ESTABLISHED 1907

MUSWELLBROOK COAL COMPANY

2020
ANNUAL ENVIRONMENTAL MANAGEMENT REPORT

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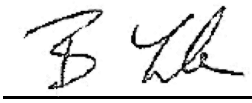
Name of Leaseholder:	**Muswellbrook Coal Company Limited**
Name of Mine:	**Muswellbrook Coal**
Titles/Mining Leases:	**Consolidated Coal Lease 713** **Mining Lease 1304** **Mining Lease 1562**
MOP Commencement Date: MOP Completion Date:	**31 March 2017** **31 December 2023**
AEMR Commencement Date: AEMR End Date:	**1 January 2020** **31 December 2020**
Reporting Officer:	**Brooke York**
Title:	**Environmental Superintendent**
Signature:	
Date:	30/03/2021

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

Muswellbrook Coal Company (MCC) is a wholly owned subsidiary of the Idemitsu Kosan Company Ltd. Group. MCC has a long association with coal mining at Muswellbrook, with underground coal mining commencing in 1907 and open cut operations in 1944. The mine is located on Muscle Creek Road, approximately 3 kilometres to the north-east of Muswellbrook.

On 1 September 2003, Development Consent for DA 205/2002 was granted by Muswellbrook Shire Council (MSC) to extend the former MCC No.1 Open Cut. The No.1 Open Cut Extension commenced operations in March 2005 and has a capacity to produce up to 2,000,000 tonnes coal per annum. This approval has subsequently been modified on several occasions with the latest modification granted in 2016 to allow mining in an area known as the "Continuation Project" and to extend the life of the mining operations to 2022. Rehabilitation activities will continue past this date.

1.1 STRUCTURE OF THIS REPORT

The structure of this report is based on the document "*Guidelines and Format for Preparation of Annual Environmental Management Report*", Department of Mineral Resources, Document No. EDG03 MREMP Guide V3 dated January 2006 and incorporates the reporting requirements stipulated in the MCC Development Consent, specifically Condition 42. This report also incorporates the reporting requirements in MCC's water licences and mining leases.

This Annual Environmental Management Report (AEMR) provides a summary of activities, environmental management and performance at MCC from 1 January 2020 to 31 December 2020 (herein referred to as the 'reporting period').

In accordance with the Development Consent, copies of this AEMR will be made available to:

- Muswellbrook Shire Council (MSC);
- Department of Planning, Industry and Environment – Resources Regulator (RR);
- Environment Protection Authority (EPA);
- Office of Environment, Energy and Science (OEES);
- Natural Resources Access Regulator (NRAR); and
- MCC Community Consultative Committee (CCC).

A copy of the report is also available on MCC's website:
https://www.idemitsu.com.au/operations/muswellbrook-coal/approvals-plans-reports/

1.2 CONSENTS, LEASES AND LICENCES

MCC operates under many development consents issued by MSC. The primary consent is DA 205/2002, which was approved by MSC in 2003. This DA has been modified on several occasions with the latest modification being approved in 2016.

Mining activities at MCC are carried out wholly within Consolidated Coal Lease 713, Mining Lease 1562 and Mining Lease 1304.

In addition to the above approvals MCC operates under the following licences:

- Environmental Protection Licence (EPL) 656 issued under the Protection of the Environment Operations Act 1997.
- Water Licences WAL39806, WAL41503, and WAL41521, issued under the Water Management Act 2000.

Relevant consents, authorisations and licences are summarised in **Table 1**.

Table 1: Consents, Authorisations and Licences

Approval	Description	Consent Authority	Date Granted	Expiry/ Renewal Date
DA 205/2002 (MSC)	Approval for Extension of MCC Open Cut 1	Muswellbrook Shire Council	1 Sep 2003	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) – Amendment to Condition 1.1	Power line relocation and additions to Workshop	Muswellbrook Shire Council	19 Dec 2005	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) Amendment to 1.1 and 11.3	Relocate office buildings, workshop and bath-house	Muswellbrook Shire Council	13 July 2009	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) Amendment to 11.1	Extension of mining into Area C	Muswellbrook Shire Council	23 Dec 2010	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) Amendment to 1.1(a), 31, 33, 39, 45 and 58.	Revision to Mining Infrastructure Building Requirements and Rehabilitation Plan Revision to permit the continuation of mining operations for an additional 5 years.	Muswellbrook Shire Council	29 Oct 2013	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) Amendment to 1.1, 1.2 & 6.3.2 and additional conditions 59 & 60.	Modification to Permit the Continuation of Mining Operations at Muswellbrook Coal Mine for an Additional Five (5) Years- Multiple Allotments- Coal Road Muswellbrook.	Muswellbrook Shire Council	12 Dec 2013	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) General revision of consent conditions	Modification to allow mining operations to mine additional areas and to extend the mine life to 2022.	Muswellbrook Shire Council	26 Oct 2016	Mining to 31 Dec 2022 No end date to approval
Consolidated Coal Lease 713	Mining Lease	Department of Planning and Environment	5 May 1990	24 Nov 2024
Mining Lease 1304	Mining Lease	Department of Planning and Environment	12 Jan 1993	24 Nov 2024

Approval	Description	Consent Authority	Date Granted	Expiry/ Renewal Date
Mining Lease 1562	Mining Lease	Department of Planning and Environment	16 Feb 2005	16 Feb 2026
Environmental Protection Licence 656	Environmental Licence	Environmental Protection Authority	6 Dec 2000	Not applicable
WAL39806	Water Licence	WaterNSW	3 Nov 2016	Continuing
WAL41503	Water Licence	WaterNSW	25 Oct 2017	Continuing
WAL41521	Water Licence	WaterNSW	4 Nov 2019	Continuing

1.2.1 CHANGES TO APPROVALS

During the reporting period, MCC sold of part of the site water allocation to other mines. Details of the sales are included in Section 2.10.2. There were no other changes to approvals during the reporting period.

1.3 MINE CONTACTS

The names and contacts of site personnel responsible for mining, rehabilitation and environmental management, planning and support functions are shown in **Table 2**.

Table 2: Mine Contacts

Name	Position	Contact Number
Grant Clouten	General Manager	(02) 6542 2300
Brooke York	Acting Environmental Superintendent	(02) 6542 2300
Rod Gallagher	Production Manager Mine Manager	(02) 6542 2300
Leon Claassens	Technical Services Manager	(02) 6542 2300

1.4 EMPLOYEE LEVELS

The number of employees and full-time equivalent contractors at MCC for this reporting period is shown in **Table 3**, along with a comparison to the numbers from the last five reporting periods.

Table 3: Employee Levels

Year	Employees	Full-Time Equivalent Contractors
2020	62	82
2019	65	93
2018	67	77
2017	69	85
2016	73	102
2015	75	88

1.5 ACTIONS REQUIRED FROM PREVIOUS AEMR REVIEW

Neither the RR or MSC conducted an AEMR inspection or provided feedback on the AEMR, so there are no actions arising from the previous AEMR.

1.6 COMPLIANCE STATUS

1.6.1 REPORTABLE INCIDENTS

During the reporting period, there were no reportable environmental incidents at MCC.

1.6.2 COMPLIANCE REVIEW

In accordance with the requirements of Condition 42 (a) of the development consent, a detailed compliance review of the performance of the project against conditions of this consent and statutory approvals was undertaken at the end of the reporting period. This review was against the conditions in place on 31 December 2020. MCC were compliant with the conditions of consent and statutory approvals during the reporting period, except for the following:

- Loss of wind data from the real-time metrological station. This is discussed further in **Section 3.2.**
- Loss of some data from the real-time PM10 monitoring units. This is discussed further in **Section 3.3.2.** The data capture rate is >90% and has been reported to the EPA. No correspondence has been received from the EPA regarding this loss of data.
- Loss of monitoring data from a blast monitor on two occasions during the reporting period. This is discussed further is **Section 3.11.2**.

Loss of data is reported to the EPA in the Annual Return in accordance with the EPL.

1.6.3 SITE INSPECTIONS

On 21 June 2019, two inspectors from the Resources Regulator undertook an unannounced site inspection at MCC. The inspection focused on closure planning and commitments relating to the site's Mining Operations Plan (MOP). Following this unannounced inspection MCC received a section 240 notice under the *Mining Act 1992*. This notice required MCC to complete the following:

- Complete a Rehabilitation Risk Assessment to identify and evaluate all potential risks to achieving the final land use and the specific measures to be implemented to mitigate those risks – the Rehabilitation Risk Assessment was completed and submitted to the Resources Regulator in December 2019.
- Revise the Rehabilitation Cost Estimate for the site – this was completed and submitted to the Resources Regulator on 28 January 2020.

The security deposit held by the Department of Regional NSW was revised by the Resources Regulator in July 2020. MCC received confirmation in July 2020 that the directions of the notice had been satisfied.

On 9 July 2020, an inspector from the Resources Regulator visited site to undertake a Targeted Assessment Program (TAP) on Soils and Materials Management. The assessment focused on progressive rehabilitation obligations as outlined in the MOP and how soils and material were being managed and, in addition, how this has been captured in the rehabilitation cost estimate to achieve sustainable rehabilitation outcomes.

The TAP identified two potential risks for MCC to consider:

- Deficient soil resources and growth medium materials to use in rehabilitation areas. The risk of insufficient volumes of topsoil or biosolid/growth medium material available on site for rehabilitation purposes can lead to being unable to achieve rehabilitation outcomes. This presents the risk that rehabilitation completion criteria may not be able to be achieved during the mine closure process.
- Biosolid/growth medium material found to be unsuitable and soil resources having to be imported. The risk that the cost of having to cart topsoil material to use in rehabilitation may greatly increase and result in a financial strain if this is not considered in the overall planning into

the closure phase. Calculations of exactly how much topsoil would be required should a growth medium material not be available should be considered and factored into the rehabilitation cost estimate for the site.

Five recommendations were made in relation to the TAP:

- Findings and recommendations contained in Final Rehabilitation Risk Assessment Report (required by NTCE0003170) are incorporated into a new MOP;
- The MOP is updated to include the new soil management processes currently being developed on site;
- The TARP is updated to incorporate information for seeding, seed mix and rates, rehabilitation practices, monitoring findings and recommendations, and soil analysis and biosolid/recycled material analysis currently being developed;
- A spatial register of inert stockpiles is created and maintained; and
- The MOP is updated to include study findings that are in the process of being completed in relation to management of Acacia saligna, final landform, drainage and material balance calculations.

MCC is working through the implementation of these recommendations. The MOP updates are expected to be incorporated into the new documents required under the rehabilitation reforms within the next reporting period. If the rehabilitation reforms are not enacted during the next reporting period, MCC will update the existing MOP in accordance with the above recommendations.

2.0 ACTIVITIES DURING THE REPORTING PERIOD

2.1 EXPLORATION

Previous exploration has provided a good understanding of the resources in the area. For this reason, no additional drilling or other exploration activities were done during the reporting period.

2.2 LAND PREPARATION

Land preparation is the process of preparing the land for open cut mining. Activities include vegetation clearing, topsoil stripping and topsoil stockpiling.

Prior to any vegetation clearance, a pre-clearance survey is undertaken to identify any potential habitat features located within proposed disturbance areas. The pre-clearance surveys also identify any weed infestations that may need treatment prior to clearing activities commencing. A Pre-Clearance Permit is approved by the Environmental Superintendent prior to any clearing commencing on site.

Trees containing features with the potential to provide habitat resources for birds, bats and/or arboreal mammals will be retained wherever practicable. Where practical and feasible, habitat features such as large hollows identified during the preclearance surveys will be salvaged and relocated to existing areas of rehabilitation or stockpiled for use in future rehabilitation areas.

No further disturbance for mining was undertaken during the reporting period.

2.2.1 TOPSOIL MANAGEMENT

Previously stripped topsoil is stockpiled in locations around the site for use and will be used in future rehabilitation activities. Topsoil stockpiles were sampled by an agronomist during the reporting period and analysed to determine suitability for use in rehabilitation. The stockpiled topsoil was found to have suitable chemical properties for use. The volume of topsoil remaining is very limited.

2.3 CONSTRUCTION

During the reporting period no construction activities occurred.

2.4 MINING

All mining activities this reporting period have occurred in Open Cut 1 with operations able to occur 24 hours a day, seven days a week. The status of mining activities at the end of the reporting period is shown in **Figure 1**.

The Open Cut 1 mining schedule will continue within the Northern section of the approved area during the year, mining down through the seam sequences as they present from the Fleming through to the Loder seam.

Mining has continued in Strip 23. This area will be lowered to the Lower Lewis and Loder floor to remove all underground workings.

During the second quarter overburden stripping will extend into Strip 24 and Strip 25 in Open Cut 1. At the end of mine life all UG workings will be mined out removing any fuel sources for spontaneous combustion. The mining waste will be dumped in Open Cut 1 and Open Cut 2.

Open Cut 1 will continue to expose underground workings of the No. 2 Underground and St Heliers Collieries. Site based procedures have been developed to allow safe extraction of the remaining underground pillar coal. These procedures are reviewed to reflect the operating experience gained during mining progress. Open cut wall designs were undertaken following recommendations of a geotechnical study completed for MCC by Mining Operation Services.

Mining operations at MCC are undertaken in accordance with the MOP and relevant approvals, leases and licences.

Mining is achieved through open cut methods using excavators, front-end loaders and rear dump trucks. The current fleet used for mining at MCC is provided in **Table 4**.

Table 4: Mining Fleet Utilised at MCC

Equipment	Model	No	Work Area
Excavator	Hitachi EX3600 Hydraulic Excavator	2	Overburden, interburden and coal removal
	Hitachi EX2600 Hydraulic Excavator	1	Overburden, interburden and coal removal
Dump Truck	Hitachi 3500 (170 Ton)	9	Overburden, interburden and coal removal
	CAT 777C (85 Ton)	3	Overburden, coal and rejects
Front End Loader	CAT 990H	1	Coal stockpile management
Blast Hole Drill	Drilltech 45	1	Drilling for blasting in overburden, interburden and coal
Grader	CAT 16H Grader	2	Surface preparation, road maintenance
Water Cart	Water Cart (CAT 777) 70,000 litre	2	Dust suppression, road maintenance
Dozer	CAT D10T	5	Dumps, roads, coal and overburden area preparation

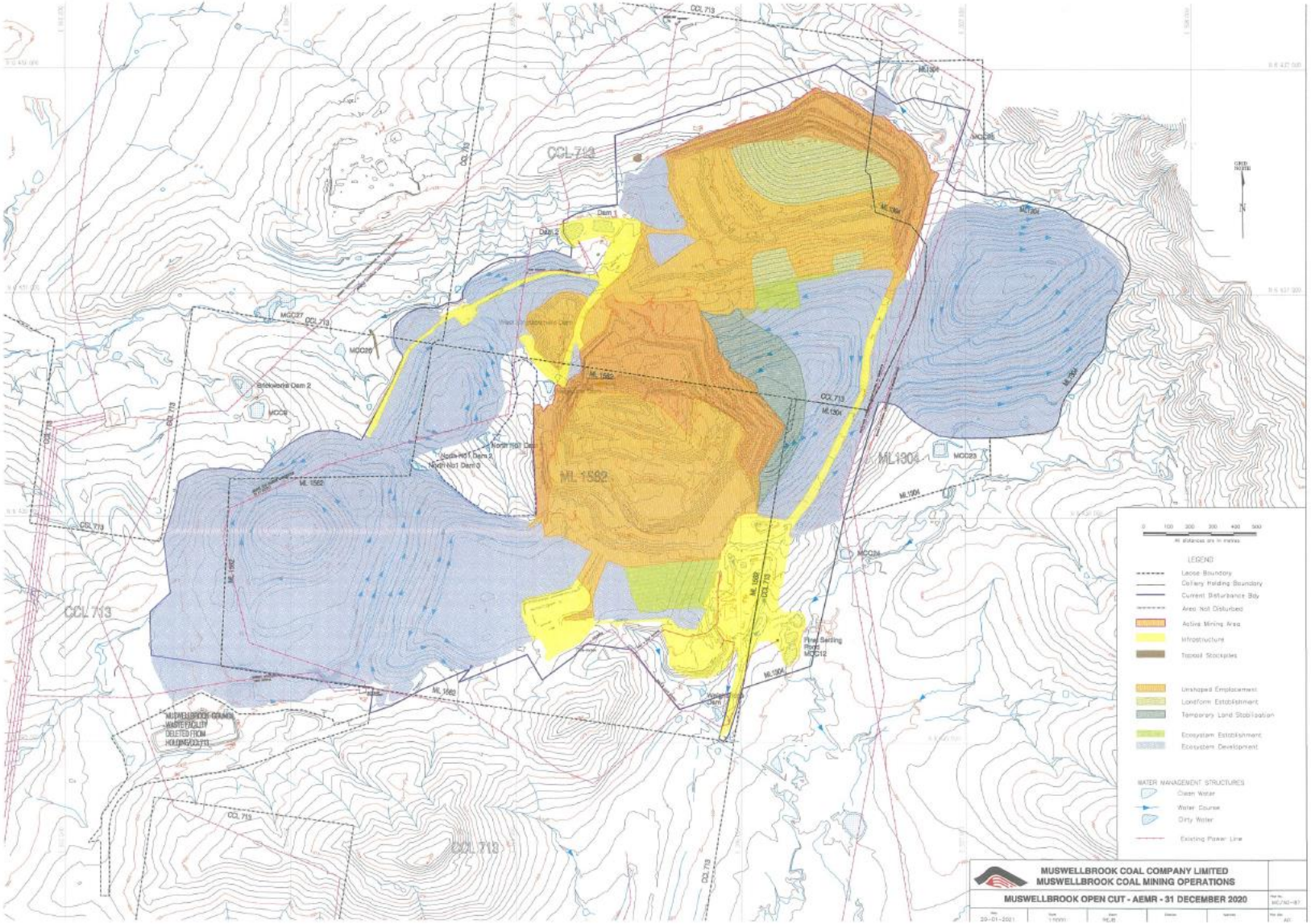


Figure 1: Mining Activities This Reporting Period

2.5 MINERAL PROCESSING

MCC produces thermal coal for the export market. High ash coal is mined, crushed and washed through the Coal Preparation Plant (CPP) while low ash coal is crushed and by-passes the CPP directly to the product stockpile.

Coal from Open Cut 1 requires washing by the CPP as a result of dilution associated with mining of the underground roadways. The CPP uses a jig as the main method of separation and has a capacity of approximately 240 tonnes per hour. The CPP is used on an 'as required' basis.

The CPP uses a belt press filter to treat the fines or tailings component of the coal feed. Both coarse and fine reject material will be trucked back to the open cuts for disposal. This material is quite dry and able to be handled in the same manner as overburden material. Disposal of carbonaceous material is undertaken in accordance with the Spontaneous Combustion Management Plan (SCMP).

2.6 WASTE MANAGEMENT

During the reporting period MCC continued to maintain a Total Integrated Waste Management Service to manage all waste streams generated on site. This includes general waste, cardboard and paper recycling, timber, waste oil, and steel. MCC continue to separate and recycle waste materials when possible, to assist in reducing the amount of waste going to the local landfill.

Table 5 shows the amount of waste that was removed from site during the reporting period. There has been a slight increase in the total waste removed from site during this reporting period, however, MCC has maintained a high percentage of waste recycled during the period.

Table 5: Waste Stream Generation

Month	Total Waste Removed (tonnes)	Total Waste to Landfill (tonnes)	Percentage Reused/ Recycled
January 2020	103.185	6.67	93.54
February 2020	96.573	3.06	96.84
March 2020	120.970	3.90	96.78
April 2020	108.795	4.53	95.84
May 2020	119.878	5.24	95.63
June 2020	116.814	2.73	97.66
July 2020	117.834	4.210	96.43
August 2020	127.681	3.345	97.38
September 2020	113.104	2.820	97.51
October 2020	110.637	3.210	97.10
November 2020	94.146	1.995	97.88
December 2020	102.915	3.37	96.73
Total	**1332.532**	**45.08**	**96.61**

2.7 PRODUCT COAL AND TRANSPORT

Product coal is hauled from the product bin by truck to the stockpiles. Five product stockpiles have a total capacity of 100,000 tonnes. Product coal is trucked off site via Muscle Creek Road and the New England Highway to the Ravensworth Coal Terminal (RCT) for train loading. This coal is then transported to the Port of Newcastle.

2.8 PRODUCTION SUMMARY

The amount of production and associated waste generated by MCC is detailed in **Table 6**.

Table 6: Production and Waste Summary

	PRODUCTION		
	At End of This Reporting Period	**At End of Last Reporting Period**	**Estimate, End of Next Reporting Period**
Topsoil Stripped (m^3)	0	0	0
Topsoil used/spread (m^3)	0	0	0
Topsoil stockpiled (m^3)	3,450	3,450	3,450
Waste Rock (BCM)	9,547,446	8,119,374	7,515,776
Open Cut ROM Coal (t)	1,148,962	1,358,987	1,487,783
Underground ROM Coal (t)	0	0	0
Total Coal (t)	1,148,962	1,358,987	1,487,783
Processing Waste (t)	171,634	182,232	169,833
Open Cut Product Coal (t)	985,008	1,176,755	1,317,950
Underground Product Coal (t)	0	0	0
Total Product Coal (t)	985,008	1,176,755	1,317,950

2.9 HAZARDOUS MATERIALS MANAGEMENT

2.9.1 FUEL STORAGE

Diesel fuel is stored in three Class C1 above ground, self-bunded tanks, with a capacity of 105,000L each. The tanks are located 50m from any major buildings.

2.9.2 CHEMALERT SYSTEM

MCC use a web based ChemAlert system to manage chemical use at the mining operation and system users can access the database from the MCC intranet site. The ChemAlert system is a chemical hazard management tool that contains information on the storage, transportation, use and disposal of chemicals. A Dangerous Goods manifest and safe operating procedure for chemical selection and use can be readily accessed from the MCC intranet server.

2.9.3 EXPLOSIVES

MCC has a licence to supply and store explosives and explosive precursors in accordance with all relevant legislation under Licence Number XSPL100002. This storage consists of 2 external magazines and an above ground tank for raw materials with 30,000L capacity. Bulk explosive product can also be stored on the mobile processing unit with a capacity of 8,000L but it is not common practice to do so as this is only used on an as needs basis. All dangerous goods on the premises are listed under MCC's Notification of Hazardous Chemicals, Licence Number NDG021999. Blasting contractors are employed to carry out total loading service on site.

2.10 WATER MANAGEMENT

The primary objective of the Water Management Plan (WMP) is to enable the effective management of on-site water to minimise the impact of mining operations on surface and ground water resources, both on and adjacent to the mine site. No changes were made to the water management system during the reporting period.

The objectives of the WMP are to:

- Meet the water supply needs of the project;
- Separate clean water runoff produced by undisturbed catchments from dirty (sediment-laden) and contaminated runoff from disturbed catchments;
- Use appropriate sedimentation controls for dirty water;
- Where possible, recycle and reuse dirty and contaminated mine water for dust suppression and wash down activities;
- Allow clean water to flow through the catchment and use clean water for firefighting supplies (firefighting system uses raw mine water) and sensitive equipment where required and allowed by harvestable rights;
- Where possible, and where mine safety permits, use disused open cuts and underground mines as mine water storages;
- Have nil discharge of saline mine water by containing all saline mine water on site and minimising the risk of accidental off-site discharge; and
- Monitor surface and groundwater to determine significant impacts to water quality or beneficial use and undertaking remedial action where required.

2.10.1 WATER STORAGE

Volumes of stored water available at MCC are provided in **Table 7**.

Table 7: Stored Water

VOLUMES (m^3)	START REPORTING PERIOD	END REPORTING PERIOD	STORAGE CAPACITY
DIRTY WATER			
Blues Crusher Dam	0	2500	8,500
Brickworks Dam 1	0	600	30,000
Brickworks Dam 2	0	400	20,000
Dam 3	3,300	6,800	8,000
SALINE OR MINE WATER			
Dam1	21,300	19,700	30,000
Dam 2	15,300	15,900	20,000
No.2 O/C Void	0	5240	1,200,000
Final Settling Pond	7,000	5,500	10,100

2.10.2 GROUNDWATER EXTRACTION

MCC holds three licences to extract ground water. The volumes of groundwater extracted in this reporting period are shown **Table 8**. No new bores were constructed during the reporting period. MCC traded part of the licenced groundwater allocation to other local mining companies during the period. A portion of the WAL41503 extraction entitlement was sold in August 2020 which reduced the limit from 3,000 units per annum to 2,200 units per annum. A portion of the WAL41521 extraction entitlement was sold in August 2020 which reduced the limit from 2,000 units per annum to 1,400 units per annum.

Table 8: Groundwater Extraction

Licence No.	Reporting Period Extraction Volume (ML)	Extraction Entitlement (ML per Annum Limit)
WAL39806 (small borehole)	304.2	1,000
WAL41503 (large borehole)	89.0	2,200
WAL41521 (open cut voids)	100.0	1,400

2.10.3 WATER BALANCE

The calculated water balance for the reporting period is provided in **Table 9**. The water balance indicates a water surplus for the year. Extra water has been stored in on-site water storages.

Table 9: Site Water Balance

INPUTS	ML/year
Ground Water Seepage	100.0
Surface Water Runoff and Dam Capture	215.8
Entrainment in Coal	86.2
Potable Water	3.8
Underground Workings – Dewatering Bores	423.1
TOTAL	**828.9**
OUTPUTS	**ML/year**
Entrainment in Coal	84.1
Discharge Off Site	0.0
Spontaneous Combustion Management – water infusion and sprays	139.9
Dust Suppression – water carts	233.5
Evaporation from Dams	113.3
Septic Pump Out	1.0
TOTAL	**571.8**
2020 Balance	**257.1**

2.11 OTHER INFRASTRUCTURE MANAGEMENT

MCC maintains Muscle Creek Road as per the requirements of the Development Consent.

The maintenance of Muscle Creek Road requires MCC to apply for a Section 138 approval from MSC which is accompanied by a Routine Maintenance Annual Plan (RMAP). The 2019 Section 138 approval covering routine maintenance works to 31 January 2020 and was extended to allow continuation of routine maintenance works until 1 May 2020. A second extension was then granted to cover works until 1 August 2020, and a further extension to 1 June 2021 has recently been granted. MCC applied for a Section 138 approval to cover continued routine maintenance works in January 2020 but was unable to obtain MSC approval of the 2020 RMAP for Muscle Creek Road. MCC is working with MSC to gain approval for the 2020 RMAP to cover routine maintenance on Muscle Creek Road for the 2021 period.

A separate Section 138 approval was granted by MSC for minor pavement maintenance work conducted 11 May 2020 to 15 May 2020.

3.0 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

3.1 ENVIRONMENTAL MANAGEMENT

To measure compliance with the management plans, the development consent and various licences, MCC undertakes a comprehensive monitoring program in the vicinity of the MCC mining areas. More details on the individual monitoring programs are provided in the following sections.

3.2 METEOROLOGICAL

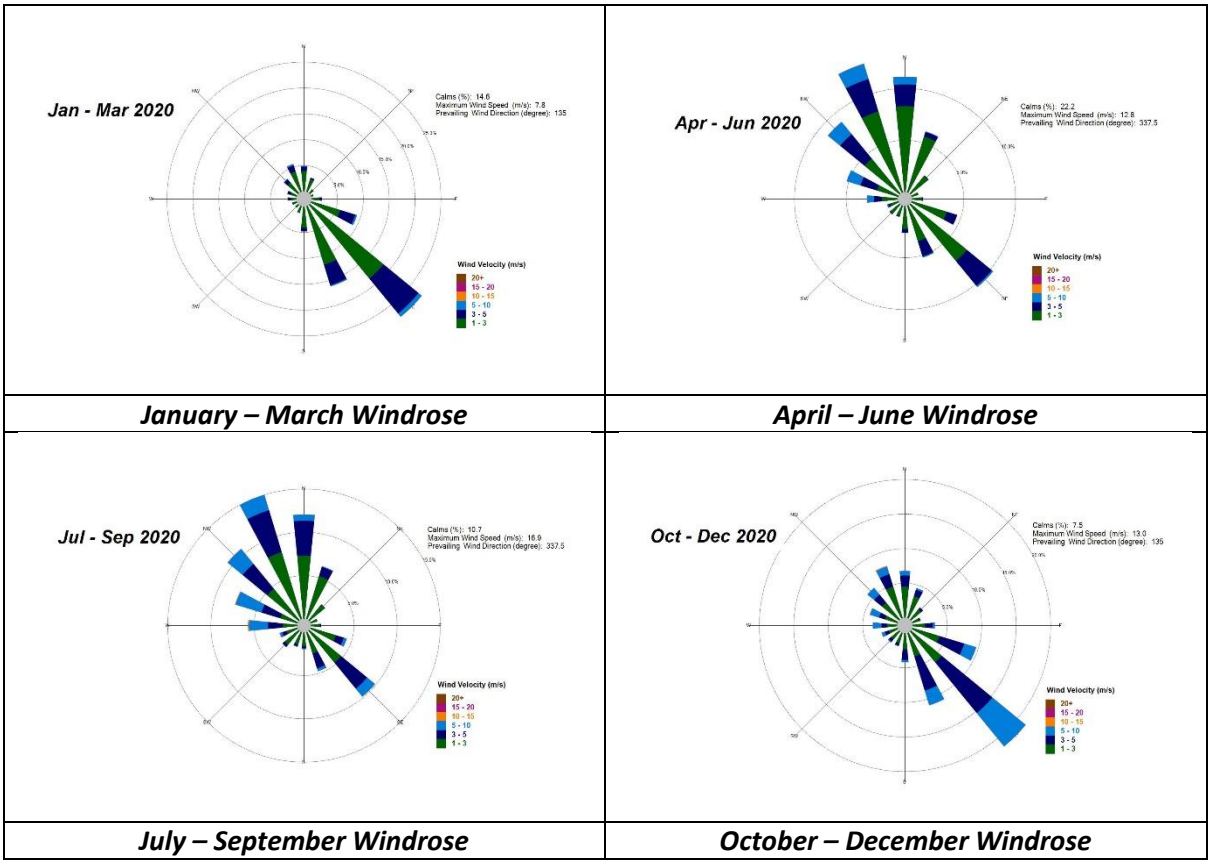
During the reporting period, MCC continued to maintain a Meteorological Monitoring Station (MMS) on rehabilitated land to the immediate west of Open Cut 1. This station is part of the Real Time Environmental Monitoring System (RTEMS).

The principal MMS provides 10m elevation wind speed and direction, 2m and 10m elevation air temperature, rainfall, humidity, barometric pressure, sigma theta and stability class. In addition, a calculation is performed to calculate temperature inversions.

Meteorological data provided in this report was sourced from the MMS. Wind data, rainfall and temperature results are summarised below. Data recovery for the monitoring period was 97.2%. The batteries stopped holding their charge during May resulting in minimal weather data for May. The batteries were replaced.

3.2.1 WIND SPEED AND DIRECTION

Quarterly wind roses are provided in **Figure 2**. These results are generally consistent with the predominant wind patterns in the Hunter Valley.



January – March Windrose | ***April – June Windrose***

July – September Windrose | ***October – December Windrose***

Figure 2: Quarterly Windroses

3.2.2 RAINFALL

Total rainfall recorded during the reporting period was 882.4mm, which is significantly above the long-term average of 620.8mm, recorded at the nearest Australian Bureau of Meteorology (BOM) site at Lower Hill Street in Muswellbrook. This year has brought above average rainfall, breaking a three-year period of significantly low rainfall. A summary of rainfall during the reporting period, compared to the historical rainfall at MCC and the closest BOM station in Muswellbrook, is provided in **Table 10** and **Figure 3**.

Table 10: Rainfall Data

Month	Muswellbrook Coal Actual (mm)	Muswellbrook Coal Average (mm)	Muswellbrook BOM Average (mm)
January	56.8	59.9	69.6
February	146.0	69.9	66.9
March	50.2	58.3	52.8
April	107.8	37.5	43.5
May	28.6	26.3	41.5
June	38.8	57.3	51.3
July	99.0	32.9	44.2
August	31.0	32.9	38.6
September	34.2	30.1	40.7
October	117.6	42.7	48.6
November	29.6	68.9	56.1
December	142.8	60.7	67.0
Total	**882.4**	**557.3**	**620.8**

3.2.3 TEMPERATURE

Maximum temperature recorded during the reporting period was 44.2°C and the minimum recorded was -0.8°C. This is consistent with the long term minimum and maximum recorded by the Australian Bureau of Meteorology site at Scone, -5.1°C and 46.5°C. A summary of minimum, maximum and average monthly temperatures during the reporting period is provided in **Table 11** and **Figure 4**.

Table 11: Temperature Data

Month	Minimum Temperature (°C)	Average Temperature (°C)	Maximum Temperature (°C)
January	17.1	26.3	44.2
February	14.0	23.1	42.0
March	10.0	19.7	35.2
April	5.2	17.6	28.6
May	1.4	13.8	25.5
June	0.6	11.4	20.8
July	-0.4	11.0	22.0
August	-0.8	11.3	23.8
September	3.5	15.6	29.0
October	6.0	18.4	32.6
November	8.7	21.4	40.7
December	9.6	21.6	40.7
Summary	**-0.8**	**17.6**	**44.2**

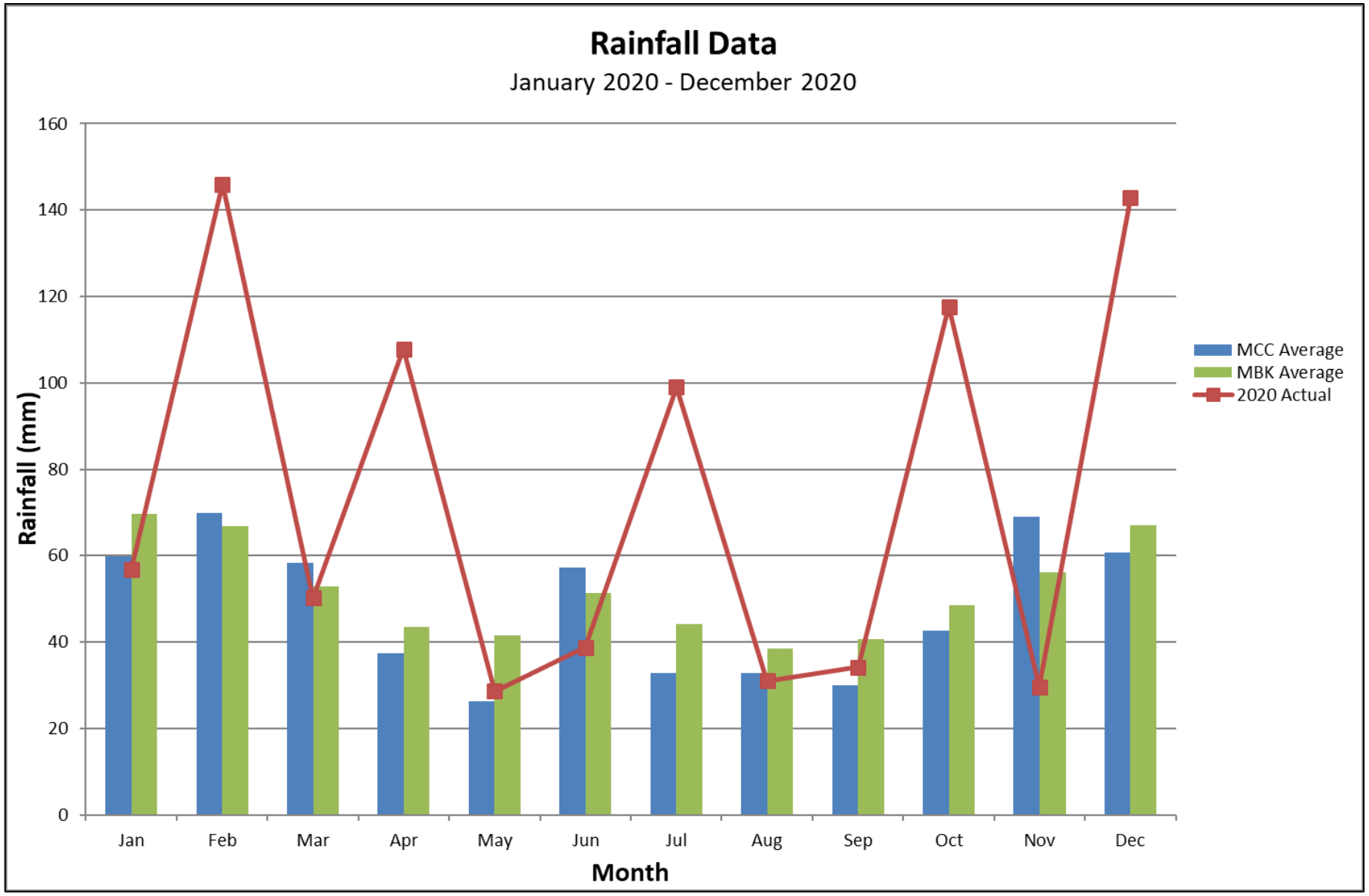


Figure 3: Rainfall Graph

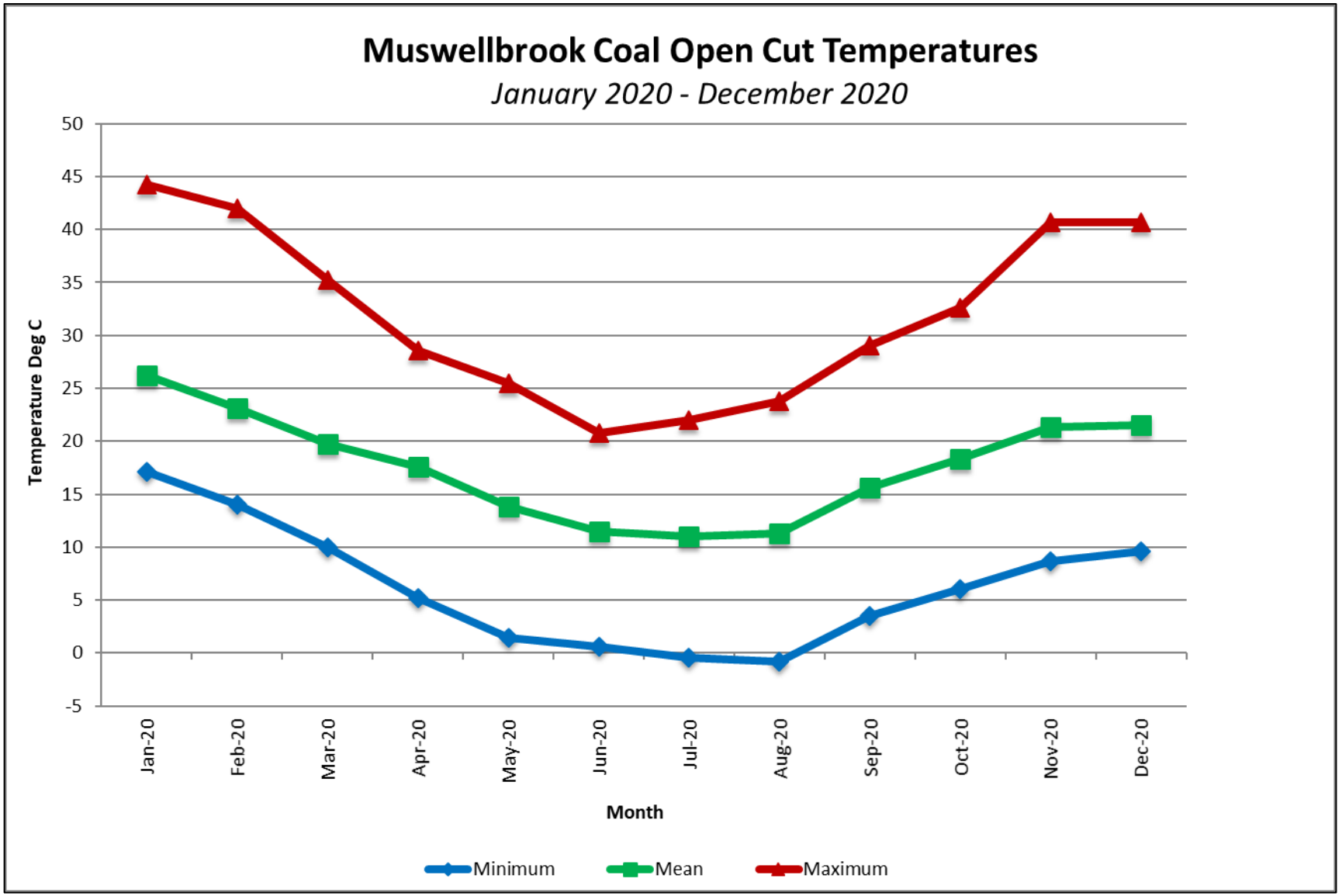


Figure 4: Temperature Graph

3.3 AIR QUALITY MANAGEMENT

3.3.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to operate in accordance with the approved Air Quality Management Plan (AQMP). The AQMP was reviewed and updated during the reporting period, in consultation with MSC. The updated AQMP was approved by MSC on 1 December 2020 and is available on the MCC website.

The primary objective of air quality management at MCC is to manage and minimise the impact of dust from the operations on the environment and nearby residences. Dust mitigation measures have been divided into control procedures for wind-blown dust and mining generated dust sources.

Dust can be generated from two primary sources, either windblown dust from exposed areas, or dust generated by mining activities. The control procedures for these sources are outlined in **Table 12** and **Table 13**.

Table 12: Control Procedures for Wind Blown Dust

Source	Control Procedures
Areas disturbed by mining	• Disturb only the minimum area necessary for mining. • Reshape, topsoil and rehabilitate completed overburden emplacement areas after the completion of overburden tipping.
Coal Handling and Coal Stockpile Areas	• Maintain coal handling areas in a moist condition using water carts to minimise windblown and traffic generated dust. • Clean-up after any spillage event. • Water carts to operate around the coal stockpile area to suppress dust on roadways and the coal stockpiles.

Table 13: Control Procedures for Mining Generated Dust Sources

Source	Control Procedures
Haul roads	• All roads and traffic areas will be watered using water carts to minimise the generation of dust. • Long term haul roads will be sheeted with hard wearing material where practicable.
Minor roads	• Development of minor roads will be limited to those roads as required by mining and rehabilitation activities. • Minor roads will be watered if used for extended periods.
Topsoil stockpiling	• All topsoil stockpiles will be located and shaped to minimise the area exposed to prevailing winds. • Long term topsoil stockpiles, not used for over 6 months will be vegetated.
Drilling	• Dust aprons will be lowered during drilling. • Drills will be equipped with dust extraction cyclones or water injection systems. • Water injection or suppression sprays will be used when high levels of dust are being generated.
Blasting	• Stemming will be used at all times. • Blasting will occur in accordance with the Blast-Vibration Management Plan relating to meteorological conditions.

Source	Control Procedures
Raw Coal Receival Bin	• Sprays are to be used when tipping raw coal into the receival bin during high wind events.
Coal Handling and Preparation Plant	• Sprays are fitted at transfer points.

Equipment used to control dust generation include: water cart (sprays on haul roads and coal stockpiles), sprays at the Raw Coal Receival Bin, sprays at conveyor transfer points, dust extraction cyclones or water injection systems on drill rigs.

Further control procedures are implemented during periods of high dust emissions and for short term episodic events. These include:

- Delaying blasting;
- Delaying rehabilitation activities;
- Delaying grading of non-essential roads;
- Operating water carts during crib breaks and between shifts;
- Working in protected areas; and
- Shutting down the operations.

MCC utilise a daily dust forecasting tool to assist with managing dust emissions from the site.

3.3.2 AIR QUALITY MONITORING

The air quality criteria that apply to MCC are shown in **Table 14** to **Table 16**.

Table 14: Long Term Particulate Matter Criteria

Pollutant	Standard / Goal
Particulate Matter <10μg (PM_{10})	30μg/m^3 (annual mean)

Table 15: Short Term Particulate Matter Goal

Pollutant	Standard/Goal
Particulate Matter <10μm (PM_{10})	50μg/m^3 (24-hour average)

Table 16: Atmospheric Gas Content Criteria

Pollutant	Criterion	
Sulphur Dioxide (SO_2)	80ppb (24 hour average)	200ppb (1 hour average)
Hydrogen Sulphide (H_2S)	100ppb (24 hour average)	500ppb (1 hour average)

The air quality monitoring sites are displayed in **Figure 5**.

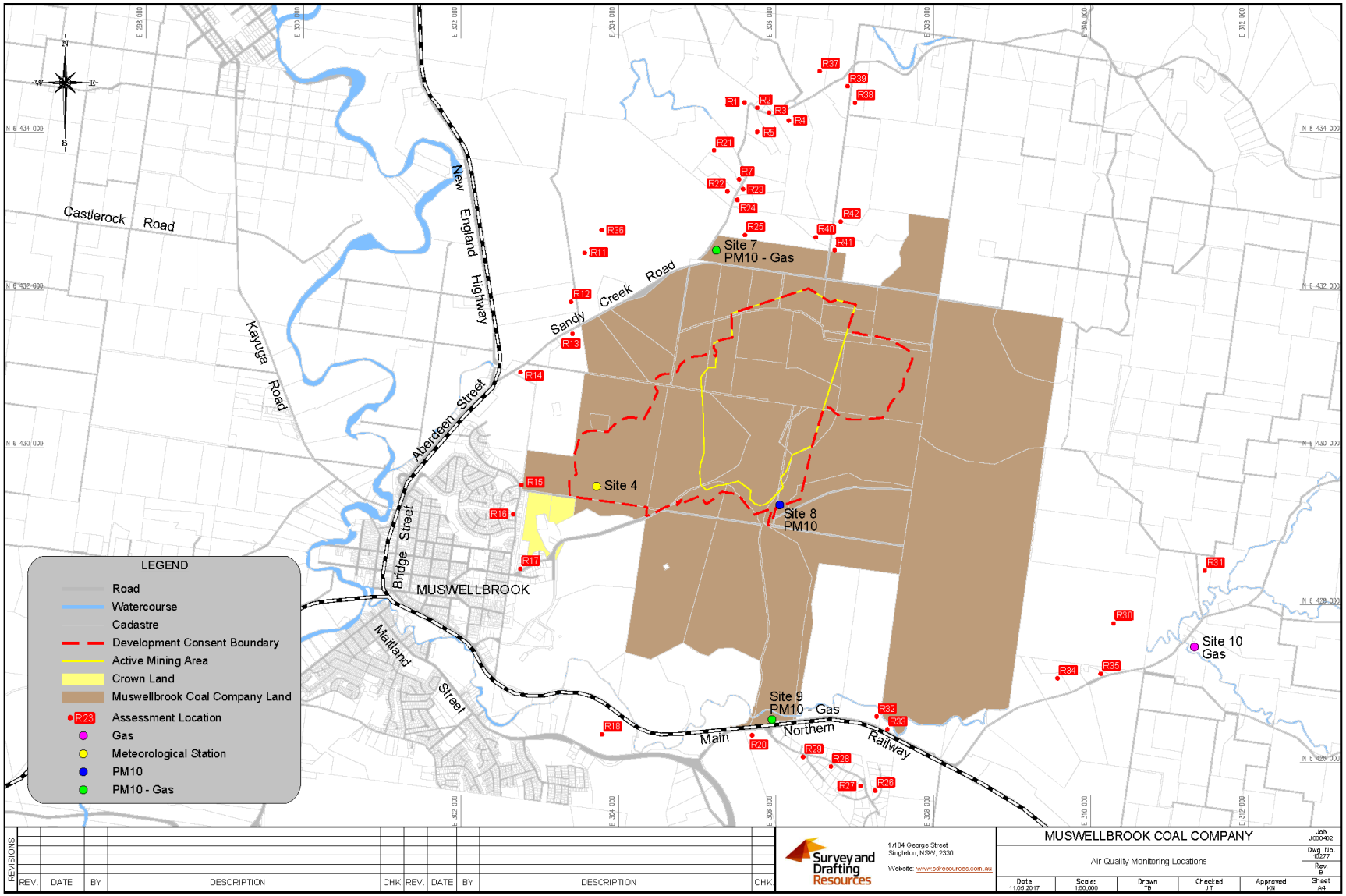


Figure 5: Air Quality Monitoring Locations

Particulate Matter <10µg (PM_{10})

MCC operate three real-time PM_{10} monitoring units with all three units continuously relaying data to a password protected website that is accessible by MCC personnel.

The PM_{10} units are continuous electronic monitoring systems that are subject to equipment faults, communication losses, power outages and maintenance downtime. High data recovery is considered essential and data recovery levels obtained during the reporting period were 97.7% across the three units. Data capture rates have improved since 2019 when the equipment at Site 9 was replaced.

The criteria in the development consent apply to PM_{10} levels at residential locations and as monitoring location Site 8 is used as a management tool, it is not subject to the criteria in the development consent. There were 24 days during the reporting period where the 24-hour PM_{10} results were above the 24-hour criteria of 50µg/m^3 at the compliance based monitoring locations. Each of these days has been investigated and they are all attributable to regional dust events or from bushfire smoke. The results are not directly attributable to MCC.

The annual average PM_{10} did not exceed the 30µg/m^3 annual criteria during the reporting period. **Table 17** displays the average PM_{10} value at each site during the reporting period with the results graphically presented in **Figure 6** to **Figure 8**. A table of comprehensive PM_{10} results is provided in **Appendix 1**.

Table 17: Real-Time PM_{10} Averages

Site Number	Annual Average PM_{10} Concentration (µg/m^3)	Annual Average Criteria (µg/m^3)	Data Recovery %
7	17.1	30	98.4
8	31.2	NA	96.2
9	18.1	30	99.5

Table 18 compares the results from Sites 7 and 9 for this reporting period, background results and predictions made in the 2016 Statement of Environmental Effects (SEE). The results this reporting period are generally consistent with the background levels and the predicted results in the EA and SEE.

Table 18: Comparison of Real-Time PM_{10} Results (Sites 7 and 9)

Year	Monitoring Results (µg/m^3)		Background Results (µg/m^3)		SEE Predicted Results (µg/m^3)	
	Site 7	Site 9	Site 7	Site 9	Site 7	Site 9
2020	17.1	18.1	16.9	16.9	23.0	17.0
2019	26.7	24.2	16.9	16.9	23.0	17.0
2018	20.2	17.8	16.9	16.9	23.0	17.0

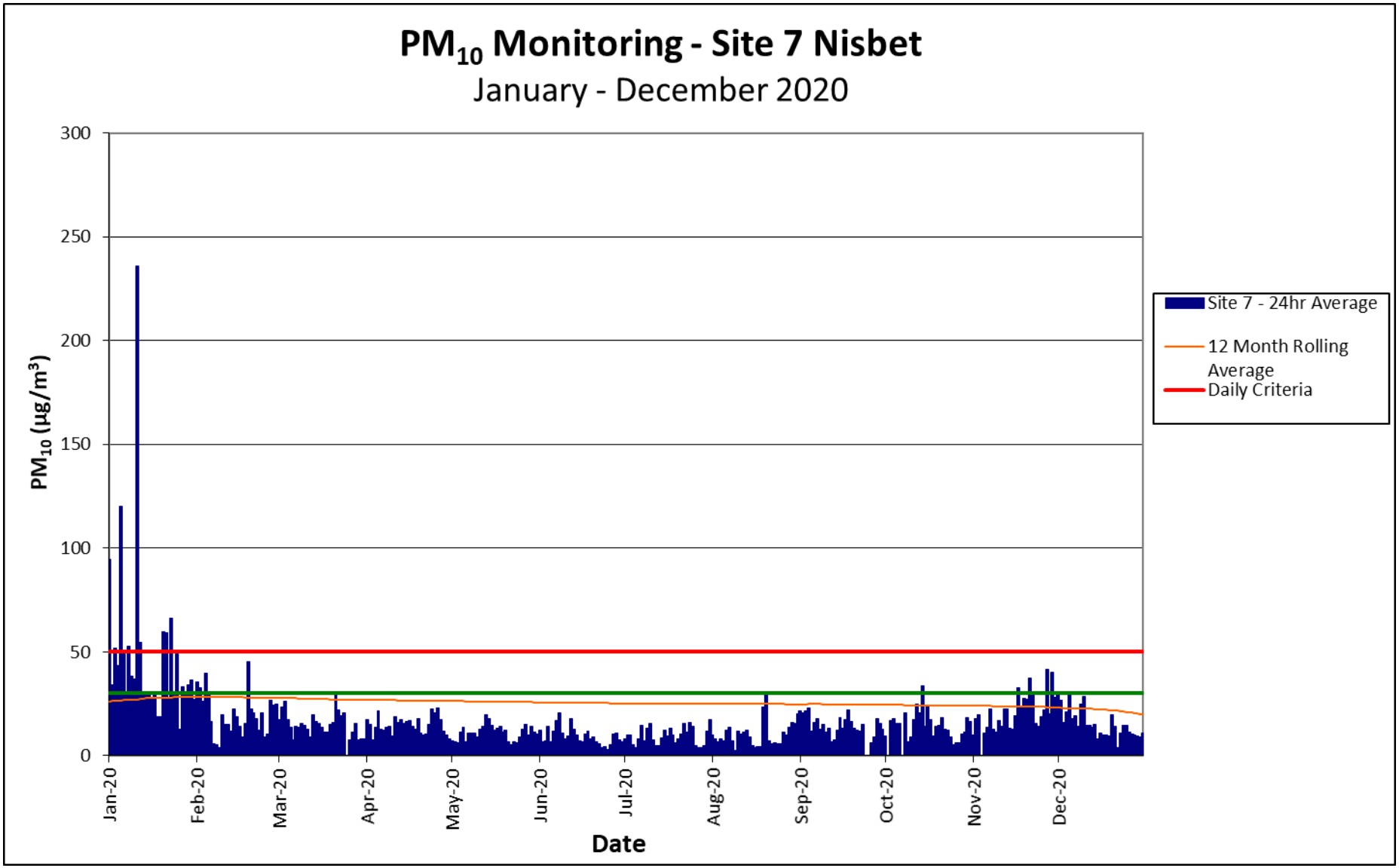


Figure 6: Site 7 PM_{10} Results

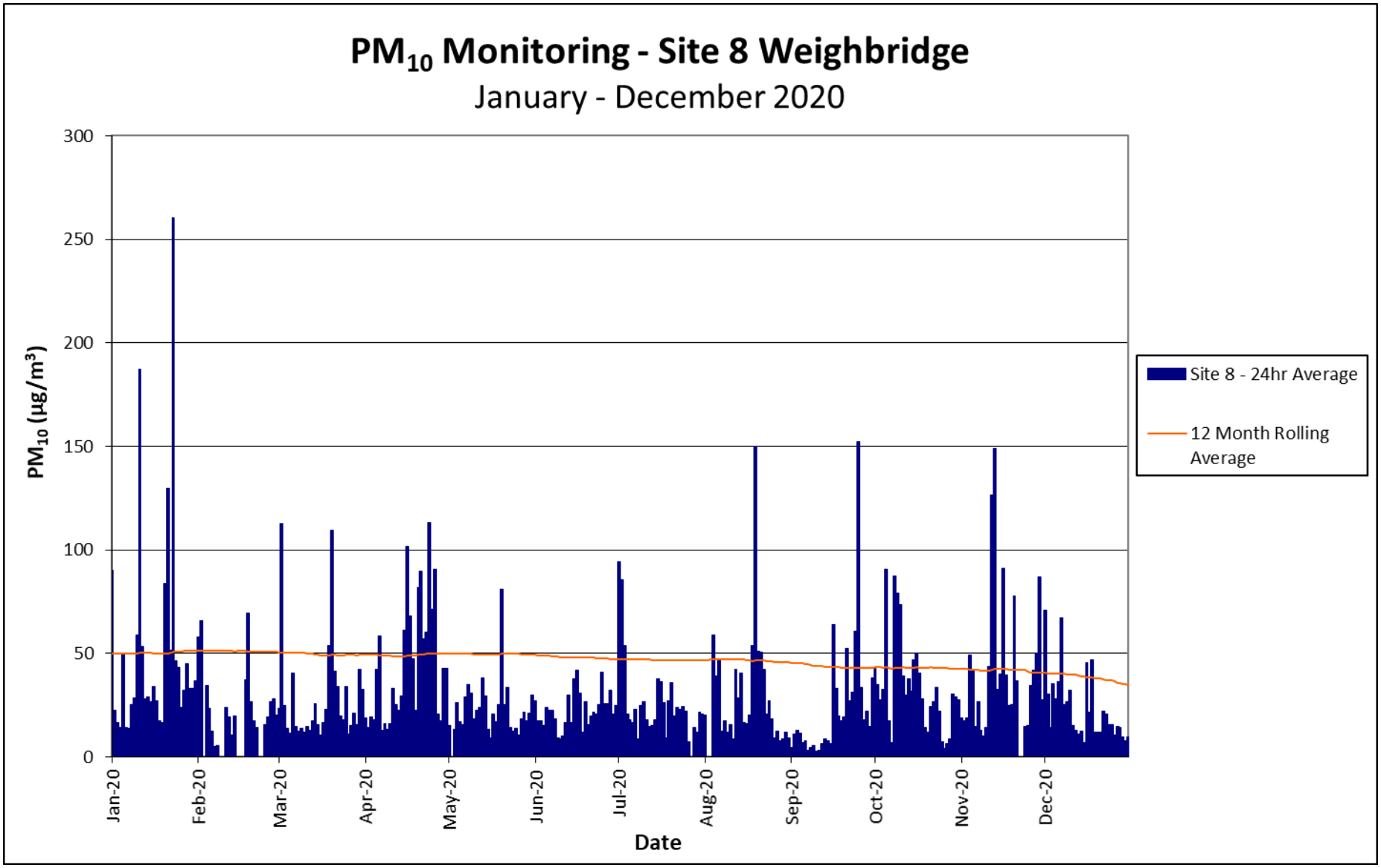


Figure 7: Site 8 PM_{10} Results

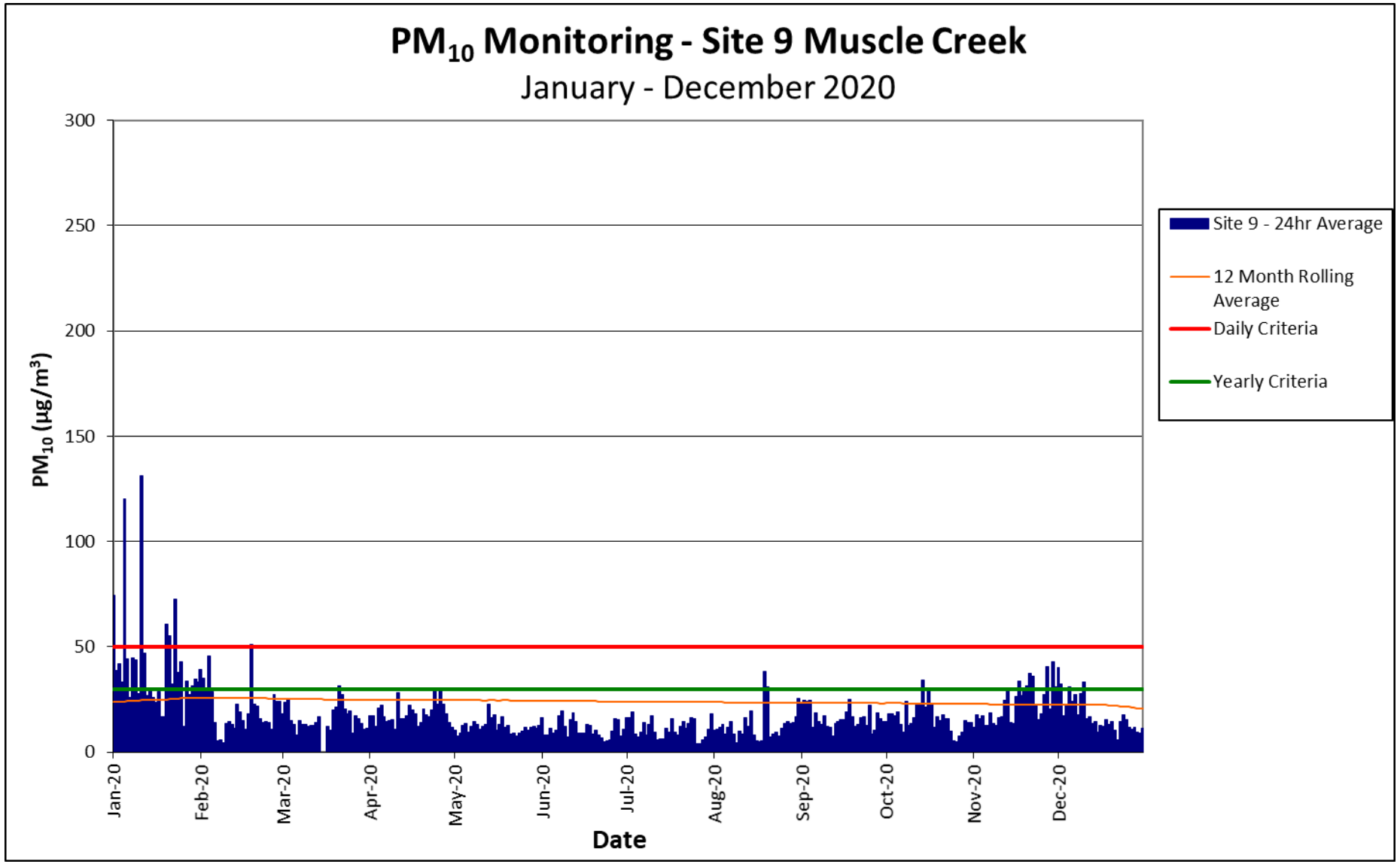


Figure 8: Site 9 PM_{10} Results

Gas Monitoring (Hydrogen Sulphide and Sulphur Dioxide)

MCC operate three real-time gas monitors that measure Hydrogen Sulphide (H_2S) and Sulphur Dioxide (SO_2). The locations of these monitors are shown in **Figure 5**. Monitoring at two of the sites (Site 7 and Site 9) is undertaken in accordance with the EPL requirements. Monitoring at Site 10 was undertaken in accordance with MSC requirements until December 2020 when MSC no longer required monitoring at Site 10. There are two types of monitor used:

- Site 7 and Site 9 – Ecotech monitor
- Site 10 – GrayWolf monitor

These monitors utilise different methodologies and have different limits of detection, which results in slightly different results being recorded. The criteria for H_2S and SO_2 are shown in **Table 16**. A summary of the monitoring results is shown in **Table 19** and this shows that there were no results above these criteria during the reporting period. The monitor at Site 10 was not working properly and failed to collect valid data during January and November. Attempts were made throughout January to fix the monitor. After failed attempts to repair the monitor and limited data capture in February, it was replaced with an interim monitor from March until the end of July 2020. The GrayWolf monitor was repaired and returned to service in August 2020 and subsequently decommissioned in December 2020.

Table 19: Summary of Gas Data Results

Month	Highest H_2S 1-hour result	Highest H_2S 24-hour result	Highest SO_2 1-hour result	Highest SO_2 24-hour result
Site 7 – Nisbet				
January 2020	3.0	1.3	10.3	3.0
February 2020	4.1	1.4	19.1	3.9
March 2020	8.9	1.8	24.3	4.0
April 2020	4.3	1.1	21.0	4.2
May 2020	6.9	1.7	13.0	3.5
June 2020	8.3	2.8	31.4	8.0
July 2020	4.4	2.1	53.2	8.5
August 2020	5.9	2.5	66.3	8.0
September 2020	7.2	2.3	60.0	8.5
October 2020	11.4	2.7	24.1	4.6
November 2020	5.4	1.2	26.9	5.2
December 2020	9.4	2.6	10.9	3.0
Site 9 – Muscle Creek (Railway)				
January 2020	6.4	1.9	20.3	3.2
February 2020	10.1	1.1	41.5	7.5
March 2020	5.3	0.8	41.7	4.0
April 2020	7.5	1.8	37.9	7.6
May 2020	4.7	1.7	29.8	1.9
June 2020	10.4	1.4	47.7	6.1
July 2020	6.6	1.8	55.8	5.5
August 2020	4.9	1.9	51.0	5.4
September 2020	5.0	1.3	62.0	8.1
October 2020	4.6	1.3	35.7	4.7
November 2020	8.0	1.3	83.8	8.9
December 2020	2.8	1.2	27.8	3.9
Site 10 – Muscle Creek (Fire Station)				
January 2020	No Data			

Month	Highest H_2S 1-hour result	Highest H_2S 24-hour result	Highest SO_2 1-hour result	Highest SO_2 24-hour result
February 2020	5.0*	5.0	5.4	5.0
March 2020	50.0*	50.0*	50.0*	50.0*
April 2020	50.0*	50.0*	50.0*	50.0*
May 2020	50.0*	50.0*	50.0*	50.0*
June 2020	50.0*	50.0*	50.0*	50.0*
July 2020	50.0*	50.0*	50.0*	50.0*
August 2020	5.2	5.0*	64.2	5.6
September 2020	35.0	5.0*	26.5	5.6
October 2020	49.2	21.0	59.2	7.6
November 2020	5.0*	No Data	5.0	No Data
December 2020	Not Required			

* All data returned less than the instrument's limit of detection (LOD). Half of the LOD value used

3.3.3 ACTIVITIES NEXT REPORTING PERIOD

MCC will continue to manage and monitor air quality impacts in accordance with the AQMP.

3.4 GREENHOUSE GAS

No methane drainage or ventilation issues were associated with the Open Cut operations during this reporting period. A number of boreholes intersect the underground workings that are used for gas and water monitoring. These boreholes are capped and opened only for monitoring purposes.

MCC supply data to Idemitsu for their corporate reporting requirements for the National Greenhouse and Energy Reporting (NGER's) process.

3.5 EROSION AND SEDIMENT CONTROL

3.5.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage erosion and sediment in accordance with the Water Management Plan (WMP).

The key considerations for erosion and sediment control at MCC include:

- restricting the extent of disturbance to the minimum that is practical and in accordance with the Mining Operations Plan/Rehabilitation Plan;
- progressive rehabilitation of disturbed land, where possible, and the construction of drainage controls to improve the stability of rehabilitated land;
- protection of natural drainage lines and watercourses by the construction of erosion control devices such as diversion banks and channels and sediment retention dams as necessary;
- restriction of access to rehabilitated areas;
- management of erosion and sediment control of affected surface watercourses/ water bodies, including creek lines within or adjacent to the development consent boundary;
- regular inspection of dams to monitor their efficiency and any required maintenance; and
- inspection and maintenance, if required, of sediment and erosion controls including dams and drainage lines following storm events.

Two main natural catchments exist in the area of mining, associated with Muscle and Sandy Creeks. The area contains undisturbed land surfaces that drain towards Sandy Creek. However, some of the runoff is captured by dams. Water from undisturbed catchments is diverted around mining operations by diversion banks and channelled into adjacent watercourses.

Drainage from the coal crushing plant and stockpile area is collected in a dam and re-used for dust suppression. All disturbed or newly rehabilitated areas contain diversion banks (major and minor graded banks) to control the flow of water from catchment areas and to contain dirty runoff on the mine site.

During the reporting period MCC maintained water management structures to contain any potentially contaminated water on site. This work included desilting of dams to maintain capacity and drain cleanout to remove blockages.

3.5.2 EROSION AND SEDIMENT CONTROL MONITORING

Erosion and sediment control monitoring is conducted as part of the surface water monitoring program. Surface water monitoring is discussed in **Section 3.6.2**.

3.5.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period, MCC will continue to manage and monitor erosion and sediment impacts in accordance with the WMP.

3.6 SURFACE WATER MANAGEMENT

3.6.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage surface water impacts in accordance with the Water Management Plan (WMP).

The trigger values for water quality in Muscle Creek are presented in Table 20.

Table 20: Trigger Values for Muscle Creek Water Quality

Site	pH 20th/80th Percentile Trigger Values	EC (µS/cm) 80th Percentile Trigger Values	TSS (mg/L) 80th Percentile Trigger Values
SW07 – Muscle Creek – Upstream	7.7–8.0	4,048	13
SW08 – Muscle Creek – Downstream	7.8–8.0	5,136	10

If monitored conditions are outside the upper or lower trigger levels for 3 continuous monthly results, MCC will conduct an investigation into the results.

3.6.2 SURFACE WATER MONITORING

MCC undertake a surface water monitoring program that consists of monthly, quarterly and annual monitoring. The locations of the surface water monitoring sites are shown in **Figure 9**.

The surface water pH, Electrical Conductivity (EC) and Total Suspended Solids (TSS) results are shown graphically in **Figure 10** to **Figure 15**. The data and the annual comprehensive surface water monitoring results are provided in **Appendix 2**.

pH

The pH levels at surface water monitoring sites were generally within the recommended ecosystem pH levels of 6.5–9.5 throughout the reporting period. As shown in **Table 21** the results from this reporting period are consistent with the results from previous reporting periods. There are no background results or predictions to compare these results to.

Table 21: Comparison of pH Results to Historical Results

Location	pH Annual Average							
	2013-2014	2014	2015	2016	2017	2018	2019	2020
Dam 1/2	7.8	7.7	7.7	7.9	8.0	7.9	7.9	7.9
MCC12 Final Settling Pond	8.3	8.3	8.3	8.4	8.4	8.7	8.5	8.5
No.2 Open Cut Void	8.0	8.1	7.9	8.0	8.0	8.1	no results	7.6
No.1 Open Cut Void	7.7	no results	no results	no results	no results	8.1	no results	no results
MCC07	7.8	7.8	7.9	8.0	8.0	7.7	7.8	7.3
MCC08	7.8	7.9	7.9	7.9	8.0	8.0	7.9	7.7
MCC09	8.6	8.7	8.7	8.4	8.1	8.1	8.3	8.4
MCC23	8.6	9.3	9.2	8.8	8.1	8.3	8.9	8.8
MCC24	8.2	8.0	7.7	7.8	no results	8.3	8.3	8.0
MCC25	7.5	no results	7.6	7.8	8.0	no results	no results	7.6
MCC26	8.7	8.9	8.3	8.4	8.8	8.7	8.9	8.5
MCC27	8.2	8.4	8.0	8.2	8.2	8.5	8.5	8.7

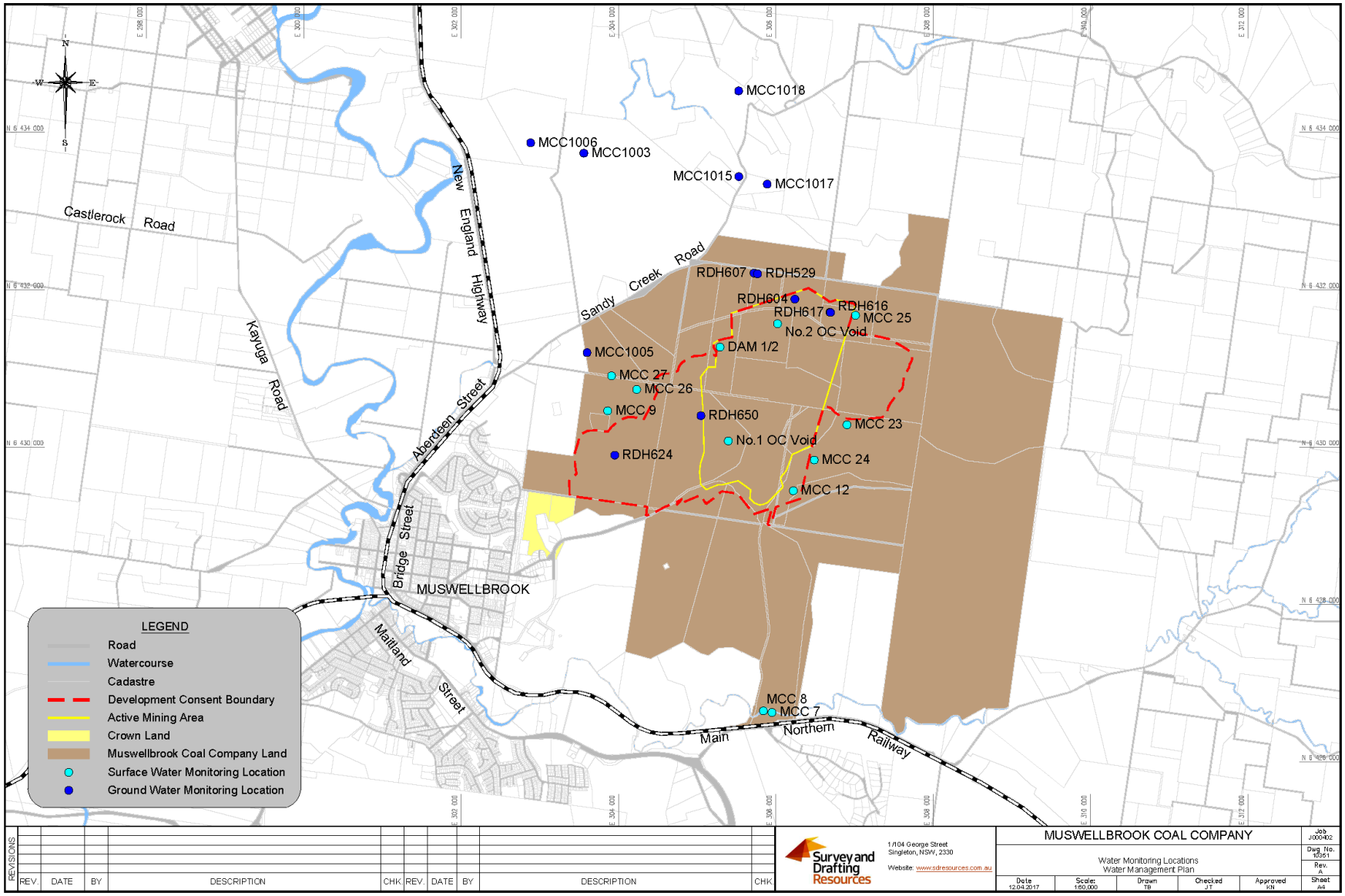


Figure 9: Water Monitoring Locations

Electrical Conductivity (EC)

Typically, EC levels for mine water are greater than 4,000µS/cm. The high rainfall during the reporting period has slightly reduced the elevated EC results from 2019 in the dams and Muscle Creek. MCC will continue to monitor the water quality in Muscle Creek to see if it returns to normal following more rainfall.

The sediment from MCC09 was removed during the previous reporting period and the EC continues to remain low. The EC at MCC23 has reduced since 2019 due to the significant runoff into the dam from elevated rainfall. MCC will continue to monitor the water in this dam to see if there is a further drop in EC following more rainfall.

As shown in **Table 22** the results from this reporting period are consistent with the results from previous reporting periods for all other sites. There are no background results or predictions to compare these results to.

Table 22: Comparison of EC Results to Historical Results

Location	Electrical Conductivity Annual Average (µS/cm)							
	2013-2014	2014	2015	2016	2017	2018	2019	2020
Dam 1/2	5,975	6,133	6,337	6,511	6,757	6,538	7,423	6,815
MCC12 Final Settling Pond	8,359	8,530	7,523	7,514	7,537	6,820	5,436	5,415
No.2 Open Cut Void	6,267	6,465	6,526	6,683	6,908	6,980	no results	3,680
No.1 Open Cut Void	5,533	no results	no results	no result	no result	5,520	no results	no results
MCC07	2,843	4,780	2,887	2,594	4,723	12,925	14,389	9,554
MCC08	3,672	5,207	3,185	3,338	5,036	6,906	6,828	5,502
MCC09	4,043	3,900	4,985	12,400	5,220	475	396	469
MCC23	1,953	2,080	1,950	1,970	4,765	11,168	14,100	10,575
MCC24	3,933	3,840	3,940	2,740	no result	5,900	1,490	713
MCC25	1,740	no results	1,533	3,413	5,470	no results	no results	815
MCC26	4,868	6,615	4,133	4,660	7,898	14,818	3,903	2,018
MCC27	9,588	9,405	8,273	8,623	12,735	11,033	11,733	10,725

Total Suspended Solids (TSS)

As shown in **Table 23** the results from this reporting period are consistent with the results from previous reporting periods, except for MCC24. The TSS in MCC24 was elevated during this monitoring period due to a high TSS result in March 2020 when the water level was low and muddy. There are no background results or predictions to compare these results to.

Table 23: Comparison of TSS Results to Historical Results

Location	Total Suspended Solids Annual Average (mg/L)							
	2013-2014	2014	2015	2016	2017	2018	2019	2020
Dam 1/2	14	7	11	9	13	7	13	8
MCC12 Final Settling Pond	22	16	18	31	19	15	21	13
No.2 Open Cut Void	20	12	12	9	12	24	no results	11
No.1 Open Cut Void	13	no results	no results	no results	no result	8	no results	no results
MCC07	16	11	8	8	18	18	5	12
MCC08	13	10	8	7	9	8	8	10
MCC09	11	4	33	608	8	27	71	25
MCC23	20	18	7	22	25	20	14	12
MCC24	13	14	7	11	no results	16	11	37
MCC25	13	no results	5	9	17	no results	no results	5
MCC26	15	42	5	7	30	44	20	5
MCC27	14	31	9	15	41	10	11	24

3.6.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period, MCC will continue to manage and monitor surface water quality impacts in accordance with the WMP. A review of the WMP will be undertaken during the next reporting period in the regular 3-yearly review cycle.

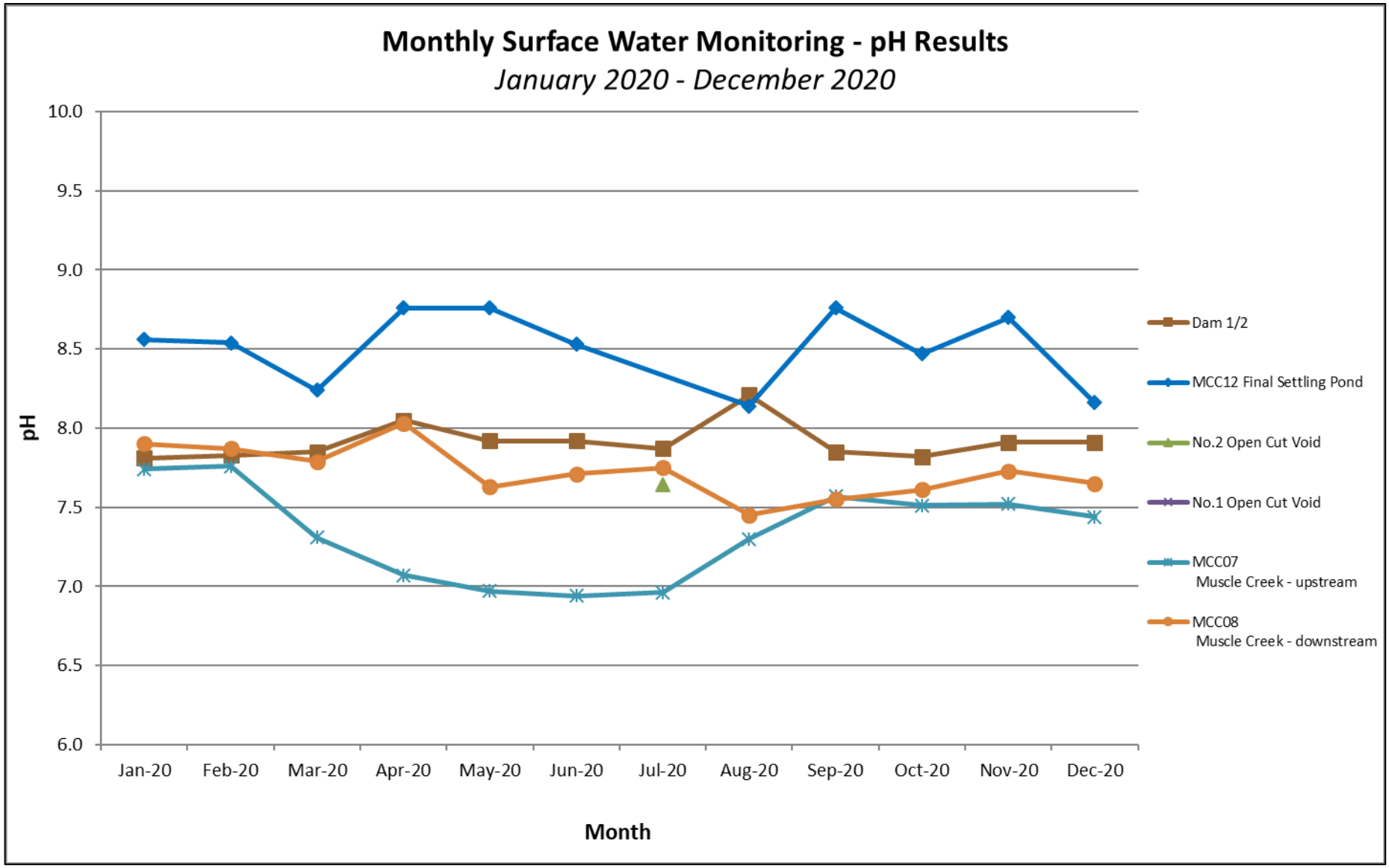


Figure 10: Monthly Surface Water Monitoring Results – pH

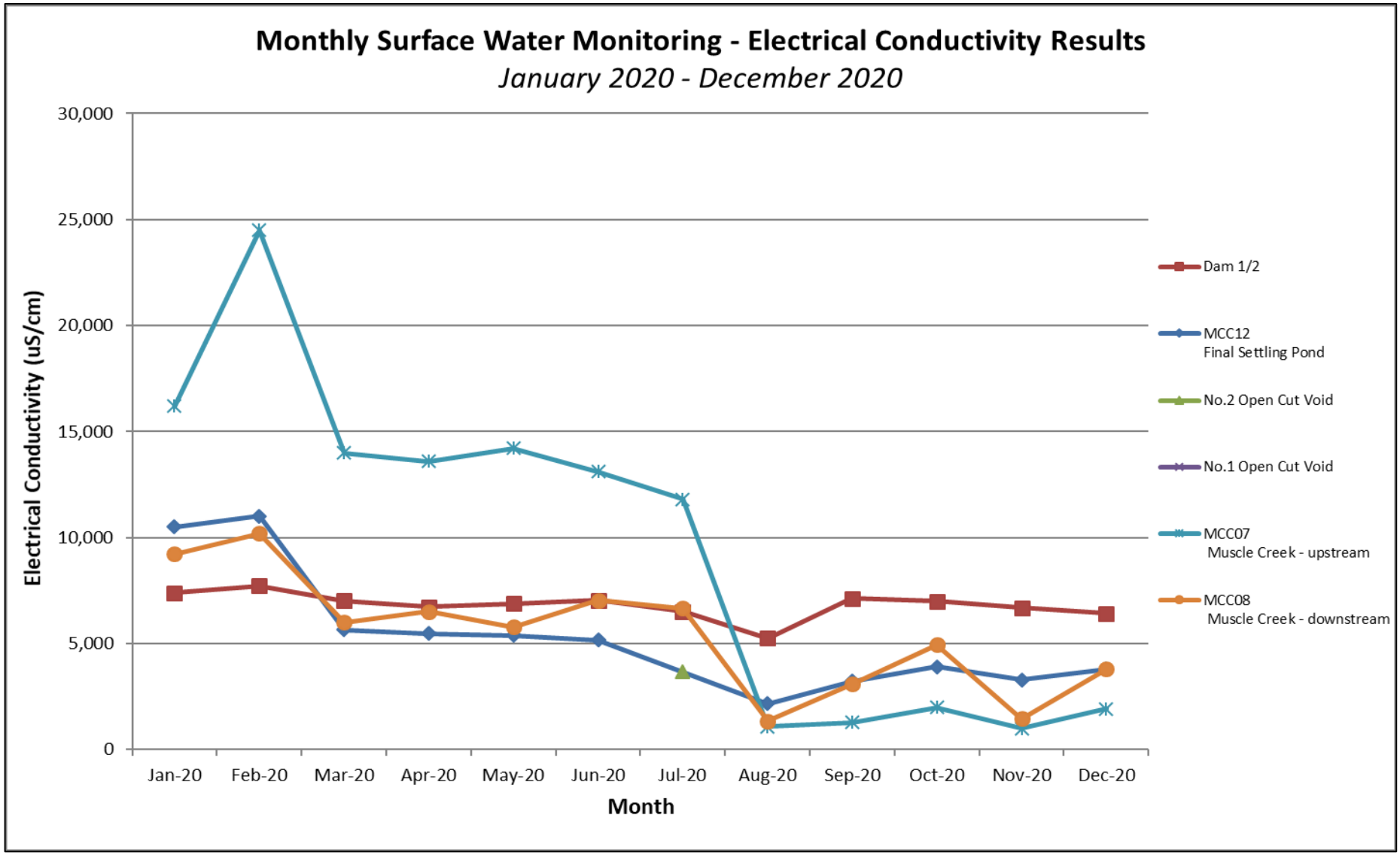


Figure 11: Monthly Surface Water Results – Electrical Conductivity

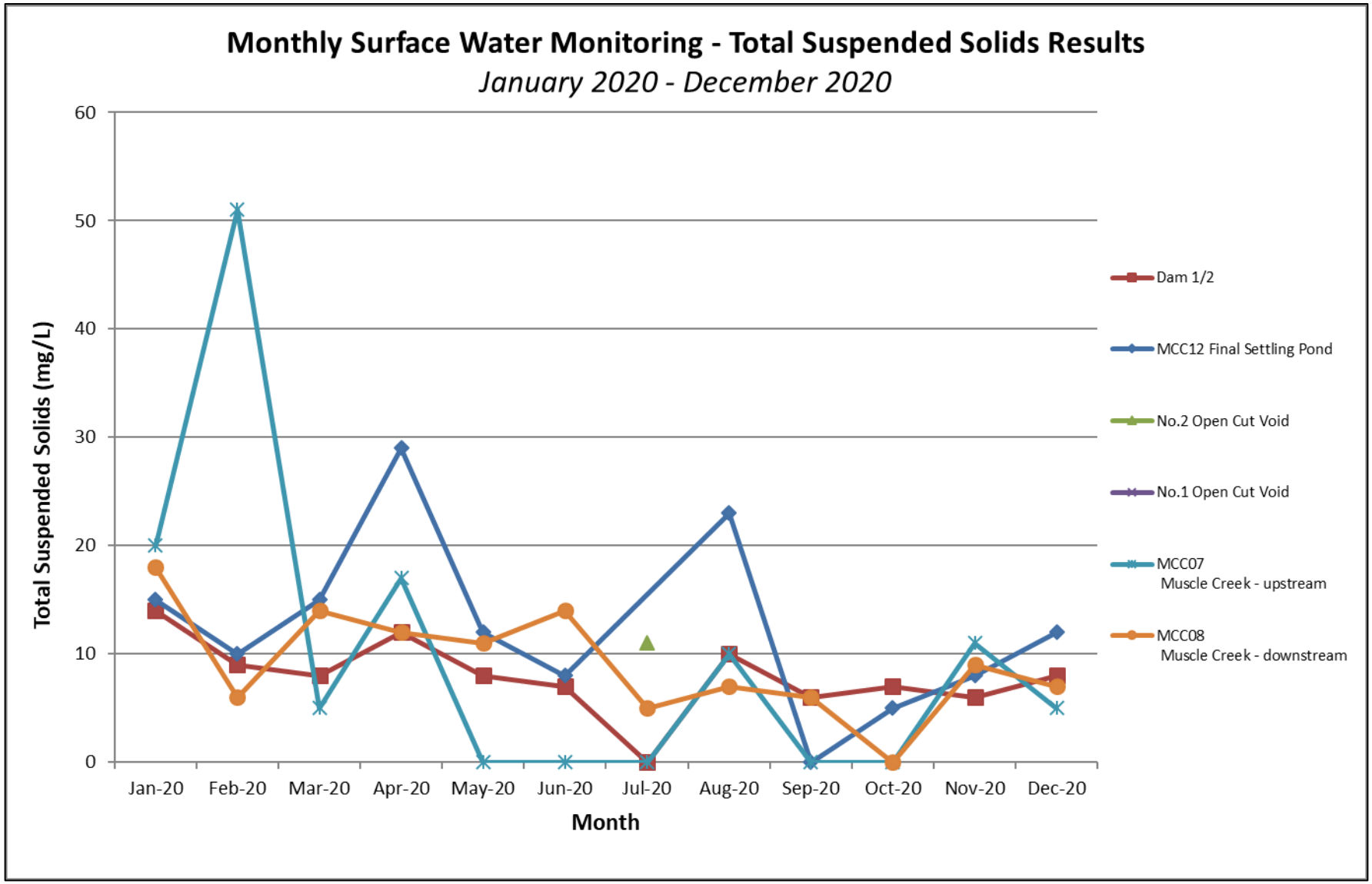


Figure 12: Monthly Surface Water Results – Total Suspended Solids

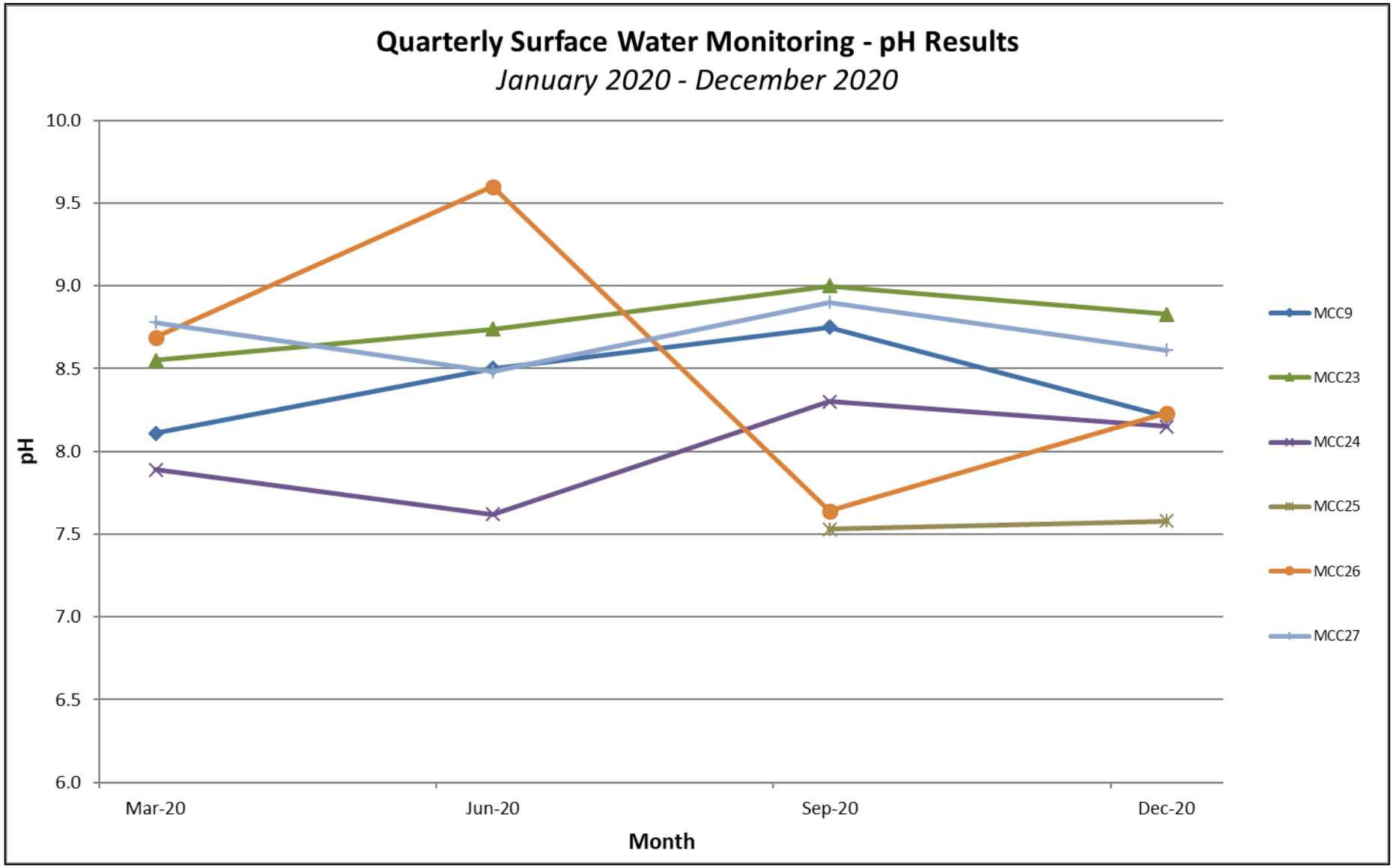


Figure 13: Quarterly Surface Water Results – pH

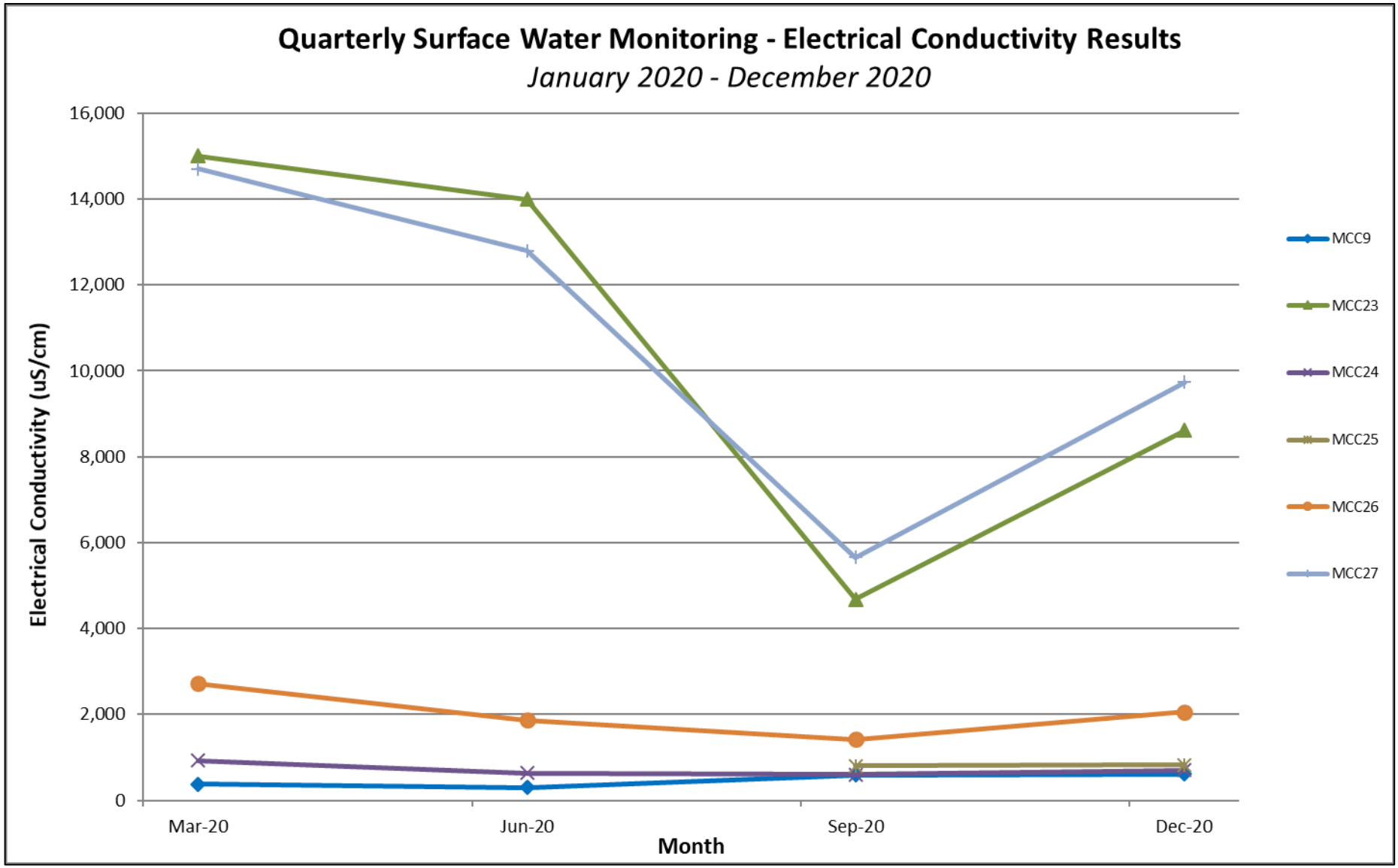


Figure 14: Quarterly Surface Water Monitoring Results – Electrical Conductivity

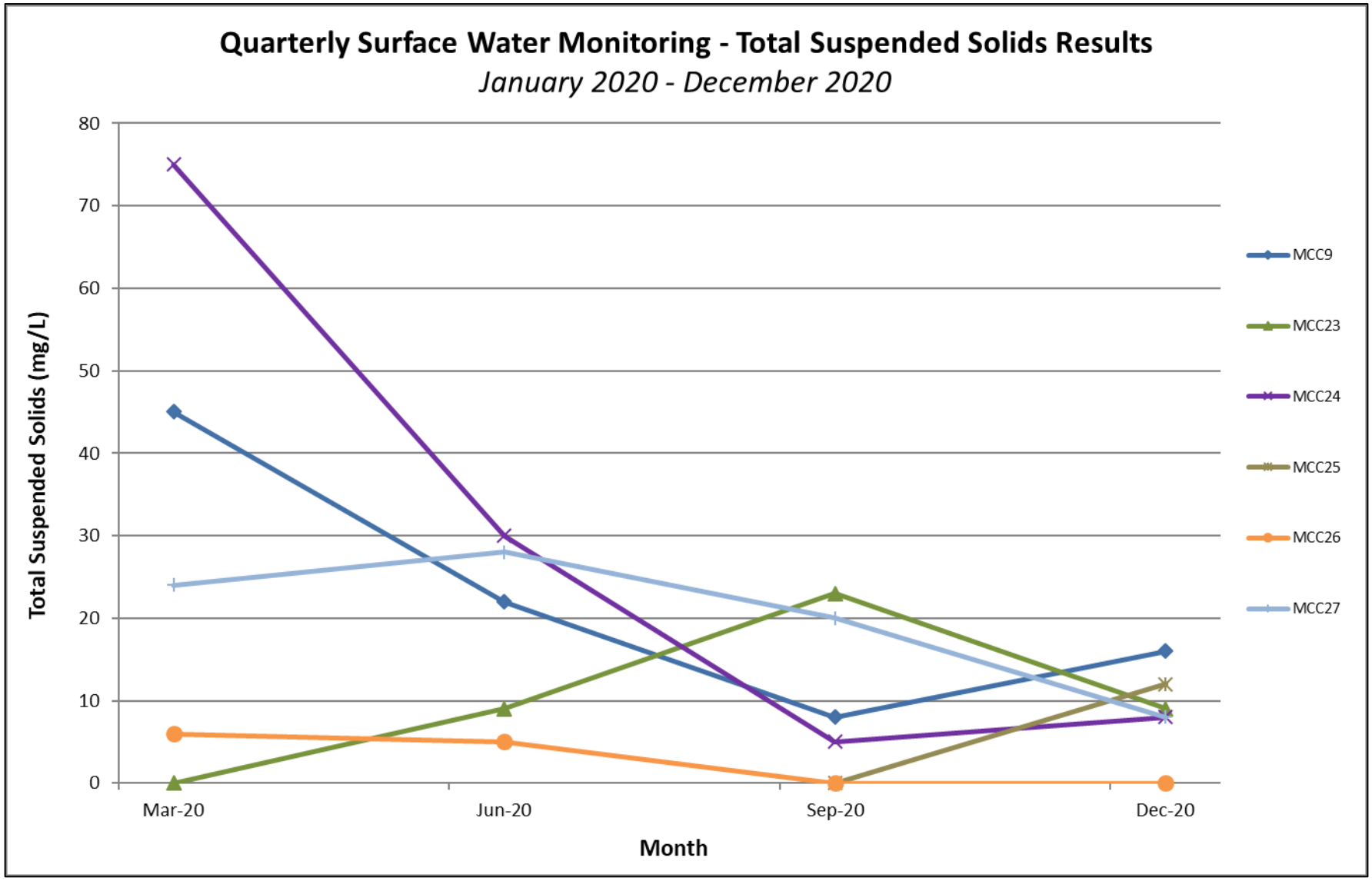


Figure 15: Quarterly Surface Water Monitoring Results – Total Suspended Solids

3.7 GROUNDWATER MANAGEMENT

3.7.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage groundwater impacts in accordance with the Water Management Plan (WMP).

Groundwater trigger levels have been established for selected sites with the trigger levels shown in **Table 24**.

Table 24: Groundwater Monitoring Trigger Levels

WATER LEVELS			
Bore/Well	**Aquifer**	**Lower Trigger Level (m) BTOC**	**Lower Trigger Level (m) AHD**
MCC1003	Alluvial	8.6	146.5
MCC1005	Alluvial	11.3	138.9
MCC1006	Alluvial	10.3	144.6
MCC1017	Hardrock	18.1	180.7
MCC1018	Hardrock	19.0	181.9
pH			
Bore/Well	**Aquifer**	**Lower Trigger pH**	**Upper Trigger pH**
MCC1003	Alluvial	7.1	7.3
MCC1005	Alluvial	6.9	7.2
MCC1006	Alluvial	7.1	7.4
ELECTRICAL CONDUCTIVITY			
Bore/Well	**Aquifer**	**Upper Trigger EC**	
MCC1003	Alluvial	1,666	
MCC1005	Alluvial	5,584	
MCC1006	Alluvial	1,152	

If monitored conditions are outside the upper or lower trigger levels for 3 continuous monthly results, MCC will conduct an investigation into the results.

3.7.2 GROUNDWATER MONITORING

MCC undertake a groundwater monitoring program that consists of monthly and annual monitoring. The locations of the groundwater monitoring sites are shown in **Figure 9**.

Ground Water Monitoring Results – Mining Operations

The water level, pH and Electrical Conductivity of the underground working are shown in **Figure 16** and **Figure 17**. The water levels in groundwater monitoring wells located on site are shown in **Figure 18**. These results show that water levels in the underground workings have increased in 2020 due to elevated rainfall and less need for MCC to pump water from the workings for operations. The regional monitoring has shown that there is no impact on alluvial water sources from this drop in water level in the underground workings. The data and the annual comprehensive groundwater monitoring results are provided in **Appendix 2**.

As shown in **Table 25** the pH and Electrical Conductivity results from this reporting period are consistent with previous results and the water levels have risen slightly from 2019 levels. There are no background results or predictions to compare these results to.

Table 25: Comparison of Underground Working Results

Year	Average pH	Average EC *(µS/cm)*	Relative Level (RL) *(AHD metres)*
2020	7.1	6,098	106
2019	7.3	6,265	104
2018	7.0	5,965	107
2017	7.5	6,455	114
2016	7.5	6,482	114
2015	7.3	6,327	114
2014	7.3	5,468	116
2013-2014	7.2	5,375	125

Ground Water Monitoring Results – Sandy Creek Area

The alluvial and hard rock aquifers in the Sandy Creek area are a significant lateral distance from the open cut footprint and no impacts have been determined. Ground water depths and quality results are presented in **Figure 19** to **Figure 21**. The data and the annual comprehensive groundwater monitoring results are provided in **Appendix 2**.

As shown in **Table 26** to **Table 28** the results from this reporting period are generally consistent with the results from previous reporting periods. There are no background results or predictions to compare these results to.

Table 26: Comparison of Depth to Historical Results

Location	Depth Annual Average (mbgl)							
	2013-2014	2014	2015	2016	2017	2018	2019	2020
MCC1003	4.5	5.8	3.6	3.9	4.6	7.2	7.1	5.9
MCC1005	7.8	8.3	7.9	7.5	8.0	8.8	9.2	8.9
MCC1006	6.5	no results	no results	5.6	6.4	no results	no results	no results
MCC1017	17.1	16.8	17.1	17.1	17.2	17.6	17.9	18.1
MCC1018	16.7	16.8	17.3	17.6	17.8	18.2	18.4	18.9

Table 27: Comparison of pH Results to Historical Results

Location	pH Annual Average							
	2013-2014	2014	2015	2016	2017	2018	2019	2020
MCC1003	7.3	7.2	7.2	7.1	7.1	7.0	7.1	7.2
MCC1005	7.2	7.2	7.1	7.2	7.1	7.0	6.9	7.0
MCC1006	7.2	no results	no results	7.2	7.2	no results	no results	no results

Table 28: Comparison of EC Results to Historical Results

Location	Electrical Conductivity Annual Average (µS/cm)							
	2013-2014	2014	2015	2016	2017	2018	2019	2020
MCC1003	1,480	1,701	1,345	1,471	1,347	1,392	1,212	1,319
MCC1005	2,544	2,697	2,768	2,170	2,235	2,851	3,880	4,231
MCC1006	1,117	no results	no results	982	931	no results	no results	no results

3.7.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period, MCC will continue to manage and monitor groundwater quality impacts in accordance with the WMP. A review of the WMP will be undertaken during the next reporting period in the regular 3-yearly review cycle.

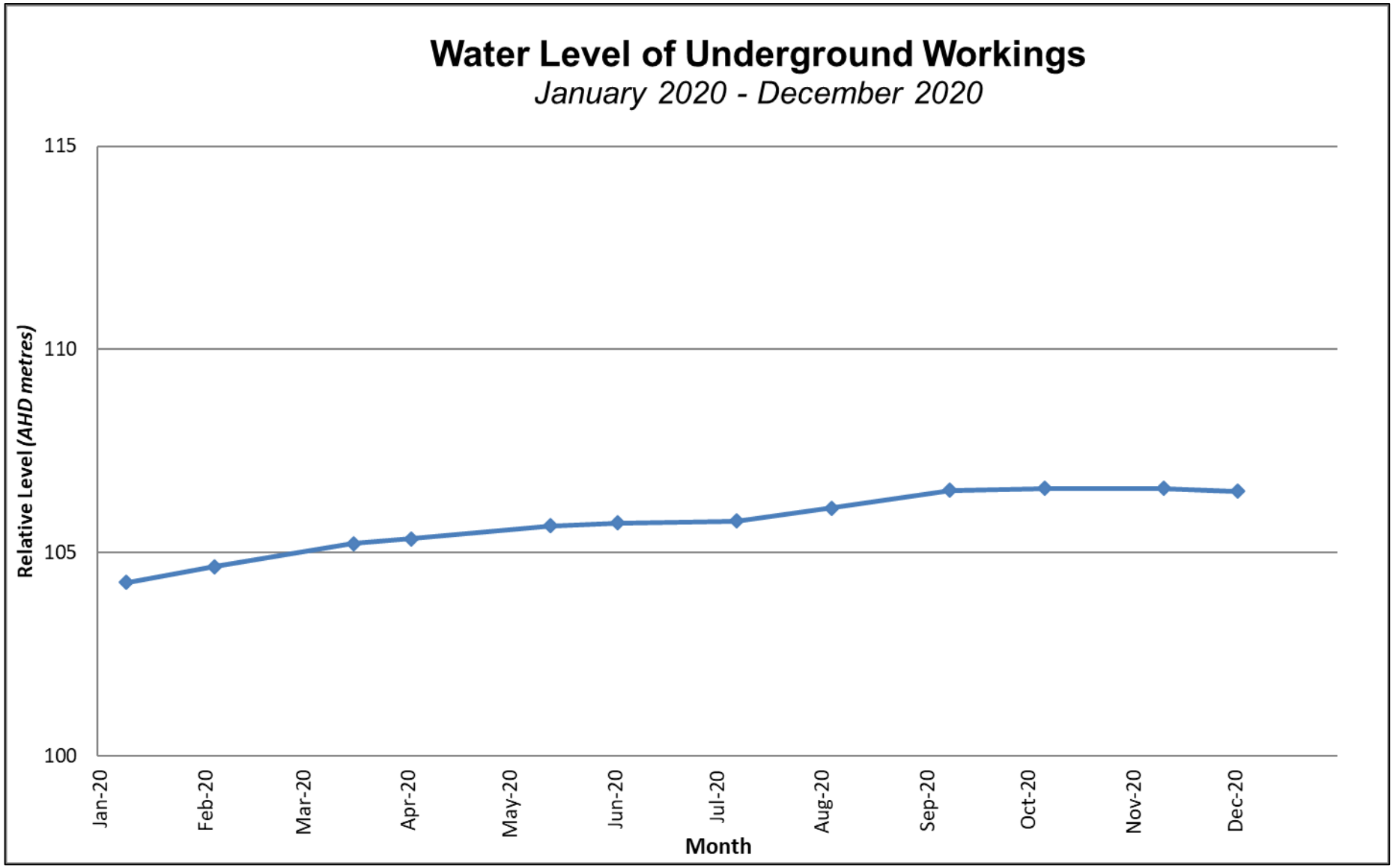


Figure 16: Water Level for Underground Workings

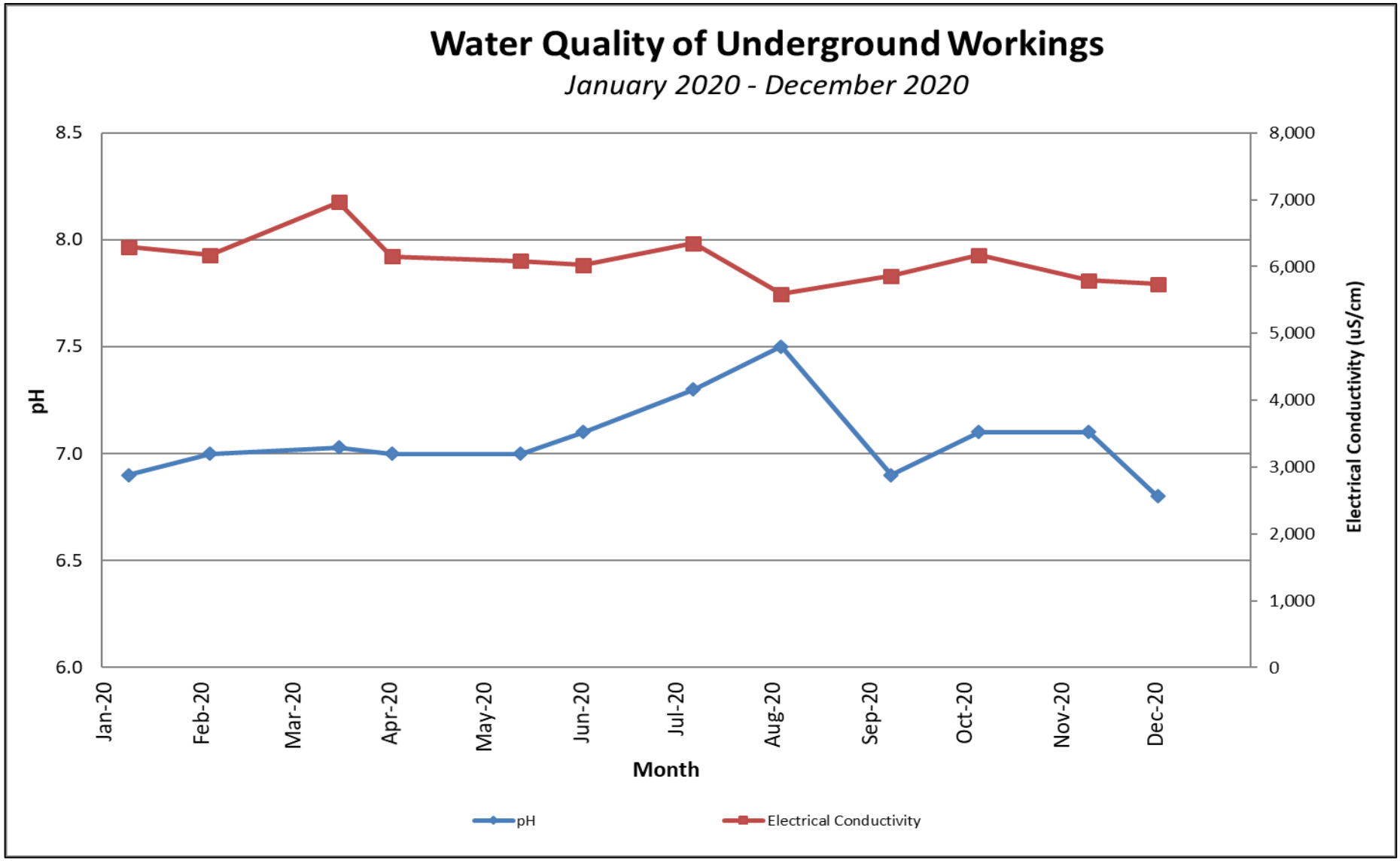


Figure 17: Water Quality Data in Underground Workings

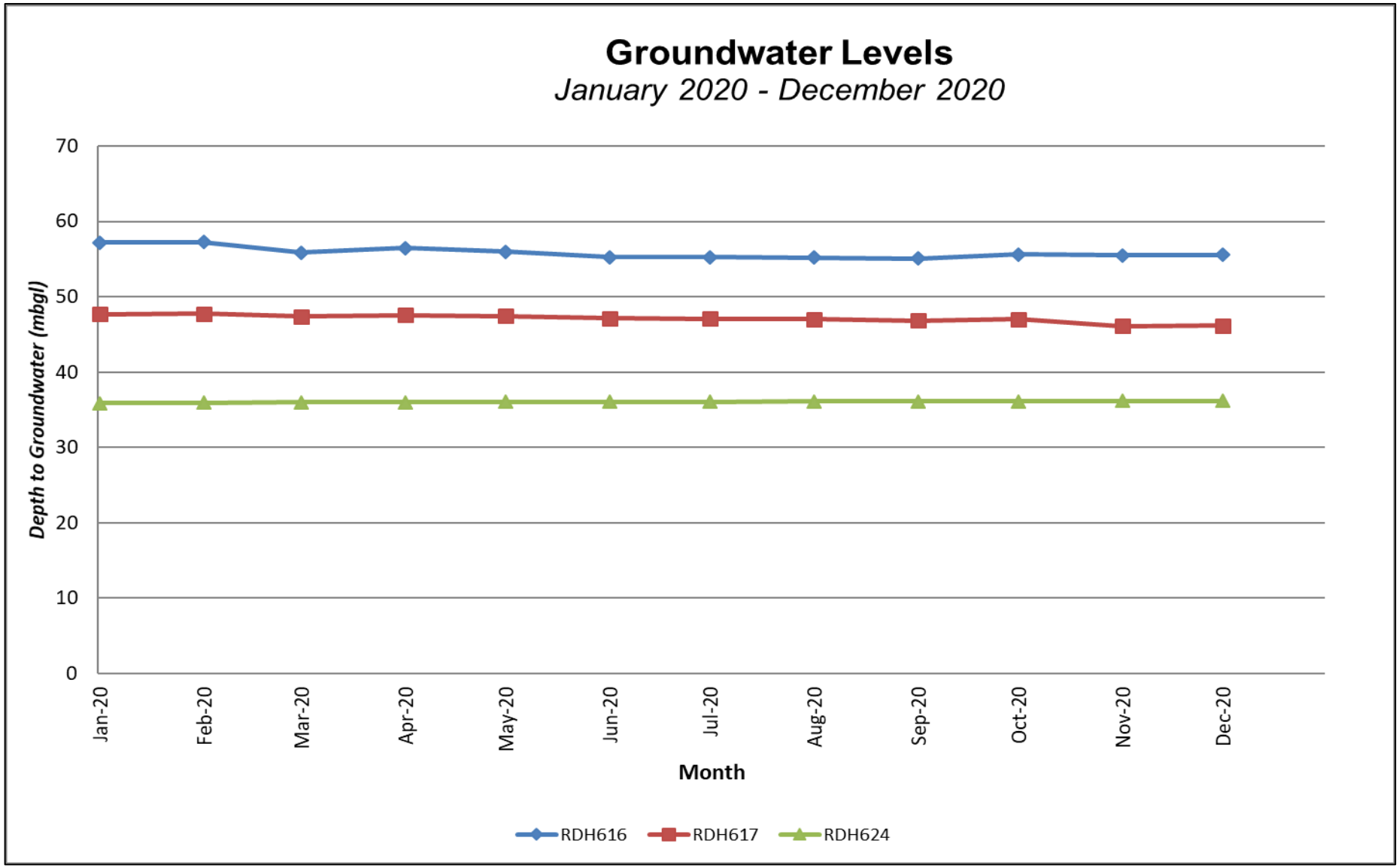


Figure 18: Water Level for On Site Groundwater Monitoring

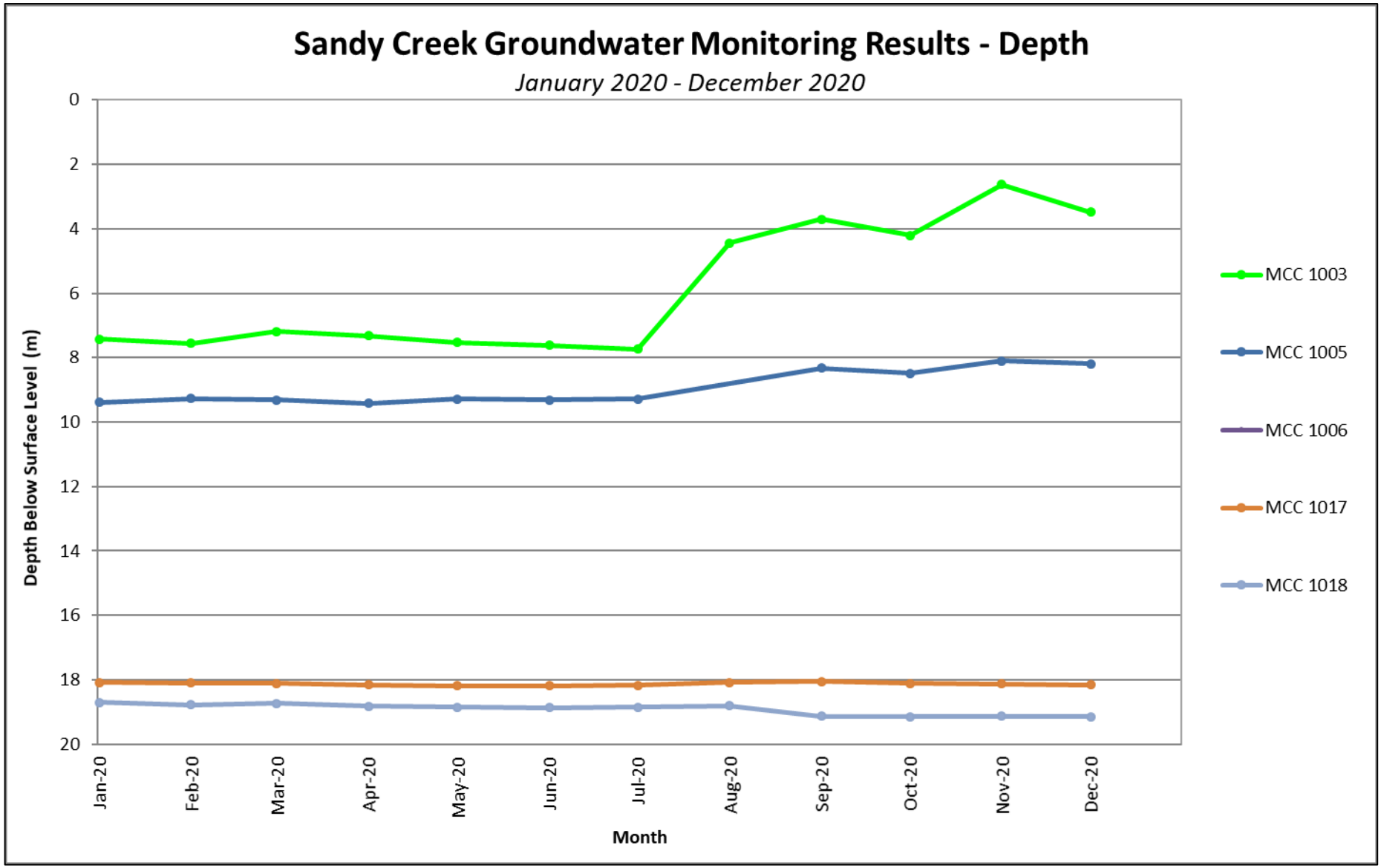


Figure 19: Sandy Creek Groundwater Depth

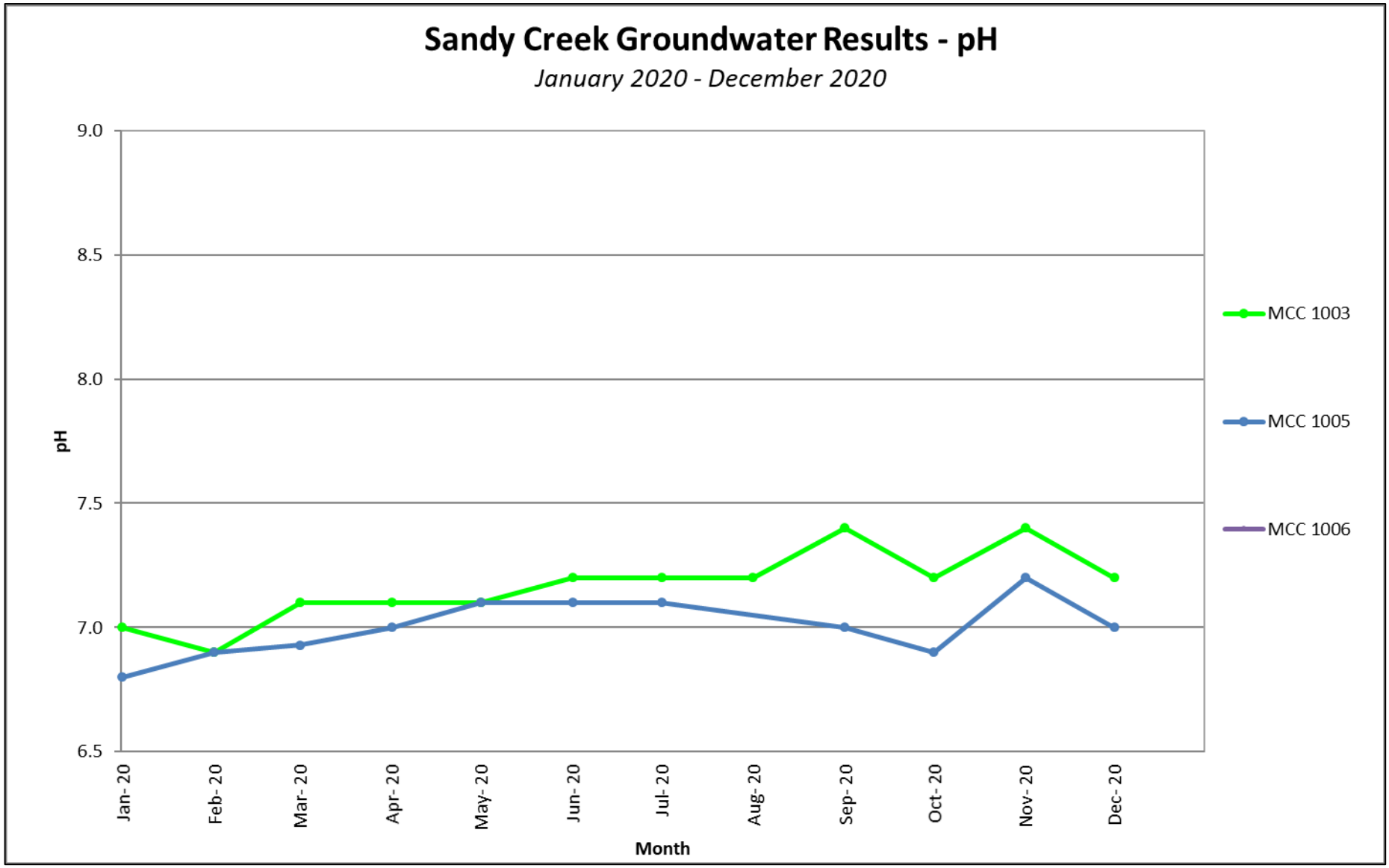


Figure 20: Sandy Creek Water Quality – pH

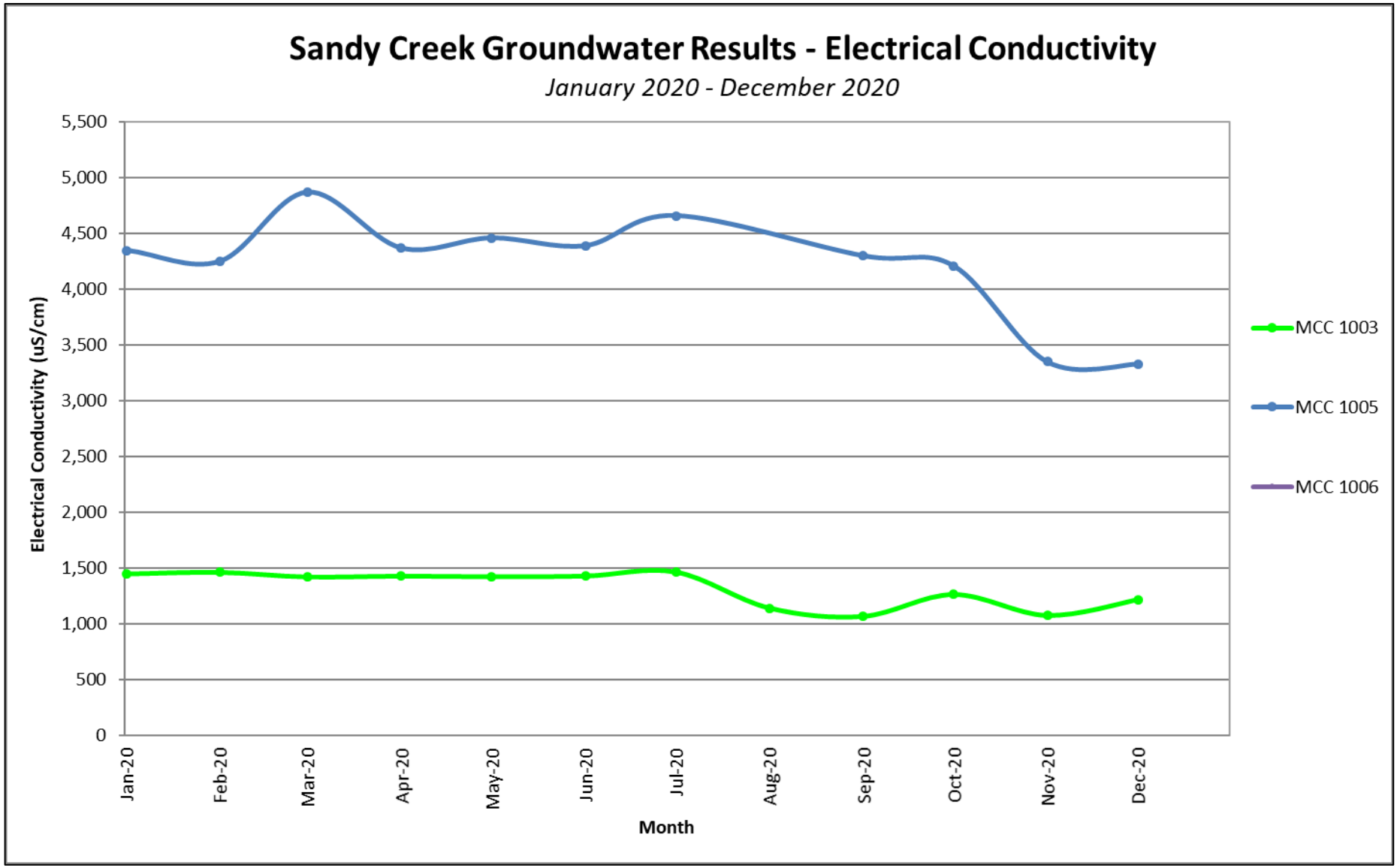


Figure 21: Sandy Creek Water Quality – Electrical Conductivity

3.8 CONTAMINATED LAND

MCC has a Bioremediation Area where material contaminated with hydrocarbons is managed and tested. When the test results indicate that the material is no longer contaminated it is removed and disposed of in the carbonaceous dump in the mining area.

3.9 FLORA AND FAUNA MANAGEMENT

3.9.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage impacts on flora and fauna in accordance with the Mining Operations Plan (MOP). The latest modification to the development consent removed the requirement for a Flora and Fauna Management Plan with the management of flora and fauna impacts to be discussed in the MOP.

MCC is set amongst an area of existing disturbed and mined land. The area to be mined is extensively altered from its natural state through current and past mining operations.

Five vegetation communities have been identified within the DA boundary at MCC. These are:

- Hunter Floodplain Red Gum Woodland;
- Central Hunter Grey Box-Ironbark Woodland;
- Regenerating Central Hunter Grey Box-Ironbark Woodland;
- Aquatic Forbland; and
- Mine Rehabilitation.

No threatened flora species have been identified at MCC. The area to be disturbed is not considered important habitat for threatened fauna. The area is also not considered critical habitat.

No tree clearing was undertaken during the reporting period.

3.9.2 FLORA AND FAUNA MONITORING

Inspections of nesting boxes are performed on a regular basis. Inspections were performed twice during this reporting period with the results of the inspections shown below.

- Sugar Glider (2) – not occupied at the time of inspection and no signs of activity were observed.
- Bat (4) – not occupied at the time of inspection and no signs of activity were observed.
- Brushtail Possum (2) – not occupied at the time of inspection and no signs of activity were observed.

3.9.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage impacts on flora and fauna in accordance with the Mining Operations Plan (MOP).

3.10 WEEDS, PEST AND FERAL ANIMALS

3.10.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage weeds, pest and feral animals on site.

<u>Weed Control</u>

Weed control and eradication techniques used at MCC include:

- Promotion of vigorous pasture growth to out-compete weeds;

- Minimisation of area available for weed infestation, through prompt revegetation of bare areas;
- Spraying with selective herbicides; and
- Physical removal by chipping/slashing.

During the reporting period MCC undertook weed control programs across the rehabilitation areas. Weed spraying and cut and paint the main forms of weed control this year. The target species for the weed control included:

- Galenia (13.5Ha);
- Prickly Pears (Prickly Pear, Tiger Pear and Creeping Pear) (32.5Ha);
- Paterson's Curse (2.6Ha);
- Mother of Millions (2.8Ha);
- Saffron Thistle (38.4Ha);
- African Boxthorn (10.1Ha);
- African Olive (2.3Ha);
- African Lovegrass (11.9Ha);
- Coolatai Grass (14.9Ha);
- Castor Oil (18.3Ha);
- Tree Tobacco (0.5Ha);
- Cotton Bush (2.2Ha);
- Pampas Grass (2 plants);
- Date Palms and Peppercorns (2.2Ha); and
- Acacia saligna (7Ha).

In addition, a stand of Acacia Saligna, approximately 0.2ha in size, was removed via physical removal.

The areas that were targeted during the reporting period are shown in **Figure 22**.

Feral Animal Control

During the reporting period, MCC undertook both a rabbit control program and a dog and fox baiting program timed in accordance with the dog baiting program conducted by Hunter Local Land Services.

The rabbit control program consisted of spotlighting for population density surveys and harbour destruction at seven locations across the mine site. Spotlighting was then conducted following the harbour destruction to determine the effectiveness of the rabbit control method. The number of rabbits sighted was reduced by 70% from the harbour destruction which is considered a high control rate. The rabbit control program was undertaken between August and September 2020.

The dog baiting program consisted of using ground baiting with Canid Pest Ejectors (CPEs) and fresh meat baits at 24 locations around the mining area. These baits and ejectors were checked weekly and replaced if they were taken. The baiting program was undertaken over 35 days in May and June 2020. Field cameras were used to assist with identifying what animals were taking the baits. The cameras and other evidence around the baiting stations indicated that wild dogs, foxes and crows took the baits. Some baits were taken by unknown animals.

3.10.2 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage weed and feral animal impacts in accordance with the Mining Operations Plan (MOP).

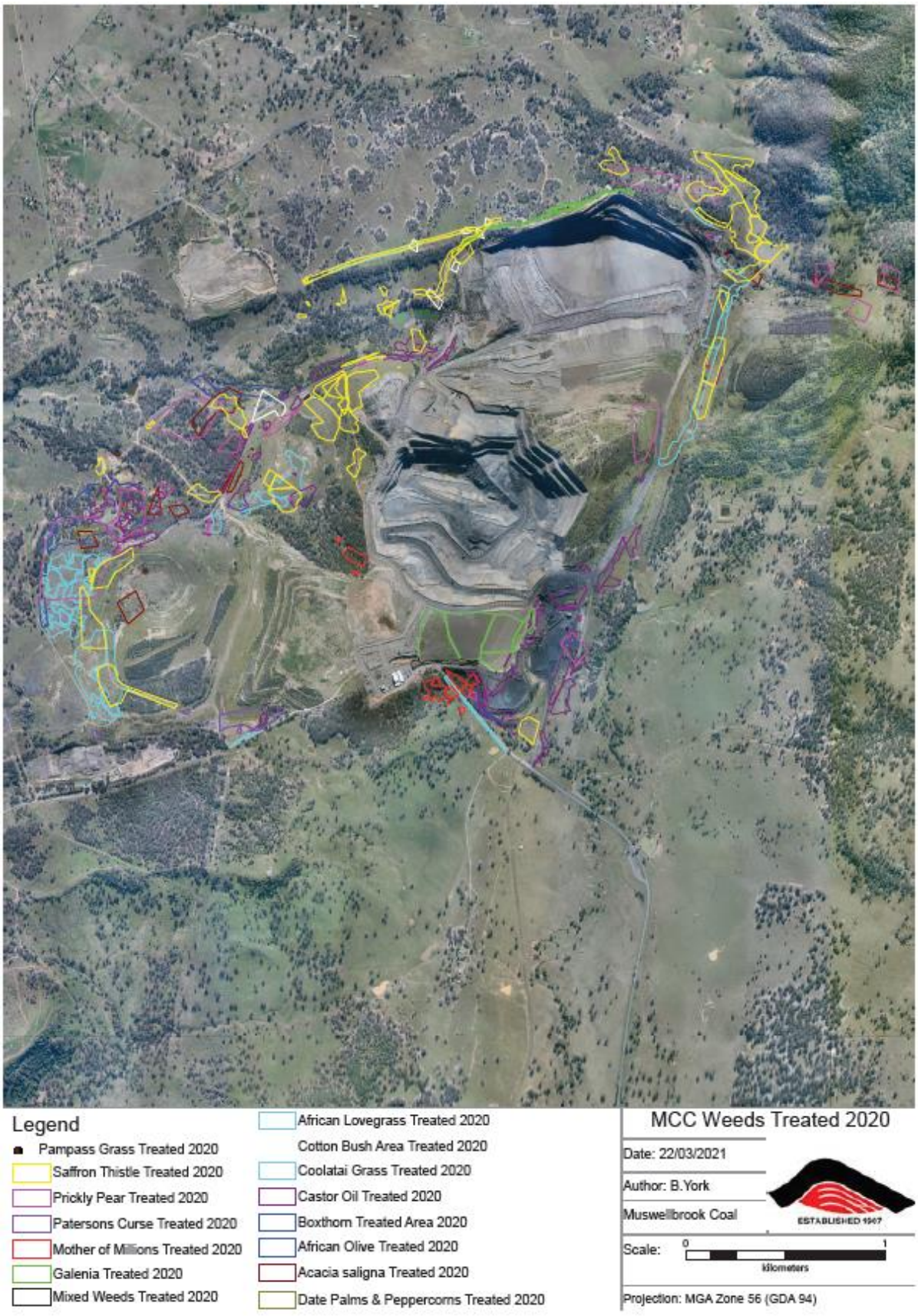


Figure 22: Weed Control Areas

3.11 BLASTING

3.11.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage blasting impacts in accordance with the Blast Management Plan (BMP). During the reporting period the BMP was reviewed and updated in consultation with MSC. The updated BMP was approved by MSC on 26 May 2020 and is available on the MCC website.

Members of the public are notified of proposed blasting times by contacting the Blast Information Service Line where they hear a recorded message or by looking at the "Blasting Notices" page of the Muswellbrook Shire Council Website.

The intent of best practice goals in drill and blast activities is to comply with the fragmentation requirements for each blast. The use of best practice techniques will reduce air blast overpressure, ground vibration, fumes and odours from blasting activities.

Best practice drill and blast activities at MCC include:

- A high degree of accuracy in the placement of drill holes so that design spacing and burden is achieved using Automatic Positioning System (APS) or other survey control;
- Management of surface and groundwater in the drill holes (to reduce fume and odour issues);
- Blast design and delays are designed to avoid wavefront reinforcement;
- Regular inspections of ground and hole conditions to identify any geological abnormalities that may create a path for the uncontrolled release of gaseous products from explosive material;
- Loading of the explosive material so that holes are not loaded in excess of the design;
- Proper placement of decking charges if required;
- Effective placement of good quality stemming to design column height for containment of explosive product;
- Reduce the sleep time of the blast pattern to minimise the potential for deterioration of the explosive material;
- Take into account any adverse meteorological conditions at the time of the blast and defer or modify the blast to accommodate those conditions;
- Video recording of blasts to identify any causal factors contributing to any aberration from the predicted outcomes; and
- Vibration and overpressure monitoring for all blasting activities on site.

3.11.2 BLAST MONITORING

All blasts are monitored by four automatically triggered blast monitors. The monitors are maintained in accordance with the relevant standards and calibrated annually.

The blasting criteria that apply to MCC are shown in **Table 29**.

Table 29: Blast Criteria

Vibration (mm/s)	Allowable Exceedance
5	5% of total number of blasts over a 12 month period
10	0%
Overpressure (dB(L))	**Allowable Exceedance**
115	5% of total number of blasts over a 12 month period
120	0%

The blast monitoring network is provided in **Table 30** and locations are displayed in **Figure 23**.

Table 30: Blast Monitoring Network

Blast Monitor	Location
B1 (Queen St)	In the vicinity of the nearest non-company owned residence
B2 (School)	At the Muswellbrook Public School, Roger Street, North Muswellbrook
B3 (99 Queen St)	At the northern end of Queen Street, North Muswellbrook
B4 (Nisbet)	Sandy Creek Road, approximately 1.2km to the north of MCC

During the reporting period, 96 blast events occurred at MCC. The four blast monitors were operational throughout the reporting period, with 99.5% of data captured during the reporting period. Results were not collected at 99 Queen St on the 24th of February 2020 and at Queen St on 25th September 2020 due to the trigger monitor causing a reset of the blast monitor at the time of the blast and an automated retrieve all data process occurring at the time of the blast. These incidents were investigated and returned no indication of faulty monitors. The automated data retrieve should not have been scheduled for daytime hours and the contractor was contacted to ensure all automated retrievals are scheduled to occur overnight.

A summary of blast monitoring results is displayed in **Figure 24** to **Figure 27**. Blast data for all monitors is shown in **Appendix 3**.

Table 31 compares the average results from the blast monitoring sites during this reporting period, historical monitoring results, and predictions made in the 2010 Environmental Assessment (EA) (for 2016 and earlier) and the 2016 Statement of Environmental Effects (SEE) (for 2017 and later). When the SEE was prepared the predicted results were recalculated. The results this reporting period are generally consistent with historical monitoring results and below the predicted results in the EA and SEE.

Table 31: Comparison of Blasting Results

Year	Vibration (mm/s)		Overpressure (dBL)	
	Average Monitoring Results	EA Predicted Results	Average Monitoring Results	EA Predicted Results
2020	0.20	0.7	98.0	111.0
2019	0.19	0.7	100.1	111.0
2018	0.20	0.7	101.3	111.0
2017	0.25	0.7	101.8	111.0
2016	0.22	2.2	101.0	114.0
2015	0.52	2.2	97.8	114.0
2014	0.11	2.2	98.0	114.0
2013-2014	0.15	2.2	99.1	114.0

3.11.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage and monitor blasting impacts in accordance with the BMP.

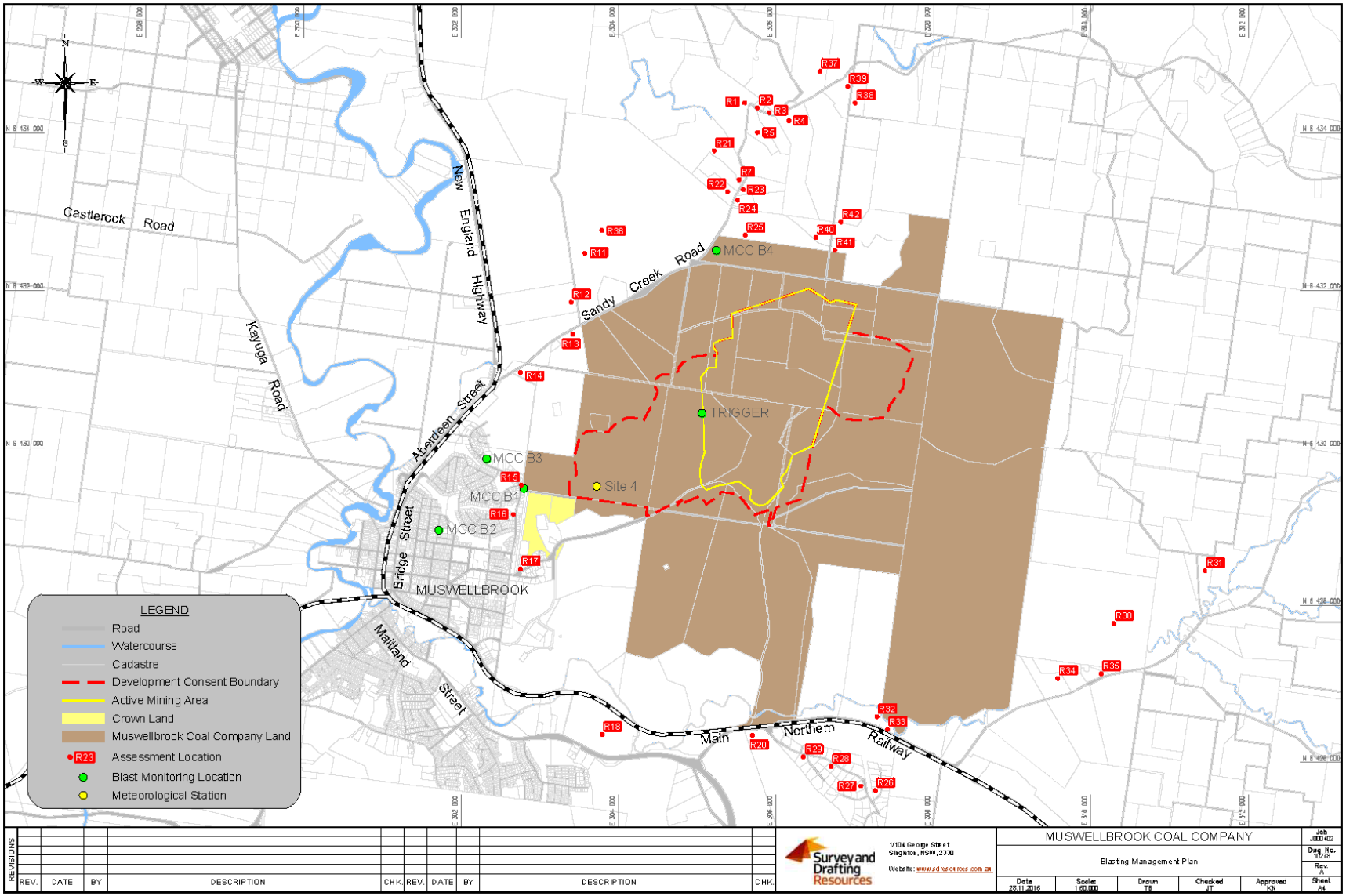


Figure 23: Blast Monitoring Locations

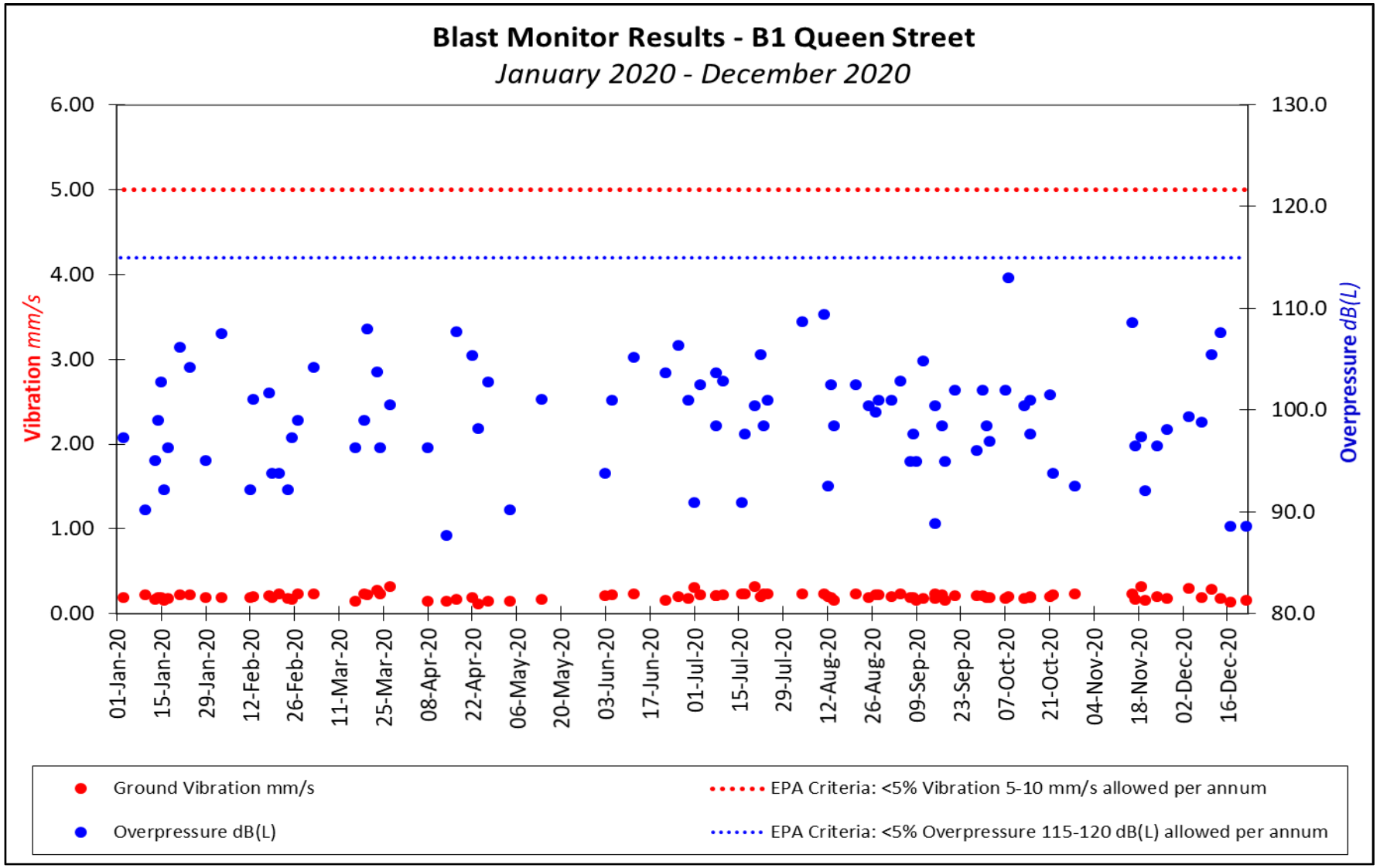


Figure 24: Queen Street Blast Monitoring Results

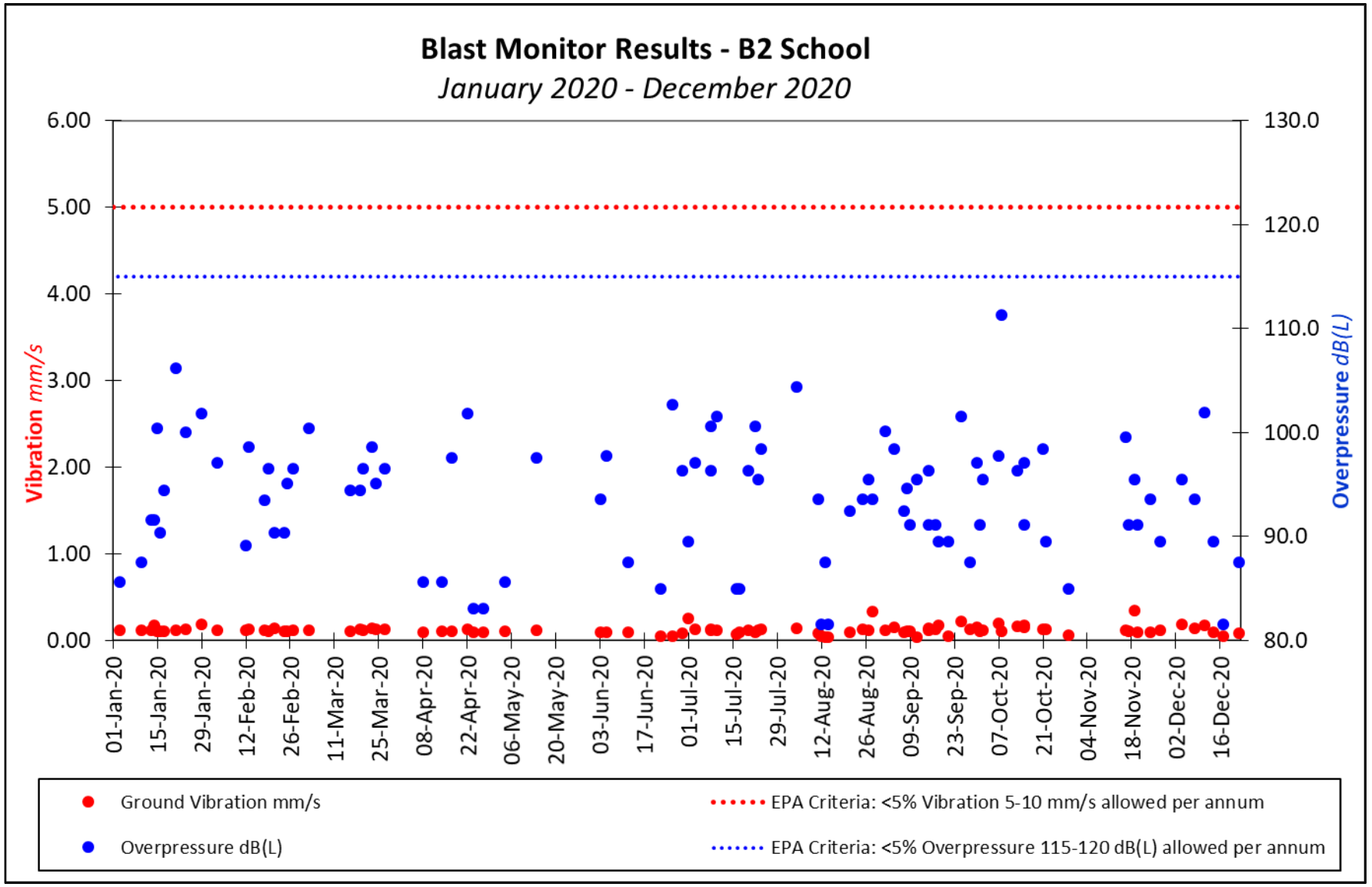


Figure 25: School Blast Monitoring Results

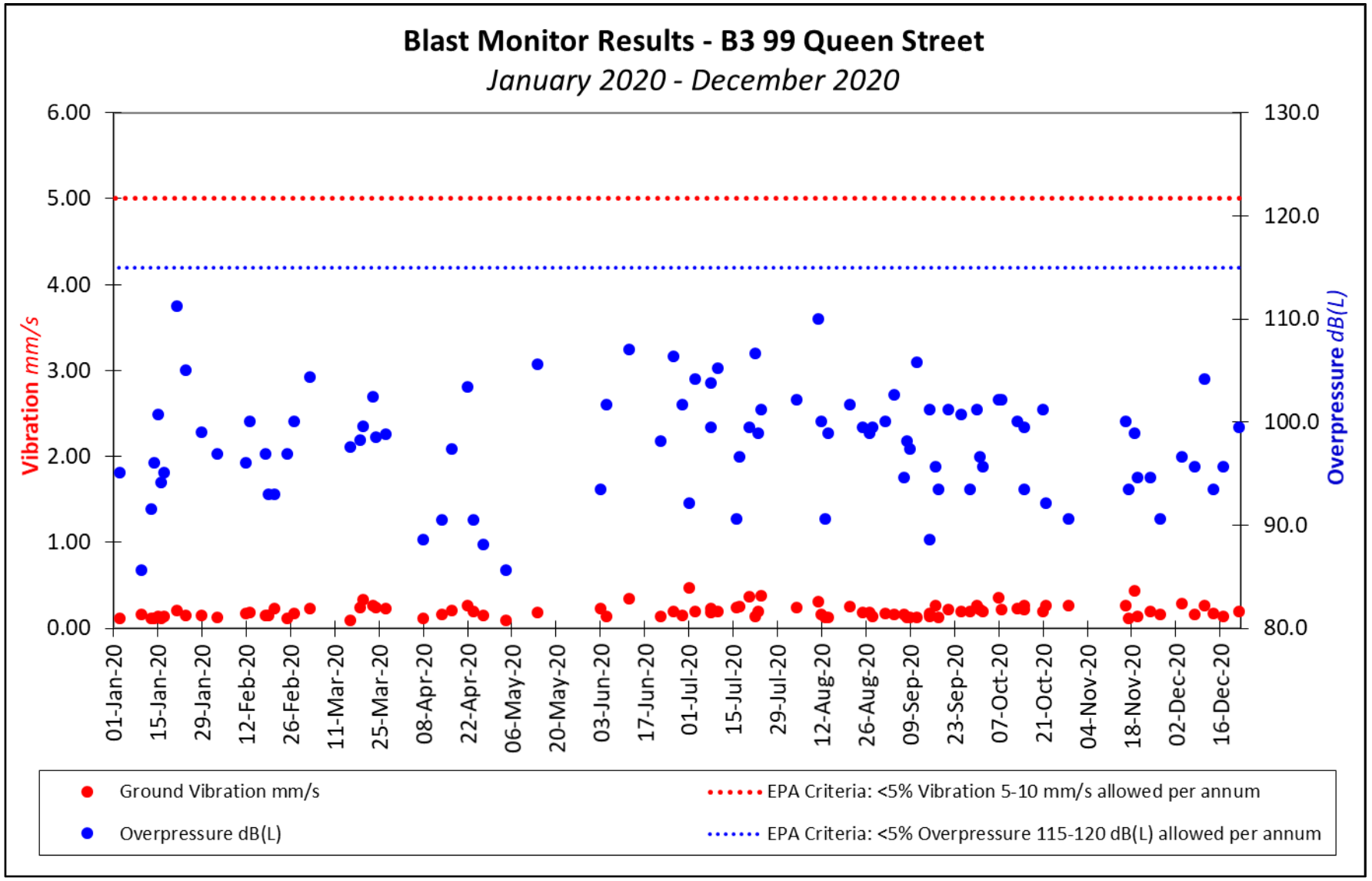


Figure 26: 99 Queen Street Blast Monitoring Results

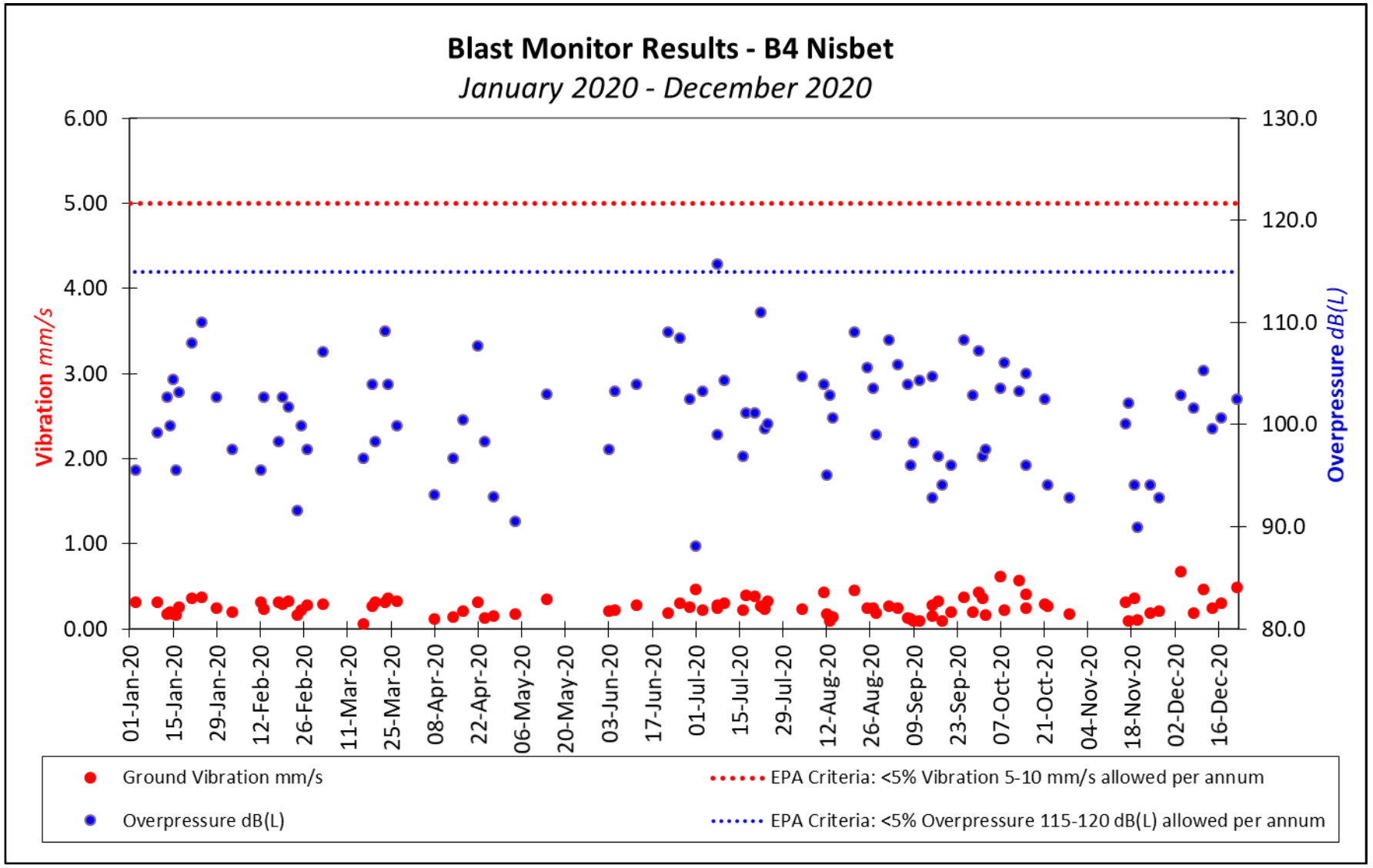


Figure 27: Nisbet Blast Monitoring Results

3.12 NOISE MANAGEMENT

3.12.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to operate in accordance with the Noise Management Plan (NMP). During the reporting period the NMP was reviewed and updated in consultation with MSC. The updated NMP was approved by MSC on 30 November 2020 and is available on the MCC website.

The main objective of the NMP is to manage and minimise the impact of noise from mining operations on the environment and nearby residences. The following actions will be undertaken to achieve this objective:

- Outline the measures to be undertaken on site to mitigate noise emissions;
- Maintain a noise monitoring program;
- Identify the risk levels at which mine operations may need to be modified to manage compliance;
- Define the mechanisms for community consultation;
- Detail the management measures to be undertaken where the noise levels are demonstrated to exceed the criterion;
- Detail the specifications and procedures to be used for the purpose of Independent Noise Investigations; and
- Specify the regulatory reporting requirements.

3.12.2 NOISE MONITORING

The noise monitoring network is provided in **Table 32** and locations are displayed in **Figure 28**.

Table 32: Noise Monitoring Network

Location	Description
R13	Sandy Creek Road
R15	Queen St
R17	Queen St
R25	Sandy Creek Road
R32	Muscle Creek Road

MCC has a network of five attended noise survey locations. Monitoring is conducted at these sites monthly. Monthly attended monitoring allows for a variety of operating configurations, weather conditions and seasonal variations to be measured. The noise consultant schedules the monitoring to occur at times unknown to MCC and they determine the intervals between surveys and the time of measurement. Each attended noise survey is conducted during night periods only.

All noise surveys are performed in accordance with the EPA "NSW Noise Policy for Industry", the Periodic Noise Monitoring programme and Australian Standard 1055 "Acoustics, Description and Measurement of Environmental Noise" as specified in the NMP. Twelve attended noise surveys were undertaken during the reporting period.

Measurements were taken in third-octave bands with an instrument that has Type 1 characteristics as defined in AS1259-1990 "Acoustics – Sound Level Meters". The instrument has a current calibration as per manufacturer's instructions and calibration was also confirmed prior to and at the completion of measurements with a Sound Level Calibrator. The LA_{eq} (15-minute) noise emission levels, at each monitoring site, were determined.

The actual noise level received at individual residences may vary because of:

- The location of mining equipment;
- The elevation of mining equipment;
- Impacts from other noise sources; and
- Prevailing meteorological conditions.

A summary of the results are shown in **Table 35** and **Table 36**.

The mining related noise sources were from engine noise, horns, dozer tracks and CHPP operations.

Table 33 and **Table 34** compare the average noise monitoring results for this reporting period, historical monitoring results, and predictions made in the 2010 Environmental Assessment (EA) (for 2016 and earlier) and the 2016 Statement of Environmental Effects (SEE) (from 2017). When the SEE was prepared the predicted results were recalculated due to the changes in mine plan. The results in 2017 are generally consistent with historical monitoring results and below the predicted results in the EA and SEE. Overall, there has been an increase in noise levels during this reporting period compared to the last reporting period.

Table 33: Comparison of Average LA_{eq} Noise Results

Year	R13 Sandy Creek Road		R15 Queen Street		R17 Queen Street		R25 Sandy Creek Road		R32 Muscle Creek Road	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
2020	27	40	24	37	22	34	25	41	26	32
2019	29	40	25	37	24	34	29	41	20	32
2018	29	40	29	37	31	34	30	41	24	32
2017	28	40	27	37	24	34	27	41	25	32
2016	28	38	20	35	23	33	no data		no data	
2015	29	38	28	35	31	33	no data		no data	
2014	35	38	25	35	23	33	no data		no data	
2013-2014	33	38	29	35	27	33	no data		no data	

Table 34: Comparison of Average $LA1_{1min}$ Noise Results

Year	R13 Sandy Creek Road		R15 Queen Street		R17 Queen Street		R25 Sandy Creek Road		R32 Muscle Creek Road	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
2020	31	37	28	33	26	31	28	40	29	32
2019	33	37	29	33	28	31	33	40	23	32
2018	34	37	34	33	37	31	35	40	26	32
2017	33	37	32	33	28	31	32	40	29	32
2016	28	no data	24	no data	23	no data	no data		no data	
2015	32	no data	30	no data	37	no data	no data		no data	
2014	40	no data	29	no data	25	no data	no data		no data	
2013-2014	34	no data	32	no data	25	no data	no data		no data	

3.12.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage and monitor noise related impacts in accordance with the NMP.

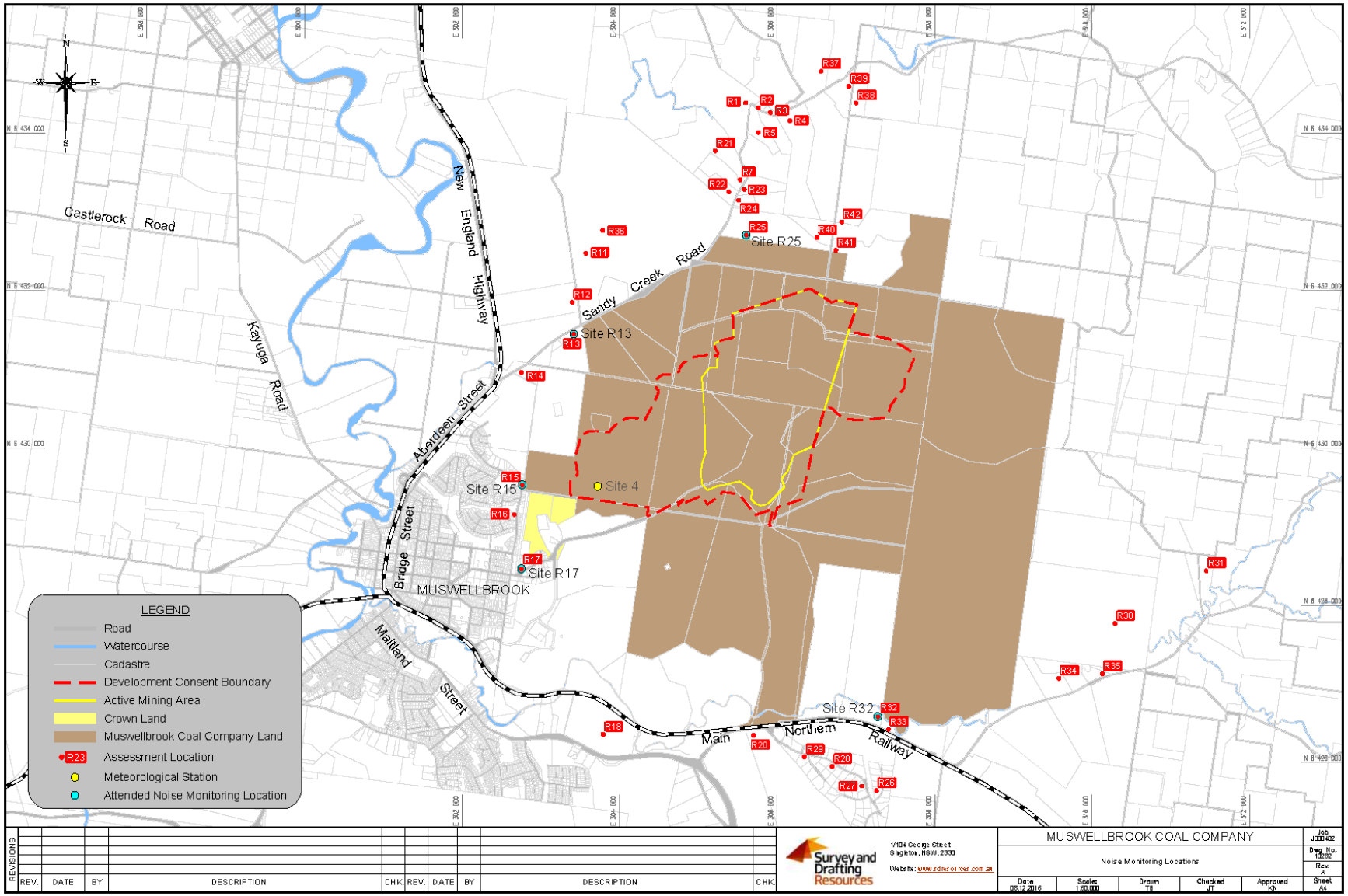


Figure 28: Noise Monitoring Locations

Table 35: Noise Monitoring Results – MCC Contribution LA_{eq}

Month	R13 Sandy Creek Rd	Criteria	R15 Queen St	Criteria	R17 Queen St	Criteria	R25 Sandy Creek Rd	Criteria	R32 Muscle Creek Rd	Criteria
Jan 20	Not audible	41	Not audible	37	Not audible	35	Not audible	42	18	35
Feb 20	30	41	30	37	Not audible	35	32	42	Not audible	35
Mar 20	28	41	27	37	25	35	29	42	28	35
Apr 20	31	41	31	37	29	35	31	42	33	35
May 20	37	41	36	37	30	35	32	42	30	35
Jun 20	32	41	33	37	28	35	31	42	Not audible	35
Jul 20	36	41	25	37	35	35	35	42	35	35
Aug 20	Not audible	41	<20	37	Not audible	35	Not audible	42	31	35
Sep 20	37	41	<20	37	Not audible	35	Not audible	42	34	35
Oct 20	Not audible	41	Not audible	37	Not audible	35	Not audible	42	28	35
Nov 20	34	41	Not audible	37	32	35	34	42	Not audible	35
Dec 20	Not audible	41	Not audible	37	Not audible	35	Not audible	42	25	35

Table 36: Noise Monitoring Results – MCC Contribution $LA1_{1min}$

Month	R13 Sandy Creek Rd	R15 Queen St	R17 Queen St	R25 Sandy Creek Rd	R32 Muscle Creek Rd	Criteria
Jan 20	Not audible	Not audible	Not audible	Not audible	18	45
Feb 20	37	37	Not audible	39	Not audible	45
Mar 20	36	32	31	35	37	45
Apr 20	39	40	37	37	39	45
May 20	42	42	37	37	34	45
Jun 20	38	36	32	34	Not audible	45
Jul 20	40	28	40	39	42	45
Aug 20	Not audible	<25	Not audible	Not audible	34	45
Sep 20	42	30	Not audible	Not audible	42	45
Oct 20	Not audible	Not audible	Not audible	Not audible	32	45
Nov 20	42	<25	39	40	Not audible	45
Dec 20	Not audible	Not audible	Not audible	Not audible	29	45

3.13 VISUAL AMENITY, LIGHTING AND LANDSCAPING

During the reporting period MCC continued to operate in accordance with the Visual Amenity, Lighting and Landscaping Management Plan (VALLMP). During the reporting period the VALLMP was reviewed and updated in consultation with MSC. The updated VALLMP was approved by MSC on 2 October 2020 and is available on the MCC website.

The primary objectives of the VALLMP are to implement visual reduction strategies to minimise the visual amenity, lighting and landscape impact on the community and meet the development consent requirements. MCC will continue to employ measures to minimise the potential for visual impacts on the nearest receptors by:

- Undertaking rehabilitation progressively where possible; and
- Orientating lights away from sensitive receptors where practical.

During the next reporting period MCC will continue to manage visual amenity, lighting and landscaping in accordance with the VALLMP.

3.14 ABORIGINAL HERITAGE

MCC has successfully completed salvage operations and continues to maintain and protect one Aboriginal cultural site located within the mine lease boundary.

During the reporting period, no ground disturbance operations required consultation with Aboriginal groups. A member of the Wanaruah Local Aboriginal Lands Council presently sits on the MCC Community Consultative Committee (CCC).

3.15 EUROPEAN HERITAGE

There are no European Heritage sites located at MCC that require ongoing management.

3.16 SPONTANEOUS COMBUSTION

3.16.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to operate in accordance with the Spontaneous Combustion Management Plan (SCMP). During the reporting period the SCMP was reviewed and updated in consultation with MSC. The updated SCMP was approved by MSC on 30 November 2020 and is available on the MCC website.

The main objective of the SCMP is to minimise the occurrence and manage the effect from spontaneous combustion in:

- The highwall and existing U/G mine workings in Open Cut 1;
- The overburden/interburden removal and coal removal in Open Cut 1;
- Active and recent emplacement areas within Open Cut 1;
- Open Cut 2;
- Coal emplacement and storage areas; and
- Elsewhere with the disturbance area.

The SCMP lists the preventative measures, control measures and trigger action response plans (TARP's) for each of these areas.

Regular spontaneous combustion reports are provided to both RR and EPA. These reports identify existing and new incidents of spontaneous combustion, mitigation procedures and improvements to these procedures, effectiveness of actions, areas capped, areas mined, areas under water infusion and complaints received. The report also includes a plan showing the extent and location of problem areas.

Twelve spontaneous combustion reports were submitted to RR and EPA during the reporting period. All affected areas were within the open cut and overburden emplacement areas. The areas that were treated each month are shown in **Table 37.** A historical comparison of affected areas without active control measures is provided in **Table 38**.

Table 37: Spontaneous Combustion Report Summary

Reporting Month	Spontaneous Combustion Areas Capped (m^2)	Spontaneous Combustion Areas Mined (m^2)	Area Under Water Infusion (m^2)
Jan-20	35	12	5,100
Feb-20	30	30	5,200
Mar-20	14	94	2,800
Apr-20	24	1,730	0
May-20	24	2,904	0
Jun-20	34	3,060	0
Jul-20	34	4,004	0
Aug-20	2,724	1,000	0
Sep-20	20	3,700	6,900
Oct-20	930	4,100	4,000
Nov-20	35,200	2,700	4,260
Dec-20	10,965	2,810	3,280

Note: Areas capped and areas mined are the total of the areas treated during that month. Area under water infusion is the area at the end of the month. This area may change during the month.

Table 38: Summary of Spontaneous Combustion Affected Areas Without Active Control

Total Area Affected by Spontaneous Combustion (m^2)										
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Jan-Mar	215	71	65	156	145	248	24	96	52	114
Apr-Jun	95	53	57	-	232	182	48	60	44	166
Jul-Sep	85	45	149	177	190	48	52	36	64	258
Oct-Dec	64	57	45	119	242	56	52	56	87	286
Yearly Average	**115**	**57**	**79**	**151**	**203**	**133**	**44**	**62**	**62**	**824**

Note: These values are the values at the end of the respective reporting period. These areas may change during the reporting period.

Planned Versus Actual Activities

One of the requirements of the SCMP is to prepare an annual plan in relation to spontaneous combustion management activities and then at the end of the reporting period to review the actual activities against the planned activities and identify any opportunities for improvement in relation to spontaneous combustion management. Below is a summary of the review of the action plan from this reporting period.

The planned fly ash and clay sealing activities for this reporting period are shown in **Figure 29** to **Figure 30**.

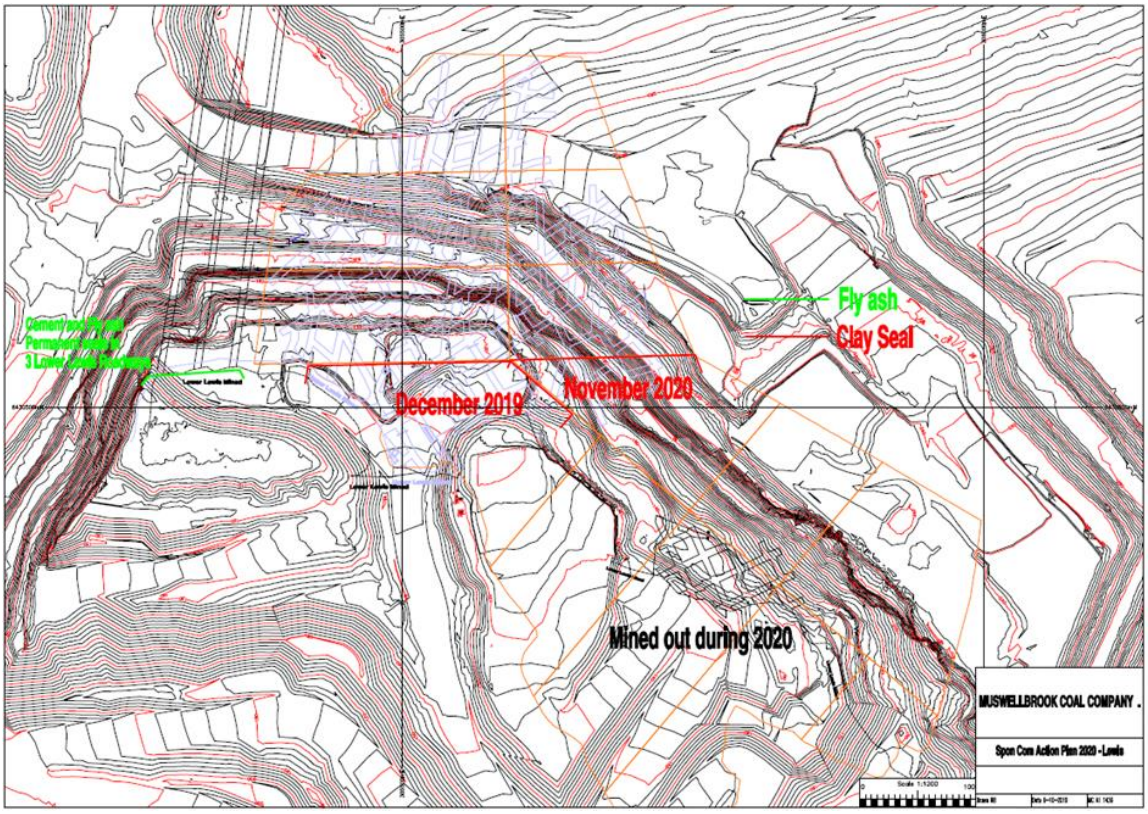


Figure 29: Proposed sealing in Lower Lewis Workings

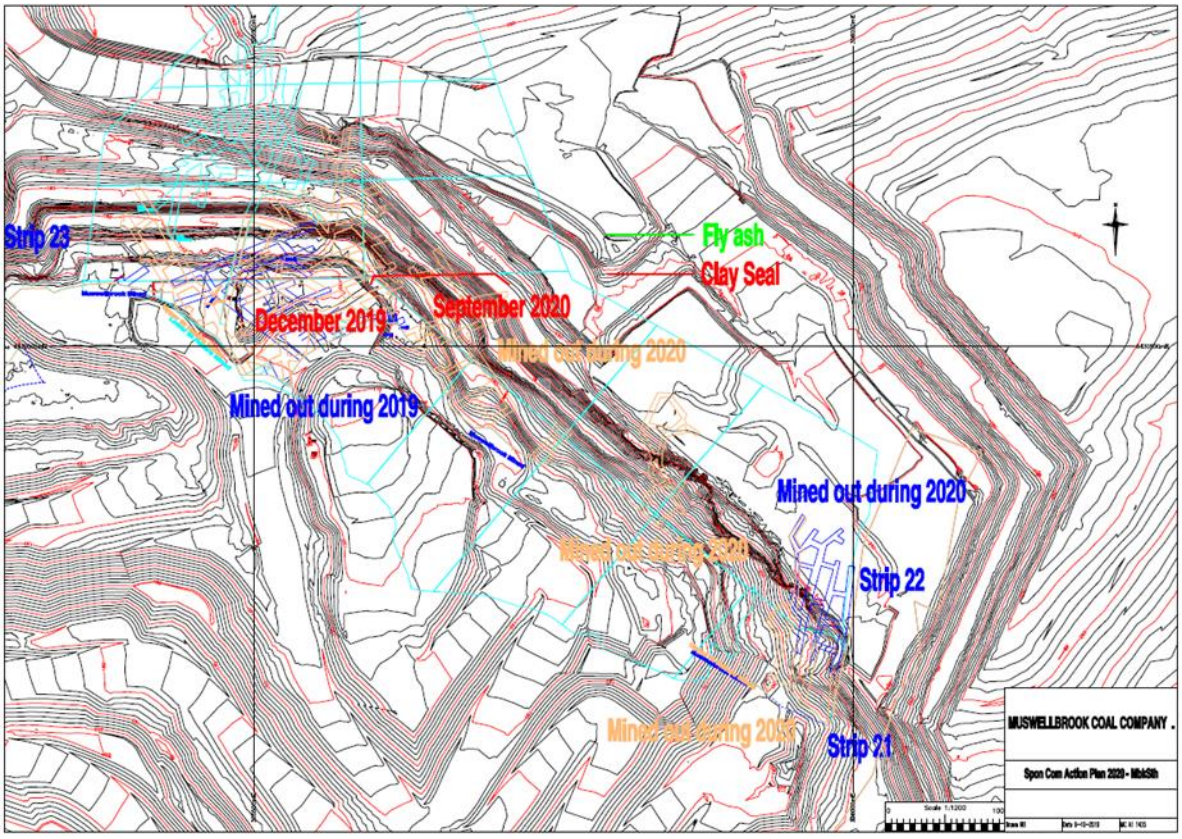


Figure 30: Proposed sealing in Muswellbrook and St Heliers Workings

The actual fly ash and clay sealing activities for this reporting period are shown in **Figure 31** to **Figure 32**.

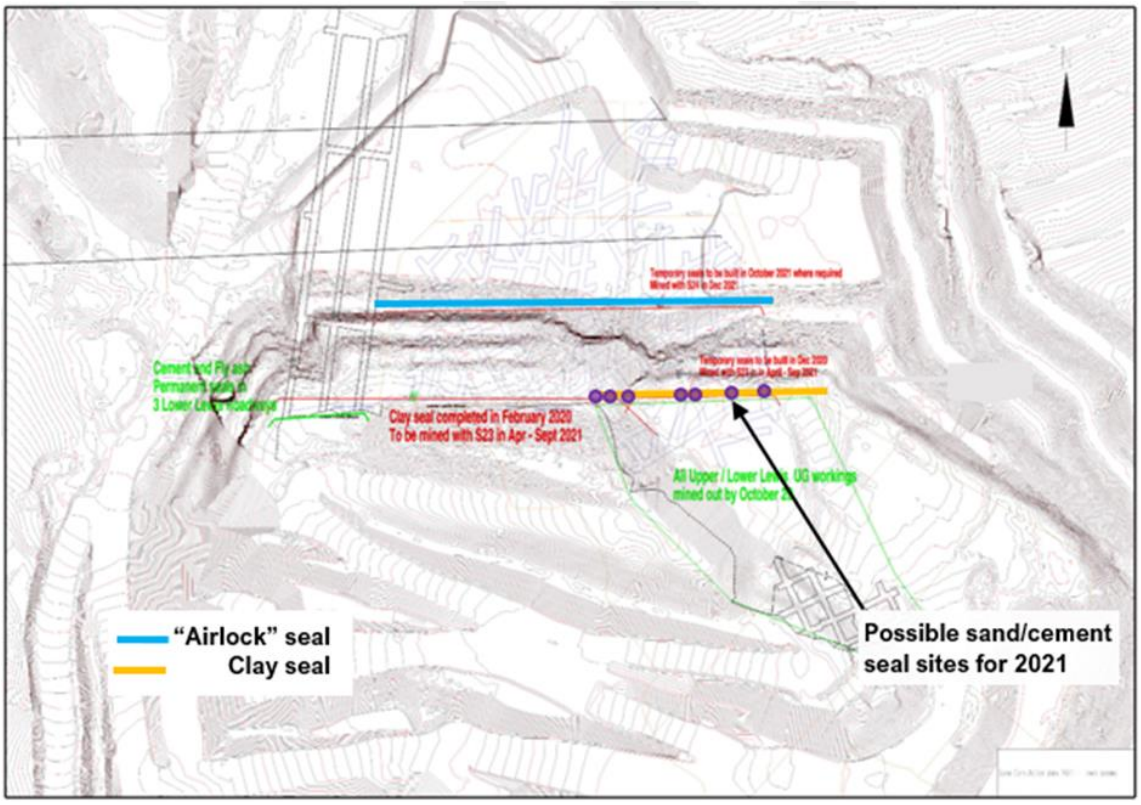


Figure 31: Actual sealing in Lower Lewis workings

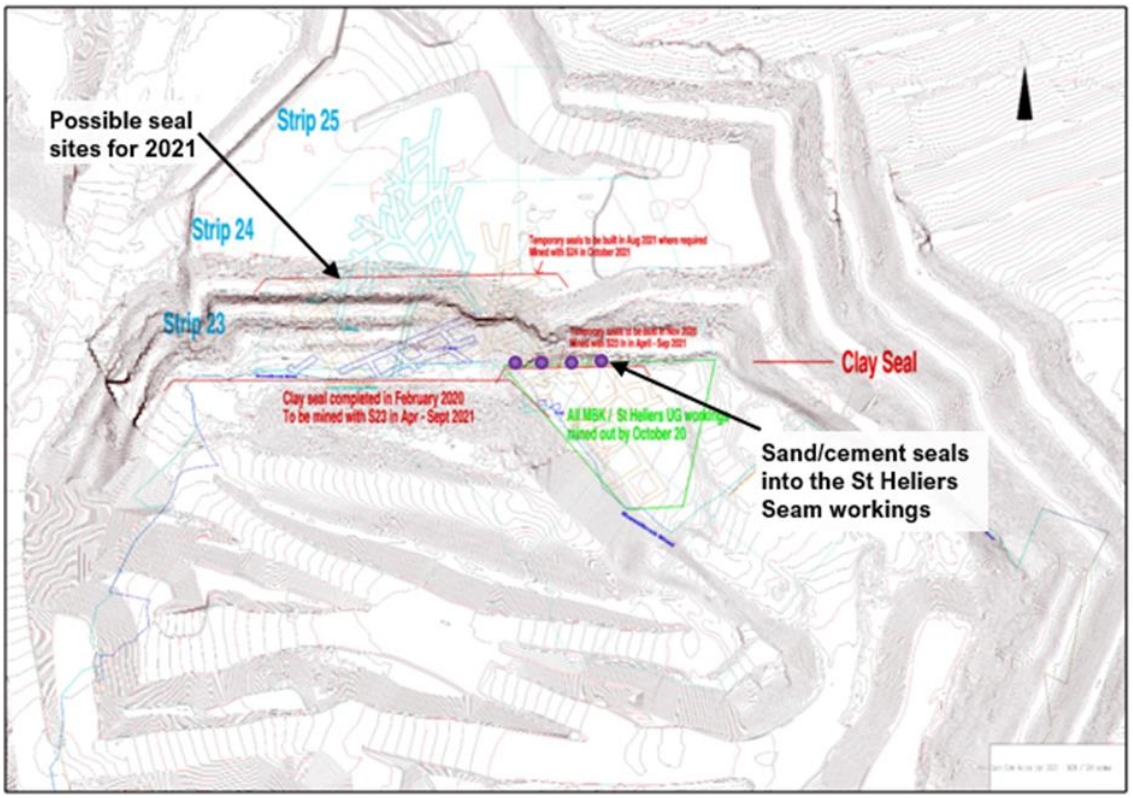


Figure 32: Actual sealing in Muswellbrook and St Heliers workings

All proposed sealing works in the St Heliers seam was completed as planned and all UG workings in Strip 23 was mined out. A total of 642.5 tonnes of sand and 42 tonnes of cement were used. Previous experience, sampling and testing showed that approximately 10% by weight of cement resulted in a low strength cement of 3 – 4 Mpa.

The reason why not all of the proposed activities were undertaken in the Upper Lewis seam workings was because of changes in the production schedule that delayed the mining of the Lewis seam coal in the northern section of Strip 23. This coal is scheduled to be mined in January 2021 after which the proposed sealing in Figure 29 will be attempted.

What Worked Well

Despite a number of impediments to best practice control, the following activity areas were managed well during the reporting period:

- very good control of spontaneous combustion in overburden dumps and excellent control of spontaneous combustion in higher risk carbonaceous material was achieved. This included the dumping of hot overburden material;
- a number of areas had higher temperature coal during mining but the mining, stockpiling, washing and stockpile residence time was well managed with minimal spontaneous combustion;
- very effective use was made by mine personnel of the very limited water supply available for spontaneous combustion control;
- the rescheduling of mining areas to ensure that the Eastern End Wall was mined safely and all underground workings, particularly those in the Lower Lewis could be mined was undertaken to an excellent standard by all concerned; and
- isolated “pockets” of spontaneous combustion in previously dumped overburden adjacent to the No.2 Open Cut area have been quickly identified, mined out and dumped in the required dump area (Figure 33).

Figure 33: Photo of Spontaneous Combustion in previously dumped overburden

Lessons Learnt

The following lessons regarding spontaneous combustion management were learnt during this reporting period:

- Maintaining an adequate reserve of water and the means of extracting this water at daily volumes that are sufficient for operational and spontaneous combustion control is crucial for 2021. This system is still being put in place.
- Availability of monitoring holes. A new drilling contractor has been brought onto site as the previous drilling contractor appeared unable to achieve monitoring hole drilling requirements consistently.
- Use of fly ash for sealing underground workings was revised during the reporting period to sand and cement seals providing improved sealing capacity.

3.16.2 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage spontaneous combustion in accordance with the SCMP. This will include:

- The priority of timely delivery for adequate "on bench" water volumes. This includes providing sufficient "lead time" for actioning of contingency water supply plans as water will be critical for optimum spontaneous combustion control.
- Maintaining and updating action plans. These have proved invaluable provided this is done.
- Having alternative plans for interim seals. This includes:
    - modifying mining sequences to minimize the time high spontaneous combustion risk areas are left unmined; and
    - options for establishing modified "airlock" seals. This has been included in the *Spontaneous Combustion Management Plan for 2020 – 2021 Briefing Note*.
- Reviewing and maintaining standards for long term elimination/control of spontaneous combustion post mine closure to help ensure post mining landforms are spontaneous combustion free.
- The current action requires a more proactive establishment of monitoring holes for accurate assessment of:
    - temperature;
    - gas;
    - strata collapse;
    - remaining strata integrity;
    - confirming model accuracy; and
    - accuracy of underground plans.

  which is crucial to maintaining optimum spontaneous combustion control.

3.17 BUSHFIRE

Management of bushfire risks are undertaken in accordance with the Bushfire Management Plan (BFMP). During the reporting period the BFMP was reviewed and updated in consultation with MSC. The updated BFMP was approved by MSC on 30 November 2020 and is available on the MCC website.

The objectives of the Bushfire Management Plan are:

- To manage activities on site are to minimise the risk of outbreak of fire;
- Contain fuel loads to acceptable levels to moderate fire intensity;
- To put in place hazard mitigation measures to contain an outbreak of fire should one occur; and
- To put in place arrangements to liaise with and support the Rural Fire Service (RFS) should an outbreak of fire occur at MCC or threaten MCC's operations.

There were no bushfire outbreaks within the development consent area during the reporting period.

The Emergency Response Team undertake firefighting training on a regular basis.

3.18 HYDROCARBON CONTAMINATION

Hydrocarbon storage facilities were constructed as part of the workshop, stores and blasting facilities. These storage facilities comply with the requirements of *AS1940 – The storage and handling of flammable and combustible liquids*. Activities undertaken on site to reduce the risk of hydrocarbon contamination include:

- Above ground fuel storage tanks are self-bunded to contain any spillage which may occur;
- Waste oil from the workshop is stored in a bunded waste oil tank and is removed as required;
- Oily water runoff from the re-fuelling bay drains into an above ground sump which is fully bunded; and
- Runoff from the hardstand wash-down bay passes through a three-staged silt trap and an oil/water separator. The collected silt is routinely cleaned out.

A Bioremediation Management Plan has been developed by MCC to provide guidance on how to manage material that is potentially contaminated with hydrocarbons. This Bioremediation Management Plan was developed at the request of RR and has been provided to them following this request. RR has not provided any comment on the Bioremediation Management Plan and the plan has been implemented by MCC.

Any material that is potentially contaminated is tested with the results being compared to the limits in the *NSW EPA Waste Classification Guidelines Part 1: Classifying Waste (2014)*. If the material is classified as solid waste it is disposed on site. If the material is classified as contaminated it is either treated on site prior to disposal or it is taken off site for disposal.

3.19 METHANE DRAINAGE/VENTILATION

As no underground mining occurred at MCC during the reporting period, no methane drainage or ventilation was required.

3.20 PUBLIC SAFETY

During the reporting period, public safety was managed in accordance with current MCC procedures. Fences surrounding the operational areas and along property boundaries were inspected and maintained.

A security patrol is conducted by a local security firm over weekends and other nominated periods (Christmas, shutdowns, etc.) when the site is not manned.

3.21 OTHER ISSUES AND RISKS

No incidents of damage to surface infrastructure were recorded during this reporting period.

4.0 COMMUNITY RELATIONS

MCC undertakes community consultation through the Community Consultative Committee, discussions with community members and operating a toll free 24-hour Environmental Contact Line (1800 600 205). MCC are an active member of the Upper Hunter Mining Dialogue – a forum for the mining industry and the community to discuss concerns relating to mining impacts. Since September 2020, MCC has been involved in the Industrial Closure Workgroup which was established by MSC.

4.1 ENVIRONMENTAL COMPLAINTS

MCC operates a toll free 24-hour Environmental Contact Line where community members can communicate their concerns to site personnel. On receiving a complaint, MCC staff investigate the complaint, take action to reduce impact as required and report back to the complainant with the findings. The recording of environmental complaints and the operation of the Environmental Contact Line is conducted in accordance with the MCC Development Consent and Environmental Protection Licence conditions.

19 complaints were received during the reporting period. More details on the complaints are provided in **Appendix 4**. **Table 39** and **Figure 34** provide a summary of the complaints received during the reporting period.

Table 39: Summary of Complaints

Type of Complaint	Number	Percentage
Odour	13	68.4%
Dust	3	15.8%
Noise	3	15.8%
Total	**19**	**100%**

In comparison to 2019, there has been a significant decrease in the number of complaints received during this reporting period. The complaint history chart is shown in **Figure 35**. In comparison to the last reporting period, there has been a significant decrease in the number of odour related complaints (13 for this reporting period compared to 18 for the previous reporting period).

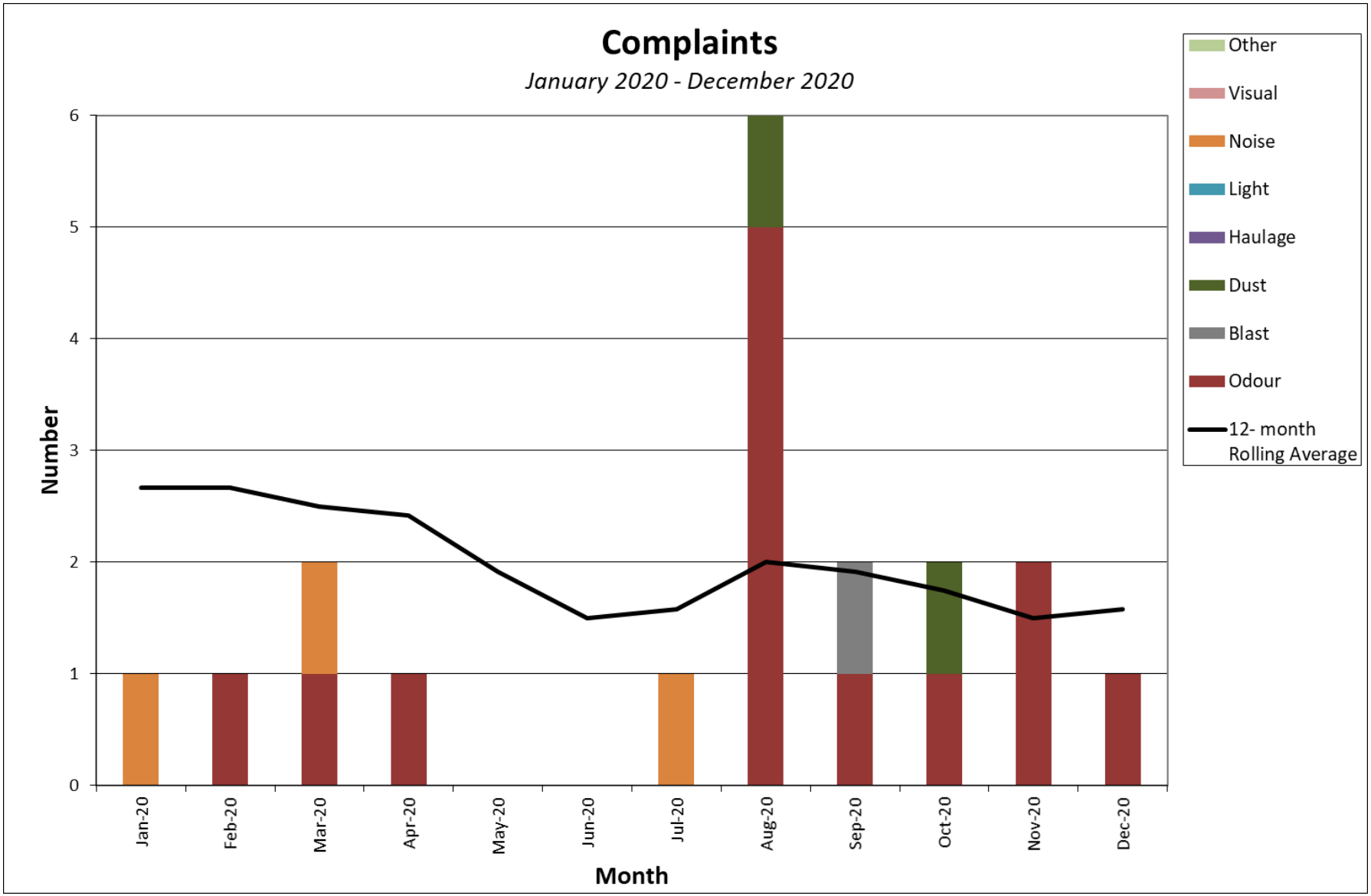


Figure 34: Complaint Summary

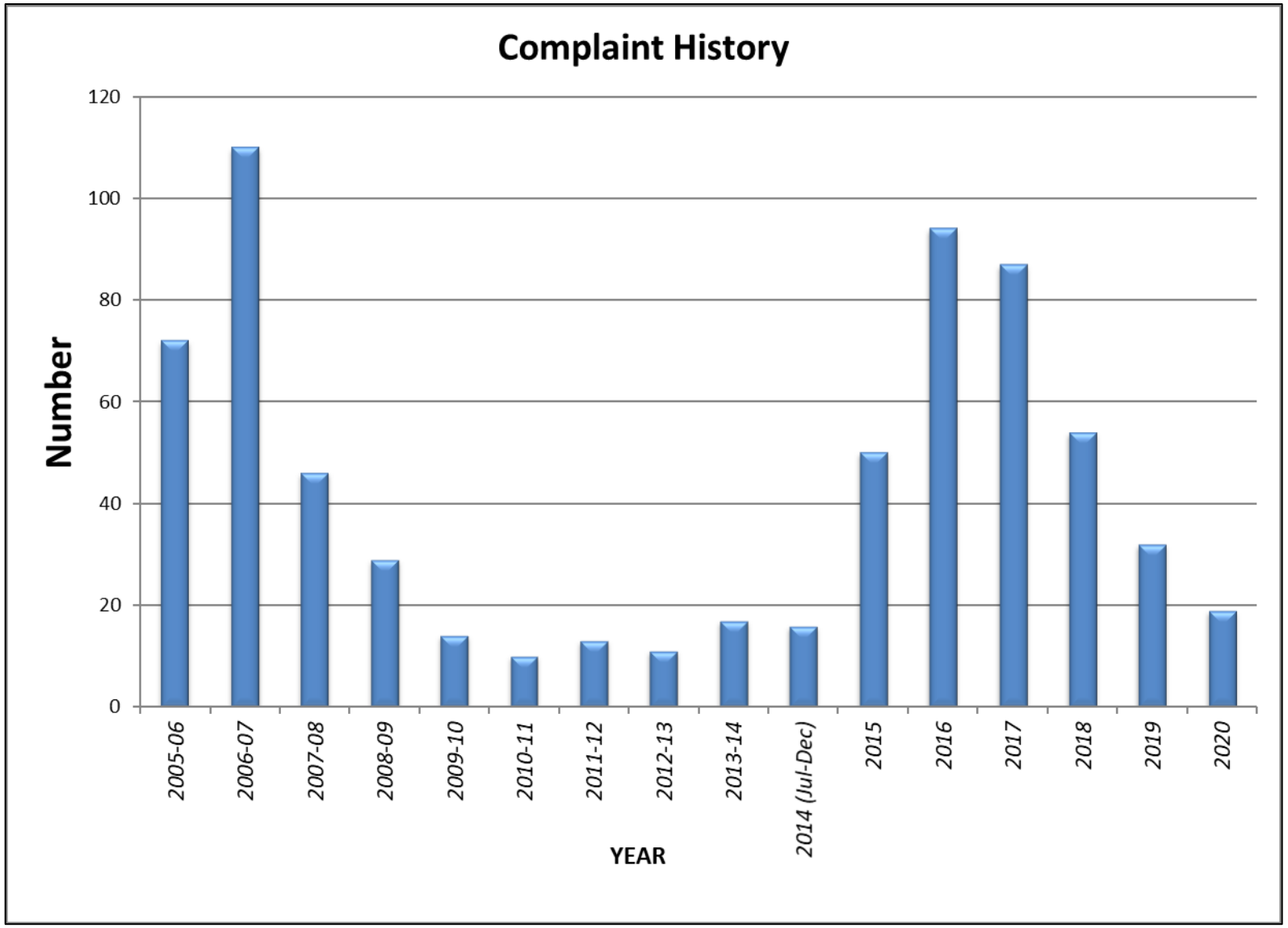


Figure 35: Complaint History

4.2 COMMUNITY LIAISON, SPONSORSHIPS AND DONATIONS

MCC personnel maintain contact with nearby residents and are committed to continually fostering and developing strong links with the community.

Community support throughout the reporting period included donations to the following organisations:

- Wybong Wild Dog Association – assistance with regional dog baiting program
- Special Children's Christmas Party – supporting local children
- Muscle Creek Fire Brigade – supporting local Rural Fire Service
- Muswellbrook Race Club – annual sponsorship
- Muswellbrook Girls Academy – support for academy

4.3 COMMUNITY CONSULTATIVE COMMITTEE

MCC's Community Consultative Committee (CCC) provides information regarding mine operations to the local community. The aim of the committee is to provide an effective communication mechanism so that members of the local community have adequate information on mining and environmental matters. CCC meetings are held twice per year at the MCC office and committee members are actively involved in the review of environmental monitoring data and are kept up to date on mining operations through presentations and site visits.

The CCC is comprised of one Councillor, one council staff representative, five community representatives (including one from the Wanaruah Local Aboriginal Lands Council) and two MCC representatives.

During the reporting period meetings were held on 9 June 2020 via Zoom meeting due to Covid 19 protocols and 2 December 2020 in the MCC board room. Minutes of the meetings can be found on MCC's website.

5.0 REHABILITATION

During the reporting period MCC continued to operate in accordance with the Mining Operations Plan/Rehabilitation Plan (MOP). This MOP was approved in March 2017 and covers mining and rehabilitation activities until 2023.

5.1 BUILDINGS

No buildings were demolished or rehabilitated during the reporting period.

5.2 REHABILITATION OF DISTURBED LANDS

5.2.1 REHABILITATION PROCESS

The rehabilitation process at MCC includes:

- Shaping conducted in accordance with the design requirements outlined in the MOP.
- Rock raking to remove large rocks from the surface.
- Contour banks are constructed.
- Growth medium is spread at the recommended application rate (this differs depending on what growth medium is being used).
- Other ameliorants as required are spread (the type of ameliorant and application rate is dependent on soil results).
- Prior to seeding, growth medium and/or other ameliorants are incorporated into the underlying soil.
- Seeding of the area with native vegetation or pasture seed mix (as required).

MCC's rehabilitation program aims to link existing remnant vegetation in Bells Mountain and Skelletar Ridge areas north and south of the lease area by establishing habitat corridors across the lease area creating a viable wildlife corridor. Rehabilitation planning for MCC includes the incorporation of native vegetation areas to continue the corridor. There has been no change to the agricultural land suitability of the site during the reporting period.

5.2.2 REHABILITATION ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC completed approximately 10Ha of new rehabilitation. The areas were approximately 7.5Ha in OC1 and 2.5Ha in OC2. The following activities were undertaken on these new rehabilitation areas:

- The areas were bulk shaped to design.
- Contour banks were constructed to design.
- Soil sampling was conducted to identify if any ameliorants were required.
- Rock raking was undertaken to remove rocks from the surface.
- Contour drains were constructed where required.
- A compost product consisting of biosolids and paper mulch was spread over the areas.
- The compost was incorporated into the surface prior to the spreading of seed.
- Pasture seed and DAP fertiliser were sown on the 7.5Ha rehabilitation area in OC1.
- Native seed was sown on the 2.5Ha rehabilitation area in OC2.

The pasture seed mix used in the rehabilitation this reporting period is shown in **Table 40**.

Table 40: Pasture Seed Mix Used in Rehabilitation

Seed Type or Fertiliser	Rate (kg/ha)
Oats – cover crop	20
Panic	1
Setaria	1
Couch	2
Kikuyu	1
Lucerne	5
White Clover	3
Medic	4
Sub-clover	3
Fescue	4
Phalaris	3
Cocksfoot	4
Vetch	5
DAP Fertiliser	100

The native seed mix used in the rehabilitation this reporting period is shown in **Table 41.**

Table 41: Native Seed Mix Used in Rehabilitation

Type	Species	Rate (kg/ha)
Trees - dominant	*Corymbia maculata*	0.1
	Eucalyptus blakelyi	0.2
	Eucalyptus crebra	0.3
	Eucalyptus moluccana	0.2
	Eucalyptus punctata	0.1
Trees – sub-dominant	*Allocasuarina luehmannii*	0.2
	Brachychiton populneus	0.3
	Notelaea microcarpa	0.2
Small trees – nitrogen fixing	*Acacia deanei*	0.2
	Acacia decora	0.3
	Acacia falcata	0.3
	Acacia implexa	0.3
	Acacia paradoxa	0.2
Shrubs	*Bursaria spinosa*	0.1
	Dodonaea viscosa	0.2
	Hardenbergia violacea	0.2
	Indigofera australis	0.2
	Myoporum montanum	0.2
Forbs and Subshrubs	*Calotis lappulacea*	0.2
	Einadia spp.	0.2
	Enchyleana tomentosa	0.2
	Solanum cinereum	0.2
Grasses	*Austrodanthonia spp.*	0.7
	Austrostipa verticillate	0.4
	Bothriochloa macra	0.5
	Chloris truncata	0.4
	Cymbopogon refractus	0.5
	Dicanthium sericeum	0.4
	Microleana stipoides	0.4
	Themeda triandra	0.7

Native seed is mixed with a bulking agent and spread by hand or using a tractor and spreader.

The native seed mix was expanded considerably during the reporting period, in consultation with a new seed supplier. The purpose of this expansion is to increase diversity on the rehabilitation areas by seeding a broader range of species. Representatives of groundcover, mid-storey and canopy species were chosen based on presence in the area (based on monitoring records including Biodiversity Offset monitoring), subjective success on rehabilitation and availability of seed. Key species from Central Hunter Grey Box Ironbark Woodland and Central Hunter Ironbark Spotted Gum Grey Box Woodland were selected for the broadest mix of representative species consistent with MOP objectives. The species mix may be further refined, based on successful species establishment on MCC rehabilitation areas over the next 3-5 years. This process is intended to increase germination and establishment of native species on rehabilitation areas by selecting endemic species that are suited to conditions onsite.

In addition to the establishment of new rehabilitation areas, MCC maintained a focus on rehabilitation maintenance activities and mine closure activities during this reporting period. These activities included:

- Weed and feral animal control (discussed further in **Section 3.10**).
- Maintenance of existing drainage structures (contour banks).
- Physical removal and control of Acacia saligna in high priority areas.
- Addition of organic matter, ripping and re-seeding on 16Ha of rehabilitation identified from aerial photography as being largely bare of vegetation.

Previous rehabilitation reviews have recommended the planting of tube stock in areas where there has been dieback of vegetation. MCC planned to plant 250 trees on rehabilitation maintenance areas during 2020. This work was delayed by rainfall and completed in January 2021. Further tree planting is planned for selected areas in the 2021 reporting period with above average rainfall expected to continue to provide favourable conditions for establishment.

MCC were notified during the last reporting period that the ban on using Organic Growth Medium (OGM) in rehabilitation will not be lifted by the EPA. The Protection of the Environment Operations (Waste) Amendment Regulation 2020 commenced on 30 October 2020. This amendment allowed disposal of stockpiled OGM by burial onsite. On 30 November 2020, MCC buried the remaining OGM in accordance with the Protection of the Environment Operations (Waste Amendment Regulation 2020. To offset the loss of the use of the OGM, MCC has been working to identify alternate growth medium suppliers. Two of these products were used on the rehabilitation areas this reporting period and MCC will evaluate the benefits of using these products in the long-term. A product developed by a local supplier using biosolids and paper mulch was used on the new rehabilitation areas. A product utilising recycled green waste was added to the maintenance areas prior to reseeding. A comparison of physical and chemical properties was made via sampling and analysis to inform future decisions regarding use of these products.

A further 15.9Ha in OC2 void was shaped, ripped, and seeded using drones during the 2020 period. The seeding is intended to provide temporary stabilisation on an area which is mostly expected to be below the final water level in the void once a steady state is reached in the post-mining landscape. The areas surrounding the void will be shaped during the next reporting period and drainage structures established to channel surface water into the void and prevent erosion of the final landform. As the seeding was conducted via drone, a modified pasture seed mix suitable for over-sowing was used.

The seed mix used in OC2 void is shown in **Table 42.**

Table 42: Seed Mix Used for Temporary Stabilisation in OC2

Seed Type or Fertiliser	Rate (kg/ha)
Oats – cover crop	20
Ryegrass	2
Couch	4
Cocksfoot	2
DAP Fertiliser	100

In addition to on-ground maintenance activities during the reporting period, approximately 96Ha of historical rehabilitation was over-sown via aerial seeding using a fixed-wing aircraft. In April 2020, the Eastern Emplacement Area (approx. 54Ha) and selected areas on the western historical rehabilitation area (Council Void approx. 26Ha and Laneway Paddock approx. 16Ha) were aerial seeded following an inspection by an agronomist. The seed mixes and fertiliser differed slightly between the eastern and western areas based on soil sampling and advice from the agronomist.

Seed mixes used in aerial seeding program are listed below in **Table 43** and **Table 44.**

Table 43: Seed Mix Used for Aerial Seeding – Western Historical Rehabilitation

Seed Type or Fertiliser	Rate (kg/ha)
White Clover	2
Sub-clover	4
Arrow-leaf clover	1
Medic	3
Vetch	3
Annual Ryegrass	5
Digitaria	1
Panic	1
DAP Fertiliser	150

Table 44: Seed Mix Used for Aerial Seeding – Eastern Historical Rehabilitation

Seed Type or Fertiliser	Rate (kg/ha)
White Clover	1
Sub-clover	4
Arrow-leaf clover	1
Medic	2
Annual Ryegrass	6
MAP Fertiliser	100

The rehabilitation and maintenance summary for the reporting period can be found in **Table 45** and

Table 46.

Table 45: Rehabilitation Summary

AREA AFFECTED / REHABILITATED (hectares)					
			To Date	**Last Report**	**Next Report (Est.)**
A	**MINE LEASE AREA**				
	A1	**Mine Lease Area: CCL 713, ML 1304 and ML1562**	**1858**	**1858**	**1858**
B	**DISTURBED AREAS**				
	B1	**Infrastructure Area**	47.6	47.6	47.6
	B2	**Active Mining Area** (excluding items B3-B5 below)	71.0	66.2	71.0
	B3	**Waste Emplacements** (active/unshaped/in or out-of-pit)	118.9	122.3	81.5
	B4	**Tailing Emplacements** (active/unshaped/uncapped)	0.0	0.0	0.0
	B5	**Shaped Waste Emplacement** (awaits final vegetation)	3.8	9.5	45.0
	B6	**Temporary Stabilisation** (vegetation area for dust control)	15.9	21.6	15.9
	ALL DISTURBED AREAS		**257.2**	**267.2**	**261.0**
C	**REHABILITATION PROGRESS**				
	C1	**Total Rehabilitation Area** (except for maintenance)	**361.0**	**351.0**	**357.2**
D	**REHABILITATION ON SLOPES**				
	D1	**10 to 18 degrees**	55.4	53.7	55.4
	D2	**Greater than 18 degrees**	0.0	0.0	0.0
E	**SURFACE OF REHABILITATED LAND**				
	E1	**Pasture and grasses**	264.2	256.7	264.2
	E2	**Native forest/ecosystems**	96.8	94.3	93.0
	E3	**Plantation and crops**	0.0	0.0	0.0
	E4	**Other** (include non-vegetative outcomes)	0.0	0.0	0.0
F	**DE-HAB -** *disturbed areas previously rehabilitated, figures reflected in Section E*				
	F1	**Pasture and grasses**	0.0	0.0	0.0
	F2	**Native forest/ecosystems**	0.0	3.2	3.8
G	**SURFACE CONVERSION -** *previously reported pasture (cover crop) areas planted to trees, hectares reflected in Section E)*				
	G1	**Pasture/Cover Crop areas planted to Trees**	0.0	0.0	0.0

Table 46: Maintenance Activities on Rehabilitated Land

NATURE OF TREATMENT	AREA TREATED (Ha)		Comment / Control Strategies / Treatment Detail
	Report Period	Next Period	
Additional erosion control works (drains, re-contouring, rock protection)	0.0	0.0	Repair erosion and remove sediment build-up in contour banks – approx. 200m
Re-covering (detail - further topsoil, subsoil sealing etc.)	0.0	0.0	
Soil Treatment (detail - fertiliser, lime gypsum etc.)	112.0	0.0	Compost incorporated 16Ha (areas re-seeded), fertiliser added 103.3Ha (aerial seeding plus re-seeded pasture area)
Treatment / Management (detail - grazing, cropping, slashing)	0.0	0.0	
Re-seeding / Replanting (detail - species density, season etc.)	16	0.0	8.7Ha re-seeded native mix, 7.3Ha re-seeded pasture mix
Adversely Affected by Weeds (detail – type and treatment)	159.4	150.0	Spraying of weeds (see **Section 3.10.1**) for more details
Feral Animal Control (detail – additional fencing, trapping, shooting, baiting etc.)	Unknown	Unknown	Regional dog baiting program with areas of MCC land being included in the program Rabbit control program See **Section 3.10.2** for more detail

5.2.3 REHABILITATION ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will complete 0Ha of new rehabilitation in accordance with the approved MOP. The focus for 2021 will be to shape all of the area in OC2 required to meet the rehabilitation target for 2022 and install surface water management structures (drop structure and contour banks) as shown in **Figure 36**. The rehabilitation of OC2 will be completed in 2022 with a combination of pasture and trees. Contour drains and drop structures will be established to design.

Ongoing rehabilitation maintenance will continue during the next reporting period. The scope of this maintenance work will be dependent on the weather conditions experienced during the next reporting period. The work will include weed control, pest and feral animal control, and tree planting.

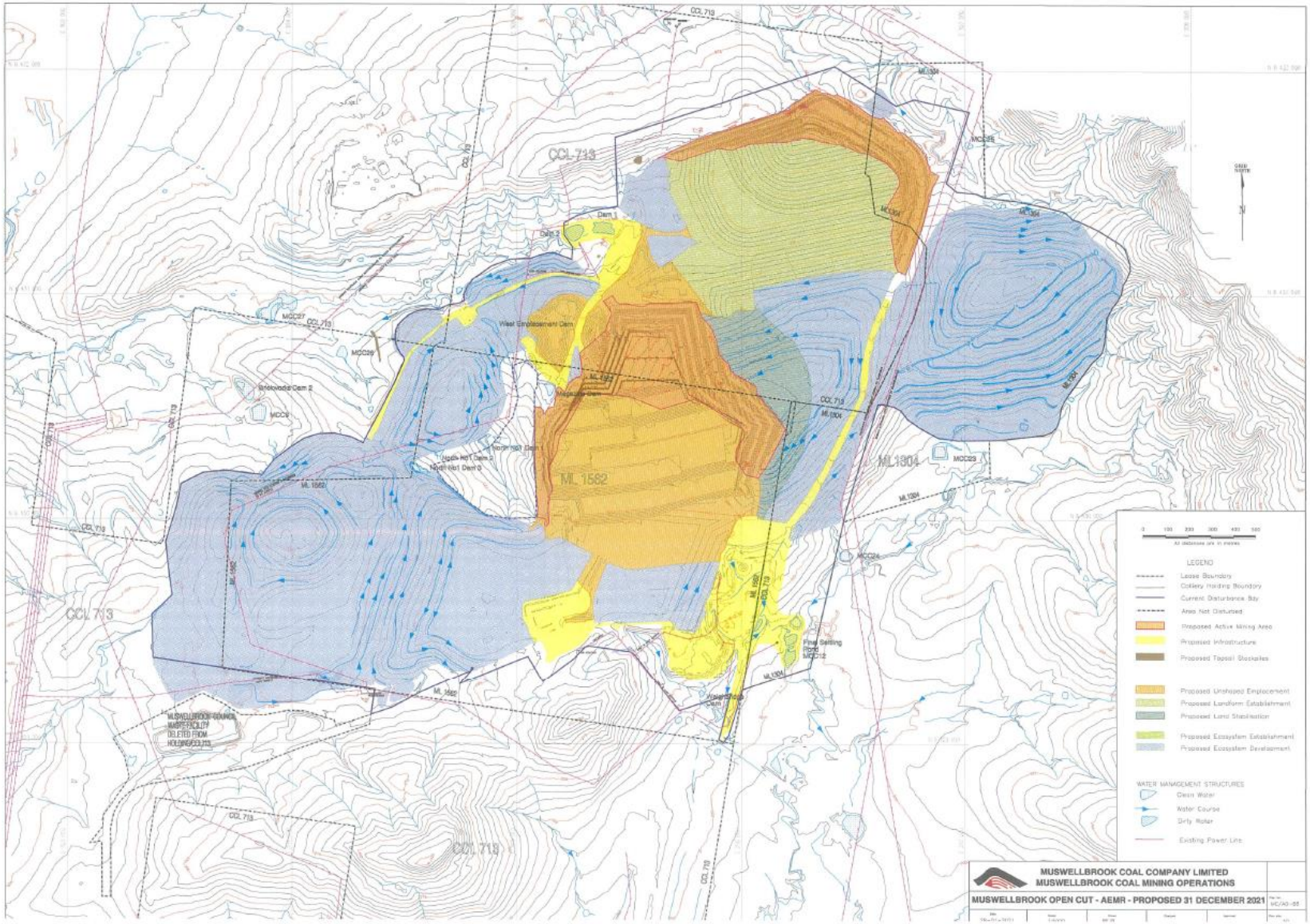


Figure 36: Proposed Activities Next Reporting Period

5.3 REHABILITATION MONITORING

5.3.1 SITE SELECTION

Eco Logical Australia were engaged to undertake rehabilitation monitoring for the 2020 reporting period. The below data is presented in their report Muswellbrook Coal 2020 Rehabilitation Monitoring Report (ELA, 2021).

A total of sixteen permanent sites, five rehabilitation and three analogue woodland sites, and five rehabilitation and three analogue pasture sites, were surveyed during the reporting period.

Within the woodland sites, three analogue sites are established within remnant patches of the Endangered Ecological Community (EEC) *Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregion* listed under the *Threatened Species Conservation Act 1995* (TSC Act). The remaining five locations are established within each of the three Rehabilitations Blocks (A, B and C).

The pasture sites monitored included three within remnant pasture areas and the remaining five were established within each of the three Rehabilitations Blocks (A, B and C).

Figure 39 indicates the location of the monitoring sites and **Figure 40** indicates where fauna monitoring equipment has been set up.

5.4 FLORA MONITORING RESULTS – WOODLAND

To demonstrate compliance with the completion criteria indicated in the MOP for woodland sites, monitoring survey results were compared to benchmarks derived through the monitoring of analogue sites.

5.4.1 SPECIES RICHNESS AND FOLIAGE COVER

The species richness measured at each woodland monitoring site this reporting period is represented in **Figure 37**. The average number of native species present within the rehabilitation woodland sites is under half (16) that of native species present across the remnant woodland sites (37).

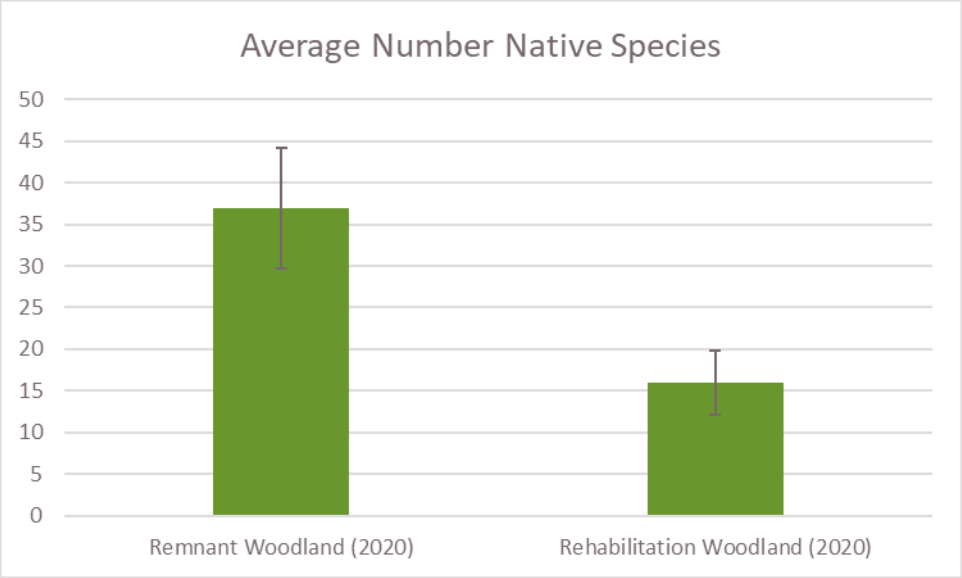


Figure 37: Comparison of Average Native Species Richness at Woodland Sites

Projected foliage cover (PFC) at each of the rehabilitation woodland sites across all strata has been calculated and is presented in **Figure 38.**

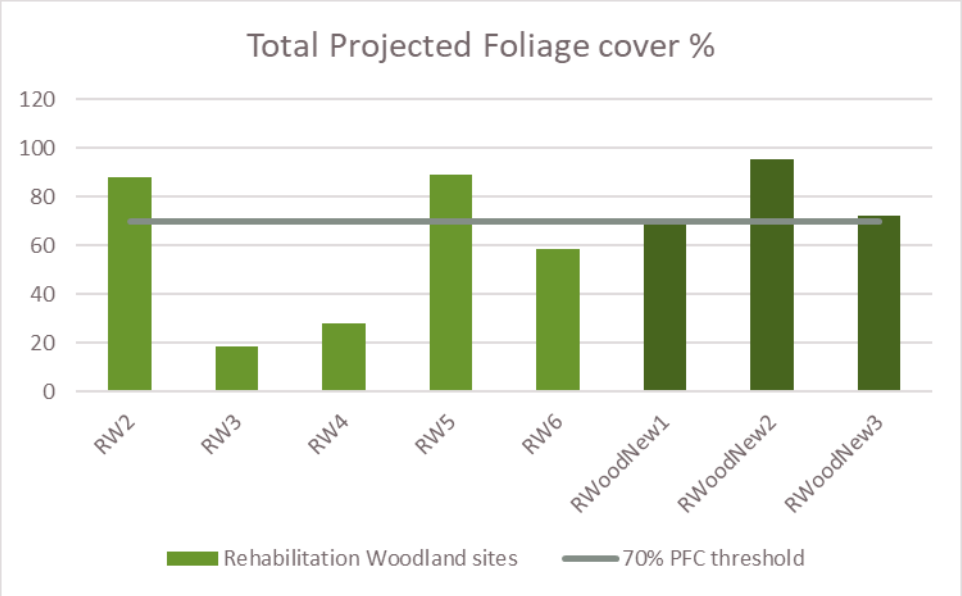


Figure 38: Total Projected Foliage Cover at Rehabilitation Woodland Sites

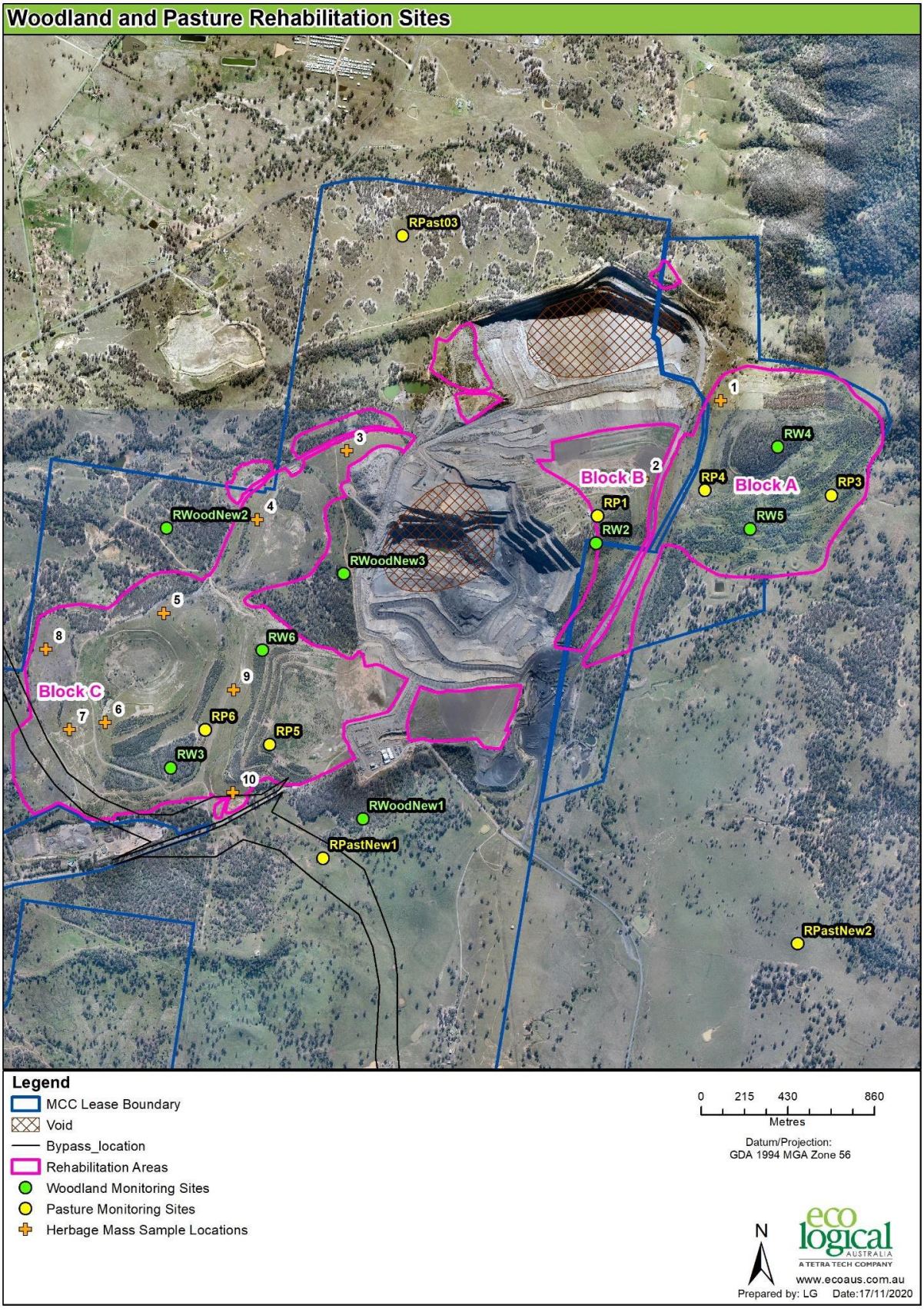


Figure 39: Rehabilitation Monitoring Program – Flora Sites

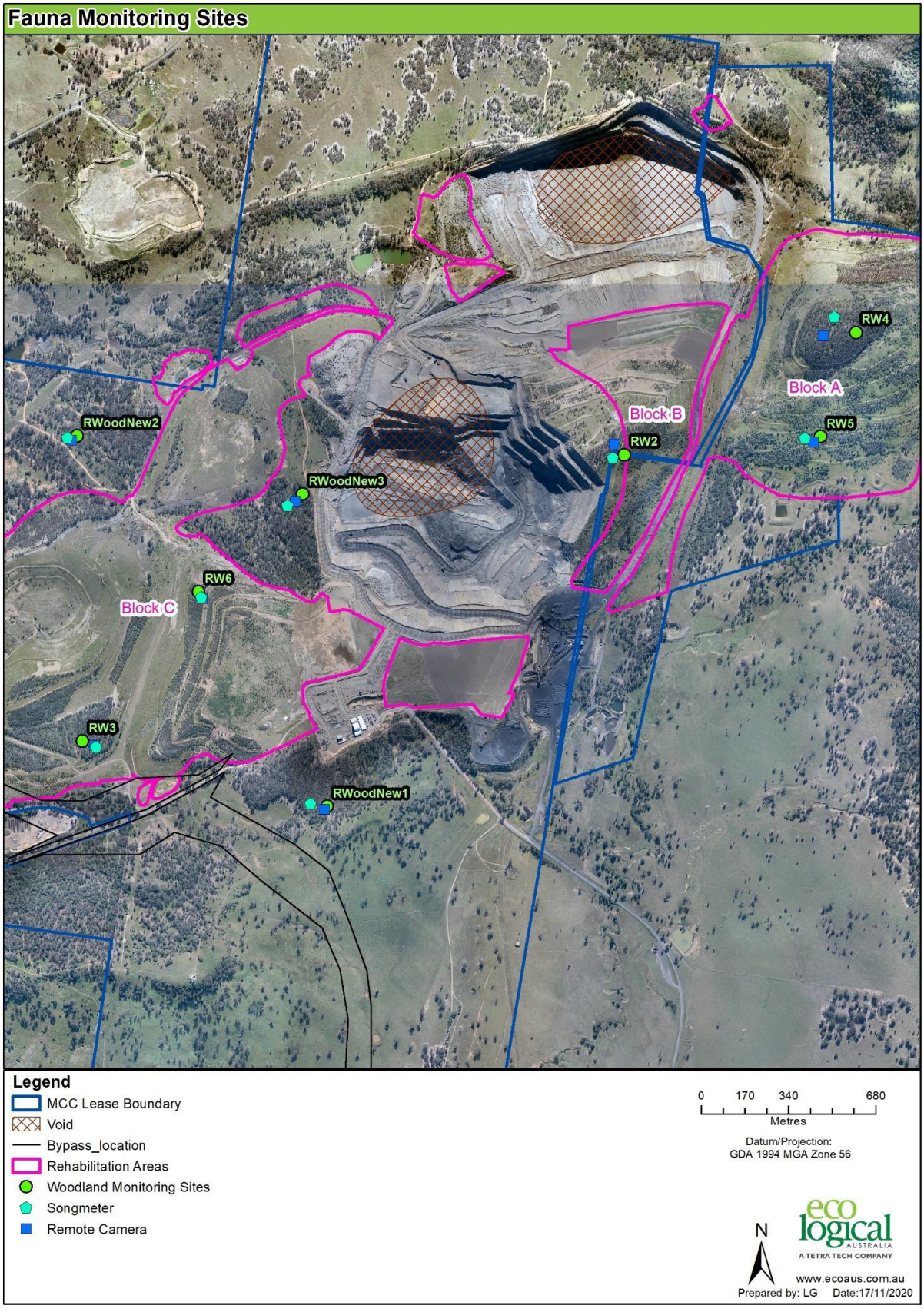


Figure 40: Rehabilitation Monitoring Program – Fauna Sites

The average weed species present at rehabilitation woodland sites was just over double that found at remnant woodland sites. Rehabilitation woodland sites comprised and average of 20 weed species and remnant woodland sites comprised and average of nine weed species (**Figure 41**).

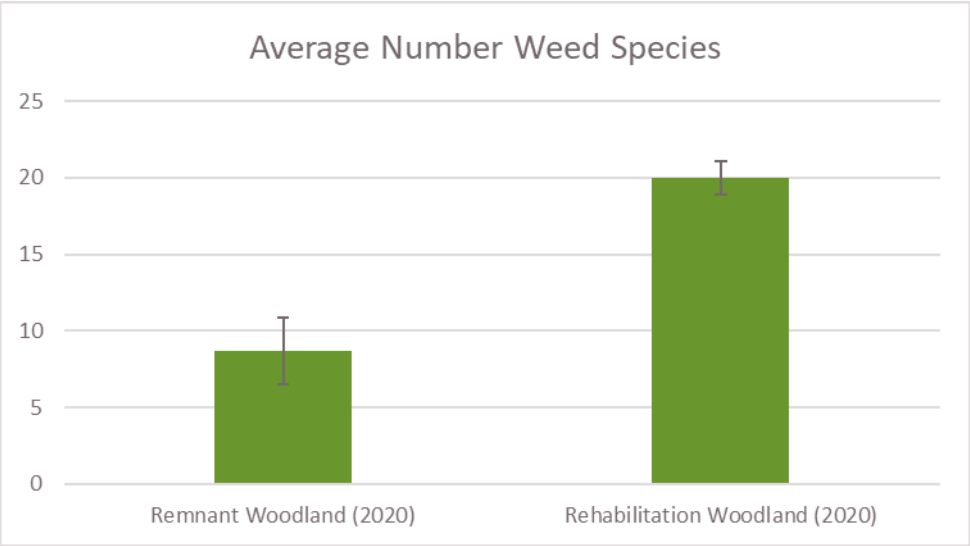


Figure 41: Comparison of Average Number of Weed Species at Woodland Sites

5.4.2 BIOMETRIC DATA

Average percentage of native over-storey, mid-storey cover, and native grass, shrub and native other cover was measured for rehabilitation and remnant woodland sites (**Figure 42**). Exotic plant cover, litter and bare ground was also recorded and provides a comparison between remnant and rehabilitation woodland sites.

The remnant woodland sites had over-storey cover and grass cover percentages double that of rehabilitation sites and native other cover was triple that of rehabilitation sites. Remnant woodland sites also comprise less exotic cover at almost three times less than rehabilitation sites. Remnant woodland sites comprised almost double the amount of litter cover and slightly less bare ground than rehabilitation woodland sites.

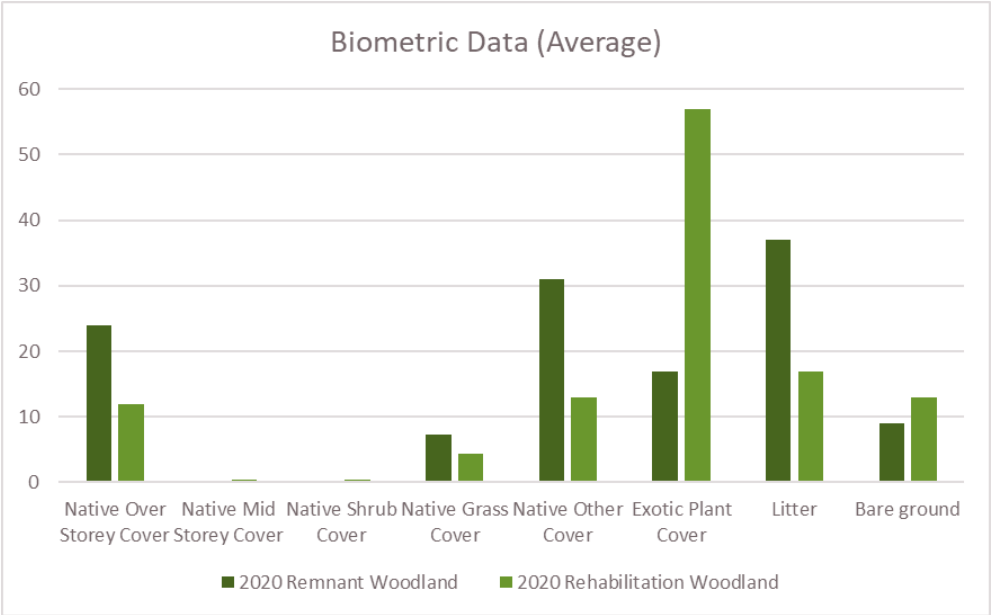


Figure 42: Biometric Data Averages

5.4.3 COMPARISON TO COMPLETION CRITERIA

In relation to the MOP completion criteria for the Land Use Establishment Phase, the results of the rehabilitation woodland sites established native species composition, projected foliage cover, number of weeds listed as WoNS and key eucalypt species is presented in **Table 47**. Woodland rehabilitation monitoring results against MOP completion criteria for the Land Use Sustainability Phase are presented in **Table 48.**

Table 47: Rehabilitation Site Completion Criteria Target – Woodland (Land Use Establishment Phase)

Site	Completion criteria target (native species established)	2020 result	Target reached	Completion criteria target (total projected foliage cover ≥ 70%)	2020 result	Target reached	Completion criteria target (WoNS) weeds <20%)	2020 result	Target exceeded	Completion criteria target (Key Eucalypt Species) Y/N	Target reached
RW2	>50%	42%	No	≥ 70%	88	Yes	<20%	5.3%	No	N	Yes
RW3	>50%	44%	No	≥ 70%	18.5	No	<20%	4.3%	No	Y	Yes
RW4	>50%	43%	No	≥ 70%	28	No	<20%	4.8%	No	Y	Yes
RW5	>50%	28%	No	≥ 70%	89	Yes	<20%	3.8%	No	Y	Yes
RW6	>50%	65%	Yes	≥ 70%	59	No	<20%	9.1%	No	N	Yes

Table 48: Woodland rehabilitation site completion criteria target (Land Use Sustainability Phase)

Site	Completion criteria target (Regrowth Evidence) Y/N	Target reached	Completion criteria target (Erosion present) Y/N	Target reached
RW2	Y	Yes	N	Yes
RW3	Y	Yes	N	Yes
RW4	Y	Yes	N	Yes
RW5	Y	Yes	N	Yes
RW6	Y	Yes	N	Yes

5.4.4 CONCLUSIONS

The following provides a summary of the overall condition of each rehabilitation woodland site, where they sit in relation to the completion criteria above and any recommendations for future works.

- RW2: This rehabilitation woodland site does not meet the first of the two staged completion criteria for >50% native species established, however, does have >70% PFC. The relatively high PFC at RW2 is primarily due to increased growth of groundcover and to a lesser degree shrub and overstorey cover. This rehabilitation area comprises a dying *Acacia saligna* overstorey and consideration may need to be given to replanting of longer-lived eucalypt species (from recommended species list in Table 27 of the MOP). The presence of both

Echidna and Lace monitor at this site is a positive indicator that the site is functioning to *enhance connectivity of vegetation to surrounding remnant native vegetation.* This site is meeting all other completion criteria objectives.

- RW3: This rehabilitation woodland site does not meet either of the completion criteria objectives being >50% of the species established and >70% PFC. This site comprises an early staged eucalypt forest, with minimal to no shrub cover and minimal native groundcovers. Presence of desirable native species such as *Wahlenbergia gracilis, Wahlenbergia communis*, *Calotis lappulacea*, and *Einadia polygonoides* is an indication of local recruitment from surrounding native vegetation and shows a natural flow of resources between remnant and rehabilitation areas. This site is meeting all other completion criteria objectives.
- RW4: This rehabilitation woodland site does not meet either of the completion criteria objectives being >50% of the species established and >70% PFC. This site comprises a maturing eucalypt forest, with minimal to no shrub cover and increasing native groundcovers. This site is located in close proximity to Bells Mountain and Skelletar Ridge and is likely to have assisted with the natural flow of resources as there is considerable presence of desirable native grasses and forbs and presence of Echidna also indicates good flow of habitat between these locations. This site is meeting all other completion criteria objectives and it is considered that, out of all the rehabilitation woodland sites, to be the most representative of a *Central Hunter Box-Ironbark Woodland* in structure and composition.
- RW5: This rehabilitation woodland site does not meet the first of the two staged completion criteria for species established, however, does have >70% PFC. The relatively high PFC at RW5 is primarily due to increased growth of groundcover and to a lesser degree shrub and overstorey cover. This rehabilitation area comprises a dying *Acacia saligna* overstorey, however, there is presence of overstorey Eucalypts and native Acacia's persisting throughout and once the A. saligna canopy dies off, it is likely that the remaining canopy species will provide adequate overstorey cover in coming years. The rehabilitation plantings in this location have been planted in a 'stepping stones' formation in between rehabilitation pasture. The end use of this location will need to be given further thought, to determine whether it functions as woodland or pasture, as it will be difficult to achieve both in its current form. This site is meeting all other completion criteria objectives.
- RW6: This rehabilitation site is the only one of the five sites that meet the first of the two staged completion criteria for >50% native species established, however, does not meet the >70% PFC. This site comprises a high number of native species, and has good structural diversity, with Eucalypts, native Acacia's and presence of many desirable native grasses and forbs. This site is meeting all other completion criteria objectives and it is considered that this site, whilst not currently representative of a *Central Hunter Box-Ironbark Woodland* in structure, is a diverse and structurally sound rehabilitation site, that will improve naturally over time.

5.5 FLORA MONITORING RESULTS – PASTURE

5.5.1 CARRYING CAPACITY

The MOP refers to estimated carrying capacities on MCC's rehabilitation areas. However, for the majority of rehabilitation pasture sites, the classification types listed only partially align with those encountered. Therefore, the best fit in terms of species composition and treatment type has been selected. Historically, the pasture types have been estimated to fall within the 'native unimproved –

moderate fertility (no seed or fertiliser added)' and 'native unimproved – low fertility based on data collected at rehabilitation pasture sites and ecological interpretation of that data. In 2019 a local agronomist assessed the rehabilitation pasture areas and provided expert advice that allowed for a re-alignment of the estimated pasture types considered to be present. The 2020 monitoring results show that four of the five rehabilitation pasture sites fall within the 'improved pasture – moderate fertility (tropical grasses, clover + fertiliser)' and RP5 falls within the 'native unimproved – moderate fertility. It was noted this year that a higher proportion of *Lolium rigidum* (Ryegrass) was also present.

In 2019, as a result of prolonged drought conditions, a 'drought' factor of -4 was applied to the estimated (DSE/ha), in order to represent the reduction in overall herbage mass available. Due to the changed conditions, and above average rainfall received during the reporting period, the drought factor was not applied in the 2020 monitoring year.

Carrying capacity for each of the rehabilitation pasture sites has been calculated using the example of a 450 kg dry stock (non-lactating, non-pregnant cow) for typical DSE equivalents (Section 2.5.2). The results in **Table 49** show that using pasture type as a guide, all three remnant pasture sites and RP6 have an estimated carrying capacity of 1.3 head per hectare; RP1, RP3 and RP4 have a carrying capacity of 1.1 head per hectare; and RP5 has a carrying capacity of 0.5 head per hectare.

Table 49: Estimated Carrying Capacity for Remnant and Regrowth Pasture Sites

Sites	Pasture Type	Range (DSE/ha)	Estimated Value (DSE/ha)	Estimated carrying capacity (450kg dry stock)
RPastNew1	Native semi-improved - high fertility (clover + fertiliser added)	3.8-8.0	8	1.3 cow per 1 ha
RPastNew2	Native semi-improved - high fertility (clover + fertiliser added)	3.8-8.0	8	1.3 cow per 1 ha
RPast03	Native semi-improved - high fertility (clover + fertiliser added)	3.8-8.0	8	1.3 cow per 1 ha
RP1	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	7	1.1 cow per 1 ha
RP3	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	7	1.1 cow per 1 ha
RP4	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	7	1.1 cow per 1 ha
RP5	Native unimproved – moderate fertility (dominated by undesirable pasture yet native species *Erodium crinitum*)	1.5-4.0	3	0.5 cow per 1 ha
RP6	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	8	1.3 cow per 1 ha

5.5.2 HERBAGE MASS

Data collected for the remnant pasture sites is presented in
Table 50**.** Data collected for rehabilitation pasture sites is presented in **Table 51**. Additional herbage mass sampling at 10 new sites is presented in **Table 52.** A comparison of the remnant and rehabilitation pasture sites is shown in **Figure 43**.

Table 50: Remnant Pasture Herbage Mass Sampling (2020 Data Average)

Component	RPastNew1	RPastNew2	RPast03
A: Cover (%) - percentage of total pasture cover (living and dead)	80.5	87.0	74.5
B: Percentage cover of live native plants	68.0	37.0	63.5
C: Percentage cover of live non-native plants	12	50	11
D: Pasture height (cm)	11	7.3	7.5
Estimate of herbage mass (kg DM/ha) (based on Meat and Livestock Australia Pasture Ruler)	2350	1810	1830

Table 51: Rehabilitation Pasture Herbage Mass

Component	RP1	RP3	RP4	RP5	RP6
A: Cover (%) - percentage of total pasture cover (living and dead)	99.5	96	67	80.5	87
B: Percentage cover of live native plants	54	75.5	44	22	67
C: Percentage cover of live non-native plants	45.5	20.5	24	61	20
D: Pasture height (cm)	7.1	14	7.1	4.1	13.8
Estimate of herbage mass (kg DM/ha) (based on Meat and Livestock Australia Pasture Ruler)	1720	3000	1720	1200	2910

Table 52: Additional Pasture Herbage Mass sampling locations across rehabilitation areas

Component	1	2	3	4	5	6	7	8	9	10
A: Cover (%) - percentage of total pasture cover (living and dead)	94.3	75.5	97.5	86.5	80	92	90	66	97.5	98.5
B: Percentage cover of live native plants	75	60.7	75.5	67.5	71.5	80.2	78	58	84.3	79
C: Percentage cover of live non-native plants	19.3	14.8	23	19	8.5	11.8	12	8	13.2	20
D: Pasture height (cm)	11	5.5	12.5	3.5	13	13.5	7.5	4.2	13.5	12.5
Estimate of herbage mass (kg DM/ha) (based on Meat and Livestock Australia Pasture Ruler)	2400	1560	2600	1160	2400	2910	1790	1260	2940	2630

Herbage mass was generally high across both the analogue and rehabilitation pasture sites for the 2020 monitoring event. Herbage mass at remanent pasture sites ranged from 1810 to 2350 kg DM/ha with a median of 1830 kg DM/ha. The herbage mass across rehabilitation sites showed

wider variation ranging from similar, if not greater at some sites with RP1 being 1720 to 3000 kg DM/ha at RP3, however, the median was slightly higher at 2110 kg DM/ha (Table 51 and Figure 43). This data is considered to be a better reflection of potential productivity on rehabilitation areas than suggested by the estimates in Table 51. A similar range of results was obtained from the additional plots (Table 52) (range 1160 to 2940 kg DM/ha and median of 2400 kg DM/ha) and indicates that the routine monitoring sites (excluding RP5) provide a good representation of pasture condition.

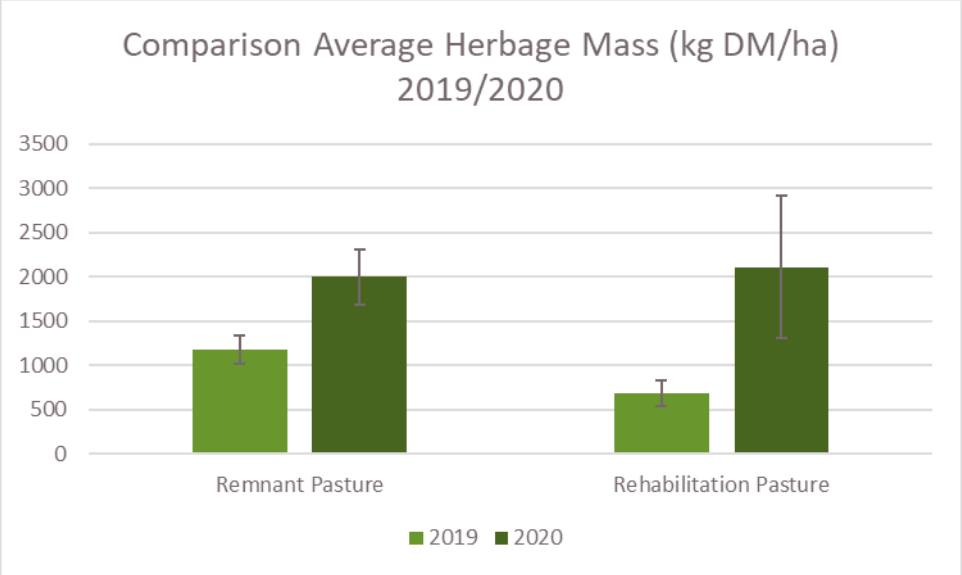


Figure 43: Comparison 2020/2019 average Herbage Mass (kg DM/ha) between Remnant and Rehabilitation Pasture Sites

5.5.3 PASTURE QUALITY

Pasture quality has been qualitatively assessed by estimating the digestible percentage using the graph shown in **Figure 44**. The three remnant pasture sites and rehabilitation pasture sites RP1, RP3, RP4 and RP6 fall within the 'Moderate Production' range. Rehabilitation pasture site RP5 is considered to fall within 'Maintain dry stock' range due to the lesser amount of suitable forage species present.

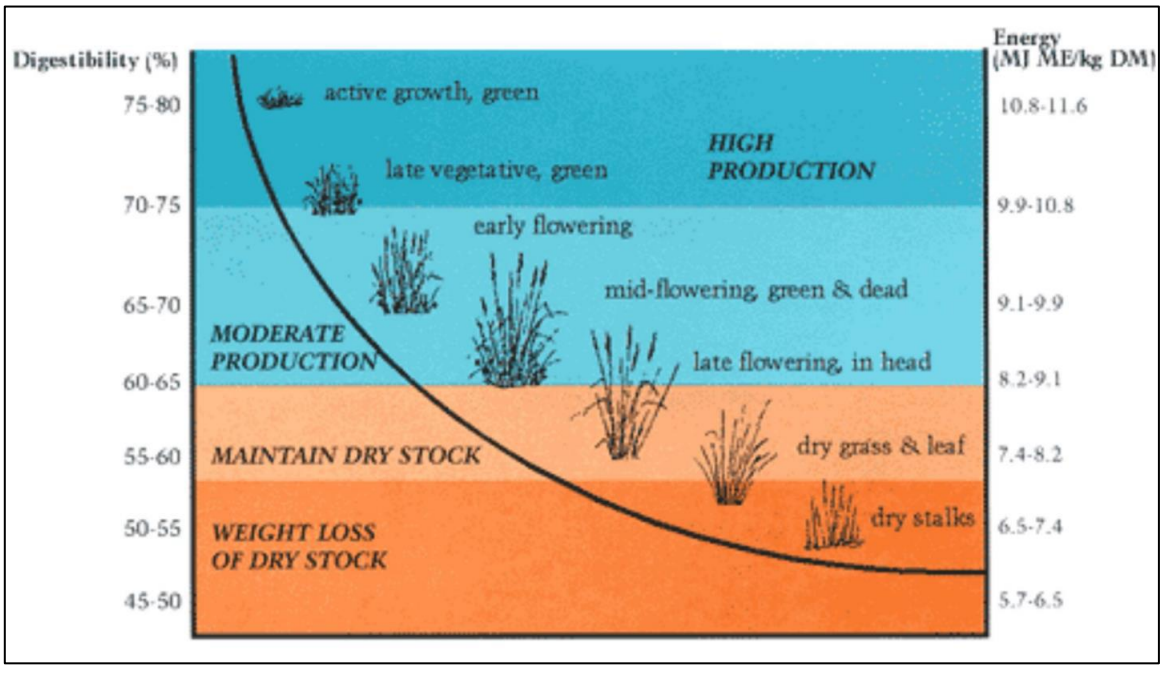


Figure 44: A Guide to Digestibility Percentage in Temperate Pasture Mixes

5.5.4 PASTURE SPECIES RICHNESS

The average number of native/desirable pasture species has been compared between remnant and rehabilitation pasture sites (**Figure 48**). The average number of native/desirable species present within the remnant pasture sites is double (18) that of native/desirable species present across the rehabilitation pasture sites (9).

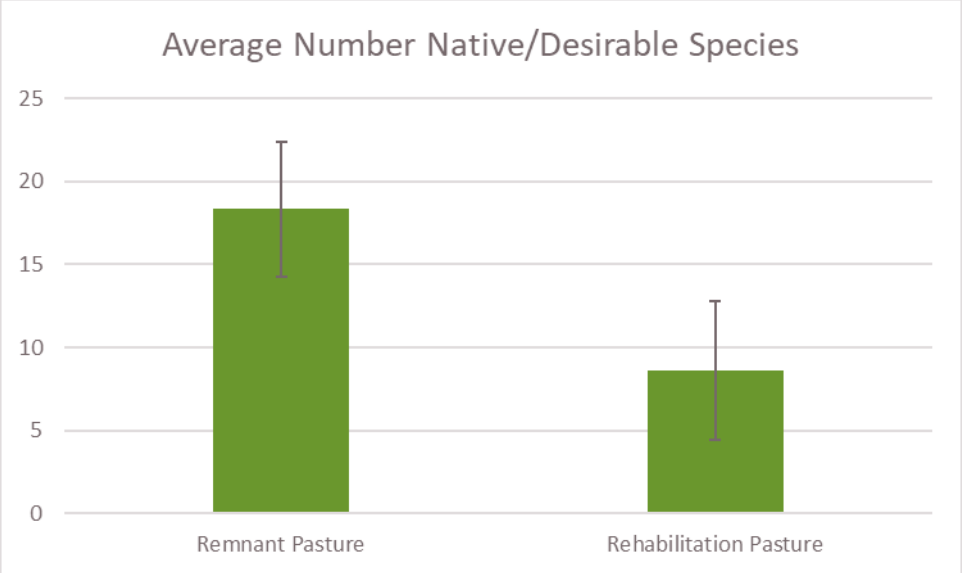


Figure 45: Comparison Between Remnant and Rehabilitation Pasture Sites for Average Native/Desirable Species

Percentage Foliage Cover (PFC) at each of the rehabilitation pasture sites has been calculated and is presented in **Figure 46**.

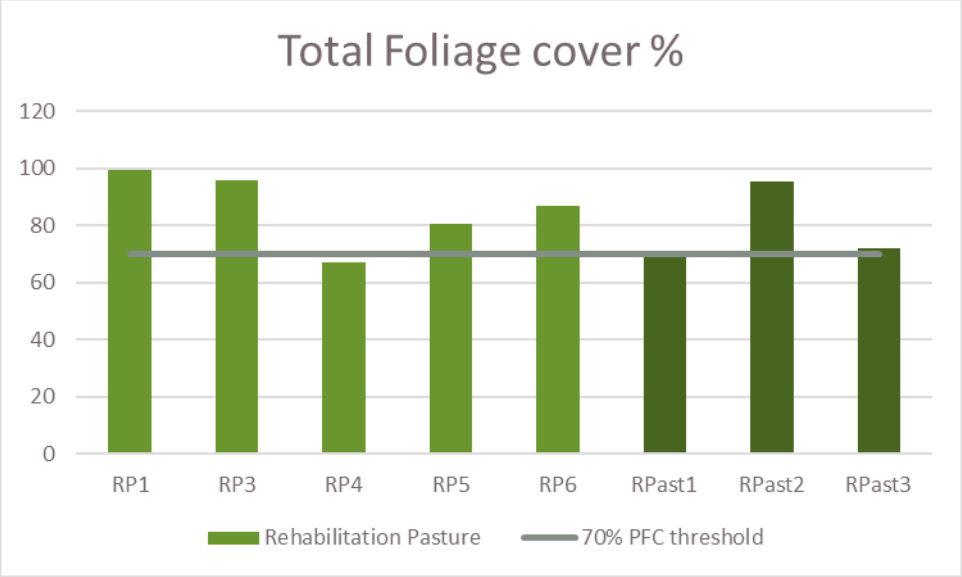


Figure 46: Total Projected Foliage Cover at Rehabilitation Pasture Sites

The average number of weed species has been compared between remnant and rehabilitation pasture sites (**Figure 47**). The average weed species present at both remnant and rehabilitation pasture sites was very similar, with remnant pasture sites comprising 18 weed species and rehabilitation pasture sites comprising 16 species.

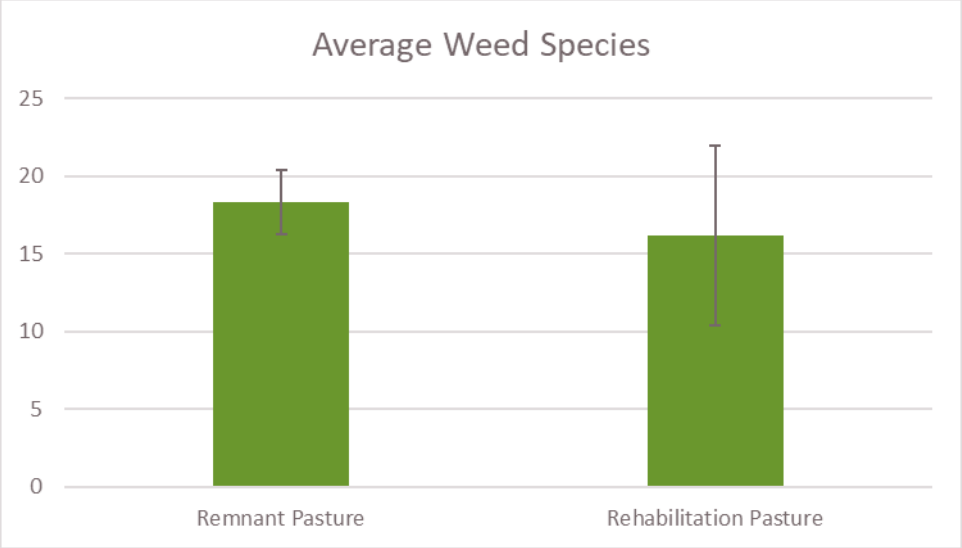


Figure 47: Comparison Between Remnant and Rehabilitation Pasture Sites for Average Weed Species Richness

5.5.5 COMPARISON TO CLOSURE CRITERIA

In relation to the completion criteria, the results of the rehabilitation pasture sites established native/desirable species composition, projected foliage cover and number of weeds listed as WoNS is presented in **Table 53**.

Table 53: Rehabilitation Site Completion Criteria Target – Pasture

Site	Completion criteria target (native\desirable) species established)	2020 result	Target reached	Completion criteria target (projected foliage cover ≥ 70%)*	2020 result	Target reached	Completion criteria target (WoNS) weeds <20%)	2020 result	Target exceeded	Completion criteria target (Key Pasture Species) Y/N	Target reached
RP2	>50%	35	No	≥ 70%	99.5	Yes	<20%	13	No	Y	Yes
RP3	>50%	38	No	≥ 70%	96	Yes	<20%	4	No	Y	Yes
RP4	>50%	45	No	≥ 70%	67	No	<20%	12.5	No	Y	Yes
RP5	>50%	31	No	≥ 70%	80.5	Yes	<20%	9	No	Y	Yes
RP6	>50%	38	No	≥ 70%	87	Yes	<20%	15	No	Y	Yes

Table 54: Pasture rehabilitation site completion criteria target (Land use Sustainability Phase)

Site	Completion criteria target (Regrowth Evidence) Y/N	Target reached	Completion criteria target (Erosion present) Y/N	Target reached
RP1	Y	Yes	N	Yes
RP3	Y	Yes	N	Yes
RP4	Y	Yes	N	Yes
RP5	Y	Yes	N	Yes
RP6	Y	Yes	N	Yes

5.5.6 CONCLUSIONS

The following provides a summary of the overall condition of each rehabilitation pasture site, where they sit in relation to the completion criteria above and any recommendations for future works. Where sites are similar, the discussion has been grouped.

- RP1; RP3; RP6: These rehabilitation pasture sites do not meet the first of the two staged completion criteria for >50% pasture species established, however, do have >70% PFC. Each of these sites have responded well to the favourable growing conditions and increased rain and have a considerable amount of native/desirable species present, however, also comprise a significant number of weeds/undesirable native pasture species. These sites all have the ability to stock similar rates to that of the analogue pasture sites. These pasture sites are meeting all other completion criteria objectives. Weed control measures, to reduce the number of weed species present in these locations may assist with meeting the first completion criteria target in the future.
- RP4: This rehabilitation pasture site does not meet either of the completion criteria targets for >50% pasture species established or >70% PFC. This site is located on a steeper slope than other rehabilitation sites and this may have contributed to establishment of species at planting times. It is noted that this site did not miss the >70% foliage cover target by much, sitting at 67%, therefore, it is not considered that any remediation works are necessary, and that with continued favourable conditions, this site will increase in overall foliage cover naturally. This pasture site meets all other completion criteria objectives. Weed control measures, to reduce the number of weed species present in this location may assist with meeting the first completion criteria target in the future.
- RP5: This rehabilitation pasture site does not meet the first of the completion criteria targets for >50% pasture species established, however does meet the >70% PFC. Whilst this site has met the second target, this site has a high proportion of undesirable pasture species, which are not palatable stock feed. Since 2018, the site has been managed to decrease the cover of undesirable species and there is increased growth of *Lolium rigidum* (Ryegrass) which is positive for this site, however, until palatable species cover increases, the area represented by site RP5 would not be suitable for sustained grazing. This pasture site meets all other completion criteria objectives and continued weed control measures, to reduce the number of weed species/ undesirable pasture species present in this location may assist with meeting the first completion criteria target in the future.

5.6 FAUNA MONITORING RESULTS

5.6.1 REMOTE CAMERA SURVEY

The results of the remote camera data are presented in **Figure 48** and **Table 55** and provides an indication of fauna species richness at each woodland site surveyed from 2015 to 2020 monitoring period.

Results show that across the analogue woodland sites, mammals are consistent from the 2019 period at four species which is an increase from the previous 2017 and 2018 periods. Birds have remained generally consistent over the last six years with between one to two species. Reptile

presence was again confirmed during 2020 with one species recorded. One pest species was identified at analogue woodland sites during 2020.

Across the rehabilitation woodland sites, the number of mammals has increased from two in 2018, three during 2019 and four in 2020. Birds have decreased by one species from the 2019 monitoring period, however, is one more than the 2016, 2017 and 2018 monitoring events. For the first year since monitoring began in 2015, reptiles were recorded at rehabilitation woodland sites. Pest species have remained fairly consistent at one to two species presence over the last six monitoring years.

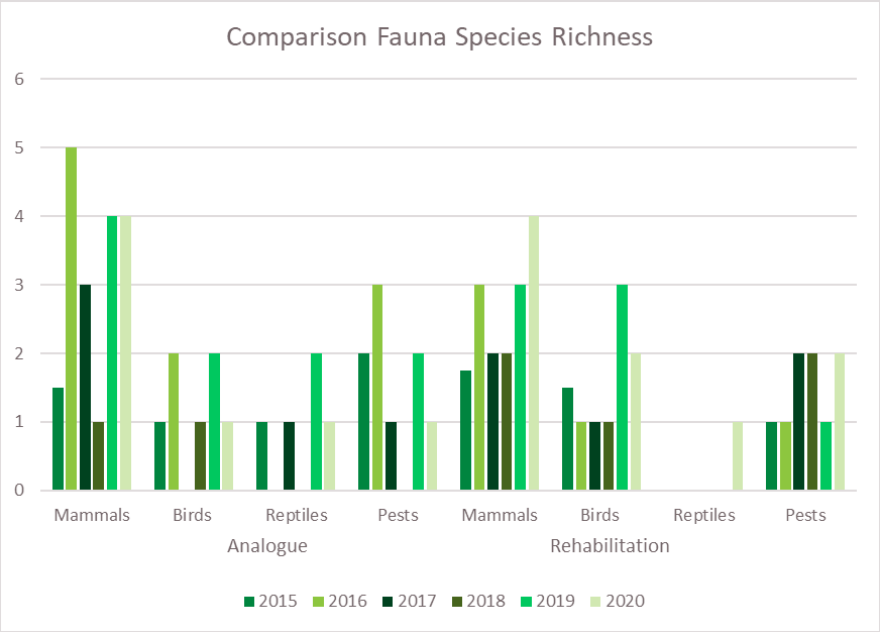


Figure 48: Comparison of Average Fauna Species Richness

Table 55: Remote Camera Results

Species	Analogue Woodland Sites			Rehabilitation Woodland Sites				
	RWoodNew1	RWoodNew2	RWoodNew3	RW2	RW3	RW4	RW5	RW6
Mammals								
Macropus rufogriseus (Red-necked Wallaby)		x		x	x	x	x	x
Macropus giganteus (Eastern grey kangaroo)	x		x	x	x	x		x
Macropus robustus robustus (Eastern Wallaroo)			x					
Wallabia bicolor (Swamp Wallaby)								
Trichosurus vulpecula (Brush-tailed possum)		x						
Monotreme								
Tachyglossus aculeatus (Short-beaked echidna)*				x		x		

Species	Analogue Woodland Sites			Rehabilitation Woodland Sites				
	RWoodNew1	RWoodNew2	RWoodNew3	RW2	RW3	RW4	RW5	RW6
Birds								
Gymnorhina tibicen (Australian Magpie)				x	x	x		x
Corvus coronoides (Australian Raven)				x				
Corcorax melanorhamphos (White wing Chough)	x							
Reptiles								
Varanus varius (Lace Monitor)*		x	x	x				
Pest species								
Oryctolagus cuniculus (Rabbit)			x					x
Lepus europaeus (European hare)				x				

* fauna species observed at site

5.6.2 BIRD CENSUS

Bird species were identified with a comparison between remnant and rehabilitation woodland sites and across the 2015 to 2020 monitoring periods is shown in **Figure 49**. Across the remnant woodland sites, bird species richness is generally consistent from 2015 through to 2020. Average bird species increasing slightly from the 2018 and 2019 monitoring with an average of 14 species recorded during the 2020 monitoring. The rehabilitation woodland sites have recorded their highest average species richness since monitoring began in 2015, with 16 species recorded in 2020.

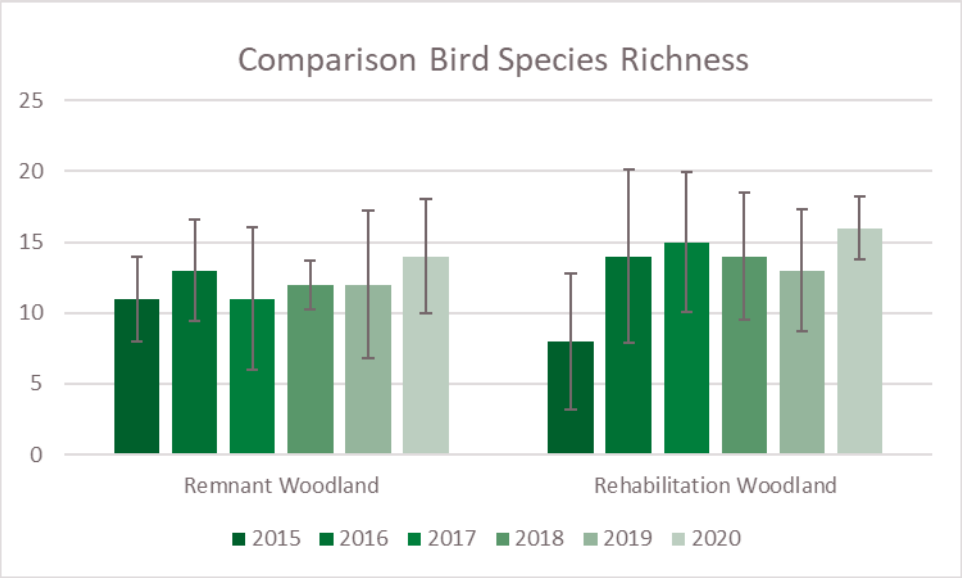


Figure 49: Bird Species Identified at Remnant and Rehabilitation Sites

5.6.3 MICROCHIROPTERAN BATS

The results of the Micro-bat census using songmeter data capture is presented in **Figure 50** indicating the presence of bat species utilising the woodland sites surveyed. Of the common microbat species, RW5 had the highest number of recorded bats being ten, RWoodNew1 was slightly lower at nine species and RWoodNew2, RW2 had eight species. RWoodNew3 had seven species and RW4 and RW6 had five species. RW3 had the lowest recorded species at three. Definite and potential call sequences for threatened microbat species were identified at all sites. Where a definite and potential call has been recorded at a site for a species within a 'species complex' i.e. Vespadelus species complex being either a threatened or common species, it is assumed that the call is the common species. RWoodNew2, RW2 and RW5 recorded the highest number of threatened species being two, RWoodNew1, RWoodNew3, RW4 and RW6 all recorded one threatened species and RW3 did not record any threatened species. Threatened microbats recorded included Myotis macropus (Southern Myotis), Saccolaimus flaviventris (Yellow-bellied Sheath-tailed Bat), Miniopterus orianae oceanensis (Large Bent-winged Bat), Scoteanax rueppellii (Greater Broad-nosed Bat).

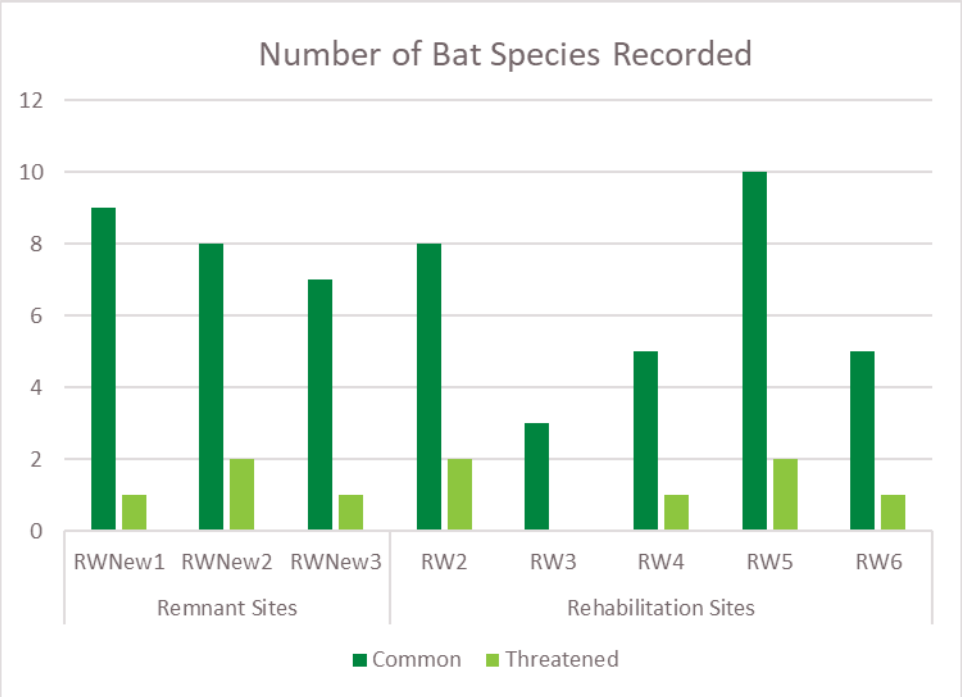


Figure 50: Number of Common and Threatened Bat Species Recorded at Woodland Sites

5.6.4 CONCLUSIONS

Overall, there seems to have been a slight increase in the number of mammals, especially Grey Kangaroo and Red-necked Wallaby occurring in both the analogue and rehabilitation woodland sites and the presence of the reptile, Lace Monitor and Echidna within rehabilitation woodland sites is positive.

There is no discernible pattern as to preference of analogue sites over rehabilitation sites as mammals, including Grey Kangaroo and Red-necked Wallaby seem to inhabit both analogue and rehabilitation sites and reptile species such as the Lace monitor were recorded at both analogue and rehabilitation sites. The assemblage and consistent presence of these woodland species demonstrates the development and maturation of the rehabilitation woodland areas.

There has been an overall increase in the average number of species recorded within rehabilitation woodland sites from the 2015 to 2020 monitoring events with an average of eight species recorded in

2015 and 16 species recorded in 2020. Examination of the data collected indicates a greater diversity of small woodland birds present across many of the rehabilitation sites as compared to the analogue sites. This is attributed to these sites having a more complex shrub cover which may be attractive to small woodland birds seeking protection and foraging resources.

Monitoring indicates considerable microbat activity, both common and threatened species have been recorded across all analogue woodland sites, and the majority of rehabilitation sites. There is considerable data (and activity) across most of the rehabilitation woodland sites which indicates these sites are providing suitable habitat for a range of microbat species including threatened species.

5.7 SOIL MONITORING RESULTS

The Rehabilitation Objectives in the MOP state that 'Key soil characteristics are within 10% variance of analogue sites'. However, this assumes that the analogue sites provide optimum conditions and that plants will not tolerate a significant deviation from these values. This is not true as plants have different tolerances to soil pH, salinity and fertility and there is a distinct difference between soil quality requirements for pasture and native woodland. These considerations have been included in the following discussion of the soil data.

All rehabilitation woodland sites (excepting RW4) fall within the range 5.5 to 7.5 which is optimal for the growth of a wide range of plants. Interestingly, Analogue sites RWoodNew1, RWoodNew2 are slightly more acidic falling just below the lower pH specificed in the completion criteria range (5.5). All rehabilitation pasture sites (except RP1 and RP6) fall within the target 5.5 to 7.5 range.

The low pH at RW4, RP1 and RP6 and concurrent evaluated EC recorded at these three sites may indicate the localised presence of oxidising sulphides, with the apparently elevated EC being associated with the presence of the neutralising reaction product gypsum (calcium sulfate). The analysis confirms that sulfate sulfur is also elevated. Gypsum is only sparingly soluble, but large amounts go into solution in the dilute 1:5 (w/v) soil: water extracts used to measure EC and screen for salinity (and used for the assessment of the completion criteria). This results in a higher EC value being recorded than would be expected in the soil solution around roots and falsely indicates an elevated salinity risk. The standard 1:5 extract is not a reliable method for assessing salinity in samples that contain sulfate and future monitoring should also include soluble chloride to improve the assessment of salinity and to correct for the presence of sulfate.

Low pH values and evidence of elevated chloride salinity (scalding) have not been observed at these locations in the past and the results do not appear to be indicative of the general characteristics of the surface soil material. In addition, the localise low pH has not resulted in potentially toxic levels of aluminium (the main risk associated with acid soil conditions) and soil chemical characteristics do not indicate a threat to the long-term success of the rehabilitation. Although it is an isolated incident, it warrants continued monitoring to determine if localised soil amelioration is required.

The elevated EC levels recorded at RW4, RP1 and RP6 are well outside the completion target range of <600 µs/cm. This is likely due to the concurrently elevated sulfate levels and in order to improve future soils sampling, soluble chloride should be added to the analytical suite for 2021 to better assess the potential salinity hazard.

Potassium is needed for a wide range of important processes within the plant including cell wall development, flowering and seed set. Potassium levels are not a limiting factor in soils across the rehabilitation sites. Adequate potassium is evident to support the growth of a wide range of pastures.

High sulphur levels are common across the Muswellbrook Open Cut Coal Mine rehabilitation sites. Sulfur values <10 mg/kg are considered to be low and pasture would likely show a response to fertiliser if applied. Sulfur values of 10 – 20 mg/kg is considered adequate. Values above this range do not necessarily indicate a limitation, just that pasture would not respond to applications of sulfur fertiliser.

Of the rehabilitation sites, RW2, RW3, RW6 and RP5 are within the adequate sulphur range. RW4 is above this range at 2,085 mg/kg. RP1 and RP6 are also above this range at 4,000 mg/kg and 1,076 mg/kg respectively. As discussed above this may be due to the localised presence of calcium sulfate, but it does not appear to have affected rehabilitation outcomes.

Nitrogen is an essential plant nutrient. The completion criteria require total nitrogen levels to be within the 2600 – 3150 mg/kg range. Although two of the analogue woodland sites are within the acceptable range, RWoodNew1 has a total nitrogen content is in excess of the range (3300 mg/kg). Of the rehabilitation woodland sites RW3 (at 2800 mg/kg) is within this range.

Of the rehabilitation pasture sites, none fall within the acceptable range for nitrogen. Both RP5 and RP6 have nitrogen levels above the completion criteria range at 3500 and 3700 mg/kg respectively. Analogue pasture site RPast03 has total nitrogen well below the acceptable range, as do rehabilitation pasture sites RP1, RP3 and RP4.

Total nitrogen content is not a reliable measure of plant available N as it does not take account of how readily the soil nitrogen can be mineralized into form that can be taken up by actively growing plants. Values that fall outside the completion criteria range do not necessarily indicate that soil conditions re poor. The above ground productivity provides an indication of nutrient supply and productivity, particularly in pasture systems. The results of pasture biomass indicate that rehabilitated areas are just as productive as analogue areas and the nitrogen results do not indicate that nutrient supply is restricted in rehabilitation areas. Therefore, where nitrogen sits below the acceptable level of 2600 mg/kg it is considered that nitrogen-based fertiliser could be utilised to improve nitrogen levels.

The range required to meet the nitrate-nitrogen completion criteria is very narrow and as demonstrated by the results recorded at analogue woodland and analogue pasture sites, it is not a realistic measure of acceptable background conditions. RW6, RP1 and RP5 are within the acceptable range and all other sites were slightly outside of this range, with RW3 well above the range at 8.5 mg/kg.

Nitrate levels fluctuate seasonally with rainfall and would be expected to fall outside the range of the completion criteria frequently without adverse outcomes. No obvious signs, particularly at RW3 indicate that excess nitrate-nitrogen is impacting plant growth.

Generally, the average soil organic matter for all sites are within the completion criteria range of between 3-10%. Although good soil organic matter is important for soil physical and chemical fertility, like total nitrogen, organic matter content is a very crude measure of overall fertility. As with nitrogen, organic matter values below the completion criteria range do not necessarily translate to poor rehabilitation outcomes. RP1 and RP3 fall just below the lower target at 2.7% and 2.9% respectively

and RW3 and RW4 are both above the upper target at 17% and 12% respectively. The method used to estimate soil organic matter is also important. Mine soils may contain coarse fragments of carbonaceous material which is not readily mineralizable and does not contribute to soil chemical or physical fertility. Likewise soils in analogue areas may contain charcoal. Some methods of analysis will include all these forms of organic carbon in estimates of organic matter and this may explain some of the apparently elevated organic matter values reported. The value of organic matter targets and the methods of analysis need to be reviewed.

5.8 EROSION AND LANDFORM STABILITY

Generally, there was little active erosion occurring within the rehabilitation sites. Vegetative cover is moderate to high in most areas and is likely to have assisted in stabilising rehabilitation areas.
No action required other than to monitor to determine whether conditions worsen.

5.9 BIODIVERSITY OFFSET AREA

The Biodiversity Offset Area is a diverse parcel of land comprising a variety of vegetation types. The parcel is approximately 20Ha located to the north of the mine site on MCC owned land. MCC is in the process of registering a positive covenant and restriction on the use of land on the parcel in consultation with, and as directed by, MSC. The vegetation present in the Biodiversity Offset Area includes pockets of Grey-Myrtle Rusty Fig dry rainforest in the deeper gullies and two communities which are considered equivalent to the Threatened Ecological Community *Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* (PCT1603 *Narrow-leaved Ironbark – Bulloak – Grey Box shrub – grass open forest* and PCT1605 *Narrow-leaved Ironbark – Native Olive shrubby open forest*).

Flora and fauna monitoring were undertaken in the Biodiversity Offset Area in 2016 and again during the reporting period. No significant changes to the vegetation communities present were noted. Monitoring revealed minimal weed species present and areas of cleared land showing very good regeneration of locally indigenous trees and shrubs. The number of native species has increased at all five monitoring locations compared to the 2016 monitoring. No signs of vehicle access or presence of livestock were apparent during monitoring. Monitoring also confirmed that there is evidence of new growth and successive generation of locally native species present in all vegetation communities surveyed.

5.10 REHABILITATION TRIALS AND RESEARCH

MCC are not currently undertaking any trials within the rehabilitation areas.

5.11 FURTHER DEVELOPMENT OF THE FINAL REHABILITATION PLAN

As part of the modification to the development consent the final landform was reviewed with improvements made to the final landform. The revised final landform has been modified such that all slopes, including final void batters, would be equal to or less than 14 degrees. One high wall will remain, in Open Cut 2, which will be appropriately treated with the installation of a safety fence and/or berms, as well as capping of exposed coal seams. There are no proposed changes to this final rehabilitation plan.

6.0 ACTIVITIES PROPOSED IN THE NEXT AEMR PERIOD

During the next reporting period, the following activities are planned:

- Continuing to implement the commitments in the Environmental Management Plans and the Mining Operations Plan.
- Place a positive covenant and restriction on the use of land on the title for the Biodiversity Offset Area.
- Bulk shape 45Ha of overburden for rehabilitation in 2022.
- Maintenance activities on the rehabilitation areas will continue.
- Complete the three-yearly review of the Water Management Plan.
- Prepare an EIS for remediation of the Old No1 Pit Top site.
- Continue working with MSC to gain approval for the Mine Closure Plan.

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Appendix 1: Air Quality Monitoring Results

REAL-TIME PM_{10} MONITORING RESULTS

January 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Jan-20	94.4	90.1	74.4
02-Jan-20	34.3	22.5	39.0
03-Jan-20	51.6	16.4	42.2
04-Jan-20	43.6	14.4	33.2
05-Jan-20	120.0	49.5	120.3
06-Jan-20	49.2	14.2	44.3
07-Jan-20	30.3	13.8	25.8
08-Jan-20	52.7	25.2	44.8
09-Jan-20	38.3	28.6	43.7
10-Jan-20	36.7	58.9	28.0
11-Jan-20	236.1	187.4	131.1
12-Jan-20	54.4	53.3	47.2
13-Jan-20	29.2	28.0	26.7
14-Jan-20	30.8	29.2	29.0
15-Jan-20	29.7	26.6	26.1
16-Jan-20	28.0	34.2	23.6
17-Jan-20	31.1	27.2	28.7
18-Jan-20	18.8	17.6	16.6
19-Jan-20	18.6	16.4	17.0
20-Jan-20	59.8	83.5	60.9
21-Jan-20	59.3	129.6	55.1
22-Jan-20	28.1	51.6	32.2
23-Jan-20	66.0	260.5	72.7
24-Jan-20	30.5	46.4	37.7
25-Jan-20	48.8	43.3	42.9
26-Jan-20	12.7	23.7	12.1
27-Jan-20	33.2	32.2	33.8
28-Jan-20	29.2	45.2	27.1
29-Jan-20	34.1	32.9	31.5
30-Jan-20	36.3	33.2	34.8
31-Jan-20	27.1	36.9	33.1

February 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Feb-20	35.7	57.8	39.3
02-Feb-20	33.0	65.7	35.3
03-Feb-20	26.1	No Data	30.7
04-Feb-20	39.8	34.3	45.8
05-Feb-20	29.4	23.5	28.9
06-Feb-20	16.4	12.2	13.9
07-Feb-20	5.9	5.1	5.2
08-Feb-20	5.3	5.4	5.7
09-Feb-20	4.1	No Data	4.5
10-Feb-20	19.9	No Data	13.8
11-Feb-20	15.2	24.0	14.6
12-Feb-20	15.2	19.5	12.9
13-Feb-20	11.9	10.6	11.4
14-Feb-20	22.3	19.7	22.9
15-Feb-20	18.6	No Data	19.0
16-Feb-20	14.1	No Data	14.8
17-Feb-20	9.2	No Data	10.9
18-Feb-20	15.4	37.1	18.0
19-Feb-20	45.2	69.6	51.3
20-Feb-20	22.5	26.4	22.8
21-Feb-20	20.8	17.6	22.0
22-Feb-20	17.9	14.1	15.9
23-Feb-20	12.3	No Data	13.9
24-Feb-20	20.9	No Data	14.6
25-Feb-20	9.1	15.6	14.0
26-Feb-20	10.3	19.1	10.8
27-Feb-20	26.7	26.7	27.3
28-Feb-20	24.6	28.0	24.3
29-Feb-20	24.7	20.2	23.9

March 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Mar-20	17.5	23.4	18.3
02-Mar-20	23.5	112.8	23.8
03-Mar-20	26.4	24.7	25.2
04-Mar-20	17.4	13.6	14.9
05-Mar-20	13.9	11.4	13.1
06-Mar-20	7.4	40.4	8.1
07-Mar-20	14.1	14.7	14.9
08-Mar-20	13.5	12.2	13.3
09-Mar-20	15.6	13.7	13.2
10-Mar-20	14.6	11.9	12.4
11-Mar-20	12.8	14.5	12.8
12-Mar-20	9.2	12.8	12.9
13-Mar-20	19.5	17.6	14.0
14-Mar-20	16.3	25.7	16.8
15-Mar-20	15.4	15.4	No data
16-Mar-20	13.7	10.4	No data
17-Mar-20	11.4	16.4	12.0
18-Mar-20	11.6	23.0	10.5
19-Mar-20	14.9	53.9	20.2
20-Mar-20	16.1	109.5	21.5
21-Mar-20	30.6	41.1	31.3
22-Mar-20	22.1	34.0	27.1
23-Mar-20	19.2	19.9	20.6
24-Mar-20	20.5	17.8	18.2
25-Mar-20	No data	34.2	19.4
26-Mar-20	7.9	10.8	9.1
27-Mar-20	11.4	15.0	17.2
28-Mar-20	15.7	21.2	15.9
29-Mar-20	7.4	15.5	13.4
30-Mar-20	8.2	42.5	10.6
31-Mar-20	8.2	32.5	11.3

April 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Apr-20	17.3	18.9	17.3
02-Apr-20	14.9	14.3	17.5
03-Apr-20	7.4	19.2	12.1
04-Apr-20	13.6	17.8	20.7
05-Apr-20	21.4	42.5	22.4
06-Apr-20	12.9	58.3	16.8
07-Apr-20	12.5	12.8	14.3
08-Apr-20	13.5	15.9	15.1
09-Apr-20	14.3	13.3	15.5
10-Apr-20	9.4	15.9	10.9
11-Apr-20	18.6	33.2	28.1
12-Apr-20	16.0	25.4	16.0
13-Apr-20	17.3	22.7	15.8
14-Apr-20	15.5	29.3	17.1
15-Apr-20	16.5	61.0	22.1
16-Apr-20	16.9	101.5	20.1
17-Apr-20	13.9	68.0	18.2
18-Apr-20	12.7	47.2	12.2
19-Apr-20	17.9	22.5	14.2
20-Apr-20	10.8	81.7	20.5
21-Apr-20	9.8	89.5	17.7
22-Apr-20	10.5	56.8	17.0
23-Apr-20	15.0	60.3	20.1
24-Apr-20	22.4	112.9	30.0
25-Apr-20	20.8	71.4	23.0
26-Apr-20	23.0	90.5	29.4
27-Apr-20	17.3	20.7	23.0
28-Apr-20	11.7	17.5	17.9
29-Apr-20	10.2	42.8	13.9
30-Apr-20	8.1	42.7	11.6

May 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-May-20	7.2	15.0	10.2
02-May-20	6.8	No Data	7.6
03-May-20	6.4	13.3	9.1
04-May-20	11.5	26.2	12.7
05-May-20	13.5	16.8	13.4
06-May-20	6.9	15.5	9.5
07-May-20	11.1	28.9	12.2
08-May-20	10.8	35.1	14.7
09-May-20	11.1	30.9	13.3
10-May-20	8.8	18.2	11.0
11-May-20	12.6	22.3	12.2
12-May-20	14.0	23.8	13.3
13-May-20	19.9	38.1	22.7
14-May-20	17.9	29.2	16.4
15-May-20	14.6	13.2	17.5
16-May-20	12.4	9.2	10.5
17-May-20	13.2	20.5	13.0
18-May-20	14.3	16.9	16.9
19-May-20	11.5	25.1	11.8
20-May-20	12.1	81.0	12.8
21-May-20	6.6	25.1	8.7
22-May-20	5.5	33.8	8.9
23-May-20	6.5	14.1	7.8
24-May-20	6.3	12.5	9.2
25-May-20	8.9	13.9	9.8
26-May-20	12.8	10.7	11.7
27-May-20	15.0	18.6	10.5
28-May-20	9.8	21.3	11.6
29-May-20	14.1	17.3	12.3
30-May-20	11.5	21.1	11.5
31-May-20	10.3	29.9	12.8

June 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Jun-20	12.5	27.0	16.2
02-Jun-20	6.7	17.6	8.0
03-Jun-20	7.1	17.6	8.1
04-Jun-20	14.3	15.3	11.4
05-Jun-20	6.9	23.8	8.9
06-Jun-20	11.8	22.6	10.3
07-Jun-20	17.1	22.5	17.3
08-Jun-20	20.8	18.3	19.4
09-Jun-20	11.0	9.3	12.1
10-Jun-20	8.0	8.8	7.1
11-Jun-20	9.6	10.0	15.3
12-Jun-20	17.8	16.3	18.5
13-Jun-20	12.9	30.0	14.3
14-Jun-20	9.7	16.7	9.2
15-Jun-20	7.0	37.7	8.9
16-Jun-20	6.6	41.7	8.8
17-Jun-20	10.3	30.7	13.1
18-Jun-20	11.8	12.1	12.5
19-Jun-20	8.0	26.4	8.4
20-Jun-20	9.3	15.7	10.5
21-Jun-20	6.9	19.7	8.2
22-Jun-20	5.7	21.5	6.6
23-Jun-20	4.1	20.5	4.9
24-Jun-20	4.4	25.2	5.4
25-Jun-20	3.2	40.7	5.6
26-Jun-20	5.5	25.8	10.1
27-Jun-20	10.4	25.7	15.9
28-Jun-20	10.8	32.1	15.3
29-Jun-20	7.5	20.5	7.5
30-Jun-20	6.7	24.9	10.6

July 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Jul-20	8.3	94.1	16.4
02-Jul-20	9.8	85.5	16.3
03-Jul-20	10.1	53.8	19.0
04-Jul-20	5.2	20.8	8.4
05-Jul-20	4.0	17.9	7.4
06-Jul-20	7.9	16.7	9.4
07-Jul-20	14.7	22.9	14.2
08-Jul-20	7.0	8.7	8.0
09-Jul-20	13.3	24.9	13.0
10-Jul-20	15.3	26.6	17.3
11-Jul-20	7.4	17.9	9.3
12-Jul-20	4.7	14.8	5.7
13-Jul-20	5.0	15.0	6.1
14-Jul-20	8.6	18.0	6.4
15-Jul-20	12.3	37.5	11.4
16-Jul-20	9.6	36.2	9.7
17-Jul-20	13.3	26.1	15.8
18-Jul-20	9.9	9.0	9.4
19-Jul-20	6.1	27.2	8.3
20-Jul-20	8.1	35.9	12.2
21-Jul-20	10.3	19.8	14.4
22-Jul-20	15.6	23.9	11.5
23-Jul-20	11.1	23.0	13.5
24-Jul-20	15.9	24.3	16.5
25-Jul-20	14.2	22.1	15.9
26-Jul-20	4.7	7.4	4.1
27-Jul-20	3.9	No Data	3.8
28-Jul-20	3.8	14.2	5.6
29-Jul-20	5.0	11.9	7.0
30-Jul-20	11.6	21.8	11.0
31-Jul-20	17.3	20.5	18.0

August 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Aug-20	9.8	20.23	10.6
02-Aug-20	8.0	No Data	11.1
03-Aug-20	6.9	No Data	12.0
04-Aug-20	8.3	58.8	13.1
05-Aug-20	7.0	39.0	8.7
06-Aug-20	12.2	47.1	11.6
07-Aug-20	13.8	12.5	14.5
08-Aug-20	7.0	17.6	8.4
09-Aug-20	2.6	12.0	4.4
10-Aug-20	12.0	15.8	10.1
11-Aug-20	10.3	8.5	8.3
12-Aug-20	11.2	42.2	16.5
13-Aug-20	12.2	28.5	12.4
14-Aug-20	9.1	40.4	19.7
15-Aug-20	5.0	16.4	7.9
16-Aug-20	3.9	15.9	5.1
17-Aug-20	4.2	20.2	4.7
18-Aug-20	4.2	53.9	5.4
19-Aug-20	23.5	150.0	38.5
20-Aug-20	30.6	51.2	31.2
21-Aug-20	7.0	50.7	7.3
22-Aug-20	5.8	42.3	8.4
23-Aug-20	6.3	20.9	9.4
24-Aug-20	5.8	27.1	7.4
25-Aug-20	6.0	18.5	11.3
26-Aug-20	11.4	8.9	13.6
27-Aug-20	9.8	12.4	14.3
28-Aug-20	13.8	8.0	13.5
29-Aug-20	16.11	8.9	14.2
30-Aug-20	15.4	12.1	16.8
31-Aug-20	20.0	9.1	25.6

September 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Sep-20	21.5	4.7	22.6
02-Sep-20	20.7	11.1	24.4
03-Sep-20	21.8	12.6	24.0
04-Sep-20	22.9	11.6	24.8
05-Sep-20	11.8	6.8	11.6
06-Sep-20	16.2	7.7	18.5
07-Sep-20	18.1	3.2	14.7
08-Sep-20	12.5	4.4	12.9
09-Sep-20	15.2	5.5	17.3
10-Sep-20	11.6	2.8	12.3
11-Sep-20	13.1	3.0	12.0
12-Sep-20	6.7	6.3	7.7
13-Sep-20	7.6	8.5	13.4
14-Sep-20	12.5	7.7	14.6
15-Sep-20	18.2	6.5	15.6
16-Sep-20	13.2	64.0	15.4
17-Sep-20	17.4	33.0	19.3
18-Sep-20	21.9	19.7	25.2
19-Sep-20	16.2	17.5	16.6
20-Sep-20	13.1	19.3	12.4
21-Sep-20	12.4	52.2	13.2
22-Sep-20	11.7	27.2	16.5
23-Sep-20	15.1	31.4	17.0
24-Sep-20	No Data	60.5	12.6
25-Sep-20	No Data	152.2	22.3
26-Sep-20	6.2	33.5	8.4
27-Sep-20	9.1	18.0	10.5
28-Sep-20	18.0	22.0	18.8
29-Sep-20	15.5	14.8	15.9
30-Sep-20	12.9	37.9	14.5

October 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Oct-20	9.5	42.9	14.38
02-Oct-20	No Data	34.8	18.1
03-Oct-20	17.0	27.8	18.1
04-Oct-20	17.8	32.8	17.0
05-Oct-20	15.5	90.5	18.9
06-Oct-20	15.5	17.4	13.3
07-Oct-20	No Data	6.9	9.5
08-Oct-20	20.5	87.3	24.1
09-Oct-20	6.5	79.0	12.9
10-Oct-20	8.9	73.5	13.5
11-Oct-20	17.3	38.9	16.3
12-Oct-20	24.7	29.9	23.1
13-Oct-20	20.7	37.5	22.2
14-Oct-20	33.5	31.8	34.2
15-Oct-20	14.1	46.7	21.5
16-Oct-20	24.4	50.2	30.4
17-Oct-20	17.6	40.5	22.7
18-Oct-20	9.7	28.0	11.7
19-Oct-20	14.3	14.4	16.9
20-Oct-20	14.8	11.9	14.7
21-Oct-20	18.4	24.1	17.7
22-Oct-20	12.5	26.4	15.8
23-Oct-20	12.3	33.3	16.0
24-Oct-20	8.9	21.9	10.0
25-Oct-20	5.5	7.1	5.5
26-Oct-20	6.4	4.0	5.0
27-Oct-20	6.3	6.5	7.7
28-Oct-20	10.3	8.8	9.5
29-Oct-20	11.5	30.3	15.2
30-Oct-20	18.2	28.8	14.2
31-Oct-20	16.6	27.6	14.2

November 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Nov-20	10.0	19.0	11.6
02-Nov-20	18.1	17.4	17.5
03-Nov-20	19.9	18.7	15.8
04-Nov-20	No Data	49.2	17.2
05-Nov-20	10.7	42.3	12.7
06-Nov-20	13.9	14.7	12.9
07-Nov-20	22.6	26.7	18.5
08-Nov-20	12.9	13.0	13.6
09-Nov-20	11.2	10.0	12.7
10-Nov-20	17.0	14.1	16.5
11-Nov-20	13.9	43.9	16.9
12-Nov-20	22.7	126.6	24.7
13-Nov-20	22.6	149.2	30.7
14-Nov-20	13.3	32.4	14.2
15-Nov-20	12.6	39.9	13.5
16-Nov-20	19.2	91.2	26.3
17-Nov-20	32.6	39.5	34.0
18-Nov-20	23.8	24.8	26.6
19-Nov-20	27.8	25.4	30.6
20-Nov-20	27.2	77.6	31.2
21-Nov-20	37.3	36.8	37.5
22-Nov-20	29.4	No Data	35.9
23-Nov-20	15.7	No Data	22.3
24-Nov-20	14.2	14.6	15.4
25-Nov-20	18.7	14.9	18.3
26-Nov-20	22.3	34.2	27.4
27-Nov-20	41.4	41.9	40.4
28-Nov-20	20.1	50.1	20.4
29-Nov-20	40.3	87.1	42.8
30-Nov-20	28.2	27.4	31.1

December 2020			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Dec-20	30.5	70.7	40.1
02-Dec-20	26.7	30.4	32.6
03-Dec-20	16.0	14.4	17.4
04-Dec-20	21.2	35.3	22.6
05-Dec-20	29.7	27.9	31.2
06-Dec-20	17.8	36.3	24.1
07-Dec-20	19.2	67.1	27.2
08-Dec-20	14.1	25.3	17.5
09-Dec-20	24.9	26.6	27.9
10-Dec-20	28.5	32.0	33.1
11-Dec-20	14.5	15.0	16.0
12-Dec-20	14.5	12.9	16.6
13-Dec-20	13.5	10.9	13.4
14-Dec-20	15.1	12.1	14.5
15-Dec-20	8.0	6.7	9.4
16-Dec-20	11.1	45.3	12.7
17-Dec-20	10.1	21.6	12.1
18-Dec-20	9.9	46.7	15.3
19-Dec-20	9.5	12.0	13.0
20-Dec-20	19.9	12.1	14.3
21-Dec-20	14.1	11.7	10.2
22-Dec-20	4.0	22.1	5.7
23-Dec-20	11.1	20.6	14.3
24-Dec-20	14.8	15.7	17.9
25-Dec-20	14.7	15.7	15.3
26-Dec-20	11.4	10.4	12.0
27-Dec-20	10.5	14.6	11.0
28-Dec-20	9.8	14.4	11.7
29-Dec-20	9.5	9.8	9.4
30-Dec-20	9.0	7.8	8.9
31-Dec-20	10.8	9.4	11.2

Appendix 2: Water Monitoring Results

MONTHLY SURFACE WATER MONITORING RESULTS - pH

DATE	Dam 1/2	MCC12 Final Settling Pond	No.2 Open Cut Void	No.1 Open Cut Void	MCC07	MCC08
9-Jan-20	7.81	8.56	No Access	No Access	7.74	7.90
4-Feb-20	7.83	8.54	No Access	No Access	7.76	7.87
16-Mar-20	7.85	8.24	No Access	No Access	7.31	7.79
2-Apr-20	8.05	8.76	No Access	No Access	7.07	8.03
13-May-20	7.92	8.76	No Access	No Access	6.97	7.63
2-Jun-20	7.92	8.53	No Access	No Access	6.94	7.71
7-Jul-20	7.87	Too Low to Sample	7.64	No Access	6.96	7.75
4-Aug-20	8.21	8.14	No Access	No Access	7.30	7.45
7-Sep-20	7.85	8.76	No Access	No Access	7.57	7.55
6-Oct-20	7.82	8.47	No Access	No Access	7.51	7.61
10-Nov-20	7.91	8.70	No Access	No Access	7.52	7.73
2-Dec-20	7.91	8.16	No Access	No Access	7.44	7.65

MONTHLY SURFACE WATER MONITORING RESULTS – ELECTRICAL CONDUCTIVITY

DATE	Dam 1/2	MCC12 Final Settling Pond	No.2 Open Cut Void	No.1 Open Cut Void	MCC07	MCC08
9-Jan-20	7400	10500	No Access	No Access	16200	9220
4-Feb-20	7720	11000	No Access	No Access	24500	10200
16-Mar-20	7010	5650	No Access	No Access	14000	6000
2-Apr-20	6740	5470	No Access	No Access	13600	6500
13-May-20	6890	5390	No Access	No Access	14200	5780
2-Jun-20	7030	5170	No Access	No Access	13100	7040
7-Jul-20	6520	Too Low to Sample	3680	No Access	11800	6670
4-Aug-20	5250	2170	No Access	No Access	1080	1340
7-Sep-20	7130	3230	No Access	No Access	1280	3080
6-Oct-20	6990	3910	No Access	No Access	1980	4940
10-Nov-20	6680	3280	No Access	No Access	1000	1460
2-Dec-20	6420	3800	No Access	No Access	1910	3790

MONTHLY SURFACE WATER MONITORING RESULTS – TOTAL SUSPENDED SOLIDS

DATE	Dam 1/2	MCC12 Final Settling Pond	No.2 Open Cut Void	No.1 Open Cut Void	MCC07	MCC08
9-Jan-20	14	15	No Access	No Access	20	18
4-Feb-20	9	10	No Access	No Access	51	6
16-Mar-20	8	15	No Access	No Access	5	14
2-Apr-20	12	29	No Access	No Access	17	12
13-May-20	8	12	No Access	No Access	<5	11
2-Jun-20	7	8	No Access	No Access	<5	14
7-Jul-20	<5	Dry	11	No Access	<5	5
4-Aug-20	10	23	No Access	No Access	10	7
7-Sep-20	6	<5	No Access	No Access	<5	6
6-Oct-20	7	5	No Access	No Access	<5	<5
10-Nov-20	6	8	No Access	No Access	11	9
2-Dec-20	8	12	No Access	No Access	5	7

QUARTERLY SURFACE WATER MONITORING RESULTS – pH

DATE	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
16-Mar-20	8.11	8.55	7.89	Dry	8.69	8.78
2-Jun-20	8.50	8.74	7.62	Dry	9.60	8.48
7-Sep-20	8.75	9.00	8.30	7.53	7.64	8.90
2-Dec-20	8.21	8.83	8.15	7.58	8.23	8.61

QUARTERLY SURFACE WATER MONITORING RESULTS – ELECTRICAL CONDUCTIVITY

DATE	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
16-Mar-20	374	15000	921	Dry	2720	14700
2-Jun-20	299	14000	638	Dry	1870	12800
7-Sep-20	594	4680	596	803	1420	5660
2-Dec-20	609	8620	697	827	2060	9740

QUARTERLY SURFACE WATER MONITORING RESULTS – TOTAL SUSPENDED SOLIDS

DATE	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
16-Mar-20	45	<5	75	Dry	6	24
2-Jun-20	22	9	30	Dry	5	28
7-Sep-20	8	23	5	<5	<5	20
2-Dec-20	16	9	8	12.00	<5	8

ANNUAL SURFACE WATER MONITORING RESULTS

Sampled 16 March 2020

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC7	MCC8	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
pH	7.85	8.24	NO ACCESS	NO ACCESS	7.31	7.79	8.11	8.55	7.89	DRY	8.69	8.78
EC (*µS/cm*)	7010	5650			14000	6000	374	15000	921		2720	14700
TSS *(mg/L)*	8	15			5	14	45	<5	75		6	24
Hardness - total (calculation - *mg/L*)	3300	2690			3220	1610	136	8650	313		1330	5780
Alkalinity - Hydroxide *(mg $CaCO_3$/L)*	<1	<1			<1	<1	<1	<1	<1		<1	<1
Alkalinity - Carbonate *(mg $CaCO_3$/L)*	<1	<1			<1	<1	<1	44	<1		2	21
Alkalinity - Bicarbonate *(mg $CaCO_3$/L)*	260	80			447	296	123	251	103		100	82
Total Alkalinity - *(mg $CaCO_3$/L)*	260	80			447	296	123	295	103		102	104
Sulfates *(mg/L)*	3550	2970			2540	1230	39	8440	207		1630	7140
Chloride *(mg/L)*	720	544			3660	1200	14	1260	69		71	1390
Calcium *(mg/L)*	555	501			594	297	28	397	61		184	516
Magnesium *(mg/L)*	464	350			422	212	16	1860	39		212	1090
Sodium *(mg/L)*	622	483			2120	774	23	1510	64		133	1870
Potassium *(mg/L)*	41	29			10	5	5	63	15		10	33
Iron- filterable *(mg/L)*	<0.05	<0.05			0.09	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05
Arsenic *(mg/L)*	<0.001	0.001			0.003	0.005	0.002	0.004	0.003		<0.001	0.002
Barium *(mg/L)*	0.029	0.051			0.128	0.019	0.098	0.04	0.087		0.033	0.091
Cadmium *(mg/L)*	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001
Chromium *(mg/L)*	<0.001	<0.001			<0.001	<0.001	0.005	<0.001	0.001		0.001	<0.001
Copper *(mg/L)*	<0.001	<0.001			<0.001	<0.001	0.003	0.001	0.002		<0.001	<0.001
Nickel *(mg/L)*	0.009	0.007			0.004	0.001	0.007	0.016	0.007		0.007	0.002
Lead *(mg/L)*	<0.001	<0.001			<0.001	<0.001	0.002	<0.001	<0.001		<0.001	<0.001
Zinc *(mg/L)*	<0.005	<0.005			0.006	<0.005	<0.005	<0.005	<0.005		<0.005	<0.005

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC7	MCC8	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
Manganese *(mg/L)*	0.28	0.16			1.41	0.318	0.021	0.013	0.454		0.017	0.077
Selenium *(mg/L)*	<0.01	<0.01			<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Boron *(mg/L)*	0.63	0.36			0.13	0.12	0.08	0.76	0.07		0.12	0.12
Iron - total *(mg/L)*	0.42	0.09			0.92	0.33	4.16	<0.05	1.33		0.1	0.06
Mercury *(mg/L)*	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001
Fluoride *(mg/L)*	0.8	1			0.4	0.4	0.6	1	0.9		0.7	0.6
Nitrogen Ammonia *(mg N/L)*	1.97	<0.01			<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	0.02
Nitrite as N *(mg/L)*	0.07	<0.01			<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Nitrates *(mg N/L)*	0.45	<0.01			<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Nitrite + Nitrate as N *(mg/L)*	0.52	<0.01			<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Oil & Grease *(mg/L)*	<5	<5			<5	<5	<5	<5	<5		<5	<5
Total Anions *(meq/L)*	99.4	78.8			165	65.4	3.66	217	8.31		38	190
Total Cations *(meq/L)*	94	75.6			157	66.1	3.84	240	9.42		32.7	198
Ionic Balance *(meq/L)*	2.81	2.09			2.55	0.52	2.37	5.04	6.24		7.51	1.99
Naphthalene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Acenaphthylene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Acenaphthene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Fluorene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Phenanthrene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Anthracene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Fluoranthene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Pyrene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Benz(a)anthracene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Chrysene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Benzo(b+j)fluoranthene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC7	MCC8	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
Benzo(k)fluoranthene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Benzo(a)pyrene	<0.5	<0.5			<0.5	<0.5	<0.5	<0.6	<0.5		<0.5	<0.5
Indeno(1.2.3.cd)pyrene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Dibenz(a.h)anthracene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Benzo(g.h.i)perylene	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0
Sum of polycyclic aromatic hydrocarbons	<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
Benzo(a)pyrene TEQ (zero)	<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
Total Petroleum Hydrocarbons *(mg/L)*												
C6 - C9 Fraction	<20	<20			<20	<20	<20	<20	<20		<20	<20
C10 - C14 Fraction	<50	<50			<50	<50	<50	<50	<50		<50	<50
C15 - C28 Fraction	<100	<100			<100	<100	<100	<100	<100		<100	<100
C29 - C36 Fraction	<50	<50			<50	<50	<50	<50	<50		<50	<50
C10 - C36 Fraction (sum)	<50	<50			<50	<50	<50	<50	<50		<50	<50
C6 - C10 Fraction	<20	<20			<20	<20	<20	<20	<20		<20	<20
C6 - C10 Fraction minus BTEX (F1)	<20	<20			<20	<20	<20	<20	<20		<20	<20
>C10 - C16 Fraction	<100	<100			<100	<100	<100	<100	<100		<100	<100
>C16 - C34 Fraction	<100	<100			<100	<100	<100	<100	<100		<100	<100
>C34 - C40 Fraction	<100	<100			<100	<100	<100	<100	<100		<100	<100
>C10 - C40 Fraction (sum)	<100	<100			<100	<100	<100	<100	<100		<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	<100	<100			<100	<100	<100	<100	<100		<100	<100
Benzene *(µg/L)*	<1	<1			<1	<1	<1	<1	<1		<1	<1
Toluene *(µg/L)*	<2	<2			<2	<2	<2	<2	<2		<2	<2
Ethylbenzene *(µg/L)*	<2	<2			<2	<2	<2	<2	<2		<2	<2
meta- & para-Xylene (µg/L)	<2	<2			<2	<2	<2	<2	<2		<2	<2
ortho-Xylene *(µg/L)*	<2	<2			<2	<2	<2	<2	<2		<2	<2

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC7	MCC8	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
Total Xylenes *(µg/L)*	<2	<2			<2	<2	<2	<2	<2		<2	<2
Sum of BTEX *(µg/L)*	<1	<1			<1	<1	<1	<1	<1		<1	<1
Naphthalene *(µg/L)*	<5	<5			<5	<5	<5	<5	<5		<5	<5

GROUND WATER MONITORING RESULTS – MINING AREAS

DATE	Relative Level (mAHD)	pH	Electrical Conductivity (µS/cm)	Depth to Water (mbgl)		
BORE RDH650				RDH616	RDH617	RDH624
09-Jan-20	104.27	6.9	6290	57.21	47.72	35.86
04-Feb-20	104.66	7.0	6170	57.28	47.77	35.91
16-Mar-20	105.23	7.0	6960	55.9	47.4	35.97
02-Apr-20	105.35	7.0	6150	56.46	47.55	35.99
13-May-20	105.66	7.0	6080	55.98	47.48	36.04
02-Jun-20	105.74	7.1	6020	55.28	47.12	36.07
07-Jul-20	105.78	7.3	6350	55.27	47.1	36.06
04-Aug-20	106.10	7.5	5590	55.18	47.01	36.14
08-Sep-20	106.54	6.9	5860	55.06	46.85	36.14
06-Oct-20	106.58	7.1	6170	55.61	47.05	36.1
10-Nov-20	106.59	7.1	5790	55.54	46.11	36.19
02-Dec-20	106.51	6.8	5740	55.57	46.15	36.18
AVERAGE	**105.75**	**7.1**	**6,098**	**55.86**	**47.11**	**36.05**

ANNUAL GROUNDWATER MONITORING RESULTS – MINING AREAS
Sampled 16 March 2020

ANALYTE	RDH529
pH	7.03
EC (*µS/cm*)	6960
TSS *(mg/L)*	14
Total Hardness (calculation - *mg/L*)	3400
Alkalinity - Hydroxide (mg CaCO3/L)	<1
Alkalinity - Carbonate *(mg CaCO3/L)*	<1
Alkalinity - Bicarbonate *(mg CaCO3/L)*	358
Total Alkalinity - *(mg CaCO3/L)*	358
Sulfates (mg/L)	3450
Chloride *(mg/L)*	689
Calcium *(mg/L)*	585
Magnesium *(mg/L)*	471
Sodium *(mg/L)*	621
Potassium *(mg/L)*	42
Iron- filterable *(mg/L)*	8.23
Arsenic *(mg/L)*	<0.001
Barium *(mg/L)*	0.032
Cadmium *(mg/L)*	<0.0001
Chromium *(mg/L)*	<0.001
Copper *(mg/L)*	<0.001
Lead *(mg/L)*	<0.001
Manganese *(mg/L)*	1.2
Nickel *(mg/L)*	0.004
Selenium *(mg/L)*	<0.01
Zinc *(mg/L)*	0.065
Boron (*mg/L*)	0.65
Iron - total *(mg/L)*	8.15
Mercury *(mg/L)*	<0.0001
Fluoride *(mg/L)*	0.8
Nitrogen Ammonia *(mg N/L)*	4.04
Nitrite as N *(mg/L)*	<0.01
Nitrates *(mg N/L)*	<0.01
Nitrite + Nitrate as N *(mg/L)*	<0.01
Oil & Grease *(mg/L)*	<5
Total Anions *(meq/L)*	98.4
Total Cations *(meq/L)*	96
Ionic Balance *(meq/L)*	1.22
Naphthalene	<1.0
Acenaphthylene	<1.0
Acenaphthene	<1.0
Fluorene	<1.0
Phenanthrene	<1.0

ANALYTE	RDH529
Anthracene	<1.0
Fluoranthene	<1.0
Pyrene	<1.0
Benz(a)anthracene	<1.0
Chrysene	<1.0
Benzo(b+j)fluoranthene	<1.0
Benzo(k)fluoranthene	<1.0
Benzo(a)pyrene	<0.5
Indeno(1.2.3.cd)pyrene	<1.0
Dibenz(a.h)anthracene	<1.0
Benzo(g.h.i)perylene	<1.0
Sum of polycyclic aromatic hydrocarbons	<0.5
Benzo(a)pyrene TEQ (zero)	<0.5
C6 - C9 Fraction	<20
C10 - C14 Fraction	<50
C15 - C28 Fraction	<100
C29 - C36 Fraction	<50
C10 - C36 Fraction (sum)	<50
C6 - C10 Fraction	<20
C6 - C10 Fraction minus BTEX (F1)	<20
>C10 - C16 Fraction	<100
>C16 - C34 Fraction	<100
>C34 - C40 Fraction	<100
>C10 - C40 Fraction (sum)	<100
>C10 - C16 Fraction minus Naphthalene (F2)	<100
Benzene *(µg/L)*	<1
Toluene *(µg/L)*	<2
Ethylbenzene *(µg/L)*	<2
meta- & para-Xylene (µg/L)	<2
ortho-Xylene *(µg/L)*	<2
Total Xylenes *(µg/L)*	<2
Sum of BTEX *(µg/L)*	<1
Naphthalene *(µg/L)*	<5

GROUND WATER MONITORING RESULTS – SANDY CREEK

Date Sampled	MCC 1003			MCC 1005			MCC 1006			MCC 1017	MCC 1018
	Depth (mbgl)	pH	EC (µS/cm)	Depth (mbgl)	pH	EC (µS/cm)	Depth (mbgl)	pH	EC (µS/cm)	Depth (mbgl)	Depth (mbgl)
9-Jan-20	7.43	7.0	1447	9.38	6.8	4350	Dry			18.09	18.70
4-Feb-20	7.55	6.9	1461	9.27	6.9	4250				18.10	18.77
5-Mar-20	7.19	7.1	1420	9.32	6.9	4870				18.11	18.73
2-Apr-20	7.32	7.1	1427	9.42	7.0	4370				18.16	18.82
13-May-20	7.53	7.1	1422	9.29	7.1	4460				18.19	18.85
2-Jun-20	7.62	7.2	1428	9.32	7.1	4390				18.18	18.87
7-Jul-20	7.73	7.2	1464	9.28	7.1	4660				18.17	18.85
4-Aug-20	4.44	7.2	1140	No Access						18.09	18.81
8-Sep-20	3.71	7.4	1065	8.32	7.0	4300				18.05	19.13
6-Oct-20	4.21	7.2	1262	8.48	6.9	4210				18.11	19.14
10-Nov-20	2.62	7.4	1073	8.10	7.2	3350				18.13	19.13
2-Dec-20	3.48	7.2	1216	8.19	7.0	3330				18.16	19.15

ANNUAL GROUNDWATER MONITORING RESULTS – SANDY CREEK
Sampled 16 March 2020

ANALYTE	MCC1003	MCC1005	MCC1006
pH	7.08	6.93	
EC (*µS/cm*)	1420	4870	
TSS *(mg/L)*	42	7	
Hardness - total (calculation - *mg/L*)	394	1380	
Alkalinity - Hydroxide (mg CaCO3/L)	<1	<1	
Alkalinity - Carbonate *(mg $CaCO_3$/L)*	<1	<1	
Alkalinity - Bicarbonate *(mg $CaCO_3$/L)*	253	316	
Total Alkalinity - *(mg CaCO3/L)*	253	316	
Sulfates *(mg/L)*	141	215	
Chloride *(mg/L)*	334	1380	
Calcium - total *(mg/L)*	95	258	
Magnesium - total *(mg/L)*	38	178	
Sodium - total *(mg/L)*	156	444	
Potassium - total *(mg/L)*	2	4	
Iron- filterable *(mg/L)*	<0.05	<0.05	
Arsenic *(mg/L)*	<0.001	<0.001	
Barium *(mg/L)*	0.064	0.065	
Cadmium *(mg/L)*	<0.0001	<0.0001	
Chromium *(mg/L)*	<0.001	<0.001	
Copper *(mg/L)*	0.001	0.001	
Lead *(mg/L)*	0.002	<0.001	
Manganese - filterable *(mg/L)*	0.023	0.014	Dry
Nickel *(mg/L)*	<0.001	0.003	
Selenium *(mg/L)*	<0.01	<0.01	
Zinc *(mg/L)*	0.255	0.033	
Boron *(mg/L)*	0.11	0.08	
Iron - total *(mg/L)*	0.73	0.43	
Mercury *(mg/L)*	<0.0001	<0.0001	
Fluoride - total *(mg/L)*	0.3	0.2	
Ammonia *(mg/L)*	<0.01	<0.01	
Nitrite *(mg N/L)*	<0.01	<0.01	
Nitrate *(mg N/L)*	0.28	1.72	
Nitrite + Nitrate as N *(mg/L)*	0.28	1.72	
Total Anions *(meq/L)*	17.4	49.7	
Total Cations *(meq/L)*	14.7	46.9	
Ionic Balance *(meq/L)*	8.43	2.87	
Oil & Grease (mg/L)	<5	<5	
Naphthalene	<1.0	<1.0	
Acenaphthylene	<1.0	<1.0	
Acenaphthene	<1.0	<1.0	
Fluorene	<1.0	<1.0	
Phenanthrene	<1.0	<1.0	
Anthracene	<1.0	<1.0	

ANALYTE	MCC1003	MCC1005	MCC1006
Fluoranthene	<1.0	<1.0	
Pyrene	<1.0	<1.0	
Benz(a)anthracene	<1.0	<1.0	
Chrysene	<1.0	<1.0	
Benzo(b+j)fluoranthene	<1.0	<1.0	
Benzo(k)fluoranthene	<1.0	<1.0	
Benzo(a)pyrene	<0.5	<0.5	
Indeno(1.2.3.cd)pyrene	<1.0	<1.0	
Dibenz(a.h)anthracene	<1.0	<1.0	
Benzo(g.h.i)perylene	<1.0	<1.0	
Sum of polycyclic aromatic hydrocarbons	<0.5	<0.5	
Benzo(a)pyrene TEQ (zero)	<0.5	<0.5	
C6 - C9 Fraction	<20	<20	
C10 - C14 Fraction	<50	<50	
C15 - C28 Fraction	<100	<100	
C29 - C36 Fraction	<50	<50	
C10 - C36 Fraction (sum)	<50	<50	
C6 - C10 Fraction	<20	<20	
C6 - C10 Fraction minus BTEX (F1)	<20	<20	
>C10 - C16 Fraction	<100	<100	
>C16 - C34 Fraction	<100	<100	
>C34 - C40 Fraction	<100	<100	
>C10 - C40 Fraction (sum)	<100	<100	
>C10 - C16 Fraction minus Naphthalene (F2)	<100	<100	
Benzene *(µg/L)*	<1	<1	
Toluene *(µg/L)*	<2	<2	
Ethylbenzene *(µg/L)*	<2	<2	
meta- & para-Xylene (µg/L)	<2	<2	
ortho-Xylene *(µg/L)*	<2	<2	
Total Xylenes *(µg/L)*	<2	<2	
Sum of BTEX *(µg/L)*	<1	<1	
Naphthalene *(µg/L)*	<5	<5	

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Appendix 3: Blast Monitoring Data

BLAST MONITORING RESULTS

Date	Time	Queen Street (B1)		School (B2)		99 Queen Street (B3)		Nisbet (B4)	
		Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s
03-Jan-20	13:13	97.3	0.19	85.6	0.12	95.1	0.12	95.6	0.32
10-Jan-20	13:16	90.2	0.22	87.5	0.12	85.6	0.16	99.2	0.32
13-Jan-20	13:18	95.1	0.17	91.6	0.12	91.6	0.11	102.7	0.18
14-Jan-20	13:18	99.0	0.19	91.6	0.17	96.1	0.12	99.9	0.20
15-Jan-20	13:18	102.8	0.19	100.4	0.11	100.7	0.14	104.4	0.18
16-Jan-20	14:11	92.2	0.16	90.4	0.11	94.1	0.11	95.6	0.17
17-Jan-20	12:53	96.3	0.18	94.4	0.11	95.1	0.14	103.2	0.26
21-Jan-20	13:15	106.2	0.22	106.2	0.12	111.2	0.21	108.0	0.36
24-Jan-20	9:27	104.2	0.22	100.0	0.13	105.0	0.15	110.0	0.37
29-Jan-20	15:28	95.1	0.19	101.8	0.18	99.0	0.15	102.7	0.24
03-Feb-20	13:13	107.5	0.19	97.1	0.12	96.9	0.13	97.6	0.20
12-Feb-20	13:11	92.2	0.19	89.1	0.12	96.1	0.17	95.6	0.32
13-Feb-20	13:08	101.1	0.20	98.6	0.13	100.1	0.18	102.7	0.23
18-Feb-20	15:07	101.7	0.21	93.5	0.12	96.9	0.15	98.4	0.32
19-Feb-20	15:50	93.8	0.19	96.5	0.11	93.0	0.15	102.7	0.29
21-Feb-20	9:43	93.8	0.23	90.4	0.14	93.0	0.23	101.7	0.33
24-Feb-20	13:15	92.2	0.18	90.4	0.11	No Data	No Data	91.6	0.17
25-Feb-20	12:37	97.3	0.17	95.1	0.11	96.9	0.12	99.9	0.22
27-Feb-20	13:13	99.0	0.23	96.5	0.12	100.1	0.17	97.6	0.28
03-Mar-20	13:12	104.2	0.23	100.4	0.12	104.4	0.23	107.1	0.29
16-Mar-20	13:27	96.3	0.15	94.4	0.11	97.6	0.09	96.7	0.06
19-Mar-20	13:25	99.0	0.23	94.4	0.13	98.3	0.24	104.0	0.27
20-Mar-20	14:41	108.0	0.22	96.5	0.12	99.6	0.33	98.4	0.32
23-Mar-20	9:56	103.8	0.28	98.6	0.14	102.5	0.26	109.2	0.31
24-Mar-20	13:10	96.3	0.24	95.1	0.13	98.5	0.24	104.0	0.36
27-Mar-20	13:16	100.5	0.32	96.5	0.13	98.8	0.23	99.9	0.33
08-Apr-20	13:11	96.3	0.15	85.6	0.10	88.6	0.11	93.1	0.12
14-Apr-20	13:16	87.7	0.15	85.6	0.11	90.5	0.16	96.7	0.14

Date	Time	Queen Street (B1)		School (B2)		99 Queen Street (B3)		Nisbet (B4)	
		Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s
17-Apr-20	13:28	107.7	0.17	97.6	0.11	97.4	0.21	100.5	0.21
22-Apr-20	13:12	105.4	0.19	101.8	0.13	103.4	0.27	107.7	0.32
24-Apr-20	9:41	98.2	0.12	83.1	0.10	90.5	0.20	98.4	0.13
27-Apr-20	10:54	102.8	0.15	83.1	0.10	88.1	0.15	93.0	0.15
04-May-20	13:14	90.2	0.15	85.6	0.11	85.6	0.09	90.5	0.18
14-May-20	9:50	101.1	0.17	97.6	0.12	105.6	0.18	103.0	0.35
03-Jun-20	14:34	93.8	0.21	93.6	0.10	93.5	0.23	97.6	0.21
05-Jun-20	13:20	101.0	0.22	97.8	0.10	101.7	0.14	103.3	0.22
12-Jun-20	9:48	105.2	0.24	87.5	0.09	107.0	0.34	104.0	0.28
22-Jun-20	10:39	103.7	0.16	85.0	0.05	98.2	0.14	109.1	0.19
26-Jun-20	16:35	106.4	0.20	102.7	0.05	106.4	0.19	108.5	0.30
29-Jun-20	14:06	101.0	0.18	96.3	0.08	101.7	0.15	102.5	0.26
01-Jul-20	13:21	90.9	0.31	89.5	0.25	92.1	0.47	88.1	0.47
03-Jul-20	13:08	102.5	0.22	97.1	0.13	104.2	0.19	103.3	0.22
08-Jul-20	13:12	98.5	0.21	96.3	0.12	99.5	0.23	99.0	0.25
08-Jul-20	13:23	103.7	0.21	100.6	0.13	103.8	0.18	115.7	0.28
10-Jul-20	11:48	102.9	0.22	101.5	0.12	105.2	0.20	104.3	0.30
16-Jul-20	13:45	90.9	0.24	85.0	0.07	90.6	0.24	96.9	0.22
17-Jul-20	13:16	97.7	0.24	85.0	0.09	96.6	0.25	101.2	0.40
20-Jul-20	13:11	100.4	0.32	96.3	0.12	99.5	0.37	101.2	0.39
22-Jul-20	13:26	105.5	0.20	100.6	0.10	106.7	0.14	111.0	0.27
23-Jul-20	13:27	98.5	0.24	95.5	0.12	98.9	0.20	99.6	0.23
24-Jul-20	14:10	101.0	0.24	98.4	0.13	101.2	0.38	100.1	0.33
04-Aug-20	15:06	108.7	0.23	104.4	0.14	102.2	0.24	104.7	0.23
11-Aug-20	13:51	109.4	0.24	93.6	0.08	110.0	0.31	104.0	0.43
12-Aug-20	14:27	92.5	0.20	81.5	0.05	100.1	0.16	95.1	0.18
13-Aug-20	13:20	102.5	0.19	87.5	0.04	90.6	0.13	102.9	0.10
14-Aug-20	9:43	98.5	0.16	81.5	0.04	98.9	0.13	100.7	0.14
21-Aug-20	9:14	102.5	0.23	92.4	0.09	101.7	0.25	109.1	0.45

Date	Time	Queen Street (B1)		School (B2)		99 Queen Street (B3)		Nisbet (B4)	
		Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s
25-Aug-20	13:14	100.4	0.19	93.6	0.13	99.5	0.18	105.6	0.24
27-Aug-20	13:12	99.8	0.22	95.5	0.12	98.9	0.18	103.6	0.25
28-Aug-20	9:42	101.0	0.22	93.6	0.33	99.5	0.14	99.0	0.19
01-Sep-20	13:08	101.0	0.20	100.1	0.12	100.1	0.17	108.3	0.27
04-Sep-20	9:01	102.9	0.24	98.4	0.15	102.6	0.16	105.9	0.25
07-Sep-20	14:24	95.0	0.19	92.4	0.10	94.6	0.16	104.0	0.13
08-Sep-20	11:34	97.7	0.19	94.6	0.11	98.2	0.13	96.0	0.12
09-Sep-20	11:34	95.0	0.16	91.1	0.11	97.4	0.13	98.3	0.10
11-Sep-20	14:03	104.8	0.18	95.5	0.04	105.8	0.13	104.3	0.09
15-Sep-20	9:41	100.4	0.24	96.3	0.12	101.2	0.17	104.7	0.28
15-Sep-20	15:22	88.9	0.18	91.1	0.14	88.6	0.14	92.9	0.15
17-Sep-20	13:16	98.5	0.22	91.1	0.13	95.7	0.26	96.9	0.33
18-Sep-20	11:31	95.0	0.16	89.5	0.17	93.5	0.13	94.1	0.10
21-Sep-20	11:35	102.0	0.21	89.5	0.05	101.2	0.22	96.0	0.20
25-Sep-20	9:01	No Data	No Data	101.5	0.22	100.7	0.19	108.3	0.37
28-Sep-20	13:10	96.0	0.21	87.5	0.13	93.5	0.19	102.9	0.20
30-Sep-20	13:10	102.0	0.21	97.1	0.15	101.2	0.26	107.2	0.43
01-Oct-20	16:01	98.5	0.19	91.1	0.11	96.6	0.22	96.9	0.36
02-Oct-20	13:04	96.9	0.19	95.5	0.12	95.7	0.20	97.6	0.17
07-Oct-20	13:09	102.0	0.18	97.8	0.20	102.2	0.36	103.6	0.62
08-Oct-20	13:15	113.0	0.20	111.3	0.11	102.2	0.22	106.1	0.22
13-Oct-20	9:46	100.4	0.18	96.3	0.16	100.1	0.23	103.3	0.57
15-Oct-20	13:07	97.7	0.20	91.1	0.17	93.5	0.22	96.0	0.25
15-Oct-20	13:25	101.0	0.19	97.1	0.15	99.5	0.27	105.0	0.41
21-Oct-20	13:12	101.5	0.20	98.4	0.13	101.2	0.19	102.5	0.29
22-Oct-20	13:08	93.8	0.22	89.5	0.13	92.1	0.26	94.1	0.27
29-Oct-20	14:06	92.5	0.24	85.0	0.06	90.6	0.26	92.9	0.18
16-Nov-20	11:23	108.6	0.23	99.6	0.12	100.1	0.26	100.1	0.31
17-Nov-20	9:23	96.5	0.17	91.1	0.11	93.5	0.12	102.1	0.10

Date	Time	Queen Street (B1)		School (B2)		99 Queen Street (B3)		Nisbet (B4)	
		Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s
19-Nov-20	13:10	97.4	0.32	95.5	0.35	98.9	0.44	94.1	0.36
20-Nov-20	12:41	92.1	0.16	91.1	0.10	94.6	0.14	90.0	0.11
24-Nov-20	13:15	96.5	0.20	93.6	0.10	94.6	0.20	94.1	0.19
27-Nov-20	11:30	98.1	0.18	89.5	0.12	90.6	0.16	92.9	0.21
04-Dec-20	9:38	99.4	0.30	95.5	0.19	96.6	0.29	102.9	0.68
08-Dec-20	10:51	98.8	0.19	93.6	0.14	95.7	0.16	101.6	0.19
11-Dec-20	9:57	105.5	0.29	101.9	0.17	104.2	0.26	105.3	0.47
14-Dec-20	11:49	107.6	0.18	89.5	0.09	93.5	0.17	99.6	0.24
17-Dec-20	9:32	88.6	0.14	81.5	0.05	95.7	0.14	100.7	0.30
22-Dec-20	9:42	88.6	0.16	87.5	0.08	99.5	0.19	102.5	0.49

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Appendix 4: Complaints Summary

SUMMARY OF COMPLAINTS

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
15-Jan-20	10:45 PM	15-Jan-20	10:45 PM	Woodlands Ridge	NOISE	Direct call to MCC office - OCE responded	Noise - excavator and dozer	OCE on shift visited Woodlands Ridge to discuss complaint and used hand held noise monitor to register sound levels. Mining operations were then altered by changing dig sequence to face digger away from the affected area. Reinforced 1st gear operations, and returned to check noise at Woodlands Ridge. Observed it was audibly quieter.
09-Feb-20	6:05 PM	09-Feb-20	6:05 PM	Scone	ODOUR	Direct call to MCC office - OCE responded	Couldn't do gardening, issue with odour	OCE on shift explained factors indicating the odour experienced by the resident was unlikely to originate from MCC operations. The gas monitors site did not indicate levels of SO2 and H2S gases were elevated.
05-Mar-20	9:52 PM	05-Mar-20	9:52 PM	McCully's Gap	NOISE	Environmental Hotline - OCE responded	Dozer noise in background	Operational activities were minimal during this time due to wet weather. Weather at the time consisted of winds of 0.6m/s swinging from the south east to south west and a stability class of F. Other operational activities at the time of the complaint included a digger, two dump trucks, and a dozer in Strip 22 east moving waste to the Open Cut 1 dump, one dozer on the Open Cut 1 dump. Two dozers on the eastern rehabilitation area were being relocated to Open Cut 1 to commence wet weather road recovery during the time when the complaint was received. Complainant was called at 10.30 pm and a message was left. No call back was received from the complainant. OCE undertook a review of operations following the call

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
26-Mar-20	6:57 PM	26-Mar-20	Unknown	Scone	ODOUR	Direct call to MCC office - OCE responded	Odour complaint	Spontaneous combustion management was ongoing. Other mining operations occurring during time of complaint included two dozers and two graders conducting road recovery following rainfall event. Complainant did not require a follow up call.
13-Apr-20	7:58 AM	13-Apr-20	7:58 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded	Odour Complaint	OCE discussed odour management with the complainant, who appreciated what was being done onsite to control odour. OCE conducted an odour observation in the surrounding area, noting the spontaneous combustion odour was not detectable. Weather conditions were cool and calm.
No complaints received during May 2020.								
No complaints received during June 2020.								
17-Jul-20	10:34 PM	17-Jul-20	10:34 PM	McCully's Gap	NOISE	Text message sent to the OCE - OCE responded	Noise Complaint	OCE on shift reviewed operations in response to the complaint including reviewing noise levels. It was determined that no changes were required to be made to the mining operations. The OCE reinforced the controls to minimise noise, such as use of the silent horn and operating dozers in first gear only, with the crew. The Environmental Superintendent left a message for the complainant regarding the complaint.
09-Aug-20	1:55 PM	09-Aug-20	1:55 PM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded.	Smell	Mining had been taking place through a hot area in OC1. Water carts were assisting with managing the heat. Odour observations at 7am did not detect any odour near the complainant's residence. No gas data is available due to a fault with the monitor. Attempts to contact the complainant have been unsuccessful.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
10-Aug-20	10:23 AM	10-Aug-20	10:23 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded.	Sulphur smell	Mining had stopped due to heavy rain. Steam was coming off the hot areas in OC1. Odour observations at 7am and 11am did not detect any odour near the complainant's residence. No gas data is available due to a fault with the monitor. The OCE spoke with the complainant with no additional comments related to the complaint made.
19-Aug-20	4:40 PM	19-Aug-20	4:40 PM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded.	Sulphur smell	Mining operations were occurring in OC1 with water carts assisting to manage the heat. Gas levels at the local monitor were <10ppb. Attempts to contact the complainant have been unsuccessful.
28-Aug-20	7:21 PM	28-Aug-20	All day	N. Muswellbrook	DUST	Environmental Hotline - OCE responded.	Dust problem	Complainant was concerned about dust covering their car that day. OCE and Env Super discussed the complainant's concerns with them. The wind was blowing from the SW-NW during the day indicating that the dust did not blow from the direction of MCC.
29-Aug-20	9:05 AM	29-Aug-20	9:05 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded.	Sulphur smell and smoke haze	Mining operations were occurring in OC1. Odour observations conducted at 7am and following the complaint did not detect any odour near the complainant's residence. It was noted there a general mist in the area (upwind and downwind of MCC). Gas levels at the local monitor were <10ppb. The Step-Up OCE discussed the complainant's concerns with them in person.
30-Aug-20	9:13 AM	30-Aug-20	9:13 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded.	Sulphur smell and smoke haze	Mining operations were occurring in OC1. Odour observations conducted at 7am did not detect any odour near the complainant's residence. No gas data is available due to a fault with the monitor. Attempts to contact the complainant have been unsuccessful.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
01-Sep-20	6:03 PM	01-Sep-20	1:08 PM	Aberdeen	BLAST	Email from the EPA	Dust from Blast	Blast in S23 at 1.08 pm. The complainant commented they were from Aberdeen and they noticed a cloud of dust as they drove past. The review of the blast recording indicates the dust cloud dispersed before leaving site. A response was provided to the EPA.
12-Sep-20	7:40 AM	12-Sep-20	7:40 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded.	Spontaneous Combustion odour and visual amenity	Mining operations were occurring in OC1 and spontaneous combustion management was ongoing. Odour observations conducted at 7.20 am did not detect any odour near the complainant's residence and wind was not blowing towards the complainant's house. No gas data was available at the time of the complaint due to the monitor being offline. Gas results before 1.30am and after 9.30am were all zero. Attempt to contact the complainant was unsuccessful.
05-Oct-20	8:18 PM	05-Oct-20	8:18 PM	Woodlands Ridge	DUST	Environmental Hotline - OCE responded.	Dust coming from mine	The OCE inspected the pit in response to the complaint and observed dust being generated from hot material being uncovered in S22. Two water carts were running, and the water infusion spray was operating in S22, at the time of the complaint. The OCE stopped mining operations in S22 and waited for infusion sprays to cool the area before continuing. The OCE called the complainant back to explain what measures had been taken.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
15-Oct-20	7:45 AM	15-Oct-20	7:45 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded.	Sulphur smell	The ES performed odour observations on Muscle Creek Road approximately 15min after complaint was received but could not detect any sulphur odour. The gas monitor in the vicinity did not detect any sulphur dioxide (<10 ppb) and recorded 10 ppb hydrogen sulphide for 10 minutes at 7:24am. The ES called the complainant back to discuss the odour complaint. The complainant was not satisfied with the explanation and subsequently spoke to the GM regarding the issue.
05-Nov-20	5:15 PM	05-Nov-20	5:15 PM	Scone	ODOUR	MCC Workshop Phone	Strong Odour	Complainant called MCC about a strong odour and explained they weren't satisfied with MCC's response. No operations were occurring at the time of the complaint due to wet weather. The OCE inspected the mine area. No further action was taken.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
11-Nov-20	7:58 AM	11-Nov-20	7:58 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded	Sulphur smell	Complainant called MCC about a strong odour. The EO performed odour observations on Muscle Creek Road approximately 10 minutes after the complaint was received and noted a smell of smoke. The gas monitor in the vicinity did not detect any sulphur dioxide (<10 ppb) and recorded 10 ppb hydrogen sulphide for 10 minutes at 7:24am. Conditions were foggy at the time of the complaint. A dozer on the ROM was sealing and containing hot coal from night shift when the complaint was received. The OCE inspected the mine area. Water sprays and water carts were conducting spontaneous combustion management. A water cart was sent to cool the hot coal on the ROM. The ES called the complainant back and left a message.
13-Dec-20	9:46 PM	13-Dec-20	9:46 PM	Scone	ODOUR	Environmental Hotline - OCE responded	Sulphur smell	Complainant called MCC about a sulphur smell. No coal mining was occurring at the time of the complaint. Coal was being processed and stockpiled at the CHPP at the time of the complaint. The OCE inspected mine areas. No further action was taken.