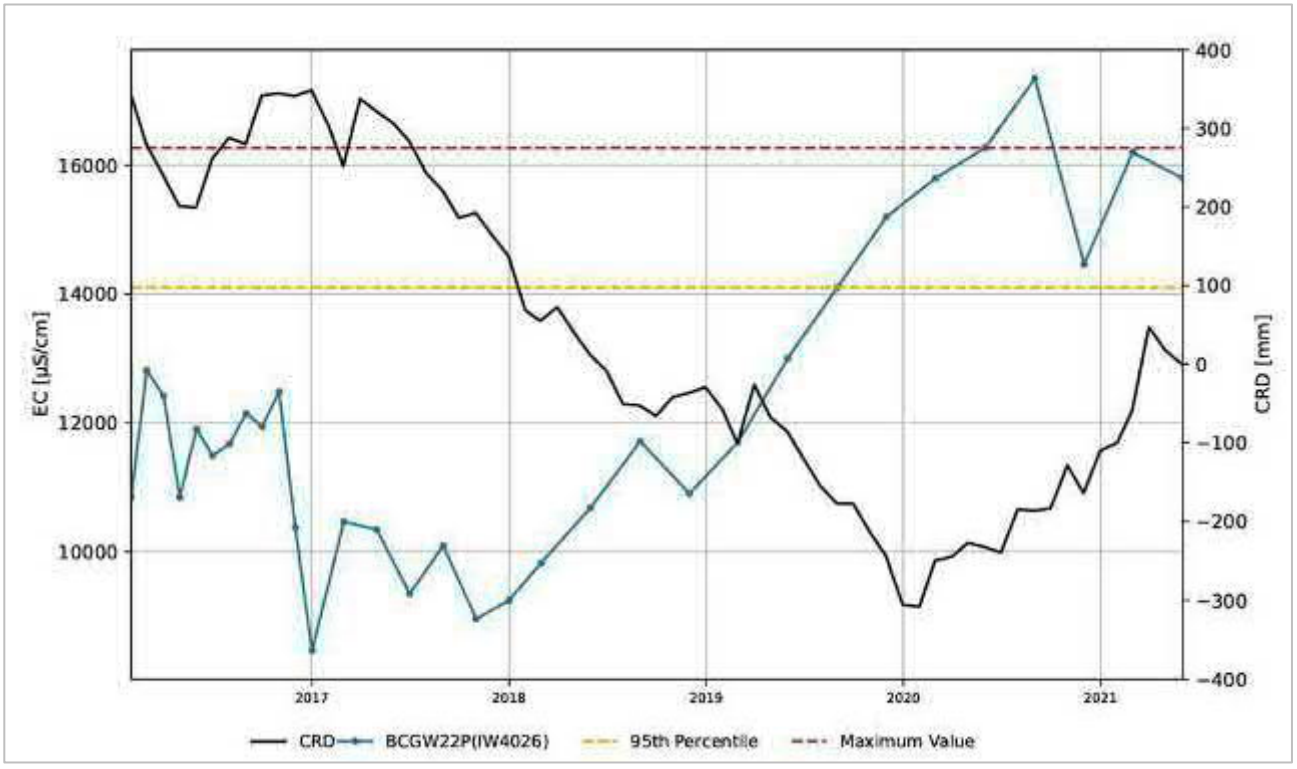
EC – GW47 – Saddlers Creek Alluvium



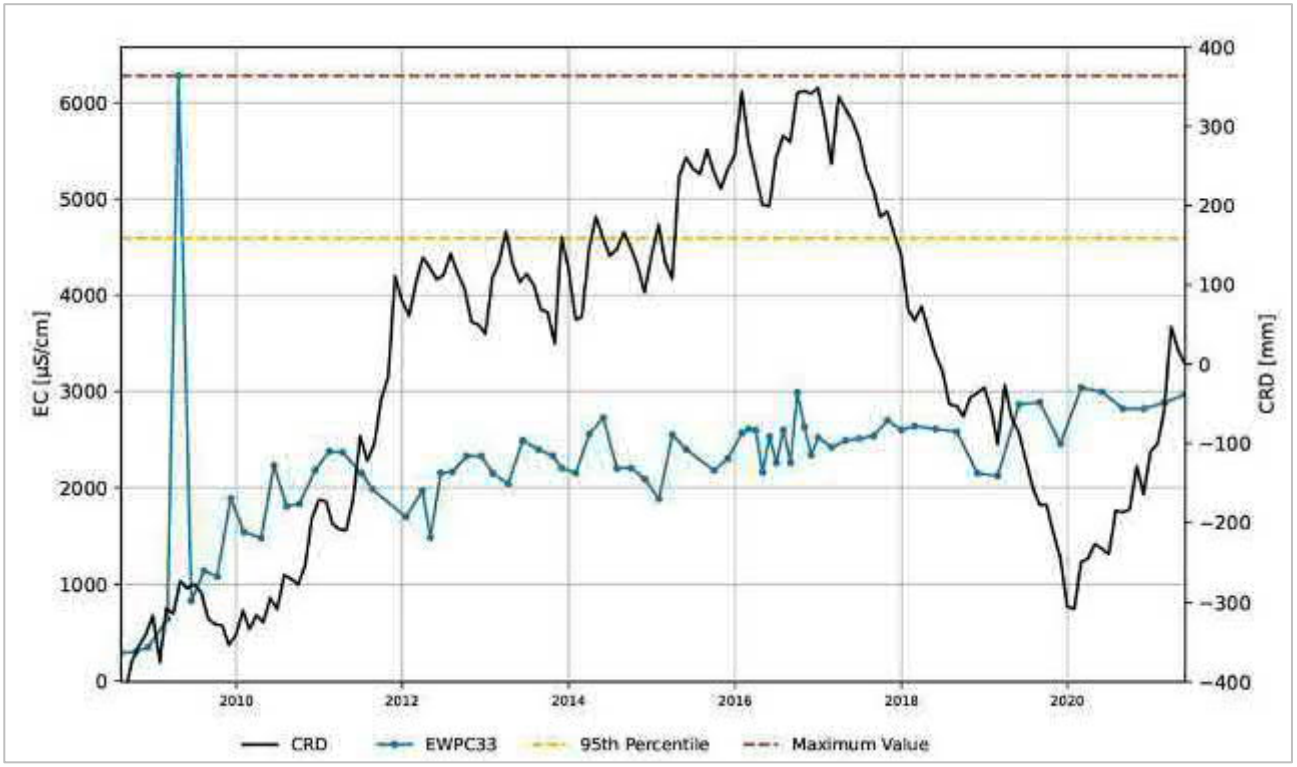
EC - BCGW18 – Permian Coal Measures



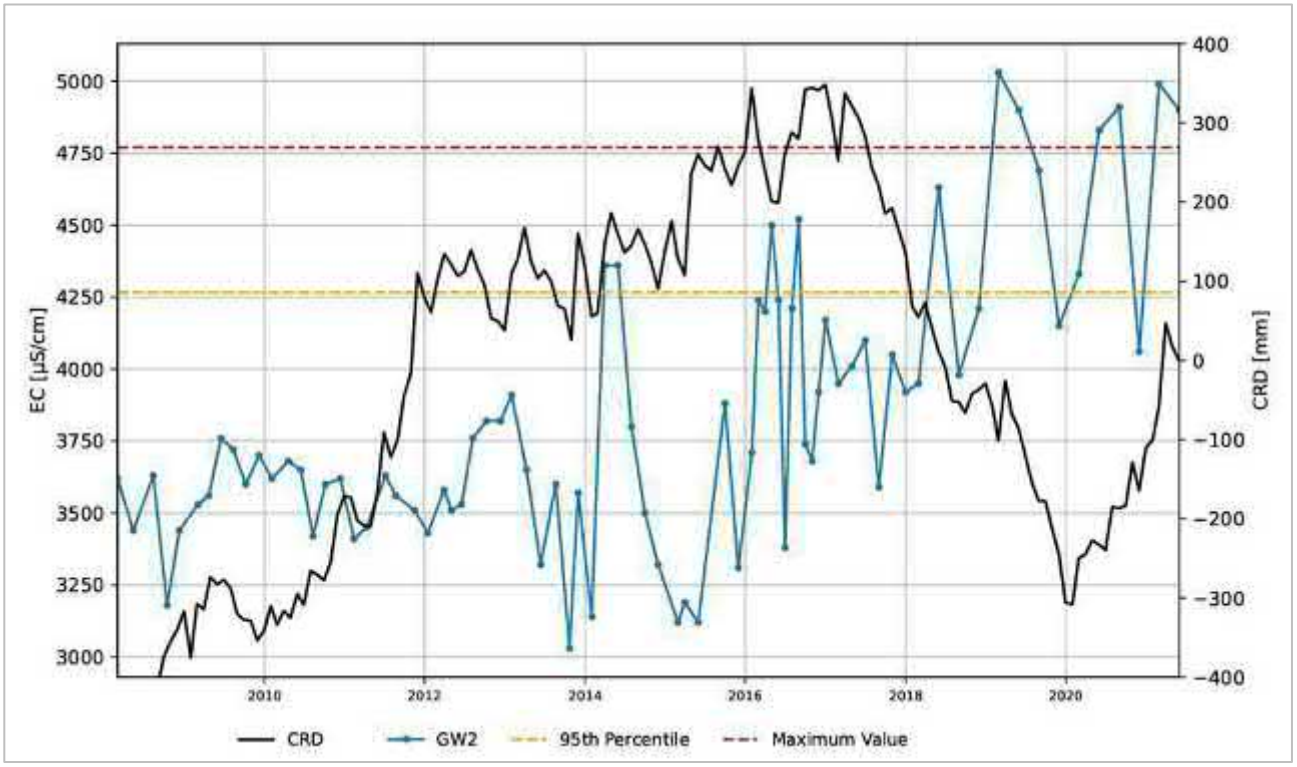
EC - BCGW22P (IW4026) – Permian Coal Measures



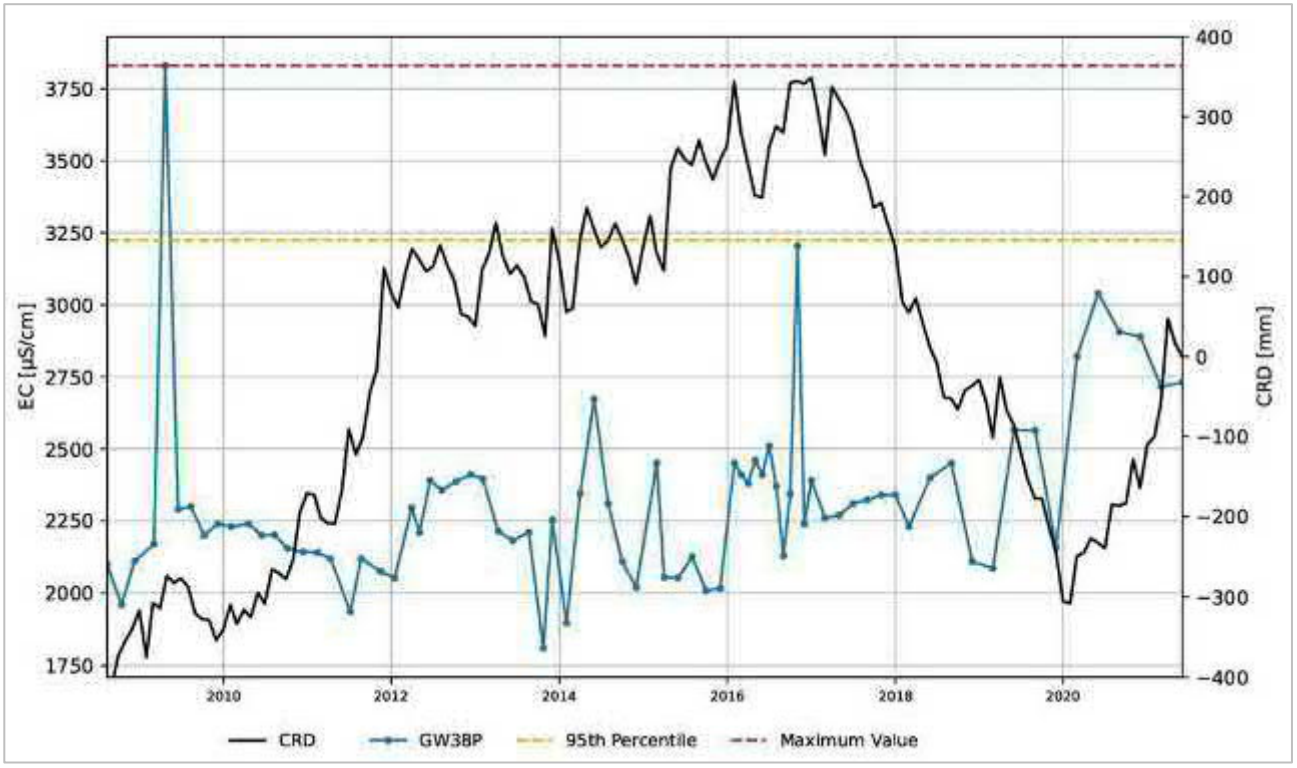
EC – EWPC33 – Permian Coal Measures



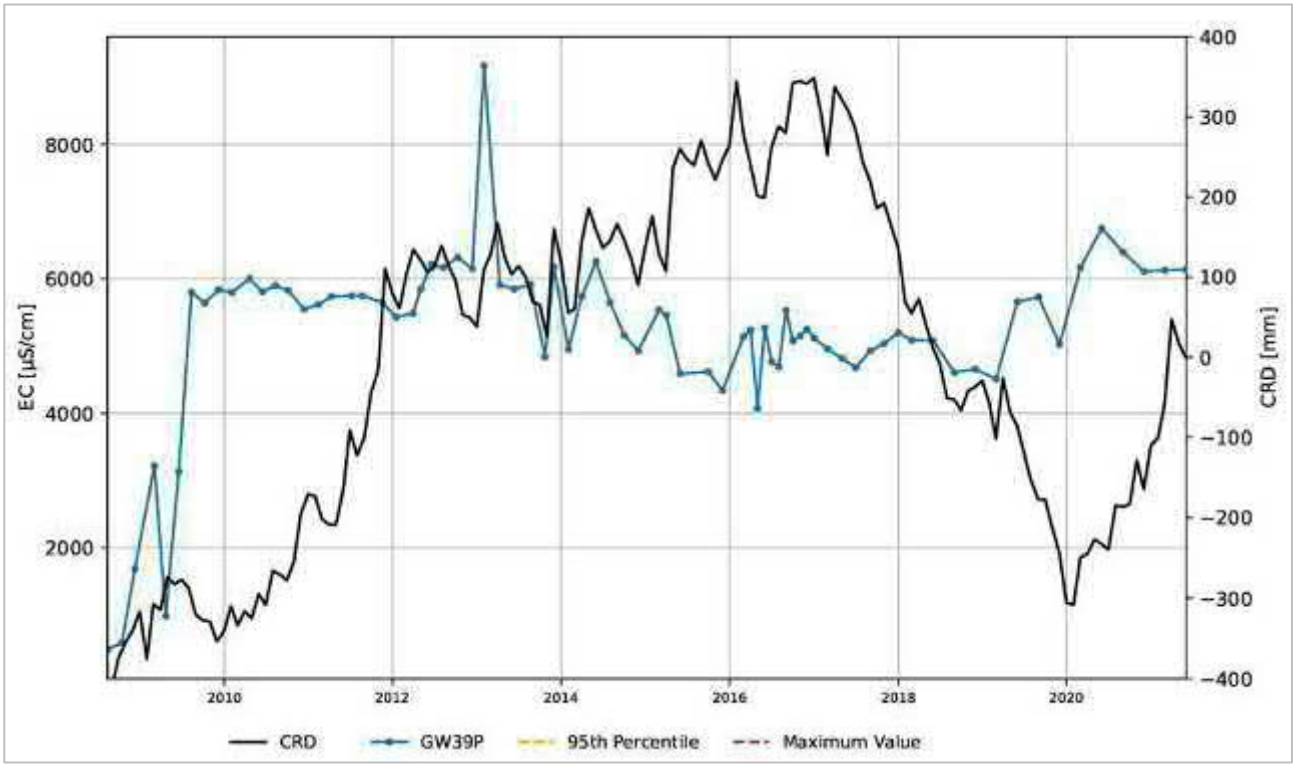
EC – GW2 – Permian Coal Measures



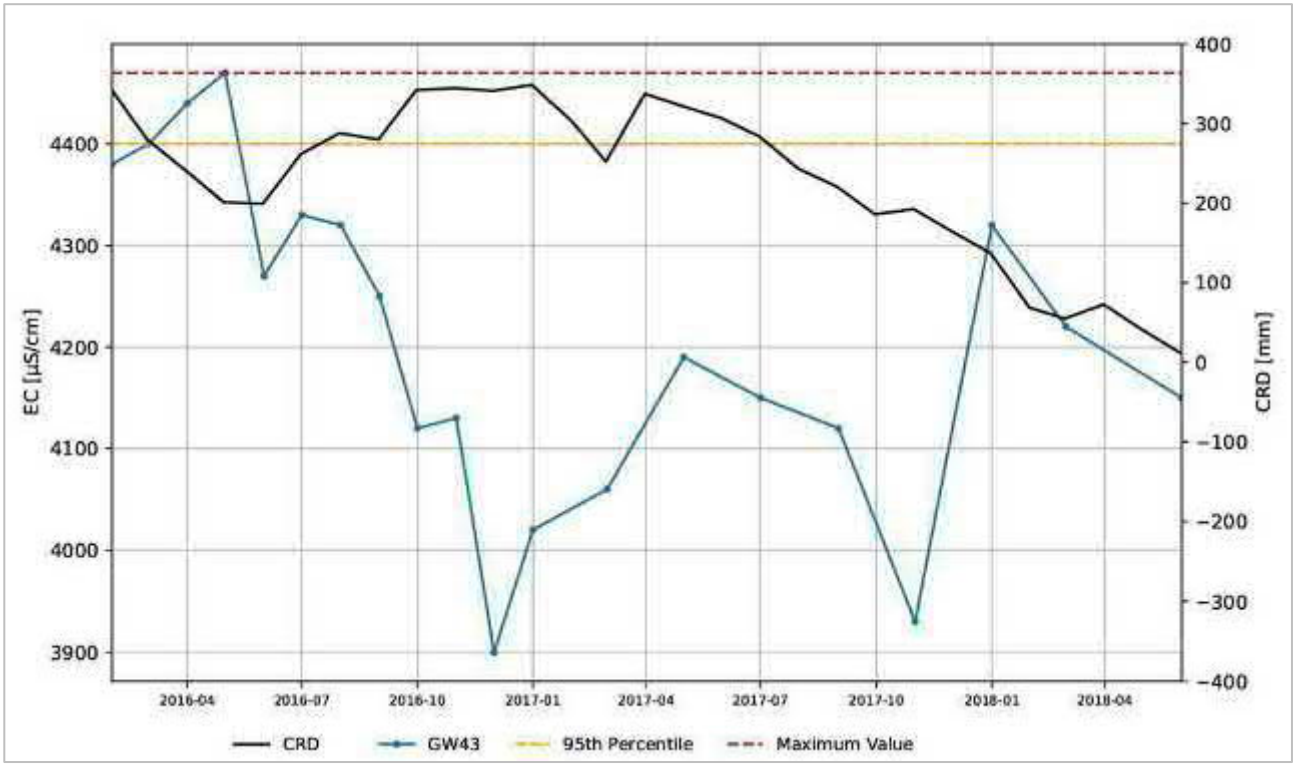
EC – GW38P – Permian Coal Measures



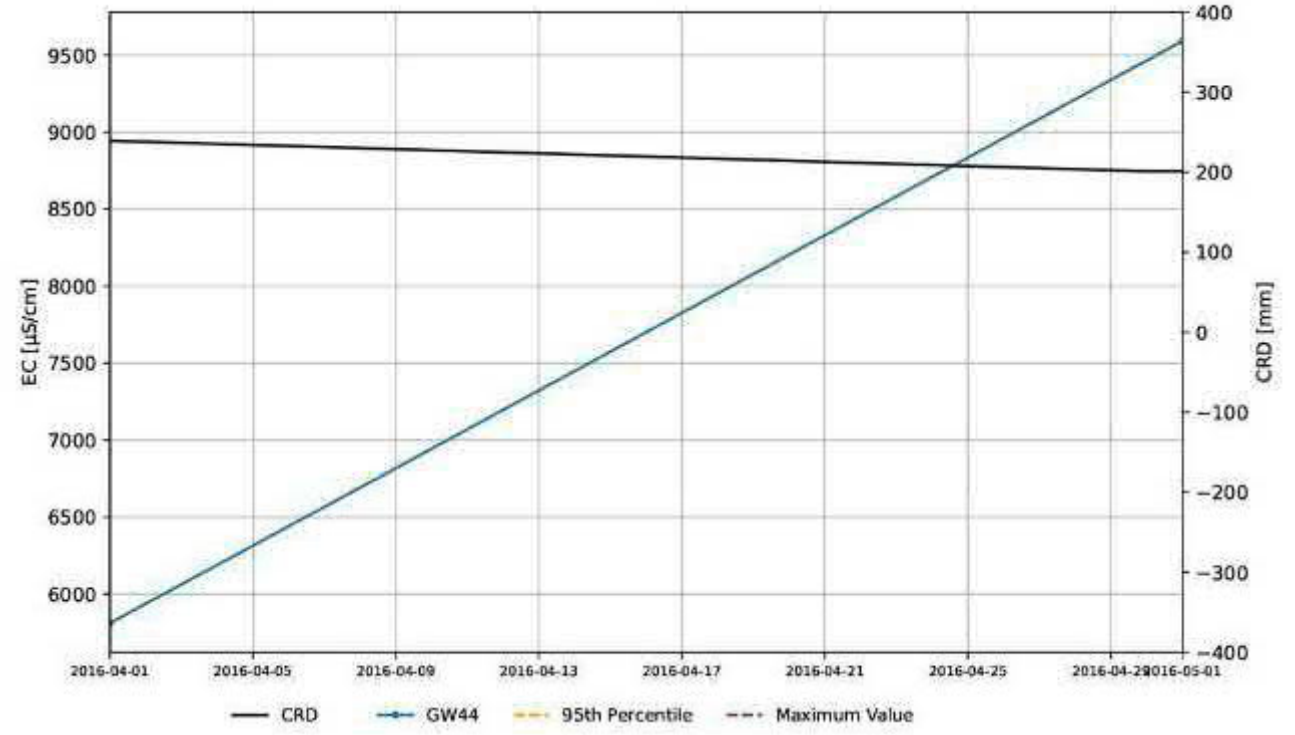
EC – GW39P-25mm – Permian Coal Measures



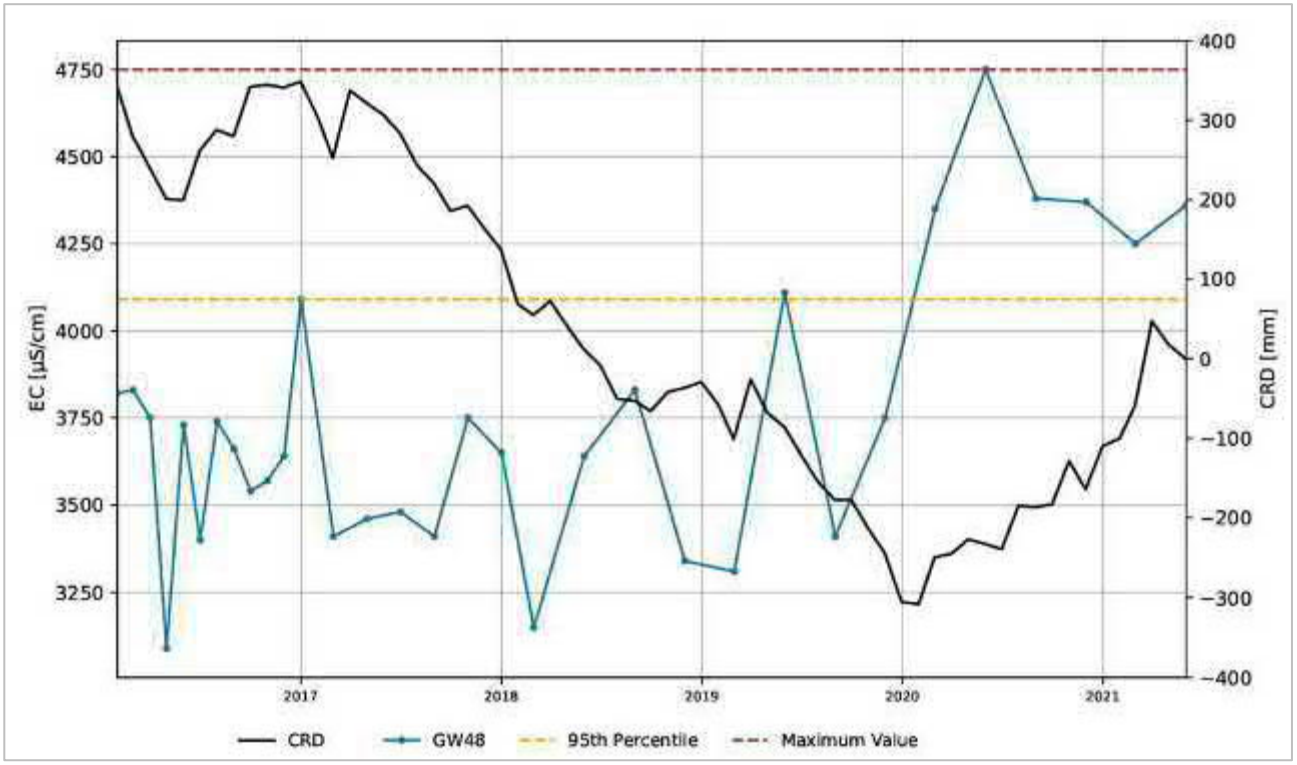
EC – GW43 – Permian Coal Measures



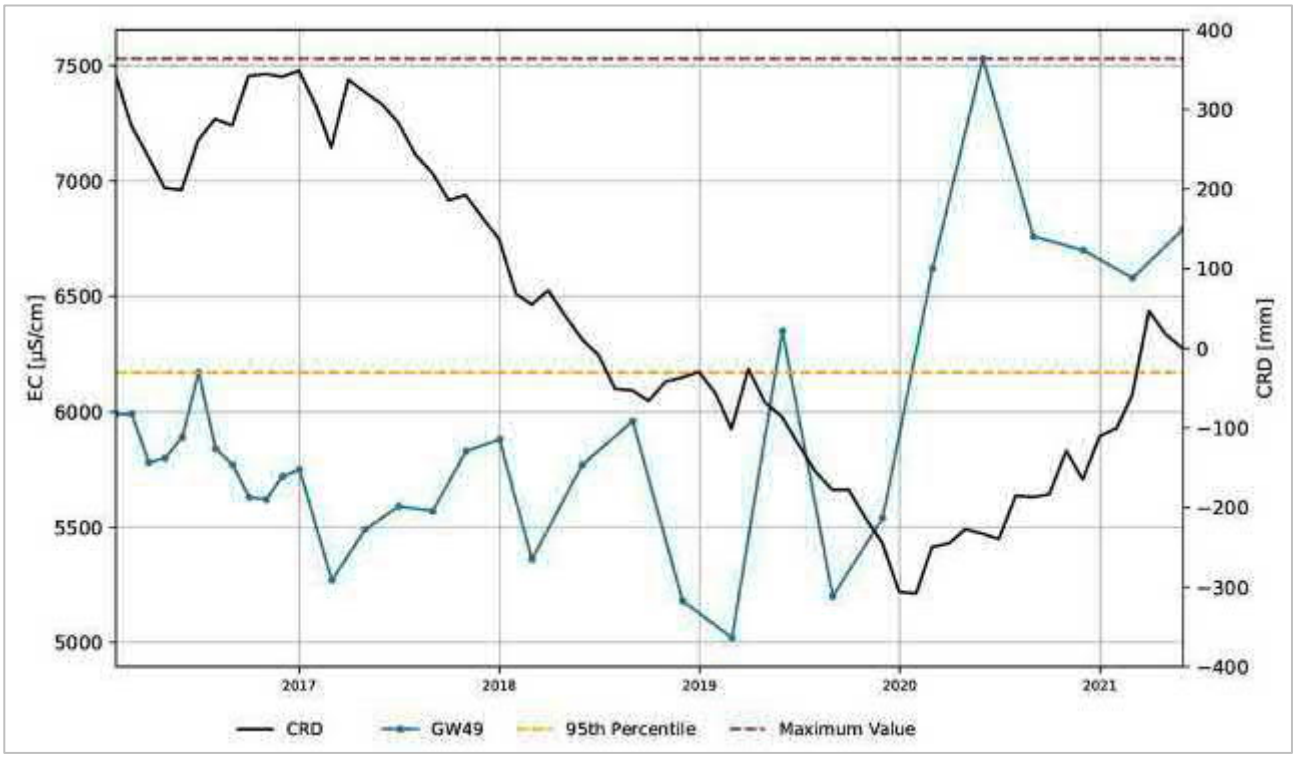
EC – GW44 – Permian Coal Measures



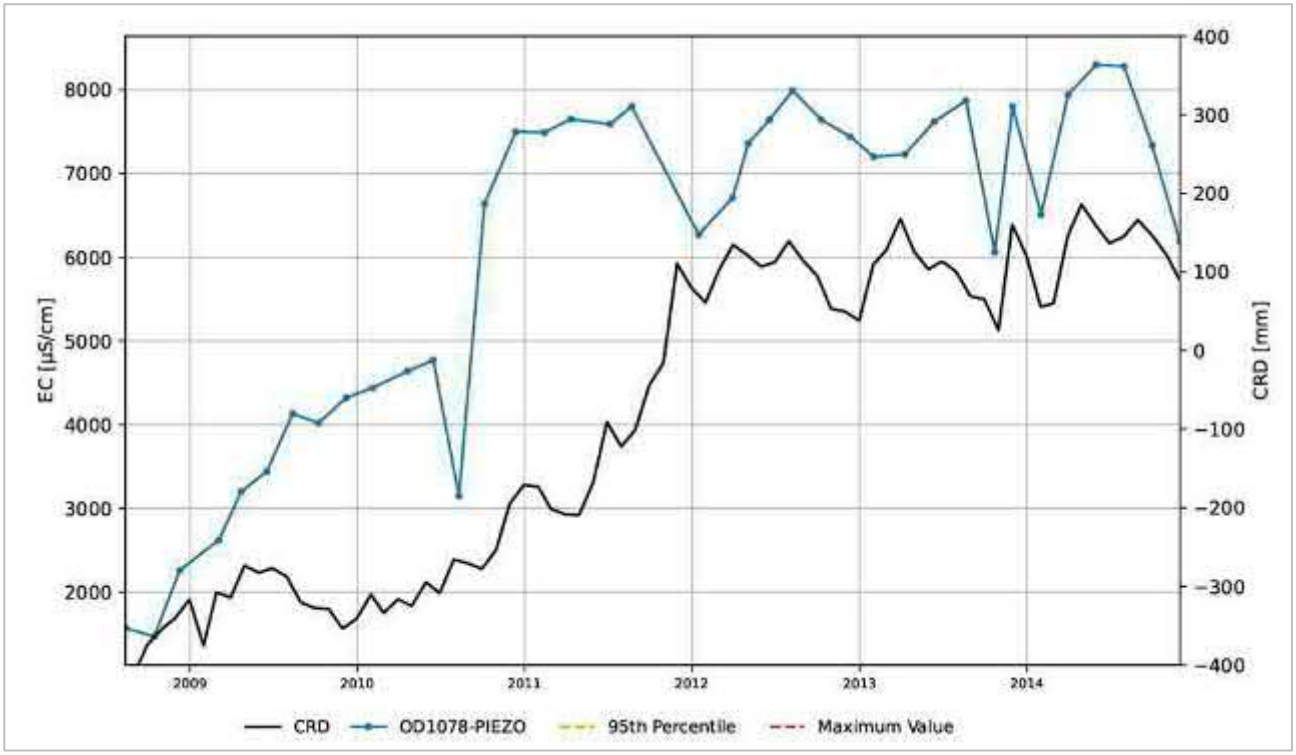
EC – GW48 – Permian Coal Measures



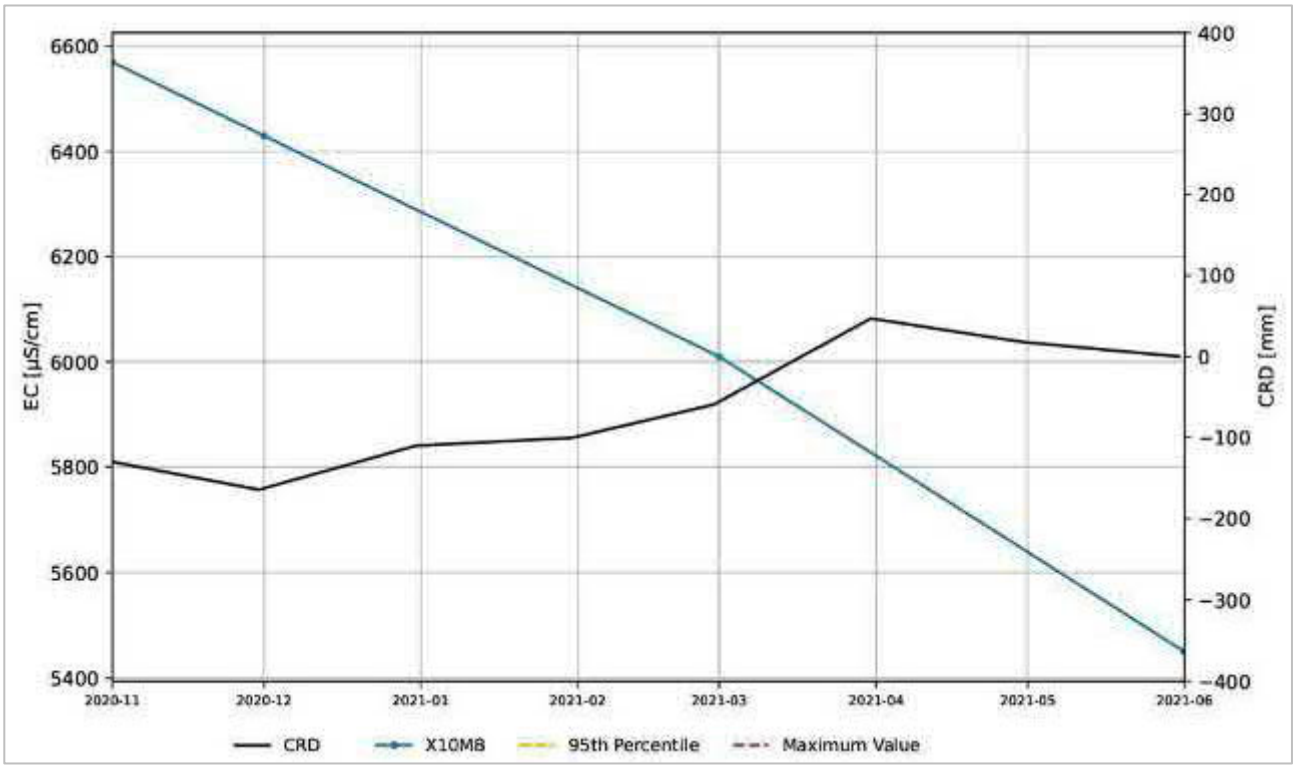
EC – GW49 – Permian Coal Measures



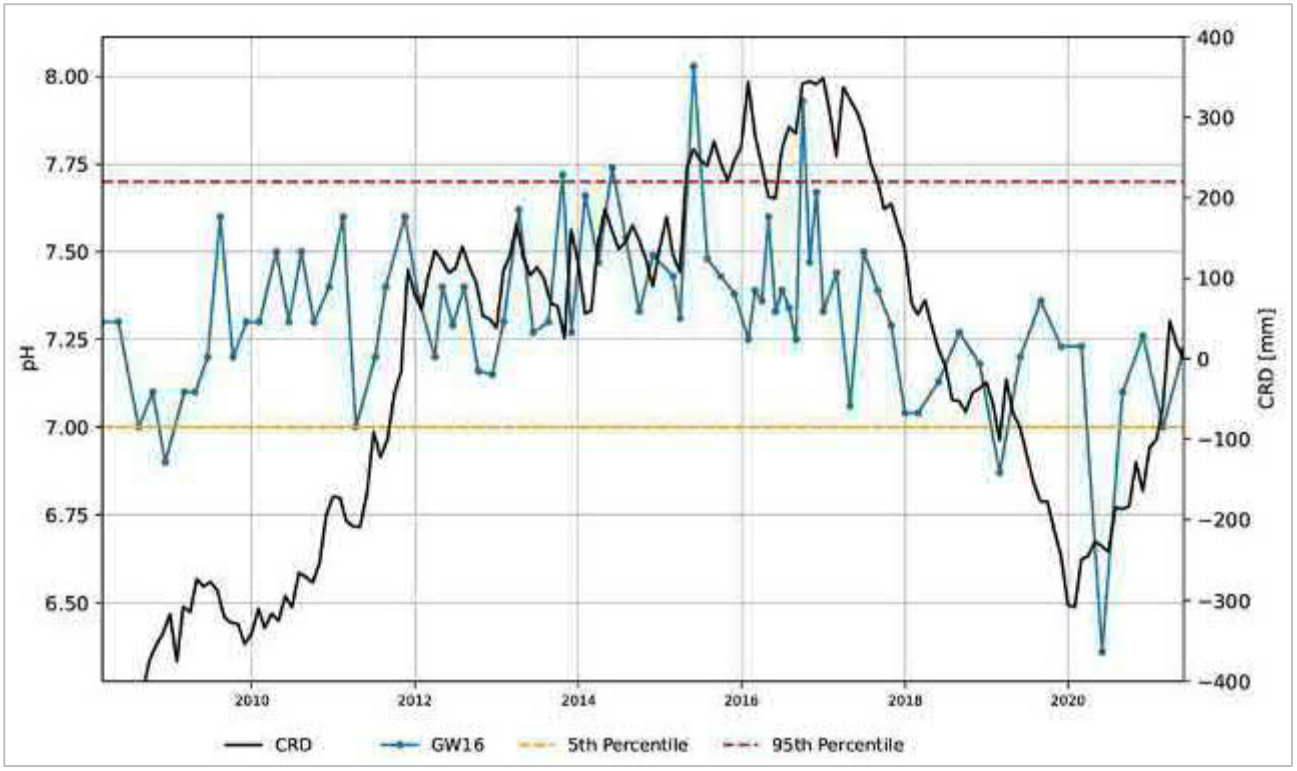
EC – OD1078-PIEZO – Permian Coal Measures



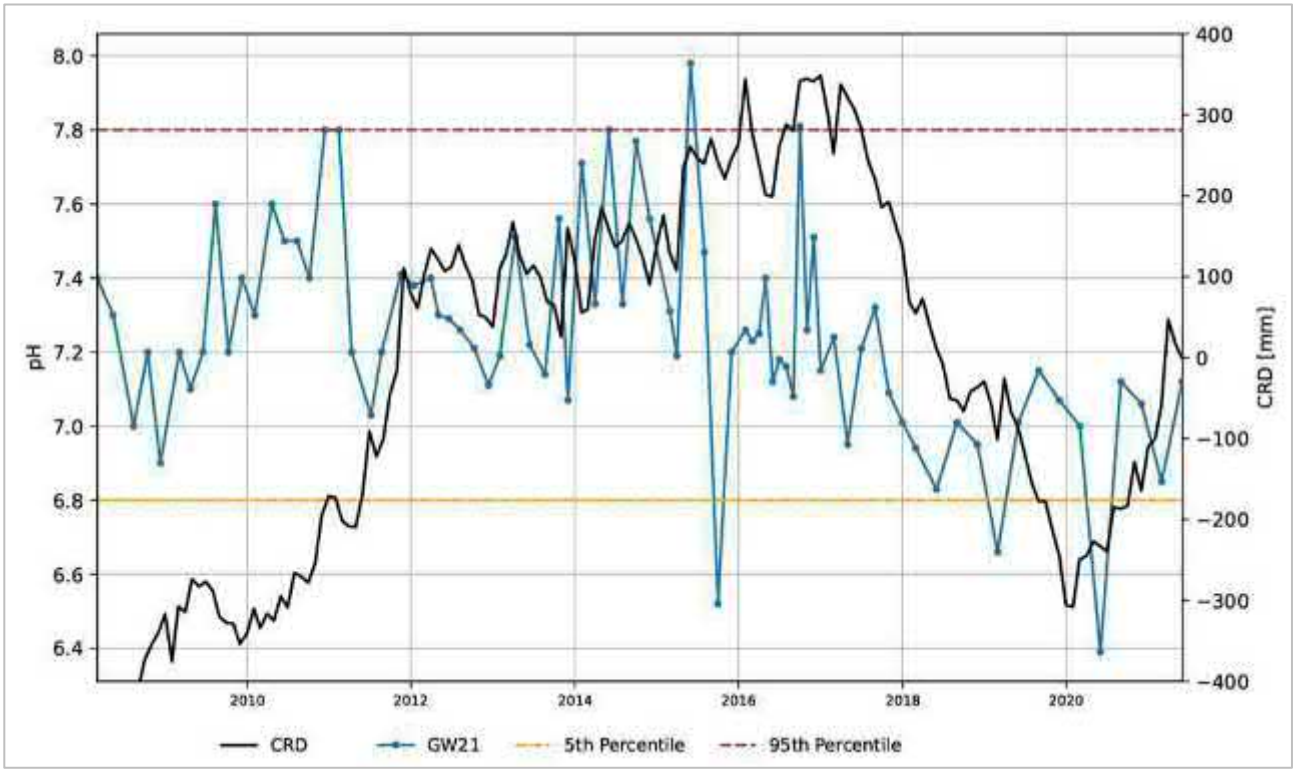
EC – X10MB – Permian Coal Measures



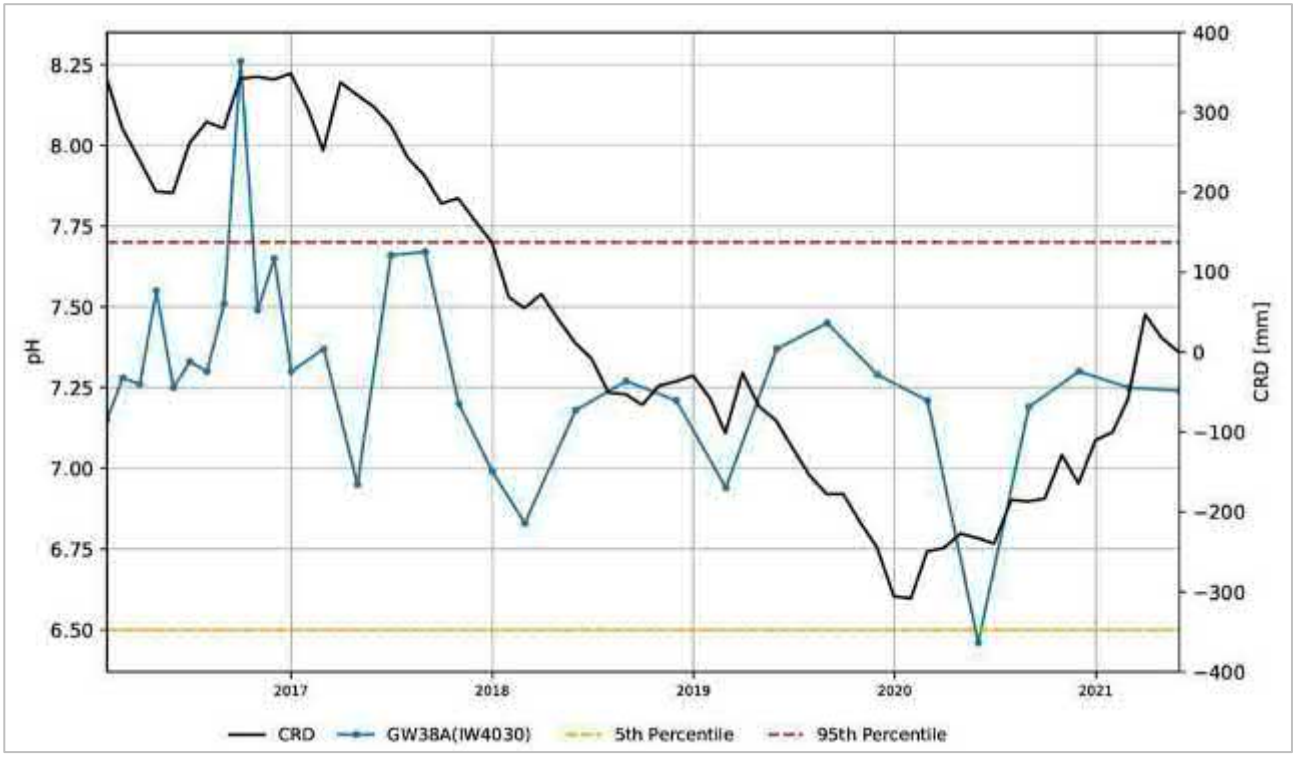
pH – GW16 – Hunter River Alluvium



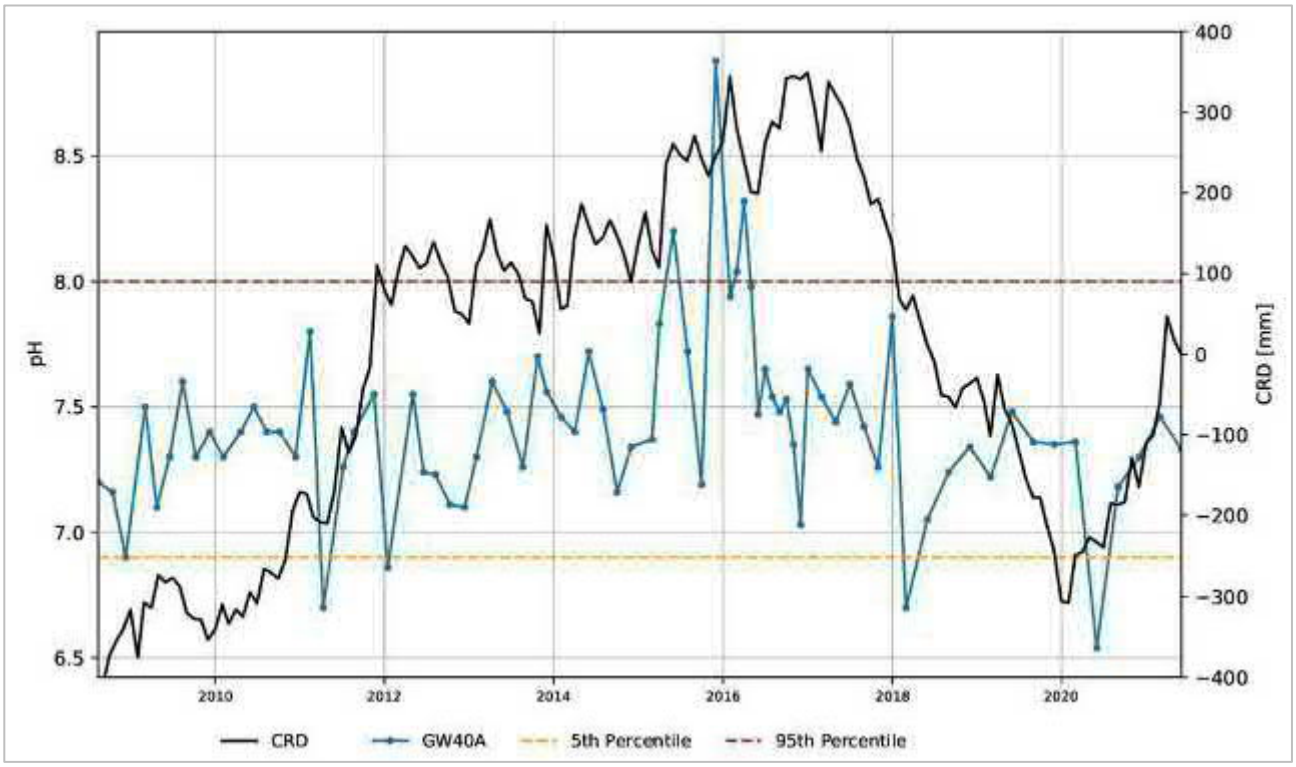
pH – GW21 – Hunter River Alluvium



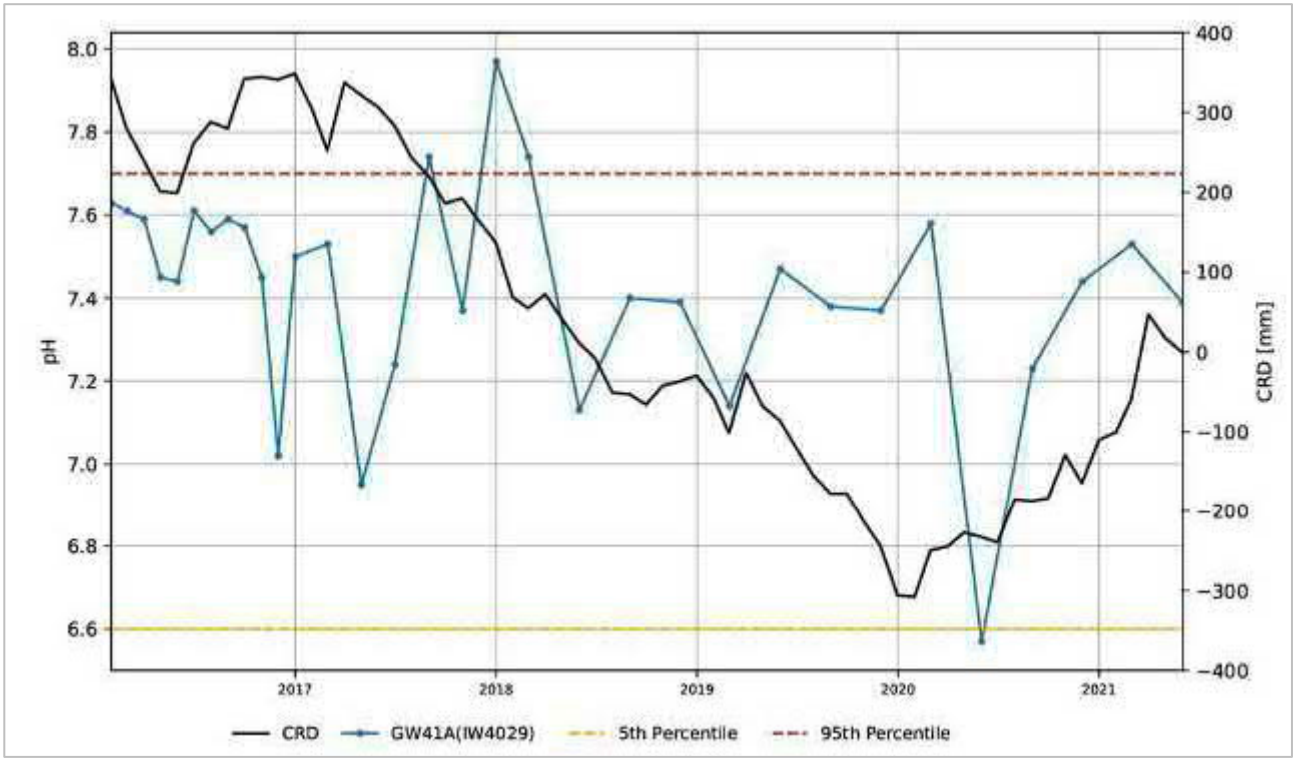
pH – GW38A (IW4030) – Hunter River Alluvium



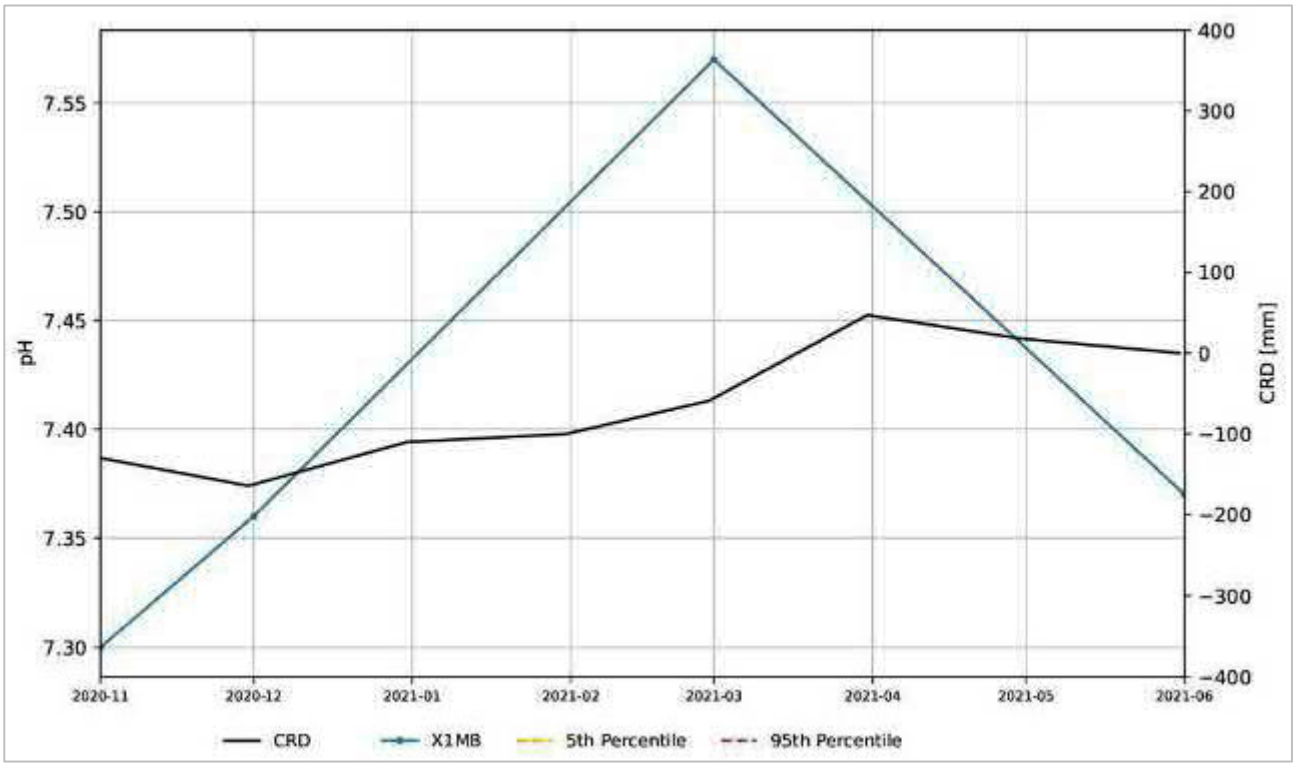
pH – GW40A – Hunter River Alluvium



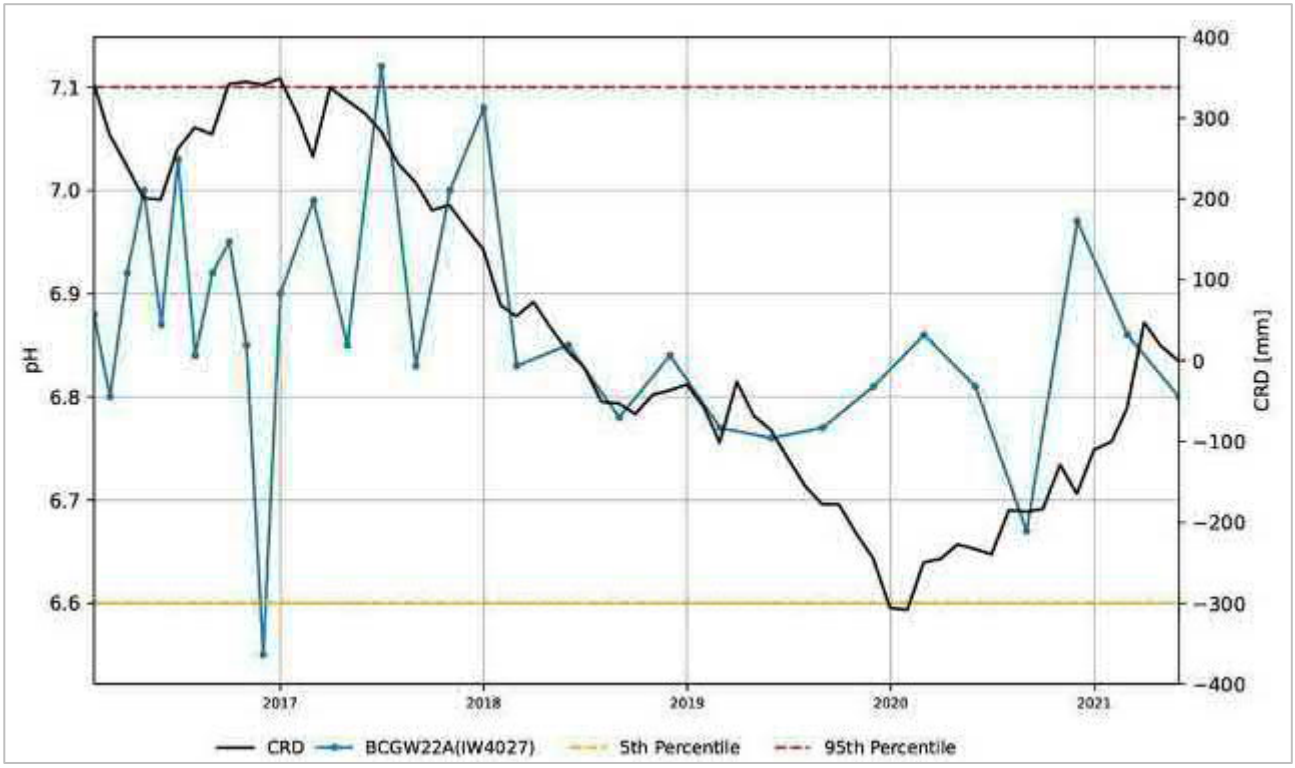
pH - GW41A (IW4029) – Hunter River Alluvium



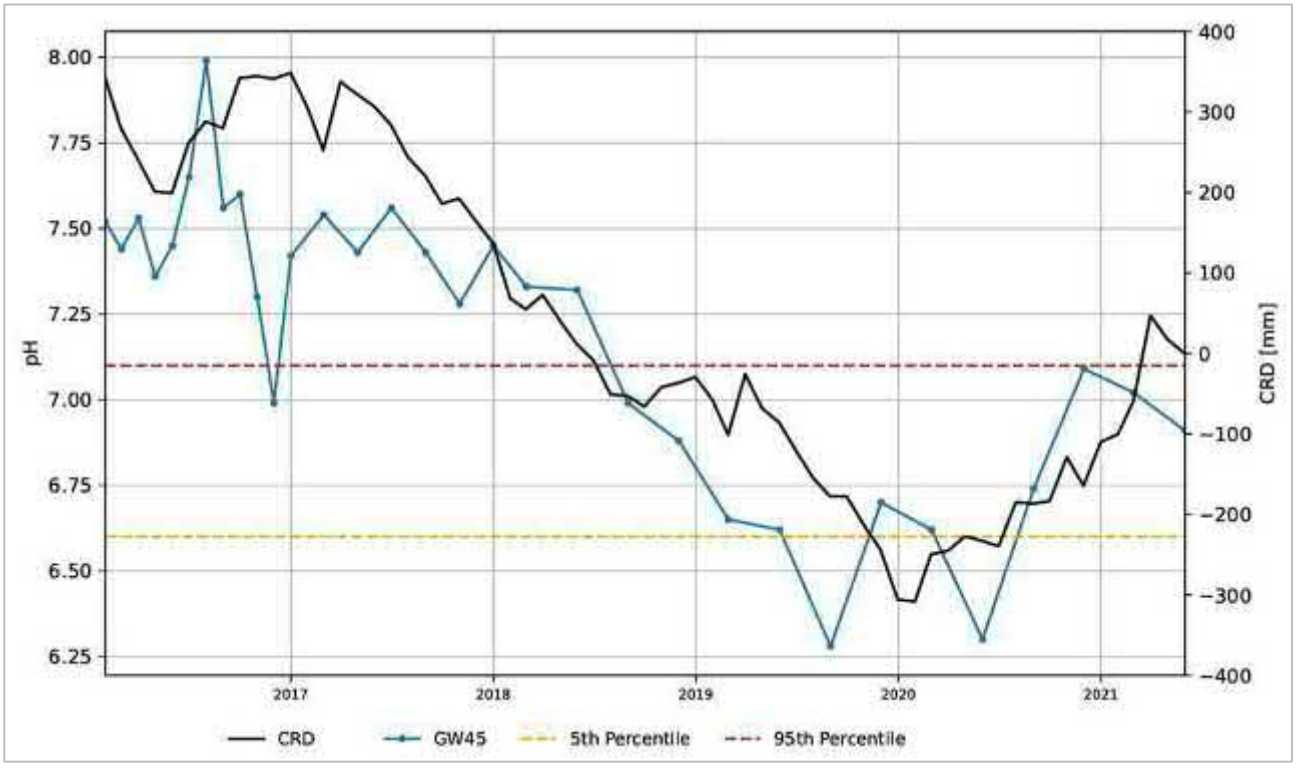
pH – X1MB – Hunter River Alluvium



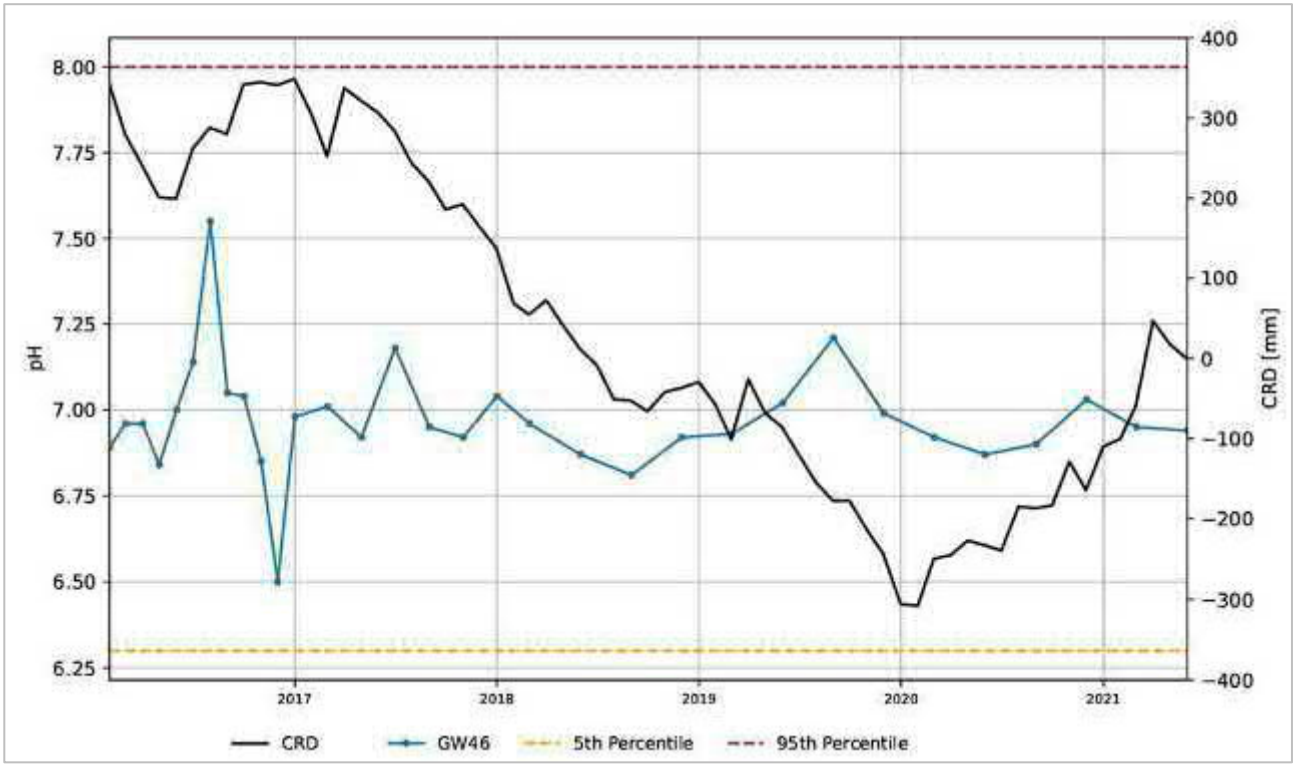
pH – BCGW22A (IW4027) – Saddlers Creek Alluvium



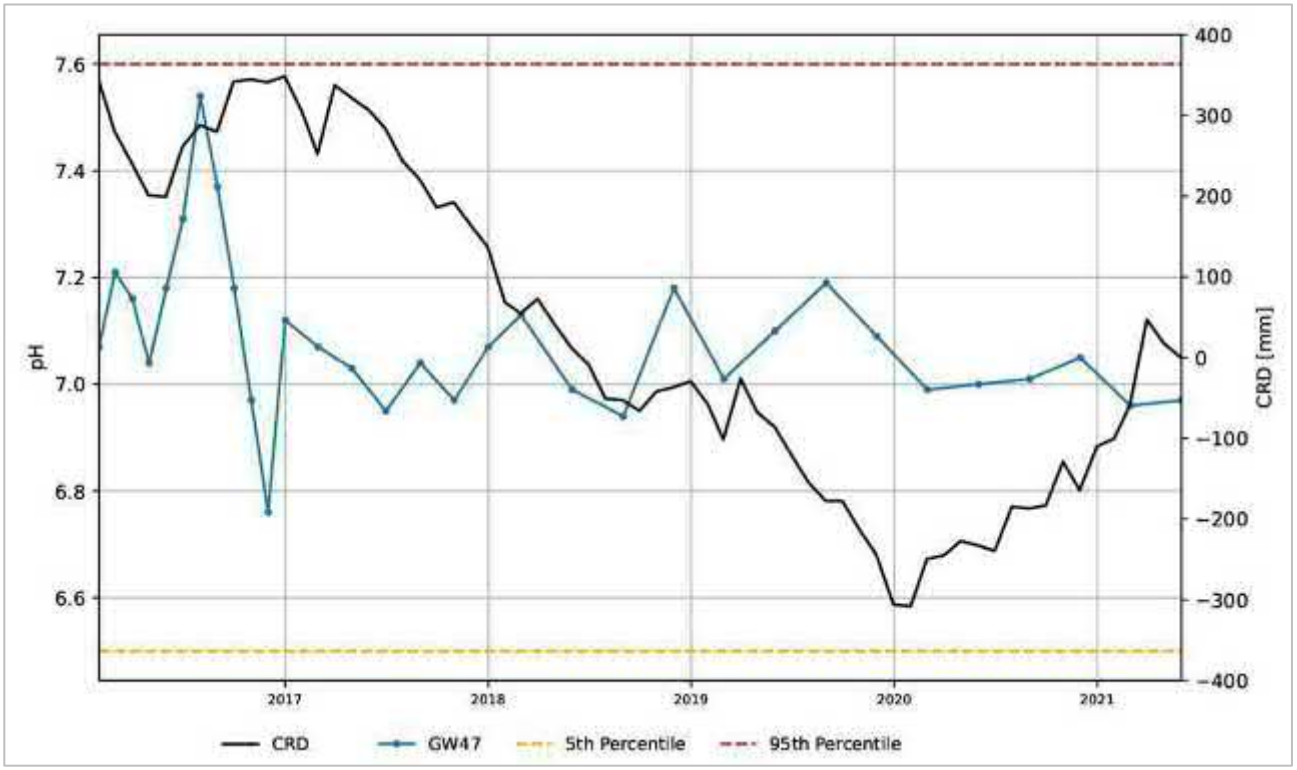
pH – GW45 – Saddlers Creek Alluvium



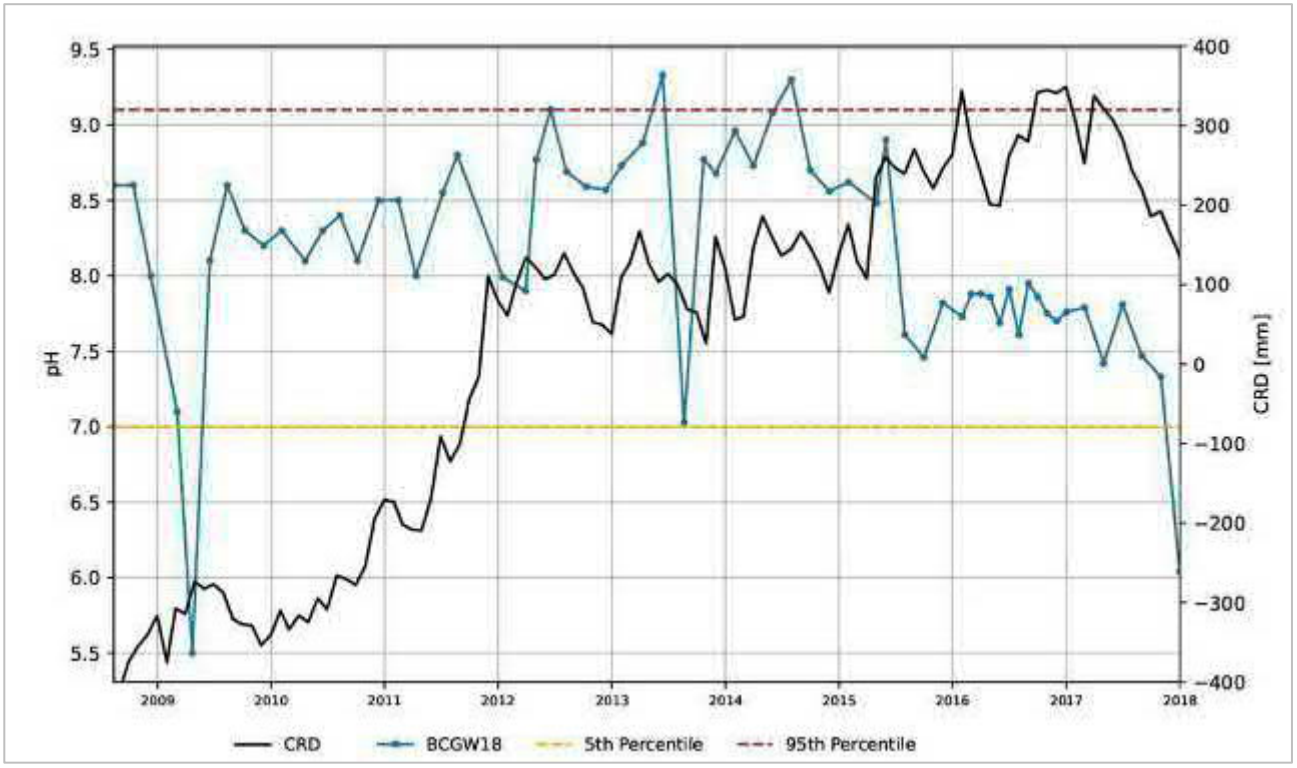
pH – GW46 – Saddlers Creek Alluvium



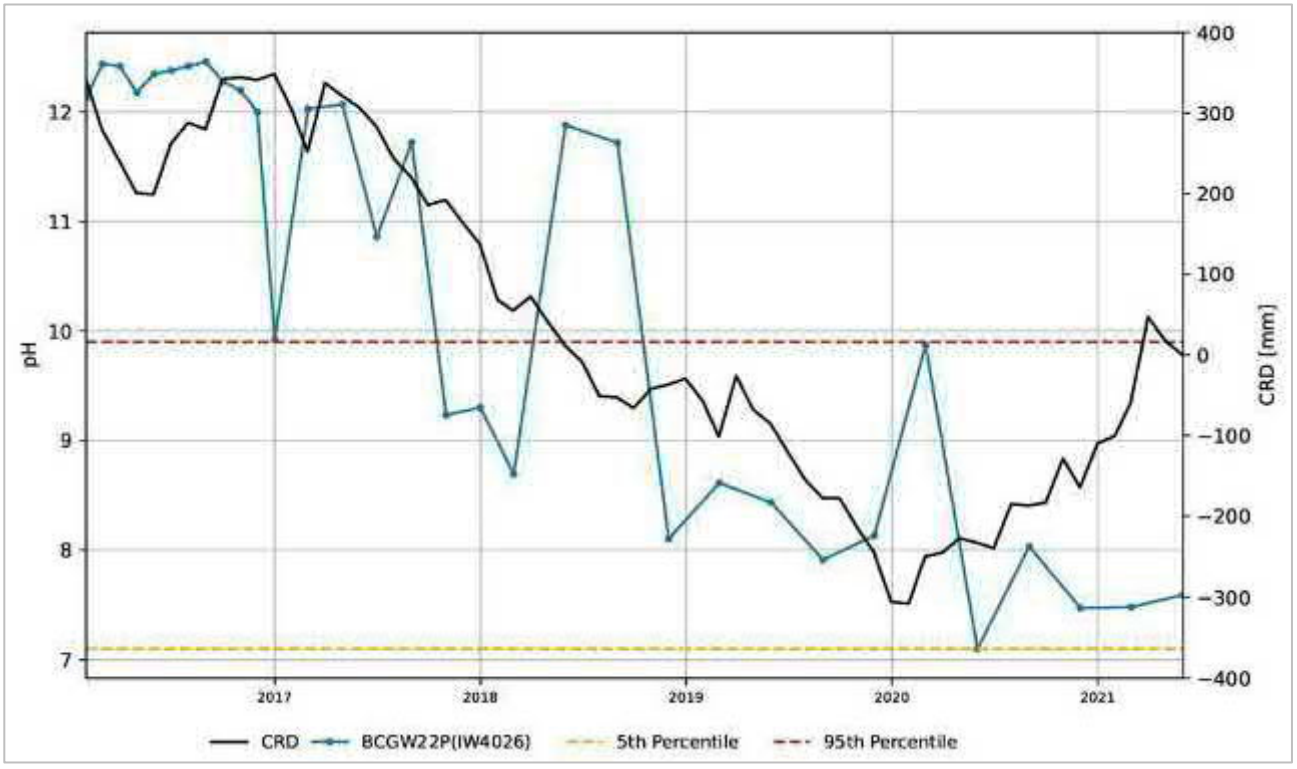
pH – GW47 – Saddlers Creek Alluvium



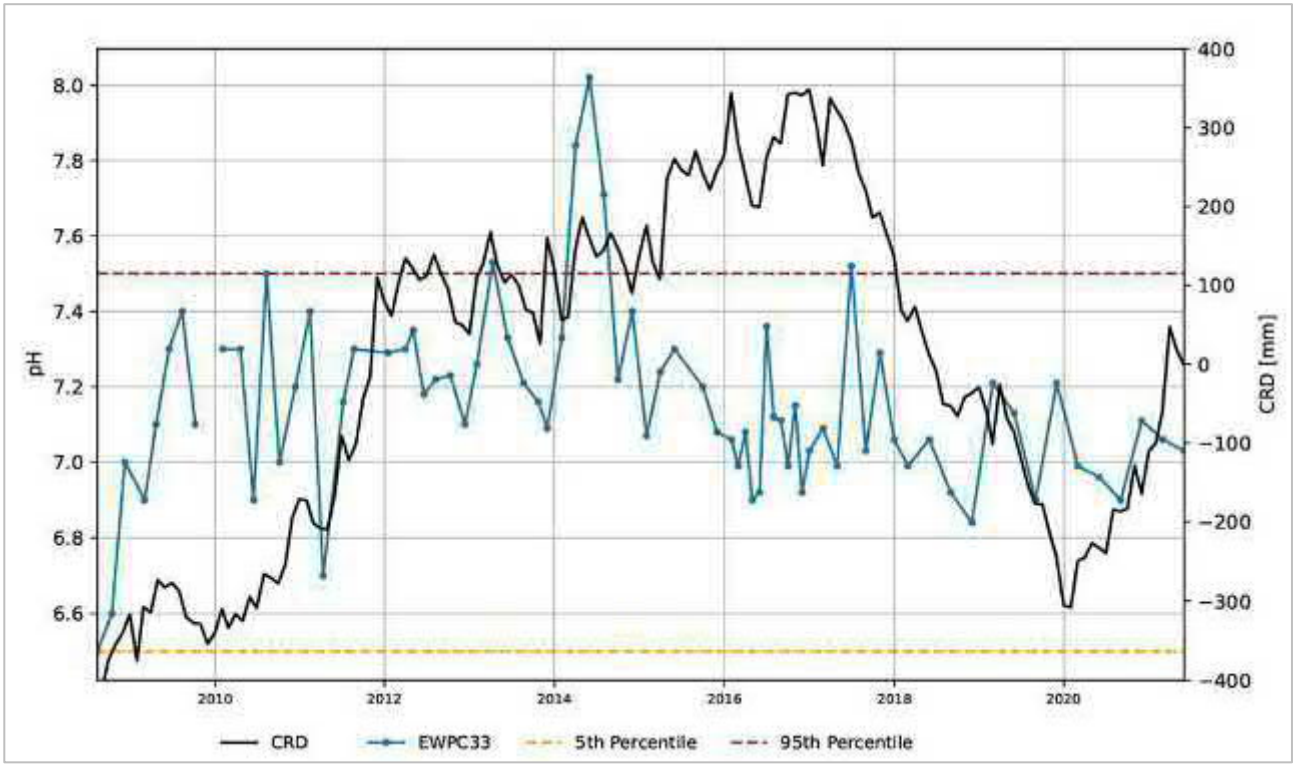
pH – BCGW18 – Permian Coal Measures



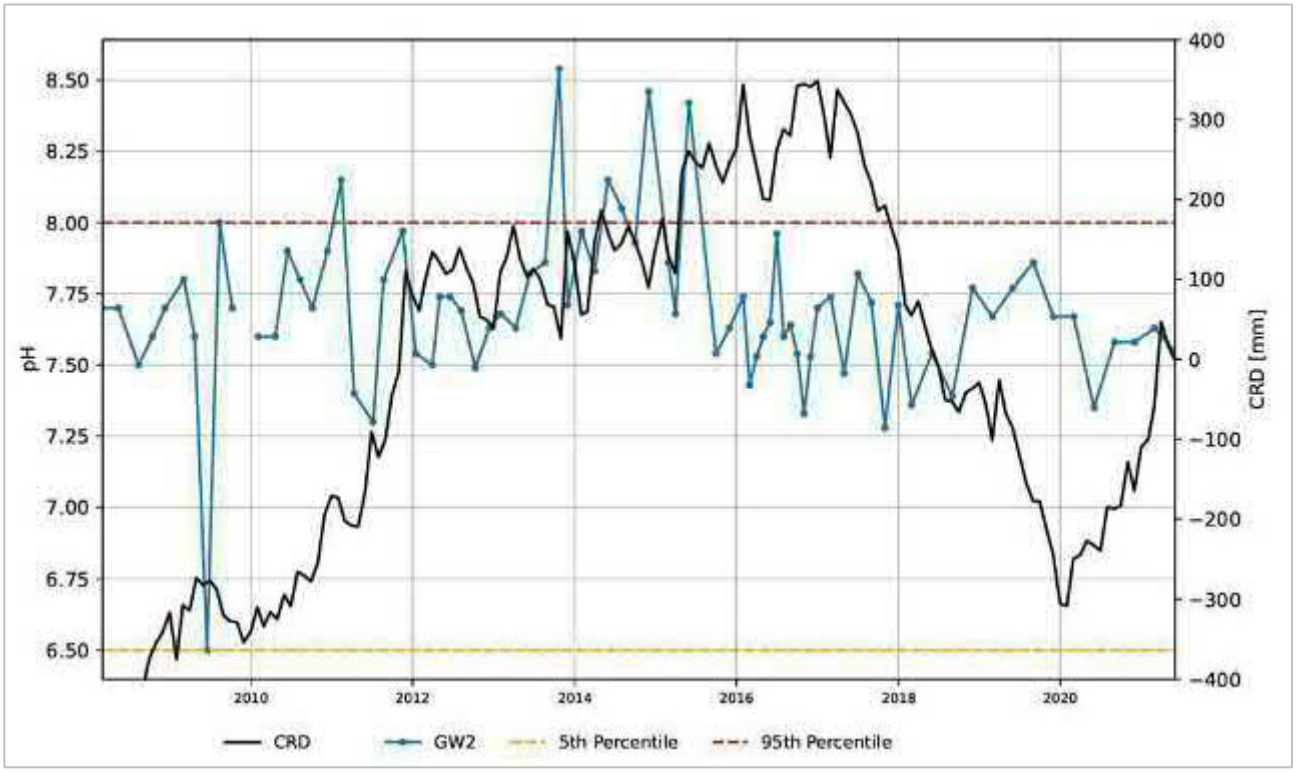
pH – BCGW22P (IW4026) – Permian Coal Measures



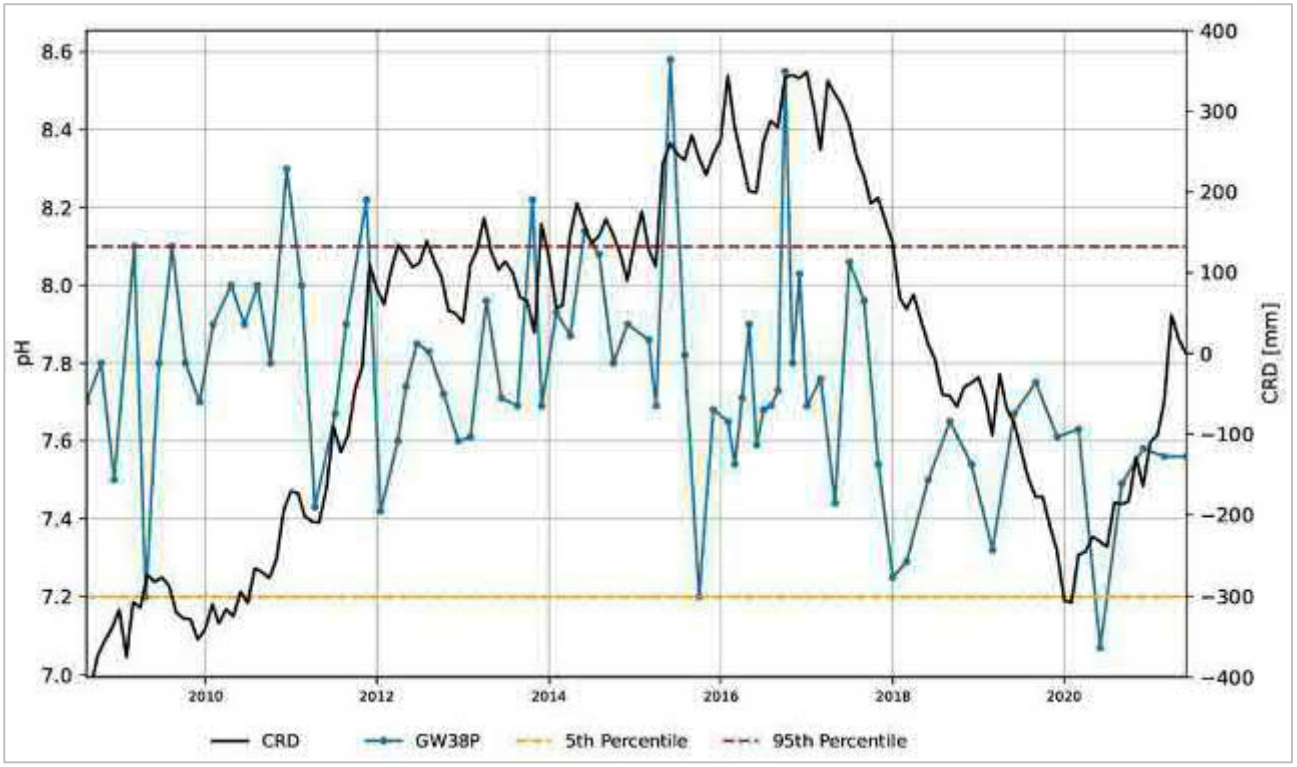
pH – EWPC33 – Permian Coal Measures



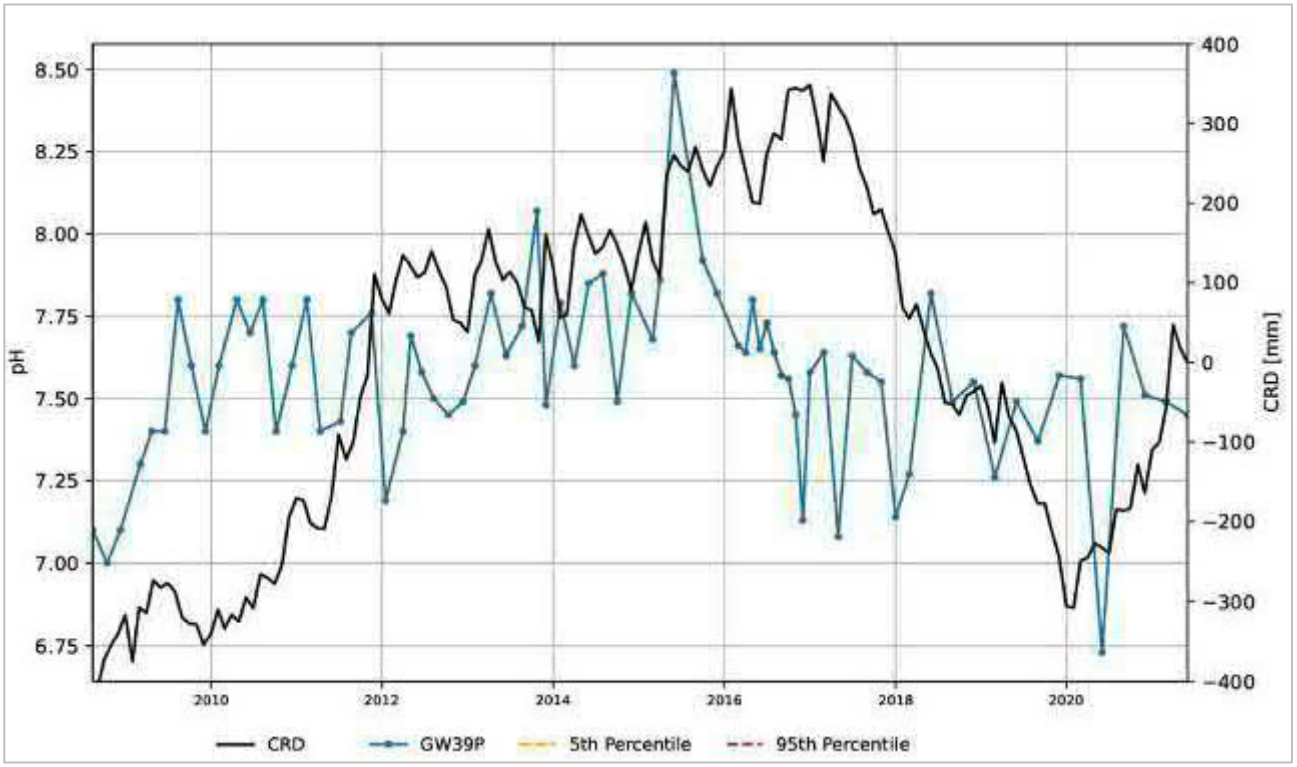
pH – GW2 – Permian Coal Measures



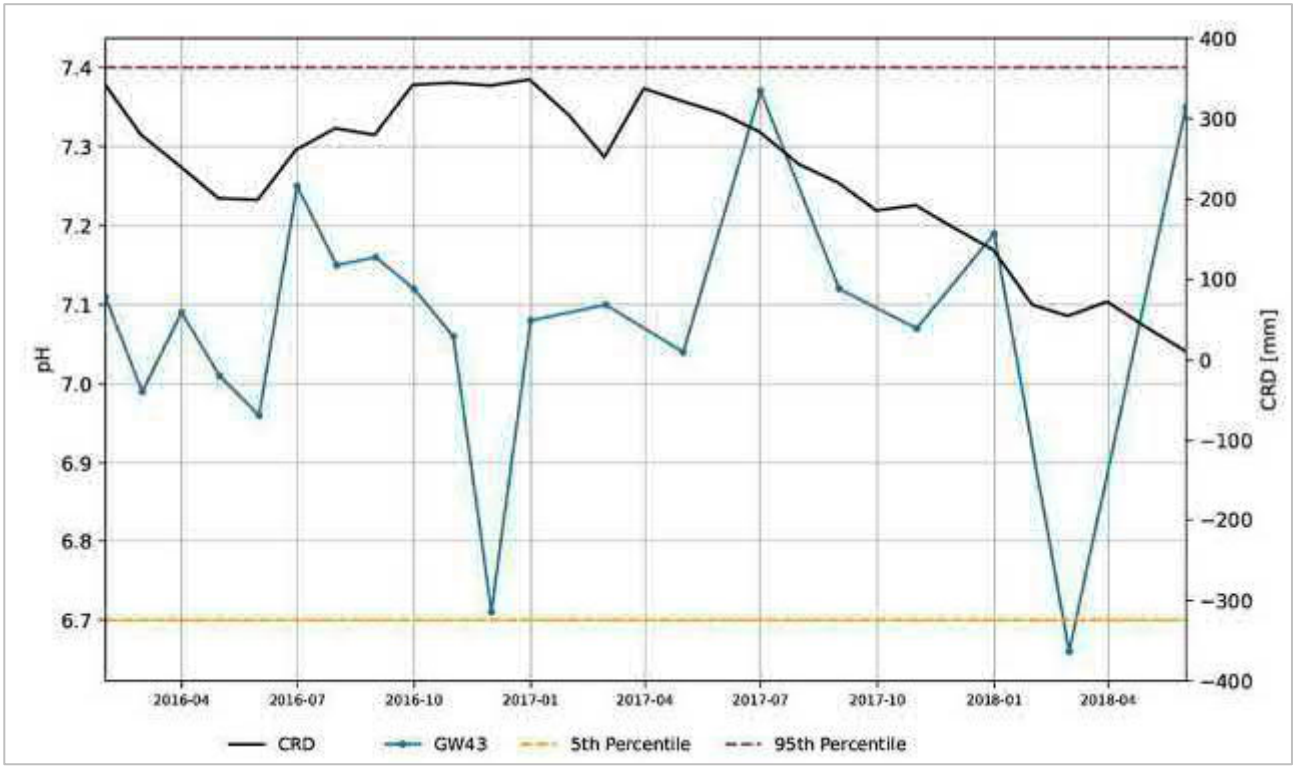
pH – GW38P – Permian Coal Measures



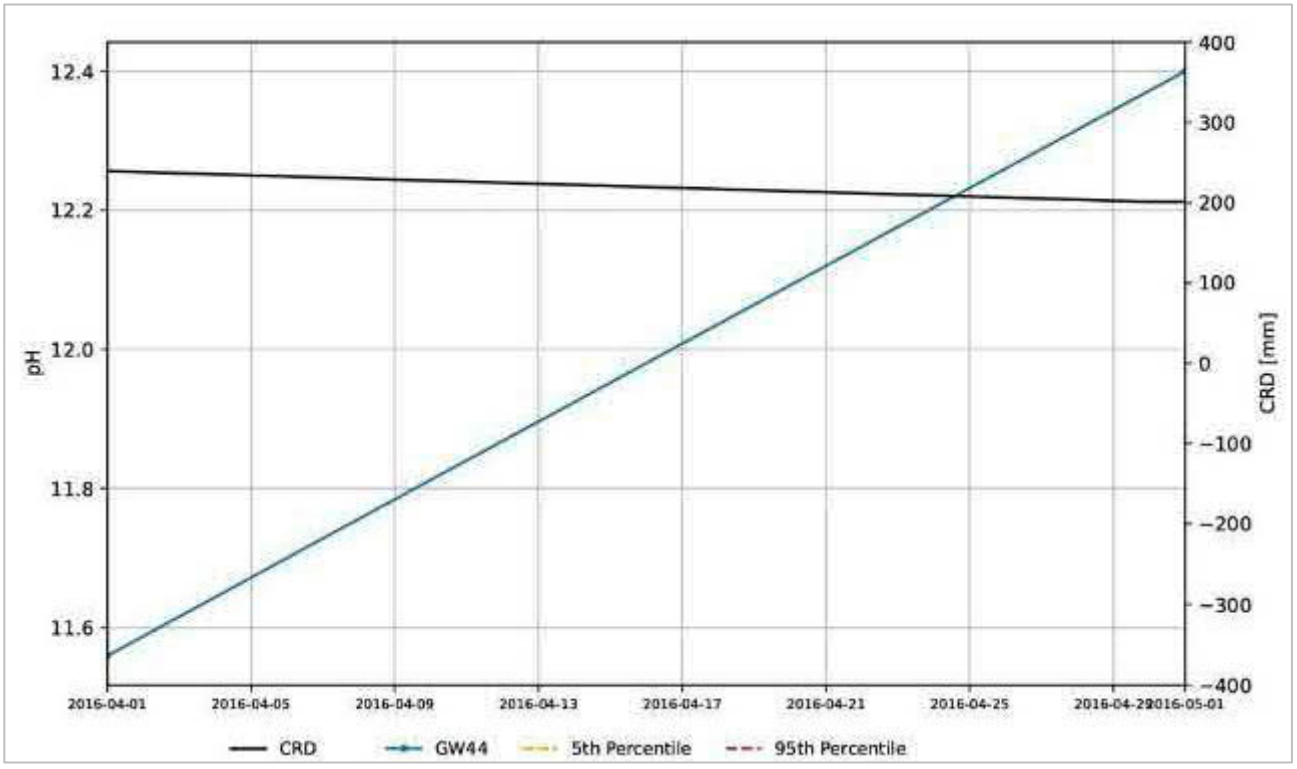
pH – GW39P-25mm – Permian Coal Measures



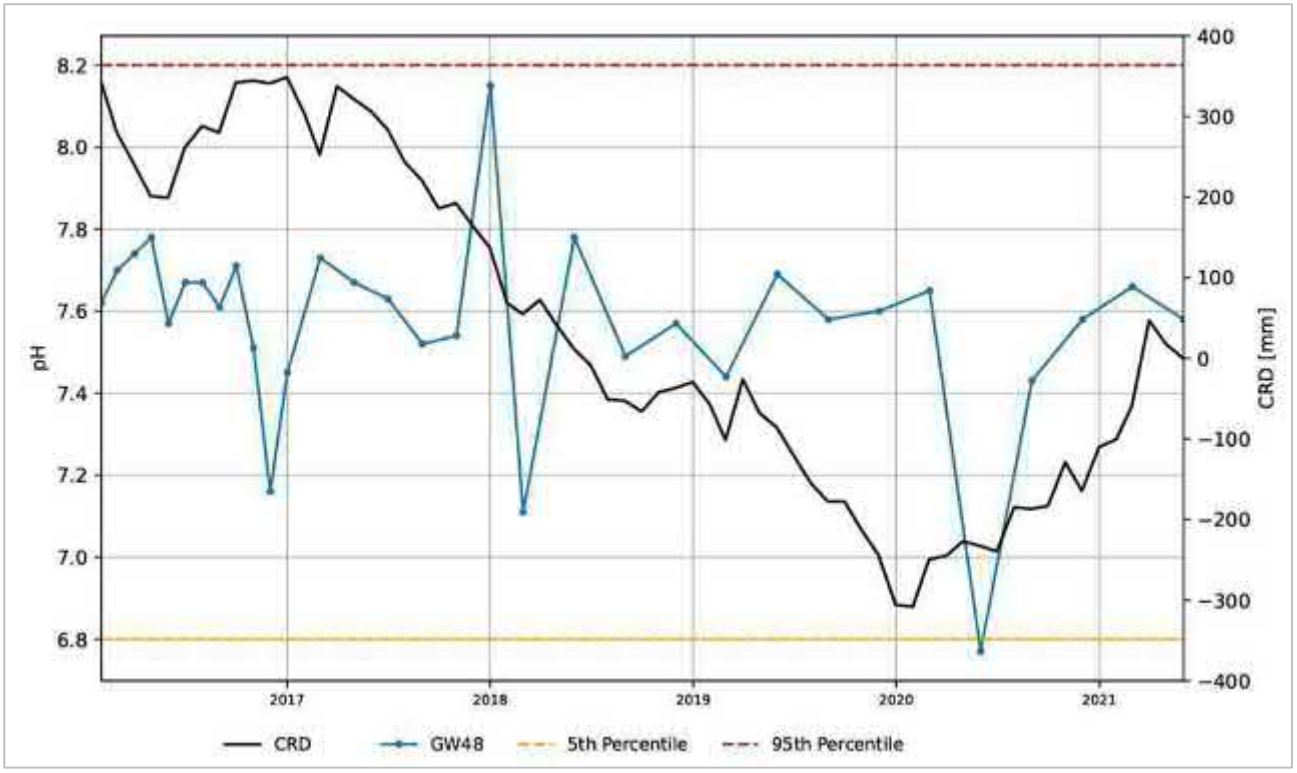
pH – GW43 – Permian Coal Measures



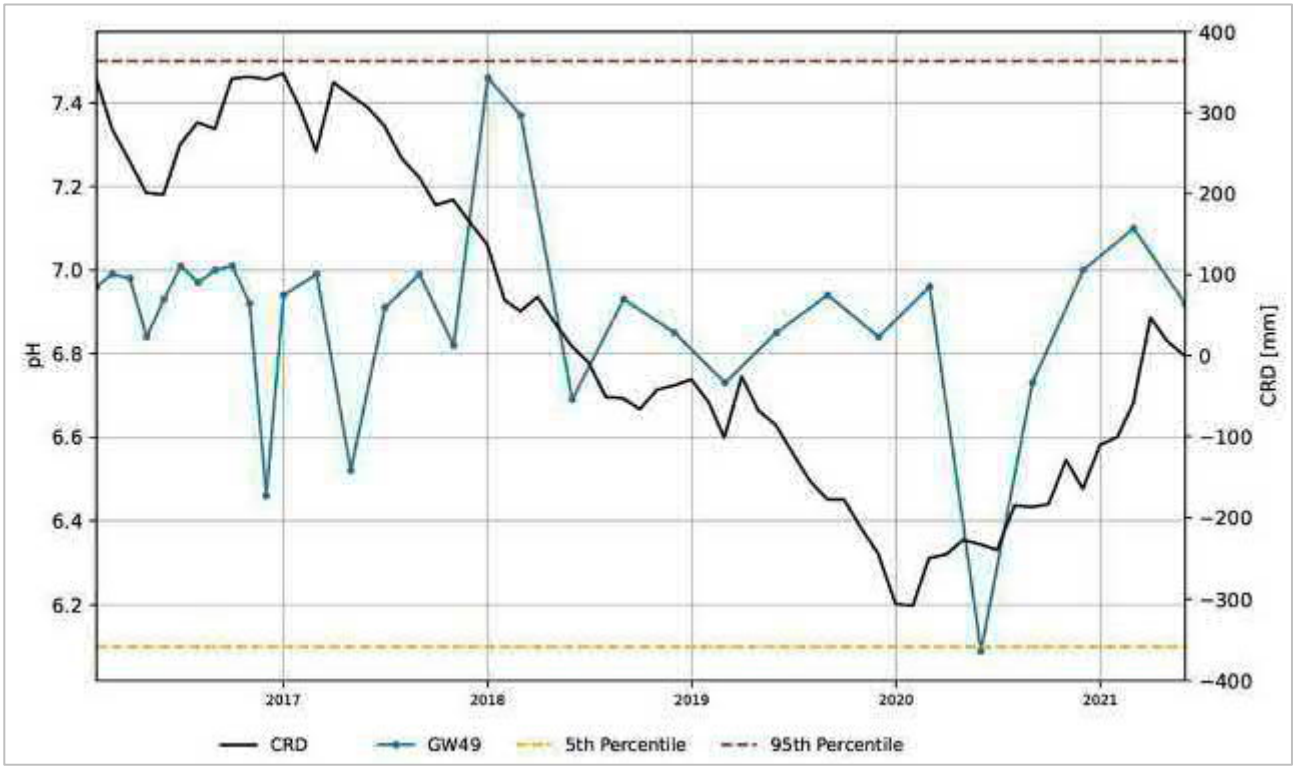
pH – GW44 – Permian Coal Measures



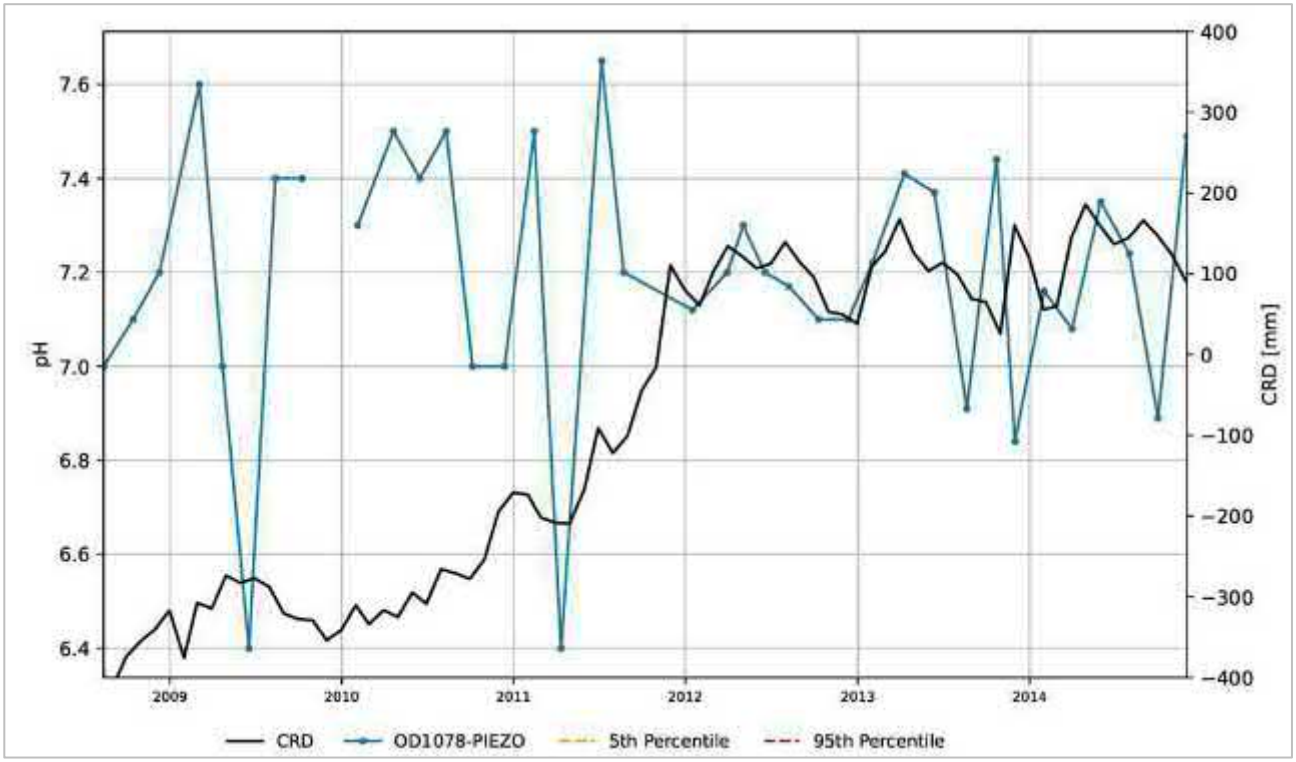
pH – GW48 – Permian Coal Measures



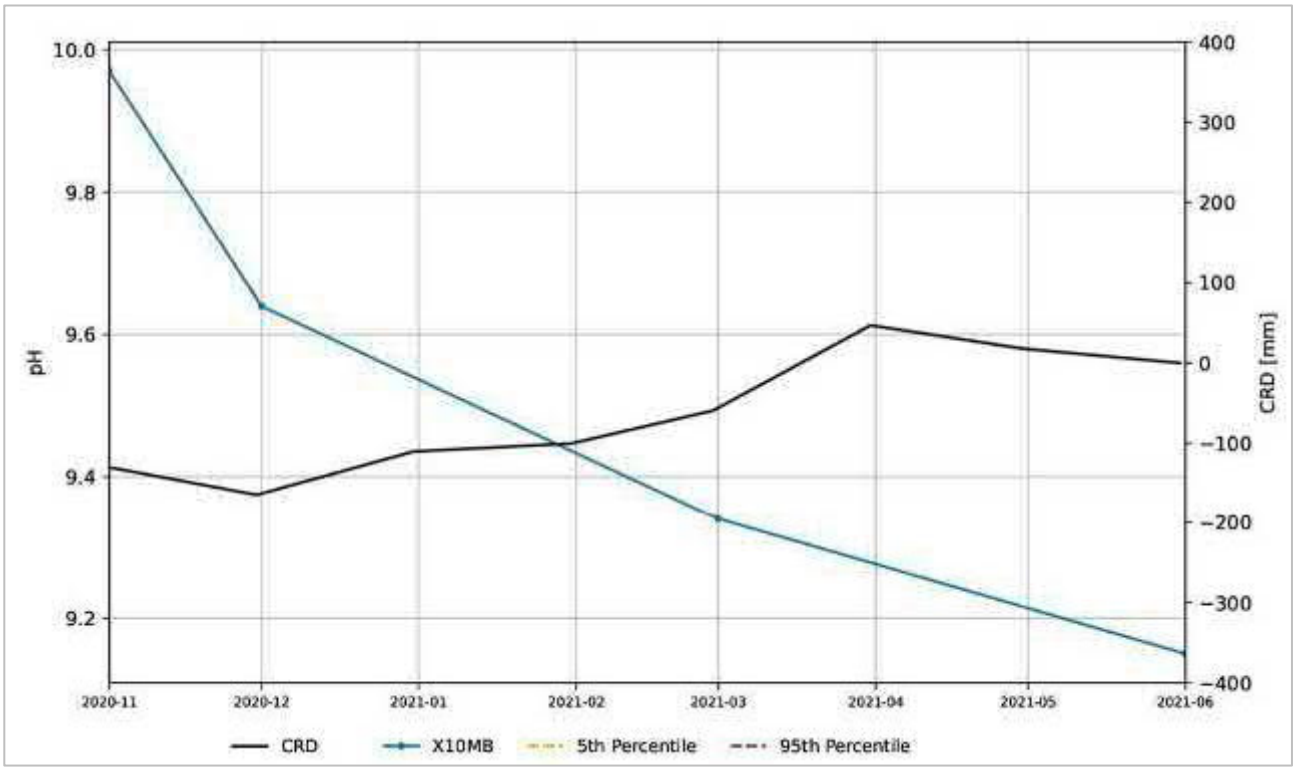
pH – GW49 – Permian Coal Measures



pH – OD1078-PIEZO – Permian Coal Measures



pH – X10MB – Permian Coal Measures



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	20/07/2020	9:41pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of lights, which were redirected or turned off. Caller was advised of investigation and action taken.
2		23/07/2020	5:34pm	Ironbark Road	Lighting	Community Response Line	Investigation revealed location of lights, which were redirected or turned off. Caller was advised of investigation and action taken.
3	August	12/08/2020	6:15pm	Ironbark Road	Lighting	Community Response Line	Investigation revealed location of lights, which were redirected or turned off. Caller was advised of investigation and action taken.
4		24/08/2020	11:05pm	Bureen Road	Lighting	Community Response Line	Investigation revealed location of lights, which were redirected or turned off. Caller was advised of investigation and action taken.
5		25/08/2020	8:07pm	Bureen Road	Lighting	Community Response Line	Investigation revealed location of lights, which were redirected or turned off. Caller was advised of investigation and action taken.
6		30/08/2020	3:29am	Roxburgh Road	Noise	Community Response Line	Results at the nearest real-time monitor indicated noise levels were within regulatory criteria. Caller was advised of investigation and monitoring results.
7	September	30/09/2020	4:30pm	Denman Road	Dust	NSW EPA	
8	October	7/10/2020	8:21pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of lights, which were redirected or turned off. Caller was advised of investigation and action taken.

Number	Month	Date	Time	From	Issue	Lodgement type	Investigation and response to caller
9		11/10/2020	8:06pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of lights, which were redirected or turned off. Caller was advised of investigation and action taken.
10		15/10/2020	9:42pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of lights, which were redirected or turned off. Caller was advised of investigation and action taken.
11		19/10/2020	5:36am	Roxburgh Road	Noise	Community Response Line	Results at the nearest real-time monitor indicated noise levels were within regulatory criteria. Caller was advised of investigation and monitoring results.
12		19/10/2020	8:41pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of lights, which were redirected or turned off. Caller was advised of investigation and action taken.
13		26/10/2020	12:34am	Roxburgh Road	Noise	Community Response Line	Results at the nearest real-time monitor indicated noise levels were within regulatory criteria. Caller was advised of investigation and monitoring results.
14	November	5/11/2020	1:22pm	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.
15		13/11/2020	10:45pm	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
16		26/11/2020	1:00pm	Denman Road	Blast	Community Response Line	Nearest real-time monitor did not record any exceedances or distribute any alerts. Caller was advised of investigation and monitoring results.
17		28/11/2020	10:00am	Thomas Mitchell Road	Blast	NSW Environment Protection Authority	
18	December	9/12/2020	9:35pm	Skelletar Stock Route	Lighting	Community Response Line	Investigation revealed location of lights, which were modified (redirected or turned off). Caller was advised of investigation results.
19		11/12/2020	8:45pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of lights, which were modified (redirected or turned off). Caller was advised of investigation results.
20	January	15/01/2021	12:00pm	Muswellbrook	Other	Community Response Line	Alleged and unsubstantiated inappropriate language on public two way radio.
21		19/01/2021	2:03pm	Denman Road	Dust	Community Response Line	Mining operations immediately modified to suit strong Southerly conditions which caused a sudden increase in generation of wind-blown dust. Results at the nearest monitor indicated 24 hour average dust levels remained within regulatory criteria.
22	February	14/02/2021	1:49AM	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
23		27/02/2021	11:31PM	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	March	2/03/2021	4:26PM	Thomas Mitchell Drive	Other	Community Response Line	Littering of cigarette butts causing potential fire hazard. Liaison with caller to install water-filled bollards to prevent public access to land.
25		4/03/2021	9:14PM	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of light, which was modified (redirected). Caller was advised of investigation results.
26	April	6/04/2021	8:05AM	Roxburgh Road	Dust	Community Response Line	Results at the nearest monitor indicated dust levels were not elevated at the time, and the 24 hour average remained within regulatory criteria. Caller was advised of investigation and monitoring results.
27		13/04/2021	9:23AM	Roxburgh Road	Dust	Community Response Line	Results at the nearest monitor indicated dust levels were not elevated at the time, and the 24 hour average remained within regulatory criteria. Caller was advised of investigation and monitoring results.
28	May	1/05/2021	2:45pm	Roxburgh Road	Blast	Community Response Line	Investigation revealed weather conditions were suitable for blasting at the time. Results at the nearest monitor indicated dust levels were not elevated at the time, and the 24 hour average remained within regulatory criteria. Caller was advised of investigation and monitoring results.
29		10/05/2021	8:40am	Denman Road	Blast	Community Response Line	Investigation revealed weather conditions were suitable for blasting at the time. Results at the

Number	Month	Date	Time	From	Issue	Lodgement type	Investigation and response to caller
							nearest monitor indicated dust levels were not elevated at the time, and the 24 hour average remained within regulatory criteria. Caller was advised of investigation and monitoring results.
30		28/05/2021	7:31pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of one stationary light, which was relocated. Caller was advised.
31	June	4/06/2021	8:04pm	Roxburgh Road	Lighting	Community Response Line	Investigation revealed location of four stationary lights, which were turned off. Caller was advised.
32		8/06/2021	1:47pm	Muswellbrook	Other (Indigenous social inclusion)	Community Response Line	Caller was advised that all local Indigenous businesses have the opportunity to tender for BHP work at Mt Arthur Coal.
33		9/06/2021	7:37am	Roxburgh Road	Blast (vibration)	Community Response Line	Overpressure and vibration results from the blast were within approval limits, and the blast was conducted in accordance with licence requirements for time of blast. Caller was advised of investigation.
34		9/06/2021	9:37am	Denman Road	Blast (vibration)	Community Response Line	Overpressure and vibration results from the blast were within approval limits, and the blast was conducted in accordance with licence requirements for time of blast. Caller was advised of investigation.
35		21/06/2021	1:53pm	Denman Road	Blast (vibration)	Community Response Line	Overpressure and vibration results from the blast were within approval limits, and the blast was conducted in accordance with licence requirements for time of blast. Caller was advised of investigation.

Number	Month	Date	Time	From	Issue	Lodgement type	Investigation and response to caller
36		21/06/2021	2:09pm	Roxburgh Road	Blast (vibration and dust)	Community Response Line	Overpressure and vibration results from the blast were within approval limits, and the blast was conducted in accordance with licence requirements for time of blast. Caller was advised of investigation.

Appendix 4. Annual Coal Transport Report FY20

Mt Arthur Coal

Annual Coal Transport Report FY21

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 2021:

- 14.713 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 3,326; 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 34: Daily train movements FY21

Date	No. of train movements
1/07/2020	16
2/07/2020	10
3/07/2020	14
4/07/2020	10
5/07/2020	16
6/07/2020	10
7/07/2020	2
8/07/2020	8
9/07/2020	6
10/07/2020	8
11/07/2020	0
12/07/2020	4
13/07/2020	4
14/07/2020	10
15/07/2020	4
16/07/2020	4
17/07/2020	8
18/07/2020	12
19/07/2020	10
20/07/2020	16
21/07/2020	8
22/07/2020	6
23/07/2020	12
24/07/2020	10
25/07/2020	8
26/07/2020	10
27/07/2020	2
28/07/2020	8
29/07/2020	6
30/07/2020	10
31/07/2020	14
1/08/2020	10
2/08/2020	2
3/08/2020	6
4/08/2020	0
5/08/2020	0
6/08/2020	0
7/08/2020	12
8/08/2020	10
9/08/2020	2
10/08/2020	6
11/08/2020	6
12/08/2020	2
13/08/2020	12
14/08/2020	6
15/08/2020	10
16/08/2020	12
17/08/2020	10
18/08/2020	16
19/08/2020	8
20/08/2020	12

Date	No. of train movements
21/08/2020	8
22/08/2020	14
23/08/2020	14
24/08/2020	12
25/08/2020	16
26/08/2020	16
27/08/2020	14
28/08/2020	14
29/08/2020	12
30/08/2020	6
31/08/2020	8
1/09/2020	4
2/09/2020	8
3/09/2020	14
4/09/2020	12
5/09/2020	8
6/09/2020	8
7/09/2020	8
8/09/2020	12
9/09/2020	10
10/09/2020	6
11/09/2020	12
12/09/2020	8
13/09/2020	14
14/09/2020	10
15/09/2020	8

Date	No. of train movements
16/09/2020	10
17/09/2020	10
18/09/2020	12
19/09/2020	10
20/09/2020	12
21/09/2020	8
22/09/2020	2
23/09/2020	0
24/09/2020	0
25/09/2020	6
26/09/2020	8
27/09/2020	6
28/09/2020	10
29/09/2020	6
30/09/2020	12
1/10/2020	12
2/10/2020	6
3/10/2020	8
4/10/2020	8
5/10/2020	14
6/10/2020	12
7/10/2020	8
8/10/2020	2
9/10/2020	12
10/10/2020	6
11/10/2020	10

Date	No. of train movements
12/10/2020	12
13/10/2020	12
14/10/2020	10
15/10/2020	8
16/10/2020	6
17/10/2020	14
18/10/2020	12
19/10/2020	10
20/10/2020	10
21/10/2020	10
22/10/2020	18
23/10/2020	14
24/10/2020	16
25/10/2020	14
26/10/2020	4
27/10/2020	4
28/10/2020	12
29/10/2020	8
30/10/2020	2
31/10/2020	4
1/11/2020	6
2/11/2020	0
3/11/2020	0
4/11/2020	2
5/11/2020	8
6/11/2020	10

Date	No. of train movements
7/11/2020	14
8/11/2020	12
9/11/2020	10
10/11/2020	16
11/11/2020	12
12/11/2020	6
13/11/2020	14
14/11/2020	14
15/11/2020	8
16/11/2020	10
17/11/2020	6
18/11/2020	0
19/11/2020	0
20/11/2020	0
21/11/2020	12
22/11/2020	8
23/11/2020	14
24/11/2020	10
25/11/2020	16
26/11/2020	10
27/11/2020	8
28/11/2020	14
29/11/2020	8
30/11/2020	10
1/12/2020	10
2/12/2020	12

Date	No. of train movements
3/12/2020	10
4/12/2020	8
5/12/2020	10
6/12/2020	18
7/12/2020	18
8/12/2020	12
9/12/2020	16
10/12/2020	14
11/12/2020	4
12/12/2020	8
13/12/2020	10
14/12/2020	10
15/12/2020	10
16/12/2020	8
17/12/2020	12
18/12/2020	12
19/12/2020	8
20/12/2020	0
21/12/2020	8
22/12/2020	8
23/12/2020	2
24/12/2020	0
25/12/2020	0
26/12/2020	0
27/12/2020	6
28/12/2020	6

Date	No. of train movements
29/12/2020	8
30/12/2020	8
31/12/2020	10
1/01/2021	6
2/01/2021	8
3/01/2021	0
4/01/2021	8
5/01/2021	10
6/01/2021	8
7/01/2021	14
8/01/2021	12
9/01/2021	8
10/01/2021	12
11/01/2021	14
12/01/2021	8
13/01/2021	6
14/01/2021	4
15/01/2021	6
16/01/2021	10
17/01/2021	8
18/01/2021	0
19/01/2021	0
20/01/2021	2
21/01/2021	4
22/01/2021	16
23/01/2021	4

Date	No. of train movements
24/01/2021	6
25/01/2021	6
26/01/2021	10
27/01/2021	4
28/01/2021	8
29/01/2021	10
30/01/2021	6
31/01/2021	8
1/02/2021	6
2/02/2021	10
3/02/2021	10
4/02/2021	14
5/02/2021	12
6/02/2021	14
7/02/2021	6
8/02/2021	14
9/02/2021	0
10/02/2021	0
11/02/2021	0
12/02/2021	6
13/02/2021	10
14/02/2021	14
15/02/2021	10
16/02/2021	12
17/02/2021	10
18/02/2021	12

Date	No. of train movements
19/02/2021	10
20/02/2021	12
21/02/2021	6
22/02/2021	10
23/02/2021	8
24/02/2021	14
25/02/2021	4
26/02/2021	8
27/02/2021	10
28/02/2021	12
1/03/2021	10
2/03/2021	12
3/03/2021	10
4/03/2021	10
5/03/2021	8
6/03/2021	8
7/03/2021	10
8/03/2021	8
9/03/2021	4
10/03/2021	6
11/03/2021	10
12/03/2021	6
13/03/2021	8
14/03/2021	12
15/03/2021	8
16/03/2021	0
17/03/2021	0

Date	No. of train movements
18/03/2021	6
19/03/2021	0
20/03/2021	0
21/03/2021	0
22/03/2021	0
23/03/2021	2
24/03/2021	4
25/03/2021	12
26/03/2021	4
27/03/2021	10
28/03/2021	10
29/03/2021	14
30/03/2021	10
31/03/2021	8
1/04/2021	12
2/04/2021	12
3/04/2021	4
4/04/2021	10
5/04/2021	8
6/04/2021	0
7/04/2021	0
8/04/2021	4
9/04/2021	18
10/04/2021	10
11/04/2021	2
12/04/2021	6
13/04/2021	4

Date	No. of train movements
14/04/2021	10
15/04/2021	14
16/04/2021	12
17/04/2021	10
18/04/2021	10
19/04/2021	10
20/04/2021	18
21/04/2021	8
22/04/2021	10
23/04/2021	16
24/04/2021	18
25/04/2021	18
26/04/2021	14
27/04/2021	4
28/04/2021	0
29/04/2021	0
30/04/2021	16
1/05/2021	12
2/05/2021	20
3/05/2021	10
4/05/2021	8
5/05/2021	10
6/05/2021	8
7/05/2021	10
8/05/2021	12
9/05/2021	18
10/05/2021	14

Date	No. of train movements
11/05/2021	6
12/05/2021	10
13/05/2021	14
14/05/2021	10
15/05/2021	10
16/05/2021	10
17/05/2021	8
18/05/2021	0
19/05/2021	6
20/05/2021	6
21/05/2021	8
22/05/2021	2
23/05/2021	10
24/05/2021	8
25/05/2021	2
26/05/2021	0
27/05/2021	0
28/05/2021	4
29/05/2021	12
30/05/2021	12
31/05/2021	10
1/06/2021	20
2/06/2021	10
3/06/2021	18
4/06/2021	10
5/06/2021	12
6/06/2021	14
7/06/2021	16
8/06/2021	14
9/06/2021	10
10/06/2021	20
11/06/2021	12
12/06/2021	18
13/06/2021	20
14/06/2021	16
15/06/2021	12
16/06/2021	20
17/06/2021	14
18/06/2021	20
19/06/2021	18
20/06/2021	18
21/06/2021	20
22/06/2021	18
23/06/2021	14
24/06/2021	16
25/06/2021	14
26/06/2021	14
27/06/2021	12
28/06/2021	20
29/06/2021	16
30/06/2021	14
Total	**3326**
Maximum daily train movements	**20**

Appendix 5. Rehabilitation Plan & and Monitoring Results

ML1757
ML1487
ML1655
AUTH171
AUTH171
ML1548
MPL263
CCL744
CL396
ML1739
ML1739
EL5965
AUTH437
ML1548
ML1739
ML1739
ML1358
ML1593S
EL5965
ML1593
EL5965
EL5965
AUTH437
Sad dlers Creek
EDDERTON ROAD
EDDERTON ROAD
MUSWELLBROOK
BLACK HILL
LITTLE GRASSTREE HILL

Actual Rehabilitation (June 2021)

Rehabilitation vegetation type

- Rehabilitation Area - Box Gum Woodland
- Rehabilitation Area - Native Woodland
- Rehabilitation Area - Pasture
- FY21 Rehabilitation Areas

Actual Disturbance (June 2021)

- Active Mining Area (Open cut void)
- Overburden Emplacement Area
- Landform Establishment
- Growth Media Development
- Infrastructure Area
- Tailings Storage Facility
- Topsoil Stockpile
- Water Management Area

BHP
Mapping Services Brisbane

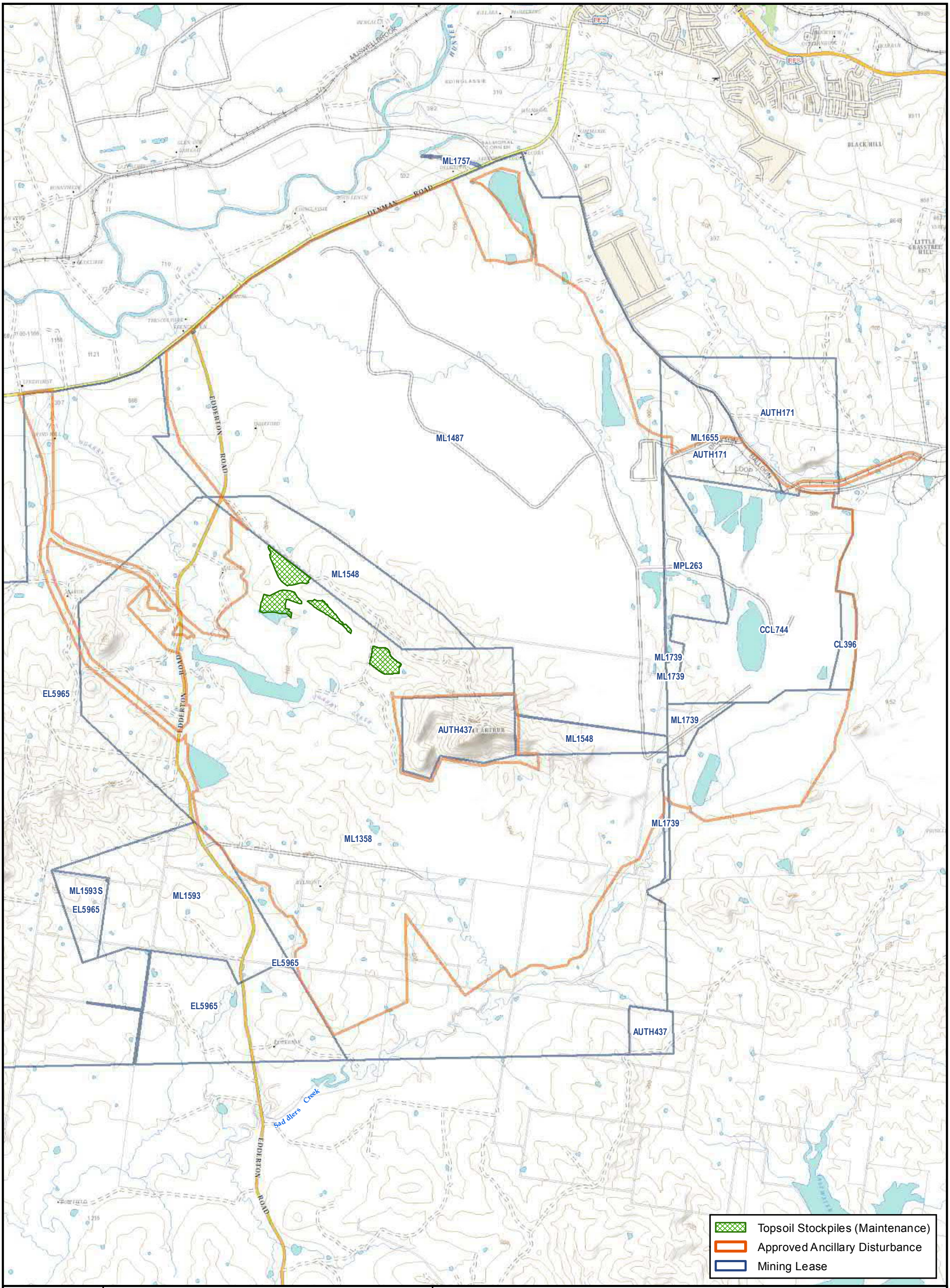
0 500 1,000 1,500 2,000 m

Transverse Mercator Projection.
MGA Zone 56. GDA94 Datum.

MOUNT ARTHUR COAL

Annual Review - Rehabilitation Plan

Drawn: B. Kleinschmidt	Checked: J. Deacon	Date: 20/9/2021	Revision: 0	Filename: MAC_AR_RehabPlan	Appen. 5



BHP

Mapping Services Brisbane

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

Transverse Mercator Projection.
MGA Zone 56. GDA94 Datum.

MOUNT ARTHUR COAL

Topsoil Stockpile Maintenance

Drawn: B. Kleinschmidt	Checked: J. Deacon	Date: 20/9/2021	Revision: 0	Filename: MAC_6_StockpileMaint	Figure 6

ML1757
AUTH171
ML1487
ML1655
AUTH171
MPL263
ML1548
CCL744
CL396
ML1739
ML1739
EL5965
ML1739
AUTH437
ML1548
ML1739
ML1358
ML1593S
EL5965
ML1593
EL5965
EL5965
AUTH437
Sad dlers Creek
DENMAN ROAD
EDDERTON ROAD
MUSWELLBROOK
HUNTER
BLACK HILL
LITTLE GRASSTREE HILL

Rehabilitation Maintenance Areas
Existing Rehabilitation (FY21)
Approved Ancillary Disturbance
Mining Lease

BHP
Mapping Services Brisbane

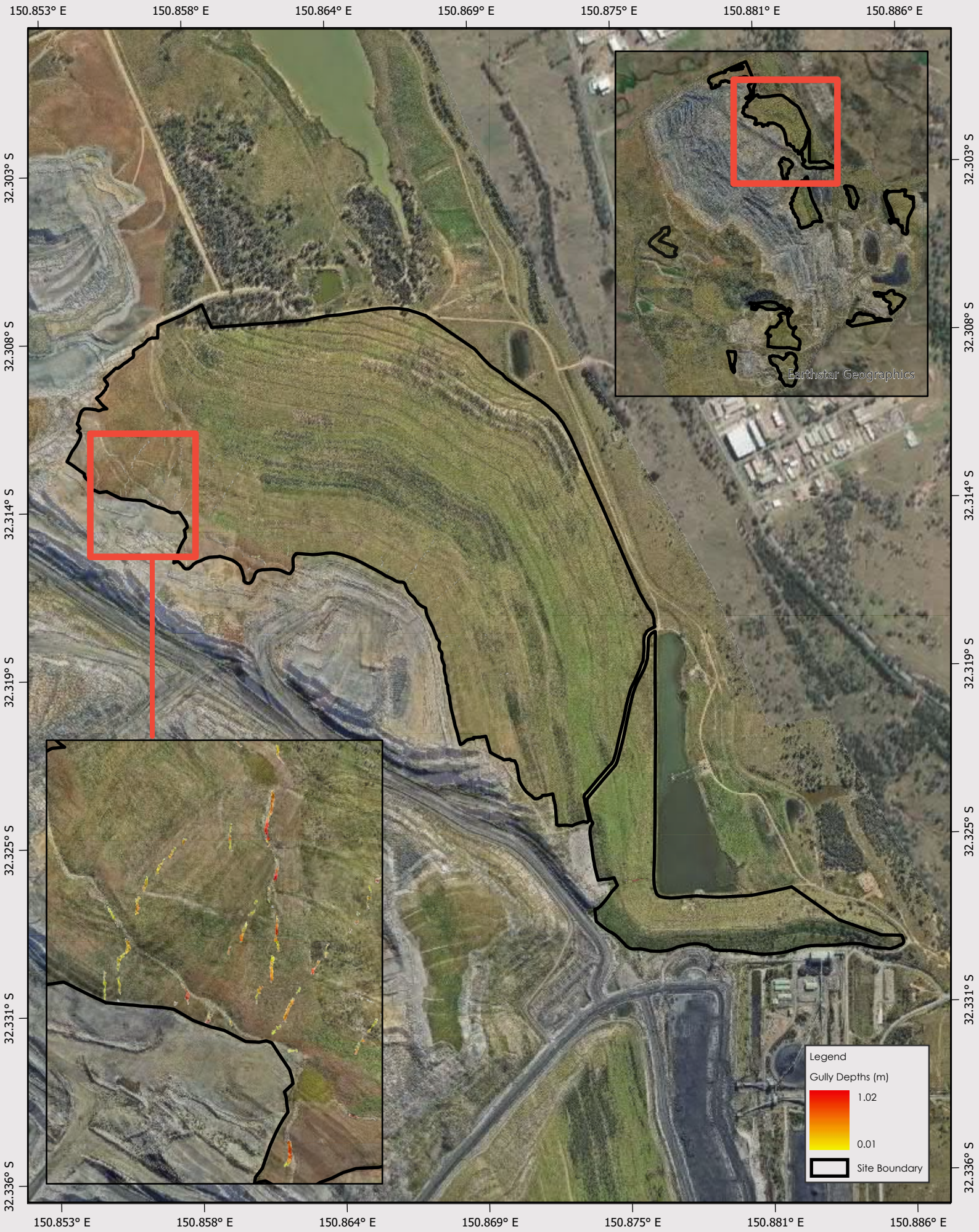
0 500 1,000 1,500 2,000 m

Transverse Mercator Projection.
MGA Zone 56. GDA94 Datum.

MOUNT ARTHUR COAL

Rehabilitation Maintenance Areas

Drawn: B. Kleinschmidt	Checked: J. Deacon	Date: 20/9/2021	Rev: 0	Filename: MAC_11_RehabMaintAreas	Figure 11



BHP Mount Arthur Rehabilitation

Figure 5.12: Erosion - VD 1

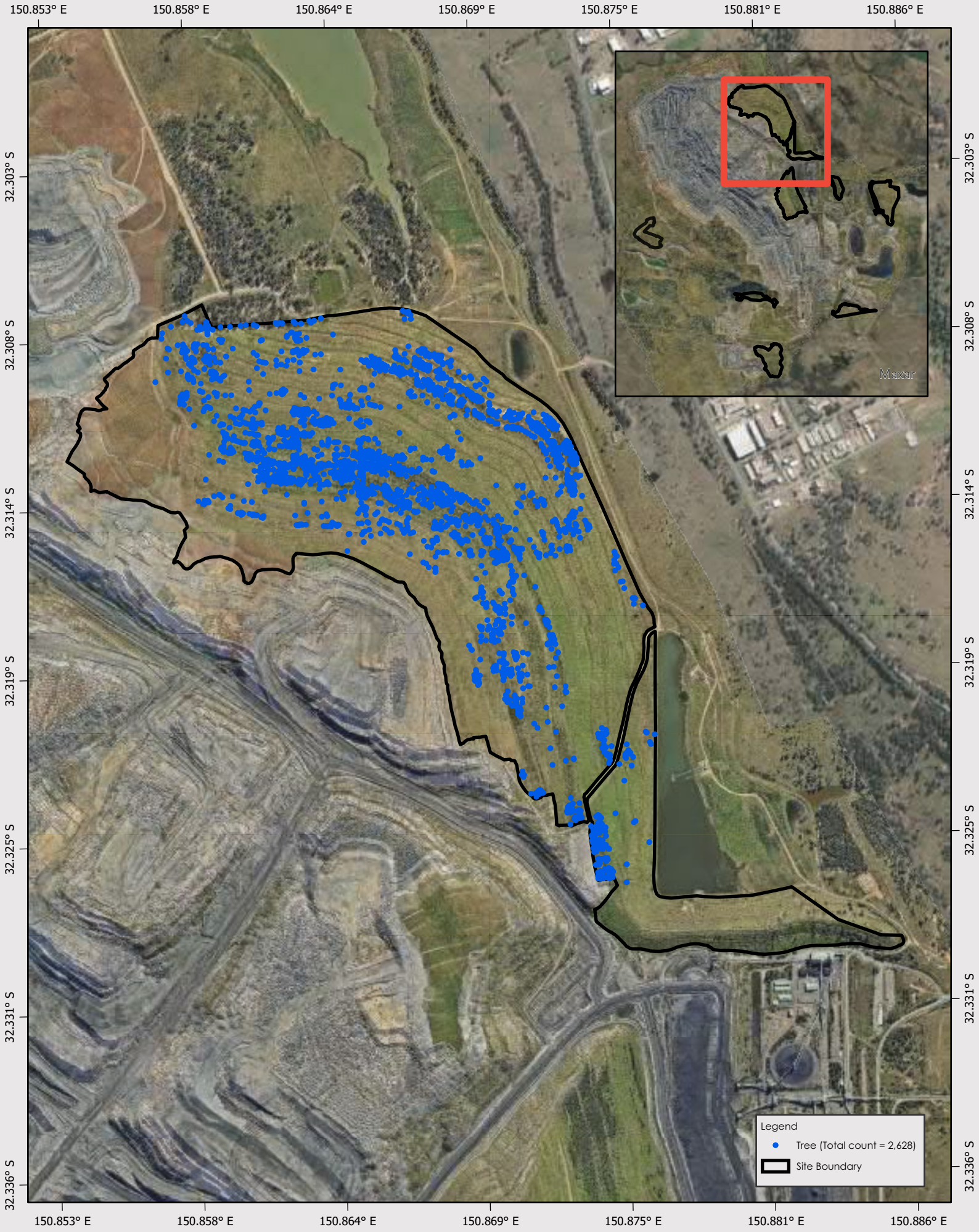
N

0 500 1,000 m

Coordinate System: WGS 1984 UTM Zone 55S

k2fly

Author: T. Hasnein | Cartographer: R. Khan | Date: 30/06/2021 | Figure Ref: RS_April2021_BHPMtArthur_VD1_Erosion_V01



BHP Mount Arthur Rehabilitation

Figure 2.8: Tree count - VD 1

N

0 500 1,000 m

Coordinate System: WGS 1984 UTM Zone 55S

Author: T. Hasnein | Cartographer: R. Khan | Date: 24/06/2021 | Figure Ref: RS_April2021_BHPMtArthur_VD1_TreeCount_V01

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY21 Response	FY20 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)	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.	Changes have been made to the REMP as detailed in Section 8.5. In the next reporting period Mt Arthur Coal will expand flyovers to increase the frequency that rehabilitation areas are captured in aerial routine aerial imagery and LiDAR scans. Mt Arthur Coal will also investigate the usage of LiDAR in monitoring erosion and in using aerial imagery in assessing vegetation health.	**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	N/A	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)	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	N/A	**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 Ecological and Land Use Establishment Objectives regarding species composition and structure for native woodlands. 3. 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.	Processes for tracking and improving the quality of Mt Arthur Coal have been improved rehab over the reporting period by the following: - Update of monitoring program occurred in FY20 (see Section 6.5) - Update of Closure Criteria provided in the submitted Rehabilitation Strategy	**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)	FY21 Response	FY20 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)	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	FY20 soil sampling targeted topsoils and waste rock material used in the specific rehabilitation projects. This was due to most projects utilising a combination of direct placement and stockpiled materials. Further soil sampling of stockpiles and rehabilitation materials is planned in FY21	**Complete:** 1. Sample rehabilitation materials. 2. Create a Topsoil Management Plan 3. Create a Topsoil database **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 desktop review of rehab surface materials to better understand parameters, qualities and balance 2. Scoping of research trials into the viability of recreating topsoil profiles at analogue sites **FY24** 1. Field work to assess soil parameters at analogue sites 2. Continue trials into using waste rock as growth medium	Soil sampling results and report can be supplied on request.	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.	Rabbit management continued in FY20. Rabbit control using a broad baiting will be carried out in FY21 with results reported in the next Annual Review. Kangaroo harvesting continued in operational areas in FY20, focusing on VD1 and surrounding area. Mt Arthur Coal plans to continue kangaroo harvesting in FY21.	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	FY20 seed spreading FY21 will also include seeding using a tractor pulled spreader.	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)	FY21 weed treatment focused on priority weeds and exotic perennial grasses	Weed assessment completed and weed works commenced for the reporting period. Focus of weed treatment continued to VD1, however treatment was also completed on CD1. A broader list of weed species was targeted in FY20. Mt Arthur Coal continued to trial the into high resolution image processing to quantify weed infestations. This trial will continue into FY21.	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)	FY21 maintenance scope of VD5 imported	The initial application of mulch has been delayed Q2 FY21. Recommendations were originally for the use of hay mulch as temporary stabilisation. Sourcing this material was not possible. A new vendor was on boarded as the supplier and spreader of mulch products in FY20. Mt Arthur Coal intends to utilise temporary stabilisation in newly established rehabilitation in areas where there is a high risk of erosion	**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)	FY21 Response	FY20 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
	1.9	Contour drain removal	As required	Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.	(Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018)	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.	Design requirements assessment scheduled for completion in 2020 will be an ongoing design process due to the complexity of the work. As areas undergo maintenance each area will be assessed for removal contour drains.	**FY22:** Trial area to be completed on a section of VD1 "Native grasslands with emergent Box - Gum canopy and mid-storey"	Follow up materials sampling, RAW, revegetation inspections, Ecological Development Modelling	To be confirmed	N/A
		~~Use successful examples of rehabilitation success from around site and develop standard practice~~				This is to be removed. Review of previous successful rehabilitation areas indicate that success is due to the following factors: 1. Greater rainfall due establishment, and 2. Shallower slopes.	~~Work to date has focussed on centralising data to establish previous methodologies. Work on a new spatial tracking system incorporating graphical representation commenced in June 2019. This work has been incorporated into the recently submitted Forward Program and is part of a broader project covering all of BHPs Australian operations.~~ ~~Routine monitoring (such as RAW) will be spatially represented to improve tracking of maintenance and improvement requirements.~~ ~~Improvements to the Rehabilitation Management Plan have been submitted with the Forward Program, including the incorporation of more quantitative closure criteria.~~		~~Updates to RMP~~	~~Continual improvement and updating GIS database, RAW and revegetation inspections~~	~~N/A~~
		~~Translocation of key species~~					~~Work was assessed in this reporting period and was determined not to be cost effective.~~		~~N/A~~	~~N/A~~	~~N/A~~
2. VD1	2.1	~~Excavate soil from the sediment dam at VD1 to re-establish its design functionality~~		~~Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.~~		Area mislabelled - see VD4 and VD5	~~VD1 sed dam will be excavated in FY21 as part of maintenance work in the area including application of stabilising mulch and re-seeding.~~	~~FY21~~	N/A	~~RAW and Revegetation Inspections~~	
	2.2	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)	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.	Weed treatment trials were delayed to allow for integration with the Royal Botanic Gardens Sydney (RBGS) collaboration work. The partnership with the RBGS will no longer go ahead The scopes for these trials will be reviewed in FY21 with the intent to focus on the most cost effective solution and progress in the next reporting period.	**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
	2.4	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)	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.	The Cumberland Ecology 2019 report recommended nest boxes. Mt Arthur Coal will focus on bringing more stag trees, larger felled timber and rock piles to the rehabilitation areas in the interim. Stag trees have been stockpiled at the top of VD1 and initial installations scheduled for FY21.	**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
	2.5	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)	FY21 works will include continued spot weed treatment.	FY20 - Stem density reduction – Work was completed in to reduce stem density to approximately 250 stems per ha.. Ripping and seeding with native grasses was deemed as impractical as areas accessible for machinery is densely covered in exotic grass used in the initial	**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

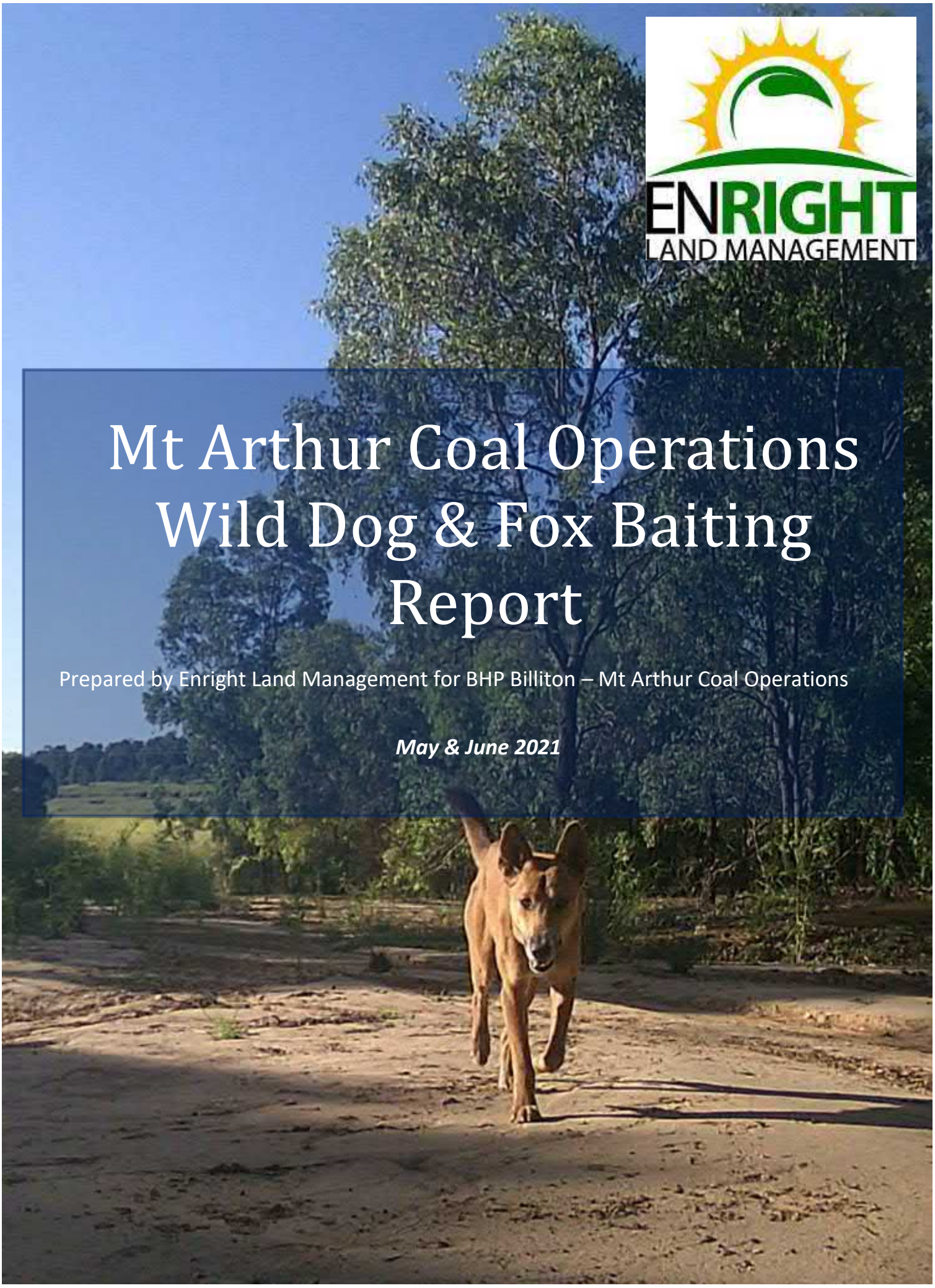
Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY21 Response	FY20 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
	2.6	Exotic and depleted grasslands	To be determined	1. Inadequate weed control, leading to extreme weed competition 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)	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.	Efforts over the reporting period focussed on spot weed treatment in areas adjacent to the Spotted Gum / Box forest. FY21 will commence with approximately 5 ha in the designated Trial Area 1 above. Other areas will be investigated based on resources 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
	2.7	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 2. Diversify ground and mid-storey (Future Harvest Ecological Development Strategy, 2019) 3. Emplacement of bush rock, logs and nest boxes (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	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.	The increase in rainfall over the reporting period has increased the presence of perennial exotic grasses such as Green Panic (*Panicum maximum var. trichoglume*). These areas were originally seeded with exotic pasture crop. Ground cover diversity seeding projects were scheduled to commence in Autumn 2020. However, the increased exotic grass cover indicates that strategy would not have been effective. These areas will be categorised as per 2.10 above in future reports.	**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
	2.8	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)	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.	Weed treatment in this area will continue in FY21. Any works regarding water availability will be aligned with significant earth works as per 1.9 above. Revegetation Inspection conducted late in the reporting period indicates that despite weed treatment efforts establishment of target species has been poor. Monitoring of the area will continue	**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
	2.9	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)	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.	Targeted spot weed treatment is planned for FY21. Other works listed above are planned for FY22-23.	**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
	~~All weather road access~~		~~N/A~~		Removed to target individual project areas.	~~This work will be incorporated into individual projects across the VD 1 rehab. Additional track to be installed as part of 2.1 and 2.2 above.~~		~~N/A~~	~~N/A~~	~~N/A~~
	~~Fill erosion gullies at VD1 (FY17 rehabilitation) to the landform design surface~~		~~Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.~~		See VD4 and VD5 work, the area was incorrectly labelled.	~~Work scheduled for completion FY21 after on boarding vendors in FY20. Work will be completed as part of maintenance work in the area including application of stabilising mulch and re-seeding.~~	~~FY21~~	~~See Appendix 5 for Revegetation Inspection results~~	~~N/A~~	~~N/A~~

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY21 Response	FY20 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
		~~Application of ameliorants~~		~~Sodicity and/or salinity of spoils/soils leading to accelerated erosion and preventing successful vegetation establishment.~~		Removed to target individual project areas.	A significant amount of fertiliser and gypsum is to be applied to VD1 based on the soil assessment (see 2.4). This work was scoped in the reporting period to determine the most efficient means of application. Initial it was planned that an aerial application of gypsum would provide the most efficient methodology. The advice on fertiliser application has been reviewed and determined that this may result in increase of weed infestation. It was determined that individual project areas (see 2.9-2.13 below) will have appropriate ameliorants applied.		~~N/A – follow up soil sampling may be required as determined by monitoring results.~~	~~RAW, Revegetation Inspections and soil sampling~~	
		~~Irrigation~~		~~Severe and/or prolonged drought leading to widespread failure of revegetation.~~		Removed to target individual project areas.	Broad acre irrigation was deemed as impractical in the last reporting period. Mt Arthur will investigate the use of tanks and drip lines to aid in the establishment of tube stock over FY21.		~~To be provided in future Annual Reviews in Section 8.5~~	~~RAW and Revegetation Inspections~~	
		~~Habitat and water availability~~		~~N/A~~		To be included in individual rehab projects	~~Schedule of this work will be determined by removal of contour drains (see 1.9).~~		~~N/A~~	~~To be confirmed~~	
3. VD4 and VD5	3.1	Drought Impacted Rehab	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.	1. Erosion repair 2. Re-rip, seed and fertilise 3. Application of mulch (Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018)	Works completed.	RAW inspections have identified erosion gulleys formed over the previous reporting periods. These will be reworked in FY21 A revegetation inspection scheduled for the reporting period was conducted late in the reporting due to impacts of Covid-19. As such ripping work will be determined following the and be re-scheduled for FY20. Areas will be progressively seeded following mulching with a composted mulch from FY21. The use of a composted mulch product is intended to negate the need for a chemical fertiliser. See 1.8 above. An initial application of mulch will to higher risk areas in FY21.	N/A	N/A	RAW and Revegetation Inspections	Annually
	3.2	Excavate soil from the sediment dam at VD1 to re-establish its design functionality	To be determined	Failure of water management structures (or natural drainage lines), leading to erosion, unstable landform and potential pollution.	Excavate soil from the sediment dam at VD1 to re-establish its design functionality (Highlands Environmental, MAC Rehabilitation Annual Rapid Assessment Report, 2018)	Complete as part of VD4 and VD5 project (refer to Section 8.5)	VD1 sed dam will be excavated in FY21 as part of maintenance work in the area including application of stabilising mulch and re-seeding.	N/A	See Appendix 5 for Revegetation Inspection results	RAW and Revegetation Inspections	Annually
	3.3	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)	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	N/A	**FY22**: Complete construction of 2 new rock armoured drains		RAW and Revegetation Inspections	Annually
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.	A significant amount of fertiliser and gypsum is to be applied to CD1 based on the soil assessment (see 2.4). This work is to be scoped to determine the most efficient means of application. Scoping was to be completed by the end of September 2020 however, has been delayed until further progress is made on VD1 and VD5. As such work is not expected to commence until FY23-24.	Subject to works on VD1-5 **FY25**: 1. Design of drainage control works 2. Design irrigation 3. Weed treatment 4. Order tube stock for FY24 planting **FY26**: 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.	To be completed following 2.9. Focus is currently on VD1 improvements. As such work is not expected to commence until FY23-24.		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.	To be completed following 4.2. Focus is currently on VD1 improvements. As such work is not expected to commence until FY23-24.		N/A	N/A	

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY21 Response	FY20 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
	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.	Focus is currently on VD1 and VD5 improvements. As such work is not expected to commence until FY23-24.		N/A	Annual ecological development monitoring and Revegetation Inspections.	Annually
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	Formerly reported on as part of the MacDonalds and Belmont areas. This area was dehabbed as part of the construction of the new Earth Moving Equipment (EME) Build Pad. Area surrounding the EME Pad will be rehabbed in FY21.	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.	This work is to be re-assessed based on the longer term plan as some of the areas will be required for further dumping.	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.	This work is to be re-assessed based on the longer term plan as some of the areas will be required for further dumping.	N/A	N/A	N/A	N/A
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.	Monitoring occurred in this location for the first time in this reporting period. A revegetation plan was included in the monitoring results. Further monitoring results are presented in Revegetation Inspection (see Appendix 5). The area requires reduction in exotic grasses, establishment of native ground cover and mid storey species and increase in the density of native canopy species. As this area is currently stable works will be delayed until VD1 and VD5 works have progressed further, estimated top commence in FY24.	**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	The 5 yearly ground pasture assessment (GPA) recommended that broad leaf weed control occur. Scheduled to occur in Spring FY22 to allow for equipment availability.	**FY22**: Broadleaf weed treatment	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	Independent revegetation inspection was conducted in this area for the first time this reporting period. Ecological development monitoring is planned to commence in FY21 to gain data for planning maintenance work	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.	Spot weed treatment is scheduled for the SDc area in FY21	**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 FY21	N/A	**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	N/A	**FY24**: Placement of habitat structures	N/A	Annual ecological development monitoring and RAW and Revegetation Inspections.	Annually

Area	Item		Monitoring Location	RMP TARP trigger	Recommendations and scope (source)	FY21 Response	FY20 Response	Improvement work schedule	Results	Follow up monitoring	Monitoring Schedule
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	N/A	Dependent on access **FY23**: Broadleaf weed treatment	N/A	GPA, RAW and Revegetation Inspections.	Annually

Appendix 6. Baiting & Weed Management Reports



Mt Arthur Coal Operations Wild Dog & Fox Baiting Report

Prepared by Enright Land Management for BHP Billiton – Mt Arthur Coal Operations

May & June 2021

Contents

1. Introduction

During May and June 2021, Enright Land Management conducted a wild dog and fox baiting program for BHP Billiton - Mt Arthur Coal. This report outlines our baiting procedure and the program's results. It also includes maps depicting the location of each of the baits and those locations where baits were consumed. In addition, it contains a selection of photos taken by our trail cameras, which were installed at selected baiting locations, as well as our observations regarding the results. It also includes a comparison of the results against the results from previous baiting programs and recommendations for future work. This baiting program was conducted simultaneously with baiting programs at several other sites in the Greater Ravensworth and Muswellbrook areas, and as such formed part of a broad scale baiting program, in order to target and control the large populations of foxes and wild dogs in the Hunter Valley.

Wild dogs and foxes are targeted through a baiting program as part of Mt Arthur Coal's ongoing commitment to controlling feral animals on site. In addition to the Autumn 2021 Wild Dog and fox baiting program, an opportunistic wild dog shoot was also carried out one week after the baiting program had been completed. The results for this program can be found in section seven (7) of this report. Wild dogs and fox populations are controlled as they have the potential cause harm to, or displace, native wildlife, spread and carry disease and they can also cause harm to neighbouring domestic animals and livestock. Mt Arthur Coal's policy with respect the control of feral animals is contained in their Biodiversity Management Plan. 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. Below is an excerpt from the *MAC-ENC_MTP-050 Biodiversity Management Plan,* outlining its Pest Management Policy:

Pest Management

Feral fauna at the Mt Arthur Coal Complex may impact on the native fauna species through predation and competition for resources such as food, shelter, and breeding sites. Feral animals can also have a detrimental effect on regenerating areas as well as soil stability. In addition elimination of pest animals in biodiversity offsets is a requirement of the *Rural Lands and Protection Act 1998* and as such HVEC has regulatory requirements to do so.

The ongoing fauna and flora monitoring program will include surveys for the presence of significant populations of feral fauna species. Records of significant populations of such species may trigger appropriate control strategies to reduce and control numbers. In addition Mt Arthur Coal has a pest management register where sightings of pest animals are recorded to help inform requirements for management measures.

Feral animal control programs will be completed at least annually and more frequently if required. These programs typically consist of feral dog and fox baiting and trapping. This will include details of feral animal sightings, control actions and assess the effectiveness of these control strategies. A summary of the pest management activities undertaken on site will be reported in the Annual Review.

2. Outline of Baiting Procedure

Enright Land Management was requested to conduct the baiting program using 1080 poison baits. The rules governing the use of such baits in NSW are outlined in the *Pesticide Control (1080 Bait Products) Order 2020* ('PCO') and the *Pesticide Control (1080 Ejector Capsules) Order 2015*.

Throughout the course of the baiting program, we adhered to the following procedure:

2.1. Public Notification: Notice was provided to all neighbours required by the PCO by way of newspaper notification and letterbox drop, as shown in the images below. We note that no neighbours contacted Enright Land Management to discuss the proposed baiting program.
Prior to the installation of the baiting locations, 1080 baiting signs (provided by Local Land Services 'LLS', Singleton) were installed at required positions on each property on which baits were to be laid.
(Note: Due to caching practices by foxes and wild dogs, it is a requirement to leave 1080 bait program boundary signage up for a four (4) week period after the conclusion of the baiting program; this assists in minimising the potential risk to domestic animals.)

Insert 1 & 2: Examples of the baiting notices used for public notification. **Insert 1** is in the form of a letterbox drop. Copies of this letter was placed in mailboxes of neighbouring properties within the notifiable area. **Insert 2** is in the form of a Newspaper advert published in the online and printed version of the Hunter Valley News as per PCO requirements.

Wild Dog and Fox Baiting Notice

Please be advised that Enright Land Management will be conducting a Fox and Wild Dog Baiting Program within the bounds of Mt Arthur Coal Mine, buffer lands and offset areas. The Fox and Wild Dog Baiting Program will involve the use of poison baits and 1080 Ejector Capsules containing Sodium Fluoroacetate (1080).

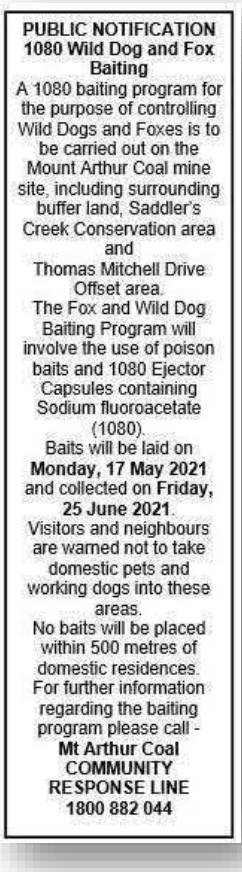
The baits and ejector capsules (containing 1080) will be laid from
Monday, 17 May 2021 **until** Friday, 25 June 2021

Visitors and neighbours are warned not to take domestic pets and working dogs into these areas.

No baits will be placed within 500 metres of domestic residences.

If you have any questions regarding the baiting please contact:

Mt Arthur Coal
COMMUNITY RESPONSE LINE
on 1800 882 044



PUBLIC NOTIFICATION
1080 Wild Dog and Fox Baiting

A 1080 baiting program for the purpose of controlling Wild Dogs and Foxes is to be carried out on the Mount Arthur Coal mine site, including surrounding buffer land, Saddler's Creek Conservation area and Thomas Mitchell Drive Offset area.

The Fox and Wild Dog Baiting Program will involve the use of poison baits and 1080 Ejector Capsules containing Sodium fluoroacetate (1080).

Baits will be laid on **Monday, 17 May 2021** and collected on **Friday, 25 June 2021**.

Visitors and neighbours are warned not to take domestic pets and working dogs into these areas.

No baits will be placed within 500 metres of domestic residences.

For further information regarding the baiting program please call -
Mt Arthur Coal COMMUNITY RESPONSE LINE 1800 882 044

2.2. Collection of Baits and Ejectors from Local Land Services (LLS): The LLS are authorised to provide 1080 poisoned baits and 1080 ejector capsules. The baits provided were meat pieces (lamb hearts, kangaroo steaks *or* processed baits), injected with a chemical product that contains sodium fluoroacetate (1080). The wild dog 1080 baits and ejectors contain 6mg of 1080 per bait or ejector. The consumption of one (1) bait or successful delivery of an ejector capsule is sufficient to be lethal to wild dogs and foxes. After collection, the baits and ejectors were stored in accordance with the PCO.

2.3. Laying of Baits: Bait locations/mounds are set up using 1080 meat baits. The specific time and date at which each bait was laid was recorded during the program. The baits are placed on the ground tethered with a skewer, then lightly covered by raked sand or soil mounded on top. The soil around the bait or mound is raked to form an area approximately $1m^2$. This assists in the identification of animals that visit the mound as it allows the observation of tracks and scat around the bait. Soil from the immediate area is preferred because it avoids unusual odours that wild dogs may avoid. Wild dogs will often tear the bait mound apart to get the bait, while foxes mostly make a neat hole in one side or above. Different lures and attractants are used at the bait location to aid in attracting target species. During the course of this program, a number of lures and attractants were used to evoke the interest of the target species, including fish emulsion and animal blood.

2.4. Setting of Ejector Baits: Bait locations/ejectors are set up using an ejector kit; including the ejector and stake, ejector setting pliers, hammer and driving bolt, baited ejector head and 1080 capsules, and personal protective equipment. The ejector shaft is hammered into the ground securely and the ejector baited head and capsule component is set and placed in the shaft and the locking ring is then set. The baits are then lightly covered by a branch or something similar to camouflage from unwanted disturbances, such as birdlife or goannas. The soil around the ejector is raked to form a square approximately $1m^2$. As with standard mound baits, this assists in the identification of animals that visit the ejector bait as it allows the observation of tracks and scat around the bait. Soil from the immediate area is preferred because it avoids unusual odours that wild dogs may avoid. Different lures and attractants are used at the ejector location to aid in attracting target species. Again, as stated above, during the course of this program a number of lures and attractants were used to evoke the interest of the target species, including fish emulsion and animal blood.

2.5. Subsequent Inspections & Replacement of Baits and Ejectors: The baits were checked and replaced weekly after the initial installation, recording the time and date at which each bait was laid. After being replaced, any untaken baits were disposed onsite weekly in accordance with the PCO by burying the baits at a depth of 500mm and away from waterways (*Refer to GIS Map 1 and Table 1 for Location*). Ejectors were also checked each week however not replaced. Different lures and attractants were again applied to the bait and ejector locations on each inspection.

2.6. Final Inspection & Disposal of Baits and Ejector Capsules: On the final inspection, all remaining baits and ejector capsules were removed from the bait locations. Baits and ejectors

were disposed of onsite, in accordance with the PCO, by burying the baits and empty ejector capsules at a depth of 500mm and away from waterways. Capsules are to be triple rinsed before burial. *Refer to GIS Map 4 for Location.*

2.7. Schedule of Works: The preferred baiting program schedule of works follows the steps outlined below:

Step Number	Process Description	Day/Timing
1	**Public Notification**	Minimum of three (3) days prior to laying of baits
2	**Bait Collection from LLS**	Collection of baits may occur the day prior to arriving on site to install baits, or on the day of installation.
3	**Bait Installation**	1st Baiting Day
4	**First Check** *(All baits replaced with fresh baits; untaken baits were disposed of onsite)*	7th Baiting Day
5	**Second Check** *(All baits replaced with fresh baits; untaken baits were disposed of onsite)*	14th Baiting Day
6	**Third Check** and Pull Up Baits *(Untaken baits were disposed of onsite)*	21st Baiting Day

2.8. Bait Distribution: The distribution of bait locations installed across the two (2) areas in this baiting program is outlined below. Fewer baits were installed on the Mt Arthur Onsite Mining Lease (East), due to fact that the area is smaller, and it is closer to populated areas, such as the industrial estate and nearby residences.

Note: Due to the LLS risk assessment no baits were laid in the north-western corner of the site as indicated on GIS Map 1, which maintains baits two kilometres from Muswellbrook.

Bait Distribution	
Baited Site	**Number of Bait Locations**
Mt Arthur Onsite Mining Lease (East)	18
Mt Arthur Onsite Mining Lease (West)	33
Mt Arthur Onsite Offset – Saddlers Creek	Not baited due to poor accessibility

3. Baiting Program Results, GIS Maps, Observations & Comparison with Previous Baiting Programs

3.1. 2021 Autumn Baiting Program Results

Throughout the 2021 Autumn Baiting Program, bait locations were monitored on a weekly basis over three (3) weeks. Weekly results were collated based on the observations around the bait mounds and trail cameras.

3.1.1. 2021 Autumn Baiting Program Overall Results

The Table below outlines these results, identifying the number of baits taken and the species that removed the bait. It also indicates bait locations that were disturbed without the bait being removed and any other relevant observations or results. The table also provides:

- A tallied result of number of baits taken by target species and the bait locations where takes occurred; and
- The percentage of available baits taken by target species. *(Please Note: 'Unknown' Bait takes are not included as a positive result in the final results, as Enright Land Management does not consider it to be a positive take by a Target Species due to too many variable possibilities).*

Mound Bait ID	CHECK 1 27/05/2021		CHECK 2 03/06/2021		CHECK 3 10/06/2021	
	Bait Taken (Y/N)	Species	Bait Taken (Y/N)	Species	Bait Taken (Y/N)	Species
M01	N		N		N	
M02	N	WDD	N		N	
M02 Ejector	N		N		N	
M03	Y	Wild Dog	N		N	
M04	Y	Crow	Y	Unknown/MD	N	
M05	Y	Fox	N		Y	Fox
M06	Y	Wild Dog	N	FD	N	
M07	Y	Wild Dog	N		Y	Unknown/RD
M08	N	FD	Y	Unknown/MD	N	
M09	Y	Wild Dog	Y	Wild Dog	N	
M10	Y	Fox	N	FD	Y	Fox
M11	Y	Fox	Y	Fox	Y	Wild Dog
M11 Ejector	**Y**	**Fox**	**N**	**FD**	**N**	
M12	N		N	FD	N	
M13	Y	Wild Dog	Y	Fox	N	FD

Mound Bait ID	CHECK 1 27/05/2021		CHECK 2 03/06/2021		CHECK 3 10/06/2021	
	Bait Taken (Y/N)	Species	Bait Taken (Y/N)	Species	Bait Taken (Y/N)	Species
M14	Y	Wild Dog	Y	Fox	Y	Unknown/RD
M15	Y	Wild Dog	Y	Fox	N	
M16	N		Y	Fox	N	
M17	N		Y	Crow	N	
M18	N		Y	Crow	N	
M19	Y	Wild Dog	Y	Wild Dog	Y	Unknown/RD
M20	Y	Wild Dog	Y	Fox	N	
M21	Y	Unknown	Y	Wild Dog	Y	Unknown/RD
M22	N		N		N	
M23	Y	Unknown	N		N	
M24	N	FD	Y	Wild Dog	Y	Fox
M25	Y	Unknown	N		N	
M26	Y	Wild Dog	Y	Wild Dog	N	
M27	Y	Wild Dog	N		N	
M28	N	WDD	N		N	
M29	Y	Unknown	Y	Crow	N	
M30	N		N		N	
M31	Y	Wild Dog	N		N	
M32	Y	Wild Dog	Y	Fox	N	
M33	Y	Wild Dog	N	FD	N	
M34	Y	Unknown	Y	Wild Dog	Y	Unknown/RD
M35	N		N		Y	Unknown/RD
M36	Y	Fox	N		N	
M37	N		N		N	
M38	N		N	FD	Y	Unknown/RD
M39	N		N	WDD	N	
M40	N		N		Y	Fox
M41	N	FD	N		Y	Unknown/RD
M42	N	WDD	N	FD	N	
M43	N	FD	N		N	

Mound Bait ID	CHECK 1 27/05/2021		CHECK 2 03/06/2021		CHECK 3 10/06/2021	
	Bait Taken (Y/N)	Species	Bait Taken (Y/N)	Species	Bait Taken (Y/N)	Species
M44	N	WDD	N		N	
M45	Y	Fox	Y	Fox	N	FD
M46	Y	Fox	Y	Fox	N	
M47	Y	Fox	Y	Unknown	N	
M48	Y	Wild Dog	Y	Wild Dog	Y	Wild Dog
M48 Ejector	**Y**	**Crow**	**N**		**N**	
M49	Y	Wild Dog	Y	Wild Dog	Y	Wild Dog
M50	Y	Wild Dog	Y	Wild Dog	Y	Wild Dog
M50 Ejector	**Y**	**Wild Dog**	**N**		**N**	
Table 1 Results: Tally						
Check Tally	**54** Lethal Baits Laid	**30 Baits Taken** *(25 Baits Taken by Target Species)* **18 Wild Dogs** **7 Foxes** **5 Unknown** **2 Crows** **8 Bait Shyness**	**54** Lethal Baits Laid	**24 Baits Taken** *(18 Baits Taken by Target Species)* **9 Wild Dogs** **9 Foxes** **3 Unknown** **3 Crows** **8 Bait Shyness**	**54** Lethal Baits Laid	**16 Baits Taken** *(8 Baits Taken by Target Species)* **4 Wild Dogs** **4 Foxes** **8 Unknown** **2 Bait Shyness**
Tally Totals	**Wild Dog Takes**		**31**	**Total Takes by Target Species 51**		
	Fox Takes		**20**			
	Unknown Takes		**16**			
	Crow Takes		**5**			
	Cases of Bait Shyness		**18**			
Number of Baits Disposed	**20**		**26**		**34**	
Bait Disposal Location	**-32.3412, 150.9055**		**-32.3578, 150.8385**		**-32.3508, 150.8220**	

Table 1 Results: Percentage Breakdown						
	CHECK 1 27/05/2021		CHECK 2 03/06/2021		CHECK 3 10/06/2021	
Percentage of Baits Taken by Target Species Each Check	46%		33%		15%	
Percentage Breakdown of Baits taken by Target Species	Fox Takes 13%	Wild Dog Takes 33%	Fox Takes 17%	Wild Dog Takes 17%	Fox Takes 7%	Wild Dog Takes 7%
Overall Percentage of Baits Taken over Baiting Program	Over the baiting program there were 162 baits made available to target species (50 baits + 4 ejectors in each of the three (3) check weeks). 51 of the 162 baits were taken by the Target Species. *(Unknown takes are not included in this calculation)*				Total available baits taken by Target Species is 31%	
Percentage of Baits Taken by Foxes or Wild Dogs over Baiting Program					Wild Dog Takes	19%
					Fox Takes	12%
Percentage of Baits Taken by Non-Target species and Unknown Takes; as well as Cases of Bait Shyness over the Baiting Program.					Unknown Takes	10%
					Crow Takes	3%
					Cases of Bait Shyness	11%

Legend: *(Table 1)*

Wild Dog = Wild Dog took the bait

Fox = Fox took the bait

Crow = Crow took the bait

WDD = Wild Dog disturbed/ scratched at the bait mound and left bait.

FD = Fox disturbed/ scratched at the bait mound and left bait.

Unknown/MD = Mechanical Disturbance displacing bait or removing animal prints, making it unable to determine if the bait was taken by a target species or not.

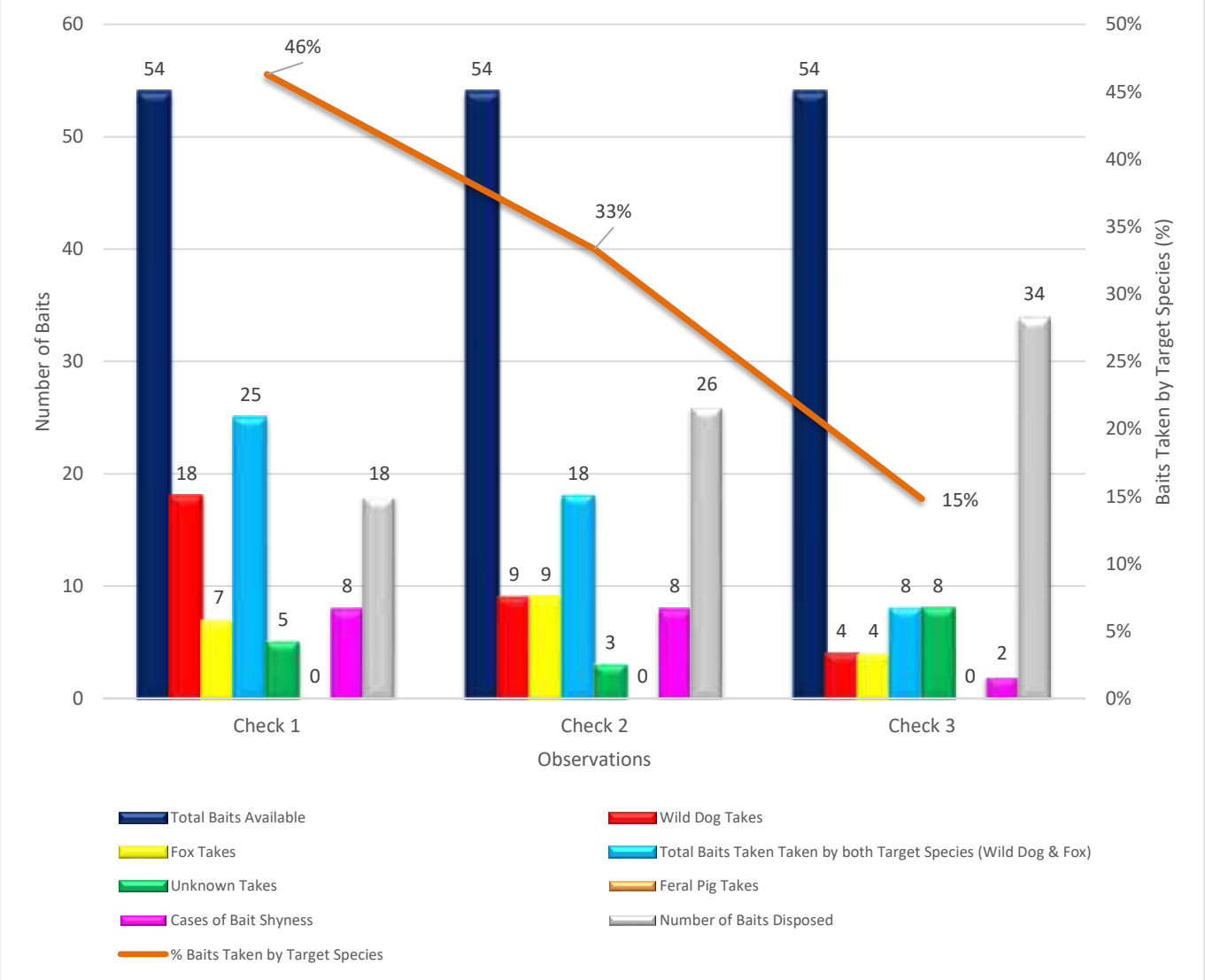
Unknown/RD = Rainfall has disturbed the bait site, making it unable to determine if the bait was taken by a target species or not.

3.1.2. 2021 Autumn Baiting Program Trends

The following graph depicts the trend of observed 1080 baits taken during the 2021 Autumn Baiting Program. It illustrates:

- Total baits installed;
- Baits taken by Foxes;
- Baits taken by Wild Dogs;
- Combined total takes by both Target Species;
- Unidentified taken baits (Unknown Takes);
- Baits taken by Feral Pigs
- Cases of Bait Shyness; and
- Bait consumption trend line depicting the percentage of takes per inspection over the baiting period.

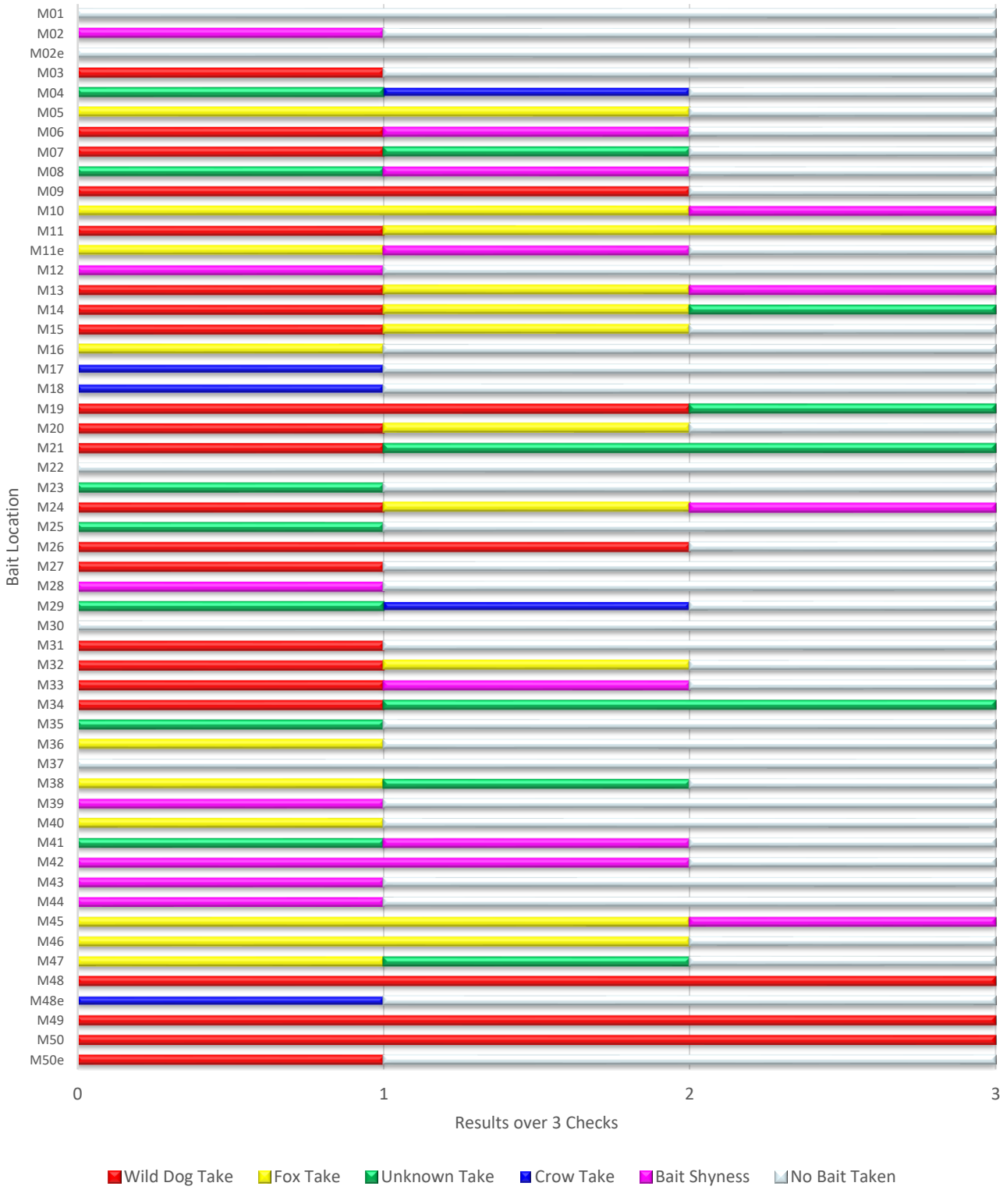
Graph 1: Mt Arthur Coal Bait Consumption Trends 2021



3.1.3. 2021 Autumn Individual Bait Location Results

The graph below illustrates the 2021 Baiting Program results, with reference to each individual bait location. It identifies the locations at which baits were taken, which target species removed the bait and how many times over the baiting program a bait was taken at each location. The graph also indicates the locations at which there were 'Unknown Takes' *(Due to Lack of Conclusive Evidence)*, cases of 'Bait Shyness' *(bait disturbance by Target Species, no bait taken)* and, if no baits were taken at a bait location. This information may assist when determining the location of baits during the next Program.

Graph 2: Mt Arthur Coal Operations – 2021 Autumn Bait Location Results.



3.1.4. Autumn 2021 Baiting Program 1080 Ejector Baits

During the baiting program four (4) bait locations were set up with 1080 ejectors. Ejectors are used as an alternative to mound baits to help combat bait shy wild dogs and foxes. Ejector baits are fixed to the ground surface by a pin driven into the ground. The spring-loaded ejector head is loaded with a 1080 bait capsule, which is enclosed within dried kangaroo meat to lure the target species. Dried kangaroo meat is ideal to lure the target species as it is a common addition to the target species existing diet. The ejector head is set off by an upward pulling force on the bait head.

We have identified target animals as 'bait shy' when they have interacted with a bait location but have not gone on to consume the bait. Ejector baiting is a different control method that is easily integrated into the existing mound baiting program. Due to its comparative cost to mound baiting and lengthier installation time it has only been found to be suitable on a small scale.

Table 2: Mt Arthur Coal Operations 1080 Ejector Bait Results for Autumn 2021 Baiting Period
(extracted from Table 1 Results)

Ejector Bait ID	CHECK 1 27/05/2021		CHECK 2 03/06/2021		CHECK 3 10/06/2021	
	Bait Taken (Y/N)	Species	Bait Taken (Y/N)	Species	Bait Taken (Y/N)	Species
M02 Ejector	**N**		**N**		**N**	
M11 Ejector	**Y**	**Fox**	**N**	**FD**	**N**	
M48 Ejector	**Y**	**Crow**	**N**		**N**	
M50 Ejector	**Y**	**Wild Dog**	**N**		**N**	
Table 2 Results: Tally						
Check Tally	**4** Ejectors Set	**3 Baits Taken** **1 Wild Dog** **1 Fox** **1 Crow Take**	**4** Ejectors Set	**No Baits Taken** **1 Bait Shyness**	**4** Ejectors Set	**No Baits Taken**
Table 2 Results: Percentage Breakdown						
Percentage of Baits Taken by Target Species Each Check	**50%**		**0%**		**0%**	
Overall Percentage of Baits Taken over Baiting Program	**Over the baiting program there were 12 Ejector baits made available to target species (Four (4) in each of the three (3) check weeks). Two (2) of the 12 baits were taken by the target species.**				**Total available Ejector baits taken by Target Species is 17%**	

Legend:

Wild Dog = Wild Dog took the bait
Fox = Fox took the bait
Crow = Crow took the bait
FD = Fox disturbed / scratched at the bait mound and left the bait

3.1.5. 2021 Autumn Baiting Program Observations

- During the baiting program, 50 bait locations were installed and monitored plus 4 ejector baits. Over the baiting period this amounts to 162 bait opportunities for target species. During the program, there were 51 takes likely by target species – 31 wild dogs takes and 20 fox takes. This equates to an overall baiting efficiency of 31% confirmed takes by target species. *Refer GIS Map 1*, *Table 1, Graph 1 & Graph 2.*

- During the course of the baiting period, it was noted that the percentage of baits taken peaked in week one (1) and reduced as the program progressed. (46% for Check 1, 33% for Check 2 and 15% for Check 3). *Refer Table 1 & Graph 1*

- At some bait locations on this site, evidence of bait shyness was detected. This was identified from the photographs taken by our trail cameras and from observations made of the bait locations. It was observed that the level of bait shyness varied, having similar results for week one (1) and two (2) and being significantly lower in week three (3) of the available baits during the baiting program (eight (8) for Check 1, eight (8) for Check 2 and two (2) for Check 3). There were 18 cases of bait shyness over the baiting program, this accounts for 11% of the program. It is common for wild dog bait shyness to occur during baiting programs through their natural learned behaviour. Alternate management practices such as an open range shooting or soft-jaw trapping are encouraged for target species that become bait shy. A depiction of areas of bait shyness across all bait locations is contained in *GIS Map 3, Graph 1 & Graph 2.*

- During the baiting program it was observed in some instances that, where baits were located within a similar area or along an identified target species track, the takes in that area/along that track were removed by the same species. It is difficult to identify whether these baits have been taken by the same animal or whether a group of the same species has gone through the area. Both target species have natural food gathering tendencies to store food for a later time by burying or hiding it. This food hoarding is known as caching. *(Due to caching practices by foxes and wild dogs, it is a requirement to leave 1080 Bait Program boundary signage up for a four (4) week period after the conclusion of the Baiting Program; this assists in minimising the potential risk to domestic animals).*

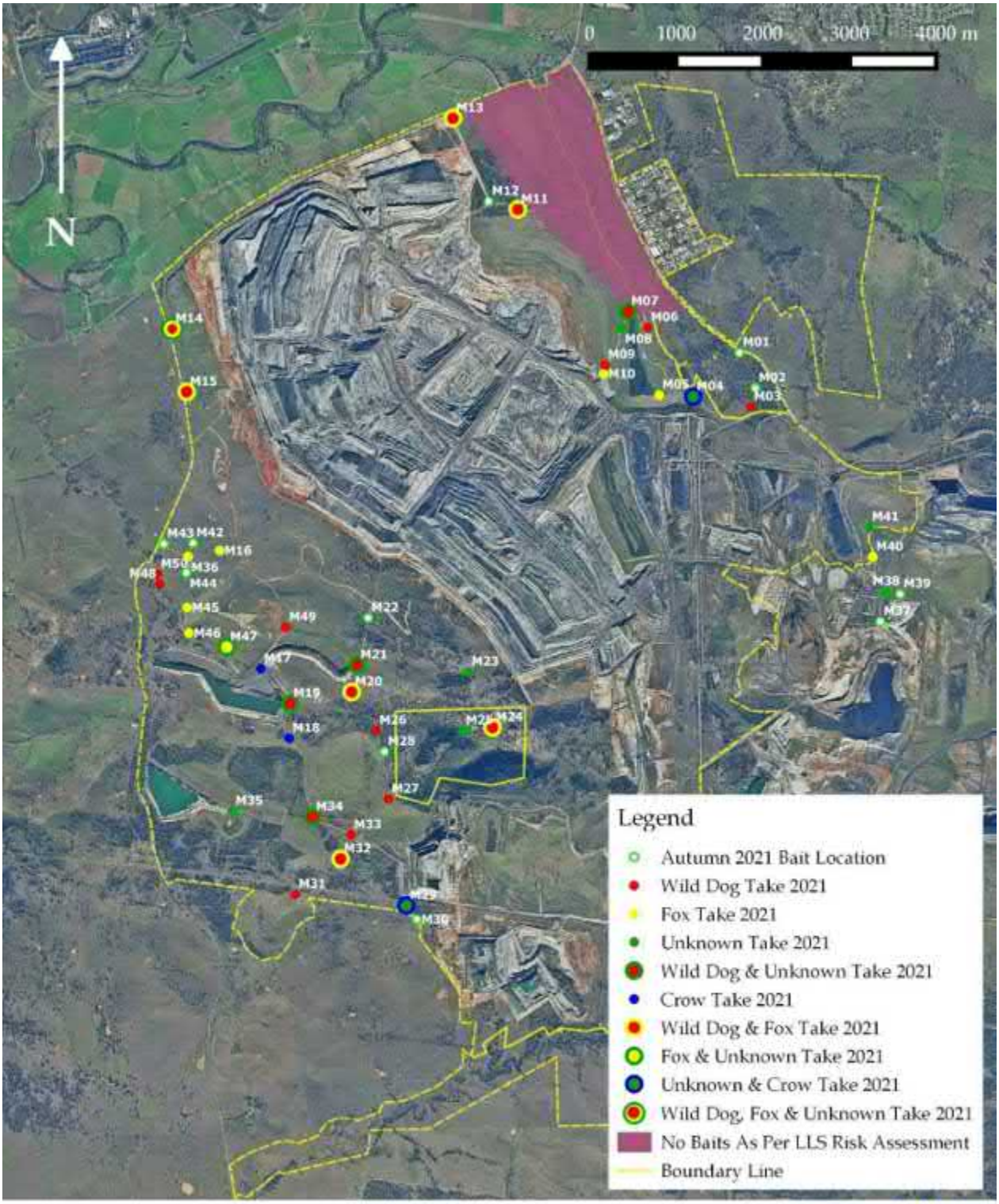
- A total of 16 baits were taken during the baiting program in circumstances where the animal that took the bait could not be determined. This hindered the monitoring process of the Baiting Program as it failed to produce identifiable results. As the consumption of these baits cannot be confirmed, they are referred to in the results as 'unknown'. The 16 baits account for approximately 10% of the baiting program.

- The baits were disposed in accordance with the PCO requirements. The bait disposal coordinates for checks one, two and three respectively *(Refer to GIS Map 1)*:
    - -32.3412 Latitude, 150.9055 Longitude
    - -32.3578Latitude, 150.8385 Longitude
    - -32.3508 Latitude, 150.8220 Longitude

3.1.6. GIS Map 1: 2021 Bait Locations & Takes

In the following GIS Map the results of Individual 2021 Autumn Bait Locations are presented, detailing the location at which baits were taken by wild dogs or foxes. It also depicts the bait locations where both or no target species have taken the baits.

(Please note a white circle with a light green border indicates that no bait was taken from that Bait Location).



3.1.7. GIS Map 2: 2021 Bait Location Success Rates

The following GIS Map indicates the level of success at individual bait locations by indicating the number of baits taken by the Target Species. The success ratings range from 'No Baits Taken' up to 'Three Baits Taken' by Target Species

BHP Billiton - Mt Arthur Coal Operations
VERTEBRATE PEST CONTROL
1080 BAITING AUTUMN 2021:
Wild Dog & Fox Bait Location Success Rate - Map 2

ENRIGHT LAND MANAGEMENT

Compiled by ENRIGHT LAND MANAGEMENT 10/06/2021

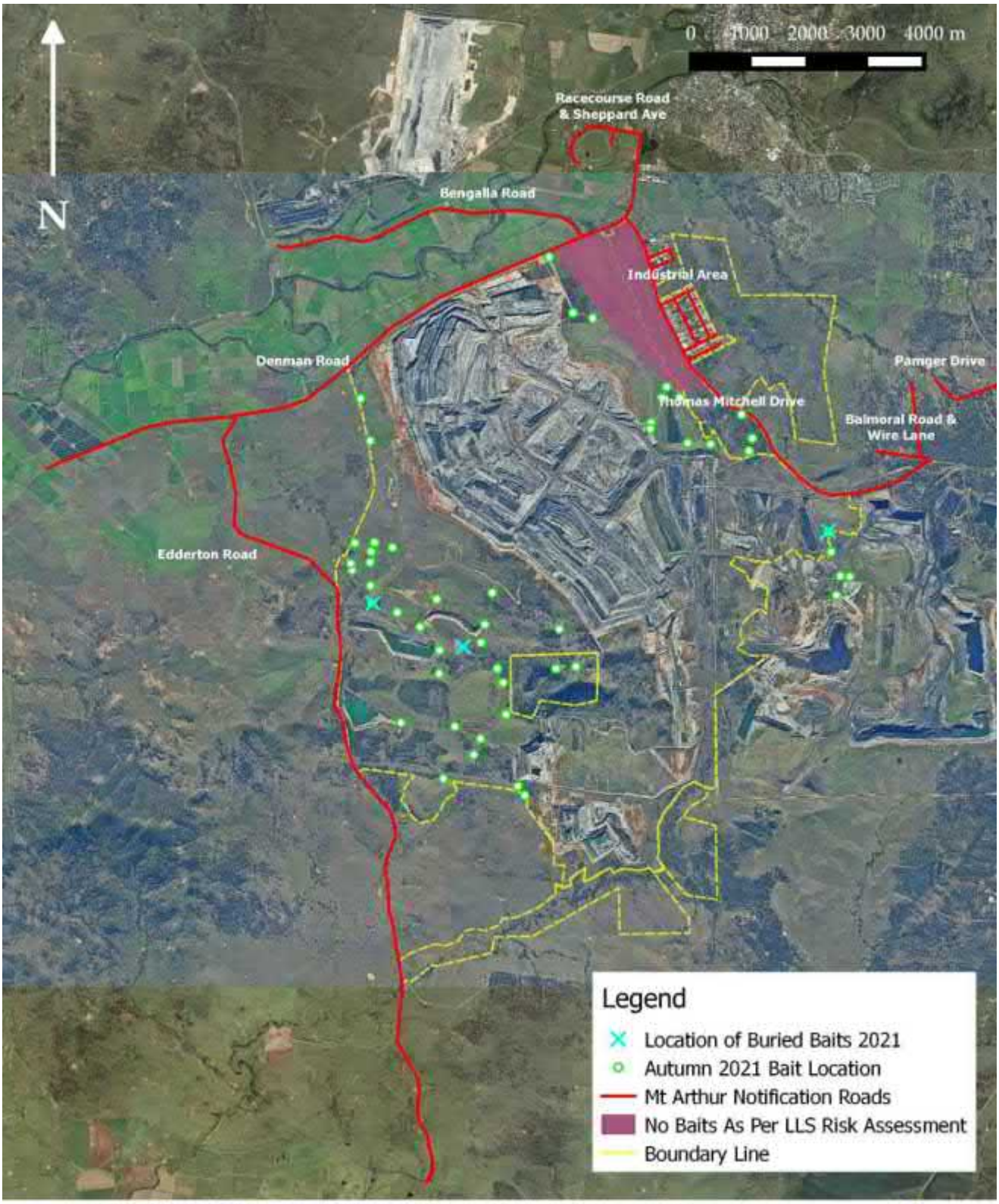
3.1.8. GIS Map 3: 2021 Bait Shyness

The following GIS Map depicts bait locations where evidence of bait shyness was observed during the 2021 Autumn baiting program. Bait shyness occurs when the target species have shown interest in the bait or dug at the bait mound and then left the bait and moved on. The level of bait shyness ranges from 'One Case of Bait Shyness' up to 'Two Cases of Bait Shyness' by Target Species.

(Please note a white circle with a light green border indicates that no bait shyness was observed at that Bait Location).

3.1.9. GIS Map 4: 2021 Baiting Program Notification Area

The following GIS Map depicts bait notification areas, where the letterbox notification was delivered prior to the commencement of the baiting program, as per the PCO.



BHP Billiton - Mt Arthur Coal Operations
VERTEBRATE PEST CONTROL
1080 BAITING AUTUMN 2021:
Letterbox Drop Notification Area - Map 4

ENRIGHT LAND MANAGEMENT

Compiled by ENRIGHT LAND MANAGEMENT 10/06/2021

3.2. Comparison with Previous Baiting Programs

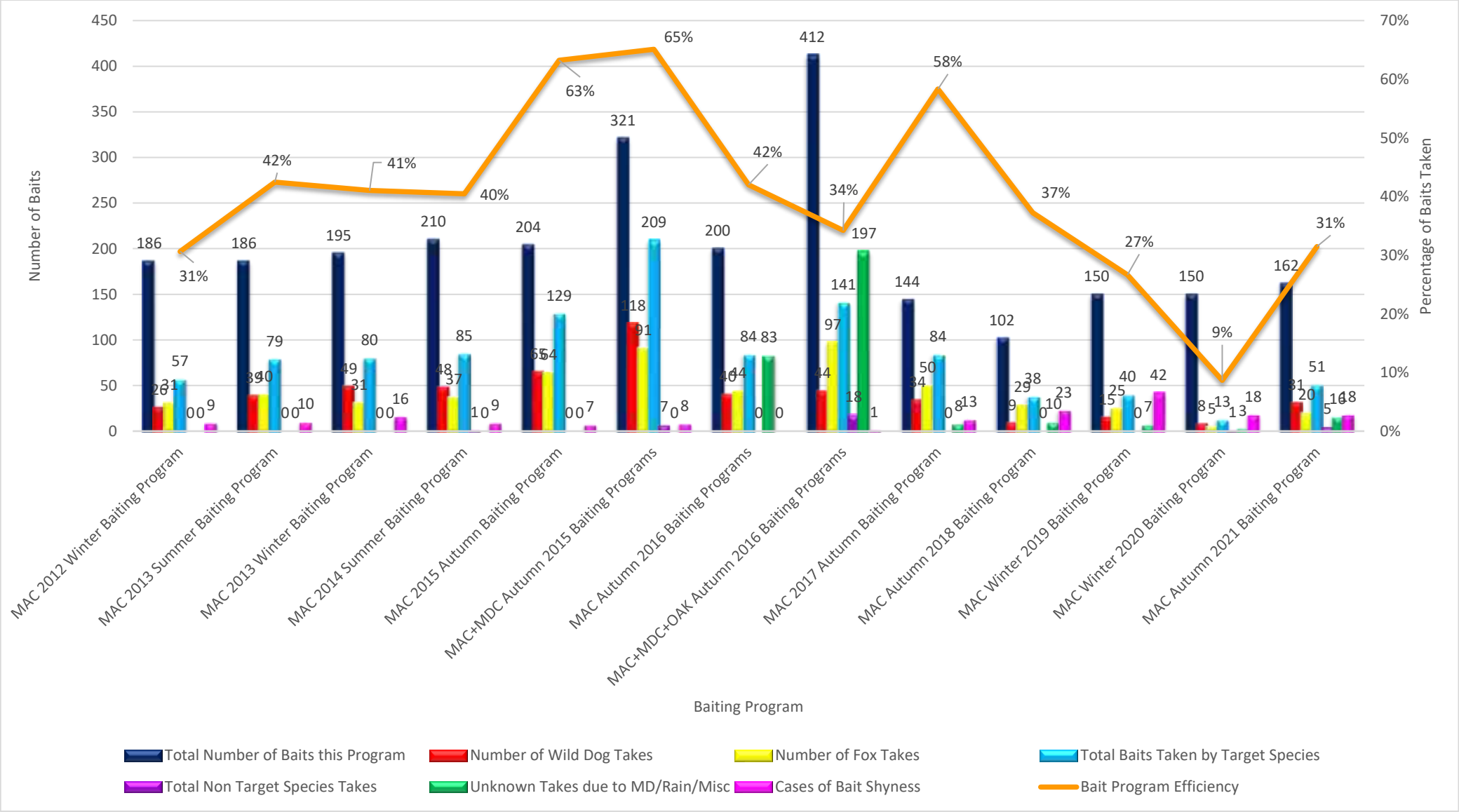
3.2.1. Summary of Results from Baiting Programs between 2012 to Autumn 2021

A summary of the results of the baiting programs between 2012 and Autumn 2021 is outlined in the table below (**Table 3**):

Baiting Program	Number of Baits per Check	Total Number of Baits this Program	Number of Wild Dog Takes	Number of Fox Takes	Total Baits Taken by Target Species	Total Non Target Species Takes	Unknown Takes due to MD/Rain/Misc	Cases of Bait Shyness	Bait Program Efficiency
MAC 2012 Winter Baiting Program	62	186	26	31	57	0	0	9	31%
Winter 2012 Percentage Results			14%	17%	31%	0%	0%	5%	
MAC 2013 Summer Baiting Program	62	186	39	40	79	0	0	10	42%
Summer 2013 Percentage Results			21%	22%	42%	0%	0%	5%	
MAC 2013 Winter Baiting Program	65	195	49	31	80	0	0	16	41%
Winter 2013 Percentage Results			25%	16%	41%	0%	0%	8%	
MAC 2014 Summer Baiting Program	70	210	48	37	85	1	0	9	40%
Summer 2014 Percentage Results			23%	18%	40%	0%	0%	4%	
MAC Autumn 2015 Baiting Programs	68	204	65	64	129	0	0	7	63%
Autumn 2015 Percentage Results (MAC only)			32%	31%	63%	0%	0%	3%	
MAC+MDC Autumn 2015 Baiting Programs	107	321	118	91	209	7	0	8	65%
Autumn 2015 Percentage Results			37%	28%	65%	2%	0%	2%	
MAC Autumn 2016 Baiting Programs	50	200	40	44	84	0	83	0	42%
Autumn 2016 Percentage Results (MAC only)			20%	22%	42%	0%	42%	0%	
MAC+MDC+OAK Autumn 2016 Baiting Programs	103	412	44	97	141	18	197	1	34%
Autumn 2016 Percentage Results			11%	24%	34%	4%	48%	0%	
MAC 2017 Autumn Baiting Program	48	144	34	50	84	0	8	13	58%
Autumn 2017 Percentage Results			24%	35%	58%	0%	6%	9%	
MAC Autumn 2018 Baiting Program	34	102	9	29	38	0	10	23	37%
Autumn 2018 Percentage Results			9%	28%	37%	0%	10%	23%	
MAC Winter 2019 Baiting Program	50	150	15	25	40	0	7	42	27%
Winter 2019 Percentage Results			10%	17%	27%	0%	5%	28%	
MAC Winter 2020 Baiting Program	50	150	8	5	13	1	3	18	9%
Winter 2020 Percentage Results			6%	3%	9%	1%	2%	12%	
MAC Autumn 2021 Baiting Program	54	162	31	20	51	5	16	18	31%
Autumn 2021 Percentage Results			19%	12%	31%	3%	10%	11%	

3.2.2. Comparison of Baiting Program Trends from 2012 to 2021

Graph 3 depicts the baiting results and consumption trends for the baiting programs between 2012 and Autumn 2021:

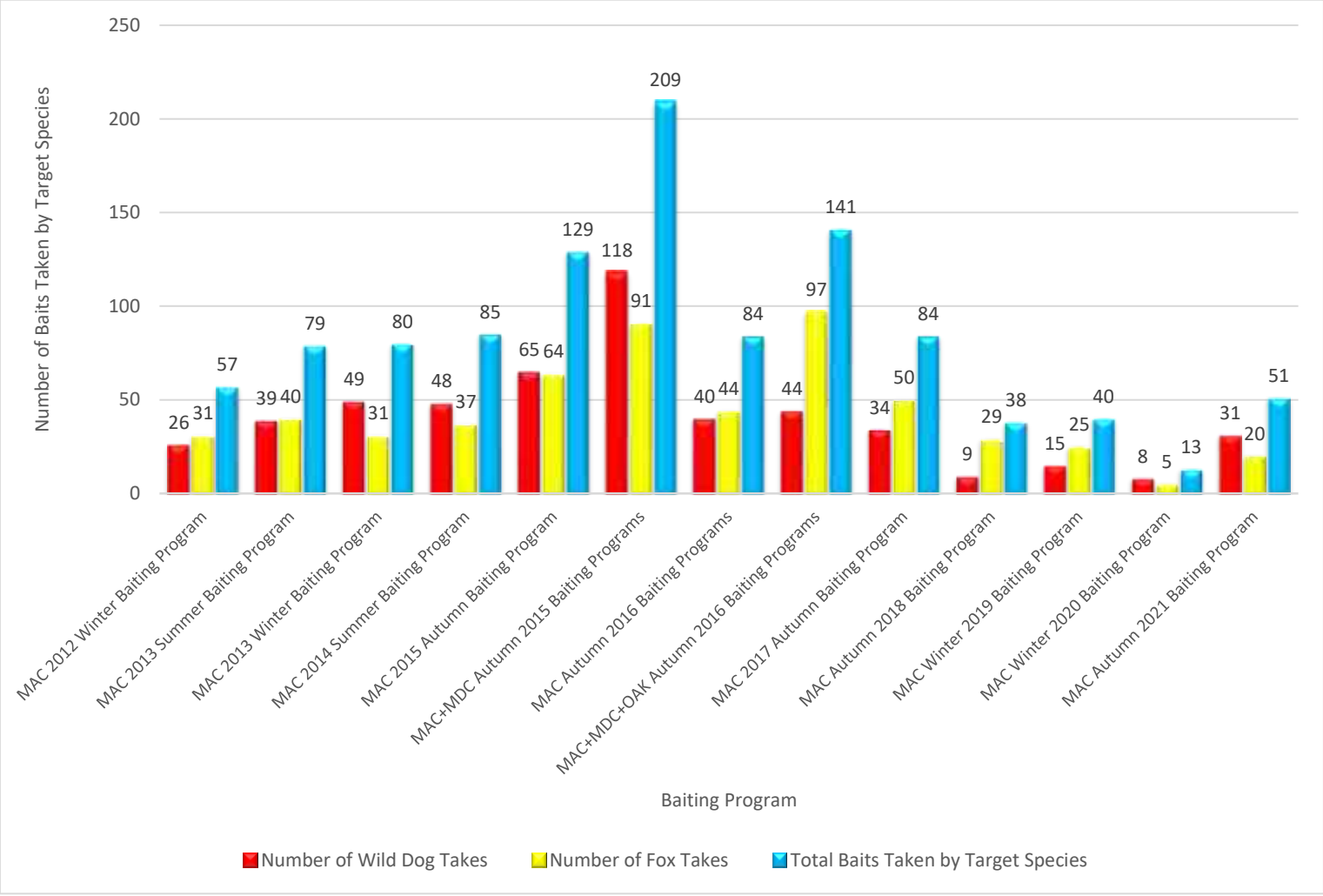


3.2.3. Observations and Comparisons with previous Baiting Programs

- The overall baiting efficiency for the 2021 Autumn Baiting Program was 31%, compared to the 9% and 27% confirmed takes by target species in the 2020 Winter Baiting Program and 2019 Winter baiting program, respectively. This may indicate an increase in target species in the area, possibly due to increased vegetation and therefore food sources. *(Please note that Baiting Program Efficiency calculations are only accurate to utilise for Baiting Program comparisons when there are limited variables in between individual Baiting Programs).*
- There were 18 recorded cases of bait shyness for the 2021 Autumn Baiting Program, similar for the same period last year, however far less than the Winter 2019 program. To counteract bait shyness, an integrated management approach is required, including multiple management strategies to support the baiting programs, such as soft-jaw trapping and open range shoots.
- The 2021 Winter Baiting Program had 51 baits taken by the target species, this is 38 more than baits taken than the Winter 2020 Baiting Program, however similar to baiting programs previous the Winter 2020 program. *Refer to Table 3, Graph 2 and GIS Maps 1.*
- Overall, the baiting efficiency has increased when compared to the trend over the past four (4) years, indicating that the population of target species may have increased, or more target species were in the immediate area during the Autumn 2021 program.
- The Baiting Program Achievement Rate for the baiting programs from 2012 to Autumn 2021 is illustrated in Graph 4 below. The Autumn 2021 program has the highest amount of target takes in the last two (2) years, specifically the number of wild dog takes.
- The average of 'Total Baits Taken by Target Species in a Baiting Program' is **84** Takes. The 2021 Autumn Baiting Program is 33 lower than the long-term average.

- **Graph 4** Baiting Program Achievement Rate is illustrated by the comparisons of baits taken by Target Species for Baiting Programs from 2014 to 2021:

  (Please note that the comparisons are based on 1080 Baiting Programs that have been carried out on Mt Arthur Coal mining lease. The Middle Deep Creek and Oakvale Offset Baiting Program was not carried out by Enright Land Management in 2017, 2018, 2019, 2020 and 2021 therefore the information has been omitted from the Baiting Program Achievement Rate comparison graph below).



4. Recommendations for Future Work

- Conduct future 1080 Baiting Programs, twice yearly – in Autumn and in early Spring. It is best to avoid the summer months, to reduce the potential interference of goannas. The continued implementation of regular 1080 baiting programs would include both mound baiting and ejector baiting. Consistent 1080 baiting will minimise animal reinfestation and keep animal numbers low.
- It can be very difficult to control animals that are shy of baits. An integrated approach is required in addition to 1080 mound and ejector baiting including other methods of control, such as trapping and shooting. Trapping can be the best method to control bait shy animals. The traps can also be monitored with sim card motion cameras, to alert when something is in the trap, and ensure that target animals are dispatched efficiently and humanely.

5. References

- *Pesticide Control (1080 Bait Products) Order 2020*
- *Pesticide Control (1080 Ejector Capsules) Order 2015*.
- *NSW Department of Primary Industries and NSW EPA Websites*
- *NSW Local Land Services Websites and 1080 Canid Pest Ejectors (CPE's) documents*
- *MAC-ENC_MTP-050 Biodiversity Management Plan*

6. Baiting Program Appendix:

The following Images are a selection of photographs taken by trail cameras that were set up as part of the monitoring process of the 2021 Autumn Baiting Program. The photos depict wild dogs, foxes, birds, and a wallaby at bait location across site.

Image 1: Fox inspecting the scent at Bait Location M50.

Image 2: Birds inspecting the bait at Bait Location M50.

Image 3: Wild dog inspecting bait mound at Bait Location M50. The wild dog did not consume the bait on this occasion.

Image 4: Wild dog inspecting bait location area at Bait Location M50.

Image 5: Two wild dogs passing the bait at Bait Location M50.

Image 6: Wallaby inspecting bait area at Bait Location M50.

Image 7: Fox inspecting the bait at Bait Location M48.

7. Wild Dog Wild Dog Shoot

7.1. Wild Dog Shoot Results

In conjunction with the autumn 2021 baiting program, two nights of opportunistically shooting wild dogs was carried out. On the nights of the 17th and 18th of June, one week after the baiting program had finished, Enright Land Management conducted a vertebrate pest shoot at Mt Arthur – BHP lands, targeting wild dogs and other vertebrate pests.

The results from this shoot are as follows:

First night: 17th June

On the first night the shoot was concentrated on the south-western side of site, in shooting area 1 in the shoot plan.

Little was seen other than approximately dozen kangaroos and a wombat. 15 rabbits were shot and used as scent and bait for wild dogs/foxes. All areas were driven, specifically all tracks and through newly slashed areas with no sign of wild dogs. Both howling and distressed animal noises were utilised however no visual or verbal sign of wild dogs were observed. The lack of sign of wild dogs was likely part due to windy and cold weather with gusts of up to 15kph and a minimum of 10 degrees.

Second night: 18th June

The second nights shoot was concentrated in the northwest of site on the VD1 rehabilitation area, in shooting areas 2 in the shoot plan.

Similarly, there was no sign of any vertebrate pests besides rabbits with several dozen kangaroos in the area. All areas on the rehabilitation areas were monitored, again utilising both howling and distressed animal noises however no sign of wild dogs were observed. Weather was again windy and cold with wind gusts of up to 25kph and a minimum of 10 degrees. Vegetation height was over one meter making visibility difficult over the area. A safety interaction with site officials was carried out with a positive outcome with appropriate hazard controls in place, with mention that the signs in place at all access roads were great.

Summary Observations:

Overall, there was no sign detected of wild dogs in the area during the shooting program and no wild dogs were shot. This may have been due to a combination of the following:

- No wild dogs were currently in the immediate area at the time of the shoot.
- Unfavourable (cold and windy) weather kept wild dog activity to a minimum.
- Allocated shoot areas were small and limited possible areas where wild dogs could be found and shot.
- A reduction in wild dog population has occurred after the 1080 baiting program. Noting that it is likely a population is still present on site, however the recent baiting program may have made the population in the area more wary of interaction.

7.2. Wild Dog Shoot Appendix

NEED TO KNOW INFORMATION

Pest Animal Control Shooting – Night Shift 17th and 18th of June

Pest animal control shooting will be carried out over 2 nights

- Designated shooting areas are within non active mining areas;
- These areas will be **CLOSED TO ALL PERSONNEL** and demarcated as per shooting areas maps;
- This is in line with the Local Land Services pest animal control programs to control pest animal populations on site in order to assist Mt Arthur Coal in meeting its regulatory obligations; and
- For any concerns during shooting hours times please contact Production 11 – 21011.

BHP

Shooting Area 1 – 17th June

Key
- Access block
- Firing line

Pest Animal Control Shooting
31 July 2021

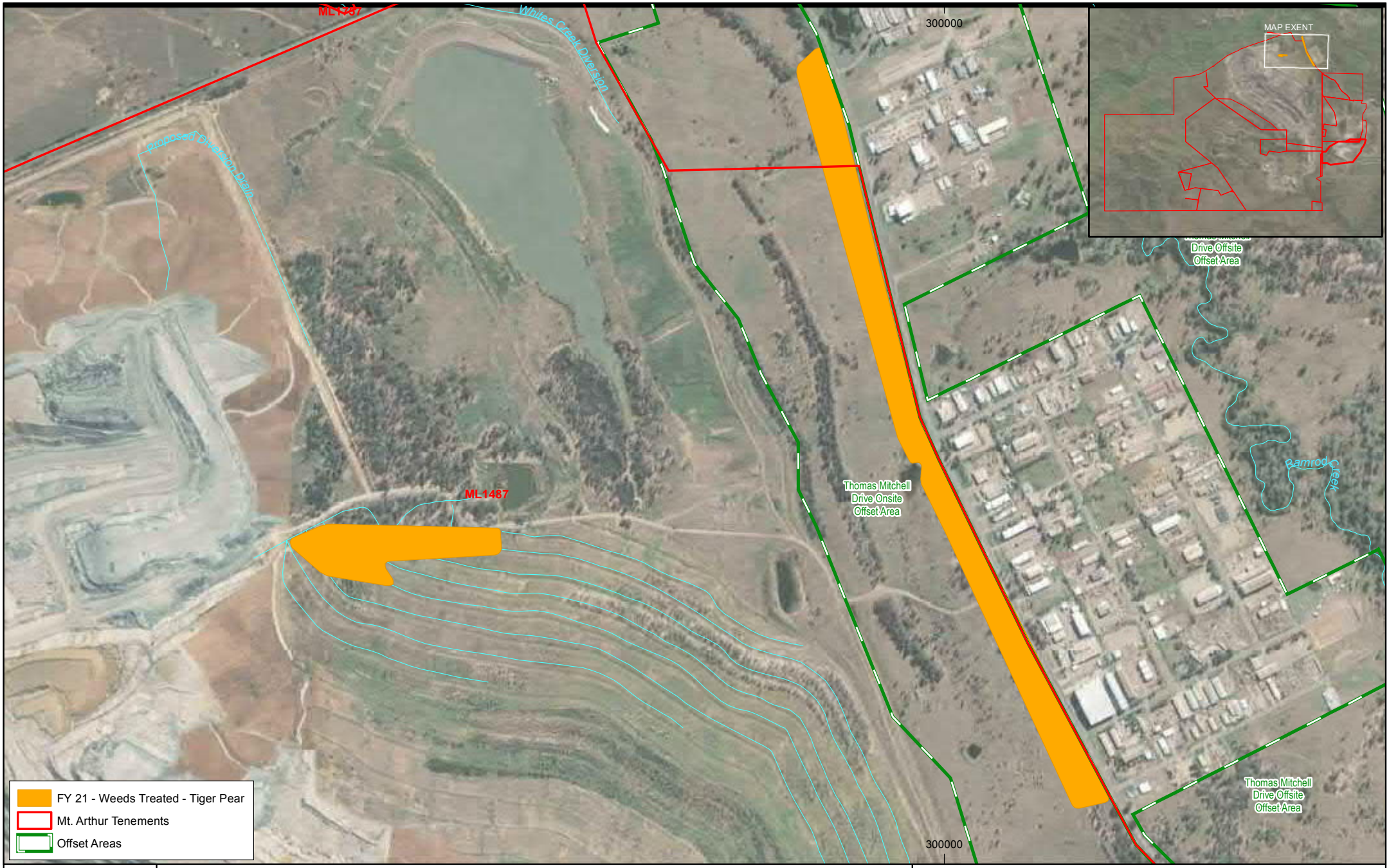
BHP

Shooting Area 2 – Night Shift 18th

Key
- Access block
- Firing line

Pest Animal Control Shooting
31 July 2021

BHP



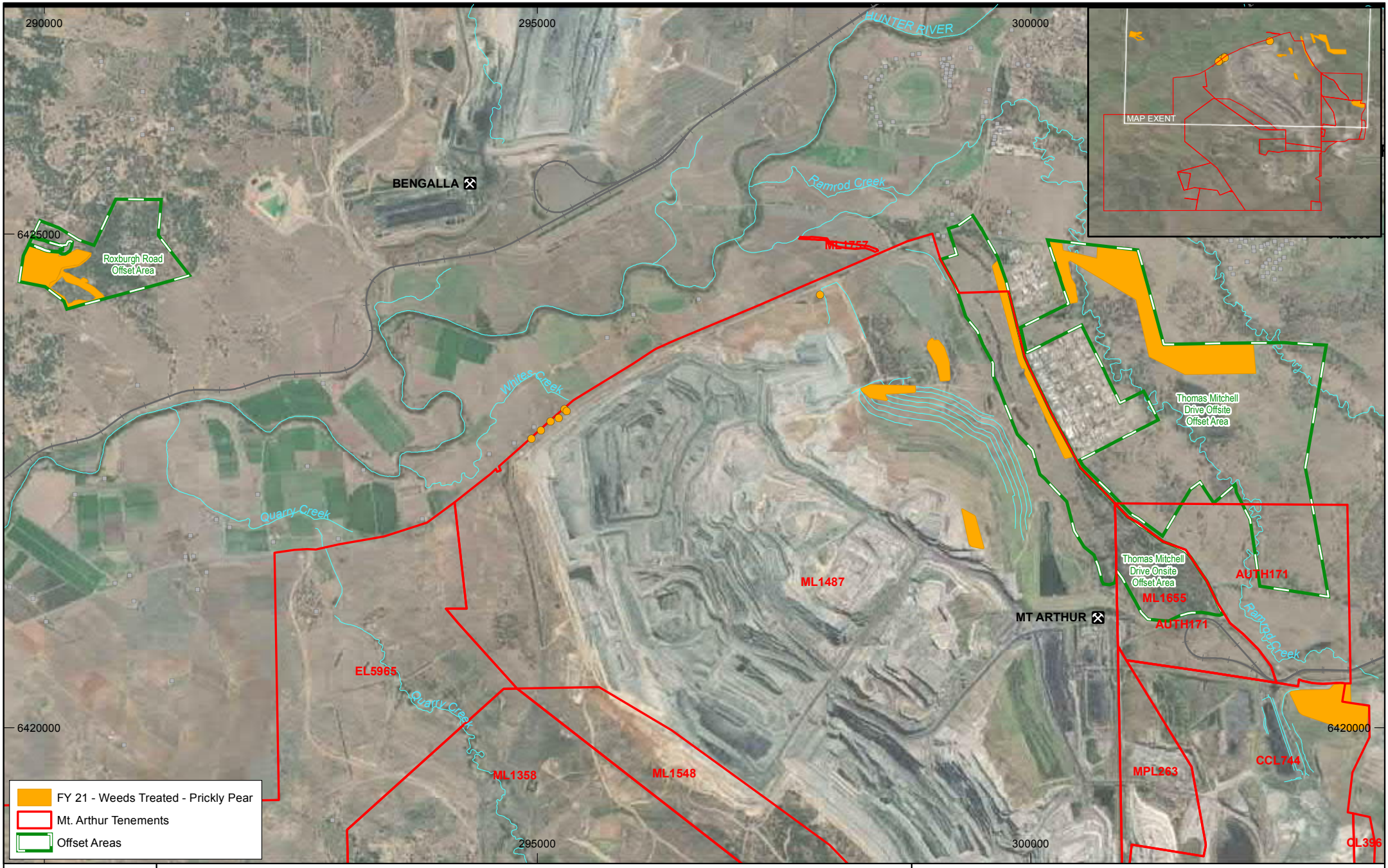
BHP
Geospatial Team
Brisbane

0 500 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - TIGER PEAR

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1k_Tiger_Pear	



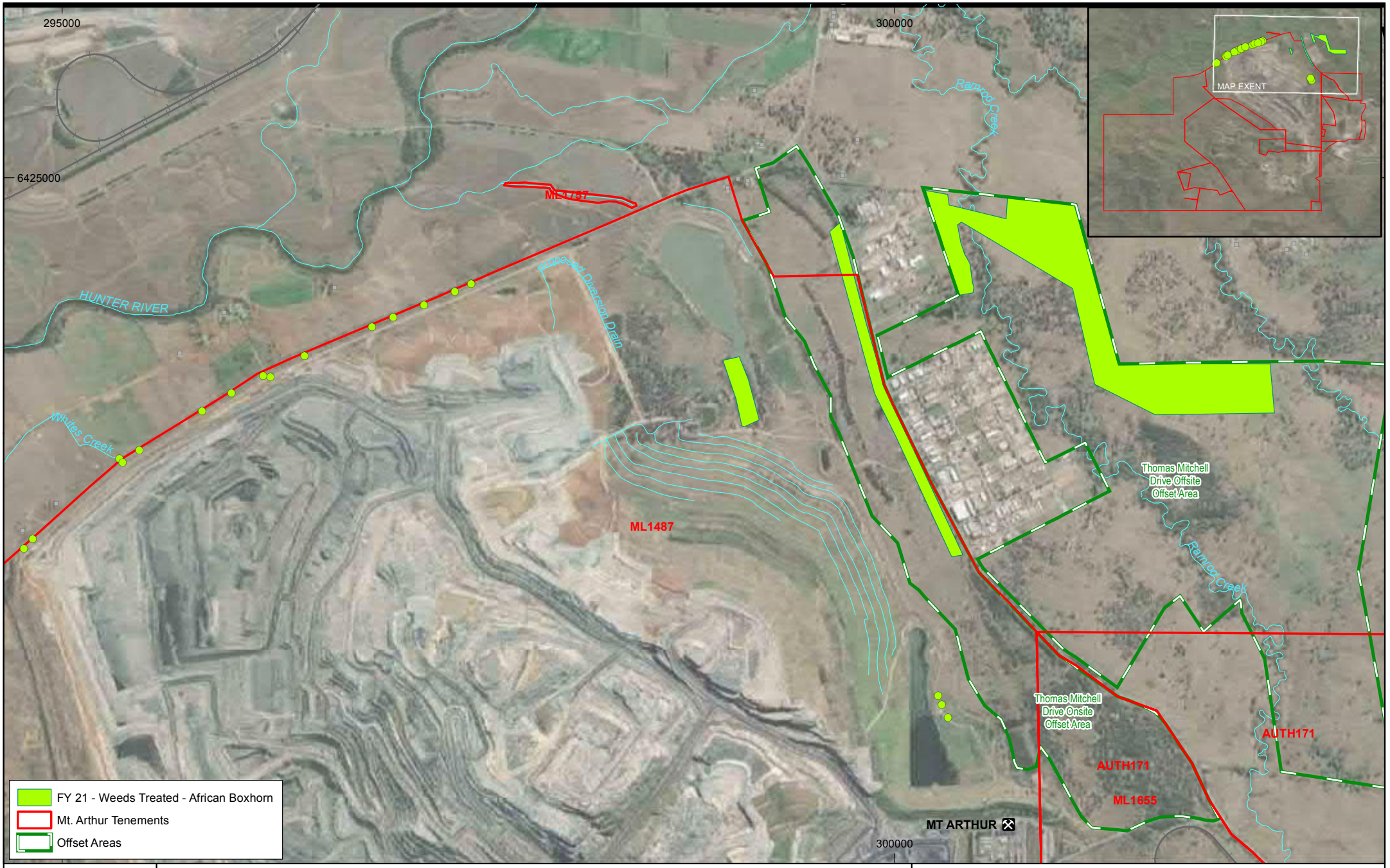
BHP
Geospatial Team
Brisbane

0 1,000 2,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - PRICKLY PEAR

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1a.mxd	



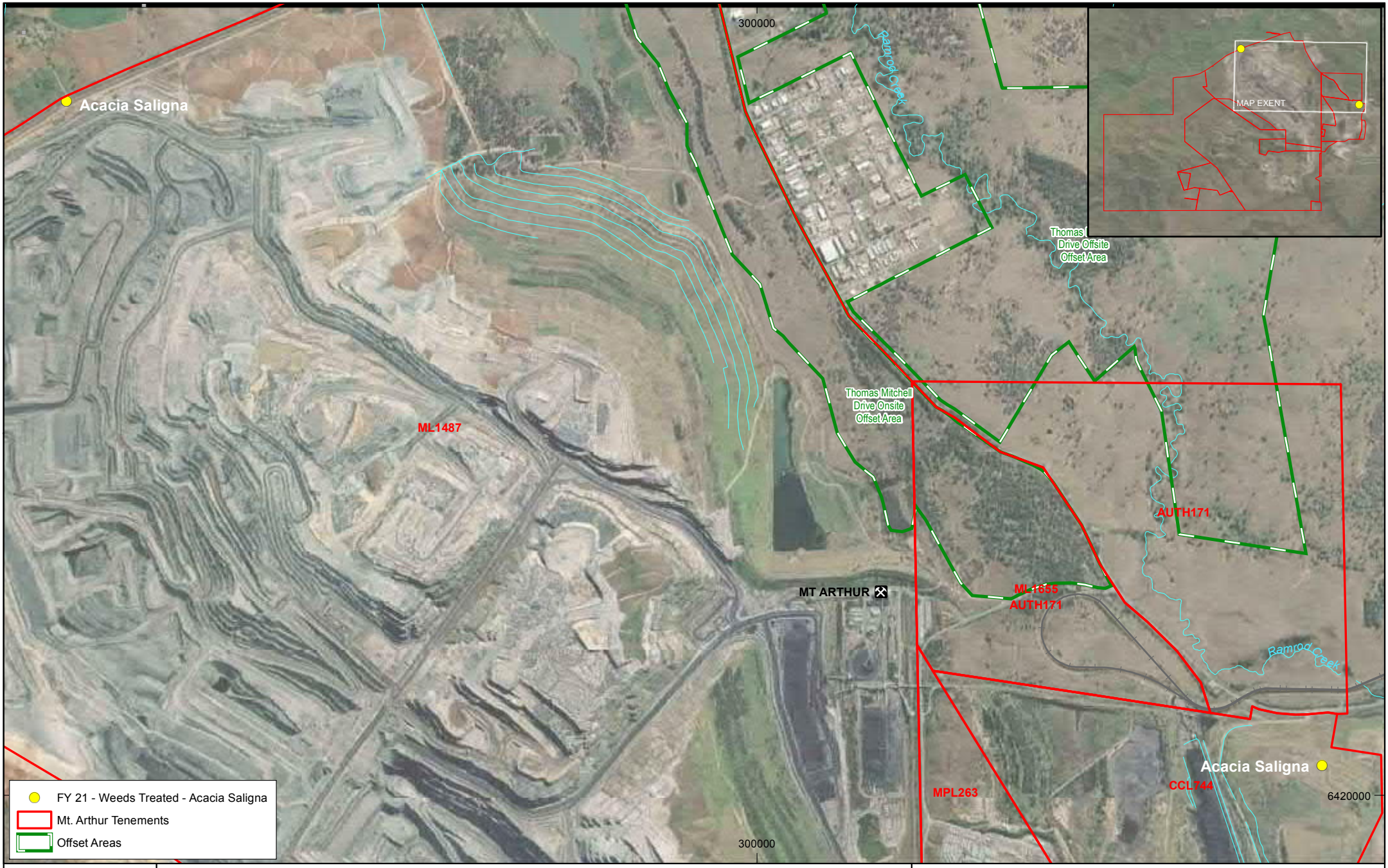
BHP
Geospatial Team
Brisbane

0 500 1,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - AFRICAN BOXHORN

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1b_African_Boxhorn	



BHP

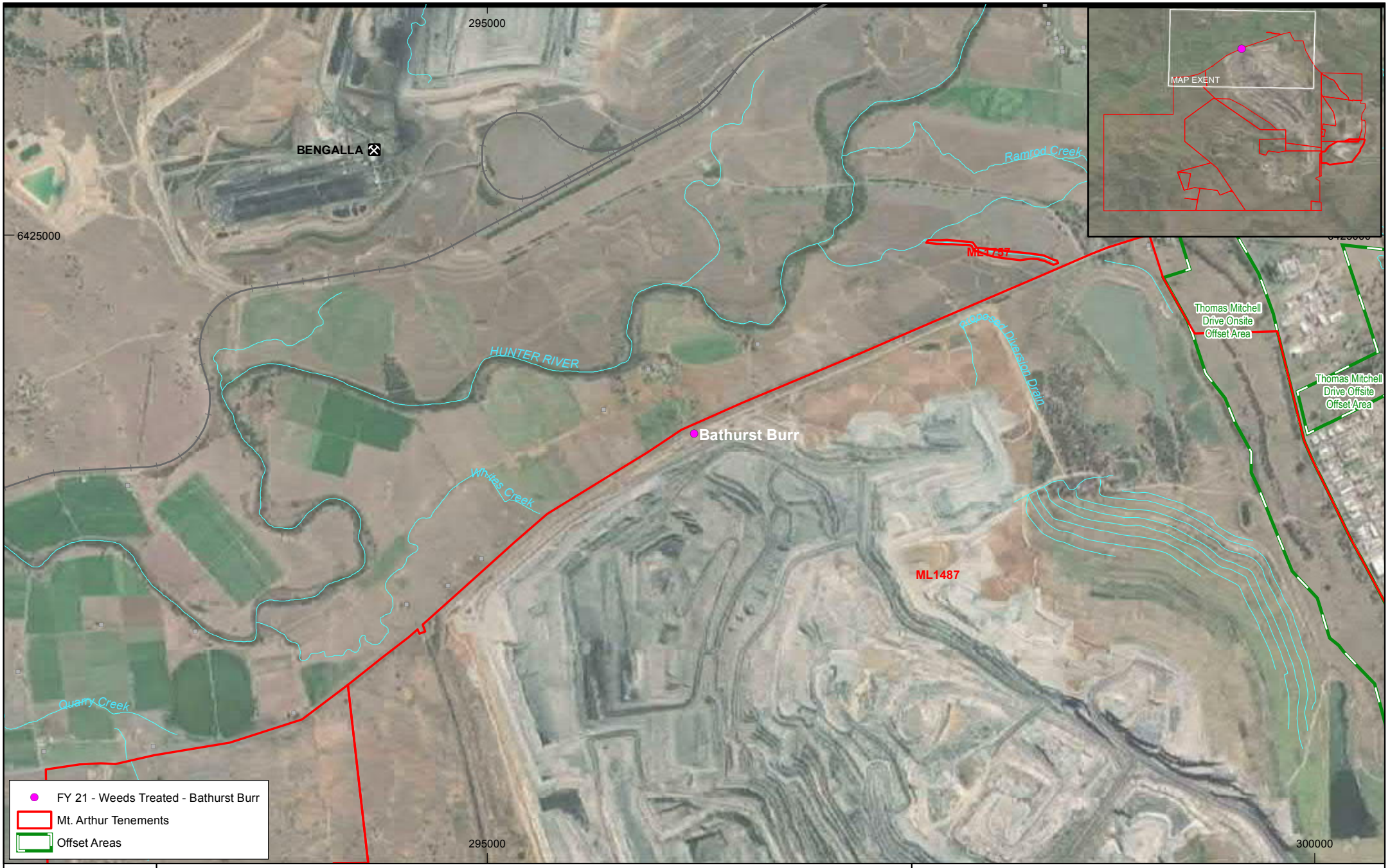
Geospatial Team
Brisbane

0 500 1,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - ACACIA SALINGA

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1c_Acacia_Salinga	



BHP
Geospatial Team
Brisbane

0 500 1,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - BATHURST BURR

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1d_Bathurst_Burr	

BHP
Geospatial Team
Brisbane

0 500 1,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - COBBLERS PEG

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1e_Cobblers_Peg	

BHP

Geospatial Team
Brisbane

0 500 1,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - COTTON BUSH

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1f_Cotton_Bush	

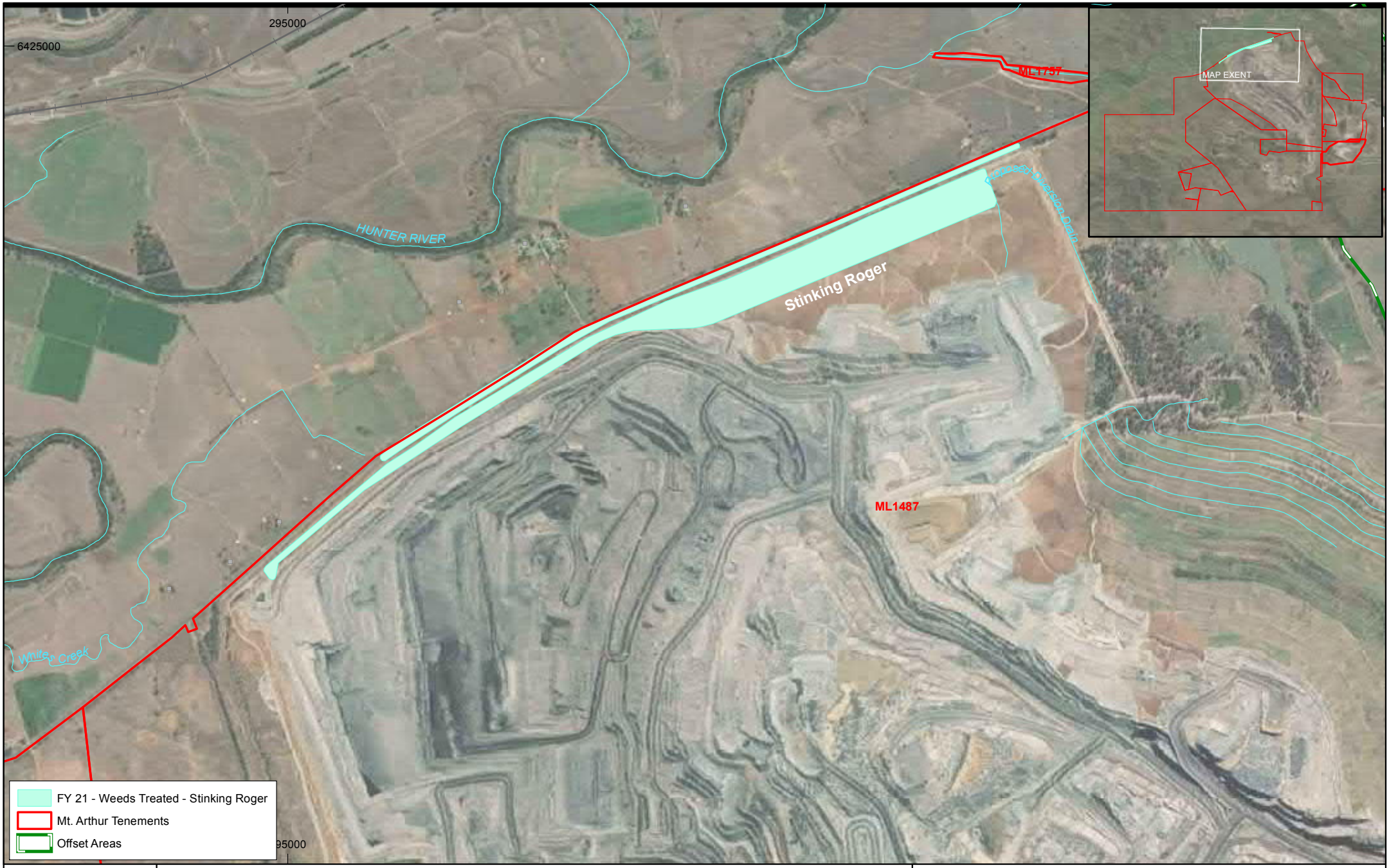
BHP
Geospatial Team
Brisbane

0 500 1,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - GALENIA

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1g_Galenia	



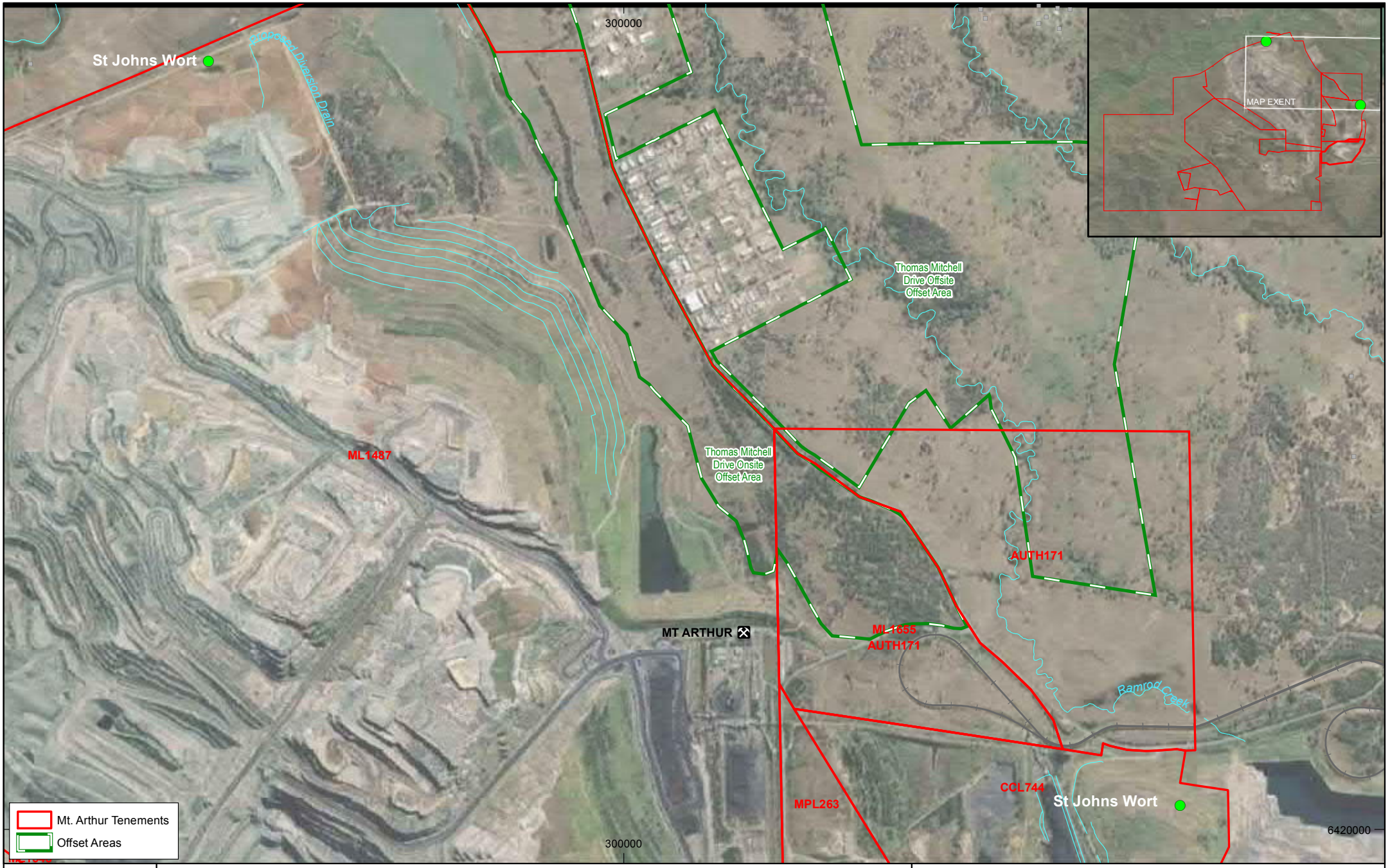
BHP
Geospatial Team
Brisbane

0 500 1,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - STINKING ROGER

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1g_Stinking_Roger	



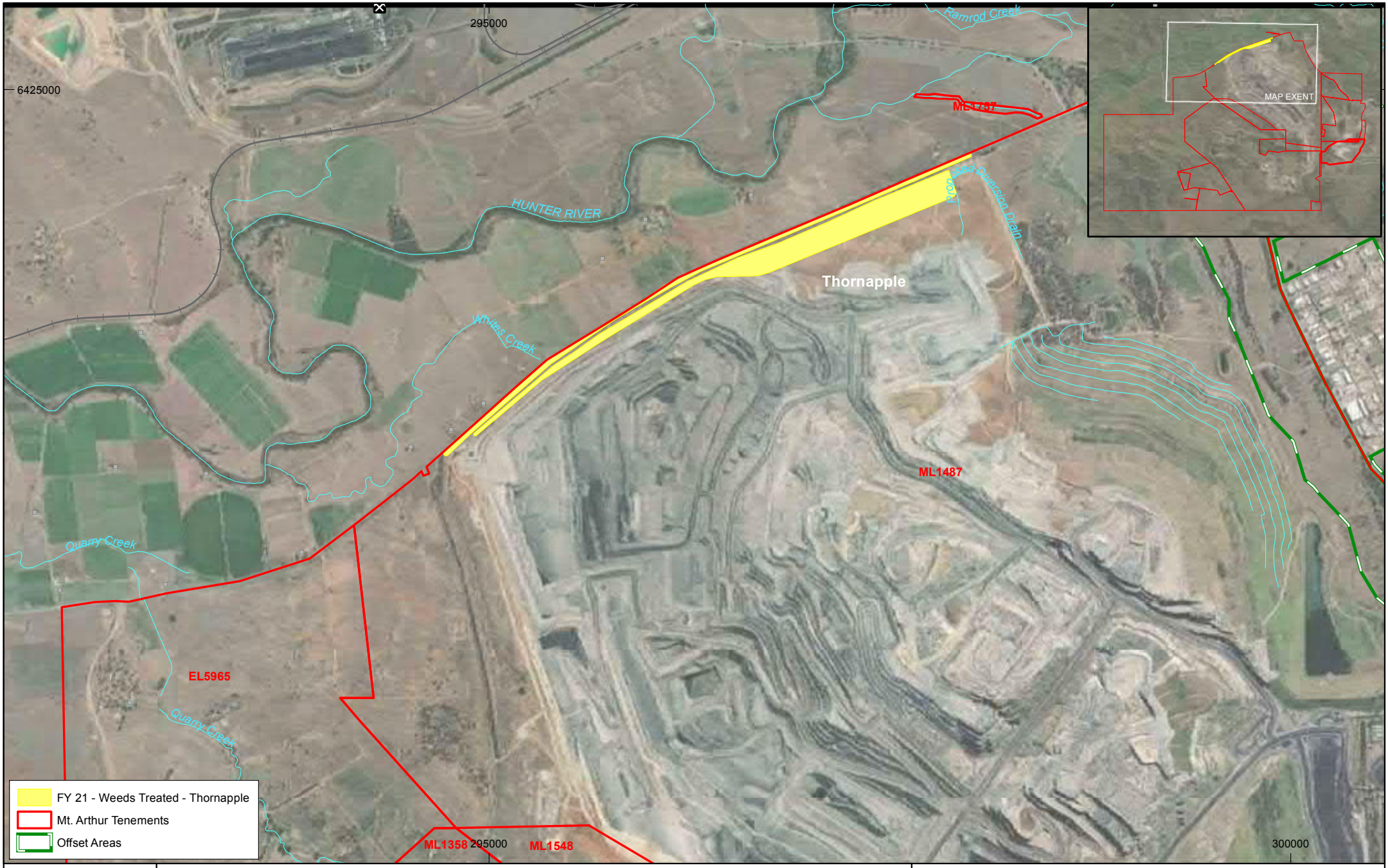
BHP
Geospatial Team
Brisbane

0 500 1,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - ST JOHNS WORT

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1_St_Johns_Wort	



BHP

Geospatial Team
Brisbane

0 500 1,000 m

Transverse Mercator Projection
GDA 1994 MGA Zone 56

MT. ARTHUR MINE
FY21 WEEDS TREATED - THORNAPPLE

Drawn: B. Lang	Date: 6/09/2021	Revision: 1
Checked: J. Deacon	Filename: 20210903-1j_Thornapple	