MANGOOLA
OPEN CUT

GLENCORE

Aerial view of 2017 south pit rehabilitation

Mangoola Open Cut

2020 Annual Review

1 January 2020 to 31 December 2020

Main pit 2016 rehabilitation wetland area

Aerial view of south pit active mining and progressive rehabilitation

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Mangoola Coal Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.30112-R01-v1.0	26 March 2021	Samantha Hayes	Renae Gifford	Renae Gifford

EXECUTIVE SUMMARY

Name of Operation	Mangoola Open Cut
Name of Operator	Mangoola Coal Operations Pty Ltd
Project Approval #	PA 06_0014
Name of holder of Project Approval	Mangoola Coal Operations Pty Ltd
Mining lease #	ML 1626, ML 1747, AL 9, EL 5552
Name of holder of mining lease	Mangoola Coal Operations Pty Ltd
Water licence #	Various (refer Section 3.3)
Name of holder of water licence	Mangoola Coal Operations Pty Ltd
MOP start date	1 January 2019
MOP end date	31 March 2021
Annual Review start date	1 January 2020
Annual Review end date	31 December 2020

I, Nathan Lane, certify that this audit report is a true and accurate record of the compliance status of Mangoola Open Cut for the period 1 January 2020 to 31 December 2020 and that I am authorised to make this statement on behalf of Mangoola Open Cut.

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	Nathan Lane
Title of authorised reporting officer	Environment and Community Manager
Signature of authorised reporting officer	
Date	26 March 2021

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APPENDICES

1 Statement of Compliance

A summary of compliance at Mangoola Open Cut during 2020 is provided in **Table 1**.

Table 1 Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	Yes/No
PA 06_0014	No
EPL 12894	No
ML 1626	Yes
ML 1747	Yes
AL 9	Yes
EL 5552	Yes

A summary of the non-compliances during the reporting period have been summarised in **Table 2**. The non-compliances during the 2020 reporting period are discussed further in **Section 11**. The non-compliance categories are described in **Table 3**.

Table 2 Non-Compliances During 2020

Relevant Approval	Condition #	Condition Description Summary	Compliance Status	Comment	Where Addressed
PA 06_0014	Schedule 3, Condition 19	24h PM_{10} criterion of 50µg/m^3	Non-compliant	Exceedance of 50 µg/m^3 24h PM_{10} criteria at: • 2 December 2020 – D02-DC (57.2 µg/m^3) and D06-DC (55.9 µg/m^3) - DPIE reviewed the information presented in the report and was satisfied Mangoola Coal undertook reasonable and feasible mitigation measures to minimise dust emissions from the site on this day. • 24 December 2020 – D02-DC (61.9 µg/m^3) - DPIE reviewed the information presented in the report and was satisfied Mangoola Coal undertook reasonable and feasible mitigation measures to minimise dust emissions from the site on this day.	Section 6.2.2 and Section 11
EPL 12894	M2.2	Air Monitoring Requirements	Non-compliant	Between 17-21 March 2020, the monitoring unit malfunctioned at Monitoring Point 19 (D7-DC).	Section 6.2.3 and Section 11

Relevant Approval	Condition #	Condition Description Summary	Compliance Status	Comment	Where Addressed
PA 06_0014	Schedule 3, Condition 15	Blasting – Operating Conditions	Non-compliant	On 10 January 2020, a category 4B fume occurred, however this did not leave the site boundary and dissipated on-site. This was reported to DPIE. Correspondence received from DPIE on 12 February 2020 indicate they were satisfied with the fume rankings and investigation outcomes.	Section 6.4.3 and Section 11
PA 06_0014	Schedule 3, Condition 10	Blasting – Blasting Criteria	Non-compliant	On 4 March 2020 there was an exceedance of overpressure criteria. The blast was located in Main Pit West and recorded an overpressure result at BM07 (EPL monitoring point 21) of 120.9dB (exceedance of 120dB threshold). DPIE and EPA were notified.	Section 6.4.3 and Section 11
EPL 12894	Condition L4.2	Blasting			
PIRMP		Surface Water Discharge – Sandy Creek Farm Dam 1	Non-compliant	On 17 February 2020, Mangoola experienced a 5-10% AEP storm event. Due to the runoff exceeding the pumping and freeboard of the dams, water was discharged from site. The PIRMP was enacted in accordance with Section 147 of the POEO Act. DPIE and EPA were notified.	Section 7.4.3 and Section 11

Table 3 Compliance Status Categories

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	Non-compliance which does not result in any risk of environmental harm

2 Introduction

2.1 Mining Operations

Mangoola Open Cut (Mangoola) is owned and operated by Mangoola Coal Operations Pty Ltd which is a Glencore managed operation. Mangoola is located near Wybong, New South Wales (NSW), approximately 20 kilometres (km) west of Muswellbrook and approximately 10 km north of Denman in the Muswellbrook Local Government Area (LGA). A locality plan is presented in **Figure 1**. This Annual Review has been prepared for the 12-month reporting period of 1 January 2020 to 31 December 2020 (herein referred to as the reporting period).

Project Approval 06_0014 (PA 06_0014) was granted in June 2007 for the construction of an open cut coal mine and associated infrastructure in the Wybong area. The mine, then owned by Centennial Coal and known as the Anvil Hill Project, was approved to extract up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Since April 2014, Mangoola has been approved to extract up to 13.5 Mtpa ROM coal under PA 06_0014. The Site also operates a Coal Handling and Preparation Plant (CHPP) and Train Loading Facility.

This Annual Review has been prepared in accordance with the following:

- Schedule 5, Condition 6 of PA 06_0014;
- The NSW Government Annual Review Guideline (October 2015);
- Mining Lease 1626 (ML 1626);
- Mining Lease 1747 (ML 1747);
- 2019-2021 Mining Operations Plan (MOP); and
- Outcomes from the 2019 Annual Review feedback and inspection.

Copies of this Annual Review will be made available to the Department of Planning, Industry and Environment (DPIE), the Department of Regional NSW – Resources Regulator (Resources Regulator), the Biodiversity Conservation Division (BCD), the Natural Resources Access Regulator (NRAR) and the Environment Protection Authority (EPA). Copies and/or a link to the company website will also be provided to the members of the Mangoola Community Consultative Committee (CCC). A copy will also be made available on the Mangoola website in accordance with PA 06_0014 for any public person to access.

2.2 Mine Contacts

The relevant mine contacts for Mangoola are listed in **Table 4**.

Table 4 Mine Contacts

Contacts	Details
Operations Manager	Nick Slater
Environment and Community Manager	Nathan Lane
Address	PO Box 495 Muswellbrook NSW 2333
Phone Number	(02) 6549 5500
Fax Number	(02) 6549 5655
24 Hour Community Hotline	1800 014 339
Website	www.mangoolamine.com.au
General Enquiries Email	mangoolaenquiries@glencore.com.au

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Figure 1 - Regional context

Legend

- Major road
- Main road
- Watercourse
- Approved Mangoola Coal EPL and Disturbance Boundary
- NPWS reserve
- State Forest

3 Approvals

Operations at Mangoola are regulated by a range of leases, licences and approvals, which are summarised in the following sections.

3.1 Project Approval

PA 06_0014 (as modified) allows for the extraction, processing and transportation of up to 13.5 Mtpa for a period of up to 21 years from the granting of a Mining Lease. Mining Lease 1626 was granted on 20 November 2008, therefore PA 06_0014 expires in 2029. Eight modifications to PA 06_0014 have been approved, as detailed in **Table 5**.

Table 5 Mangoola PA 06_0014 and Modifications

Approval	Title	Date Granted	Expiry
06_0014	Original Approval	7 June 2007	20 November 2029
06_0014 Mod 1	Change to Road Access and Water Supply	22 July 2008	20 November 2029
06_0014 Mod 2	Relocate Water Supply Pipeline	23 June 2009	20 November 2029
06_0014 Mod 3	Relocate Mine Infrastructure Area	4 November 2009	20 November 2029
06_0014 Mod 4	Modify Approved Mine Plan	22 June 2012	20 November 2029
06_0014 Mod 5	Night-time Works	23 February 2010	20 November 2029
06_0014 Mod 6	Extraction Rate Increase	28 April 2014	20 November 2029
06_0014 Mod 7	Removal of Schedule 3, Condition 3 – Traffic Noise Criteria	22 August 2016	20 November 2029
06_0014 Mod 8	Update of Project Layout Plan	14 June 2017	20 November 2029

During 2020, the Mangoola Coal Continued Operations (MCCO) Project environmental assessment process continued. A Public Exhibition of the Environmental Impact Statement (EIS) was undertaken for the period 18 July 2019 to 28 August 2019 with 335 submissions received. A Response to Submission Report was furnished to DPIE in December 2019. Ongoing assessment continued in 2020 and possible determination of the project will continue throughout 2021.

The MCCO Project proposes the continuation of the existing mine to a new mining area immediately north of the existing operation. Further details can be viewed at the Mangoola Website via the 'Mangoola Coal Continued Operations Project' link on the home page.

3.2 Leases

Mangoola currently holds four active leases as shown in **Table 6**.

Table 6 Mangoola Leases

Title	Date Granted	Expiry
ML 1626	20 November 2008	20 November 2029
ML 1747	24 August 2016	5 December 2037
Exploration Lease 5552	8 May 2006	7 November 2019 (renewal lodged 1 November 2019)
Assessment Lease 9	8 November 2004	7 November 2019 (renewal lodged 1 November 2019)

3.3 Licences

3.3.1 Environment Protection Licence

Mangoola operates under Environment Protection Licence (EPL) 12894, with an anniversary date of 7 July. Monitoring results are reported to the EPA as part of the Mangoola EPL Annual Return and monitoring data is available on the Mangoola website. No variations of this licence were sought during the reporting period.

The environmental reporting and monitoring activities undertaken at Mangoola as required under EPL 12894, are discussed in **Section 6**.

3.3.2 Surface Water Licences

Mangoola currently holds the following surface water licences, as detailed in **Table 7.**

Table 7 Mangoola Surface Water Licences

WAL No.	DPI Water Reference Number	Share Allocation (ML)	Water Source	WAL No.	DPI Water Reference number	Share Allocation (ML)	Water Source
503	20AL200112	159	Hunter Regulated River	6571	20AL201639	111	Hunter Regulated River
644	20AL200456	3	Hunter Regulated River	6572	20AL201640	8	Hunter Regulated River
645	20AL200457	432	Hunter Regulated River	6576	20AL201869	600	Hunter Regulated River
691	20AL200578	50	Hunter Regulated River	6577	20AL201870	8	Hunter Regulated River
692	20AL200579	8	Hunter Regulated River	7291*	20AL202589	63	Wybong Creek
735	20AL200676	72	Hunter Regulated River	7292*	20AL202610	44	Wybong Creek
822	20AL200912	3	Hunter Regulated River	9061	20AL203156	6	Hunter Regulated River
823	20AL200913	310	Hunter Regulated River	9062	20AL203157	18	Hunter Regulated River
824	20AL200915	175	Hunter Regulated River	9343*	20AL203174	25	Wybong Creek

WAL No.	DPI Water Reference Number	Share Allocation (ML)	Water Source	WAL No.	DPI Water Reference number	Share Allocation (ML)	Water Source
830	20AL200933	306	Hunter Regulated River	9344*	20AL203206	164	Wybong Creek
831	20AL200934	8	Hunter Regulated River	9986	20AL203182	5	Hunter Regulated River
895	20AL201081	8	Hunter Regulated River	9987	20AL203183	82	Hunter Regulated River
897	20AL201085	55	Hunter Regulated River	9988	20AL203184	8	Hunter Regulated River
898	20AL201086	8	Hunter Regulated River	11085*	20AL203320	128	Wybong Creek
933	20AL201156	43	Hunter Regulated River	11216	20AL203370	86	Hunter Regulated River
1000	20AL201324	3	Hunter Regulated River	13083	20AL203454	100	Hunter Regulated River
1001	20AL201325	334	Hunter Regulated River	13228	20AL202591	0	Wybong Creek
1057	20AL201469	509	Hunter Regulated River	13229	20AL202592	77	Wybong Creek
1159	20AL201722	159	Hunter Regulated River	18689	20AL209242	15	Muswellbrook
1239	20AL203080	40	Hunter Regulated River	18701	20AL209198	28	Muswellbrook
1349	20AL202949	8	Hunter Regulated River	18712	20AL209241	5	Muswellbrook
1387	20AL202878	40	Hunter Regulated River	20343	20AL204331	48	Wybong Creek
6260*	20AL202522	36	Wybong Creek	37027*	20AL213134	30	Wybong Creek
6261	20AL202524	1	Wybong Creek	37028*	20AL213135	96	Wybong Creek
6262*	20AL202525	8	Wybong Creek	6294*	20AL202631	39	Wybong Creek
6264*	20AL202531	30	Wybong Creek	6296*	20AL202639	86	Wybong Creek
6272*	20AL202554	50	Wybong Creek	6298*	20AL202643	39	Wybong Creek
6275	20AL202561	5	Wybong Creek	6300	20AL202647	5	Wybong Creek
6276*	20AL202562	12	Wybong Creek	6304	20CA202655	5	Wybong Creek
6278*	20AL202569	117	Wybong Creek	6305	20CA202656	74	Wybong Creek
6306*	20AL202658	52	Wybong Creek	7495	20AL202699	27	Wybong Creek

**WAL covered under water use approval 20MW065001 (Miscellaneous Works Approval for licence of harvestable rights).*

3.3.3 Groundwater Licences

Mangoola currently holds the following groundwater licences shown in **Table 8**.

Table 8 Mangoola Groundwater Licences

WAL No.	Works Approval No.	Share Allocation (ML)	Type of Works	WAL No.	Works Approval No.	Share Allocation (ML)	Type of Works
6316	20CA202449	175	Well	-	20BL172827	0	Test bore
6317	20CA202451	19	Well	-	20BL171778	0	Test bore
6322	20CA202463	5	Well	-	20BL171860	0	Test bore
6327	20CA202482	30	Well	-	20BL171861	0	Test bore
18068	20CA208143	5	Bore	-	20BL171862	0	Test bore
18136	20CA208033	596	Bore	-	20BL171864	0	Test bore
18170	20CA207847	219	Well	-	20BL171865	0	Test bore
18214	20CA208151	218	Well	-	20BL171867	0	Test bore
18219	20CA208171	5	Bore	-	20BL172567	0	Test bore
18232	20CA208179	5	Bore	-	20BL172568	0	Test bore
18690	20CA209155	10	Bore/Well	-	20BL172569	0	Test bore
18695	20CA209151	131	Well	-	20BL172570	0	Test bore
18696	20CA209157	53	Well	-	20BL172573	0	Test bore
18701	20CA209199	28	Bore	-	20BL172788	0	Test bore
18718	20CA209147	151	Well/Bore	-	20BL172789	0	Test bore
30247	20CA212344	98	Well	-	20BL172790	0	Test bore
41561	20BL172598	700	Excavation	-	20BL172806	0	Test bore
6325	20CA202475	0	Well	-	20BL172807	0	Test bore
-	20WA216010	1	Bore	-	20BL172808	0	Test bore
-	20WA207550	0	Bore	-	20BL172809	0	Test bore
-	20WA214821	0	Bore	-	20BL172811	0	Test bore
-	20WA207593	0	Well	-	20BL172812	0	Test bore
-	20WA207594	0	Well	-	20BL172813	0	Test bore
-	20WA209128	0	Bore	-	20BL172814	0	Test bore
-	20WA215330	0	Bore	-	20BL168135	0	Test bore
-	20WA207651	0	Bore	-	20BL168414	0	Test bore
-	20WA215537	0	Bore	-	20BL168696	0	Test bore
-	20WA207655	0	Well	-	20BL168743	0	Test bore
-	20WA207668	0	Well	-	20WA216315	0	Bore
-	20WA209113	0	Bore	-	20WA207700	0	Well
-	20WA212410	0	Bore	-	20WA209139	0	Spear points

WAL No.	Works Approval No.	Share Allocation (ML)	Type of Works	WAL No.	Works Approval No.	Share Allocation (ML)	Type of Works
-	20WA209136	0	Bore	-	20WA207718	0	Well
-	20WA209112	0	Bore	-	20WA215573	0	Well
-	20WA215016	0	Bore	-	20WA215826	0	Well
-	20WA215082	0	Bore	-	20BL167003	0	Bore
-	20WA215502	0	Bore				

3.3.4 Radiation Licence

Mangoola holds Radiation Licence 5063445 which expires 28 April 2021. This annual licence was renewed during the reporting period.

3.3.5 Sewage Management System Licence

Mangoola Coal holds an approval to operate an onsite sewerage management system – license number WTA5/2010 which allows for the operation of a Sewage Management System in accordance with the requirements of the Muswellbrook Shire Council and the sites EPL 12894. The licence expires on 16 March 2021. All results required under EPL 12894 are published on the Mangoola Coal website.

3.4 Other Approvals

3.4.1 Mining Operations Plan (MOP)

The Mangoola Mining Operations Plan (MOP) was approved for a 1 year period on 18 December 2019. An extension of this MOP was subsequently received with approval to 31 March 2021. A comparison of 2020 rehabilitation and disturbance against the revised MOP predictions is provided in **Section 8.2**.

A new MOP will be furnished to the Department prior to 31 March 2021 to outline disturbance and rehabilitation schedules for future areas of approved mine progression.

3.4.2 Compliance with MOD 6 EIS Predictions

In accordance with the Annual Review Guideline (October 2015), this Annual Review compares the predictions made in the PA 06_0014 Modification 6 EIS with the environmental monitoring results from the 2020 reporting period. **Table 9** details the location of these prediction comparisons.

Table 9 PA 06_0014 MOD 6 Comparison Against Predictions

Environmental Aspect	Section Reference
Air Quality	Section 6.2.2.2
Noise	Section 6.3.2.2
Blasting	Section 6.4.2.2
Surface Water	Section 7.4.2.2
Groundwater	Section 7.5.2.2

4 Operations During the Reporting Period

4.1 Mining Operations

4.1.1 Overview

Open cut mining continued at Mangoola during the reporting period. Truck and shovel mining methods are used to handle overburden and coal, following pre-strip and drilling and blasting activities. Product coal is loaded and transported to market via the rail loop connected to the Muswellbrook – Ulan railway. The mine operates 24 hours a day, seven days a week, and currently employs 378 full time equivalent employees (with approval for 450 employees). The general site layout is presented in **Figure 2**. Activities undertaken during the reporting period included open cut mining, coal processing and coal transport, which are detailed in the following sections.

4.1.2 Exploration

No exploration was undertaken during 2020.

4.1.3 Land Preparation

Land clearing is undertaken in accordance with the Mangoola Environmental Management System. Areas are assessed prior to clearing to minimise potential ecological, water management, sediment and erosion and cultural heritage impacts in accordance with the pre-clearing requirements.

4.1.4 Mining

Open cut mining operations continued during the reporting period, with 9.37 Million tonnes (Mt) of ROM coal being extracted. Mining operations during the reporting period continued in the Main Pit and South Pit. Approximately 34.41 million bank cubic metres (BCM) of overburden were moved. The 2020 production summary is presented in **Table 10**.

Table 10 2020 Production Summary

Material	Approved Limit (PA 06_0014)	2020 MOP Prediction	2019 Reporting Period (Actual)	2020 Reporting Period (Actual)	2021 Reporting Period (Forecast)
Waste Rock/ Overburden (BCM)	No limit	39,140,910	37,832,133	34,405,258	36,426,715
ROM Coal (t)	13,500,000	10,805,777	12,920,522	9,373,538	10,294,717
Coarse reject (t)	No limit	2,129,345	1,250,014	981,760	939,176
Fine reject (Tailings) (t)	No limit		1,391,110	958,751	902,345
Saleable product (t)	No limit	8,676,432	10,163,802	7,003,610	8,453,196

** The MOP predicted a combined reject volume rather than separating out into coarse and fine rejects.*

ROM production in 2020 was below the MOP predictions by approximately 1.43 Mt due to the COVID-19 pandemic and the market conditions, however this was within the PA 06_0014 approval limit. During 2020, the mining fleet remained unchanged following the conversion of Excavator 101 (Tier 1) to backhoe configuration in 2019. No gravel crushing operations occurred on site during 2020.

Mangoola Coal

Figure 2 - Site Layout

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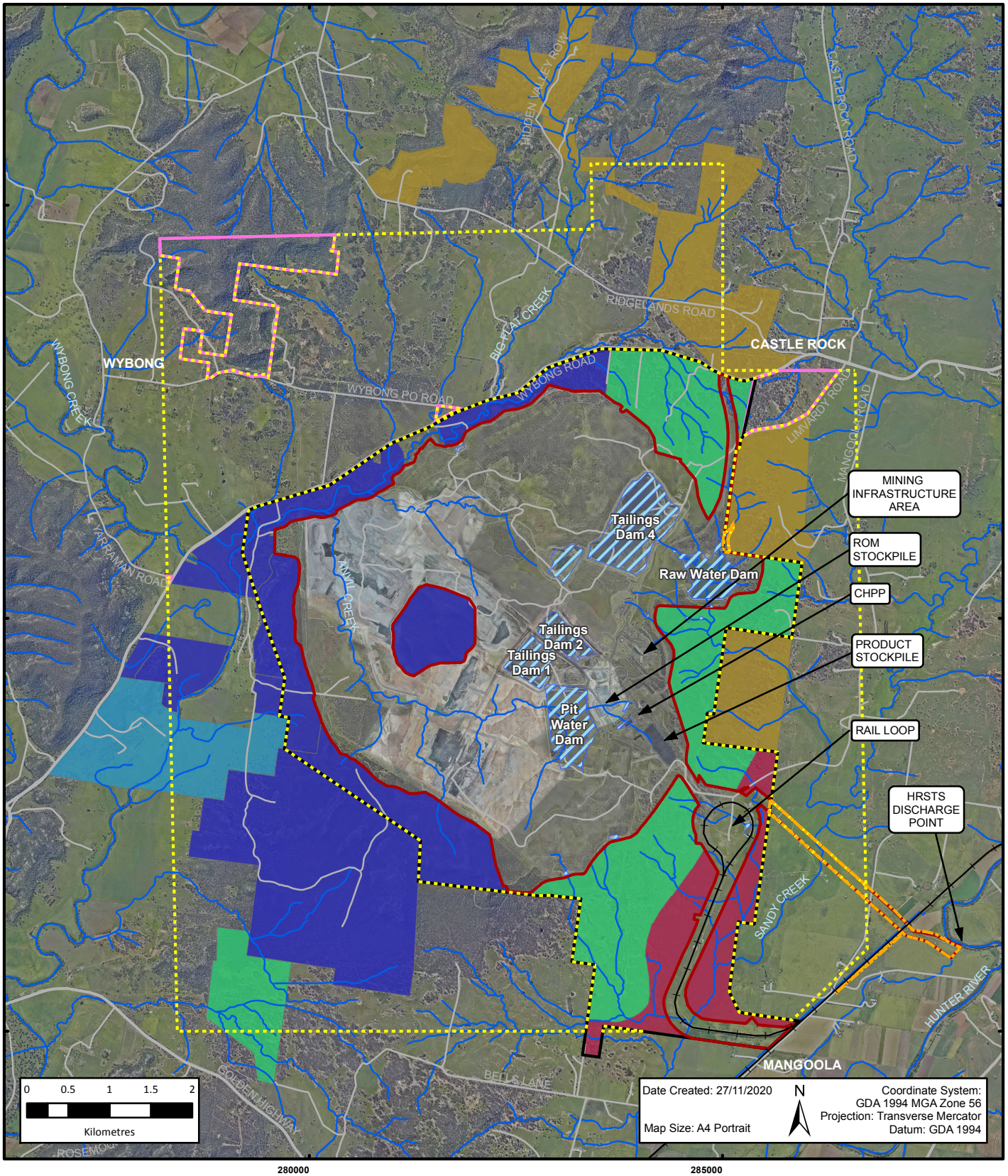


Ref: D:\OperationsGIS\Mangoola GIS\03.MapDocuments\16 AR\20202020201127_SiteLayout_V01.mxd

Legend

- Approved Mangoola Coal EPL and Disturbance Boundary
- Mining Lease 1626
- ML 1747
- EL5552
- Assesment Lease 9
- Dam locations
- Watercourse
- Railway

Biodiversity Offset Areas

- Aboriginal Cultural Heritage Offset Area
- Habitat Enhancement Offset Area
- Northern Corridor
- Southern Offset Area
- Western Corridor

4.2 Other Operations

4.2.1 Coal Processing

During the reporting period approximately 7 Mt of product coal, 0.96 Mt of tailings, and 0.98 Mt of coarse rejects were produced from the CHPP. The CHPP washed or bypassed all coal produced at Mangoola and Mangoola utilised Tailings Dam 4 for fine rejects disposal.

Tailings Dam 4 has sufficient capacity for Life-Of-Mine. No capping took place for Tailings Dam 1 or Tailings Dam 2 during 2020.

4.2.2 Coal Transport

During the reporting period there were 1,513 train movements from the Mangoola rail loader, which transported approximately 6.88 Mt of coal. Each train consists of two movements (one movement into the loop and one movement out of the loop). This equates to an average of 4.14 train movements generated by Mangoola on a daily basis, with a maximum of 13 train movements in one day. This is within the 20 train movements per day limit stipulated in Schedule 3, Condition 49 of PA 06_0014. No coal was transported other than by rail during the reporting period.

Annual train movements are included as **Appendix F**.

4.2.3 Construction

There were no construction works undertaken during 2020.

4.2.4 Waste Management

Waste at Mangoola is managed in accordance with the Environmental Management System (EMS) (incorporating waste reuse and recycling). The EMS has been developed in accordance with the requirements of the *Protection of the Environment Operations Act 1997* (POEO Act).

A licensed waste contractor undertakes the collection, transport and recording of waste material, with as much material as possible being recycled. During the reporting period 1,903 tonnes of waste was disposed of offsite with 1,671 tonnes of that being recycled (88% recycled). This represents an overall decrease in total waste disposal compared to 2019 (2,280 tonnes). This decrease was primarily a result of waste types associated with building demolitions (asbestos and concrete) not occurring in 2020 (ten houses were demolished in 2019).

The major waste streams during the reporting period were waste oil (772 tonnes), scrap steel (346 tonnes), mixed solid waste (196 tonnes) and effluent (382 tonnes).

A summary of waste disposal from 2015 to 2020 is presented in **Figure 3**.

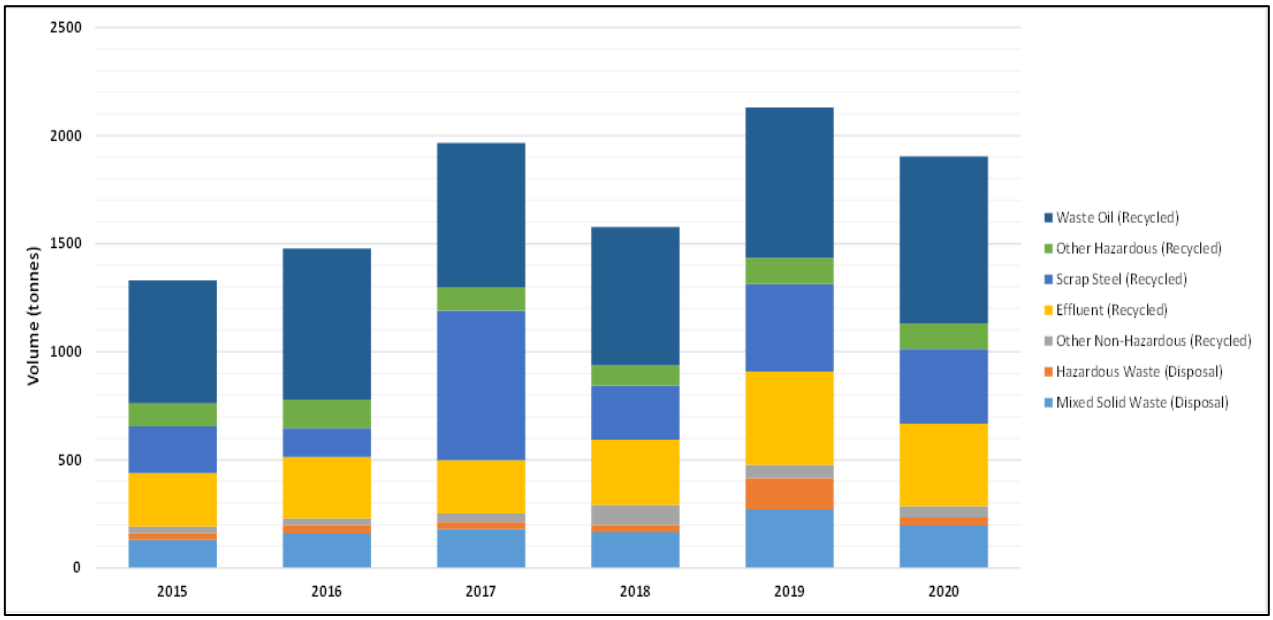


Figure 3 2015-2020 Waste Streams Generated

4.3 Next Reporting Period

4.3.1 Mining

During 2021, coal extraction will continue in the Main Pit and in South Pit. Forecast production for 2021 is 10.3 Mt of ROM coal and 8.5 Mt of product coal. Mining in 2021 will remain the same as 2020 with the same mining equipment, personnel and mining techniques to be utilised in-pit.

Both Main and South Pit will continue progressing in line with the mine plan (and MOP) with rehabilitation expected to reach MOP predictions.

4.3.2 Exploration

No exploration activities within AL9 are currently planned for the next reporting period.

4.3.3 Construction

There is no planned construction for 2021 with regards to the existing approved operation. Should the MCCO Project be approved, construction will commence in line with any approval granted.

4.3.4 Tailings Disposal

During 2021, tailings will be disposed of in Tailings Dam 4, which has sufficient capacity for Life-Of-Mine.

5 Actions Required From Previous Annual Review

Mangoola received a letter from the DPIE on 11 June 2020, stating the Mangoola Annual Review 2019 was found to satisfy the requirements of Condition 6, Schedule 5 of PA 06_0014 (as modified).

No other correspondence was received from other government departments regarding the 2019 Annual Review.

The follow up actions to the commitments made in the 2019 Annual Review are summarised in **Table 11**.

Table 11 Actions Required From 2019 Annual Review

Action Required from Previous Annual Review	Due Date	Action Taken by Mangoola	Where Discussed
A new MOP was approved on the 20 December 2019 for the period of 2020 calendar year with revision to occur during 2020 for further years.	September 2020	The Mangoola MOP was approved for a one year period on 18 December 2019. An extension of this MOP was subsequently received with approval to 31 March 2021.	Section 3.4.1
Complete actions required from IEA undertaken 2019 that are required to be completed in 2020.	Various – As per audit action plan available on company website	Actions completed as per **Table 44**.	Section 10
In response to high levels of complaints in 2019, additional attended noise monitoring will again be undertaken to the north-west of operations through the winter period 2020 to ensure site operates within approved noise criteria.	June to August 2020	Additional attended noise monitoring was conducted at four additional locations to the north west of operations throughout the winter period in 2020. No non-compliances were measured throughout this additional monitoring program.	Section 6.3.3
In response to changes to increasing noise complaints north west the operation, review the continuous noise monitoring network to determine whether continuous noise monitoring units can be relocated to provide better coverage north west of mining operations.	June 2020	A review of the real-time noise monitoring network was completed in early 2020 resulting in an additional directional noise monitor being relocated to the north-west of operations in April 2020. This improved noise alarm and monitoring capabilities.	Section 6.3.3
Supplementary plantings of canopy and shrub species will be undertaken based on the BOMP.	When the drought has broken.	Infill planting of 7,956 canopy and mid-storey plants was undertaken during June and July 2020 to further enhance canopy cover and floristic diversity across the rehabilitation areas at the site. These plantings represent specific targeted actions as recommended in rehabilitation walkover and ecological monitoring inspections.	Section 6.6.2.8

Action Required from Previous Annual Review	Due Date	Action Taken by Mangoola	Where Discussed
Continuation of the rehabilitation research and trials for threatened terrestrial orchid translocation, continued development to increase the seed mix species diversity, particularly in the ground cover and shrub layer, the establishment of additional aquatic habitat features, and a focus on achieving the rehabilitation targets as outlined in the approved MOP.	31 December 2020	The threatened terrestrial orchid translocation and monitoring program continued and new recruitment of 29 *Diuris tricolor* was recorded during 2020. Seed mix diversity continues to improve with additional species added to most vegetation community mixes during the year. Additional frog ponds/aquatic habitat were developed in 2020 rehabilitation areas and seeded with appropriate wetland fringing vegetation mixes. The MOP target of 100ha of rehabilitation was achieved during the year.	Section 8.5

6 Environmental Performance

6.1 Meteorology

In accordance with Schedule 3, Condition 24 of PA 06_0014, and Condition P1.1 of EPL 12894, Mangoola continued to operate the Weather Station North (WSN) meteorological station throughout the reporting period. Additionally, the Weather Station South (WSS) meteorological station continued to operate, as required under EPL 12894. The WSN monitor is located to the north of the site, along Wybong Road, and the WSS monitor is located to the south of the site at the CHPP (refer **Figure 7**). Meteorological data recorded during the reporting period is available on the Mangoola website.

2020 was a substantially wetter year with drought conditions broken across much of NSW, as can be seen in **Figure 5**, a map produced by the Bureau of Meteorology (BOM) which shows national rainfall deficiencies from 1 January 2020 to 31 December 2020. Total annual rainfall for 2020 was 941 mm, which was more than double the rainfall in 2019 (399 mm). As shown in **Figure 4**, annual rainfall at WSN was lowest in November and highest in February 2020. Long term rainfall data is presented in **Appendix B**, which shows that rainfall at the site was the highest during 2020 since reporting began in 2010.

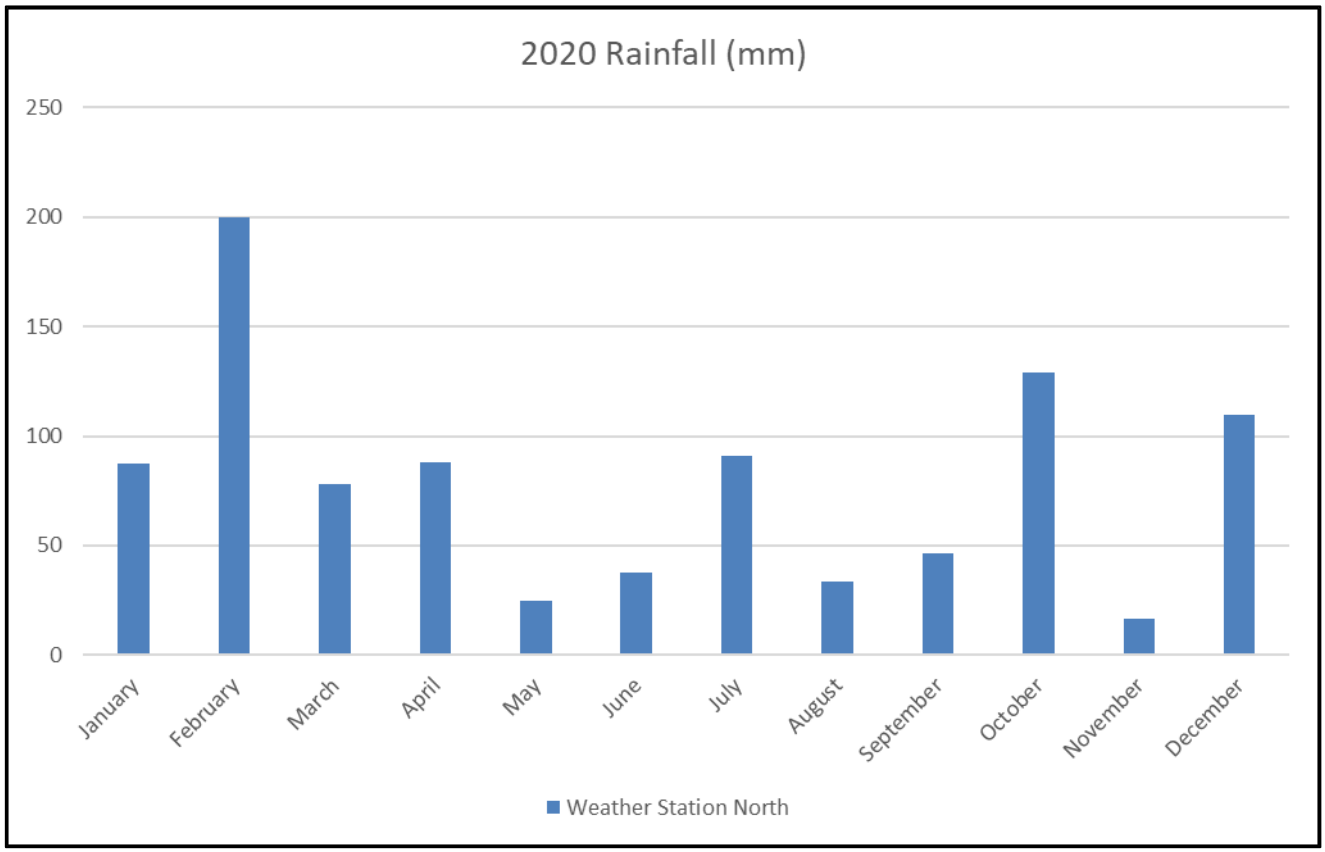
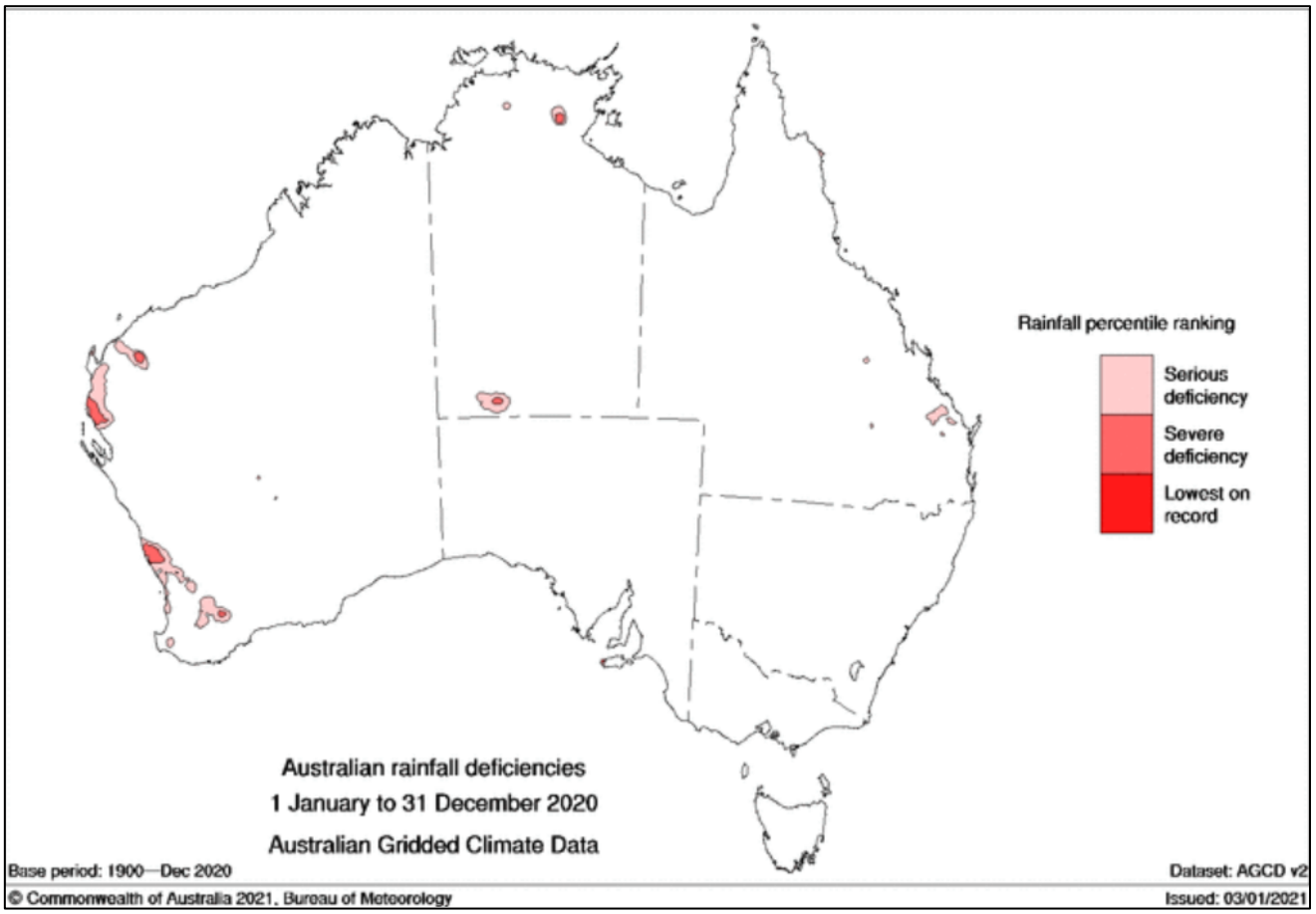


Figure 4 WSN 2020 Rainfall Data



Source: Commonwealth of Australia, BOM 2021

Figure 5 BOM Rainfall Deficiency: 12 months (2020)

As shown in **Figure 6**, the daily minimum and maximum 2 metre (m) above surface level temperatures ranged from -2.9°C to 44.4°C respectively, with an average daily maximum of 24.0°C, which is cooler than the 2019 daily average of 26.4°C. Humidity during 2020 ranged from 10.9% to 98.4%.

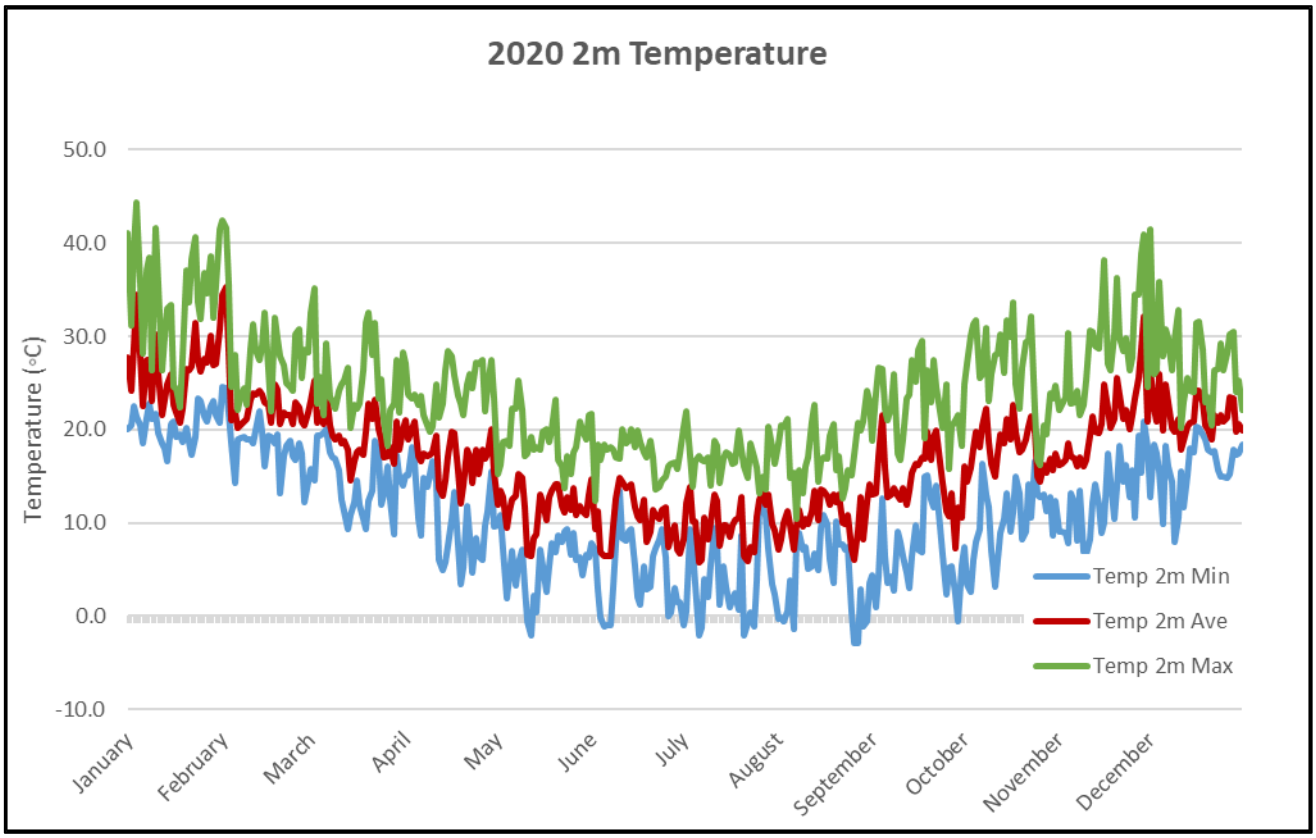


Figure 6 WSN 2020 2m Temperature Data

6.2 Air Quality

6.2.1 Environmental Management

Mangoola operates in accordance with the approved Air Quality Management Plan (AQMP), which is available on the Mangoola website. The AQMP was approved in 2020 and describes air quality management and monitoring requirements associated with operating the mine. Mangoola operated the following equipment (as shown in **Figure 7**) for the measurement of air quality in the reporting period:

- Eighteen depositional dust gauges known as DG01-DG04, DG06-DG07, DG09-DG20 which are monitored monthly;
- Five Tapered Element Oscillating Microbalance (TEOM) dust monitors continuously measuring PM_{10} known as D02-DC to D06-DC;
- Two PM_{10} E-Sampler Particulate Monitors continuously measuring PM_{10} known as D7-DC and D8-DC (EPL Monitoring Points 19 and 20);
- Three High Volume Air Sampler (HVAS) dust monitors measuring Total Suspended Particulates (TSP) over one 24-hour period every six days, known as D02-TSP to D04-TSP; and
- Four HVAS dust monitors measuring PM10 over one 24-hour period every six days, known as D01-PM_{10}, D05-PM_{10}, D06-PM_{10} and D07-PM_{10}.

PA 06_0014 stipulates the criteria for PM_{10}, TSP and deposited dust, as presented in **Table 12**.

Table 12 PA 06_0014 Air Quality Criteria

Pollutant	Averaging Period	Criterion[4]
Long Term Impact Assessment Criteria for Particulate Matter		
TSP	Annual Average	[1] 90 µg/m^3
PM_{10}	Annual Average	[1] 30 µg/m^3
Short Term Impact Assessment Criteria for Particulate Matter		
PM_{10}	24-hour Average	[1] 50 µg/m^3
Long Term Impact Assessment Criteria for Deposited Dust		
Deposited Dust[3]	Annual Average	[1] 4 g/m^2/month (maximum total deposited dust level) [2] 2 g/m^2/month (maximum increase in deposited dust level)

1 – Incremental impact (i.e. incremental increase in concentrations due to the development on its own;

2 – Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations sure to all other sources);

3 – Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method; and

4 – Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

Mangoola currently implements a Dust Management Trigger Action Response Plan (TARP) developed in line with the *Dust Assessment Handbook* (NSW EPA 2019).

In addition, Mangoola also implements key operational controls as described in Section 3.2 in the AQMP. These controls include, but are not limited to, predictive meteorological forecasting, water carts, chemical dust suppressants, progressive rehabilitation and dust suppression sprays on stockpiles and conveyors.

Mangoola implements best practice for the management of air quality including the implementation of reasonable and feasible measures to minimise/mitigate offsite odours. Mangoola will continue to implement all controls in the Spontaneous Combustion Management Plan, Blast Fume Management Plan and the AQMP. There were no incidents regarding odour in the 2020 reporting period.

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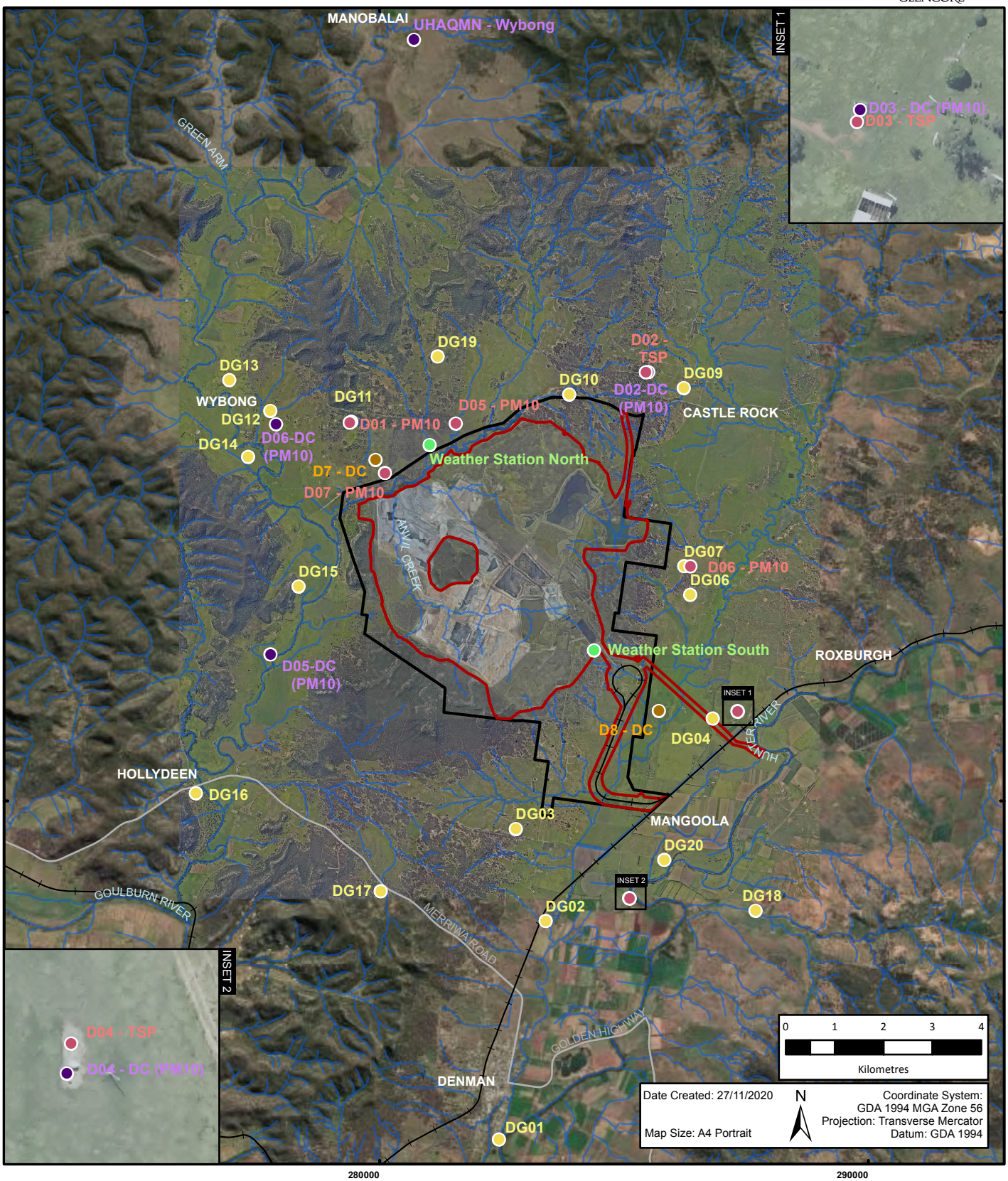
Figure 7 - Air Quality Monitoring Locations



Ref: D:\OperationsGIS\Mangoola GIS\03.MapDocuments\16 AR\2020\20201127_AQ_Monitoring.mxd

Legend

- Approved Mangoola Coal EPL and Disturbance Boundary
- Mining Lease 1626
- Major road
- Watercourse
- Depositional dust gauge
- Esampler
- HVAS
- Meteorological monitoring locations
- TEOM

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DATA SOURCE

6.2.2 Environmental Monitoring Results

6.2.2.1 Results from the Reporting Period

Depositional Dust Gauges

Depositional dust gauge data collected during the reporting period is available on the Mangoola website and is summarised in **Table 13**. The data presented is corrected for contamination of samples (by bird droppings or insects) and presents annual average deposition rate of insoluble solids as g/m^2/month.

Table 13 2020 Depositional Dust Gauge Results (Insoluble Matter)

Gauge	Location Description	No. Of Samples Collected	No. of valid samples	Background level (g/m²/month)	Annual Average^ (g/m²/month)
DG01	Cnr Babbington and Palace St	12	12	1.2	1.7
DG02	Mangoola Rd	12	11 – 1 x contaminated (insects, bird droppings, high combustible matter)	1.0	2.9
DG03	Mangoola Rd	12	12	0.9	1.7
DG04	Mangoola Rd	12	11 – 1 x contaminated (insects)	1.8	2.2
DG06	Mangoola Rd	12	8 – 4 x contaminated (bird droppings, insects, high organic matter)	1.7	2.7
DG07	Mangoola Rd	12	12	1.6	2.0
DG09	Castlerock Rd	12	12	1.3	1.8
DG10	Wybong Rd	12	11 – 1 x contaminated (insects)	1.7	2.2
DG11*	Wybong Post Office Rd	12	12	1.3	2.2
DG12	Wybong Post Office Rd	12	12	1.4	2.1
DG13	Yarraman Rd	12	12	0.9	2.1
DG14	Yarraman Rd	12	12	1.4	2.0
DG15	Wybong Rd	12	12	1.0	2.3
DG16	Golden Highway	12	12	0.9	2.0
DG17	Golden Highway	12	11 – 1 x contaminated (insects)	0.7	2.1
DG18	Denman Rd	12	9 – 3 x contaminated (insects, bird droppings, high combustible matter)	1.6	2.2
DG19	Ridgelands Rd	12	12	1.1	2.0
DG20	Bells Lane East	12	12	1.2	2.0

^ – Depositional Dust Criteria 4g/m^2/month Max Annual Average; and

** – Represents management monitoring point (not used for compliance purposes).*

During 2020, the annual average dust deposition did not exceed 4 g/m^2/month at any monitoring locations. This is consistent with the results for 2019 and was helped by significantly higher rainfall throughout 2020. Additionally, the annual average results did not exceed background levels by more than 2 g/m^2/month at any monitor.

TEOM (PM_{10})

TEOM results for PM_{10} concentrations are available on the Mangoola website and are summarised in **Table 14**. The table excludes all 'extraordinary events' results as per Note 'd' of Schedule 3, Condition 19 of PA 06_0014.

Table 14 2020 PM_{10} 24-hr Average Results

Gauge	Location Description	Minimum (µg/m^3)	Annual Average# (µg/m^3)	Maximum (µg/m3)^	Mangoola contribution (µg/m^3)
D02-DC	96 Ridgelands Rd	3.2	12.3	61.9	1.4
D03-DC	830 Mangoola Rd	3.6	17.2	48.3	-
D04-DC	22 Bells Lane	0.0	13.6	45.3	-
D05-DC	2909 Wybong Rd	0.2	10.5	43.8	-
D06-DC	393 Wybong PO Rd	3.2	14.6	55.9	7.8
D7-DC*	Wybong Rd	0.0	8.7	57.9	-
D8-DC*	CHPP	0.1	11.9	71.8	-

** 'Early warning' unit which represents management monitoring point (not used for compliance purposes as it is not representative of private receptors);*
 # PM_{10} Annual Average Criteria 30 µg/m^3; and
^PM_{10} 24h Max Criteria 50 µg/m^3.

There were no exceedances of the 30 µg/m^3 annual average at any of the monitoring locations throughout the reporting period.

There were numerous reportable exceedances of the 24hr averaging period (PM_{10} criterion) early during 2020 due to ongoing bushfires and dry, dusty conditions (with the state still in drought) prior to the wettest month of February. The majority of these were determined as being 'extraordinary events' by the DPIE and are discussed further in **Section 11**. There were also two instances in December where criteria was exceeded.

There were two reportable exceedances to the 24hr averaging period (PM_{10} criterion) during 2020 that were not deemed 'extraordinary events' by DPIE, including:

- 2 December 2020 – D02-DC (PM_{10}) was recorded as 57.2 µg/m^3 and D06-DC (PM_{10}) was recorded as 55.9 µg/m^3. As per PA 06_0014, DPIE were notified of the exceedance and an internal investigation commenced. A specialist consultant was engaged to prepare an assessment for DPIE. The assessment determined that Mangoola's contribution to the D02-DC and D06-DC monitors would have been less than or equal to 1.4 µg/m^3 and 7.8 µg/m^3, respectively. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. A follow-up request for more information was made by DPIE on 18 December 2020 and provided by Mangoola on 23 December 2020; and

- 24 December 2020 – D02-DC (PM_{10}) was recorded as 61.9 µg/m³. As per PA 06_0014, DPIE were notified of the exceedance and an internal investigation commenced. The investigation determined the peak dust levels were recorded between 20:00 – 22:50 on 24 December originated from upwind of the monitor and was caused by a nearby residence with a backyard bonfire. During this time, Mangoola was downwind of the monitor had ceased operations at 16:30 for the Christmas/Boxing Day period.

In both instance the Department was satisfied that reasonable and feasible dust control measures were implemented and no further action was required.

High Volume Air Sampler (HVAS) TSP and PM_{10}

HVAS results for TSP and PM_{10} concentrations are available on the Mangoola website and are summarised in **Table 15**. The table excludes all 'extraordinary events' results as per Note 'd' of Schedule 3, Condition 19 of PA 06_0014.

Table 15 2020 PM_{10} and TSP 24-hr Average Results

Monitoring Point	Minimum (µg/m³)	Annual Average (µg/m³)*	Maximum (µg/m³)**
D02-TSP#	0	34.5	119
D03-TSP#	7	42.1	124
D04-TSP#	1	32.9	121
D01-PM_{10}^	0	13.3	42
D05-PM_{10}^#	0	11.5	34
D06-PM_{10}^	0	15.6	43
D07-PM_{10}^	1	14.1	41

** PM_{10} Annual Average Criterion 30 µg/m³, TSP Annual Average Criterion 90 µg/m³;*
*** PM_{10} 24hr Criterion 50 µg/m³, no specified 24hr Criterion for TSP under PA 06_0014;*
^ Monitor located on Mine Owned Land; and
 # Representative of private receptors.

There were no exceedances of the TSP annual average criteria of 90 µg/m³. There were no exceedances of the PM_{10} annual average of 30 µg/m³ during the reporting period. The PM_{10} 24hr maximum criteria of 50µg/m³ was exceeded on four days, however, all four were confirmed as extraordinary events by DPIE under note 'd' of Schedule 3, Condition 19 of PA 06_0014.

It is noted that these exceedances were recorded at monitors on mine-owned tenanted properties, with the purpose of informing tenants of any elevated results. Each exceedance was investigated and reported internally as an incident, as per the AQMP.

Odour

In accordance with PA 06_0014 and EPL 12894, no odour monitoring is required at Mangoola. Odour is not considered an issue at Mangoola and no complaints have been received during the reporting period in relation to odour.

6.2.2.2 Comparison with Predictions

The PA 06_0014 MOD 6 Environmental Assessment (EA) Air Quality Impact Assessment (Todoroski Air Sciences, 2013) predicted dust emissions for the project in years 2, 5, and 10. As MOD 6 was approved in 2014, a comparison of 2020 dust data against Year 5 data has been made in **Table 16**.

Table 16 Comparison of 2019 and 2020 Dust Emissions

Dust Monitor	Closest Privately Owned Residence	Year 5 Prediction (MOD 6)	2019 Annual Average	2020 Annual Average
Depositional Dust (g/m^2/month)				
DG01	214	1.7	1.9	1.7
DG02	200	1.7	2.7	2.9
DG03	121	1.7	1.6	1.7
DG04	125D, E and F	2.1	2.7	2.2
DG06	125B	2.3	2.6	2.7
DG07	198	2.4	2.5	2.0
DG09	111	1.9	1.8	1.8
DG10	111	1.9	1.9	2.2
DG11	81	2.0	1.9	2.2
DG12	134B	1.9	1.7	2.1
DG13	134A	1.9	1.6	2.1
DG14	130	2.0	1.9	2.0
DG15	83	2.0	2.3	2.3
DG16	265	1.7	1.7	2.0
DG17	147	1.7	1.9	2.1
DG18	201A, B and C	1.8	2.8	2.2
DG19	81	2.0	2.1	2.0
DG20	184	1.7	2.1	2.0
TEOM (PM_{10}) Monitoring Sites (µg/m^3)				
D02-DC	111	13.0	17.6	12.3
D03-DC	125D, E and F	23.0	21.0	17.2
D04-DC	184	11.0	20.6	13.6
D05-DC	176	9.0	15.6	10.5
D06-DC	110	14.0	20.0	14.6
E-Samplers (PM_{10}) (µg/m^3)				
D7-DC	130	15.0	13.3	8.7
D8-DC	125	23.0	15.6	11.9
HVAS (PM_{10} and TSP) Monitors (µg/m^3)				
D02-TSP	111	38.0	54.0	34.5

Dust Monitor	Closest Privately Owned Residence	Year 5 Prediction (MOD 6)	2019 Annual Average	2020 Annual Average
D03-TSP	125D, E and F	49.0	62.1	42.1
D04-TSP	184	33.0	49.9	32.9
D01-PM_{10}	110	14.0	18.3	13.3
D05-PM_{10}	157	10.0	18.3	11.5
D06-PM_{10}	130	15.0	22.9	15.6
D07-PM_{10}	190	26.0	23.3	14.1

As shown in **Table 16**, the 2020 annual averages for air quality were above the predicted levels in the Year 5 MOD 6 Assessment at 12 depositional dust monitors (DG02, DG04, DG06, DG10-DG13, DG15-DG18, DG20), three TEOMs (D04-DC, D05-DC, D06-DC) and two HVAS monitors (D05-PM_{10}, D06-PM_{10}).

6.2.2.3 Long Term Trend Analysis

A long term trend analysis of air quality monitoring results at Mangoola has been undertaken using data from July 2010 to December 2020 to identify any trends in the monitoring data over the life of the project. These graphs are presented in **Appendix C**. Depositional dust monitoring results have been variable since mining operations commenced in 2010, however results generally peaked in 2012 and declined to the lowest results during 2015-2016. Results were generally increasing during 2017-2019 which correlates with low rainfall and the ongoing drought conditions. Increased rainfall in 2020 has resulted in lower results than the previous few years (refer **Appendix B**).

The annual average HVAS TSP data has shown a gradual increase from 2010 to 2014, then declining in 2015, remaining low in 2016 and 2017, before rising again in 2018 and 2019. The results from 2018 and 2019 saw an increase in TSP results due to prolonged period of drought and increased bushfire activity. Due to increased rain in 2020, results have decreased to be consistent with results from 2015 to 2017.

The 24hr maximum TEOM data show seasonal peaks in the summer months. The annual average TEOM results have remained consistent with results from 2011 through to 2017 and results have been generally increasing during 2018-2019 which correlates with low rainfall and the ongoing drought conditions. Increased rain during 2020 has decreased results to be consistent with those from 2015 to 2017.

6.2.3 Key Performance and/or Management Issues

There were several exceedances of the 24hr PM_{10} maximum criteria during 2020. All except two of these exceedances were classified as extraordinary events by DPIE due to the extensive bushfires in NSW throughout late 2019 and continuing into early 2020. Where exceedances were recorded, DPIE was notified and specialist consultants were engaged, as required, to complete an independent report. As per Schedule 4, Condition 3 of PA 06_0014, unless an extraordinary event was declared by DPIE, applicable private landowners are provided with a copy of the NSW Health fact sheet “Mine Dust and You”. Further detail on non-compliances is provided in **Section 11**.

PM_{10} monitoring is required continuously in accordance with Condition M2.2 of EPL 12894. Between 17-21 March 2020, the monitoring unit malfunctioned at Monitoring Point 19 (D7-DC), as outlined in Table 4.3 of the approved AQMP. This was a non-compliance in accordance with Sampling Method – Special Method 1. Field maintenance was undertaken on the E-Sampler at the earliest time (19 March 2020) to attempt to repair, however the unit could not be fixed in the field and was taken offsite for repairs. A replacement unit was installed, however the stabilising period resulted in a loss of four days data. This was reported in the EPL 12894 Annual Return in 2020.

Continuous weather monitoring is required in accordance with Condition M4.1 of EPL 12894 and the approved AQMP. Any non-compliances relevant to data capture are not reported as incidents in accordance with the footnotes on Table 4.1, 4.2 and 4.3 of the AQMP which states 'units may not operate at this frequency 100% of the time due to maintenance and calibration requirements, power outages, prevention of access by landowner, no access due safety concerns of personnel and other external events outside the control of Mangoola Coal'. No loss of data aside from routine maintenance occurred during 2020 from Weather Station North (EPL Monitoring Point 5) or Weather Station South (EPL Monitoring Point 18).

There were two community complaints received by Mangoola during the reporting period relating to dust, which is a decrease from the eight community complaints received in the previous reporting period. Further detail on the complaints received in 2020 is provided in **Section 9.3**.

6.2.4 Proposed Improvements

The non-compliance with Condition M2.2 of EPL 12894 from October 2019 was reported in the EPL Annual Return in 2020.

6.3 Noise

6.3.1 Environmental Management

Mangoola operates in accordance with the approved Noise Management Plan (NMP) required under PA 06_0014 which is available on the Mangoola website. Noise monitoring consists of both attended and unattended monitoring to meet the requirements of PA 06_0014 and EPL 12894. Monitoring undertaken during the reporting period is summarised as follows:

- Attended monthly monitoring occurred at eight locations representative of privately-owned residences and the Anglican Church (NM4, NM6, NM8, NM10, NM13-16) as per the NMP; and
- Continuous unattended noise monitoring was undertaken at five permanent locations (NC02, NC03, NC05, NC06 and NC10). Three mobile units are also utilised and are relocated as needed. This monitoring is used for proactive and reactive management of day to day operations at Mangoola Open Cut, rather than a tool to monitor compliance.

The noise monitoring locations are illustrated in **Figure 8**.

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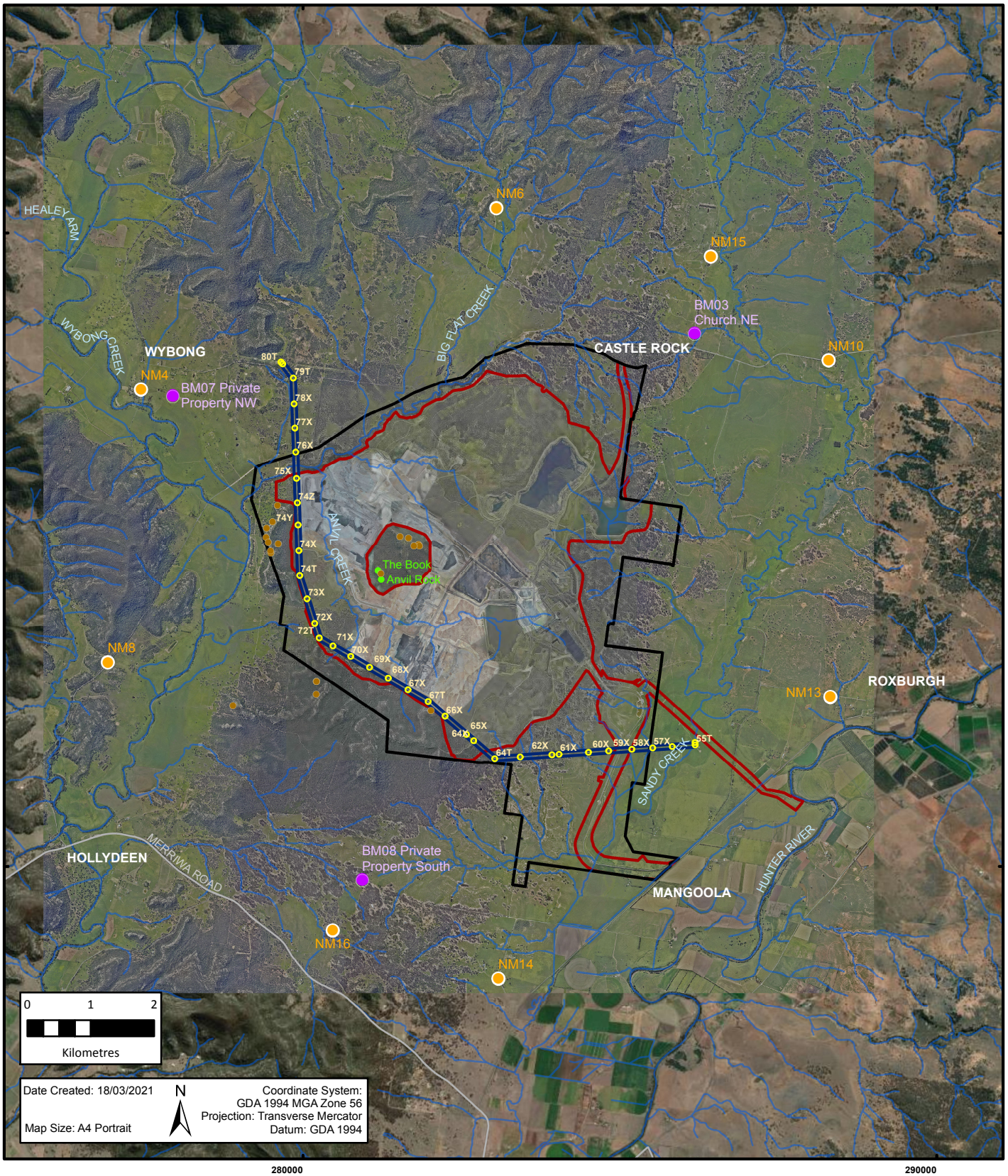
Figure 8 - Noise and Blast Monitoring Locations



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Legend

- Approved Mangoola Coal EPL and Disturbance Boundary
- Mining Lease 1626
- Blast Monitor - Private Receptors
- Monthly attended noise monitoring locations
- Rock Shelters
- Rock Structures
- 500kV electricity transmission line tower location
- 500kV electricity trnasmission line
- Major road
- Watercourse

Noise Impact Assessment Criteria

Mangoola's noise limits are provided in Table 2, Schedule 3, Condition 2 of PA 06_0014 and Condition L3.2 of the EPL and are provided in **Table 17** and **Table 18**.

Table 17 PA 06_0014 – Noise Impact Assessment Criteria

Land Number	Day $L_{Aeq(15\ minute)}$	Evening $L_{Aeq(15\ minute)}$	Night $L_{Aeq(15\ minute)}$	Sleep Disturbance $L_{A1(1minute)}$
132A	40	40	40	45
121, 132B	39	39	39	45
176	38	38	38	45
25, 66, 110, 130, 148, 154, 164#	37	37	37	45
106C, 111, 174A, 174B, 175*	36	36	36	45
109, 134A, 134B, 177, 190, 251	35	35	35	45
All other privately-owned land	35	35	35	45
Anglican Church, Castlerock Road	41	41	41	-

 # Property ID 164 entered a negotiated agreement with Mangoola taking effect from 13 August 2018 at which time noise criteria ceased; and
** Property ID 175 was purchased by Muswellbrook Coal on 29 October 2018 and by definition is no longer a privately owned property, therefore noise criteria are no longer applicable.*

Table 18 EPL 12894 – Noise Impact Assessment Criteria

Monitoring Location	EPL ID Number	EA Reference	Night $L_{Aeq(15\ minute)}$	Night $L_{A1(1minute)}$
NM4	23	109, 110, 130, 148, 134A, 134B	37	45
NM6	24	66	37	45
NM8	26	176, 106C	38	45
NM10	27	251	35	45
NM13	29	190	35	45
NM14	30	200	35	45
NM15	22	154, 174A, 174B, 175*	36	45
NM16^	34	177	35	45

** Property ID 175 was purchased by Muswellbrook Coal on 29 October 2018 and by definition is no longer a privately owned property, therefore noise criteria are no longer applicable.*

The approved NMP adopts eight attended noise monitoring (NM) locations that are representative of residences outlined in the PA and consistent with those provided in the EPL. Where several assessment locations are located in one NM catchment, a representative noise criteria has been adopted to ensure that the lowest (most stringent) criteria within the NM catchment can be achieved. Noise criteria only apply in specific meteorological conditions in accordance with the PA 06_0014 and EPL 12894. Additionally, in accordance with the Noise Policy for Industry (NPI) (EPA 2017), relevant modifying factor adjustments apply when assessing the characteristics of Mangoola's mine noise emissions.

Cumulative Noise Criteria

PA 06_0014 cumulative noise criteria for privately owned land as outlined in Schedule 3, Condition 5 are:

- $LA_{eq(11\ hour)}$ 50 dB(A) – Day;
- $LA_{eq(4\ hour)}$ 45 dB(A) – Evening; and
- $LA_{eq(9\ hour)}$ 40 dB(A) – Night.

All reasonable and feasible measures must be made to ensure that the noise generated by Mangoola combined with the noise generated by other mines does not exceed the cumulative noise criteria.

Management and Mitigation Measures

In addition to conducting noise monitoring, Mangoola continues to implement a number of mitigation measures with regard to the management of noise to minimise potential noise impact on nearby receivers, and to comply with the conditions of the Project Approval. Mitigation measures are completed as per the NMP and include, but are not limited to:

- Consideration of noise impacts during mine planning;
- Controlling mine noise at the source through the use of equipment with appropriate sound attenuation fitted, where practical;
- Maintaining mining equipment in a proper and efficient manner;
- Restricting, where possible, operations on outer dump faces or elevated dumps in sensitive areas during adverse weather conditions;
- Ensuring trucks operating during the night time are restricted to operational areas below the maximum elevation of the overburden emplacement areas; and
- Using real-time noise monitors that incorporate automatic alarms so that proactive control can be implemented.

6.3.2 Environmental Monitoring Results

6.3.2.1 Results from the Reporting Period

EPL 12894 and PA 06_0014 Noise Monitoring

During the reporting period monthly attended noise surveys were undertaken at eight representative locations in accordance with PA 06_0014, and EPL 12894 as described in **Section 6.3.1**. During 2020, Mangoola was compliant with all the noise criteria set out in PA 06_0014 and EPL 12894 (where the meteorological conditions were such that noise limits were applicable). A summary of results is presented in **Table 19** and **Table 20**. Where the meteorological conditions did not apply, these cells have been shaded grey.

All noise monitoring results are available in full on the Mangoola website.

Cumulative Noise Monitoring

During the reporting period cumulative mining noise was assessed based on the results of attended noise monitoring results at NM10, NM13 and NM15, in accordance with the NMP.

Cumulative mine noise contributions, including those from Mangoola, were below the noise limits at all monitoring locations during the reporting period.

6.3.2.2 Comparison with Predictions

The MOD 6 Noise and Vibration Assessment (EMM 2013) predicted the 10% $L_{Aeq(15minute)}$ and L_{Amax} operational noise levels at private receptors in Years 2, 5 and 10. As MOD 6 was approved in 2014, a comparison of 2020 noise data against the Year 5 data has been made in **Table 19** and **Table 20**.

Where the data exceeded the MOD 6 predictions (and where the meteorological conditions are suitable), these have been bolded.

Table 19 Attended Noise Monitoring Results and Comparison against MOD 6 Predictions ($LA_{eq(15minute)}$)

	NM4	NM6	NM8	NM10	NM13	NM14	NM15	NM16	Compliance Against Criteria
EA Property Reference	109, 110, 130, 148, 134A, 134B	66	176, 106C	251	190	200	154, 174A, 174B, 175~	177	
$L_{Aeq(15\ minute)}$ Criteria	37	37	38	35	35	35	36	35	
$L_{Aeq(15\ minute)}$ Year 5 Prediction	35[1], 37[2], 37[3], 37[4], 35[5], 35[6]	32	34[7], N/A[8]	31	33	30	31[9], 29[10], 29[11], 29[12]	35	
January	27	IA	25	IA	IA	26	26	IA	Yes
February	35	IA	30	IA	IA	IA	IA	IA	Yes
March	28	IA	23	IA	IA	IA	IA	IA	Yes
April	IA	22	IA	**33**	32	26	**32**	<20	Yes
May	28	≤20	30	IA	IA	<20	IA	<20	Yes
June	IA	31	IA	31	27	22	**31**	IA	Yes
July	35	32	28	<23	IA	IA	30	IA	Yes
August	32	29	27	31	32	32	30	28	Yes
September	34	<25	33	26	27	20	25	27	Yes
October	29	31	26	27	22	<20	27	IA	Yes
November	30	20	27	IA	IA	IA*	IA	IA*	Yes
December	32	<20	29	IA	IA	<20	IA	27	Yes

1. EA Reference 109 *2. EA Reference 110* *3. EA Reference 130* *4. EA Reference 148* *5. EA Reference 134A* *6. EA Reference 134B*
7. EA Reference 176 *8. Property 106C not included in 2013 Noise Assessment* *9. EA Reference 154* *10. EA Reference 174A* *11. EA Reference 174B*
12. EA Reference 175 *IA= Inaudible* ** Initially unable to monitor due to access restrictions, remonitored within one week of surveys at other locations.*
~ID175 purchased 29/10/18 by other mining company, no longer privately owned. *Note: Grey shaded cells denote noise limits do not apply due to meteorological conditions.*

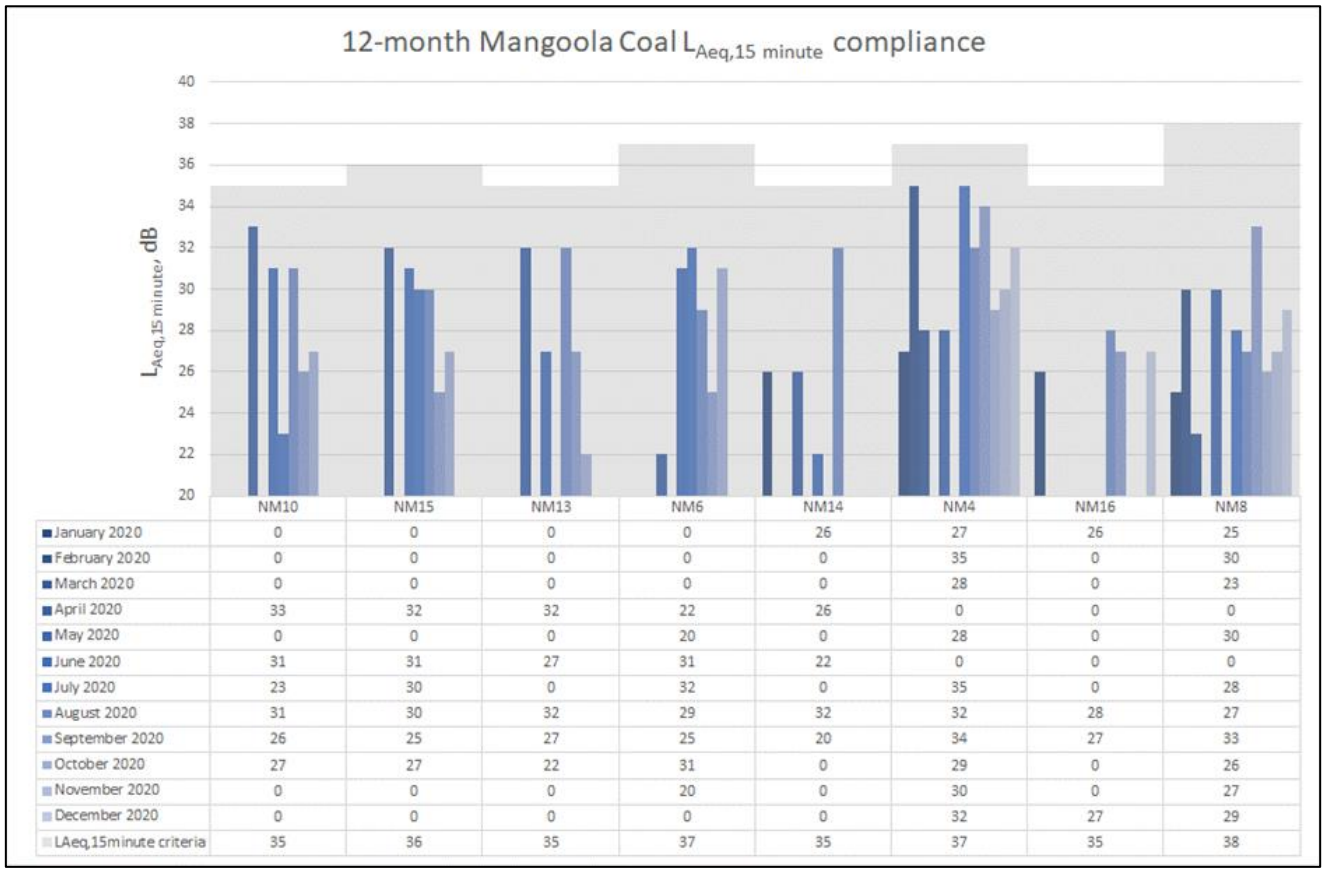
Table 20 Attended Noise Monitoring Results and Comparison against MOD 6 Predictions (LAmax)

	NM4	NM6	NM8	NM10	NM13	NM14	NM15	NM16	Compliance Against Criteria
EA Property Reference	109, 110, 130, 148, 134A, 134B	66	176, 106C	251	190	200	154, 174A, 174B, 175~	177	
L_{AMax}[1] Criteria	45	45	45	45	45	45	45	45	
L_{AMax} Year 5 Prediction	40[2], 40[3], 40[4], 40[5], 38[6], 39[7]	38	<30[8], N/A[9]	<30	35	38	<30[10], <30[11], <30[12] <30[13]	38	
January	32	IA	27	IA	IA	**40**	IA	29	Yes
February	38	IA	**34**	IA	IA	IA	IA	IA	Yes
March	35	IA	27	IA	IA	IA	IA	IA	Yes
April	IA	24	IA	**36**	**38**	28	**35**	<20	Yes
May	38	<20	**34**	IA	IA	<20	IA	<20	Yes
June	IA	38	IA	**38**	30	27	**37**	IA	Yes
July	**43**	**39**	**32**	**33**	IA	IA	**37**	IA	Yes
August	37	33	**31**	**34**	34	38	**33**	33	Yes
September	**39**	30	**36**	30	29	22	**34**	33	Yes
October	36	35	**34**	**38**	24	<20	29	IA	Yes
November	37	22	**38**	IA	IA	IA*	IA	IA*	Yes
December	38	<20	**35**	IA	IA	<20	IA	**39**	Yes

1. For assessment purposes the LAmax and the LA1(1min) are interchangeable. *2. EA Reference 109* *3. EA Reference 110* *4. EA Reference 130* *5. EA Reference 148*
6. EA Reference 134A *7. EA Reference 134B* *8. EA Reference 176* *9. Property 106C not included in 2013 Noise Assessment* *10. EA Reference 154* *11. EA Reference 174A*
12. EA Reference 174B *13. EA Reference 175* *IA = Inaudible* **Initially unable to monitor due to access restrictions, remonitored within one week of surveys at other locations.*
Note: Grey shaded cells denote meteorological conditions not applicable.

As shown in **Table 19**, the 2020 noise levels recorded at Mangoola were compared against the Year 5 noise predictions presented in the 2013 Noise and Vibration Assessment (EMM 2013) and the PA 06_0014 criteria for $L_{Aeq(15minute)}$. On three monitoring occasions (where meteorological conditions met consent condition parameters for noise limits to apply), results were recorded above the Year 5 $L_{Aeq(15minute)}$ EIS predictions however, these levels were well below criteria. The remaining results were lower than the predicted levels where noise limits were applicable due to suitable meteorological conditions.

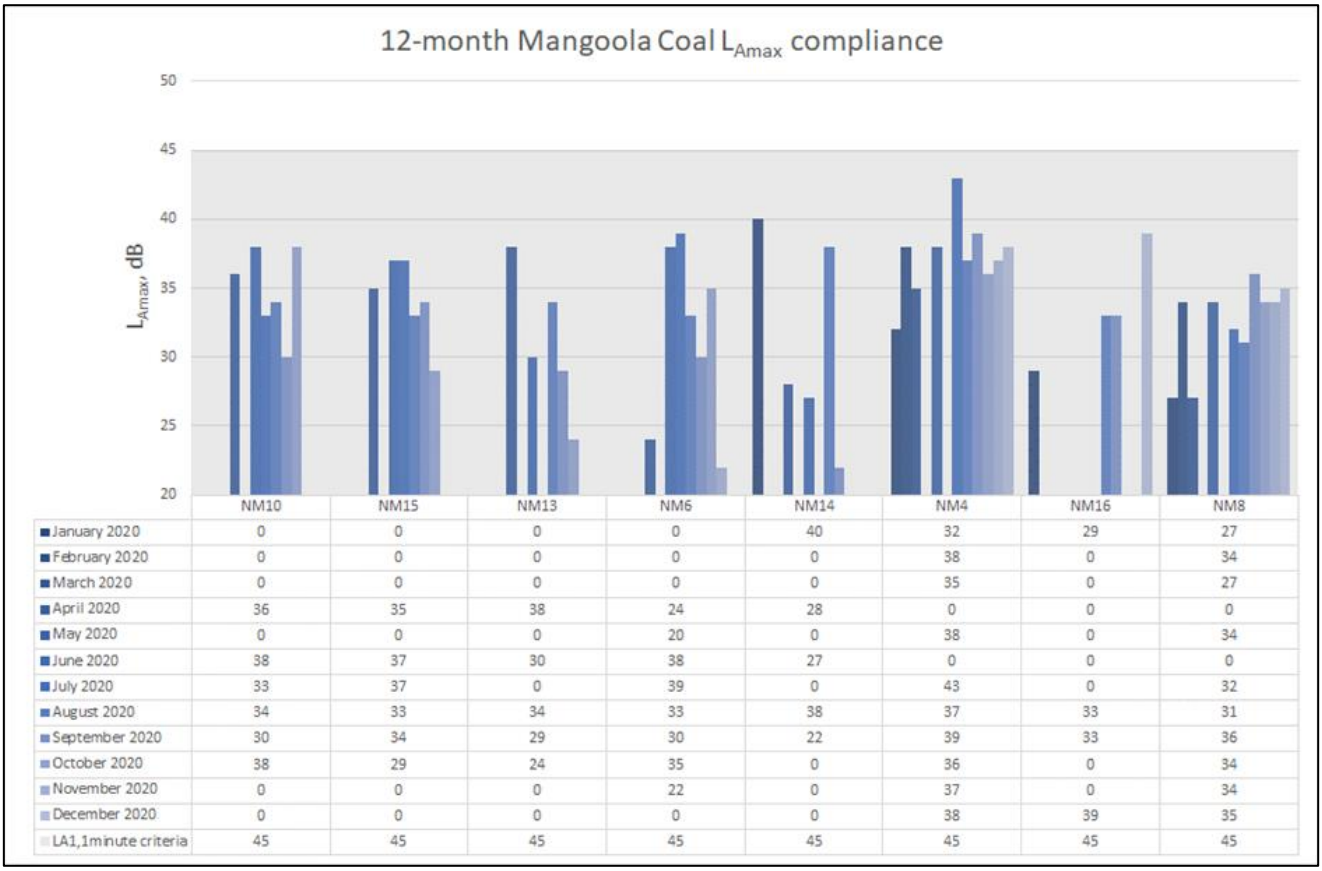
Table 20 compares 2020 L_{Amax} noise levels against 2013 Noise and Vibration Assessment Year 5 noise predictions and approval criteria. Three monitoring locations (NM13, NM14 and NM16) recorded one result above the Year 5 L_{Amax} predictions, two monitoring locations (NM10 and NM15) recorded two results above the Year 5 L_{Amax} predictions and one monitoring location (NM8) recorded six results above the Year 5 L_{Amax} predictions. All other measured L_{Amax} noise levels were below the predicted levels. The main reason for the difference between modelled noise emissions and those measured is likely due to differences in the modelling assumptions compared to the actual operational or weather scenarios. This includes features such as mine topography as well as the locations and sound power levels of plant and equipment. Importantly, measured Mangoola noise emissions did not exceed the $L_{Aeq(15minute)}$ or L_{Amax} noise criteria during 2020. **Figure 9** and **Figure 10** compare the 2020 noise levels recorded at Mangoola with the relevant approval criteria.



	NM10	NM15	NM13	NM6	NM14	NM4	NM16	NM8
January 2020	0	0	0	0	26	27	26	25
February 2020	0	0	0	0	0	35	0	30
March 2020	0	0	0	0	0	28	0	23
April 2020	33	32	32	22	26	0	0	0
May 2020	0	0	0	20	0	28	0	30
June 2020	31	31	27	31	22	0	0	0
July 2020	23	30	0	32	0	35	0	28
August 2020	31	30	32	29	32	32	28	27
September 2020	26	25	27	25	20	34	27	33
October 2020	27	27	22	31	0	29	0	26
November 2020	0	0	0	20	0	30	0	27
December 2020	0	0	0	0	0	32	27	29
LAeq,15minute criteria	35	36	35	37	35	37	35	38

'0' indicates that the Mangoola Coal noise contribution was determined to be 20 dB or less.

Figure 9 Annual Review Attended Noise Monitoring Compliance Results ($L_{Aeq(15minute)}$)



	NM10	NM15	NM13	NM6	NM14	NM4	NM16	NM8
January 2020	0	0	0	0	40	32	29	27
February 2020	0	0	0	0	0	38	0	34
March 2020	0	0	0	0	0	35	0	27
April 2020	36	35	38	24	28	0	0	0
May 2020	0	0	0	20	0	38	0	34
June 2020	38	37	30	38	27	0	0	0
July 2020	33	37	0	39	0	43	0	32
August 2020	34	33	34	33	38	37	33	31
September 2020	30	34	29	30	22	39	33	36
October 2020	38	29	24	35	0	36	0	34
November 2020	0	0	0	22	0	37	0	34
December 2020	0	0	0	0	0	38	39	35
LA1,1minute criteria	45	45	45	45	45	45	45	45

'0' indicates that the Mangoola Coal noise contribution was determined to be 20 dB or less.

Figure 10 Annual Review Attended Noise Monitoring Compliance Results (L_{Amax})

6.3.2.3 Long Term Trend Analysis

Exceedances of the PA 06_0014 and EPL 12984 criteria have been generally decreasing over the previous years. During 2020, there were no occasions where noise levels were measured to exceed the PA 06_0014 or EPL 12894 criteria. These results represent a continuation of the zero exceedances reported in 2019.

6.3.3 Key Performance and/or Management Issues

During 2020, one property (Property ID 176), eligible for noise mitigation, which triggered those rights under Schedule 3, Condition 4 of PA 06_0014.

A review of the real-time noise monitoring network was completed in early 2020 resulting in an additional directional noise monitor being relocated to the north-west of Mangoola operations in April 2020. This improved noise alarm and monitoring capabilities.

A total of 122 noise related complaints were received during 2020, which is a decrease from the 172 noise complaints received during the 2019 reporting period. These complaints were predominately from residences to the north-west of operations. In response to continued high levels of complaints in this area, weekly attended noise monitoring was once again conducted for a 12 week period over Winter. Monitoring results indicated that the site was operating within noise compliance levels. Complaints are further discussed in **Section 9.3**.

6.3.4 Proposed Improvements

In response to changes to property ownership around the operation, Mangoola will review the noise monitoring network to determine whether continuous noise monitoring units can be relocated to provide better coverage around the mining operations.

Additional attended noise monitoring will again be undertaken to the north-west of operations through the winter period to ensure noise emissions are managed appropriately.

6.4 Blasting and Vibration

6.4.1 Environmental Management

Blasting at Mangoola is undertaken in accordance with the approved Blast Management Plan (BMP) which was updated in 2020. The Blast Fume Management Procedure is also implemented, which defines practises to reduce the potential for fume generation and therefore reduce the impact of fume on the environment and community.

Prior to blasting and in accordance with the BMP, predictive and current meteorological data is reviewed to ensure that blasting is undertaken in appropriate weather conditions. In particular, wind speed, wind direction and the presence of temperature inversions are analysed prior to initiating blasting activities.

Blast overpressure and vibration was monitored at six monitoring locations during 2020, known as BM03, BM07, BM08, Anvil Rock, the closest rock formation to the blast, transmission line powerline pylons (where necessary) and Castle Hill Slab Hut. Blasting within close proximity to the powerline easement is undertaken as per a written agreement between the mining company and electricity infrastructure owner.

6.4.2 Environmental Monitoring Results

6.4.2.1 Results from the Reporting Period

During the reporting period there was an average of 3.0 blast events per week which is compliant with Schedule 3, Condition 12(b) of PA 06_0014, which allows a maximum of 6 blasts per week, averaged over a calendar year. A total of 157 blast events occurred during the reporting period and no more than 2 blast events per day which is compliant with Schedule 3, Condition 12(a) of PA 06_0014 (see **Figure 11**).

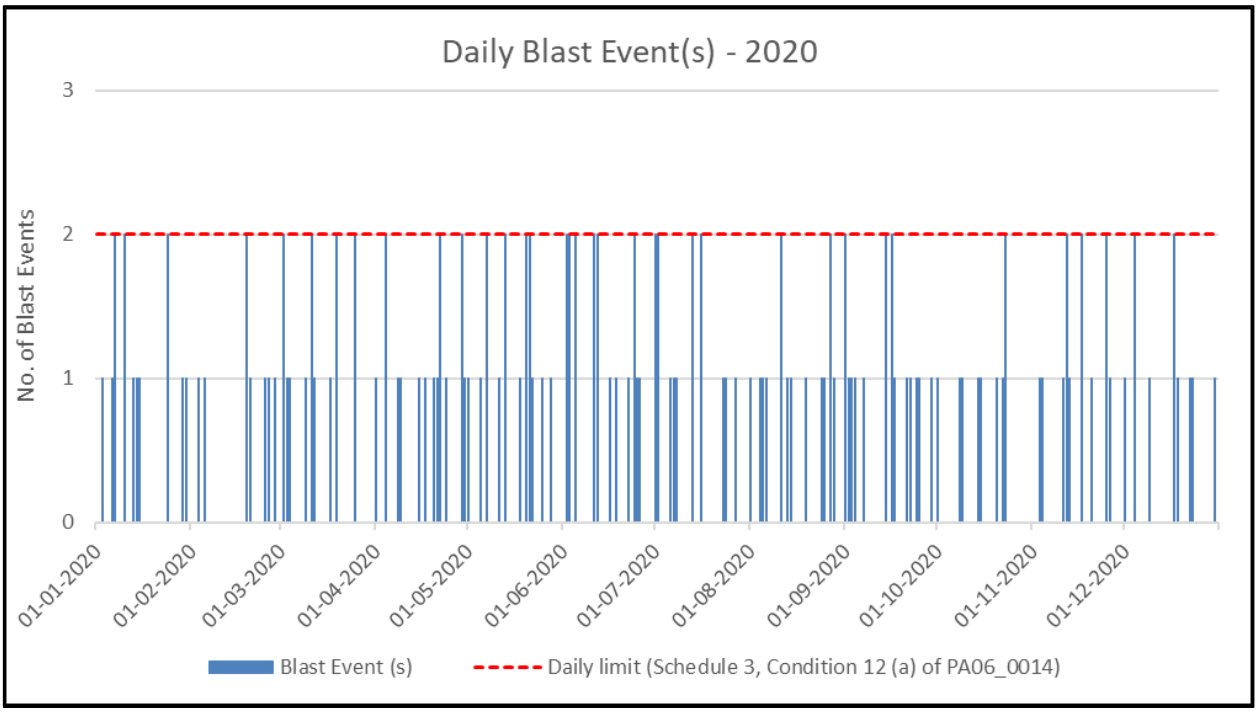


Figure 11 Daily Blast Events

Schedule 3, Condition 10 of PA 06_0014, as well as Section L4 of EPL 12894, provide the criteria for allowable airblast overpressure and ground vibration as measured at any privately owned residence. PA 06_0014 also provides ground vibration criteria for the Electricity Transmission Pylons. **Table 21** summarises the blasting criteria, as defined in the PA 06_0014 and EPL 12894, and other compliance monitoring requirements as defined in the approved BMP and Conservation Management Strategy (CMS) for Mangoola Open Cut.

Table 21 Compliance Monitoring Location Summary and Adopted Criterion

Monitoring Location Requirement	Monitoring Site Name (and PA/EPL ID)	Airblast Overpressure Limit	Ground Vibration Limit	Comments
PA[1]: Nearest residence on privately owned land EPL[2]: At monitoring points 16, 21 and 32	Private Property NW (BM07/21)	115 dB (Lin Peak) (allowable exceedance of 5% over 12 months) and 120 dB (Lin Peak)	5 mm/s (peak particle velocity (PPV)) (allowable exceedance of 5% over 12 months) and 10 mm/s (PPV)	Blast monitoring is conducted at the nearest residence on privately owned land to the blast zone. Locations may change over the life of the mine as properties are acquired and the mining progresses. Criteria applies to the nearest privately owned residence (as per PA 06_0014 and EPL definition). The EPL requires blast monitoring at monitoring points 16, 21 and 32 as per Condition M7.1. BM03 represents Point 16, BM07 represents Point 21 and BM08 represents Point 32.
	Church NE (BM03/16)			
	Private Property S (BM08/32)			
PA[1]: 500 kV Transmission Line	Pylon 64X through to Pylon 75X	N/A (not measured)	60 mm/s^3 for tension towers	Monitoring requirements and limits apply as per agreement with the infrastructure owner (TransGrid).
			125 mm/s^3 /150mm/s^3 for suspension towers	
PA[1]: Rock Formations	Anvil Hill The Book Rockshelter sites	N/A (not measured)	*Safe blasting limit as determined by specialist analysis*[4]	Representative blast monitoring of Anvil Hill to inform vibration monitoring. The closest rock formation is monitored for every blast if not Anvil Hill.

1 PA: A requirement of Mangoola's PA 06_0014 (Schedule 3, Condition 10);

2 EPL: A requirement of Mangoola's EPL 12894 (condition L4.1, L4.2, L4.3 and L4.4 and M7.1);

3 As per TransGrid Agreement. On the 22nd September 2015, DPIE was notified that the TransGrid 500 kV transmission line should be limited to 60 mm/s for the tension pylons (PA 06_0014 limit is 50mm/s) and 125 mm/s for the suspension pylons (PA Limit is 100mm/s) following studies conducted and a letter of approval from TransGrid dated 7th September 2015. Suspension tower limits were increased on 17th September 2020 to 150mm/s via agreements with TransGrid and DPIE; and

4 For the 2020 reporting period this safe blast limit was defined as 50mm/s (PPV).

Airblast Overpressure

Airblast overpressure results at all monitoring locations for the reporting period are available on the Mangoola website, with the results recorded at the nearest privately owned residences and sensitive location summarised in **Table 22.**

Table 22 Airblast Overpressure Summary

Location	Minimum (dBL)	Average (dBL)	Maximum (dBL)	Exceedances (Y/N)
BM03	73.1	96.3	112.0	N
BM07	74.4	99.5	**120.9**	Y
BM08	71.9	94.8	113.7	N

During the reporting period there was one reportable incident where the threshold of 120dB was exceeded at BM07. This result was reported to DPIE in accordance with Schedule 5, Condition 4 of PA06_0014 and an investigation undertaken. Further detail on non-compliances is provided in **Section 11**.

Ground Vibration

Ground vibration monitoring data for the reporting period is available on the Mangoola website and is summarised in **Table 23**.

Table 23 Ground Vibration Summary

Location	Minimum vibration (mm/s)	Average vibration (mm/s)	Maximum vibration (mm/s)*	Exceedances (Y/N)
Residences				
BM03	<0.1	0.1	0.5	N
BM07	<0.1	0.1	0.7	N
BM08	<0.1	0.1	0.7	N
Rock Formations				
Anvil Rock	0.2	3.5	27.2	N/A
Closest Rock Formation (where Anvil Rock is not the closest)	<0.1	3.8	24.5	N/A
Powerlines				
Transmission Line Pylon	8.9	51.0	**125.4**[#]	Y

** Criteria for residences 5mm/s. Specialist determined safe limit for Anvil Rock and other rock formations for 2020 period is 50mm/s. Limit for powerlines as per TransGrid Agreement are 60mm/s for Tension towers and 125mm/s for Suspension towers.*

 # Limit for Suspension Towers increased to 150mm/s as of 17th September 2020.

[1] Monitoring at the closest powerline to the blast is required only where ground vibration limits are predicted to exceed 60mm/s peak particle velocity for suspension towers and 30mm/s for tension towers.

During 2020, there were no exceedances of the 5 mm/s threshold for residential receivers or the 50mm/s specialist determined safe limit for Anvil Rock (or other closest rock formations).

Monitoring was only required at the nearest pylon for 19 blast events in 2020. There was one instance where the vibration limit of 125mm/s on a suspension pylon footing was exceeded. This was reported directly to the asset owner (TransGrid) as per the agreement with the infrastructure owner and follow-up non-destructive testing (NDT) was carried out to confirm no damage had occurred. The agreement has since been updated to a level of 150mm/s as of 17 September 2020.

6.4.2.2 Comparison with Predictions

The PA 06_0014 MOD 6 EA included a Noise and Vibration Assessment (EMM 2013) which assessed the impacts of blasting. This assessment determined the limiting factors to the blast design with respect to the relevant blast criteria.

The MOD 6 Noise and Vibration Assessment (EMM 2013) determined that blast overpressure and vibration could be managed to be within PA06_0014 criteria at all times. During 2020, there was one exceedance of the blast overpressure criteria and no exceedances of vibration criteria, therefore the results were largely consistent with predictions made in the EA (EMM 2013).

6.4.2.3 Long Term Trend Analysis

In accordance with PA 06_0014, a long term trend analysis of blast monitoring results at Mangoola has been undertaken using data from July 2010 to December 2020, and included as **Appendix D**.

Ground vibration monitoring results have remained generally consistent since monitoring commenced, with no increasing trends developing in the data. All blast vibration monitoring results at private residences have been below the PA 06_0014 criteria since monitoring commenced. All results have been below the 10mm/s criteria, and while some results have exceeded the 5mm/s criteria between 2010 and 2020, these were within the allowable 5% frequency.

Airblast overpressure monitoring results at private residences (BM03, BM07 and BM08) have remained generally constant at all locations since monitoring began.

6.4.3 Key Performance and/or Management Issues

On 4 March 2020, there was one exceedance of overpressure criteria during the 2020 reporting period. The blast was located in Main Pit West and recorded an overpressure result at BM07 (EPL monitoring point 21) of 120.9dB (exceedance of 120dB threshold). Notifications were made to both DPIE and the EPA following the blast with the follow up incident investigation reports required under Schedule 5, Condition 4 of PA 06_0014 and Condition R2.2 of EPL 12984 submitted to the relevant departments on 11 March 2020.

A formal warning letter was received from DPIE on 24 March 2020, while to date no formal response from the EPA has been received.

On 10 January 2020, there was one other reportable blasting incident, resulting from a category 4B fume which did not leave the site boundary and dissipated on-site. Upon classification of the fume event, DPIE were notified and an investigation report was provided under Schedule 5, Condition 4 of PA 06_0014. Correspondence received from DPIE on 12 February 2020 indicate they were satisfied with the fume rankings and investigation outcomes. As a result, no further actions were required.

Six complaints were received in relation to blasting during the reporting period, which is a decrease from the eight complaints received in 2019. Four complaints were relating to blast vibration/overpressure, and two complaints were relating to blast odour. Further detail on complaints is provided in **Section 9.3**.

6.4.4 Proposed Improvements

Additional rock shelter cameras were installed on the remaining rockshelters to demonstrate that no impacts as a result of blasting activities had occurred.

6.5 Erosion and Sediment Control

6.5.1 Environmental Management

Mangoola manages erosion and sediment on site in accordance with the approved Erosion and Sediment Control Plan (ESCP), which is included as Appendix C of the Water Management Plan (WMP). The ESCP was updated in 2018 and a copy is available on the Mangoola website.

Prior to land disturbance for any aspect of the mine, appropriate erosion and sediment controls are designed and constructed according to the ESCP as well as the guidelines *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) (the Blue Book) *Volume One and Volume 2E Mines and Quarries* (DECC 2008).

Site erosion and sediment controls are inspected at least monthly, and within 5 days of a high rainfall event (i.e. greater than 20 mm in 24 hours). Regular maintenance is undertaken as required to replace damaged sediment control structures and maintain other temporary measures. Annual channel stability monitoring is also undertaken at Mangoola to identify any erosion and sedimentation issues on surrounding creeks and drainage lines. The outcomes are reported in the *Annual Channel Stability Report* in accordance with Schedule 3, Condition 31(e) of PA 06_0014.

6.5.2 Environmental Monitoring Results

Monitoring of Erosion and Sediment Control structures was completed in accordance with the requirements of the approved ESCP.

The 2020 Annual Channel Stability Report (HLM 2020) saw no observed changes in the Ephemeral Stream Assessments for Big Flat Creek and Sandy Creek which surround Mangoola. Anvil Creek was removed from the assessment in 2019 due to the stream and catchment being removed as per the mining process.

6.5.3 Key Performance and/or Management Issues

There were no issues with erosion and sediment control during the reporting period. Mangoola will review and implement if required any remedial measures as per the recommendations of the 2020 Annual Channel Stability Report, as provided in **Table 24**. Remedial actions will be implemented as required following onsite erosion and sediment control inspections completed routinely and following rainfall events.

Table 24 2020 Annual Channel Stability Report Recommendations

Recommendation	Mangoola Response
Big Flat Creek Ensure stock exclusion in the lower half of Reach 2 and revegetate. This area has a long history as a salt-affected (saline) site and due to its prominent location adjacent to Wybong Rd, would provide ample public exposure for rehabilitation.	This area is in Mangoola grazing land and is only lightly stocked due to the low carrying capacity. The area adjacent to Big Flat Creek will be fenced off to exclude stock during 2021. Revegetation of adjacent offset areas is undertaken in accordance with the BOMPS.

Recommendation	Mangoola Response
Sandy Creek Manage stock access along Sandy Creek.	Several Mangoola offset areas and grazing land surround Sandy Creek. Fencing of offset areas to exclude cattle will continue to be maintained as per the BOMPS. Grazing is restricted due to low carrying capacity. The area will continue to be monitored and further stock reductions undertaken if required.
Repair active erosion points.	The area identified has a low stocking rate and any erosion in this grazing land area will continue to be monitored and remediation works undertaken if necessary.
Native revegetation and continue to manage weeds.	Weed management works continue to be undertaken regularly across all buffer land and offset areas. These works are prioritised based on weed type and numbers present. Revegetation across offset areas is undertaken in accordance with the BOMPS.

6.5.4 Proposed Improvements

There are no proposed improvements for the 2021 period.

6.6 Biodiversity

6.6.1 Environmental Management

Flora and fauna are managed in accordance with the approved MOP and Biodiversity Offset Management Plan and Strategy (BOMPS). The BOMPS was updated in 2018. Clearing activities at Mangoola have been designed to minimise impacts to any threatened flora and fauna species and vegetation communities. Suitably qualified personnel inspect all disturbance areas as part of the Pre-Clearing Procedure to ensure that no unapproved impact on any threatened species of flora or fauna will occur. Any fauna found during clearing activities are captured (where possible) and relocated by suitably qualified persons.

Two threatened terrestrial orchids and an endangered population of epiphytic orchid are present on lands at Mangoola, being *Diuris tricolor*, *Prasophyllum sp aff petilum* (Wybong) and *Cymbidium canaliculatum*. A Translocation Management Plan is in place to salvage and relocate threatened orchid species affected by the progression of mining activities, and was updated and approved during 2018.

6.6.1.1 Weather Conditions 2020

Following increased and sustained rainfall, the intense drought of 2017-2019 eased to recovery conditions in winter of 2020. The Wybong Parish was declared as non-drought in September of 2020.

Signs of vegetation recovery were observed across the majority of sites, particularly in the diversity of native and exotic flora species. Other signs of vegetation recovery included increased ground coverage and mid-story species recovering from dieback.

6.6.2 Environmental Monitoring Results

The following sites were monitored in 2020 as part of the BOMPS monitoring program:

- 12 fauna monitoring sites;
- 14 flora monitoring sites;
- One groundwater dependent ecosystem monitoring site;
- Rehabilitation monitoring included the establishment of 13 long term monitoring sites (for rehabilitation vegetation established 2011-2015) and 29 initial establishment monitoring sites; and
- Floristic values.

The breaking of the drought has resulted in floristic recovery, with general increases in vegetation height (particularly in regenerating/revegetation sites) and foliage cover at most sites. This is a good sign of resilience and recovery driven by increased rainfall. Native groundcover is increasing (in cover and richness), however exotics are as well. This will need to be the key focus of management actions, in order to prevent exotics from dominating and inhibiting the recovery of native species diversity and abundance.

Coverage by weeds was highest in areas of derived native grassland that had been subject to revegetation (compared to remnant vegetation or rehabilitated vegetation). There are a number of sites where weed management works have showed a positive outcome by way of reduced cover and diversity of these species, and some increases in natives.

Remnant monitoring sites are considered generally stable. There is recovery in native species richness and cover at these sites, however attention to managing exotic species should continue in these communities.

Defoliation and dieback was recorded across numerous monitoring sites including areas opportunistically observed in the wider Mangoola area. This was not as evident in revegetation sites, some of which have continued to show strong growth despite the drought conditions. The dieback was recorded across a variety of species, not only limited to riparian areas (see below) and in various strata/age classes. Ongoing drought recovery should see this situation improve.

6.6.2.1 Fauna Values

Habitat value provided by rehabilitated areas continues to increase and this is apparent at FA24 and FA19. Increases in height and foliage cover were recorded as were increases in habitat/niche complexity such as fallen timber, flowering and litter cover. Similar increases were seen at most revegetation sites.

Fauna diversity in 2020 (including in threatened species) has generally dropped compared to previous years – partly due to the location of the suite of these sites whereby more naturally less-diverse communities are monitored than in alternate years. This result is also likely to be influenced by the drought, where highly mobile or nomadic species may have moved to more favourable areas. In such cases, it is likely that these species would return as the vegetation recovers.

Less mobile species (particularly those likely to be resident within the site) are likely to have focused their activity around water sources on the site, thus detectability may be reduced. With the breaking of the drought and associated vegetation recovery, it is likely that fauna diversity will return to pre-drought patterns. This would need to be a focus of ongoing monitoring works.

Mollusc numbers are mostly stable, and similar numbers to those previously recorded. Most live specimens were detected under logs, rocks etc, as is typical of these species particularly during dry weather when moisture is captured under structures.

6.6.2.2 Threatened Species

Seven threatened fauna species were recorded during monitoring in 2020, including:

- Grey-crowned babbler (plus opportunistic observations throughout the year);
- Speckled warbler (plus opportunistic observations throughout the year);
- Large-eared pied-bat;
- Little bentwing-bat;
- Large-footed myotis;
- Black falcon; and
- Spotted harrier (opportunistic record).

No targeted threatened flora species work was undertaken as part of this program during 2020 and none were identified at any off the monitoring sites. However, tiger orchids (*Cymbidium canaliculatum*) and weeping myall (*Acacia pendula*) were identified opportunistically while moving between sites. All these records are known to Mangoola.

Ecological monitoring locations are shown in **Figure 12**.

Mangoola Coal

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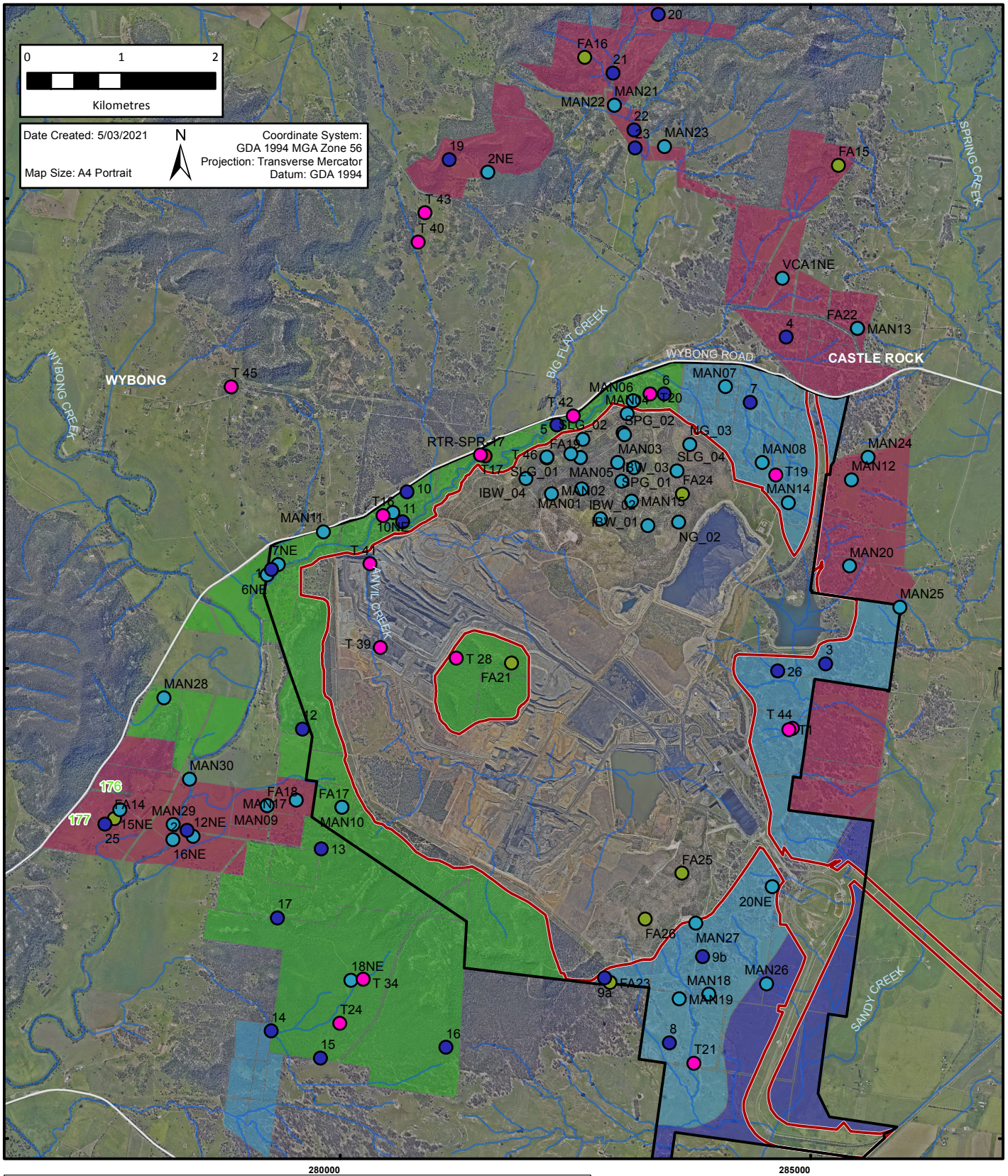
Figure 12 - 2020 Ecological Monitoring Sites



Ref: \\AUSYDSRVC5590\OperationsGIS\Mangoola GIS\03.MapDocuments\16 AR\2020\20201127_Ecological_Monitoring_Sites_v3.mxd

Legend

- Approved Mangoola Coal EPL and Disturbance Boundary
- Mining Lease 1626

Approved offsets

- Biodiversity Corridor
- Conservation Offset Area (Aboriginal)
- Habitat Enhancement Offset Area
- Southern Offset Area

Biodiversity and Rehabilitation Monitoring Locations

Monitoring

- CA Photo
- Fauna
- Flora
- GDE Monitoring
- LFA Monitoring

6.6.2.3 Conservation Agreement Monitoring

In 2020, the biodiversity offset areas were managed under the terms of the Conservation Agreements that are registered with the Biodiversity Conservation Division of DPIE.

Annual monitoring of the Conservation Areas was undertaken during 2020, which includes photo monitoring for comparison against baseline photos, quadrat monitoring to compare data to benchmarks and a walk-through assessment of all conservation areas. The following monitoring was undertaken:

- Big Flat Creek Conservation Area:
    - 11 photo monitoring points; and
    - 5 quadrat plots.
- Western Corridor and Anvil Hill Conservation Area:
    - 18 photo monitoring points; and
    - 11 quadrat plots.
- Southern Offset Conservation Area:
    - 8 photo monitoring points; and
    - 5 quadrat plots.
- Eastern Offset Conservation Area:
    - 10 photo monitoring points; and
    - 7 quadrat plots.
- Northern Corridor Conservation Area:
    - 12 photo monitoring points; and
    - 6 quadrat plots.

The monitoring data and reports related to the Conservation Agreements have been provided to the Biodiversity Conservation Trust as per conditions of the agreement.

6.6.2.4 Landscape Function Analysis

Landscape Function Analysis (LFA) is conducted every two years at Mangoola. 2020 saw a total of 17 sites monitored. Results from the key soil condition features were reflective of the previous drought conditions, litter cover increased at some sites (likely drought-related leaf fall) and decreased at others (reduced foliage production due to drought). Protected sites (such as those in denser vegetation communities) tended not to display substantial changes since 2018. However, sites in sparse community types tended to show increased groundcover and associated litter.

6.6.2.5 Nest Box Monitoring

Nest boxes at Mangoola are monitored every two years for the presence of fauna and the condition of each box monitored every four years. A total of 684 nest boxes were monitored as part of the program during 2020, comprising 533 boxes monitored for content and condition and 151 for condition only.

Results are summarised below:

- 96 of the boxes monitored for content during 2020 showed some signs of use, comprising a mixture of eggs, shells, various nesting materials, feathers, scats and fur;
- 66 of the boxes monitored for content contained an animal at the time of monitoring. These included mammals, marsupials, reptiles, amphibians, birds and their chicks/eggs;
- An additional two boxes monitored for condition only contained fauna at the time of monitoring;
- No threatened species were recorded in the boxes in the offset or rehabilitation areas in 2020;
- Of the rehabilitation nest boxes monitored in 2020, three species were identified, being the Australian owlet nightjar (*Aegotheles cristatus*), Gould's wattled bat (*Chalinolobus gouldii*) and lesser long-eared bat (*Nyctophilus geoffroyi*). Australian owlet nightjars were identified on two occasions, in a treecreeper and possum box respectively. Gould's wattled bats were recorded in three small bat boxes, with one in one, two in the second and 21 in the third. Lesser long-eared bats (*Nyctophilus geoffroyi*) were recorded in two feathertail glider boxes (four and six individuals) and one small bat box (eight individuals); and
- Nest box occupation is much lower in the rehabilitation areas, at only 6.2%, however signs of presence were in an additional 16 boxes (12.3%). The most common signs of presence included evidence of use by birds.

6.6.2.6 Threatened Terrestrial Orchid Monitoring

Following good rainfall throughout 2020, orchid emergence and flowering during the 2020 monitoring program have reversed the downward trend observed since the drought years of 2017-19. Orchid detection within translocation plots during 2020 increased markedly, in many cases approaching or exceeding levels last seen in 2016-17 pre-drought. Over the course of ten years, improvements in monitoring methods have dramatically enhanced orchid detection rates with successive monitoring events. Considered together, detectability for most recipient plots in 2020 was between 2% and 67%.

Importantly, new recruitment has now been confirmed for *Diuris* (but not *Prasophyllum*) within two of the four rehabilitation plots, where 29 new *Diuris* individuals were observed in 2020, including two immediately outside of fenced plots but approximately 1.5m from translocated plants. Sporadic individuals of *Diuris* within some offset plots observed in recent years may also represent new recruitment, however it is difficult to know if they were already in those locations prior to the initial translocation event.

Permanently tagged orchids within the four orchid control plots were censused for the fourth time in 2020, and with the changing weather patterns is now beginning to yield important emergence and detection data. Since installation, numbered individuals of *Diuris* and *Prasophyllum* declined in detection during the drought years of 2017-19, but in 2020 they have begun an increasing trend. For both species, less than 8% of all individuals were detected over five consecutive seasons, suggesting that annual emergence of individuals is uncommon.

Some minor issues relating to the management of translocation recipient sites became apparent and action is required to:

- Control outbreak of Coolatai grass near the gate to the offset area containing translocations #6 and #7;
- Repair gap in mesh in translocation #6; and
- Treat areas of Saffron Thistle in areas of the rehabilitation adjacent to orchid plots.

Management actions are outlined in **Section 6.4.4**.

Publication has recently been undertaken of the progressive results of the orchid translocation and monitoring program, including:

- Bell, S. (2019) *Translocation success is all about detection: experiences with two threatened orchids from the Hunter Valley of NSW*. Australasian Plant Conservation 28: 27-31; and
- Bell, S.A.J. (2020) *Translocation of threatened terrestrial orchids into non-mined and post-mined lands in the Upper Hunter Valley of New South Wales, Australia*. Restoration Ecology 28:1396-1407.

6.6.2.7 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystem (GDE) monitoring was undertaken along Big Flat Creek to identify if floristic data reflects any substantial negative changes that may have resulted from predicted groundwater depressurisation associated with groundwater inflows.

The GDE monitoring site (RTR-SPR-17) has experienced dieback since 2017 with over-storey and mid-storey cover both reducing by over 50%. This dieback was in both the mature and regenerating swamp oak (*Casuarina glauca*) within the monitoring plot. This dieback remains present in 2020, however has not worsened substantially since 2019. The site continues to have significant regeneration present, and these younger plants remain in good condition. This decline in vegetation condition has occurred during a prolonged period of drought.

Observations along Big Flat Creek has showed similar levels of dieback in vegetation outside of the predicted groundwater depressurisation zone as within it. Observations made since the 2020 monitoring also detected foliage recovery in some of the swamp oak trees (both inside and outside of the predicted depressurisation zone).

Swamp oak and river oak (*Casuarina cunninghamiana*) dieback has been observed across the Hunter Valley over the past several years and is likely to be influenced by the drought conditions.

Groundwater quantitative data is collected at two sites along Big Flat Creek and in proximity to RTR-SPR-17, being MP17-B and MP8-B (in alluvium and weathered conglomerate), these flows move in a south-westerly direction. In 2012, baseline depth to water (DtW) levels for MP17-B and MP8-B was recorded at 2.96 m and 3.35 m, respectively. These levels would have been within the root zones of treed vegetation or at least within a zone where soil capillary action allows groundwater to influence soil moisture and thus be available to surface vegetation.

Ongoing monitoring of these bores has identified them as being dry for at least five years. However, groundwater depressurisation around RTR-SPR-17 is occurring within the parameters predicted as part of the groundwater modelling of this site.

It is probable that the Swamp Oak Riparian Forest vegetation (canopy species) above RTR-SPR-17 is at least partially groundwater dependent. This dependence may be more pronounced during extended periods of drought where surface water availability is reduced or absent.

This vegetation monitoring site will continue to be monitored as part of the existing program, and an additional vegetation monitoring site will be added on Big Flat Creek outside of the predicted groundwater depressurisation zone (as a reference). If RTR-SPR-17 continues to show signs of deterioration despite the breaking of the drought, Mangoola will investigate causes of this deterioration further and this may include consultation with a groundwater specialist or pathogen consideration.

6.6.2.8 Offset Tree Planting Program 2020

Tree planting activities are undertaken in the biodiversity offset areas in accordance with the BOMPS to extend and enhance existing woodland areas and create vegetation corridors to link the offset areas and rehabilitation with remnant vegetation to the north and west of Mangoola mine.

As outlined in the BOMPS, approximately 40,000 trees were planted for Year 10 (2020), covering an area of 39.8 ha, including:

- 1.81 ha of Ironbark Woodland Complex in NC-02;
- 5.27 ha of Forest Red Gum Riparian Woodland in NC-02;
- 5.87 ha of Spotted Gum Open Forest in NC-02; and
- 16.84 ha of Ironbark Woodland Complex in NC-05.

In addition, due to favourable post-drought soil moisture conditions, an additional 6,350 plants were opportunistically planted across the offset areas including NC-02, WC-01, SO-1 and HEO-3.

Riparian area revegetation plantings were also undertaken along Spring Creek, near Brays Dam and the Wybong Road Spring Creek Bridge.

Photo 1 and **Photo 2** show offset tree planting during 2020.

Photo 1 Offset Tree Planting during 2020

Photo 2 Offset Tree Planting during 2020

6.6.3 Key Performance and/or Management Issues

During the reporting period there were no reportable incidents, performance or management issues relating to flora and fauna. Management issue recommendations related to biodiversity monitoring are:

- Recommendations from the 2020 Ecological Monitoring Report (Umwelt 2021) are listed below:
    - Continue to undertake ongoing maintenance and monitoring of weed species in line with the identified areas of concern and the 2021 Weed Action Plan (ongoing action).
- Recommendations for future nest box activities (Umwelt 2021) include:
    - Continue to tag new nest box installations with cattle tags and re-tag existing boxes as numbers fade;
    - Maintain nest box diversity to cater for a wide range of species; and
    - Install diversity of small nest box designs into rehabilitation and regenerating areas to encourage use by small birds, microbats, reptiles and insects.

Mangoola will review and implement these recommendations where appropriate as part of the 2021 ecological monitoring program.

6.6.4 Proposed Improvements

Proposed improvements include:

- Installation of new control plots, after at least two consecutive years of good rainfall to identify suitable locations;
- Installation of trail cameras at representative plots, to quantify the potential impact of White Winged Chough may be having on orchid survival through orchid tuber grazing;
- Trial the use of fire to address the dense weed swards that have developed in and around some of the rehabilitation plots;
- Introduce fire into translocation plot #2 to clean out competing grasses and weeds to enable accurate re-marking of orchids prior to the next flowering season;

- Monitor vegetation dieback in western side of Anvil Hill for signs of post-drought recovery; and
- Install diversity of small nest box designs into rehabilitation and regenerating areas to encourage use by small birds, microbats, reptiles and insects.

6.7 Weed and Pest

6.7.1 Environmental Management

6.7.1.1 Weed Management Activities

During the reporting period, contractors were engaged to undertake weed management works at the mine, within rehabilitation and offset areas. Noxious and highly populated weeds were prioritised with environmental weeds treated opportunistically when encountered. A summary of the weed management and control activities undertaken during the reporting period is listed below:

- High and low volume spraying was conducted across all offset areas targeting *Galenia pubescens* (Galenia), *Opuntia stricta* (Prickly Pear), *Echium plantagineum* (Paterson's Curse), *Hypericum perforatum* (St John's Wort), *Eragrostis curvula* (African Love Grass), *Chloris gayana* (Rhodes Grass) and *Hyparrhenia hirta* (Coolatai Grass). Primary control areas were along tracks, creek lines and within revegetation areas;
- Cut-and-paint works with chainsaws and handsaws were conducted throughout site using neat Roundup Biactive® targeting *Lycium ferocissimum*;
- Widespread high and low volume weed control throughout all mine rehabilitation areas, primarily targeting African Boxthorn (*Lycium ferocissimum*), Galenia (*Galenia pubescens*), Inkweed (*Phytolacca octandra*), Narrow-leaved Cotton Bush (*Gomphocarpus fruticosus*), African Love Grass (*Eragrostis curvula*), Chloris gayana (Rhodes Grass) and Hyparrhenia hirta (Coolatai Grass), Fireweed (*Senecio madagascariensis*), Purpletop (*Verbena bonariensis*), Mustard Weed (*Sisymbrium officinale*), Scotch Thistle (*Onopordum acanthium*), Blackberry Nightshade (*Solanum nigrum*), Sow Thistle (*Sonchus oleraceus*), Mexican Poppy (*Argemone mexicana*), Saffron Thistle (*Carthamus lanatus*), Noogoora Burr (*Xanthium strumarium*) and Blue Heliotrope (*Heliotropium amplexicaule*); and
- Targeted removal of species incompatible with the final vegetation communities including *Acacia macradenia* (Zig Zag wattle), *Acacia ligulata* (Small cooba), *Eucalyptus camaldulensis* (River Red Gum) and *Eucalyptus melanophloia* (Silver leaved ironbark).

Weed management requirements have increased in line with the improved seasonal and growing conditions, and therefore additional resources were applied during 2020.

6.7.1.2 Feral and Pest Animal Management Activities

Mangoola completed winter and spring 1080 baiting programs during 2020 which resulted in 60 fox takes and 6 wild dog takes. Mangoola is a member of the Wybong Wild Dog Association and co-ordinates vertebrate pest control activities with regional neighbours to ensure maximum program efficiency.

Additional culling programs also resulted in 21 fallow deer, 31 pigs and 2 goats being culled.

6.7.2 Key Performance and/or Management Issues

No reportable incidents, performance or management issues regarding weeds and feral animal management occurred during the reporting period.

6.7.3 Proposed Improvements

There are no proposed improvements to visual impact management during 2021.

6.8 Visual Mitigation

6.8.1 Environmental Management

All works occurring onsite are undertaken in a manner which ensures that there is minimal impact on visual amenity in accordance with *AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting*. Mangoola is committed to minimising ongoing visual impacts as a result of its operations. In order to ensure visual impacts are minimised a variety of methods are implemented, including tree screen planting, visual bunds, building placement, light shielding and lighting direction to prevent light spillage.

6.8.2 Environmental Monitoring Results

Lighting inspections were undertaken as required by Mining Supervisors to monitor mobile lighting impacts from external viewing points.

Visual tree screening was established via direct seeding of appropriate local flora species along sections of Yarraman Road during 2018 to reduce visual exposure as the mine progresses to the north-west. As a result of the ongoing drought conditions in 2019, the direct seeding campaign undertaken in 2018 resulted in no germination and 2019 there was no attempt to re-sow due to ongoing drought. In 2020, the paddocks were sprayed (where required)/slashed and planted with tube-stock. Additional areas along Wybong Rd received the same treatment.

6.8.3 Key Performance and/or Management Issues

There were no performance or management issues regarding visual mitigation or lighting during the reporting period. Two complaints were received in 2020 in relation to lighting which is a slight increase from the one lighting complaint received in 2019.

6.8.4 Proposed Improvements

There are no proposed improvements to visual impact management during 2021.

6.9 Aboriginal Heritage

6.9.1 Environmental Management

The management of activities relating to Aboriginal cultural heritage at Mangoola is undertaken in accordance with the Aboriginal Cultural Heritage Management Plan (ACHMP) and relevant other guidelines and legislation. The ACHMP was updated in 2020 and a copy is available on the Mangoola website.

A number of Aboriginal archaeological sites are recorded within or adjacent to the Mangoola project area. In order to assist with the management of Aboriginal cultural heritage, Mangoola maintains spatial information on all identified Aboriginal archaeological sites within the operational geographical information system. The GIS information is utilised to inform the GDP process.

6.9.2 Environmental Monitoring Results

Aboriginal heritage monitoring and inspections undertaken in 2020 have been summarised in **Table 25**.

Table 25 Aboriginal Heritage Monitoring and Inspections

Monitoring / Inspection	Dates	Attendees	Notes
2020 Offset Tree Planting due diligence	17 April 2020	Stephanie Rusden (OzArk - Archaeologist), Rhys Wilson (Mangoola Environment and Community Graduate) and one representative from a registered Aboriginal party.	During this inspection, one new Aboriginal site was recorded: • AHIMS #37-2-6039 Due to the scope of the proposed works and the ability to avoid impacts by excluding the sites areas from disturbance through demarcation with highly visible flagging, an AHIP application was not necessary. The works proceeded with caution.
Ground truthing following a rectification project	4 November 2020	Stephanie Rusden (OzArk - Archaeologist), Robyn Ellis (Mangoola Environment and Community Officer) and one representative from a registered Aboriginal party.	During this inspection, one artefact scatter was located and recorded: • AHIMS #37-2-6264 No work is proposed to occur in the vicinity of this location however the site was still demarcated in field to maintain visibility.
Annual offset monitoring	2-4 November 2020	Stephanie Rusden (OzArk - Archaeologist), Cameron Eckersley (Mangoola Environment and Community Officer) and two representatives from registered Aboriginal parties.	Throughout 2020, Mangoola ensured that visitation to rock shelters was kept to a minimum. Visitation was undertaken to conduct required monitoring and measurements in line with approved management plans and statutory approvals, as well as at the request of registered Aboriginal parties.

On 26 November 2020, an Aboriginal stakeholder consultation meeting was held to review previous meeting minutes and actions, and provide an update on project progress, outcomes of monitoring activities, cultural heritage inspections/surveys and any salvage activities conducted in accordance with ACHMP requirements.

6.9.3 Key Performance and/or Management Issues

There were no reportable incidents, performance or management issues relating to Aboriginal heritage during the reporting period however, actions captured in the 2020 Annual Stakeholder review meeting have been enacted.

A revised ACHMP was submitted to the DPIE on 19 June 2020 after consultation with Aboriginal communities and Heritage NSW (as required under Schedule 3, Condition 41(a) of PA06_0014) occurred. The revision included the addition of Section 4 the Care of Salvaged Artefacts, as well as the inclusion of Rockshelter AC58, which was identified during the 2018 Annual Offset Monitoring Inspection. Appendix C, containing a table of previously identified cultural heritage sites around Mangoola, was added as a recommendation post consultation with Heritage NSW.

Approval of this ACHMP was approved by DPIE on 2 October 2020 and is available on the company website.

6.9.4 Proposed Improvements

There are no proposed improvements for Aboriginal Heritage in 2021.

6.10 European Heritage

6.10.1 Environmental Management

European heritage is managed at Mangoola in accordance with the Conservation Management Strategy (CMS). A copy of the CMS is available on the Mangoola website. Specifically, the CMS identifies known European Heritage sites at Mangoola and any relevant monitoring required to be completed to assess the potential impact primarily from blasting or clearing activities.

6.10.2 Environmental Monitoring Results

During the reporting period ground vibration monitoring at key heritage sites, such as Anvil Rock, was maintained.

In 2018, blast modelling was undertaken by blast specialists (Terrock Consulting Engineers). The report noted that blast vibration was not modelled to exceed 5mm/s for future blasting activities at the Castle Hill Site. It is noted in the EA (2009) that the site is however predicted to exceed 5mm/s ground vibration.

The Castle Hill Homestead site is on private property and Mangoola does not have approval to access the site from the landholders. A representative blast monitor is however in place between mining operations and the Castle Hill site. As mining progressed to the north-west and in the direction of the Castle Hill site in 2020, two blast events during the period had a ground vibration monitoring result at the site over 5mm/s (7.41mm/s on 25 March 2020 and 5.16mm/s on 16 July 2020). As required under the Conservation Management Strategy (CMS), the landowners were contacted and a property investigation as per Schedule 4, Condition 14 of PA06_0014 was offered. No response from the landowners was received.

Terrock Consulting Engineers were engaged in July 2020 to conduct a review of blasting ground vibration limits for the Castle Hill site. In lieu of specific ground vibration monitoring results for the site, structural damage limits presented in *Australian Standard Explosives – Storage and Use, Part 2: Use of explosives* (AS2187.2-2006), was conducted to determine an appropriate safe blasting ground vibration limit.

An analysis of predicted levels of blasting ground vibration and frequencies was conducted and compared to against the guide limits from AS2187.2-2006. A frequency-based blasting ground vibration limit of 20mm/s for the Castle Hill site was recommended at the representative monitor for Castle Hill.

The CMS was updated to reflect safe blasting ground vibration limit of 20mm/s for this site at the representative monitor and it was approved post consultation with landowners and Heritage NSW (as required under Schedule 3, Condition 43 a), by DPIE on 16 November 2020.

No blast events have exceeded the vibration limit of 20mm/s at this site in 2020 and results from other blast monitors and structural monitoring undertaken has demonstrated that no damage has occurred to any sites.

6.10.3 Key Performance and/or Management Issues

No reportable incidents regarding European Heritage occurred during the reporting period.

Mangoola will continue to carry out ground vibration and physical monitoring in 2021 on Anvil Rock and The Book Rock Formations to inform the adequacy of blasting controls and management of these structures.

An annual review of safe blasting limits has been undertaken to inform blasting design to ensure there are no blasting impacts on Anvil Rock, The Book Rock Formations or Castle Hill heritage sites.

6.10.4 Proposed Improvements

There are no proposed improvements in this area in 2021**.**

6.11 Spontaneous Combustion

6.11.1 Environmental Management

Management of spontaneous combustion is undertaken in accordance with the Mangoola Spontaneous Combustion Principal Hazard Management Plan (SCPHMP). This management plan details the monitoring and control measures implemented by Mangoola to reduce the incidence and impacts of spontaneous combustion, including stockpile inspections, staff training, priority processing of areas that are heating, and track rolling/battering down stockpiles that will be stored for greater than three months.

6.11.2 Environmental Monitoring Results

No significant instances of spontaneous combustion were detected at Mangoola during the reporting period. Implementation of the SCPHMP has been effective in preventing spontaneous combustion on site to date.

6.11.3 Key Performance and/or Management Issues

There were no reportable incidents, performance or management issues involving spontaneous combustion during the reporting period.

6.11.4 Proposed Improvements

There are no proposed improvements in this area in 2021.

6.12 Bushfire

6.12.1 Environmental Management

Potential risks associated with bushfire are managed through the implementation of monitoring and control strategies as documented in the Mangoola Bushfire Management Plan. This management plan was originally developed in consultation with the NSW Rural Fire Service, Muswellbrook Shire Council, and both the Mangoola and Wybong Rural Fire Brigades.

6.12.2 Environmental Monitoring Results

There were no bushfires at Mangoola during 2020.

A bushfire hazard reduction program was implemented following the outcomes of the September 2020 bushfire hazard inspection and included:

- **Item 1** – Building Asset Protection Zone (APZ) maintained at the rear of administration building to Bushfire Management Plan Asset Protection Zone standards (30m width, 10cm grass height) (complete);
- **Item 3** – Access improvement of site access roads to the south, roads to meet Rural Fire Surface (RFS) fire trail standards with 4m width no obstruction clearance and 4m height (complete);
- **Item 4** – Access maintenance of site access roads to south (monitor minor washout damage to ensure continued access) (complete);
- **Item 5** – Provide a bushfire awareness toolbox talk document prior to total fire ban, severe, extreme or catastrophic fire risk days (to be undertaken when triggered) (contingent on weather conditions); and
- **Item 6** – Name and signpost all firefighting access trails identified on the operational map to avoid confusion when liaising with external agencies (ongoing).

6.12.3 Key Performance and/or Management Issues

There were no performance or management issues relating to bushfires during the reporting period.

6.12.4 Proposed Improvements

There are no proposed improvements in this area in 2021.

6.13 Hydrocarbon Management

6.13.1 Environmental Management

Bulk fuel facilities are managed in accordance with *AS1940-2017 The Storage and Handling of Flammable and Combustible Liquids*. All permanent fuel facilities are fully bunded, with emergency measures in place to manage spills.

All hydrocarbon spills which occur are reported via the sites incident reporting system, and investigations carried out as required. When spills occur, they are managed with one of the spill kits available onsite or treated through oily-water separators.

There is also an active bioremediation area which was constructed within the mining area in 2018 and utilised as required during 2020.

6.13.2 Environmental Monitoring Results

During the reporting period, there were eight hydrocarbon spills which were reported internally. All spills were contained on site within the active mining area and no offsite pollution or environmental harm occurred as a result of these spills. Consequently, none of these incidents required external reporting to any government agencies.

In response to each spill, the following tasks were generally implemented:

- Source of the spill controlled (pumping/machinery stopped);
- Spill contained and cleaned up with absorbent material;
- Contaminated material taken to bioremediation area, where appropriate (improvement in 2018);

- Incident reported and investigation commenced where required;
- Machinery repaired, where required; and
- Where required, procedures were updated, and staff and contractors received additional training on adequate management of hydrocarbons or spills.

6.13.3 Key Performance and/or Management Issues

There were no key performance and/or management issues relating to hydrocarbon management in 2020.

6.13.4 Proposed Improvements

There are no proposed improvements in this area in 2021.

6.14 Public Safety

6.14.1 Environmental Management

Mangoola is committed to preventing risks to public safety as a result of operations at the mine. Ongoing reviews of potential public safety issues are undertaken on a regular basis around the mine area and associated public roads.

Day-to-day monitoring of public safety at Mangoola is undertaken through the use of a variety of methods, including:

- All site visitors are directed to the main office and are required to report and log on to an electronic visitors book;
- Implementation of a security system to ensure public and employee safety is maintained in accordance with the relevant requirements under the *Coal Work Health and Safety Act 2011*, *Mining Act 1992* and the Mining Leases;
- During hazardous activities such as blasting, sentries are posted throughout the site to prevent unauthorised entry into the blasting zone;
- Site boundary fencing surround the perimeter of the site;
- Security patrols;
- Upgrade of local roads in accordance with Schedule 4, Conditions 46-47 of PA 06_0014;
- Restrictions of local road use in accordance with Schedule 4, Condition 48 of PA 06_0014; and
- Employee and contractor inductions regarding mine safety and environmental management issues prior to commencement of work at the site.

6.14.2 Environmental Monitoring Results

As required by Condition 45 of PA 06_0014, Mangoola was required to contribute funding to the upgrade of the Thomas Mitchell Drive and Denman Road intersection which was to be completed by 31 December 2017.

On 4 May 2016, Mangoola received an extension from the DPIE to complete the upgrade works by the end of 2019. During 2019 and 2020, further discussions were held between Mount Arthur Coal (who are completing the upgrade), Muswellbrook Shire Council and DPIE regarding the timing of works to be completed. On 16 April 2020, an extension from DPIE was grated until 31 December 2022.

Condition 46 and 47 were satisfied during 2016 and practical completion was received from Muswellbrook Shire Council on the 14 September 2016.

One traffic related complaint was received in 2020.

6.14.3 Key Performance and/or Management Issues

There were no public safety incidents, performance or management issues in 2020.

6.14.4 Proposed Improvements

There are no proposed improvements in this area in 2021.

6.15 Greenhouse Gas Energy

6.15.1 Environmental Management

Energy consumption (electricity, diesel and liquefied petroleum gas) at Mangoola is monitored and reported in accordance with Glencore requirements and the *National Greenhouse and Energy Reporting Act 2007* (NGER Act).

Mangoola operates in accordance with the approved *Energy Savings Action Plan* (ESAP). The ESAP has been produced to comply with Schedule 3, Condition 55 of PA 06_0014. Mangoola continually assesses the viability of initiatives to improve energy efficiency and reduce greenhouse emissions from proposed operations.

The ESAP identifies opportunities at Mangoola to reduce greenhouse gas emissions and energy consumption, as well as specifying actions to realise these opportunities.

The three-yearly energy audit was conducted in 2019 as required by the ESAP and energy efficiency improvement opportunities were investigated as a result. **Table 26** details the outcomes of these investigations.

Table 26 Proposed Energy Improvements

Opportunity Area	Improvement Under Investigation	2019 Recommendation	2020 Action
Dozer Push	Dozer push can be one of the most cost-effective methods of moving overburden. Depending on geotechnical conditions and pit configuration, dozer bulk push can replace some of the truck-shovel operations. Mangoola Coal is currently investigating the operational efficiency improvement and future diesel saving associated with dozer push.	To be analysed in 2020 to determine energy saving.	In 2020, an analysis was undertaken using typical operating scenarios. Where dozer push is practical in the mine plan a diesel saving is achieved of approximately 0.27 litres per bank cubic metre of material moved. Mangoola will continue to complete dozer push where practical in the mine plan.

6.15.2 Environmental Monitoring Results

6.15.2.1 Results from the Reporting Period

Data relating to electricity consumption, diesel usage and liquefied petroleum gas, and the associated greenhouse gas emissions, during the 2020 reporting period is presented in **Table 27**. In 2020, the total emissions produced by Mangoola were 148,556 t CO2-e which represents a ~17% decrease from 2019 (178,125 t CO2-e).

Table 27 Greenhouse Gas Data

Emissions Source	2019 T CO_2-e	2020 T CO_2-e	Year 2-9 Scope Total T CO_2-e
Scope 1 Emissions (Direct)			
Biodiesel (non-transport)	0	0	136,358[1]
Diesel Oil (non-transport) *off road*	113,301	99,900	
Diesel Oil (transport) *on road*	206	157	
Gasoline (transport) *on road*	18	14	
Liquefied Petroleum Gas (non-transport)	13	22	
Oils & grease (non-transport)	467	428	
Industrial processes (SF6)	1,613	14	
Fugitive Emissions ROM	11,053	8,575	
Scope 2 Emissions (Indirect)			
Electricity	53,053	39,446	63,962
TOTAL EMISSIONS (SCOPE 1 & 2)	**178,125**	**148,556**	**200,320**
Scope 3 Emissions (Indirect) – MOD 6 GHG emissions assessment			
Associated with energy extraction and distribution			9,759
Product transport			1,713,926
Product use			23,529,897
TOTAL EMISSIONS (SCOPE 3 only)			**25,253,582**
TOTAL EMISSIONS (SCOPE 1, 2 & 3)			**25,453,902**

[1] *Scope total made up of diesel use, explosive use and fugitive emissions – MOD 6 greenhouse gas assessment breakdown, current annual broken down more accurately than initial assessment.*

6.15.2.2 Comparison with Predictions

The MOD 6 EA included an Air Quality Impact Assessment (Todoroski Air Sciences 2013) which predicted greenhouse gas emissions for years 1, 2-9, and 10 of the project. As MOD 6 was approved in 2014, 2020 can be considered Year 7 of the modified operations. The Year 2-9 greenhouse gas emissions predictions are presented in **Table 27**.

The data shown in **Table 27** represents the average annual predicted CO2-e emissions for Years 2-9 of the modified operations. As shown in **Table 27**, the total emissions for 2020 were 148,556 t CO2-e. This is 26% less than the 200,320 t CO2-e predicted in the EA for Years 2-9 (Todoroski Air Sciences 2013) for Scope 1 (Direct) and 2 (Indirect) emissions. Scope 3 emissions are unable to be quantified and therefore have not been included here.

No reportable incidents regarding greenhouse gas and energy occurred during the reporting period.

6.15.3 Key Performance and/or Management Issues

As the three-yearly energy audit required under the ESAP was carried out in 2019, no further audits/reviews were completed in 2020.

6.15.4 Proposed Improvements

There are no proposed improvements for Greenhouse Gas and Energy for 2021.

7 Water Management

Mangoola manages water on site in accordance with the approved Mangoola Water Management Plan (WMP) which is available on the Mangoola website. The WMP was approved in 2018. Mangoola implements the following hierarchy of water supply to meet demand and reduce water take:

1. On-site runoff from within the saline water system is preferentially use for dust suppression and CHPP process water;
2. On-site runoff from within the dirty water system is preferentially used for dust suppression and CHPP process water;
3. Groundwater inflows into the open cut pits is preferentially used for dust suppression and CHPP process water;
4. Clean water incidentally collected from undisturbed areas of the site is preferentially used for dust suppression and CHPP process water in accordance with the Harvestable Rights provisions; and
5. Water extracted from the Hunter River utilising existing water access licences or purchased on the open market.

7.1 Water Balance

Mangoola operates a comprehensive and calibrated site water balance to inform water management at the site. Water held and captured onsite at Mangoola by the water management system during the calendar year reporting period is shown in **Table 28**. The Mangoola Water balance is generated from a calibrated model, with an error margin of 1.1%.

Table 28 Mangoola 2020 Water Balance (Calendar Year)

Aspect	Volume (ML)
INFLOWS	
Runoff	3,317
Hunter River Raw Water Supply	546
Groundwater Inflow	130
Spoil Seepage	164
Tailings Bleed Water	1,299
Total	**5,456**
OUTFLOWS	
Evaporation	1,724
CHPP Supply	2,536
Water Cart Usage	579
Wash Bay	11
Hunter Release	0
Spill	0
Total	**4,850**

Aspect	Volume (ML)
Inflow – Outflow	**606**
Recorded Volume Stored on Site at start of Annual Review period	1,909
Recorded Volume Stored on Site at end of Annual Review period	2,623
Recorded Change in Storage	**714**
Error	**1.1%**

7.2 Water Take

Mangoola currently operates two water extraction pumps within one pump station (20WA211008) to provide additional water for its operations, as required, from the Hunter River in accordance with its water extraction permits. The extraction limit for the Mangoola Hunter River Licences is 2,758 ML. It is noted that Hunter General Security allocations were set at 95% by Water NSW for the water year. This reduced the allowable extraction for Mangoola to approximately 2,619.2 ML.

The total Hunter River water extracted by Mangoola during the 2019-2020 water year was approximately 2,102 ML which was within the allowable extraction limit. This represents a decrease from the 2,752 ML extracted from the Hunter River during the 2018-2019 water year. It is noted that 100 ML from Water Licence 645 was transferred to other Glencore operation in April 2020.

Water taken by the operation during the previous water year (1 July 2019 to 30 June 2020) has been summarised in **Table 29**.

Table 29 Mangoola 2020 Water Take (Water Year)

Water Licence #	Water Sharing Plan, Source and Management Zone (as applicable)	Entitlement (ML) 100%	Entitlement (ML) 95%	Allocation Used (ML) (Previous Water Year)
Mangoola Licences				
503	Hunter Regulated River (zone 1A)	159	151.05	151
645	Hunter Regulated River (zone 1A)	432	410.4	270
691	Hunter Regulated River (zone 1A)	50	47.5	0
735	Hunter Regulated River (zone 1A)	72	68.4	68
823	Hunter Regulated River (zone 1A)	310	294.5	240
824	Hunter Regulated River (zone 1A)	175	166.25	0
830	Hunter Regulated River (zone 1A)	306	290.7	290
897	Hunter Regulated River (zone 1A)	55	52.25	0
933	Hunter Regulated River (zone 1A)	43	40.85	21
1159	Hunter Regulated River (zone 1A)	159	151.05	151
6571	Hunter Regulated River (zone 1A)	111	105.45	105
6576	Hunter Regulated River (zone 1A)	600	570	570
9062	Hunter Regulated River (zone 1A)	18	17.1	0

Water Licence #	Water Sharing Plan, Source and Management Zone (as applicable)	Entitlement (ML) 100%	Entitlement (ML) 95%	Allocation Used (ML) (Previous Water Year)
9987	Hunter Regulated River (zone 1A)	82	77	60
11216	Hunter Regulated River (zone 1A)	86	81.7	81
13083	Hunter Regulated River (zone 1A)	100	95	95
Hunter River Licenses Sub-Total		**2,758**	**2,619.2**	**2,102**
Colinta Licences*				
1001	Hunter Regulated River (zone 1A)	334	317.3	150
1057	Hunter Regulated River (zone 1A)	509	483.55	267
Colinta Licenses Sub-Total		**843**	**800.85**	**417**
Groundwater Inflows				
20BL172598	Excavation Groundwater	700		130
6308	Wybong Creek Water Source	96		0
6270	Wybong Creek Water Source	30		0
11085	Wybong Creek Water Source	128		0
Groundwater Licenses Sub-Total		**954**		**130**
TOTAL		**4,555**		**2,649**

7.2.1 Changes to Licences

No changes to surface water or groundwater licenses occurred in 2020, this is in line with the prediction of the 2019 Harvestable Rights assessment by Engeny and the reducing clean water catchment area of Anvil Creek.

7.2.2 Proposed Improvements

During the reporting period, the following updates were with the NRAR for consultation or the DPIE for approval:

- Water Management Plan – Updated to include the saline seepage interception system as part of the Raw Water Dam;
- Groundwater Monitoring Plan – Full document update and inclusion of new exceedance triggers based on historic data;
- Surface Water Groundwater Response Plan – Outline response to discharge of water from Sandy Creek Farm Dams and / or Raw Water Dam Seepage Collection Sump in accordance with the Engeny Saline Seepage Discharge Investigation Cover Letter 2020;
- Surface Water Monitoring Plan – Inclusion of baseline flow observations; and
- Erosion and Sediment Control Plan – Included reference in Section 3.4 to Pollution Incident Response Management Plan (PIRMP) for ESC structures and mapping.

7.3 Hunter River Salinity Trading Scheme Discharges

There were no water Hunter River Salinity Trading Scheme (HRSTS) discharges offsite from Mangoola during the 2020 reporting period.

7.4 Surface Water Monitoring

7.4.1 Environmental Management

Surface water quality continued to be monitored onsite at Mangoola and in the surrounding waterways during the reporting period in accordance with the Surface Water Monitoring Plan, which was updated in 2018. Surface water monitoring locations are shown on **Figure 13** and comprise of 16 sites (SW01-07 and SW09-17) which are sampled monthly for pH, Electrical Conductivity (EC), Total Suspended Solids (TSS), Total Dissolved Solids (TDS) and flow conditions by observation.

Water monitoring is also undertaken monthly as a requirement of EPL 12894. Monitoring is completed at surface water monitoring points SW16, SW03, SW04 and SW07 representing EPL monitoring point number 7, 8, 9 and 31, respectively.

There is no surface water monitoring criteria limit listed in EPL 12894 or PA 06_0014.

Mangoola Coal

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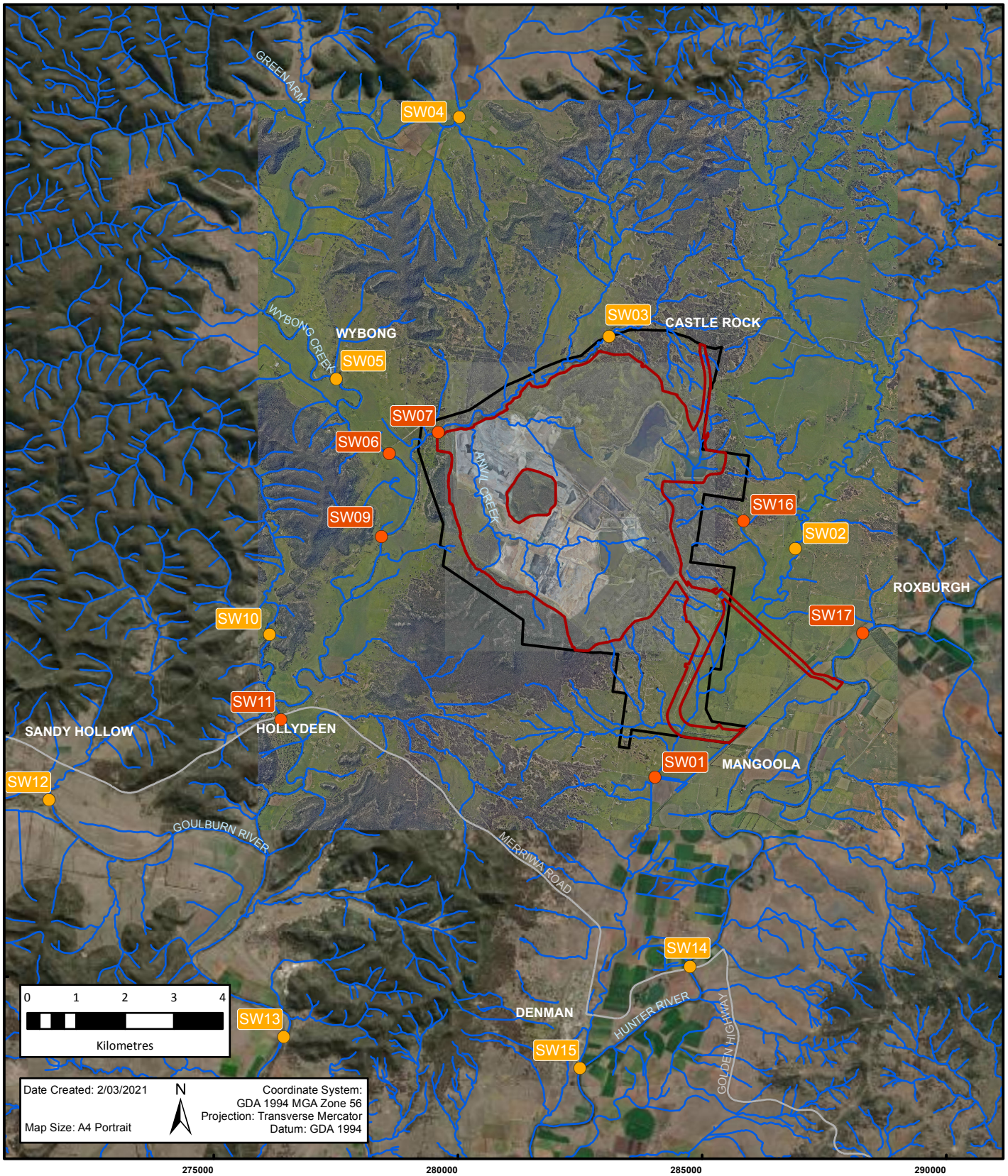
Figure 13 - Surface Water Monitoring Locations



Ref: D:\OperationsGIS\Mangoola GIS\03.MapDocuments\16 AR\2020\20201127_Surface_Water_Monitoring.mxd

Legend

- Approved Mangoola Coal EPL and Disturbance Boundary
- Mining Lease 1626
- Surface Water Monitoring
- Background Surface Water Monitoring
- Major road
- Watercourse

7.4.2 Environmental Monitoring Results

7.4.2.1 Results from the Reporting Period

The pH and EC monitoring results for the reporting period have been summarised in **Table 30**. In accordance with the Surface Water Monitoring Plan (which was updated and approved during 2018) and the Surface Water Groundwater Response Plan, exceedances of surface water monitoring criteria are not reported to DPIE unless three consecutive elevated results are recorded (and an incident is deemed to have occurred (e.g. mining impacts have impacted results)). Detailed results of surface water quality monitoring collected during the reporting period are available on the Mangoola website.

Table 30 Surface Water Monitoring Results – pH and EC

Site	pH Results					EC Results (µS/cm)				No. of Samples and Flow Conditions
	Min	Ave	Max	Lower Criteria*	Upper Criteria*	Min	Ave	Max	Criteria*	
SW01	6.8	7.9	9.5	**6.5**	**9.0/8.9**	115	340.4	492	**3,325/3,757**	10 – no flow (10), flow (2)
SW02	7.5	7.9	8.1	**6.5**	**8.2/8.2**	243	2,918	5,690	**5,569/5,654**	9 – no flow (9), flow (3)
SW03	7.2	7.8	8.5	**6.5**	**8.2/8.8**	87	497	1,046	**10,774/31,805**	9 – no flow (11), flow (1)
SW04	7.3	8.0	8.4	**6.5**	**8.7**/8.5	331	1,246	3,260	**1,939**/1,947	12 – flow (12)
SW05	7.8	8.2	8.4	**6.5**	**8.5/8.6**	775	1,266	1,799	**2,049/2,049**	12 – no flow (11), flow (1)
SW06	7.6	8.1	8.4	**6.5**	**8.5/8.5**	793	1,562	4,480	**2,540/2,422**	12 – no flow (2), flow (10)
SW07	6.8	7.7	8.1	**6.5**	**8.4/8.9**	104	586	820	**10,710/12,780**	10 – no flow (10), flow (2)
SW09	7.6	8.1	8.4	**6.5**	**8.4/8.6**	761	1,554	4,540	**3,130/3,365**	12 – no flow (1), flow (11)
SW10	-	-	-	5.6/**6.2**	7.1/**7.2**	-	-	-	950/**1,004**	0 – no flow (12)
SW11	7.3	8.0	8.4	**6.5**	**8.4/8.5**	525	1,722	4,990	**2,400/2,465**	10 – no flow (1), flow (9), no access (2)
SW12	7.7	8.2	8.4	**6.5**	**8.4/8.6**	450	689	837	**1,677/1,980**	10 – no flow (2), flow (9), no access (1)
SW13	7.7	8.1	8.4	**6.5**	**8.4/8.6**	510	742	976	**1,425/1,545**	11 – no flow (2), flow (10)
SW14	7.7	8.0	8.3	**6.5**	**8.2**/8.5	384	603	897	**753**/835	12 – flow (12)
SW15	7.7	7.9	8.1	**6.5**	**8.2**/8.3	387	623	928	**802**/878	12 – flow (12)
SW16	6.2	7.0	7.8	6.2/**6.5**	7.8/**8.0**	43	139	266	683/**809**	12 – no flow (12)
SW17	7.6	8.0	8.2	**6.5**	**8.2**/8.3	376	566	765	**761**/796	12 – flow (12)

** Criteria with two values denotes criteria for flow/no flow monitoring events (taken from May 2018 SWMP). Bold indicates this criterion was applicable at times in 2020.*

Note: shaded sites are monitored to establish background conditions upstream or separate of mining operations and used in the investigation of exceedance of impact assessment criteria at locations directly downstream of mining operations.

Surface water pH levels were slightly alkaline across the site, ranging from 6.2 to 9.5, with an average pH of 7.9 which is slightly higher than the 7.8 average for 2019. EC results across the site ranged from 43 µS/cm to 5,690 µS/cm, with an average of 1,004 µS/cm which is lower than the 2019 average of 1,894 µS/cm.

There were no reportable incidents associated with pH or EC levels during 2020.

The TDS and TSS monitoring results for the reporting period have been summarised in **Table 31**. Detailed results of surface water quality monitoring collected during the reporting period are available on the Mangoola website.

Table 31 Surface Water Monitoring Results – TDS and TSS

Site	Total Suspended Solids (mg/L)				Total Dissolved Solids (mg/L)				No. of Samples and Flow Conditions
	Min	Ave	Max	Criteria*	Min	Ave	Max	Criteria*	
SW01	2	75	374	**189.8/246**	134	283	484	**1,888/2,128**	10 – no flow (10), flow (2)
SW02	3	606	4,780	**291/89**	162	1,758	3,490	**3,119/3,248**	9 – no flow (9), flow (3)
SW03	38	356	2,230	**1,335/367**	108	399	782	**6,243/20,410**	9 – no flow (11), flow (1)
SW04	15	72	500	**496.2**/50	204	744	1,860	**1,117**/1,147	12 – flow (12)
SW05	16	36	84	**629/50**	488	767	1,070	**1,180/1,299**	12 – no flow (11), flow (1)
SW06	13	49	180	**539/50**	486	930	2,680	**1,470/1,453**	12 – no flow (2), flow (10)
SW07	6	123	1,030	129/**75**	134	403	551	5,775/**7,494**	10 – no flow (10), flow (2)
SW09	17	53	252	**338/50**	410	930	2,720	**1,720/1,917**	12 – no flow (1), flow (11)
SW10	-	-	-	43.9/**77**	-	-	-	574/**758**	0 – no flow (12)
SW11	15	52	312	**619/50**	304	997	2,830	**1,370/1,463**	10 – no flow (1), flow (9), no access (2)
SW12	14	80	460	**482/50**	312	428	515	**971/1,205**	10 – no flow (2), flow (9), no access (1)
SW13	30	113	560	**922/50**	286	442	570	**839/924**	11 – no flow (2), flow (10)
SW14	12	49	145	**183**/50	208	368	499	**455**/514	12 – flow (12)
SW15	12	40	176	**139**/50	205	376	541	**454**/527	12 – flow (12)
SW16	21	252	1,870	438/**449**	82	264	451	882/**976**	12 – no flow (12)
SW17	8	31	86	**123/50**	252	352	464	**488/518**	12 – flow (12)

** Criteria with two values denotes criteria for flow/no flow monitoring events (taken from May 2018 SWMP). Bold indicates this criterion was applicable at times in 2020.*

Note that shaded sites are monitored to establish background conditions upstream or separate of mining operations and used in the investigation of exceedance of impact assessment criteria at locations directly downstream of mining operations.

TSS levels during the reporting period ranged from 2 mg/L to 4,780 mg/L, with an average of 132mg/L which was higher than the 2019 average of 41 mg/L. TDS levels during the reporting period ranged from 82 mg/L to 3,490 mg/L, with an average of 630 mg/L which is lower than the 2019 average of 1,145 mg/L.

There were no reportable incidents associated with TSS or TDS levels during 2020.

Assessment of Surface Water Quality

In accordance with the Surface Water Monitoring Plan, speciation monitoring is undertaken annually at Mangoola surface water monitoring locations in June. There is no speciation monitoring criteria in the Surface Water Monitoring Plan. A summary of the surface water results for 2020 are presented in **Table 32**. It is noted that monitoring point SW10 was not able to be sampled during June 2020 as the monitoring location was dry. SW01, SW02, SW03, SW07, SW09 and SW16 had no flow conditions at the time of sampling.

Table 32 Annual Surface Water Specification Results

Parameter	SW01	SW02	SW03	SW04	SW05	SW06	SW07	SW09	SW10	SW11	SW12	SW13	SW14	SW15	SW16	SW17
Flow	No Flow	No Flow	No Flow	Flow	Flow	Flow	No Flow	No Flow		Flow	Flow	Flow	Flow	Flow	No Flow	Flow
pH	8.7	7.8	7.4	8.2	8.3	8.3	8	8.3	-	8.2	8.3	8.3	8.3	8	7.1	8
EC (µS/cm)	343	2,100	225	1,100	1,360	1,450	686	1,470	-	1,570	837	976	384	387	112	385
TSS (mg/L)	12	8	125	30	19	23	10	32	-	32	14	30	42	31	104	36
TDS (mg/L)	223	1,140	280	634	806	824	460	844	-	866	486	570	208	205	185	252
Nitrite (mg/L)	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.01
Nitrate (mg/L)	0.01	0.17	0.03	0.07	0.02	0.03	0.02	<0.01	-	0.04	0.03	0.1	0.17	0.16	0.14	0.17
TKN (mg/L)	1	0.8	1.2	0.3	0.2	0.2	1	0.3	-	0.2	0.2	0.2	0.3	0.2	3.3	0.4
Total Nitrogen as N (mg/L)	1	1	1.2	0.4	0.2	0.2	1	0.3	-	0.2	0.2	0.3	0.5	0.4	3.5	0.6
Total Phosphorus as P (mg/L)	0.1	0.1	0.2	0.2	0.2	0.2	0	0.2	-	0.2	0.1	0.1	0.1	0.1	0.5	0.1
Sulphate (mg/L)	6	109	13	16	17	19	26	19	-	20	46	44	19	19	3	21
Calcium (mg/L)	13	61	6	52	58	58	12	60	-	63	42	43	33	34	3	33
Magnesium (mg/L)	12	68	5	60	70	70	20	73	-	78	43	47	18	18	2	18
Sodium (mg/L)	40	257	36	90	119	125	104	134	-	140	76	87	23	24	15	23
Potassium (mg/L)	8	14	3	3	3	3	4	3	-	3	5	5	2	2	5	2
Iron (mg/L)	0.5	0.4	2.3	1.6	0.8	0.8	1.4	1.1	-	1.4	0.9	1.4	0.5	0.8	12.6	1.5
Arsenic (mg/L)	0.002	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	0.008	<0.001
Boron (mg/L)	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium (mg/L)	0.018	0.134	0.072	0.021	0.019	0.021	0.028	0.021	-	0.025	0.04	0.042	0.023	0.022	0.106	0.024
Cadmium (mg/L)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Parameter	SW01	SW02	SW03	SW04	SW05	SW06	SW07	SW09	SW10	SW11	SW12	SW13	SW14	SW15	SW16	SW17
Copper (mg/L)	0.002	0.001	0.003	0.002	0.001	0.001	0.004	0.002	-	0.002	0.001	0.002	<0.001	0.001	0.006	0.002
Manganese (mg/L)	0.055	0.073	0.074	0.128	0.077	0.075	0.035	0.082	-	0.096	0.104	0.128	0.045	0.04	0.237	0.057
Chloride (mg/L)	36	467	31	165	254	281	120	288	-	327	117	154	21	23	11	22
Selenium (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/L)	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	0.014	<0.001
Silver (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc (mg/L)	0.007	<0.005	0.01	<0.005	<0.005	<0.005	0.01	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	0.017	0.006
Mercury (mg/L)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Fluoride (mg/L)	0.3	0.4	0.2	0.2	0.2	0.2	0.2	0.2	-	0.2	0.2	0.2	0.1	0.1	0.3	0.2
Bicarbonate (mg/L)	112	322	59	388	390	373	165	384	-	394	250	273	181	172	32	166

Stream Health Monitoring

Biosis (2021) undertook stream health monitoring surveys during autumn and spring in 2020. The stream health monitoring program encompasses seven potential impact sites (monitoring sites) across four major waterways that traverse the Mangoola Open Cut site – Big Flat Creek, Wybong Creek, Anvil Creek and Sandy Creek. The program also includes five control sites with catchments similar to the monitoring sites to differentiate potential mining impacts from environmentally driven variations due to natural processes.

The control sites are located across two waterways – Cuan Creek and Wybong Creek (upstream of the mine site). The monitoring program assesses macroinvertebrate community structures, water quality and overall catchment-riparian health using NSW AUSRIVAS and Signal2 sampling and analyses, HABSCORE assessments, and physicochemical surface water quality testing.

HABSCORE assessments during 2020 surveys indicated improved stream health conditions when compared with 2019, with the results clustering within the marginal and sub-optimal categories. A result of the relative increase in water availability in 2020, following above average rainfall in this year. The AUSRIVAS and Signal2 analyses showed that while sites have been in poor condition since the commencement of baseline monitoring, the macroinvertebrate assemblages are relatively stable. Year to year fluctuations in these metrics are observed across both monitoring and control sites and therefore likely associated with changes in water availability and environmental conditions, most obviously during the most intense period of the recent drought in 2019. The 2020 monitoring results reflect modest improvements to stream health scores following above average rain during this year and a return to baseline water levels, or near to.

Stream health criteria have been established for major waterways identified as being potentially subject to impacts associated with mining activities. The assessment of the 2020 monitoring results against these criteria did not trigger the need for any further investigation with the results above the relevant trigger values. Overall, the monitoring and control sites have remained in a relatively stable but poor condition since the stream health monitoring project commenced in 2009, and no significant difference has been observed between monitoring sites and the control sites. As such it is concluded that no impacts to stream health associated with mine operation have occurred in 2020.

7.4.2.2 Comparison with Predictions

The PA 06_0014 MOD 6 EA included a Surface Water Assessment (WRM Water & Environment 2013) which predicted water usage for the project in years 2, 5, and 10, for a high water demand scenario, and a low water demand scenario.

The high water demand scenario was based on 13.5 Mtpa of ROM coal washed through the CHPP, and the low water demand scenario was based on 8.0 Mtpa of ROM coal washed through the CHPP and 5.5 Mtpa of ROM coal processed as bypass coal (i.e. unwashed). During the 2020 reporting period, approximately 100 tonnes of coal was bypassed through the CHPP.

As MOD 6 was approved in 2014, 2020 constitutes Year 5 of the modified operations, therefore, the water usage data is compared against the Year 5 high water demand scenario predictions from the MOD 6 EA, as shown in **Table 33.**

Table 33 Comparison of 2020 Water Usage with the 2013 MOD 6 Assessment

Aspect of Water Management System	2020 Data (ML)	EA Prediction (Year 5) High water demand
CHPP water use	2,536	3,970 ML/annum
Haul Road Dust Suppression	579	480 ML/annum
Pipeline Water (Hunter River)	546	889 ML/annum
Hunter River Salinity Trading Scheme Offsite Release	0	16 ML/annum

As shown in **Table 33**, only the 2020 haul road dust suppression usage was greater than predictions made in the 2013 Surface Water Assessment. The CHPP water use and pipeline water (Hunter River) usage were both below the water demand predictions.

This decrease in pipeline water (Hunter River) was primarily due to the increased rainfall received on-site during 2020 and change in the onsite water storage TARP as a result of the increased rainfall received (e.g. transition from importing water for continuity of operations to maintain water inventory levels in a steady state). The increase in the dust suppression is from an additional water cart being operational over the summer period to maintain dust suppression, prior to the wet conditions setting in throughout the year. Conversely, the Hunter River offsite release was less than the predictions in the 2013 Surface Water Assessment as infrastructure is yet to be installed.

7.4.2.3 Long Term Trend Analysis

In accordance with PA 06_0014, a long term trend analysis of surface water monitoring results at Mangoola has been undertaken using data from 2010 to 2020 to identify any trends in the monitoring data over the life of the project. Long term monitoring results for pH, EC, TDS and TSS are presented in **Appendix E.**

The results indicate the following:

- The pH of surface water monitoring locations has generally remained relatively stable since mining operations commenced in 2010;
- EC has generally remained stable from 2010-20 with the exception of monitoring locations SW01, SW02, SW03, and SW07, which have been periodically elevated. SW02 and SW03 are located upstream of the Mangoola Mining Lease boundary, and therefore the elevated salinity cannot be attributed to operations at Mangoola. Similarly, SW07, and SW01, while located within the Mangoola Mining Lease boundary, are downstream of SW03 and SW02 respectively. Monitoring locations SW01, SW02, SW03, and SW07 have been dry for most of 2017-19 due to drought conditions. An increase in rain during 2020 allowed most sites to be sampled during the year with the exception of SW02 which has trended up with frequent flushes and localised road works and cattle use of nearby paddocks; and
- TSS and TDS have also generally remained stable from 2010-20, with a few elevated readings, however no discernible trends. At the sites with sufficient water for consistent sampling, results have shown an increase in TDS during 2017-19 due to the drought's impact on flow conditions. This trend has since declined due to increased rainfall in 2020.

7.4.3 Key Performance and/or Management Issues

On Monday 17 February 2020, a water discharge event occurred where 1.8 ML of water was discharged from Sandy Creek Farm Dam 1, a saline seepage management dam, into Sandy Creek via an unnamed drainage line. The PIRMP was enacted in accordance with Section 147 of the POEO Act.

Prior to the rainfall event, Sandy Creek Farm Dam 1 was being actively dewatered to manage groundwater seepage from the raw water dam as per its purpose.

An investigation was completed where the analysis had indicated that the predominant source of water discharged was runoff from the 25.7 ha clean water catchment caused by the 5-10% annual exceedance probability (AEP) rainfall event experienced.

Discharge results show that there was no environmental harm caused based on the chemistry of the water discharged when compared to the receiving environment.

The PIRMP was enacted and the incident was reported to EPA and DPIE in accordance with applicable statutory requirements.

7.4.4 Proposed Improvements

As an outcome of the discharge from Sandy Creek Farm Dam 1, the Surface Water Groundwater Response Plan was updated and was submitted to DPIE for approval, as outlined in **Section 7.2.2**.

7.5 Groundwater Management

7.5.1 Environmental Management

Mangoola monitors groundwater quality and levels within and surrounding the site in accordance with the approved Groundwater Monitoring Plan (GWMP) which is available on the Mangoola website. The GWMP was updated in 2017 and submitted for comment to the EPA, NRAR and DPIE. Consultation continued in 2020. This later version of the GWMP has not yet been approved.

As per the approved 2016 GWMP, active groundwater monitoring locations are shown on **Figure 14** and comprise:

- Six continuous data loggers (VW) to continuously monitor groundwater levels at regular intervals and vibration wires;
- 35 groundwater monitoring bores (GW) sampled bi-monthly for groundwater level, pH, and EC. Due to the progression of mining, and one instance where the landowner has not granted permission to monitor, there are currently 25 groundwater monitoring locations sampled bi-monthly in line with the GWMP defined parameters;
- 15 Monitoring Program (MP) bores sampled quarterly for groundwater level, pH and EC; and
- 5 Big Flat Creek (BFC) bores sampled quarterly for groundwater level, pH and EC.

Mangoola also undertakes an annual comprehensive analysis of eight representative boreholes, being GW02 (coal measures), GW04 (coal measures), GW07 (alluvial), GW14 (Fassifern), GW18 (Fassifern), GW33 (deep alluvium), GW34 (Fassifern) and GW46 (alluvial).

Due to the progression of mining there are currently four groundwater monitoring locations sampled annually in line with the GWMP (GW02, GW04, GW07-S, and GW14). Groundwater monitoring points GW04 and GW26 represents the EPL monitoring points 10 and 11.

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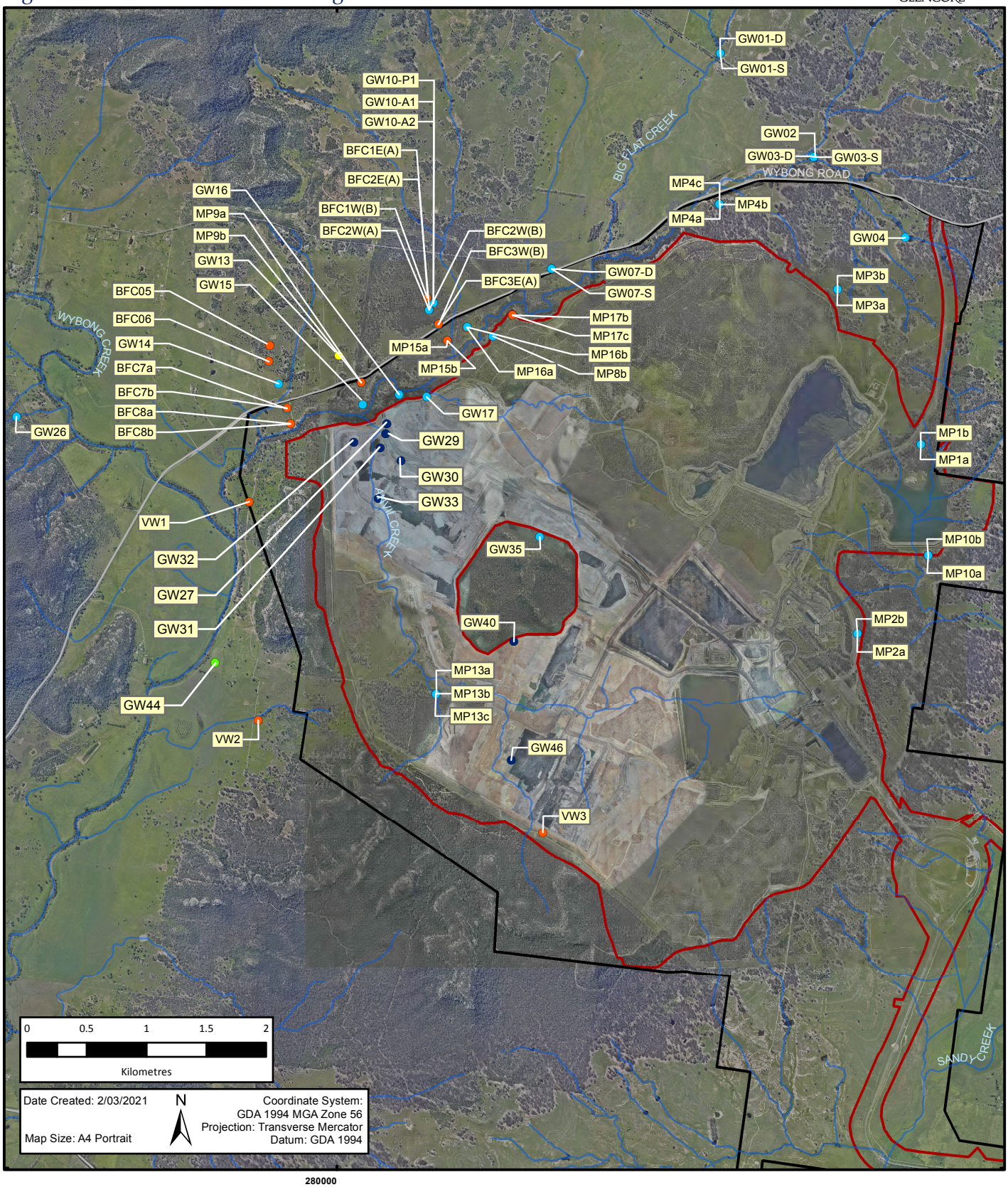
Figure 14 - Groundwater Monitoring Locations



Ref: D:\OperationsGIS\Mangoola GIS\03.MapDocuments\16 AR\2020\20201127_Groundwater_Monitoring.mxd

Legend

- Well
- Vibrating Wire Peizometer
- Bore / Stand Pipe
- Bore / Standpipe - No access from landowner
- Bore / Stand Pipe - Decomissioned
- Mining Lease 1626
- Approved Mangoola Coal EPL and Disturbance Boundary
- Main road
- Watercourse

7.5.2 Environmental Monitoring Results

7.5.2.1 Results from the Reporting Period

The results of the groundwater monitoring undertaken during the reporting period are available in full on the Mangoola website. A summary of the groundwater results for 2020 are presented in **Table 34**. Where these results exceed criteria outlined in the approved Mangoola GWMP they have been bolded.

In accordance with the approved Mangoola Groundwater Monitoring Plan, when three consecutive monitoring results are outside the adopted impact assessment criteria, Mangoola investigates as per the approved Surface Water and Groundwater Response Plan.

- GW02, GW10-P2, GW14 and GW15 exceeded the EC criterion during the January, March, May, July, September and November 2020 monitoring rounds; and
- GW04 exceeded the EC criterion during the November 2020 monitoring round.

These elevated results were investigated as per the SWGWRP as outlined in the GWMP. An investigation by an independent consultant determined that the results were due to background climatic conditions despite the above average rainfall conditions experienced in 2020 and were not attributable to mining related impacts. These elevated results are anticipated to persist while groundwater slowly responds to increased rainfall pattern. Groundwater level and parameter concentration will change from an increase in direct recharge from above rainfall conditions. As a result, the outcomes of the investigation found an incident had not occurred and, in accordance with the GWMP, the exceedances were not externally reportable to DPIE.

Table 34 Groundwater Monitoring Results – pH, EC and Groundwater Level

Monitoring Bores	Depth to Groundwater Results (m)			pH Results				EC Results (µS/cm)			
	Min	Ave	Max	Min	Ave	Max	Criteria	Min	Ave	Max	Criteria
BFC01A*	12.1	11.8	11.9	7.0	6.8	6.9	6.5-8.5	16,270	13,300	15,138	125-2,200
BFC02A*	12.2	12.0	12.1	7.1	7.0	7.1	6.5-8.5	17,040	13,890	15,775	125-2,200
BFC03A*	12.9	12.7	12.7	6.5	6.1	6.3	6.5-8.5	22,980	18,330	21,175	125-2,200
BFC07A*	12.9	12.9	12.9	dry	dry	dry	6.5-8.5	dry	dry	dry	125-2,200
BFC08A*	11.5	11.5	11.5	dry	dry	dry	6.5-8.5	dry	dry	dry	125-2,200
GW01-D*	2.9	1.6	2.0	8.2	6.9	7.3	6.5-8.5	16,400	1,801	10,380	125-2,200
GW01-S*	2.9	1.7	2.0	8.0	7.0	7.2	6.5-8.5	16,260	7,880	13,810	125-2,200
GW02	5.6	4.4	4.9	8.4	6.9	7.5	6.5-9.3	**26,850**	**20,820**	**23,677**	16,039
GW03-D	dry	dry	dry	dry	dry	dry	6.5-7.5	dry	dry	dry	29,535
GW03-S	dry	dry	dry	dry	dry	dry	6.5-7.5	dry	dry	dry	29,535
GW04*^	13.4	12.2	12.3	8.7	7.3	7.8	6.5-7.3	**9,160**	**7,950**	**8,480**	8,174
GW06	1.1	0.6	0.8	9.0	7.2	7.7	6.5-8.5	381	239	298	-
GW07-D	dry	dry	dry	dry	dry	dry	6.5-8.3	dry	dry	dry	18,547
GW07-S	dry	dry	dry	dry	dry	dry	6.5-8.1	dry	dry	dry	20,301
GW10-A2	12.1	11.4	11.7	8.0	6.4	7.0	6.5-7.9	3,470	261	967	12,864
GW10-P1	14.6	12.9	13.6	7.9	6.8	7.2	6.5-7.9	11,500	701	2,620	15,590
GW10-P2	16.1	16.0	16.0	7.9	7.0	7.3	6.5-8.1	**12,290**	**9,970**	**10,906**	8,034
GW13*	11.1	3.8	7.4	8.6	7.7	8.1	6.5-8.5	572	230	350	125-2,200
GW14	30.4	27.8	29.3	7.5	7.3	7.4	6.5-8.0	**6,700**	**5,550**	**6,043**	5,096

Monitoring Bores	Depth to Groundwater Results (m)			pH Results				EC Results (µS/cm)			
	Min	Ave	Max	Min	Ave	Max	Criteria	Min	Ave	Max	Criteria
GW15	20.6	20.5	20.6	7.3	6.8	7.0	6.5-7.3	**15,840**	**14,900**	**15,516**	11,483
GW16	dry	dry	dry	dry	dry	dry	6.5-7.1	dry	dry	dry	21,584
GW17	dry	dry	dry	dry	dry	dry	6.5-7.4	dry	dry	dry	17,997
GW26*^	17.0	16.6	16.8	7.4	7.0	7.2	6.5-8.5	2,796	2,350	2,581	125-2,200
GW35*	No access	No access	No access	No access	No access	No access	6.5-8.5	No access	No access	No access	125-2,200
GW40	dry	dry	dry	dry	dry	dry	6.5-7.1	dry	dry	dry	4,311
GW44	No access	No access	No access	No access	No access	No access	6.5-7.0	No access	No access	No access	7,878
MP1-A*	11.9	11.9	11.9	8.3	7.8	8.0	6.5-8.5	6,930	6,480	6,760	125-2,200
MP1-B*	12.5	12.3	12.4	8.9	8.3	8.5	6.5-8.5	7,800	7,350	7,543	125-2,200
MP2-A*	40.0	39.1	39.5	7.7	7.2	7.5	6.5-8.5	16,610	13,880	15,223	125-2,200
MP2-B*	23.1	21.8	22.7	7.0	6.5	6.7	6.5-8.5	23,660	21,800	22,795	125-2,200
MP3-A*	28.9	28.7	28.8	7.7	7.1	7.5	6.5-8.5	10,540	8,500	9,835	125-2,200
MP3-B*	25.7	25.3	25.6	7.5	7.1	7.3	6.5-8.5	13,970	11,150	12,973	125-2,200
MP4-A*	2.7	2.0	2.2	8.4	7.4	7.7	6.5-8.5	11,200	9,350	10,365	125-2,200
MP4-B*	3.3	2.8	3.0	8.8	7.5	7.9	6.5-8.5	7,960	6,580	7,421	125-2,200
MP4-C*	5.4	4.4	4.9	7.8	6.6	6.9	6.5-8.5	29,520	23,840	27,026	125-2,200
MP8-B*	dry	dry	dry	dry	dry	dry	6.5-8.5	dry	dry	dry	125-2,200
MP9-A*	13.7	13.1	13.4	6.8	6.3	6.6	6.5-8.5	17,020	13,980	15,630	125-2,200
MP10-A*	18.9	17.5	18.3	8.6	7.4	7.8	6.5-8.5	9,010	8,860	8,948	125-2,200
MP10-B*	10.5	10.2	10.3	7.5	6.4	6.9	6.5-8.5	18,900	15,150	16,705	125-2,200
MP13-A*	18.3	18.0	18.2	dry	dry	dry	6.5-8.5	dry	dry	dry	125-2,200

Monitoring Bores	Depth to Groundwater Results (m)			pH Results				EC Results (µS/cm)			
	Min	Ave	Max	Min	Ave	Max	Criteria	Min	Ave	Max	Criteria
MP13-B*	45.9	42.7	44.0	7.1	6.7	6.9	6.5-8.5	10,500	8,830	9,770	125-2,200
MP13-C*	41.0	41.0	41.0	dry	dry	dry	6.5-8.5	dry	dry	dry	125-2,200
MP15-B*	12.9	12.9	12.9	dry	dry	dry	6.5-8.5	dry	dry	dry	125-2,200
MP16-B*	11.9	11.9	11.9	dry	dry	dry	6.5-8.5	dry	dry	dry	125-2,200
MP17-B*	dry	dry	dry	dry	dry	dry	6.5-8.5	dry	dry	dry	125-2,200

** Locations where insufficient groundwater monitoring data exists for site specific triggers as outlined in the GWMP. These are currently being updated in a revision to the GWMP.*

^ EPL monitoring points, assessed against ANZECC criteria and investigated as per EPL 12984.

Annual Speciation Assessment

In accordance with the Groundwater Monitoring Plan, speciation monitoring is undertaken annually at Mangoola groundwater monitoring locations (GW02, GW04, GW07-S and GW14) in September. GW46 which was previously monitored in 2019 was mined through in early 2020. Until site specific values are available, the GWMP states the impact assessment criteria for speciation data at all monitoring locations is based on the ANZECC (2000) guidelines for recreational water use. A specialist consultant was engaged as per the SWGWRP and the outcome identified that an incident is not considered to have occurred. The groundwater results for 2020 are presented in **Table 35**.

Table 35 Annual Groundwater Speciation Results 2020

Parameter	GW02	GW04	GW07-S	GW14	Criteria (mg/L)	Criteria (µg/L)
TDS (mg/L)	**13,300**	**4,580**	-	**3,000**	1,000	-
Dissolved Calcium (mg/L)	57	44	-	84	N/A	-
Dissolved Magnesium (mg/L)	424	14	-	81	N/A	-
Dissolved Sodium (mg/L)	**4,050**	**1,650**	-	**949**	300	-
Dissolved Potassium (mg/L)	50	10	-	19	N/A	-
Carbonate (mg/L)	<1	<1	-	<1	N/A	-
Bicarbonate (mg/L)	177	1,550	-	863	N/A	-
Dissolved Chloride (mg/L)	**8,290**	**1,920**	-	**1,520**	400	-
Sulfate (mg/L)	36	118	-	7	400	-
Dissolved Aluminium (µg/L)	<10	<10	-	<10	-	200
Dissolved Arsenic (µg/L)	<1	<1	-	<1	-	5
Dissolved Boron (µg/L)	<50	230	-	150	-	1000
Dissolved Barium (µg/L)	39	276	-	888	-	1000
Dissolved Iron (µg/L)	**16,400**	<50	-	**700**	-	300
Dissolved Lithium (µg/L)	43	57	-	51	-	N/A
Dissolved Manganese (µg/L)	**1,360**	71	-	**416**	-	100
Dissolved Rubidium (µg/L)	51	28	-	34	-	N/A
Total Phosphorus (mg/L)	0.05	0.77	-	0.21	N/A	-
Dissolved Selenium (µg/L)	<10	<10	-	<10	-	10
Dissolved Silicon (µg/L)	<250	6,560	-	6,780	-	N/A
Dissolved Strontium (µg/L)	4,360	2,880	-	2,860	-	N/A
Dissolved Zinc (µg/L)	<5	21	-	<5	-	5,000

It is noted that GW07-S was dry during September therefore no results were available. The results of the 2020 annual groundwater speciation sampling found that at all remaining sites, the ANZECC criteria were exceeded for TDS, Sodium, Chloride, Iron, and Manganese. The exceedances were investigated by AGE (2020) who determined that the water quality exceedances are primarily occurring due to inappropriate interim trigger values which are not representative of natural baseline conditions at Mangoola. Where results have been temporarily stable since the start of monitoring, AGE states that it is therefore unlikely that the exceedances will result in environmental harm.

7.5.2.2 Comparison with Predictions

Groundwater modelling for the original EA was undertaken by Mackie Environmental Research (MER) in 2006. Since then, the progressive three yearly updates to the numerical groundwater model completed by MER in 2010 and 2013, and AGE in 2016. The numerical groundwater model was further updated and recalibrated in 2018 as part of the EIS for the MCCO Project. The latest three yearly update to the groundwater model was completed by AGE in 2019 (AGE 2019). The predictions from this model were calibrated with 2018/2019 water level monitoring data to validate the model calibration. The observed monitoring bore water level data was compared to the modelled water level data from the 2019 model predictions. Despite slight divergences between the observed and modelled datasets, the majority of the hydrographs showed similar trends in the 2020 reporting period.

The observed groundwater level trends can be generally categorised into stable or declining groundwater levels. The greatest groundwater level drawdown was measured on the western boundary of the mine, which is consistent with the model simulations and with the mining activities progressing below the groundwater table in this area. The effects of drawdown are most prominent in greater depths, decreasing with distance, both vertically and laterally, from the mining area. Groundwater levels in shallow bores screened within the alluvium of Wybong Creek began declining in 2016, suggesting climate rather than mining influences on groundwater levels in this area.

Engeny (2020) completed quarterly reviews of groundwater take associated with groundwater ingress into Main Pit using a spoil seepage model and pit water balance to track compliance with the licence conditions to take under Water Licence 20BL172598. Engeny concluded that the groundwater inflow volumes estimated by AGE were typically in accordance with the groundwater inflows from quarterly reviews (32.5 ML per quarter). Subsequently, Engeny adopted a groundwater inflow estimate of 130 ML/year based on the AGE numerical groundwater model in the water balance report. The revised groundwater model predicted groundwater inflow of 130 ML/year for the year 2020.

7.5.2.3 Long Term Trend Analysis

In accordance with PA 06_0014, a long-term trend analysis of groundwater monitoring results at Mangoola has been undertaken using data since monitoring commenced to identify any trends in water quality over the life of the project.

Long term groundwater water level, pH and EC results are presented in **Appendix E**. A summary of long-term trends identified for each monitoring dataset is provided below:

- Groundwater levels from monitoring bores generally show fluctuations reflecting climatic conditions and rainfall particularly in the shallow strata. Groundwater levels in deeper Permian strata fluctuate less with rainfall and have recorded declining levels since 2014 when mining of the coal seams progressed below the water table. This has resulted in groundwater levels declining in the order of 30 metres at some sites (GW14, MP12-A, MP12-C, MP13-B, MP13-C, and MP14-B);
- The majority of the GW monitoring bores have relatively stable long-term EC. The exceptions are the BFC and MP bores located northwest of the mine along Big Flat Creek which show fluctuations and increasing trends in EC for several years (BFC02A, BFC03A, MP2-A, MP2-B, MP3-A, and MP4-C). The bores experiencing increases in EC are also exhibiting declines in water levels/water pressure due to below average rainfall over successive years which have led to proportionally more saline water being drawn in from geological formation with inherent higher saline conditions than formations with fresher conditions (AGE 2019a). Consequently, groundwater in bores affected by the mobilisation of more saline groundwater have shown increasing EC levels since 2014; and
- The pH of groundwater has generally recorded only limited fluctuations with most monitoring sites having no discernible trends. The BFC and MP monitoring bores close to the active mine along Big Flat Creek have recorded a relatively flat trend in pH over the 2020 reporting period. The GW monitoring bores have recorded some fluctuations in pH throughout the reporting period (e.g., pH increased in all bores in March 2020 corresponding to above average rainfall) however no long term trends are observable. pH ranged between 6.1 and 8.9 in all bores, with an average of 7.3 (n=118 measurements).

7.5.3 Key Performance and/or Management Issues

The Mangoola GWMP (Umwelt 2014) establishes groundwater impact criteria and conditions (groundwater level and quality) for site monitoring bores. Water level responses in the monitoring bores are in line with either predicted drawdowns or changes expected due to the below average rainfall-recharge since early 2017. There are no sites where changing water levels are unexpected or deviate from model predictions and require further investigation in accordance with the approved GWMP (2014).

Bi-monthly exceedances were reported by Mangoola for EC at four monitoring bores (GW02, GW10-P2, GW14 and GW15) following the January, March, May, July, September, and November 2020 sampling rounds, and an additional EPL monitoring bore (GW04) in the November 2020 monitoring round. The annual groundwater chemistry speciation sampling (AGE 2019c) also identified exceedances in TDS, sodium and chloride in one bore (GW04) as well as chloride, manganese and iron exceedances in two bores (GW02 and GW14).

Where the criteria were exceeded for three consecutive monitoring events, the response protocol was enacted as per measures prescribed in the Mangoola Surface Water and Groundwater Response Plan (Glencore 2018). Following an exceedance, initial steps of the protocol require review of the results and an investigation to determine if an incident has occurred that could cause environmental harm. AGE was engaged to investigate the exceedances and report on findings. As per the Surface Water and Groundwater Response Plan, exceedances of trigger values are only reportable if an investigation determined that an incident had occurred. The AGE trigger level exceedance review reports concluded that no incidents had occurred.

7.5.4 Proposed Improvements

As noted above the three-yearly review of the numerical groundwater model (AGE 2019) for Mangoola was completed during 2019. The updated model has been calibrated with available groundwater monitoring data, in line with the GWMP. The revised findings on the magnitude and timing of groundwater impacts have been subsequently incorporated into the GWMP in October 2019. The next validation and review of the groundwater model is proposed in 2021, including revision of the GWMP.

8 Rehabilitation

Mangoola aims to develop rehabilitation of mined land that returns the site to a condition where the landforms, soils, hydrology, flora and fauna are self-sustaining and compatible with the surrounding land uses. Rehabilitation of the overburden emplacement areas is conducted progressively over the life of mine, as an integral component of mining operations.

8.1 Rehabilitation of Disturbed Land

Rehabilitation at Mangoola was undertaken in accordance with the approved 2020 MOP. A copy of the current approved MOP is available on the Mangoola website. A total of 754.89 ha of rehabilitation has been undertaken to date. All rehabilitation areas are classified as being in the Ecosystem and Land Use Establishment Phase. A summary of rehabilitation during 2019 and 2020, and the projected rehabilitation for 2021, is provided in **Table 36**.

Table 36 Rehabilitation Status

Mine Area Type	Previous Reporting Period (Actual) (Ha)	This Reporting Period (Actual) (Ha)	Next Reporting Period (Forecast) (Ha)
A. Total mine footprint[1]	2,113	2,194	2,257
B. Total active disturbance[2]	1,475	1,456	1,429
Infrastructure Areas	717	698	703
Topsoil Stockpile	26	22	22
Active Mining Areas	274	237	249
Waste Emplacements	324	365	321
Tailings Dams	117	117	117
Temporary Rehab	17	17	17
C. Land being prepared for Rehabilitation[3]	0	0	0
D. Land under active Rehabilitation[4]	638	738	828
E. Completed rehabilitation[5]	0	0	0

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. Total mine footprint differs from MOP disturbance figure due to broader scale of disturbance interpretation in MOP figures.

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 growth medium development (as defined in DRE MOP/RMP Guidelines).

4 Land under active rehabilitation - includes areas under rehabilitation and being managed to achieve relinquishment.

5 Completed rehabilitation – requires formal sign-off by DRE that the area has successfully met the rehabilitation land use objectives and completion criteria.

Topsoil is being managed to maximise the viability of soil biota. Topsoil management measures on site include varying stripping depths for different soil types, incorporation of mulched vegetation material into the topsoil resource, limiting topsoil storage stockpiles to a maximum of three metres in height, minimising any compaction of stockpiles, and seeding topsoil stockpiles with a cover crop.

Mangoola has continued with the natural landform design project and will implement this design in all final rehabilitation. The natural landform design has been integrated into the MOP. All rehabilitation undertaken is guided by the completion criteria outlined in the MOP. Current examples of site rehabilitation progress are shown in **Photos 3-7**.

A general overview of the 2020 rehabilitation process is presented below:

- After bulk shaping is completed, topsoil is applied at a nominal depth of 100-150mm in thickness. Direct topsoil placement from recently mulched and stripped areas is prioritised, where possible;
- Gypsum is applied as a soil ameliorant for incorporation into the topsoil;
- Ground timber and stag trees are placed, with the density depending on available resources;
- Frog ponds and aquatic habitat areas are shaped with habitat structures added;
- Topsoiled rehabilitation areas are double pass ripped, across the contour, to a depth ranging from 200 mm (level areas), 400 mm (gradual slopes) to 600 mm (steep slopes); and
- Rehabilitation areas are seeded by hand. This provides more detail for targeted vegetation communities, such as riparian areas and eco-tonal changes based on soil type and aspect. Seed mixes are comprised of endemic Ironbark woodland complex species sourced from adjoining offset and buffer lands.

In addition to the natural landform created at Mangoola, plant species compositions have been selected based on vegetation types of the surrounding natural landforms, e.g. Forest Gum woodland or Rough-barked Apple woodland in the drainage lines or Ironbark woodland along the ridges and Spotted Gum forest on the peaks. An example of seed mixes used at Mangoola is provided in the MOP. During 2020, there was a focus on:

- The continued increase in flora species diversity into the rehabilitation seed mixes;
- The creation of aquatic habitat resources across rehabilitated areas;
- Infill tubestock planting of recalcitrant or slow growing species to improve rehabilitation structure and complexity; and
- Fauna monitoring using remote cameras and bait lures.

During the reporting period, no rehabilitation areas received sign-off from the Resources Regulator as not all of the rehabilitation criteria have been met.

Final capping and rehabilitation of Tailings Dam 1 (TD1) is planned to commence in 2021. Further cone penetration testing and shear vane testing for TD1 and TD2 will continue to be undertaken during 2021. A High Risk Area (HRA) notification for the capping of TD1 was submitted to the Resources Regulator for review in December 2020.

Upon granting of approval, construction of the capping layer will commence progressively, from the upper beach of TD1 in the north east of the dam. With regards to TD2, the tailings strength will continue to be routinely monitored by use of the shear vane apparatus, until tailings strengths develop to those similar to Tailings Dam 1, when construction of the capping layer commences. Throughout this process any surface water will be kept to a minimum on Tailing Dam 1 and 2 to maximise the effect of solar desiccation.

Photo 3 2020 Main Pit Rehabilitation looking toward 2016 Rehabilitation Area

Photo 4 South Pit Rehabilitation Frog Ponds constructed 2019

Photo 5 View from North Pit Lookout towards 2013 and 2014 Rehabilitation

Photo 6 North Pit Rehabilitation Area Wetland

Photo 7 2017 South Pit Rehabilitation looking toward Offset Area and 500kV Powerline

8.2 Comparison with MOP Predictions

During 2020 Mangoola generally operated in accordance with the approved MOP. A comparison of 2020 rehabilitation against the predictions made in the MOP have been presented in **Table 37** and shown in the Annual Review Plan included as **Appendix A**.

Table 37 Rehabilitation Progress Compared to MOP Predictions

Predicted/Actual	Total Disturbance Area (ha)	Total Rehabilitation Area (ha) (per MOP Year)	Cumulative Rehabilitation Area (During MOP Term)
2020 Data (Actual)	1,999.94	100.1	754.89 (includes 16.97 temporary rehabilitation)
MOP Year 1 Prediction	1999.54	100	748.00

As part of the Annual Review a comparison of actual disturbance and rehabilitation with MOP Plan 3A was undertaken as per **Figure 15**. MOP Plan 3A reflects an ideal state schedule whereby mining generally advances strip by strip and the dumps/rehabilitation follows sequentially. In reality this does not always occur as planned due to factors such as:

- Breakdowns;
- Weather;
- Truck availability;
- Labour shortages;
- Market conditions;
- Blasting capacity; and/or
- Prevailing weather impacting blasting.

As a result, both the North Pit, Main Pit Central and South Pit rehabilitation areas have differed from Plan 3A. The net effect is an increase in rehabilitation in the South Pit area of 35.2 ha, an increase in Main Pit Central of 5.2 ha and a decrease in Main Pit West area of 32.1 ha. Overall, the operation still achieved its rehabilitation target of over 100 ha. Disturbance for the year was consistent with MOP Plan 3A.

8.3 Removal of Buildings

During 2020, no buildings or other infrastructure were removed or renovated.

Mangoola Coal

Figure 15 - Actual rehabilitation and disturbance compared with MOP Plan 3A

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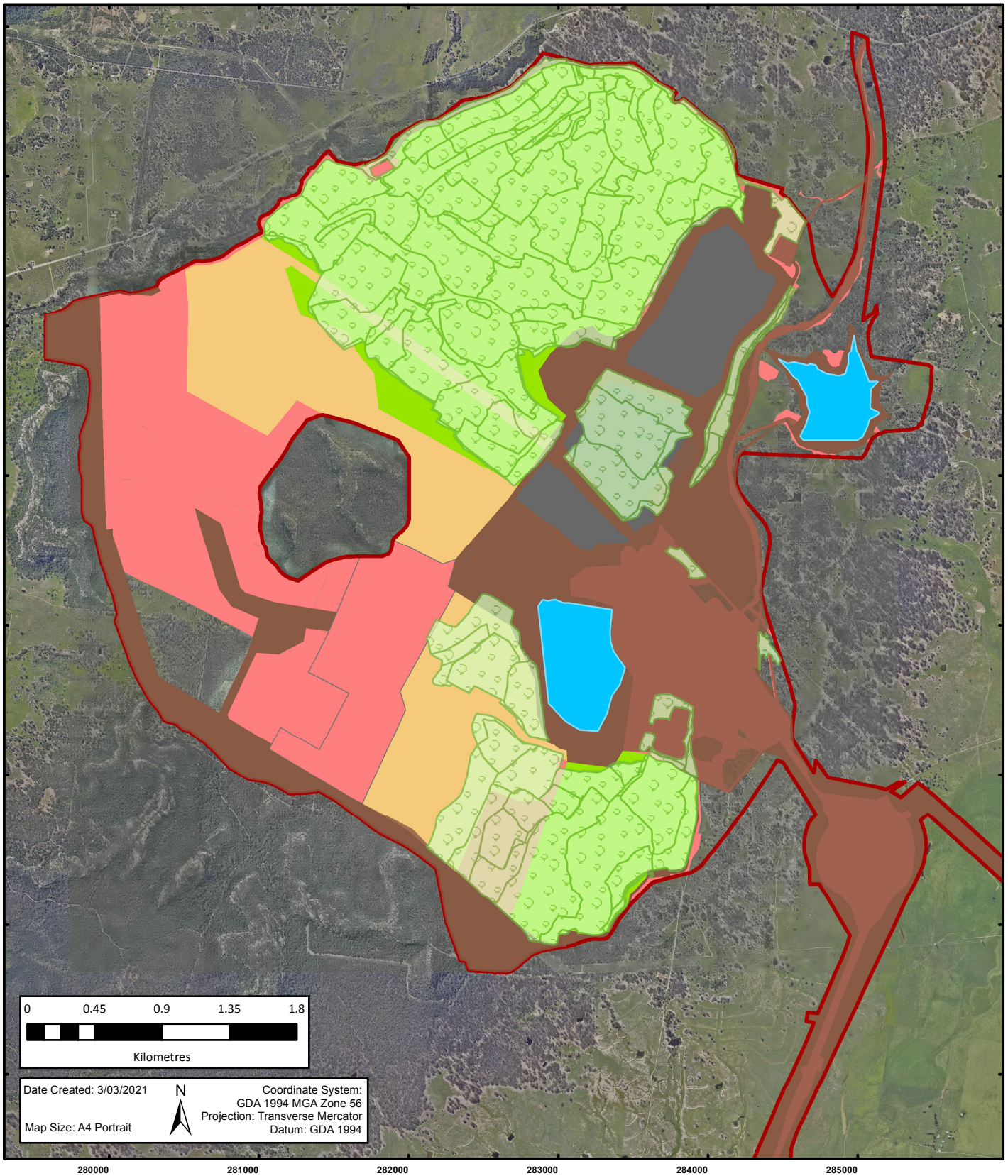

Date Created: 3/03/2021

Map Size: A4 Portrait

Coordinate System:
GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994

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Legend

- Rehabilitation - end of 2020
- Approved EPL and Disturbance Boundary

Approved MOP boundaries
Plan 3A - End of Year 2020

- Domain Primary Infrastructure
- Domain Primary Overburden Emplacement
- Domain Primary Tailings Storage
- Domain Primary Void
- Domain Primary Water Management
- Domain Secondary Rehabilitation Woodland
- Rehab Phase _Decommissioning
- Disturbance

8.4 Key Issues Affecting Rehabilitation

During October 2020, a walkthrough rehabilitation inspection audit was completed by a specialist consultant to review and report on the condition of mine rehabilitation and highlight areas where maintenance action is required. Due to the size of the area under rehabilitation, the annual walkover inspection has been moved to a biennial schedule, with ten rehabilitation blocks totalling 500ha in the northern rehabilitation area inspected during 2020.

The report stated that overall the rehabilitation works to date remain highly successful and are generally progressing towards the completion criteria listed in the MOP. Native diversity across all rehabilitation domains of sufficient age to assess remained generally high. Most areas exhibited appropriate species for the target vegetation community in all layers. Vegetation health was high across the rehabilitation area with good growth rates observed in response to favourable environmental conditions in 2020.

A diversity of artificial or salvaged habitat features is present across all areas of the rehabilitation. Significant utilisation of the habitat features has been recorded including mammals, reptiles, amphibians, birds and invertebrates. The success of these habitat features deserves commendation.

Some occurrences of rill and gully erosion with the potential to impact the rehabilitation were observed. These were primarily on the steeper slopes of younger areas with minimal vegetation establishment. It is recommended that these areas be reshaped and reseeded with additional native groundcover species. It was noted that repair works have already begun on a number of these erosion occurrences, and the methodology has been used successfully on previously identified erosion areas. No significant issues were identified with the stability and functioning of erosion and sediment control and water management structures. Ongoing works in the NOOP channel have been successful in creating a stable and functional landform.

Twelve weed species considered to have potential to adversely impact the development of target vegetation communities were recorded across the rehabilitation area during the inspection. Active weed control works have been recommended for these species. Exotic annual and perennial species were also recorded in moderate densities, likely as a result of the wetter conditions leading up to the 2020 monitoring period. Most of these weeds were not considered to be problematic as they are environmental weeds and not particularly invasive.

Some threats to the rehabilitation as identified in the MOP have been partially triggered, however these are being addressed by ongoing works and with the continuation of current management practices and continued adoption of recommendations, these are unlikely to pose a significant risk to meeting completion criteria.

The report concluded by stating that Mangoola remains an industry leader in rehabilitation within the Hunter Valley and the coal mining sector as a whole, and commended the continuous improvements and development within the rehabilitation on site.

During the reporting period the TARP as contained in the approved MOP was enacted. Triggers and corresponding actions are summarised in **Table 38** and shown in **Figure 16**.

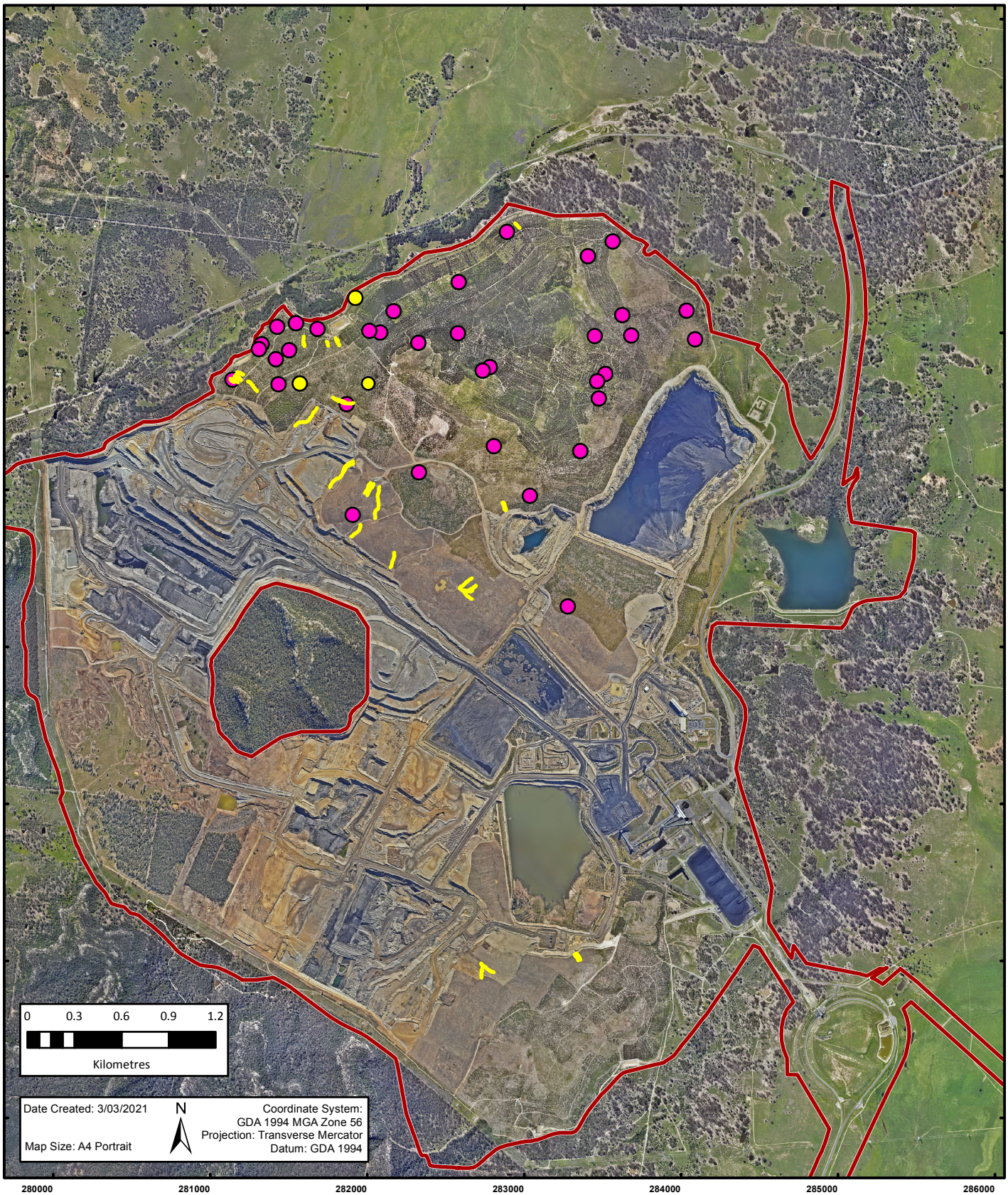
Table 38 Summary of MOP TARP Actions Completed in 2020

Aspect/ Category	Key Element	Trigger Condition (Amber / Red)	Response
Landform Stability	Erosion Control	Significant gully or tunnel erosion present and/or rilling >200 mm deep. (Southern rehabilitation area), after February 2020 heavy rainfall event.	Contractors were engaged to re-shape erosion rills, install new topsoil and rip lines then re-seed with appropriate native vegetation community seed mix.
		Significant gully or tunnel erosion present and/or rilling >200 mm deep. (Main Pit central rehabilitation area), after February 2020 heavy rainfall event.	Contractors were engaged to re-shape erosion rills, install new topsoil and rip lines then re-seed with appropriate native vegetation community seed mix.
		Significant gully or tunnel erosion present and/or rilling >200 mm deep. (Main Pit west rehabilitation area), after February 2020 heavy rainfall event.	Contractors were engaged to re-shape erosion rills, install new topsoil and rip lines then re-seed with appropriate native vegetation community seed mix.
		Significant gully or tunnel erosion present and/or rilling >200 mm deep. (Main Pit west rehabilitation area), after December 2020 heavy rainfall event.	Contractors have been engaged to undertake repair works. Work scheduled for completion early 2021.
		Significant gully or tunnel erosion present and/or rilling >200 mm deep. (Main Pit central rehabilitation area), after December 2020 heavy rainfall event.	Contractors have been engaged to undertake repair works. Work scheduled for completion early 2021.
	Weed Presence	Twelve months following revegetation, >10% but <25% cover of undesirable species present. (Weeds in northern and southern rehabilitation areas). High rainfall year contributing to additional weed growth across site.	Continue the ongoing site weed management program with a focus on the specific areas identified in the annual rehabilitation walkover report to ensure newly identified weed outbreaks are controlled.
		Twelve months following revegetation, >10% but <25% cover of undesirable species present. (Identification of native species inconsistent with the desired vegetation communities in the northern and southern rehabilitation areas). Undesirable species originally seeded in rehabilitation through contaminated seed mix. The supplier has since changed sourcing procedures to ensure that incorrect species are not provided.	Weed management contractor to continue to remove introduced species from the site during weed control activities.

Mangoola Coal Operations

Figure 16 - MOP rehabilitation TARP areas 2020

GLENCORE



Ref: \\AUSYDSRVC5590\OperationsGIS\Mangoola GIS\03.MapDocuments\16 AR\20202021010127_MOP_TARP_map_2020_v3.mxd

Legend

- Approved EPL and Disturbance Boundary
- 2020 weed areas (only assessed in NP rehab)
- 2020 erosion areas

8.4.1 Post Rehabilitation Land Use

As outlined in the MOP, the post-rehabilitation land use will be self-sustaining locally occurring vegetation communities, which emulate the pre-mining environment, enhance local and regional ecological linkages and provide for a sustainable final land use option. It has been developed with consideration of the inherently low land capability of the existing land (Class VI) across the majority of the site. The final void will remain onsite and will be appropriately rehabilitated and fenced to prevent access. Rehabilitation will establish a range of grassland, woodland and forest communities in addition to the offset area which surrounds the site.

Mangoola will establish native woodland and approximately 700 ha of native grassland across the site at closure.

Vegetation communities within the native woodland areas include:

- Forest Redgum Riparian Woodland;
- Ironbark Woodland Complex;
- Paperbark Woodland;
- Sheltered Grey gum Woodland;
- Slaty Box Woodland;
- Spotted Gum Open Forest; and
- Weeping Myall Woodland.

Table 39 compares the area of rehabilitation established for each final land use type during the 2020 reporting period and to date, against the MOP forecast.

Table 39 Final Land Use Rehabilitation

Secondary Domain Type	2020 reporting period (Actual)	Cumulative to date (Actual)	Area at end of MOP period (Forecast)
Ecosystem and Land Use Establishment			
Grassland	5.09	149.23	141.84
Woodland	95.01	605.66	606.16

In addition to the above Mangoola is monitoring overburden emplacement area rehabilitation against relevant completion criteria. **Table 40** and **Table 41** provide a summary of progress to date against relevant criteria for the stage of rehabilitation onsite, which has only been undertaken on rehabilitated waste emplacements areas to date. Further updates against criteria will be provided in future Annual Reviews as relevant criteria are triggered.

Many of the completion criteria listed in the MOP are not yet relevant, as they relate to stages of rehabilitation that have not yet been reached or triggered. The annual ecological monitoring program, rehabilitation walkover inspection and annual bushfire hazard inspection have assessed the relevant criteria, specifically landform stability, floristic diversity, vegetation health, weed presence, structural fauna habitat, management of pest species and bushfire management.

Table 40 Comparison of the 2020 Rehabilitation Walkover Inspection Results with MOP Completion Criteria

Objective	Performance Indicator	Completion Criteria	Rehabilitation Block Criteria Met Yes/No								
			2011-2015	NP: 2016-1	NP: 2016-2	NP: 2017-1	NP: 2017-2	NP: 2018-1	NP: 2018-2	NP: 2019-1	NP: 2019-2	NP: 2020
Floristic diversity is progressing towards the ecosystems planned in the final land use	Development of native ecosystems as per the final land use	<u>For Grassland areas:</u> -0-20% canopy -60-90% Groundcover <u>For Woodland Areas:</u> -20-60% canopy for Woodland areas. -10-60% Understorey -40-80% Groundcover	Partially met, generally trending towards criteria. Ground cover is poor in the earlier (2011-12) rehabilitation within this block.	Partially meet, generally trending towards criteria.				Too early to assess, appears to be trending towards criteria.				
		Signs of seeding occurring in woodland and grassland	Seeding and seedling establishment has been observed for all major canopy species and most shrubs and grasses.	Partially met. Seeding observed in the majority of species in mid and ground layers. Canopy species not yet at reproductive age.				Too early to assess, plants not yet of reproductive age.				
		More than 75% of trees are healthy and growing as indicated by long term monitoring	Criteria met.									

Objective	Performance Indicator	Completion Criteria	Rehabilitation Block Criteria Met Yes/No								
			2011-2015	NP: 2016-1	NP: 2016-2	NP: 2017-1	NP: 2017-2	NP: 2018-1	NP: 2018-2	NP: 2019-1	NP: 2019-2	NP: 2020
		Less than 30% weeds based on monitoring	Criteria mostly met Weed cover is generally less than 30% across the site. In some areas particularly grasslands and the 2011-2012 rehabilitation annual and short-lived perennial weeds exceed 30% cover in the ground layer.	Areas of high weed cover are identified in the MOP TARP.							
Fauna diversity is progressing towards the ecosystems planned in the final land use	Rehabilitation areas provide a range of structural habitats similar to pre-mining fauna communities.	Monitoring data provides evidence of a range of structural habitats similar to pre-mining fauna communities are evident in rehabilitation areas	All areas. Trending towards criteria A range of structural habitats are developing across the rehabilitation however these are currently more simplistic than the pre mining communities. The rehabilitation includes open and closed woodland communities and grassland habitats.								

Objective	Performance Indicator	Completion Criteria	Rehabilitation Block Criteria Met Yes/No								
			2011-2015	NP: 2016-1	NP: 2016-2	NP: 2017-1	NP: 2017-2	NP: 2018-1	NP: 2018-2	NP: 2019-1	NP: 2019-2	NP: 2020
	Fauna pest species are managed and controlled (where possible)	Pest monitoring will be undertaken annually. The control of pest species is undertaken in accordance with the annual pest management action plan. Pest control activities occur on an ongoing basis throughout the year. Specific control techniques will be determined from monitoring prior to the commencement of control activities.	All areas. Pest monitoring is undertaken as part of separate program however observed levels were low.								

Table 41 Comparison of the 2020 Rehabilitation Walkover Inspection Results to Threats to Rehabilitation as Extracted from MOP

Issue/Risk	2011-2015	NP: 2016-1	NP: 2016-2	NP: 2017-1	NP: 2017-2	NP: 2018-1	NP: 2018-2	NP: 2019-1	NP:2019-2	NP:2020
Unsuccessful translocation of threatened orchid species.	Assessed under separate monitoring program. Status = Not Triggered									
Erosion on rehabilitation areas.	See MOP TARP for more information Status = Partially Triggered	See MOP TARP for more information Status = Partially Triggered	See MOP TARP for more information Status = Partially Triggered	See MOP TARP for more information Status = Partially Triggered	Status = Not Triggered	Status = Not Triggered	Status = Not Triggered	See MOP TARP for more information Status = Partially Triggered	Status = Not Triggered	Status = Not Triggered
Poor water quality in runoff from rehabilitation areas.	Not assessed however none visually identified. Status = Not Triggered									
Failure to meet criteria for each rehabilitation phase.	See Table 4.1 of MOP Status = Not Triggered									
Weed infestation threatening rehabilitation success.	See Section 3.3 of MOP Status = Partially Triggered									
Damage to rehabilitation by feral animals.	No significant damage to the Rehabilitation Area by feral animals was recorded during the 2020 Walkover Inspection. Status = Not Triggered									
Growth medium not acceptable for rehabilitation requirements.	Mangoola generally has high quality top soil available for rehabilitation. This appears to be providing a suitable medium for rehabilitation across the rehabilitation area. Status = Not Triggered									

Issue/Risk	2011-2015	NP: 2016-1	NP: 2016-2	NP: 2017-1	NP: 2017-2	NP: 2018-1	NP: 2018-2	NP: 2019-1	NP:2019-2	NP:2020
Lack of habitat features in rehabilitation area to attract fauna.	Habitat features present (dams, stags, logs, boulders etc.). Status = Not Triggered									
Final landform instability resulting in poor water quality, exposed materials such as carbonaceous or Potentially Acid Forming Materials.	Not Identified Also see “erosion of rehabilitation areas “ Status = Not Triggered									
Overburden material not suitable for rehabilitation or not sufficient amounts for rehabilitation.	Not identified. Status = Not Triggered									
Topsoil quality not sufficient to support required vegetation.	Mangoola generally has high quality top soil available for rehabilitation. This appears to be suitable for supporting vegetation growth. Status = Not Triggered									
Lack of local provenance seed for use in rehabilitation.	Local provenance seed collection is undertaken as part of the Mangoola rehabilitation strategy. Status = Not Triggered									
Rehabilitation not completed in accordance with rehabilitation strategy.	Works are being undertaken in line with the rehabilitation strategy. Status = Not Triggered									
Spontaneous combustion of rehabilitation area.	No signs of spontaneous combustion were identified Status = Not Triggered									

8.5 Rehabilitation Trials and Research

Mangoola is undertaking an orchid translocation trial for the threatened species *Diuris tricolor* and *Prasophyllum petilum*. Orchids were translocated to new areas and the survival rates have been monitored annually since 2010. The results of the 2020 orchid translocation monitoring are presented in **Section 6.6.2.3**.

Invertebrate habitat "bee and bug hotels" were introduced into the rehabilitation during 2019. Early indicators are that some invertebrates are using these structures, but no studies have yet been carried out to identify particular species.

Mangoola is partnering with the BCD on a large scale translocation project of the critically endangered *Pomaderris reperta*. The aim of the project is to evaluate the effectiveness of propagation and translocation on this species as a means of extending its distribution within the natural range of the species. Two 12m x 12m translocation plots have been established within establishing Mangoola rehabilitation, and two identical sized plots located in Mangoola offset land (see **Photo 8** and **Photo 9**). Ongoing monitoring and research will be conducted to evaluate the effectiveness of the translocation project.

Photo 8 *Pomaderris Reperta* Translocation Sites within Rehabilitation Area

Photo 9 *Pomaderris Reperta* Planting within Rehabilitation Area

8.6 Actions for the Next Reporting Period

Rehabilitation activities proposed for the 2020 reporting period include the continuation of the rehabilitation research and trials for threatened terrestrial orchid translocation, continued development to increase the seed mix species diversity, particularly in the ground cover and shrub layer, the establishment of additional aquatic habitat features, and a focus on achieving the rehabilitation targets as outlined in the approved MOP.

9 Community

9.1 Community Engagement

9.1.1 Face to Face Meetings

Mangoola has developed a comprehensive Stakeholder Engagement Strategy (SES) and Plan to identify and understand stakeholder views and concerns. The 2020 SES was also reviewed to consider Government direction regarding the COVID-19 pandemic which has impacted the engagement techniques utilised as well as restricting non-essential face-to-face communications and site tours/visits.

The MCCO Environmental Impact Statement, and associated Response to Submissions Report, was prepared and submitted to the DPIE in 2019. In 2020, further community consultation was mainly in relation to:

- The Muswellbrook Shire Council's Mine Affected Road Network Plan and possible implications for the MCCO Project;
- Communication regarding notification of intention to apply for the purchase of Crown Roads and associated consultation with potentially affected landholders;
- Provision of bore census information to relevant landholders; and
- Regular MCCO Project updates through existing Mangoola consultation mechanisms.

Documents associated with this project can be found on the DPIE website: https://www.planningportal.nsw.gov.au/major-projects/project/10131 (a link is maintained on the company website also).

During the reporting period, there was no exploration activity within AL9, therefore consultation under the Community Consultation Strategy (CCS) for AL9, developed in accordance with Conditions 4 and 5 of AL9, was limited to general Mangoola and MCCO Project updates. An Annual Community Consultation report was lodged with the Resources Regulator in November 2020. Likewise, there was no exploration activity conducted in EL5552 during the reporting period. A limited Annual Community Consultation report was lodged with DRG in February 2020 (with the next report due February 2021).

In 2019, there were no acquisitions under the Landholder Liaison Program and Property Acquisition Strategy (LLPPAS) that was developed in accordance with Condition 54 of AL9.

The Mangoola CCC met four times during the reporting period. Post COVID-19 pandemic declaration, the Q2 meeting was held via teleconference/webex while the Q3 and Q4 meeting was held in a larger venue under a COVID-19 management plan. The CCC meetings include an update on mining and exploration operations, MCCO Project update, environmental monitoring, rehabilitation, land management activities (such as offset works, weed and pest control) and complaints.

Scheduled site CCC tours were postponed due to site COVID-19 controls and are now scheduled for 2021. As an alternative to site tours, drone footage of the mine and rehabilitation was presented at each CCC meeting and a rehabilitation video shown at the Q4 meeting. CCC meeting minutes are provided on the Mangoola website.

In July 2020, the Mangoola CCC also advertised for nominations for appointment of community members to the CCC. This occurred during the Month of July in accordance with the Department's Community Consultative Committee Guidelines. The advertisement was published in the Community Newsletter, local online newspapers, the new (hard copy) newspaper "The Hunter River Times" as well as emails sent to local stakeholder groups by the Independent Chairperson. Three new members were endorsed in October 2020 representing the community and two local stakeholder groups.

In addition to CCC tours, Mangoola normally offers rehabilitation tours through the quarterly Mangoola Community Newsletters as well as liaising directly with school groups, universities and other interested parties to facilitate tours. In response to COVID restrictions, such tour offers were suspended resulting in a substantially reduced number of people touring the mine in 2020. Subject to pandemic status, tours will again be offered in 2021 through the Community Newsletter and other community interactions.

In 2020, Mangoola made improvements to the visitor site tour experience through the creation of a visitor viewing area and interpretive walk. The viewing area has coach access and a series on information boards providing information regarding the mining and best practice rehabilitation processes adopted by Mangoola. Bench seats, provided by the local Denman Men's Shed, provide a rest spot overlooking the rehabilitation. The interpretive walk takes visitors on a short walk through the rehabilitation where there are more information signs showing some of the flora and fauna species visitors may encounter along the way. Schools are provided with information sign content prior to the visit so they may prepare questionnaires for the day.

Photo 10 Visitor Information Area at Mangoola's North Pit Rehabilitation Area

9.1.2 Website

Mangoola operates a website (www.mangoolamine.com.au) where members of the community can access information about the site, including the latest reports, management plans and environmental monitoring data, including previous Annual Reviews. In December 2020, the Mangoola website migrated to the Glencore website under "Current Operations". This was managed by Glencore in consultation with Mangoola to ensure compliance aspects were addressed as part of the website re-design.

An Audit of the website was undertaken by SLR in December 2020 (prior to the new website go-live date) to reflect compliance of the website that was in place for the majority of the reporting year with Schedule 5, Condition 11 of PA 06_0014. The findings of the audit are outlined in **Table 42**.

Table 42 Website Audit

Condition	Comment
The Proponent must: (a) make the following information publicly available on its website:	-
The documents listed in condition 2 of Schedule 2;	Compliant.
Current statutory approvals for the project	Compliant – Approvals tab on website.
Approved strategies, plans or programs required under the conditions of this approval	Compliant – Management Plan tab on website.
A comprehensive summary of the compliance monitoring results of the project, which have been reported in accordance with the various plans and programs approved under the conditions of this approval	Compliant – Detailed monitoring reports. Includes EPL monitoring. Copies of past Annual Reviews.
A complaints register, which is to be updated on a monthly basis	Compliant.
Minutes of CCC meetings	Compliant.
The last five annual reviews	Compliant – Annual Reviews / AEMR since 2008.
Any independent environmental audit; and the Proponent's response to the recommendations in any audit	Compliant. Link to audits.

9.1.3 Community Newsletters

Mangoola published and distributed four community newsletters during 2020. The newsletters provided information on the MCCO Project (including approvals pathway updates, Response to Submissions report summary, MARNP considerations etc.), Independent Environmental Audit outcomes, mine rehabilitation, operational updates (including COVID-19 controls implemented by the site), vertebrate pest animal control, various environmental management topics and community support. The recruitment of new CCC members was also advertised in the July 2020 Community Newsletter. Copies are available on the Mangoola website.

9.2 Community Contributions

Mangoola is committed to supporting the local community in which it operates. 2020 saw a reduced number of applications for community investment due to the pandemic resulting in the postponing and cancelling of many events/projects. Despite this, Mangoola was still able to support a diverse range of innovative local community activities in 2020, with contributions of approximately $85,000 made by Mangoola and additional funding through Glencore Coal Assets Australia. The 2020 recipients of sponsorship/donations during the reporting period are presented below:

- Upper Hunter Education Fund;
- The Upper Hunter Showgirl;
- Wybong RFS shed sign and provision of water bottles as required through bushfire season;

- Wybong Community Hall and Wybong Cemetery (mowing and hall insurance);
- Muswellbrook Chamber of Commerce and Industry Business Awards (which, due to COVID-19 pandemic has been carried over into 2021);
- End of year presentations/awards for St Josephs Public School Denman, Sandy Hollow Public School and Denman Public School;
- Muswellbrook High School Year 7 Camp;
- Hunter Valley Mining Charity Rugby League Knockout Competition;
- Wybong Cemetery (fence replacement as coordinated by Wybong Public Hall Committee in consultation with MSC – joint Mangoola/Glencore support);
- Denman Children's Centre – security fence upgrade (Glencore contribution facilitated by Mangoola); and
- Merton Living Aged Care (Denman) – installation of automated, and wider, sliding doors for improved independence (Glencore contribution facilitated by Mangoola).

Additional in kind support has included volunteering for Clean Up Australia Day and the Denman Pomaderris Project (where Mangoola personnel worked alongside the Department of Planning, Industry and Environment and school kids to plant the threatened plant species in the school grounds).

A key component of the Stakeholder Engagement Strategy is to ensure Mangoola supports the local community. Mangoola has implemented the Voluntary Planning Agreement (VPA) required under Schedule 2, Condition 12 of PA 06_0014 with Muswellbrook Shire Council. The VPA is designed to provide financial contributions commensurate with the terms set out in PA 06_0014. Mangoola is committed to meeting its obligations under the VPA.

Photo 11 Denman Children's Centre (Upgraded Security Fence)

Photo 12 Laurie Hollins from Merton Living Demonstrating How Easy it is to use the New Automated Sliding Doors

9.3 Community Complaints

Mangoola manages all complaints in accordance with the Mangoola Complaints Management Procedure, which details the process for receiving and responding to complaints. Complaints are received via a dedicated Community Response Line, in person, facsimile, email, letter or general telephone.

9.3.1 2020 Complaints Summary

A total of 133 community complaints were received by Mangoola during the reporting period. A summary of the time of year and subject of the complaints are provided in **Table 43**.

Table 43 Summary of Complaints in 2020

Month	Noise	Dust	Lighting	Blasting	Traffic	Total
January	5					**5**
February	5				1	**6**
March	22			1		**23**
April	5			1		**6**
May	24	1		1		**26**
June	17		1	2		**20**
July	14	1		1		**16**
August	8		1			**9**
September	8					**8**
October	9					**9**
November	4					**4**
December	1					**1**
Total	**122**	**2**	**2**	**6**	**1**	**133**

9.3.2 Analysis of Complaints

Complaint Subject and Quantity

As shown in **Table 43**, the majority of complaints received in the reporting period were in relation to noise (92%). This percentage has increased marginally from 2019 (90%) but consistent with 2018 (77%). Further details on management and mitigation measures regarding noise that were implemented during the reporting period are provided in **Section 6.3.** Additional attended noise monitoring was conducted once again from June to September 2020 due to the increase in complaints from the area north west of the mine in 2020.

The 133 complaints received in 2020 represent a 30% decrease from the 191 environmental complaints received in 2019. A review of complaints from 2007 to 2020 found that complaints peaked in 2011 (717 complaints) which represented the first full calendar year of operations.

Complaint Timing

Figure 17 shows the time of day that complaints were made during 2020. Analysis of this data shows that noise complaints are generally made in the early morning and late evening, whereas blast related complaints are generally made in the middle of the day.

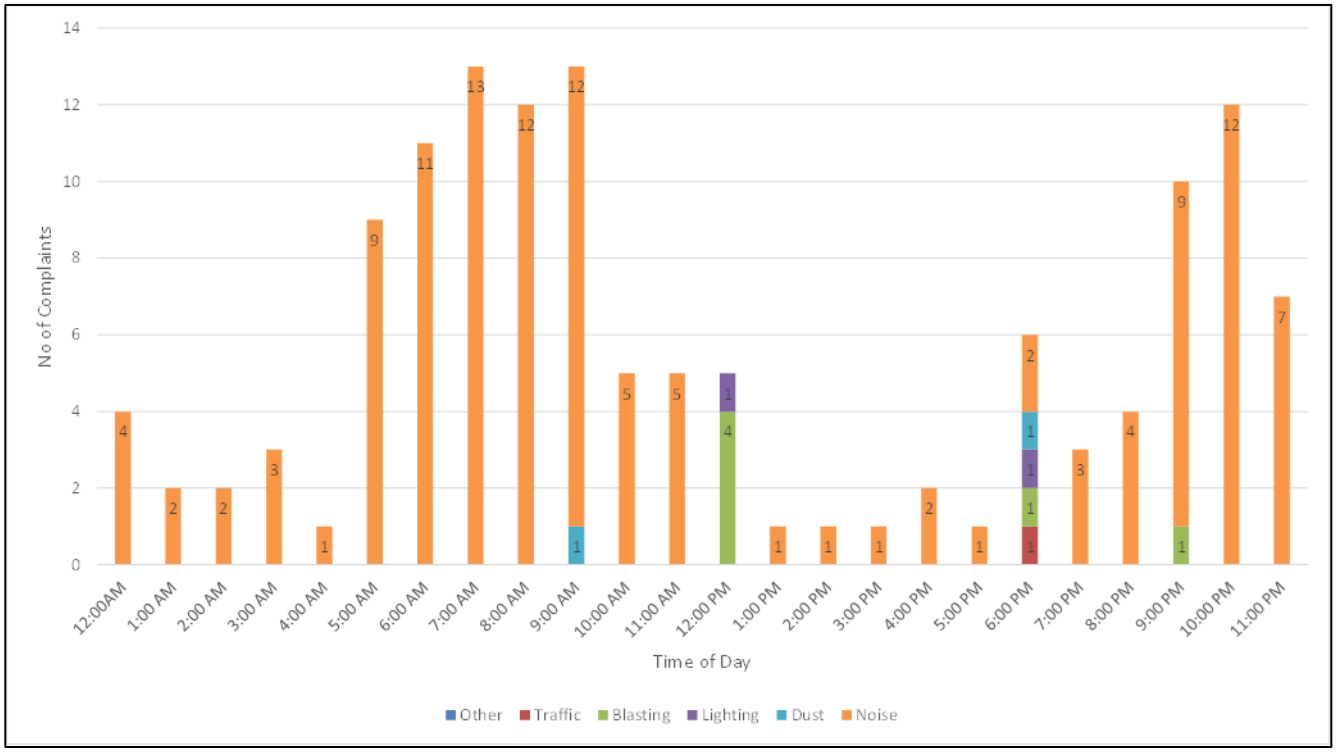


Figure 17 2020 Complaints by Time of Day

Complainants

Figure 18 shows the number of complaints made by each complainant during 2020. The 133 complaints were made by 26 individuals during 2020 and approximately a 48% of all complaints (65) were made by three complainants. These were predominantly in relation to noise.

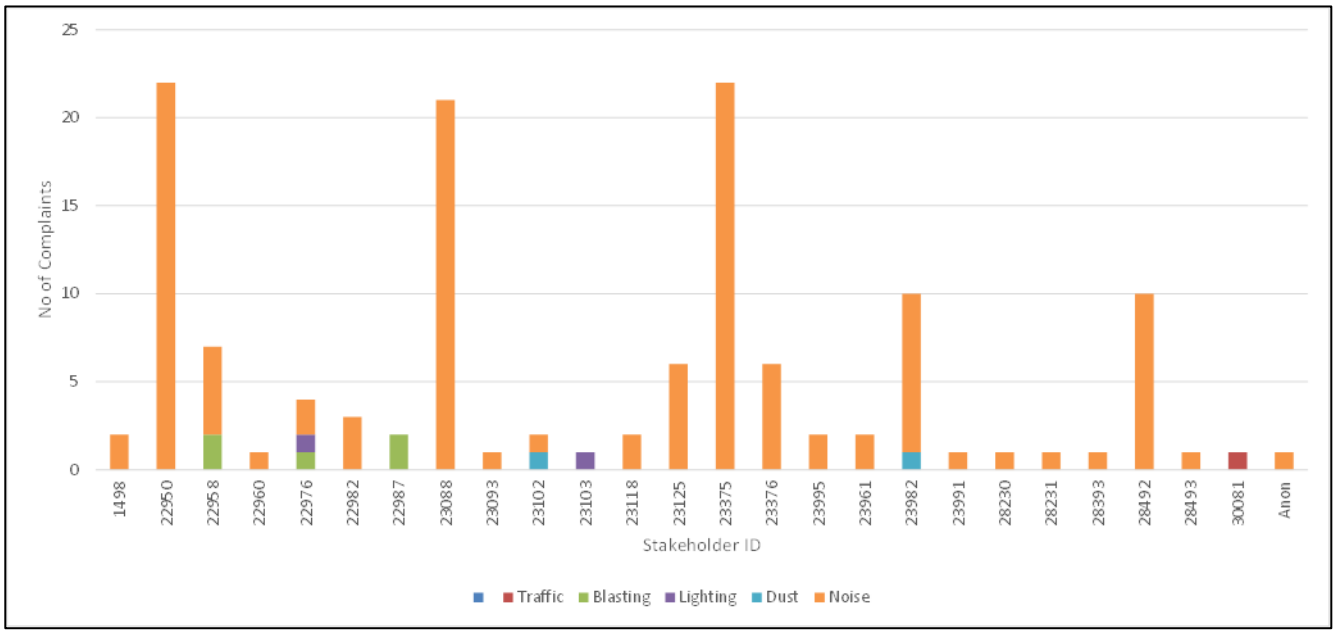


Figure 18 2020 Complaints by Complainant ID

Complaint Location

Figure 19 shows complaint location during 2020 with the majority of complaints received from the north-west sector primarily related to noise.

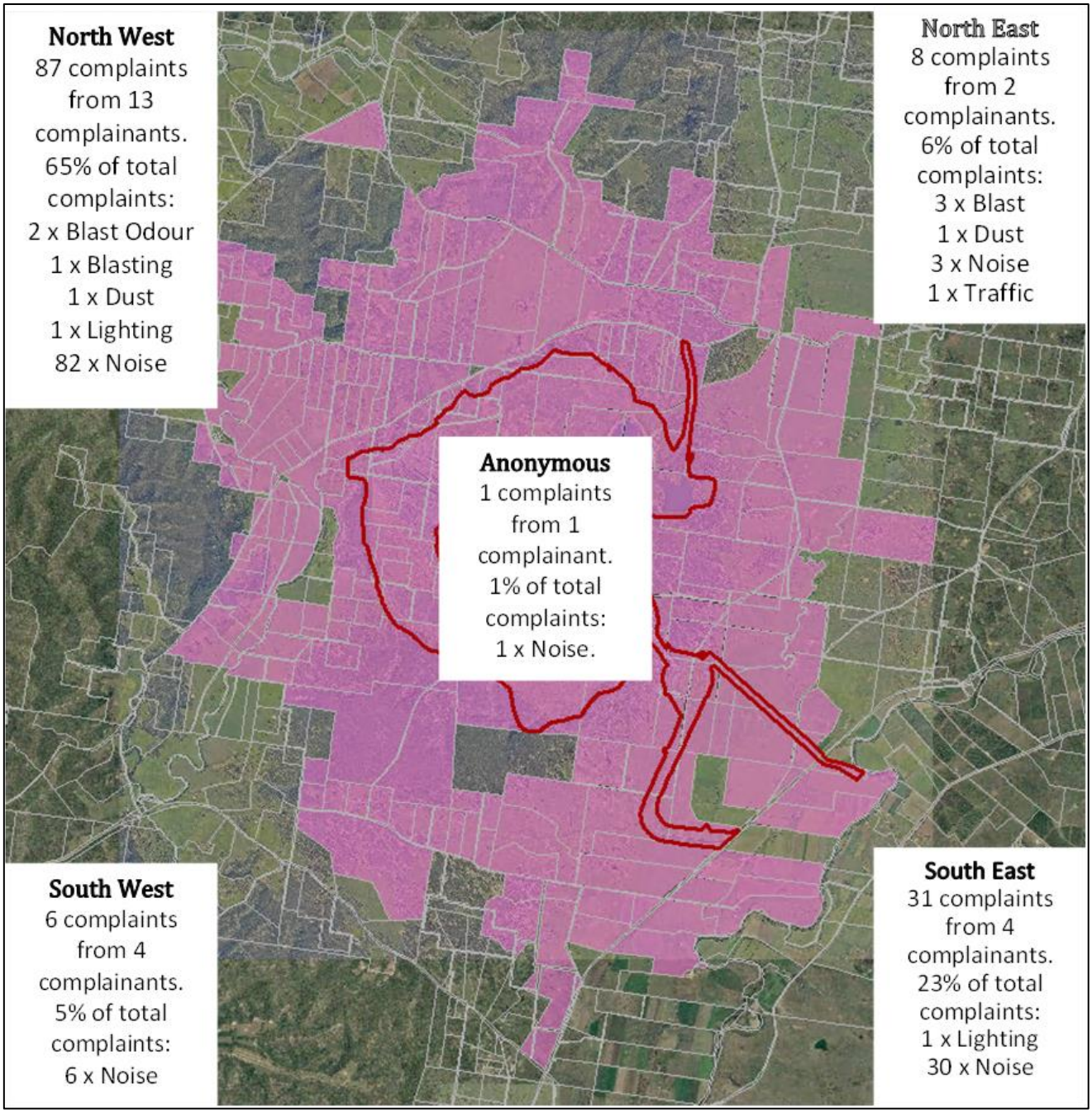


Figure 19 2020 Complaints by Location

9.3.3 Actions in Response to Complaints

In response to complaints received in 2020, the following responses were undertaken, depending on the nature of the complaint.

Noise

- Following receipt of a noise complaint, the real time noise monitors were reviewed, and noise alarms were reviewed to see if any were received prior to the complaint;
- Operational noise management controls were reviewed by the Mining Supervisor or CHPP Supervisor;
- Where noise alarms were received, and the Mining/CHPP Supervisor verified activities from our operation to be the source, the operation was reviewed with changes made as required to reduce noise levels, e.g. parking up equipment; and
- Supplementary weekly attended noise monitoring was undertaken at an additional four locations at a further distance north west of site in response to complaints. This was completed weekly during the winter period. No non compliances were measured during this monitoring.

Blast

- Depending on the nature of the blast complaint, the following were reviewed:
    - blast monitoring results;
    - the blast video;
    - pre-blast assessment to confirm meteorological conditions at time of blasting;
    - air quality monitoring results; and/or
    - other blasting activity in region (where blast time did not correlate with a Mangoola blast); and
- All blast overpressure and ground vibration results confirmed to be within compliance limits and discussed with complainant where relevant.

Dust

- Following receipt of a dust complaint, a review of alarms and the operational air quality management controls was undertaken by the Mining or CHPP Supervisor;
- Modifications to operations were made as required (e.g. pulling up circuit, relocating to lower dump – typically undertaken in response to alarms prior to or around time of complaint);
- Meteorological conditions and other relevant monitoring systems (such as the Upper Hunter Air Quality Monitoring Network) were also reviewed; and
- Complainants contacted to discuss complaint detail, outcomes of investigation and any additional actions implemented in response to alarms.

Lighting

- Following receipt of a lighting complaint, the Mining Supervisor reviewed lighting including a lighting inspection along public roads. Changes were made in all instances to reduce lighting impacts.

Traffic

- One traffic complaint was received in 2020 which was handled internally.

10 Independent Audit

In accordance with Condition 7, Schedule 5 of PA06_0014, an IEA is required every three years. An IEA was undertaken in 2019, occurring between 29 July 2019 to 1 August 2019. The next IEA will be completed in 2022.

This audit had a result of six non-compliances, which were risk ranked. There were no high or medium risks identified. Three issues were identified as 'low risk' and three issues were classified as 'administrative' in nature. All of the actions assigned to these non-compliances had been addressed and reported during the 2019 Annual Review.

In addition, Hanson Bailey (2019) provided recommendations which are outlined in **Table 44**. Where the status of the recommendations were reported as being complete or N/A during the 2019 Annual Review, these have been excluded from **Table 44**.

Table 44 Independent Environmental Audit Recommendations

Reference	Audit Finding	Mangoola Coal Response/ Action Required/ Timeline	Status Reported during 2019 Annual Review	Status at 31 March 2021
PA 06_0014 (as modified)				
PA 06_0014, Schedule 3, Condition 33	In the next update of the Biodiversity Offset Strategy, a statement should be made clarifying that no areas of Bull Oak Woodland are proposed to be re-established but existing areas will be managed and enhanced.	Section 4.4.1 of the approved BOMPS refers to the monitoring of passive regeneration. Observations to date has shown that Bulloak Woodland passive regeneration has been successful. Mangoola Coal will continue to apply the processes contained in Section 4.4.1 of the BOMPS which may include the active regeneration of Bulloak woodland if required. Clarification will be made in the periodic update of the BOMPS which will be updated and submitted to relevant Departments for consultation by 30 September 2021.	Action to be completed as part of the period update to the BOMPS which will be updated and submitted for consultation by 30 September 2021.	Action to be completed as part of the period update to the BOMPS which will be updated and submitted for consultation by 30 September 2021.
PA 06_0014, Schedule 3, Condition 43	Remove demolished sites from the main document (Figure 2 and Table 2) to avoid confusion at next review.	Mangoola Coal will make this administrative update in the next periodic review of the Conservation Management Strategy which is due by 31 December 2020.	Action is to be completed as part of the periodic review of the Conservation Management Strategy which will be updated and submitted for consultation by 30 June 2020.	The CMS was updated in 2020 and demolished sites were removed from figure 2 and table 2. This updated version was approved by the DPIE on 16 November 2020.

11 Incidents and Non-Compliances

All 2020 incidents, non-compliances and exceedances related to PA 06_0014, EPL 12894 and relevant management plans are summarised in **Table 45**.

Table 45 Incidents, Non-Compliances and Exceedances

Date	Summary	Non-Compliance	Details/Response
2 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from three of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The result is as follows: • D03-DC (PM_{10}) – 63.6µg/m³ • D05-DC (PM_{10}) – 75.0µg/m³ • D06-DC (PM_{10}) – 54.0µg/m³ As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.
3 January 2020 4 January 2020 5 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs and HVAS	PA 06_0014 Air Quality Management Plan	<u>Friday 3 January 2020</u> The 24 hour averaging result from two of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The results are as follows: • D05-DC (PM_{10}) – 67.2µg/m³ • D06-DC (PM_{10}) – 50.7µg/m³ <u>Saturday 4 January 2020</u> The 24 hour averaging result from two of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The results are as follows: • D03-DC (PM_{10}) – 53.1µg/m³ • D05-DC (PM_{10}) – 53.6µg/m³

Date	Summary	Non-Compliance	Details/Response
			Sunday 5 January 2020 The 24 hour averaging result from all five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The results are as follows: • D02-DC (PM_{10}) – 76.6µg/m^3 • D03-DC (PM_{10}) – 190.2µg/m^3 • D04-DC (PM_{10}) – 89.4µg/m^3 • D05-DC (PM_{10}) – 106.3µg/m^3 • D06-DC (PM_{10}) – 146.9µg/m^3 As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.
6 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from three of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The result is as follows: • D03-DC (PM_{10}) – 54.4µg/m^3 • D05-DC (PM_{10}) – 60.5µg/m^3 • D06-DC (PM_{10}) – 51.9µg/m^3 As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.

Date	Summary	Non-Compliance	Details/Response
8 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from three of five of Mangoola's TEOMs exceeded the 24 hour averaging PM10 criterion. The result is as follows: • D03-DC (PM_{10}) – 76.6µg/m³ • D05-DC (PM_{10}) – 58.1µg/m³ • D06-DC (PM_{10}) – 56.2µg/m³ As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.
9 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs and HVAS	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from one of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The result is as follows: • D05-DC (PM_{10}) – 73.2µg/m³ As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.
10 January 2020	Category 4B blast fume	PA 06_0014 Blast Fume Management Plan	Shot #1150 MPW Strip 14 low vibration powerline blast was blasted. The blast fumed beyond expectation, and all fume and dust dissipated onsite. The blast fume was rated at level 4 and subsequently reported as per the Blast Fume Management Plan. DPIE were notified and an investigation report was provided under Schedule 5, Condition 4 of PA 06_0014. Correspondence received from DPIE on 12 February 2020 indicate they were satisfied with the fume rankings and investigation outcomes. As a result, no further actions were required.

Date	Summary	Non-Compliance	Details/Response
10 January 2020 11 January 2020 12 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	<u>Friday 10 January 2020</u> The 24 hour averaging result from two of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The results are as follows: • D05-DC (PM_{10}) – 54.3µg/m³ • D06-DC (PM_{10}) – 52.2µg/m³ <u>Saturday 11 January 2020</u> The 24 hour averaging result from all five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The results are as follows: • D02-DC (PM_{10}) – 114.5µg/m³ • D03-DC (PM_{10}) – 128.1µg/m³ • D04-DC (PM_{10}) – 88.5µg/m³ • D05-DC (PM_{10}) – 148.9µg/m³ • D06-DC (PM_{10}) – 213.9µg/m³ <u>Sunday 12 January 2020</u> The 24 hour averaging result from four of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The results are as follows: • D03-DC (PM_{10}) – 69.5µg/m³ • D04-DC (PM_{10}) – 51.2µg/m³ • D05-DC (PM_{10}) – 56.3µg/m³ • D06-DC (PM_{10}) – 72.4µg/m³ As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.

Date	Summary	Non-Compliance	Details/Response
15 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for HVAS	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from four of Mangoola's HVAS results exceeded the 24 hour averaging PM_{10} criterion. The results are as follows: • D01-PM_{10} – 53ug/m^3 • D05-PM_{10} – 59ug/m^3 • D06-PM_{10} – 56ug/m^3 • D07-PM_{10} – 60ug/m^3 As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.
20 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from three of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The result is as follows: • D03-DC (PM_{10}) – 53.8µg/m^3 • D05-DC (PM_{10}) – 55.0µg/m^3 • D06-DC (PM_{10}) – 63.4µg/m^3 As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.
21 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from two of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The result is as follows: • D03-DC (PM_{10}) – 54.3µg/m^3 • D06-DC (PM_{10}) – 50.5µg/m^3 As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.

Date	Summary	Non-Compliance	Details/Response
23 January 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from one of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The result is as follows: • D03-DC (PM_{10}) – 55.6µg/m³ As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.
4 February 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from two of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The result is as follows: • D03-DC (PM_{10}) – 54.0µg/m³ • D06-DC (PM_{10}) – 57.5µg/m³ As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.
17 February 2020	Surface Water Discharge – Sandy Creek Farm Dam 1	PIRMP	On Monday the 17 February 2020, Mangoola experienced a 5-10% AEP storm event. Due to the runoff exceeding the pumping and freeboard of the dams, water was discharged from site. The PIRMP was enacted in accordance with Section 147 of the POEO Act and the incident was reported to EPA and DPIE in accordance with applicable statutory requirements.
19 February 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from one of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion. The result is as follows: • D06-DC (PM_{10}) – 52.5µg/m³ As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. This was classified as extraordinary event by DPIE.

Date	Summary	Non-Compliance	Details/Response
4 March 2020	Exceedance of Overpressure Criteria at BM07	PA 06_0014, Schedule 3, Condition 10 EPL 12894, Condition L4.2 Blast Management Plan	Blast #1200 was fired at 12.21pm in Main Pit West and an overpressure reading of 120.9dB was recorded at Blast Monitor 07 (BM07/ EPL Monitoring point 21). This reading is above the 120bB impact assessment criteria outlined in Schedule 3, Condition 10 of PA 06_0014 and EPL 12894, Condition L4.2. Notifications were made to both DPIE and the EPA following the blast with the follow up incident investigation reports required under Schedule 5, Condition 4 of PA 06_0014 and Condition R2.2 of EPL 12984 submitted to the relevant departments on 11 March 2020. A formal warning letter was received from DPIE on 24 March 2020, while to date no formal response from the EPA has been received.
17 March 2020	Loss of continuous monitoring data at monitoring point D7-DC	EPL 12894, Condition M2.2 Air Monitoring Requirements	On review of the monitor results on 18 March 2020, a fault (Zero Calibration Error) was identified on the monitor. The Contractor attended the monitor but was unable to repair the unit resulting in it being taken offsite for repair. A replacement monitor was installed however four (4) days of monitoring results was lost. This failure to continuously monitor at this monitoring point was reported in the Annual Return as required under Condition R1 of EPL 12894.
2 December 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from two of five of Mangoola's TEOMs exceeded the 24 hour averaging PM_{10} criterion on 2/12/2020. The result is as follows: • D02-DC (PM_{10}) – 57.2 µg/m^3 • D06-DC (PM_{10}) – 55.9 µg/m^3 As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. A response from DPIE was received on 13 January 2021: "The Department is satisfied that reasonable and feasible dust control measures were implemented on 2 December 2020 in accordance with the approved Air Quality Management Plan for Mangoola Open Cut. No further action is required at this time".

Date	Summary	Non-Compliance	Details/Response
24 December 2020	Exceedance of 24hr averaging period (PM_{10} criterion) for TEOMs	PA 06_0014 Air Quality Management Plan	The 24 hour averaging result from one Mangoola TEOM exceeded the 24 hour averaging PM_{10} criterion on 24/12/2020. The result is as follows: • D02-DC (PM_{10}) – 61.9 µg/m^3 As per PA06_0014, the Department were notified of the exceedances and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days. A response from DPIE was received on 22 January 2021: "The Department notes the avoidance and mitigations measures implemented on 24 December 2020 to minimise dust generation by site operations. No further action is required".

12 Activities to be Completed During Next Reporting Period

12.1 Management Plan Review

In accordance with Schedule 5, Condition 9 of PA06_0014 the following strategies, plans and programs will be reviewed and/or revised in 2021 as necessary, as listed in **Table 46.**

Table 46 Revision of Strategies, Plans and Programs

Document	2021 Review	Comment
Air Quality Management Plan	No	No changes required as a result of Annual Review.
Noise Management Plan	No	No changes required as a result of Annual Review.
Environmental Management Strategy	No	No changes required as a result of Annual Review.
Conservation Management Strategy	No	No changes required as a result of Annual Review.
Blast Management Plan	No	No changes required as a result of Annual Review.
Blast Fume Management Procedure	No	No changes required as a result of Annual Review.
Water Management Plan	Yes	No changes required as a result of Annual Review.
Surface Water Monitoring Plan	Yes	Seeking approval from Natural Resource Access Regulator as per PA 06_0014 prior to submitting to DPIE.
Groundwater Monitoring Plan	Yes	Seeking approval from Natural Resource Access Regulator as per 20BL172598 prior to submitting to DPIE.
Surface and Groundwater Response Plan	Yes	Management Plan with DPIE for approval.
Erosion and Sediment Control Plan	Yes	Seeking approval from Natural Resource Access Regulator as per PA 06_0014 prior to submitting to DPIE.
Site Water Balance	Yes	Completed annually.
Aboriginal Cultural Heritage Management Plan	No	No changes required as a result of Annual Review.
Biodiversity Offset Management Plan and Strategy	Yes	Three yearly periodic review due in 2021.
Translocation Management Plan	Yes	No changes required as a result of Annual Review.
Energy Savings Action Plan	No	No changes required as a result of Annual Review.
MOP 2019-21	Yes	Will be revised for approval prior to 31 March 2021.
AL9 and EL 5552 Groundwater Monitoring and Modelling Plan	Yes	No changes required as a result of Annual Review.
AL9 Community Consultation Strategy	Yes	No changes required as a result of Annual Review.

The above management plans may trigger further review depending on the outcome of the determination of the MCCO project.

12.2 2021 Actions

Table 47 outlines the actions to be implemented during the 2021 reporting period.

Table 47 2021 Actions

Action	Due Date
Mangoola will review the noise monitoring network to determine whether continuous noise monitoring units can be relocated to provide better coverage around the mining operations.	December 2021
Additional attended noise monitoring to be undertaken to the north-west of operations through the winter period to ensure noise emissions are managed appropriately.	Winter 2021
New threatened terrestrial orchid control plots will be installed.	Following least two consecutive years of good rainfall to identify suitable locations
Investigate installation of trail cameras at representative plots, to quantify the potential impact of White Winged Chough may be having on orchid survival through orchid tuber grazing.	May 2021
Trial the use of fire to address the dense weed swards that have developed in and around some of the rehabilitation plots.	Winter 2021
Introduce fire into translocation plot #2 to clean out competing grasses and weeds to enable accurate re-marking of orchids prior to the next flowering season.	Winter 2021
Monitor vegetation dieback in western side of Anvil Hill for signs of post-drought recovery.	December 2021
Install diversity of small nest box designs into rehabilitation and regenerating areas to encourage use by small birds, microbats, reptiles and insects	September 2021
Validation and review of Numerical Groundwater Model, including revision of the GWMP.	December 2021

13 References

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Todoroski Air Sciences (2013) *Air Quality and Greenhouse Gas Assessment Mangoola Coal.*

Umwelt (2014) *Mangoola Coal Groundwater Monitoring Plan*

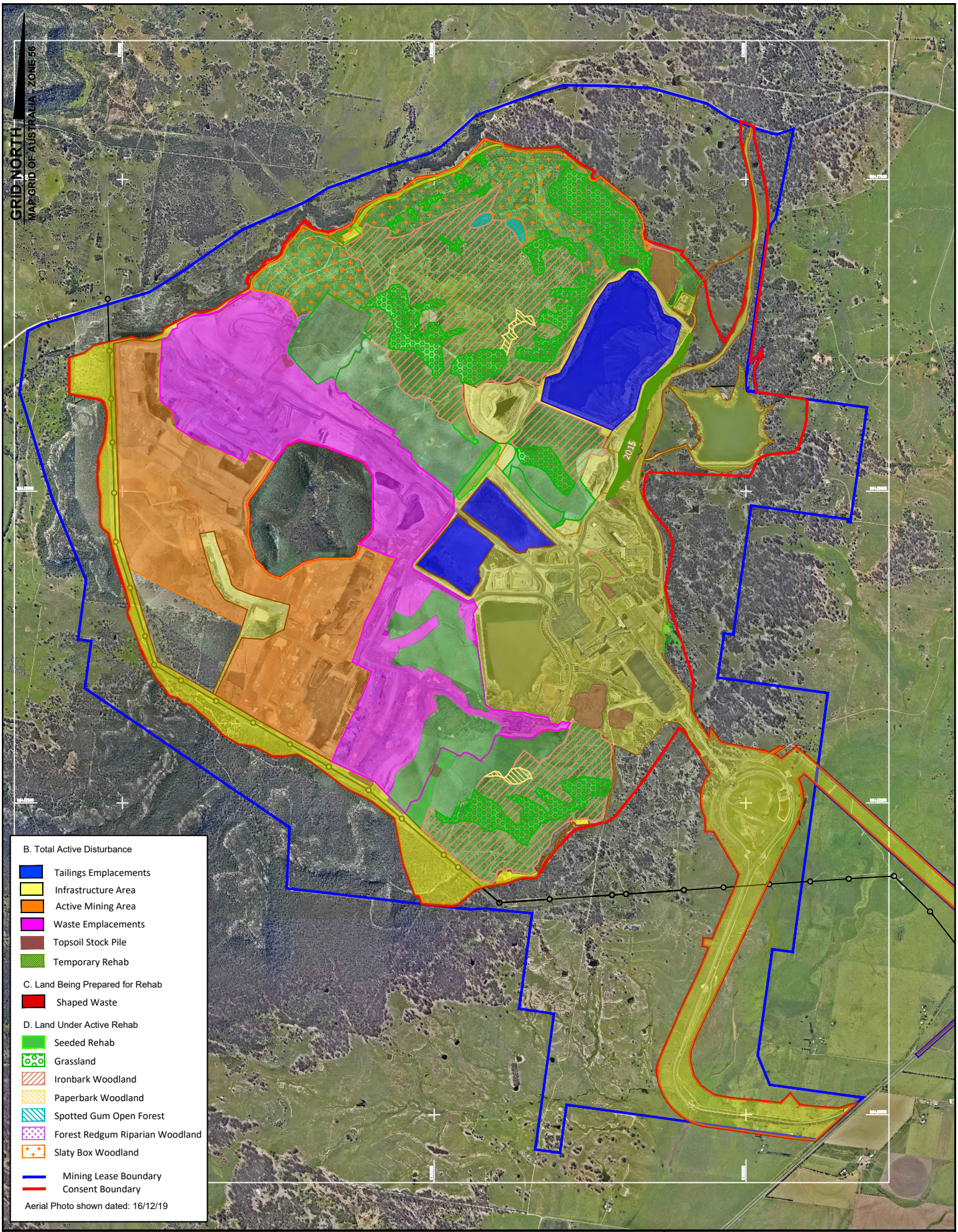
Umwelt (2021a) *Mangoola Open Cut – 2020 Ecological Monitoring Report.*

Umwelt (2021b) *Outcomes of Nest Box Monitoring in Biodiversity Offset Areas, Corridors and Rehabilitation Areas of Mangoola Open Cut – 2020.*

WRM (2013) *Mangoola Coal Modification to Project Approval Surface Water Assessment.*

APPENDIX A

Annual Review Plan



SITE : MANGOOLA			TITLE: Rehabilitation / Mining Summary 2020
DEPARTMENT : SURVEY	DATUM: A.H.D.	GLENCORE Mangoola Coal Operations Pty Ltd Wybong Road, Muswellbrook NSW 2333 Australia P.O. Box 495 Muswellbrook NSW 2333 Australia	
DRAWN : MPN	DATE : 03/03/21	SIGN:	DRAWING No. : 210303-GEN-AP-444-SJ-R0 File No. :
SCALE : NTS			REV. 0 / SHEET A4

APPENDIX B

Long Term Trend Graph – Rainfall

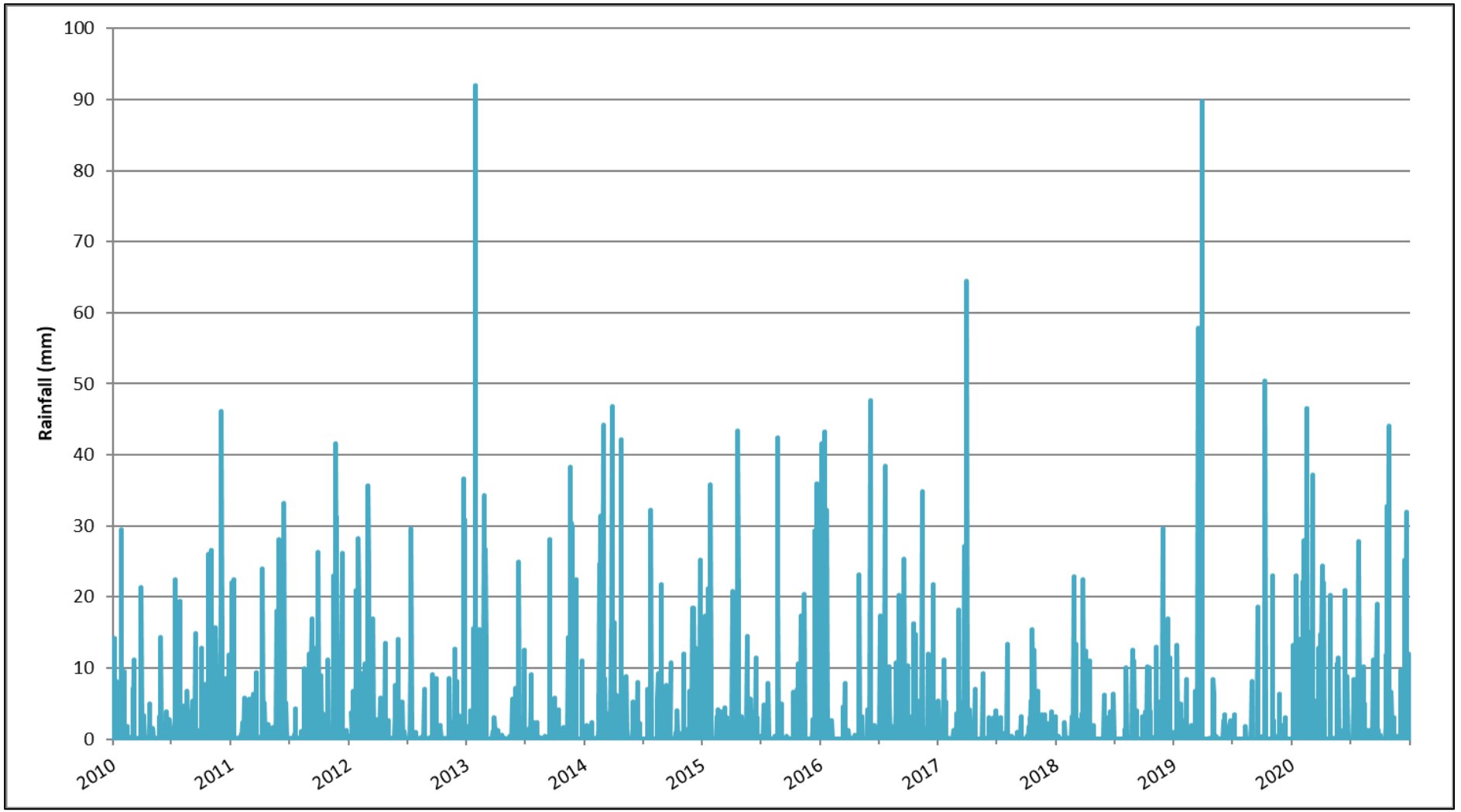


Figure 20 Long Term Daily Rainfall Data at WSN – 2010 to 2020

APPENDIX C

Long Term Trend Graphs – Air Quality

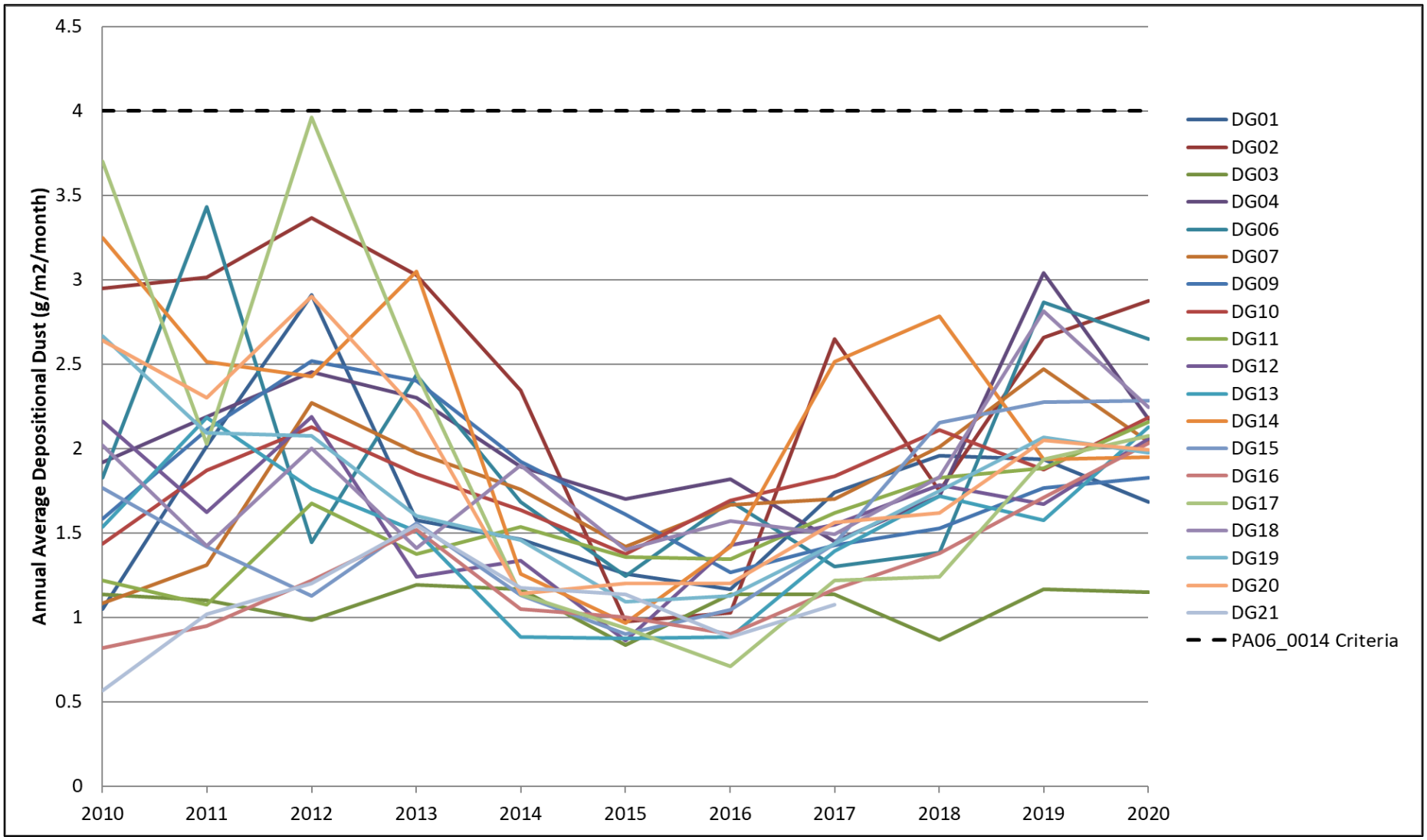


Figure 21 Long Term Annual Average Depositional Dust Monitoring Results – 2010 to 2020

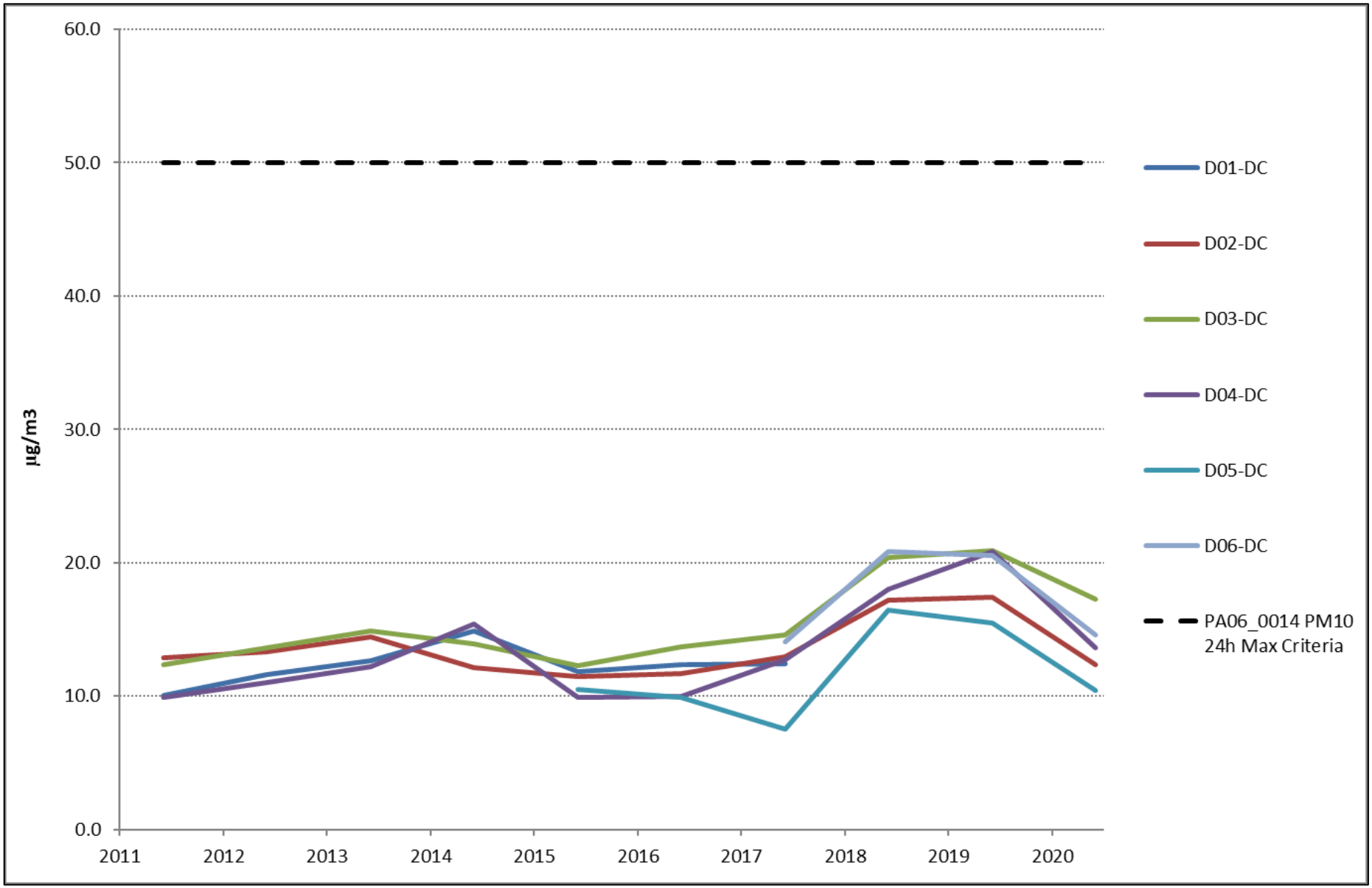


Figure 22 Long Term Annual Average PM_{10} TEOM Monitoring Results – 2011 to 2020

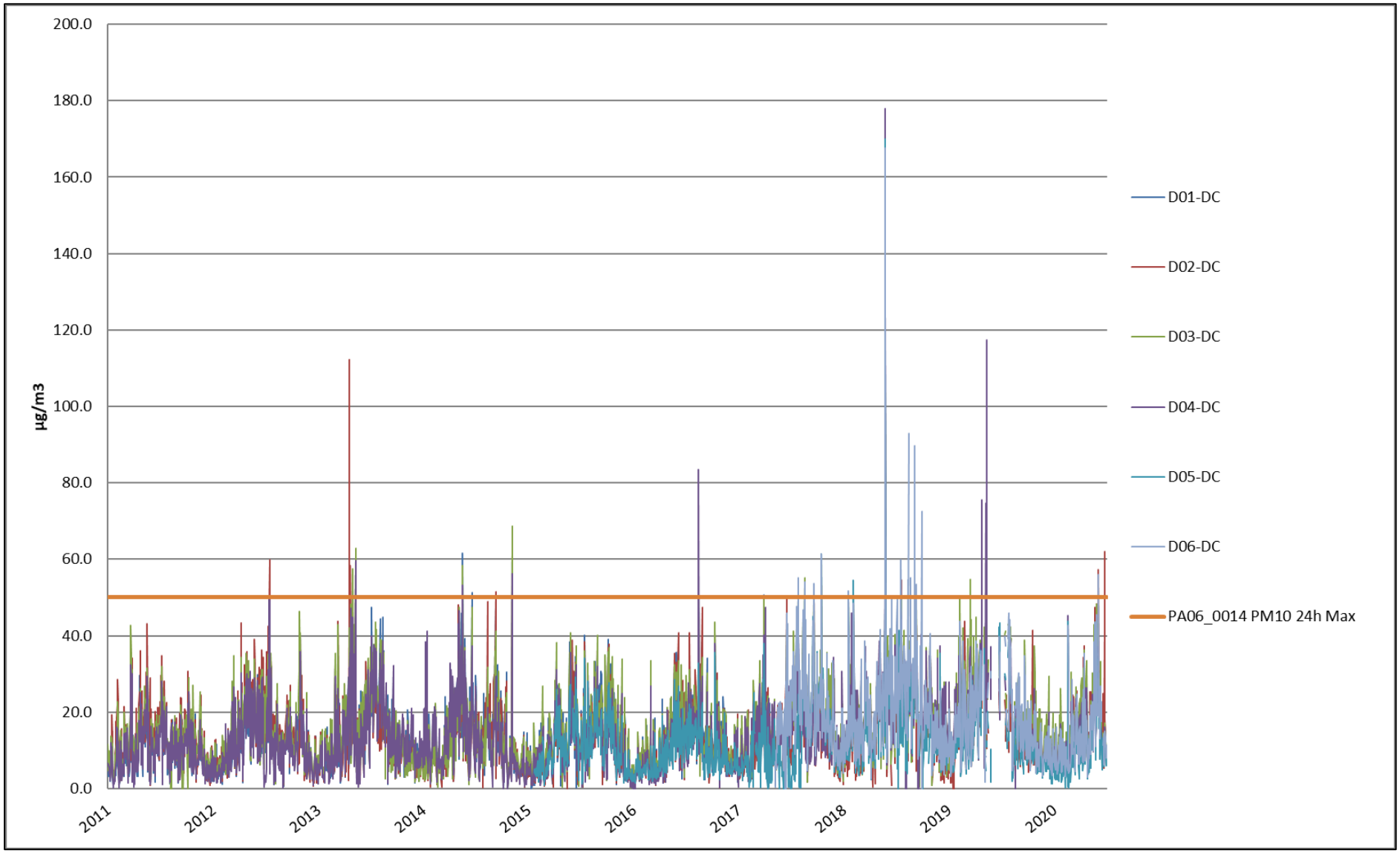


Figure 23 Long Term 24h PM_{10} TEOM Monitoring Results – 2011 to 2020

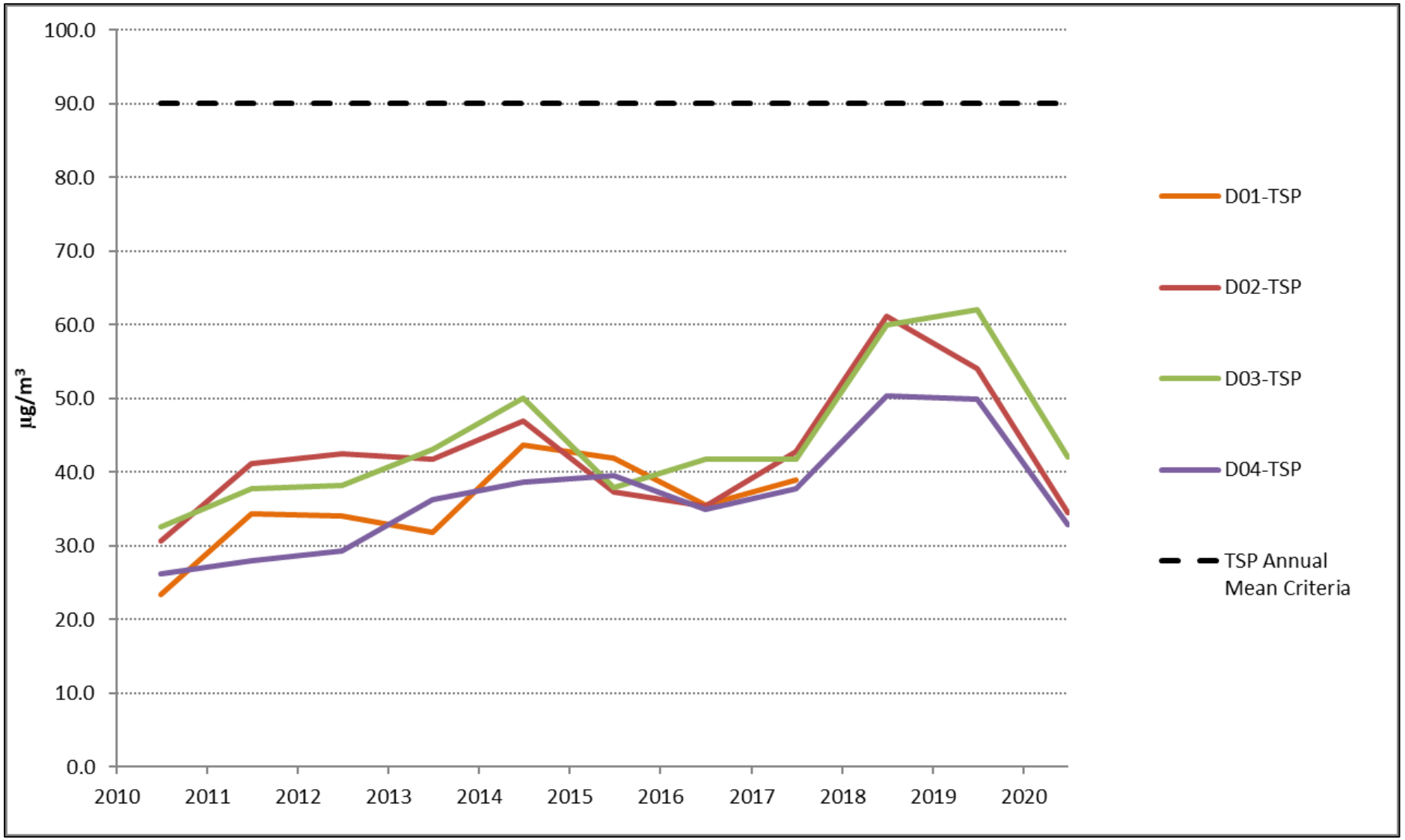
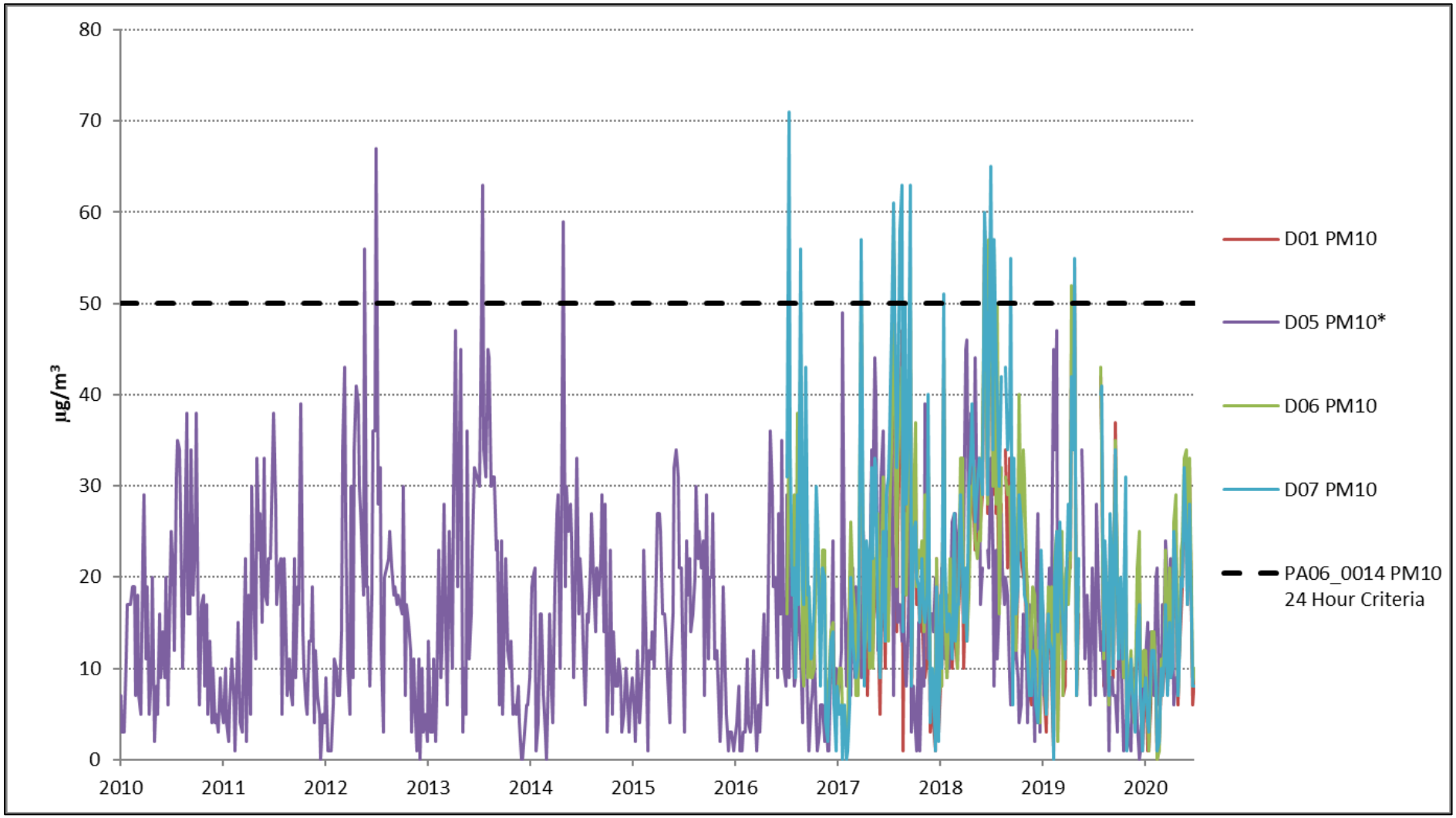


Figure 24 Long Term Annual Average TSP HVAS Monitoring Results – 2010 to 2020



** Note that D05-PM10 is the only monitor representative of a private receptor.*

Figure 25 Long Term 24h PM10 HVAS Monitoring Results – 2010 to 2020

APPENDIX D

Long Term Trends Graphs – Blasting

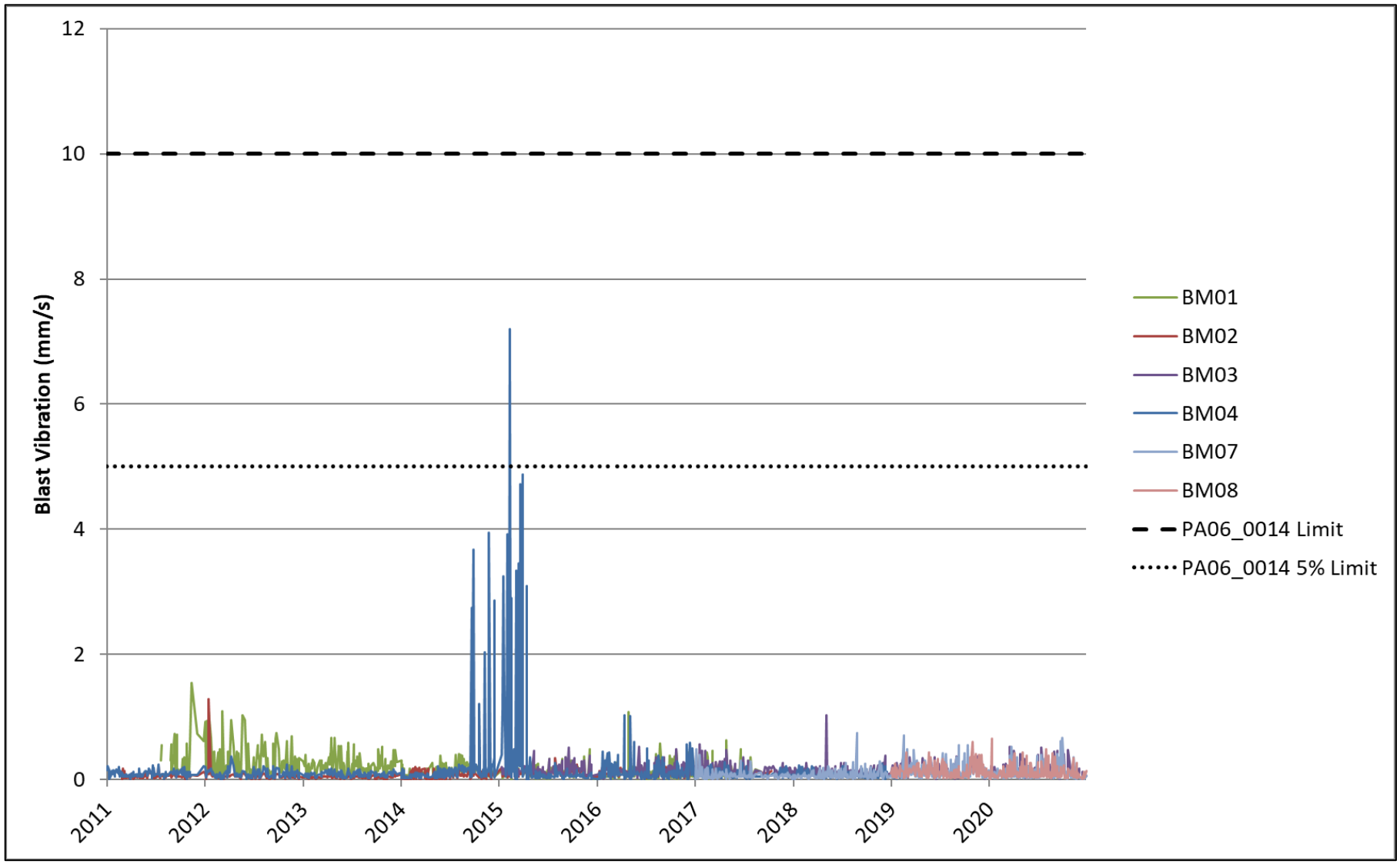


Figure 26 Long Term Blast Vibration Monitoring – BM01 to BM04 and BM07 to BM08

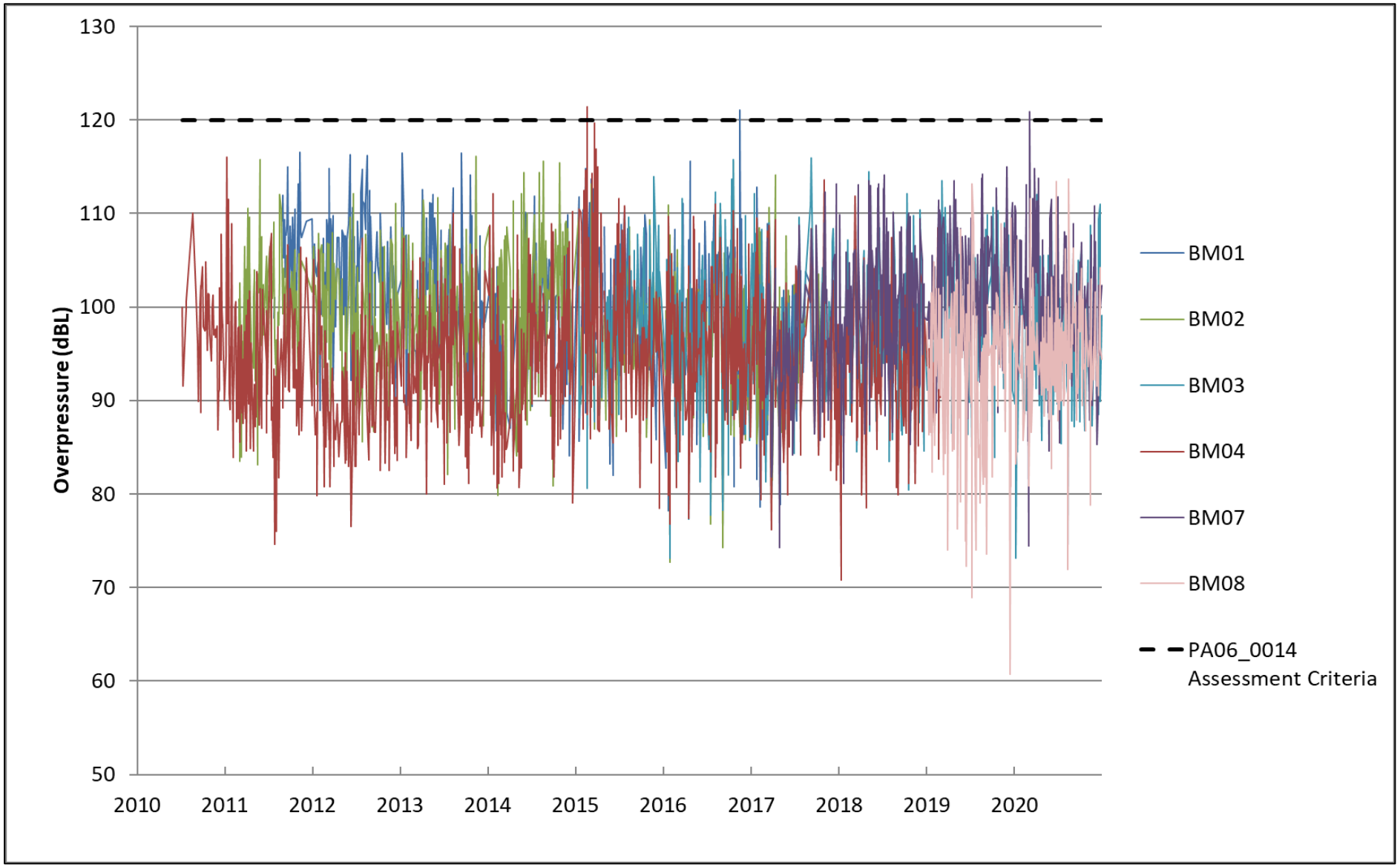


Figure 27 Long Term Overpressure Monitoring – BM01 to BM04 and BM07 to BM08

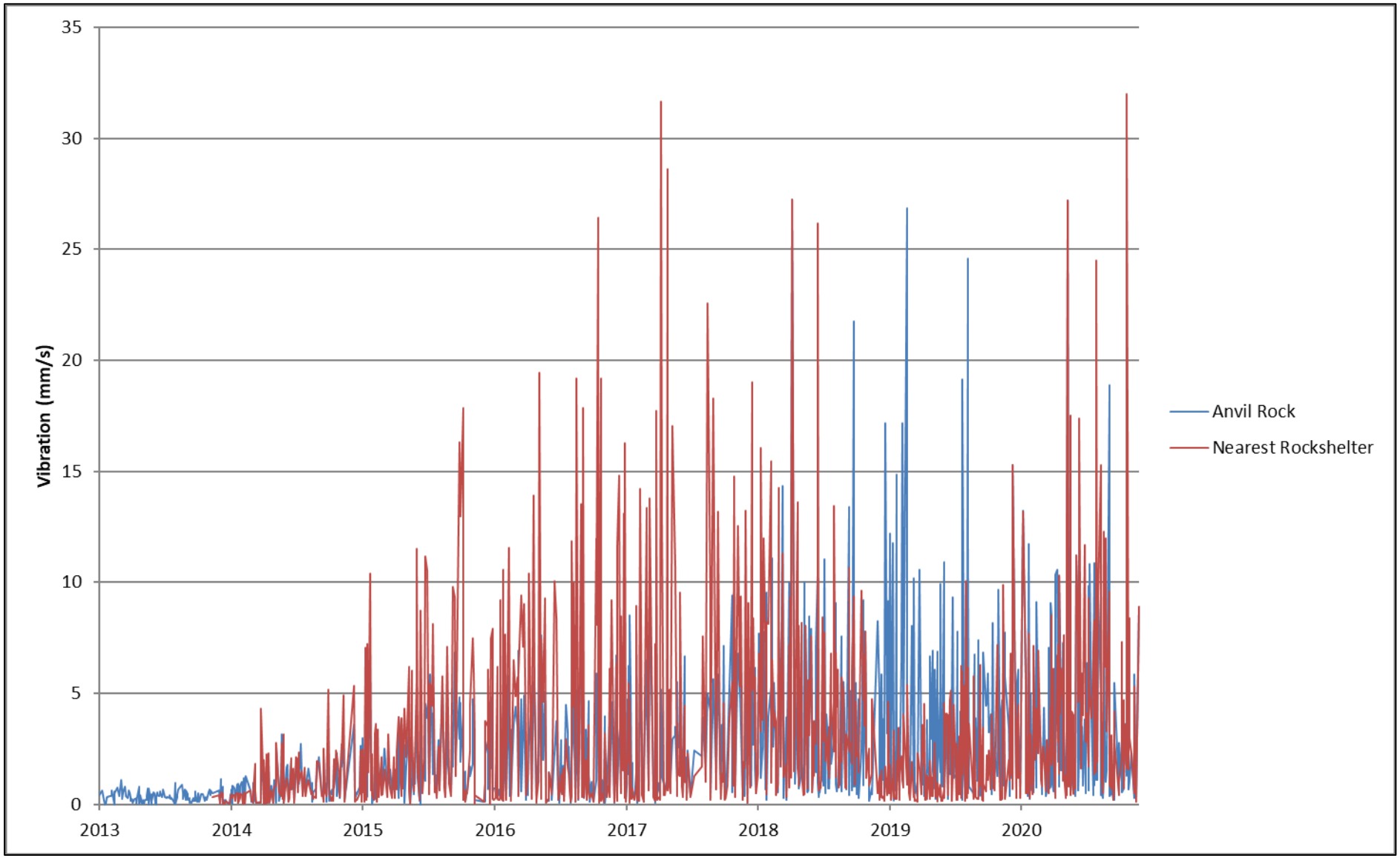


Figure 28 Long Term Blast Vibration Monitoring – Representative of Anvil Rock and Nearest Formation

APPENDIX E

Long Term Graphs – Surface and Groundwater

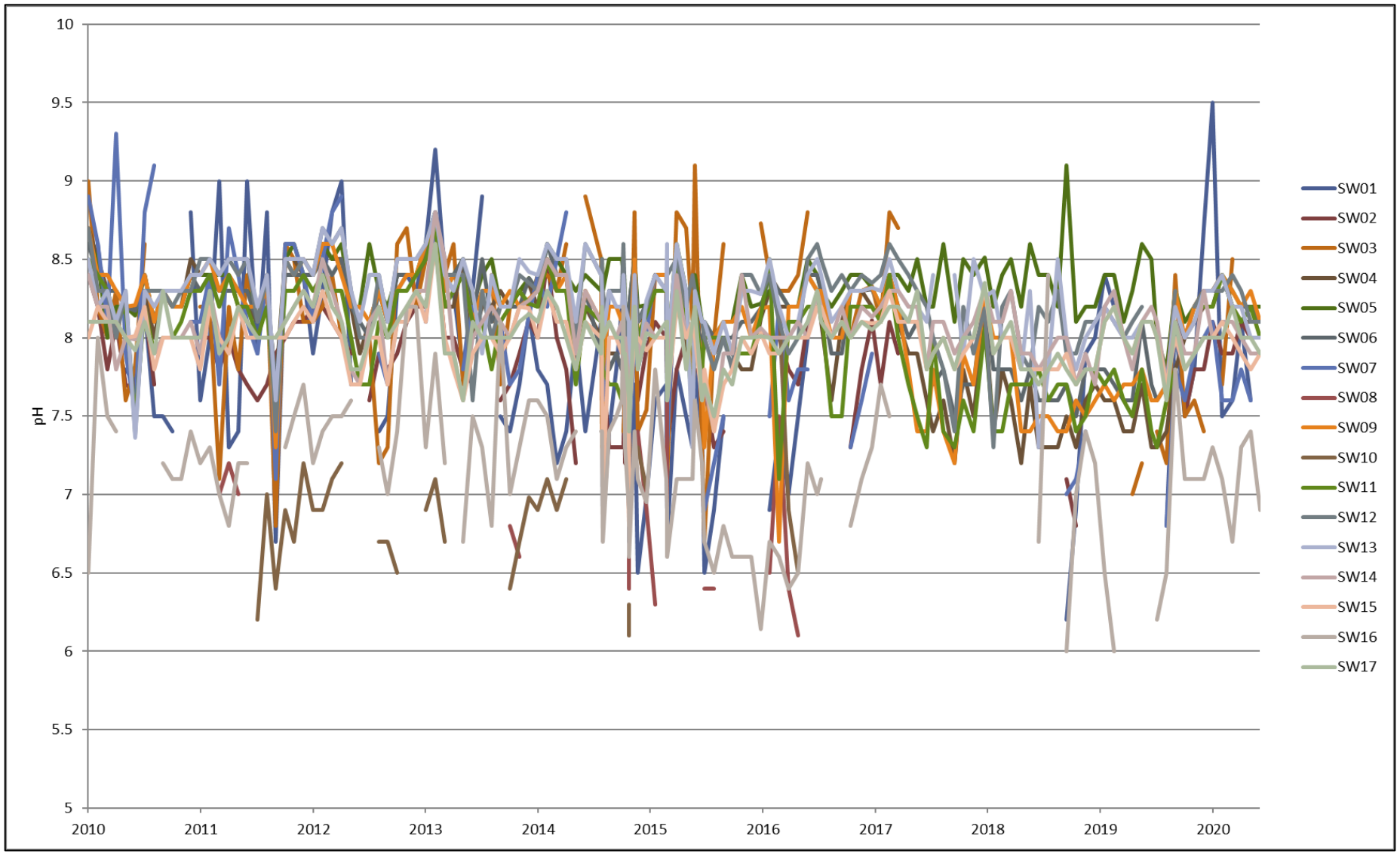


Figure 29 Long Term Surface Water pH – 2010 to 2020

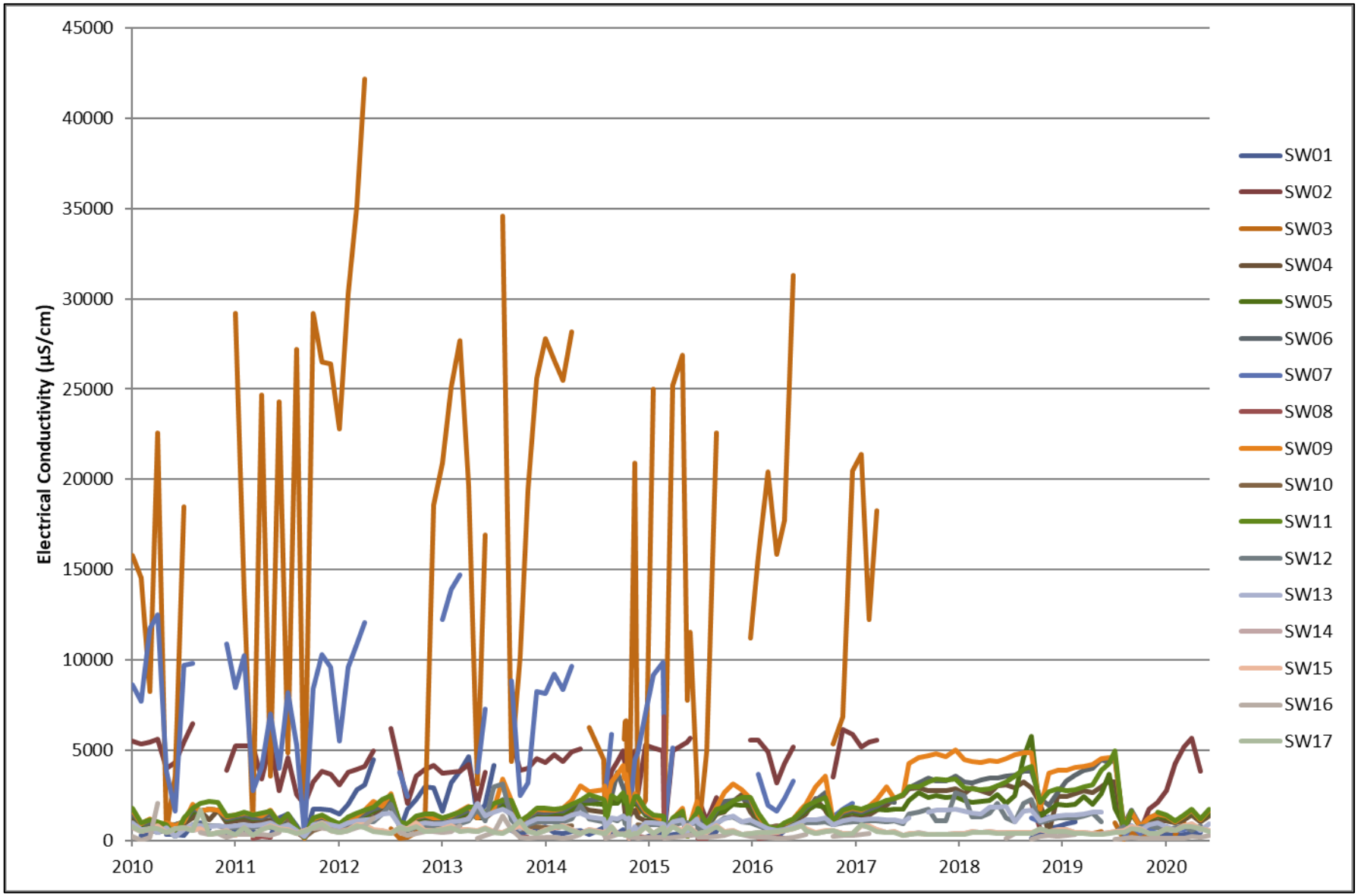


Figure 30 Long Term Surface Water EC – 2010 to 2020

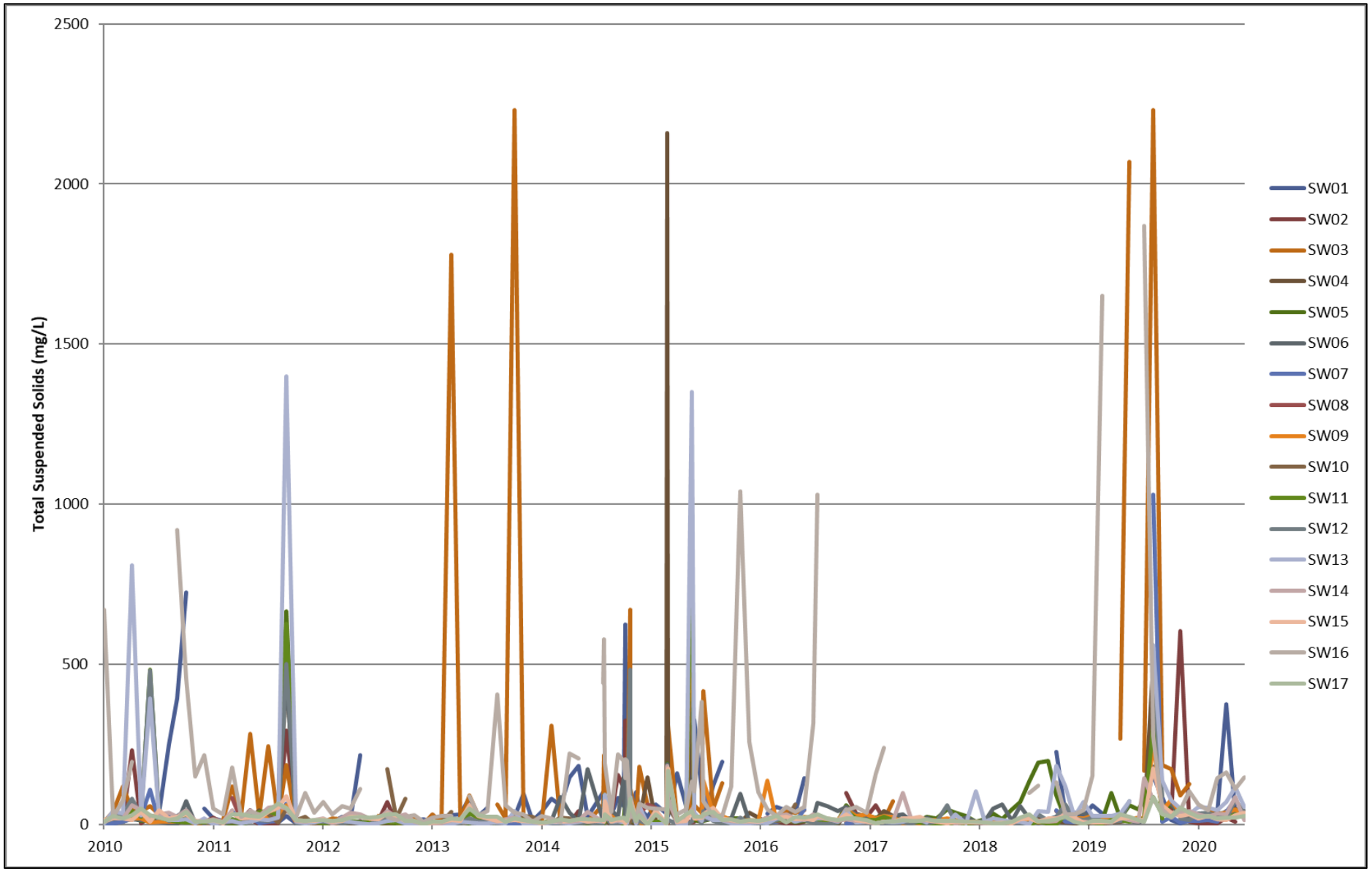


Figure 31 Long Term Surface Water TSS – 2010 to 2020

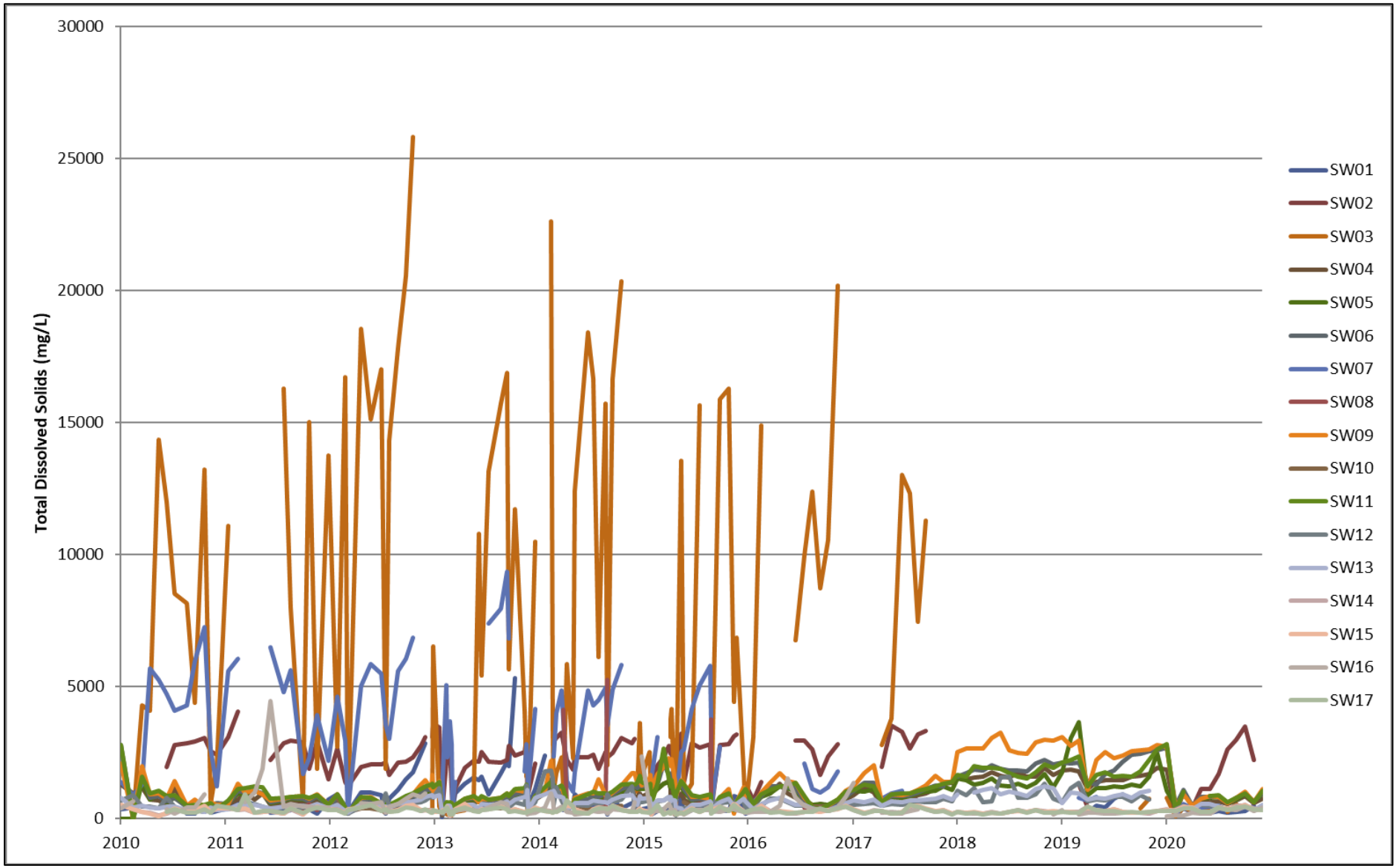


Figure 32 Long Term Surface Water TDS – 2010 to 2020

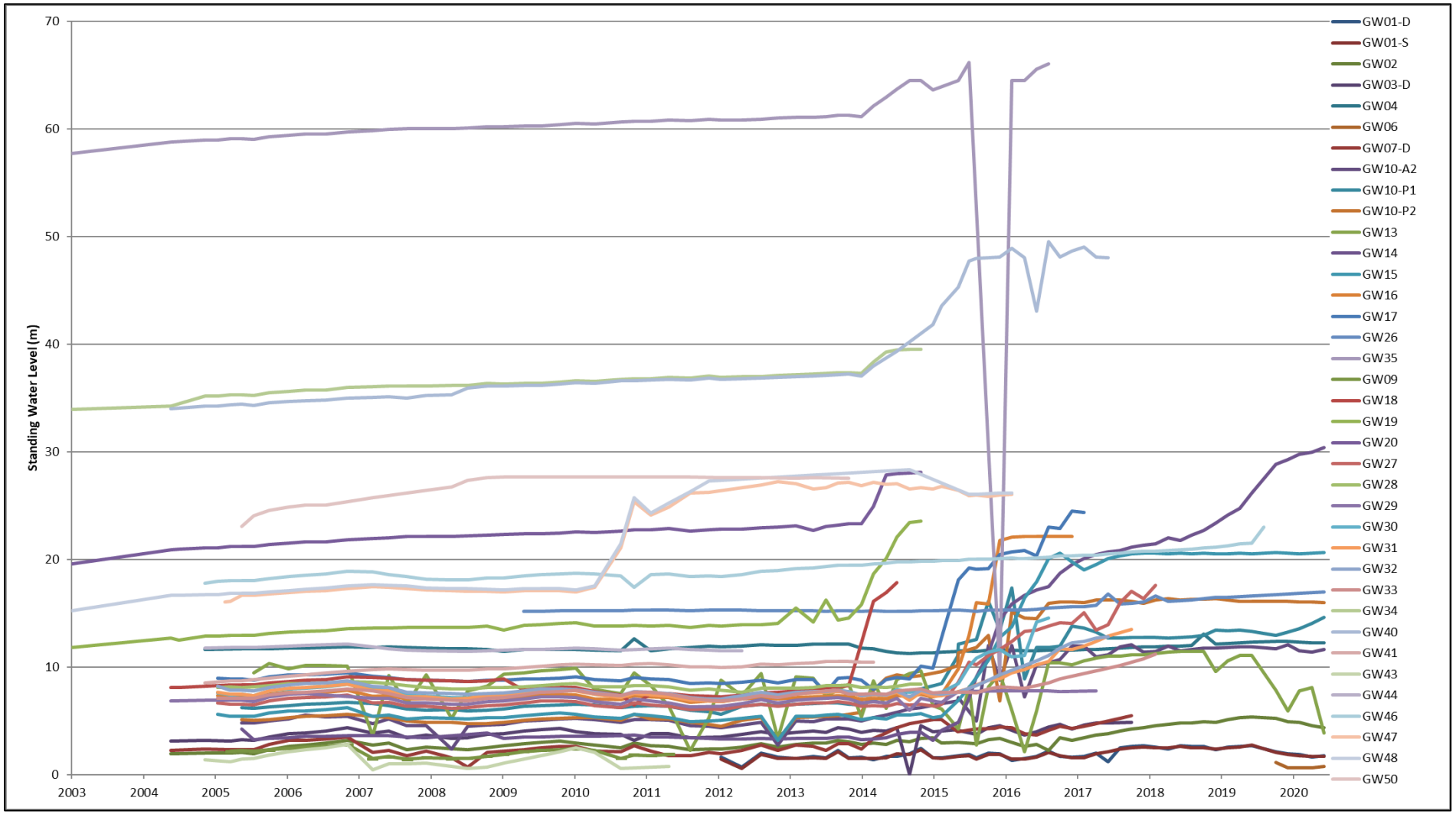


Figure 33 Standing Water Level GW Bores – 2003 to 2020

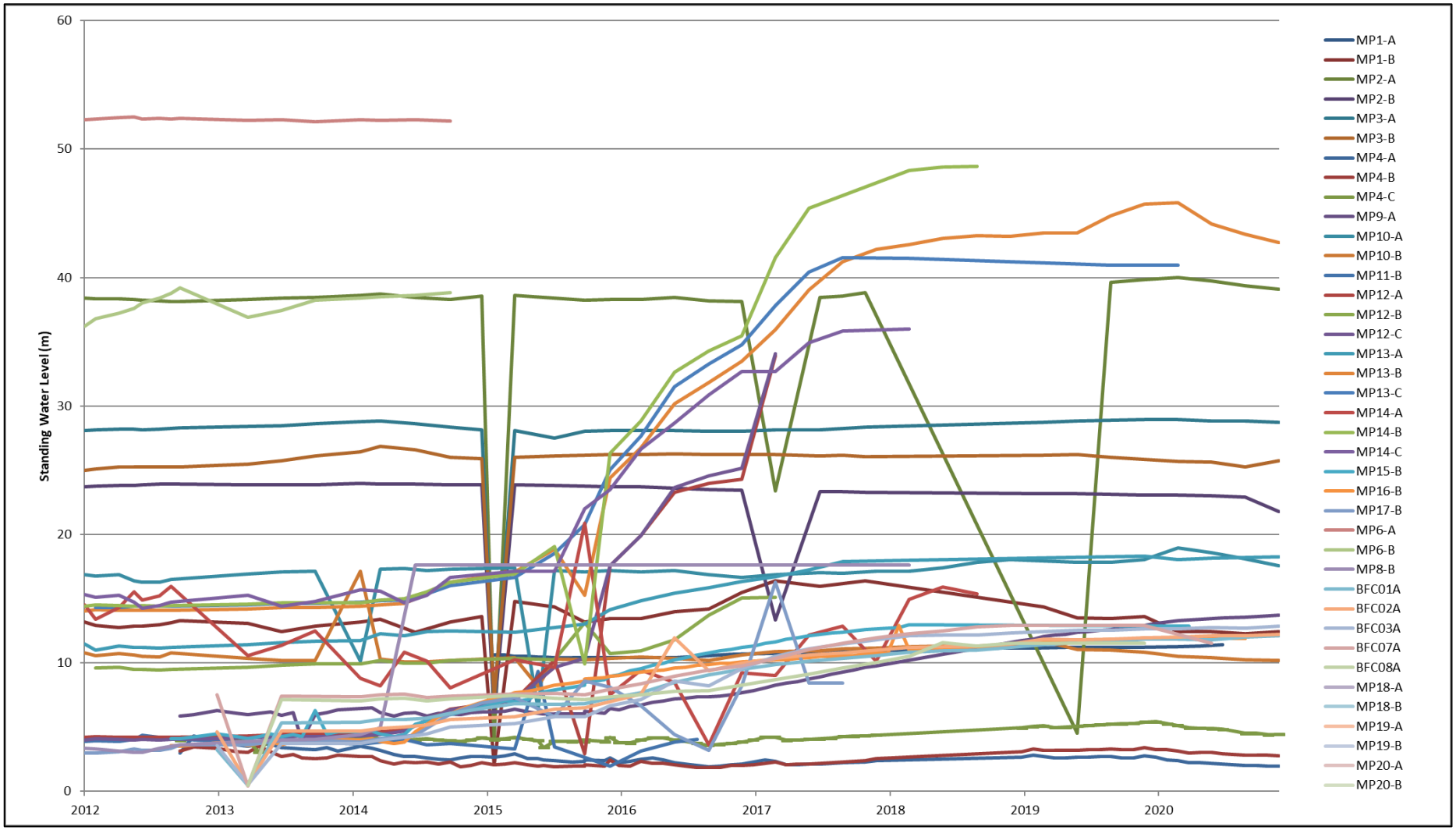


Figure 34 Standing Water Level MP and BFC Bores – 2012 to 2020

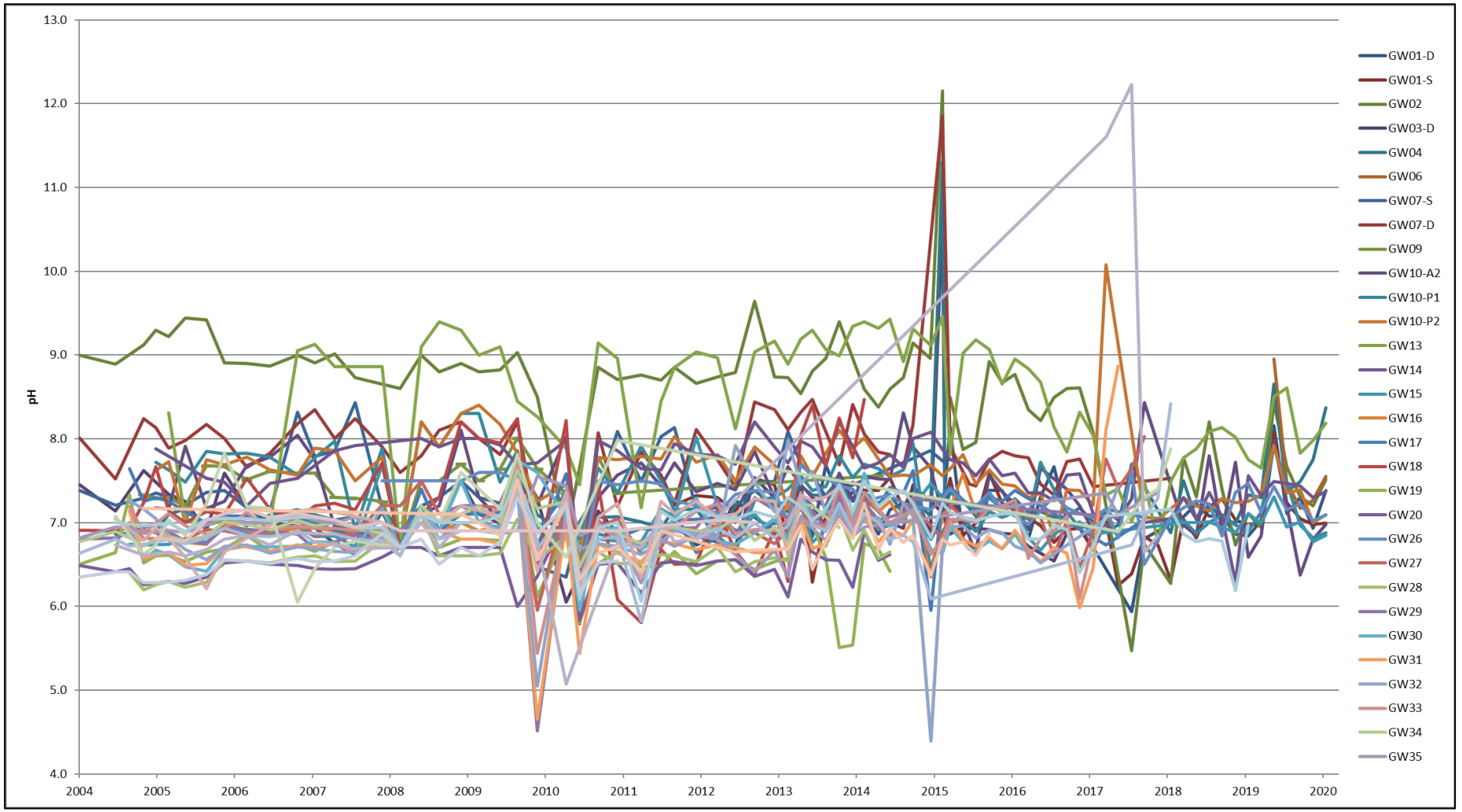


Figure 35 GW Bores pH – 2004 to 2020

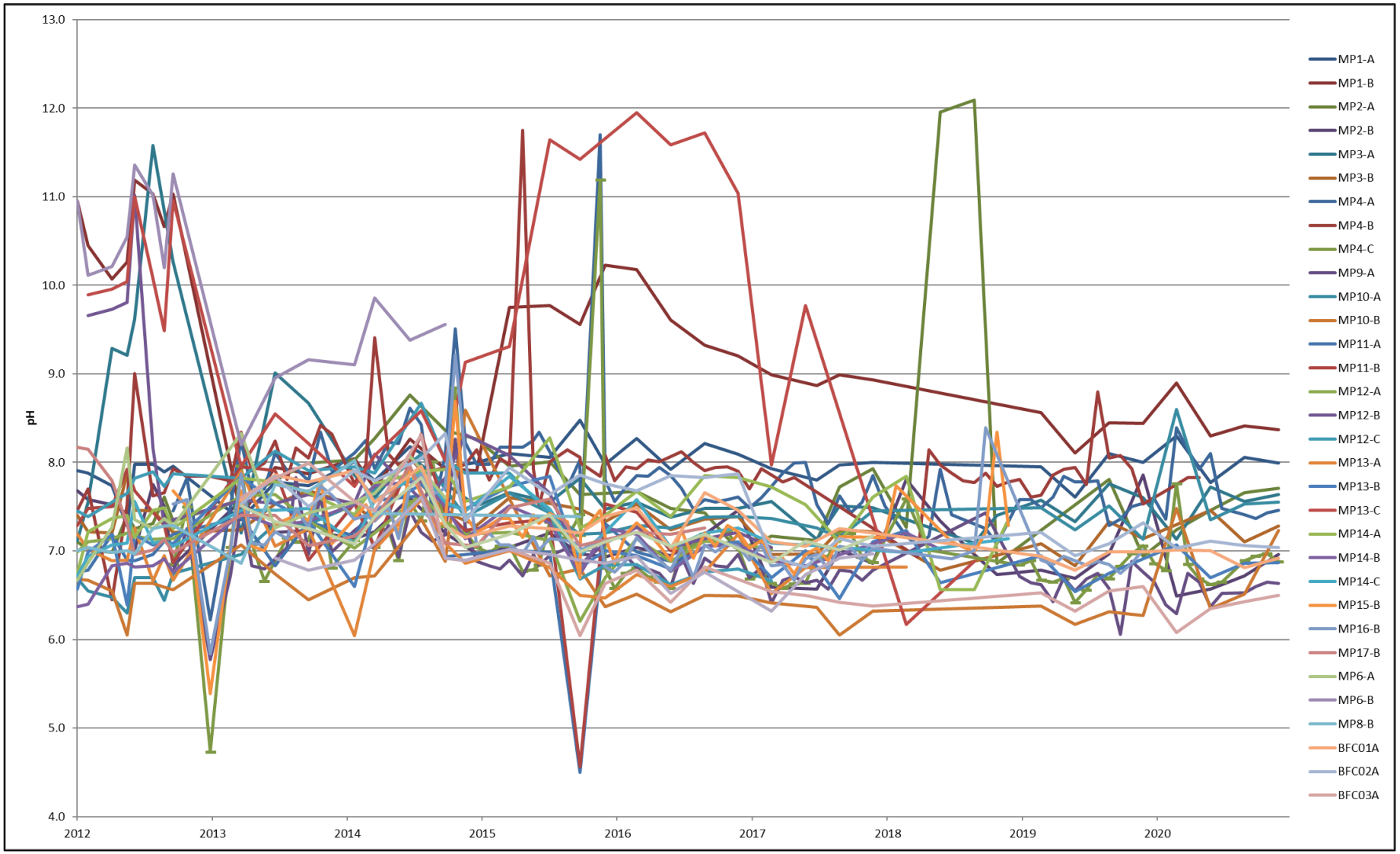


Figure 36 MP and BFC Bores pH – 2012 to 2020

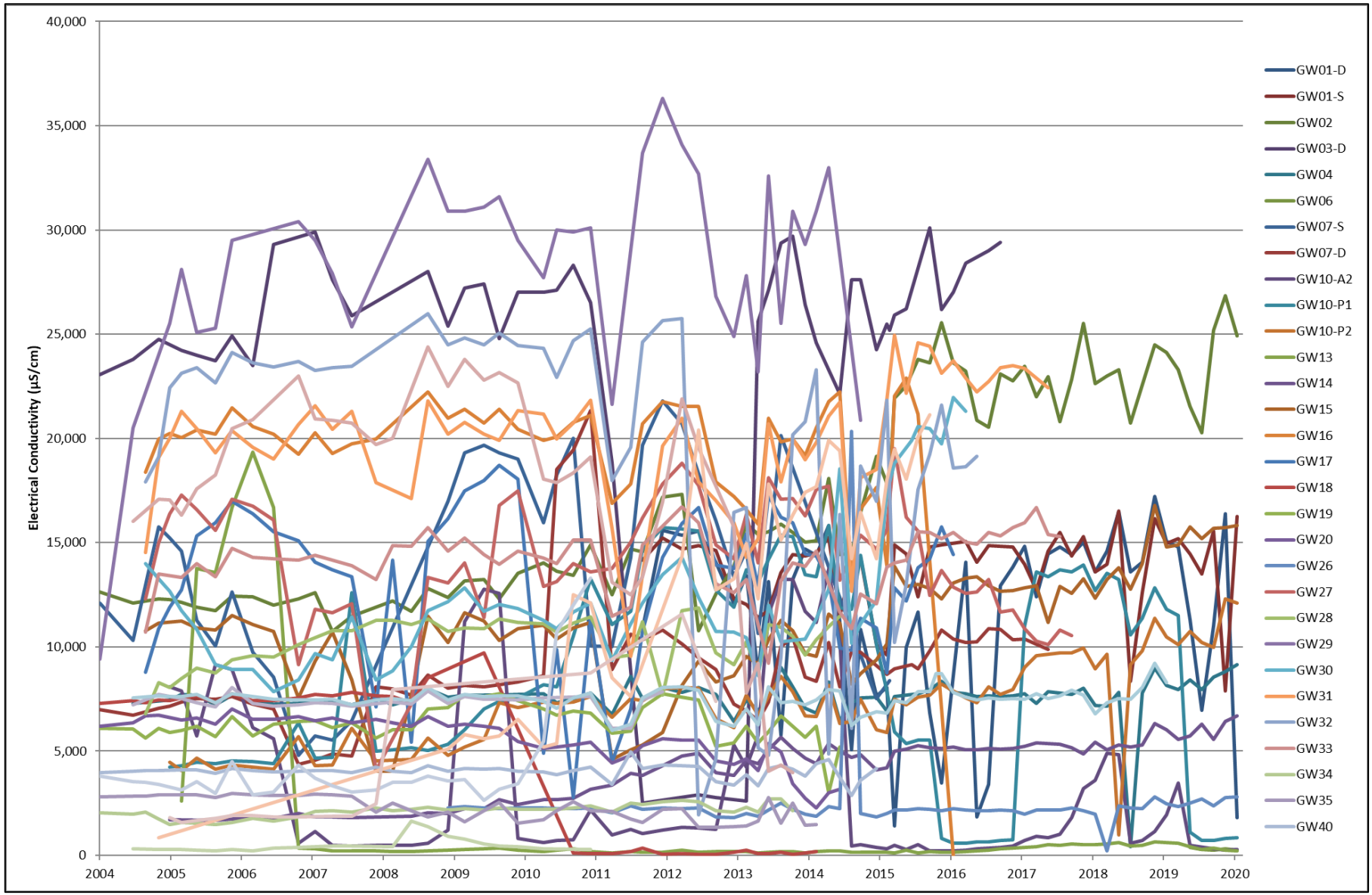


Figure 37 GW Bores EC – 2004 to 2020

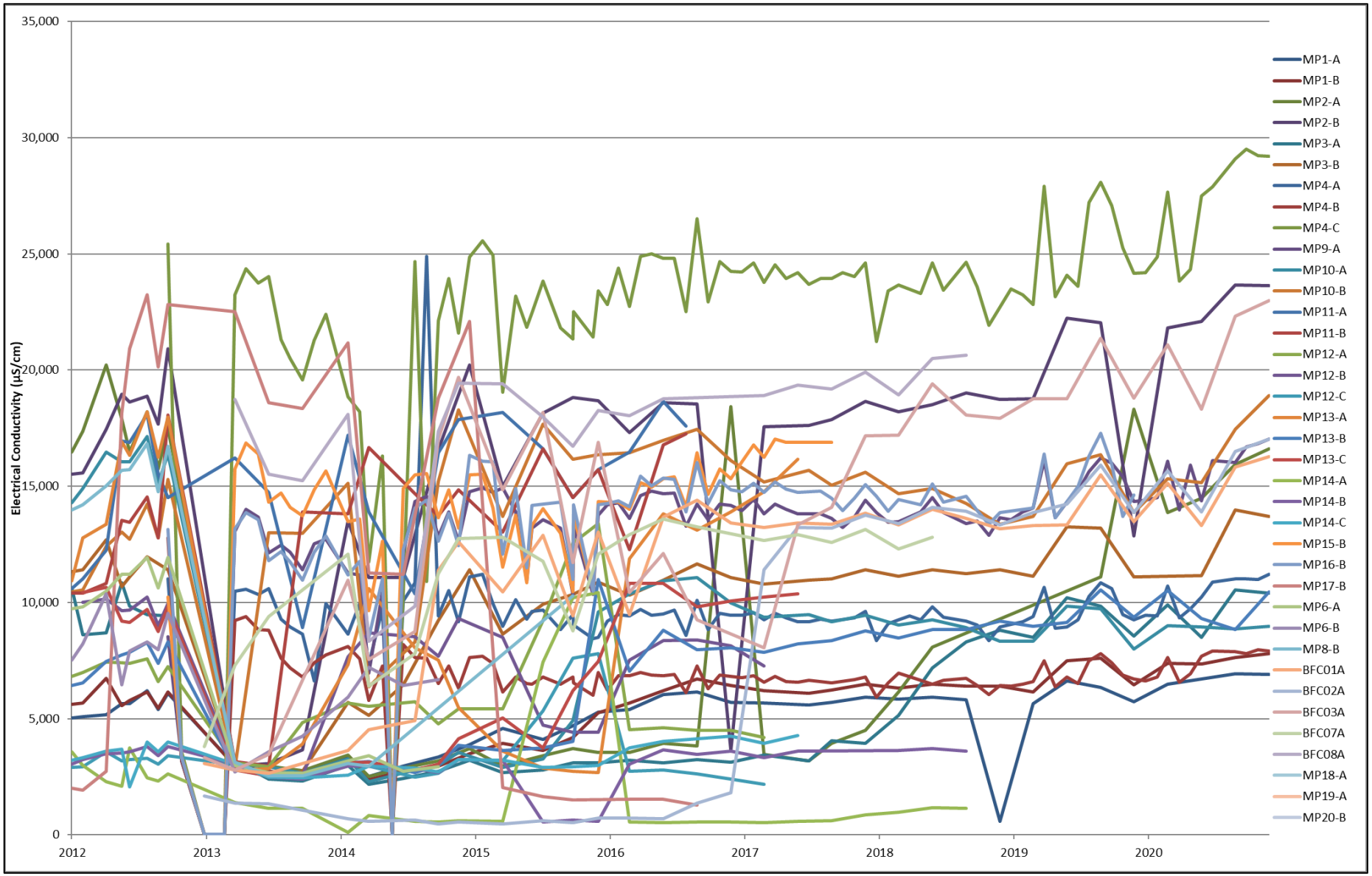


Figure 38 MP and BFC Bores EC – 2012 to 2020

APPENDIX F

Annual Train Movements 2020

Start Date	Incoming	Outgoing	Total Movements	Tonnes
01-Jan-20	6	7	13	64267.3
02-Jan-20	3	2	5	17677.3
03-Jan-20	3	3	6	27837.1
04-Jan-20	2	3	5	27062.9
05-Jan-20	4	3	7	26905.8
06-Jan-20	2	3	5	27781.8
07-Jan-20	2	2	4	18576.1
08-Jan-20	2	1	3	9304.4
09-Jan-20	3	3	6	27842.3
10-Jan-20	3	4	7	36149.0
11-Jan-20	3	3	6	27812.1
12-Jan-20	5	4	9	36728.6
13-Jan-20	1	2	3	18342.7
14-Jan-20	2	2	4	18350.0
15-Jan-20	2	2	4	17745.3
16-Jan-20	4	4	8	36914.3
17-Jan-20	3	3	6	27924.6
18-Jan-20	3	3	6	27073.6
19-Jan-20	3	3	6	27683.1
20-Jan-20	3	3	6	26649.2
21-Jan-20	3	3	6	27481.7
22-Jan-20	2	2	4	18580.8
23-Jan-20	1	0	1	0.0
24-Jan-20	2	3	5	27748.4
25-Jan-20	4	4	8	36962.1
26-Jan-20	3	3	6	27911.8
27-Jan-20	3	2	5	18200.7
28-Jan-20	2	3	5	27774.9
29-Jan-20	1	1	2	9293.2
30-Jan-20	5	5	10	46511.6
31-Jan-20	5	5	10	46503.0
01-Feb-20	3	2	5	18610.5
02-Feb-20	2	3	5	27679.7
03-Feb-20	2	2	4	18394.8
04-Feb-20	2	2	4	18608.4
05-Feb-20	4	3	7	27904.2
06-Feb-20	4	4	8	36997.2
07-Feb-20	4	5	9	46488.2

Start Date	Incoming	Outgoing	Total Movements	Tonnes
08-Feb-20	3	2	5	18626.9
09-Feb-20	1	2	3	18594.2
10-Feb-20	1	1	2	9298.7
11-Feb-20	1	1	2	9302.8
12-Feb-20	0	0	0	0.0
13-Feb-20	0	0	0	0.0
14-Feb-20	2	2	4	18599.8
15-Feb-20	3	3	6	27094.6
16-Feb-20	2	2	4	18548.4
17-Feb-20	2	2	4	18611.8
18-Feb-20	4	4	8	37062.3
19-Feb-20	5	4	9	36154.2
20-Feb-20	4	5	9	45440.4
21-Feb-20	4	4	8	36071.3
22-Feb-20	4	4	8	36372.8
23-Feb-20	2	2	4	17780.8
24-Feb-20	1	0	1	0.0
25-Feb-20	4	4	8	36327.0
26-Feb-20	1	1	2	9323.6
27-Feb-20	3	4	7	36837.0
28-Feb-20	3	3	6	27645.7
29-Feb-20	3	3	6	27859.2
01-Mar-20	2	2	4	18371.3
02-Mar-20	3	3	6	27682.0
03-Mar-20	1	1	2	9305.3
04-Mar-20	1	1	2	9302.9
05-Mar-20	3	3	6	27877.8
06-Mar-20	0	0	0	0.0
07-Mar-20	2	2	4	18593.1
08-Mar-20	4	4	8	36807.5
09-Mar-20	1	1	2	9302.1
10-Mar-20	1	1	2	9312.1
11-Mar-20	1	1	2	9299.0
12-Mar-20	0	0	0	0.0
13-Mar-20	0	0	0	0.0
14-Mar-20	4	3	7	27935.2
15-Mar-20	4	5	9	44827.3
16-Mar-20	3	2	5	18605.2

Start Date	Incoming	Outgoing	Total Movements	Tonnes
17-Mar-20	3	4	7	35560.6
18-Mar-20	2	2	4	18435.2
19-Mar-20	3	3	6	26851.2
20-Mar-20	4	4	8	36186.7
21-Mar-20	3	2	5	17776.0
22-Mar-20	2	3	5	27786.4
23-Mar-20	2	1	3	9297.5
24-Mar-20	1	2	3	17707.1
25-Mar-20	2	2	4	17751.9
26-Mar-20	4	3	7	27066.1
27-Mar-20	3	4	7	37011.6
28-Mar-20	5	5	10	44869.3
29-Mar-20	2	2	4	18616.0
30-Mar-20	5	5	10	44839.4
31-Mar-20	0	0	0	0.0
01-Apr-20	0	0	0	0.0
02-Apr-20	1	0	1	0.0
03-Apr-20	2	2	4	18615.4
04-Apr-20	2	2	4	17778.1
05-Apr-20	4	5	9	46507.4
06-Apr-20	2	2	4	17585.0
07-Apr-20	1	1	2	9224.1
08-Apr-20	6	6	12	55774.9
09-Apr-20	3	3	6	26915.9
10-Apr-20	3	2	5	17769.3
11-Apr-20	2	3	5	27062.7
12-Apr-20	1	1	2	9298.8
13-Apr-20	5	4	9	35143.5
14-Apr-20	3	4	7	36177.2
15-Apr-20	3	2	5	18602.7
16-Apr-20	2	3	5	27908.8
17-Apr-20	2	2	4	18609.5
18-Apr-20	2	2	4	18525.3
19-Apr-20	1	1	2	8479.1
20-Apr-20	0	0	0	0.0
21-Apr-20	1	1	2	9291.1
22-Apr-20	1	1	2	8511.4
23-Apr-20	3	3	6	26885.4

Start Date	Incoming	Outgoing	Total Movements	Tonnes
24-Apr-20	3	3	6	27821.3
25-Apr-20	1	1	2	9289.1
26-Apr-20	3	3	6	27054.5
27-Apr-20	1	1	2	9326.5
28-Apr-20	1	1	2	9277.1
29-Apr-20	1	1	2	9222.4
30-Apr-20	2	2	4	18544.8
01-May-20	2	2	4	18383.0
02-May-20	3	2	5	18616.2
03-May-20	2	3	5	26899.0
04-May-20	2	2	4	17786.1
05-May-20	2	2	4	18513.1
06-May-20	2	2	4	18597.0
07-May-20	4	3	7	27728.8
08-May-20	4	5	9	45643.3
09-May-20	3	2	5	18629.2
10-May-20	3	4	7	36273.1
11-May-20	4	3	7	27118.4
12-May-20	1	2	3	17819.5
13-May-20	0	0	0	0.0
14-May-20	4	3	7	27807.8
15-May-20	3	4	7	37164.0
16-May-20	5	4	9	36344.8
17-May-20	0	1	1	9298.1
18-May-20	4	4	8	35556.1
19-May-20	1	1	2	9317.4
20-May-20	0	0	0	0.0
21-May-20	0	0	0	0.0
22-May-20	4	4	8	36349.5
23-May-20	3	3	6	27675.4
24-May-20	2	2	4	18577.0
25-May-20	3	2	5	18608.5
26-May-20	2	2	4	17768.6
27-May-20	1	2	3	17788.8
28-May-20	2	2	4	18461.1
29-May-20	2	2	4	18612.3
30-May-20	3	3	6	26233.6
31-May-20	4	3	7	27802.8

Start Date	Incoming	Outgoing	Total Movements	Tonnes
01-Jun-20	2	3	5	27837.4
02-Jun-20	1	1	2	9325.1
03-Jun-20	4	4	8	37030.7
04-Jun-20	3	2	5	18620.9
05-Jun-20	1	2	3	17784.7
06-Jun-20	1	1	2	9313.3
07-Jun-20	4	4	8	36405.3
08-Jun-20	2	2	4	18601.8
09-Jun-20	1	1	2	8492.6
10-Jun-20	0	0	0	0.0
11-Jun-20	2	2	4	18440.8
12-Jun-20	3	3	6	27114.3
13-Jun-20	2	2	4	18640.3
14-Jun-20	2	2	4	17771.8
15-Jun-20	1	1	2	8462.7
16-Jun-20	0	0	0	0.0
17-Jun-20	1	0	1	0.0
18-Jun-20	0	1	1	9249.8
19-Jun-20	1	1	2	8501.5
20-Jun-20	1	1	2	8508.9
21-Jun-20	2	2	4	18606.3
22-Jun-20	2	2	4	17795.7
23-Jun-20	1	1	2	9304.9
24-Jun-20	0	0	0	0.0
25-Jun-20	1	1	2	9250.3
26-Jun-20	2	2	4	18540.7
27-Jun-20	0	0	0	0.0
28-Jun-20	2	2	4	17773.8
29-Jun-20	2	2	4	17805.2
30-Jun-20	4	4	8	34776.5
01-Jul-20	1	1	2	9269.6
02-Jul-20	3	2	5	18622.9
03-Jul-20	3	4	7	36315.0
04-Jul-20	2	2	4	16958.8
05-Jul-20	4	4	8	36384.4
06-Jul-20	1	1	2	8499.3
07-Jul-20	1	1	2	8499.9
08-Jul-20	0	0	0	0.0

Start Date	Incoming	Outgoing	Total Movements	Tonnes
09-Jul-20	2	2	4	17624.2
10-Jul-20	4	4	8	36179.5
11-Jul-20	2	2	4	17810.9
12-Jul-20	3	2	5	18546.2
13-Jul-20	1	1	2	8507.3
14-Jul-20	2	3	5	27839.9
15-Jul-20	2	2	4	18616.4
16-Jul-20	2	2	4	17794.2
17-Jul-20	1	1	2	9312.9
18-Jul-20	3	2	5	18554.2
19-Jul-20	3	3	6	27730.1
20-Jul-20	2	3	5	27757.8
21-Jul-20	4	3	7	27743.0
22-Jul-20	1	2	3	17743.0
23-Jul-20	2	2	4	18595.7
24-Jul-20	2	2	4	18404.1
25-Jul-20	2	2	4	18445.4
26-Jul-20	0	0	0	0.0
27-Jul-20	0	0	0	0.0
28-Jul-20	0	0	0	0.0
29-Jul-20	0	0	0	0.0
30-Jul-20	1	0	1	0.0
31-Jul-20	0	1	1	9303.9
01-Aug-20	3	3	6	27941.6
02-Aug-20	3	2	5	18477.6
03-Aug-20	1	2	3	18601.6
04-Aug-20	0	0	0	0.0
05-Aug-20	0	0	0	0.0
06-Aug-20	0	0	0	0.0
07-Aug-20	4	3	7	27882.4
08-Aug-20	4	5	9	45527.2
09-Aug-20	2	2	4	18399.8
10-Aug-20	2	2	4	18640.4
11-Aug-20	3	3	6	27874.1
12-Aug-20	2	2	4	17799.7
13-Aug-20	4	4	8	36421.4
14-Aug-20	3	3	6	27971.2
15-Aug-20	2	2	4	18461.9

Start Date	Incoming	Outgoing	Total Movements	Tonnes
16-Aug-20	0	0	0	0.0
17-Aug-20	1	1	2	9122.4
18-Aug-20	4	3	7	27907.3
19-Aug-20	1	1	2	8477.5
20-Aug-20	4	4	8	37068.7
21-Aug-20	2	3	5	27903.5
22-Aug-20	0	0	0	0.0
23-Aug-20	2	2	4	18553.9
24-Aug-20	4	3	7	27596.2
25-Aug-20	3	4	7	37228.5
26-Aug-20	2	2	4	18593.1
27-Aug-20	2	1	3	8454.9
28-Aug-20	2	2	4	18444.5
29-Aug-20	6	6	12	54482.9
30-Aug-20	4	5	9	45545.7
31-Aug-20	2	2	4	18437.2
01-Sep-20	3	2	5	17772.7
02-Sep-20	1	2	3	18591.1
03-Sep-20	1	1	2	9128.0
04-Sep-20	3	2	5	17788.4
05-Sep-20	1	1	2	9319.3
06-Sep-20	5	5	10	45716.7
07-Sep-20	4	4	8	35577.9
08-Sep-20	6	6	12	54039.2
09-Sep-20	4	4	8	37230.2
10-Sep-20	4	5	9	44734.1
11-Sep-20	2	2	4	17795.0
12-Sep-20	3	3	6	26259.1
13-Sep-20	3	3	6	26102.9
14-Sep-20	2	2	4	17820.5
15-Sep-20	0	0	0	0.0
16-Sep-20	0	0	0	0.0
17-Sep-20	0	0	0	0.0
18-Sep-20	1	0	1	0.0
19-Sep-20	2	3	5	27869.5
20-Sep-20	2	1	3	9321.3
21-Sep-20	3	4	7	36986.0
22-Sep-20	0	0	0	0.0

Start Date	Incoming	Outgoing	Total Movements	Tonnes
23-Sep-20	0	0	0	0.0
24-Sep-20	0	0	0	0.0
25-Sep-20	4	3	7	27737.1
26-Sep-20	3	4	7	37268.4
27-Sep-20	2	2	4	18625.7
28-Sep-20	3	3	6	27773.9
29-Sep-20	4	4	8	37089.7
30-Sep-20	1	1	2	9271.1
01-Oct-20	1	0	1	0.0
02-Oct-20	2	3	5	26866.6
03-Oct-20	1	1	2	8437.7
04-Oct-20	2	2	4	17772.9
05-Oct-20	1	1	2	9303.3
06-Oct-20	1	0	1	0.0
07-Oct-20	0	1	1	9238.8
08-Oct-20	2	2	4	17745.0
09-Oct-20	3	2	5	18416.5
10-Oct-20	1	1	2	9251.9
11-Oct-20	0	1	1	9326.5
12-Oct-20	2	2	4	17811.0
13-Oct-20	0	0	0	0.0
14-Oct-20	2	2	4	17769.3
15-Oct-20	3	2	5	18587.0
16-Oct-20	2	2	4	17796.8
17-Oct-20	2	3	5	27898.8
18-Oct-20	2	2	4	17611.3
19-Oct-20	1	1	2	8486.7
20-Oct-20	1	1	2	9283.9
21-Oct-20	0	0	0	0.0
22-Oct-20	2	2	4	17580.6
23-Oct-20	2	2	4	17775.0
24-Oct-20	4	3	7	27942.1
25-Oct-20	3	3	6	27150.5
26-Oct-20	1	2	3	18345.7
27-Oct-20	1	1	2	9300.8
28-Oct-20	1	1	2	9305.0
29-Oct-20	2	2	4	17586.8
30-Oct-20	1	1	2	9307.9

Start Date	Incoming	Outgoing	Total Movements	Tonnes
31-Oct-20	3	2	5	18636.4
01-Nov-20	1	2	3	18625.4
02-Nov-20	1	1	2	8491.0
03-Nov-20	2	2	4	18624.3
04-Nov-20	3	2	5	17803.5
05-Nov-20	1	1	2	9066.3
06-Nov-20	1	2	3	17778.7
07-Nov-20	0	0	0	0.0
08-Nov-20	2	2	4	18353.0
09-Nov-20	1	1	2	9320.1
10-Nov-20	0	0	0	0.0
11-Nov-20	2	2	4	18404.7
12-Nov-20	3	2	5	18600.0
13-Nov-20	0	1	1	9243.6
14-Nov-20	1	1	2	8476.0
15-Nov-20	0	0	0	0.0
16-Nov-20	2	2	4	17595.4
17-Nov-20	0	0	0	0.0
18-Nov-20	0	0	0	0.0
19-Nov-20	0	0	0	0.0
20-Nov-20	2	2	4	17765.6
21-Nov-20	1	1	2	9266.3
22-Nov-20	4	4	8	36083.1
23-Nov-20	1	1	2	9299.2
24-Nov-20	2	2	4	17740.3
25-Nov-20	1	1	2	9287.5
26-Nov-20	1	1	2	8472.6
27-Nov-20	3	3	6	26866.7
28-Nov-20	3	2	5	18427.4
29-Nov-20	2	3	5	27568.1
30-Nov-20	0	0	0	0.0
01-Dec-20	0	0	0	0.0
02-Dec-20	2	1	3	9319.7
03-Dec-20	2	3	5	27786.1
04-Dec-20	2	2	4	18565.4
05-Dec-20	3	3	6	26873.6
06-Dec-20	3	3	6	27824.4
07-Dec-20	0	0	0	0.0

Start Date	Incoming	Outgoing	Total Movements	Tonnes
08-Dec-20	0	0	0	0.0
09-Dec-20	2	2	4	18497.9
10-Dec-20	1	1	2	9305.7
11-Dec-20	3	3	6	27870.7
12-Dec-20	2	2	4	18431.2
13-Dec-20	5	4	9	37157.6
14-Dec-20	2	3	5	22002.7
15-Dec-20	0	0	0	0.0
16-Dec-20	0	0	0	0.0
17-Dec-20	0	0	0	0.0
18-Dec-20	3	3	6	26891.3
19-Dec-20	3	3	6	27830.2
20-Dec-20	4	4	8	36201.6
21-Dec-20	3	3	6	27860.2
22-Dec-20	2	2	4	18351.0
23-Dec-20	1	1	2	9127.2
24-Dec-20	0	0	0	0.0
25-Dec-20	0	0	0	0.0
26-Dec-20	1	1	2	9299.0
27-Dec-20	5	4	9	36708.6
28-Dec-20	4	5	9	46203.9
29-Dec-20	0	0	0	0.0
30-Dec-20	1	1	2	9323.8
31-Dec-20	0	0	0	0.0
Total	**756**	**757**	**1,513**	**6,907,151.2**

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