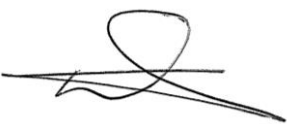




MOUNT PLEASANT OPERATION

2019 ANNUAL REVIEW & ANNUAL REHABILITATION REPORT

Document ID:	20200120		
Company:	MACH Energy Australia Pty Ltd		
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Approved By:	Richard Bailey	Revision Number:	00

MOUNT PLEASANT OPERATION 2019 ANNUAL REVIEW	
Name of Operation	Mount Pleasant Operation
Name of Operator	MACH Energy Australia Pty Ltd
Development Consent	Development Consent DA 92/97
Name of Holder of Development Consent	MACH Energy Australia Pty Ltd
Mining Leases	Mining Lease 1645, Mining Lease 1708, Mining Lease 1709, Mining Lease 1750 and Mining Lease 1713
Name of Holder of Mining Leases	MACH Energy Australia Pty Ltd J.C.D Australia Pty Ltd
Water Licences	Water Access Licences – see Table 3 Bore Licence Certificate 20BL168734
Name of Holder of Water Licences	MACH Energy Australia Pty Ltd
MOP Start Date	30 June 2019
MOP End Date	30 June 2020
Annual Review Start Date	1 January 2019
Annual Review End Date	31 December 2019
<p>I, Richard Bailey, certify that this audit report is a true and accurate record of the compliance status of the Mount Pleasant Operation for the period 1 January to 31 December 2019 and that I am authorised to make this statement on behalf of MACH Energy Australia Pty Ltd.</p> <p>Note.</p> <p>a) <i>The Annual Review is an ‘environmental audit’ for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</i></p> <p>b) <i>The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).</i></p>	
Name of Authorised Reporting Officer	Richard Bailey
Title of Authorised Reporting Officer	General Manager Operations
Signature of Authorised Reporting Officer	
Date	31 March 2020

STATEMENT OF COMPLIANCE

The compliance status of the Mount Pleasant Operation with its relevant approval conditions at the end of the reporting period (31 December 2019) is provided in Table SoC-1.

Table SoC-1
Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Development Consent DA 92/97	Yes
EPBC 2011/5795	Yes
Environment Protection Licence 20850	No
Authorisation 459	Yes
Mining Lease 1645	Yes
Mining Lease 1708	Yes
Mining Lease 1709	Yes
Mining Lease 1713	Yes
Mining Lease 1750	Yes
Water licences (as per Table 3)	Yes
Bore Licence Certificate 20BL168734	Yes

Table SoC-2 summarises the non-compliances with the approval conditions. Non-compliances are characterised as shown in Table SoC-3.

Table SoC-2
Summary of Non-Compliances

Relevant Approval	Condition Number	Condition Description	Compliance Status	Comment	Report Section
EPL 20850	Condition M2.2	Licensee must comply with the air monitoring requirements.	NC	See Table 24	10.2
EPL 20850	Condition O3.6	Licensee must comply with the timing requirements upon a shutdown of dust generating activities.	NC	See Table 24	10.2

Table SoC-3
Compliance Status Key for Table SoC-2 – Non-Compliances

Risk Level	Colour Code	Comment
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence.
Medium	Non-compliant	Non-compliance with: <ul style="list-style-type: none"> potential for serious environmental consequences, but is unlikely to occur; or potential for moderate environmental consequences, but is likely to occur.
Low	Non-compliant	Non-compliance with: <ul style="list-style-type: none"> potential for moderate environmental consequences, but is unlikely to occur; or potential for low environmental consequences, but is likely to occur.
Administrative Non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions).

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1 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), north-west of Muswellbrook and approximately 50 kilometres (km) north-west of Singleton (Figure 1). The villages of Aberdeen and Kayuga are located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively. The proponent of the MPO is MACH Energy Australia Pty Ltd (MACH Energy).

The initial development application for the MPO was made in 1997. This was supported by an Environmental Impact Statement (EIS) prepared by Environmental Resources Management Mitchell McCotter (ERM Mitchell McCotter) (ERM Mitchell McCotter, 1997). On 22 December 1999, the then Minister for Urban Affairs and Planning granted Development Consent DA 92/97 to Coal & Allied Operations Pty Ltd (Coal & Allied). This allowed for the “Construction and operation of an open cut coal mine, coal preparation plant, transport and rail loading facilities and associated facilities” at the MPO. The consent allowed for operation 24 hours per day, seven days per week and the extraction of 197 million tonnes (Mt) of run-of-mine (ROM) coal over a 21 year period, at a rate of up to 10.5 Mt of ROM coal per year.

The MPO Modification 1 (MOD 1) was submitted for approval on 19 May 2010. MOD 1 included the provision of an infrastructure envelope for siting the mine infrastructure, the provision of an optional conveyor/service corridor linking the MPO facilities with the Muswellbrook-Ulan Rail Line and modification of the existing Development Consent DA 92/97 boundaries to accommodate the optional conveyor/service corridor and minor administrative changes. MOD 1 was approved on 19 September 2011.

The MPO South Pit Haul Road Modification (MOD 2) was submitted for approval on 30 January 2017 with a supporting Environmental Assessment (EA) prepared by MACH Energy (MACH Energy, 2017a). MOD 2 proposed to realign an indicative internal haul road to enable more efficient access to the South Pit open cut. MOD 2 was approved on 29 March 2017.

The MPO Mine Optimisation Modification (MOD 3) was submitted on 31 May 2017. MOD 3 comprised an extension to the time limit on mining operations (to 22 December 2026) and extensions to the South Pit Eastern Out of Pit Emplacement to facilitate development of an improved final landform. MOD 3 was approved on 24 August 2018.

The MPO Rail Modification (MOD 4) was submitted on 18 December 2017. MOD 4 proposed the following changes:

- duplication of the approved rail spur, rail loop, conveyor and rail load-out facility and associated services;
- duplication of the Hunter River water supply pump station, water pipeline and associated electricity supply that followed the original rail spur alignment; and
- demolition and removal of the redundant approved infrastructure within the extent of the Bengalla Mine, once the new rail, product loading and water supply infrastructure has been commissioned and is fully operational.

MOD 4 was approved on 16 November 2018. Appendix 2 of the modified Development Consent DA 92/97 illustrates the Conceptual Project Layout Plan of the approved MPO at 2021 and 2025, Approved Surface Disturbance Plan and Conceptual Final Landform incorporating the MOD 4 infrastructure relocations (Development Consent DA 92/97 Attachment 1).

Figure 2 shows the general arrangement of the MPO, as well as the extent of disturbance and rehabilitation at the end of 2019 and the forecasted additional disturbance proposed in 2020.

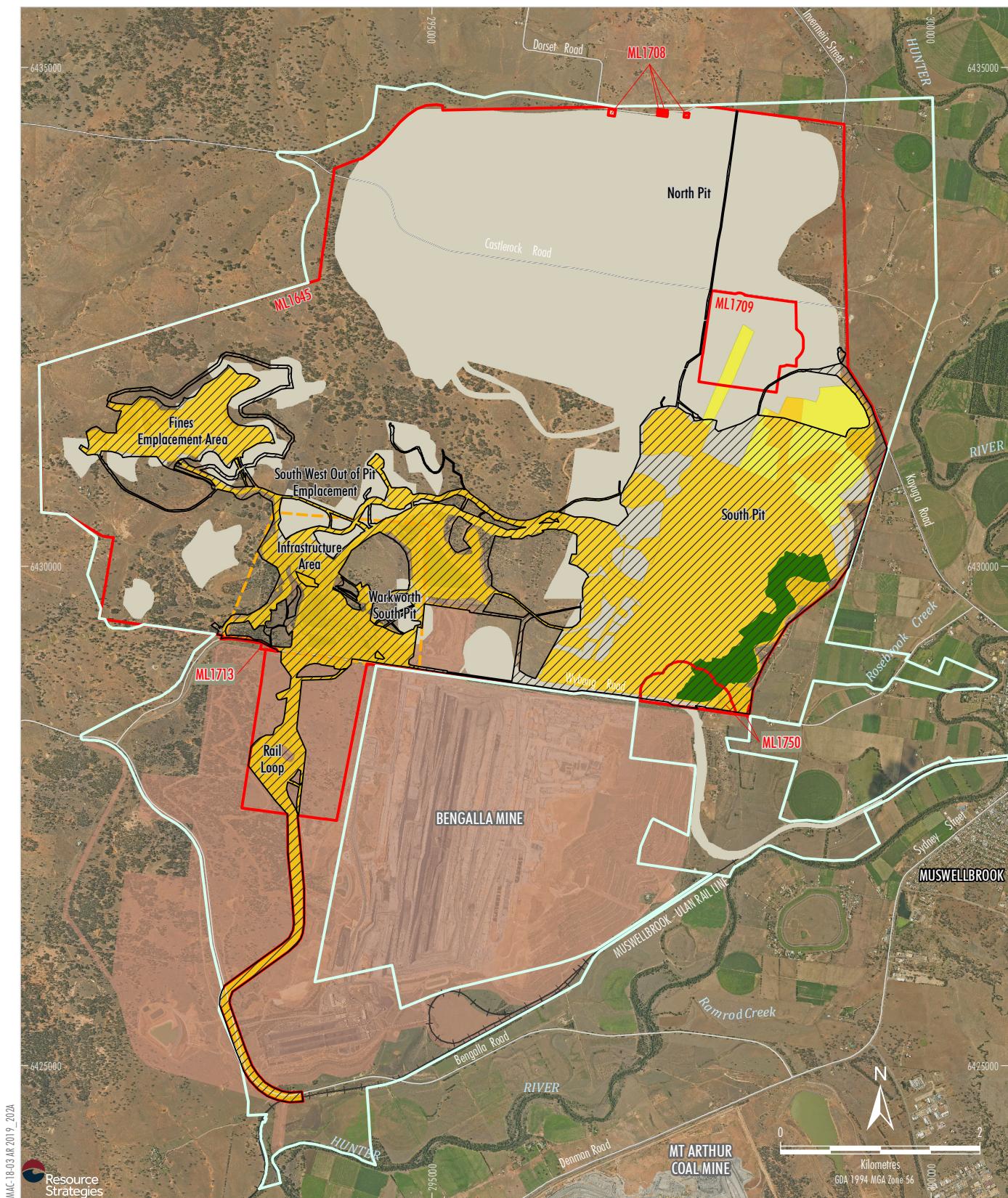


MAC18-03 AR 2019_201A



MACHEnergy
MOUNT PLEASANT OPTIMISATION PROJECT
Project Location

Figure 1



MAC-18-03 AR 2019_202A

Resource
Strategies

- LEGEND**
- Mining Lease Boundary
 - Development Consent Boundary
 - Approximate Extent of Approved Surface Development ¹
 - Infrastructure Area Envelope
 - MOP Footprint ⁺
 - End 2019 Active Disturbance Area
 - End 2019 Rehabilitation Area
 - 2020 Forecast Additional Disturbance Area
 - Bengalla Mine Approved Disturbance Boundary (SSD-5170)

NOTE

1. Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, offsite coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, signalling, other ancillary works and construction disturbance.
⁺ Mount Pleasant Operation Mining Operations Plan and Rehabilitation Management Plan (July 2019)

Source: MACH Energy (2020); NSW Spatial Services (2019);
 Department of Planning and Environment (2016)
 Orthophoto: MACH Energy (Jan 2020)

MACHEnergy
 MOUNT PLEASANT OPERATION
 2019 Mining Activities

Figure 2

1.1 PURPOSE AND SCOPE

This Annual Review details MACH Energy's environmental and community performance for the reporting period 1 January 2019 to 31 December 2019. This Annual Review has been prepared in accordance with the Department of Planning, Industry and Environment (DPIE) *Post-approval requirements for State significant mining developments - Annual Review Guideline – October 2015* (DPIE, 2015a) and MACH Energy's statutory approvals (Section 2), specifically Condition 3, Schedule 5 of Development Consent DA 92/97 and Condition 3(f) of Mining Leases (MLs) 1645, 1708, 1709, 1713 and 1750.

This Annual Review is not intended to be an exhaustive description of MACH Energy's operations, approvals and activities, rather it is a summary of MACH Energy's compliance status with respect to MACH Energy's statutory approvals.

In March 2017, the Secretary of the DPIE revised the submission timing of the MPO Annual Review to the end of March each year.

This Annual Review is distributed to a range of stakeholders including government authorities, Muswellbrook Shire Council and members of the Community Consultative Committee (CCC). A copy of the Annual Review will be made publicly available on the MACH Energy website (<https://machenergyaustralia.com.au/mount-pleasant/documentation/>).

1.2 KEY PERSONNEL

Contact details for key MACH Energy personnel responsible for the environmental and community management of the MPO are provided in Table 1.

Table 1
Key Personnel

Position	Contact	Phone Number
General Manager - Operations	Richard Bailey	0417 412 962
General Manager - Resource Development	Chris Lauritzen	0438 985 197
Environmental Superintendent	Andrew Reid	0411 440 912
Land and Property Superintendent	Ian Webber	0428 162 856
External Relations Manager	Ngaire Baker	0400 214 885

2 APPROVALS

The MPO operates under a number of statutory approvals, leases and licences that regulate activities at the MPO (Tables 2 and 3).

Table 2
Consent, Lease and Licence Details

Consent/Lease/Licence	Authority	Grant/Renewal	Expiry Date
Development Consent DA 92/97 ¹	DPIE	22/12/1999	-
EPBC Approval 2011/5795	DoEE	29/02/2012	28/10/2035
Environment Protection Licence (EPL) 20850	EPA	24/11/2016	-
Authorisation 459	DRG	07/04/1992	08/04/2018 ²
ML 1645	DRG	17/12/2010	17/12/2031
ML 1708	DRG	02/02/2015	02/02/2036
ML 1709	DRG	02/02/2015	02/02/2036
ML 1713	DRG	02/02/2015	02/02/2036
ML 1750	DRG	03/03/2017	03/03/2038
Bore Licence Certificate 20BL168734	DoI - L&W	13/03/2003	Perpetuity

Note:

EPBC = *Environment Protection and Biodiversity Conservation Act 1999*,

DoEE = Commonwealth Department of the Environment and Energy,

EPL = Environment Protection Licence, ML = Mining Lease, EPA = NSW Environment Protection Authority,

DRG = Division of Resources and Geoscience (under DPE), and DoI - L&W = NSW Department of Industry – Lands & Water.

¹ Development Consent DA 92/97 has been modified four times since the original approval was granted in 1999. Approval for MOD 1 was granted on 19 September 2011, approval for MOD 2 was granted on 29 March 2017, approval for MOD 3 was granted on 24 August 2018 and approval for MOD 4 was granted on 16 November 2018.

² A renewal request has been submitted and is currently awaiting approval. The existing approval will continue until the renewal is approved.

During the next reporting period, MACH Energy will continue to manage its existing WALs and acquire new licences, as required.

Table 3
MACH Energy Water Access Licences (WALs) (Water Management Act 2000)

Water Sharing Plan	Water Source	Licence Number	Entitlement (Unit)
<i>Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009</i>	Hunter Regulated River Alluvial Water Source	18253	74
		18266	68
		18206	24
		18199	5
		18122	33
		18131	60
		21503	21
	Muswellbrook Water Source	23935	41
	Sydney Basin – North Coast Groundwater Source	41437	40
		40298	90
	Krui River Water Source	18336	12
	Hunter Regulated River Water Source	879	224
		880	124
		1113	366
		973	3
		974	210
		975	8
		988	156
		989	8
		1307	37.5
		1229	480
		1230	8
		1259	33.2
		1227	99
		1258	5
		992	75
		7808	36
		702	267
		1260	4.8
		993	265
		1308	15.1
		604	183
		605	8
		677	24
		1338	17.5
		662	275
		663	16
		10775	243
		41438	420

2.1 MANAGEMENT PLANS

Development Consent DA 92/97 requires MACH Energy to submit management plans and strategies prior to carrying out any development on-site. The currently approved MPO management plans are summarised in Table 4.

Table 4
Approved Management Plans

Plan	Relevant Development Consent DA 92/97 Condition	Approval Date
Mining Operations Plan and Rehabilitation Management Plan (MOP) (1 July 2019 – 30 June 2020) ¹	Schedule 3, Condition 56	28 June 2019
Noise Management Plan (NMP)	Schedule 3, Condition 9	31 October 2019
Air Quality and Greenhouse Gas Management Plan (AQGGMP)	Schedule 3, Condition 23	24 May 2019
Aboriginal Heritage Management Plan (AHMP)	Schedule 3, Condition 36	31 October 2019
Water Management Plan (WMP)	Schedule 3, Condition 28	31 October 2019
Blast Management Plan (BMP)	Schedule 3, Condition 17	14 January 2019
Visual Impact Management Plan (VIMP) (previously the Landscape Management Plan)	Schedule 3, Condition 47	31 October 2019
Waste Management Plan (WasteMP)	Schedule 3, Condition 52	14 January 2019
Rehabilitation Strategy	Schedule 3, Condition 54	15 May 2019
Biodiversity Management Plan	Schedule 3, Condition 32	31 October 2019
Environmental Management Strategy	Schedule 5, Condition 1	14 January 2019

¹ The approved MOP meets the requirements for a Rehabilitation Management Plan (RMP) (Condition 56, Schedule 3 of Development Consent [DA 92/97]).

A summary of updates approved for the listed management plans during the reporting period is provided below:

- the MPO Rail Modification (MOD 4) was approved on 16 November 2018 which, in accordance with Condition 4, Schedule 5 of Development Consent DA 92/97, prompted a review and update of all management plans included in Table 4;
- the MOP was updated to include contemporary information on the MPO's current mine planning, including construction, mine development, topsoil management and rehabilitation. The MOP term was updated to 1 July 2019 to 30 June 2020.

In accordance with Condition 4, Schedule 5 of Development Consent DA 92/97, MACH Energy will review, and if necessary, revise, the strategies, plans and programs required under the consent within three months of the submission of this Annual Review, to the satisfaction of the Secretary of the DPIE.

3 OPERATIONS SUMMARY

3.1 MINING OPERATIONS

MACH Energy commenced substantial works at the MPO on 25 November 2016. During 2019, MACH Energy completed the following construction activities on site, including:

- continued development of the Mine Infrastructure Area (MIA) buildings, including expanding a section of the office building;
- construction completion of the Mine Water Dam (MWD), ED2, ED3 and Fines Emplacement Area;
- construction completion and commissioning of the Coal Handling and Preparation Plant (CHPP) including:
 - Dense Medium Separation (DMS) Module 1 and DMS Module 2;
 - wash modules; and
 - Coarse and Fine reject systems.

Mining activities that occurred during the reporting period included:

- ramp-up to 24/7 mining operations;
- steady-state coal extraction from both Pit A and Pit D;
- commencement of coal extraction from Pit B/C;
- completion of associated dams and drains; and
- progressive rehabilitation to final landform profiles.

All buildings constructed on-site were constructed in accordance with the Building Code of Australia (BCA) and the Subsidence Advisory NSW (SANSW).

During the reporting period, a total of 5.97Mt of ROM coal was produced.

A number of mine-owned dwellings along Collins Lane within Noise Assessment Group (NAG) 7 were vacated in the reporting period and most of these were demolished. All demolition was carried out in accordance with Australian Standard (AS) 2601-2001: *The Demolition of Structures*.

The amounts of waste rock, overburden, ROM coal, coarse reject, fine reject and product coal produced during the previous reporting period, current reporting period and forecast for the next reporting period, are outlined in Table 5.

Table 5
Production Summary

Material	Approved Limit	2018 Reporting Period (Actual)	2019 Reporting Period (Actual)	2020 Reporting Period (Forecast)
Waste Rock/Overburden (Mbcm)	N/A	8.78	18.49	23.31
ROM Coal (Mt)	10.5 Mt per calendar year ¹	0.15	5.97	10.4
Coarse Reject (Mt)	N/A	0	0.09	2.83
Fine Rejects (Mt)	N/A	0	0.04	0.18
Saleable Product (Mt)	N/A	0.03	5.61	7.39

Note:

Mbcm = million bank cubic metres, N/A = not applicable and Mt = million tonnes.

¹ Condition 6, Schedule 2 of Development Consent DA 92/97 relevantly states:

The Applicant must not extract more than 10.5 million tonnes of ROM coal from the site in a calendar year.

3.2 OTHER OPERATIONS

Other relevant operational conditions outlined in Development Consent DA 92/97 and their corresponding compliance status during the reporting period are outlined in Table 6.

Table 6
Other Operational Conditions Met

Operational Condition from Development Consent DA 92/97		Condition Met?	Comment
Limits on Consent (Condition 5, Schedule 2)	5. <i>The Applicant may carry out mining operations on the site until 22 December 2026.</i> <i><u>Note: Under this consent, the Applicant is required to rehabilitate the site and carry out additional undertakings to the satisfaction of both the Secretary and DRG. Consequently this consent will continue to apply in all other respects - other than the right to conduct mining operations - until the rehabilitation of the site and these additional undertakings have been carried out satisfactorily.</u></i>	Yes	-
Coal Extraction (Condition 6, Schedule 2)	6. <i>The Applicant must not extract more than 10.5 million tonnes of ROM coal from the site in a calendar year.</i>	Yes	ROM coal extraction did not exceed 10.5 Mt during 2019.
Coal Transport (Condition 7, Schedule 2)	7. <i>Product coal may only be transported from the site by rail.</i>	Yes	Product coal was transported from the site by rail only.
Train Movement (Condition 8, Schedule 2)	8. <i>The Applicant must ensure that train movements at the site (ie arrival or dispatch) do not exceed:</i> <i>(a) a maximum of 18 per day; or</i> <i>(b) 6 per day, averaged over each calendar year.</i> <i>Note: In this condition, "day" means any 24-hour period.</i>	Yes	Train movements at the site did not exceed 18 movements in one day, or six movements on average per day.

Table 6 (Continued)
Other Operational Conditions Met

Operational Condition from Development Consent DA 92/97	Condition Met?	Comment
Structural Adequacy (Condition 9, Schedule 2)	<p>9. All new buildings and structures, and any alterations or additions to existing buildings and structures, that are part of the development, must be constructed in accordance with:</p> <p>(a) the relevant requirements of the BCA; and</p> <p>(b) any additional requirements of SA NSW where the building or structure is located on land within a declared Mine Subsidence District.</p> <p><u>Notes:</u></p> <ul style="list-style-type: none"> • <u>Under Part 6 of the EP&A Act, the Applicant is required to obtain construction and occupation certificates for the proposed building works;</u> • <u>Part 8 of the EP&A Regulation sets out the requirements for the certification of the development;</u> • <u>The development is located in the Muswellbrook Mine Subsidence District. Under Section 21 of the Mine Subsidence Compensation Act 2017, the Applicant is required to obtain the Chief Executive of SA NSW's approval before carrying out certain development in a Mine Subsidence District.</u> 	<p>Yes</p> <p>All buildings constructed during the reporting period were constructed in accordance with the BCA and the SANSW.</p>
Demolition (Condition 10, Schedule 2)	<p>10. The Applicant must ensure that all demolition work on site is carried out in accordance with AS 2601-2001: The Demolition of Structures, or its latest version.</p>	<p>Yes</p> <p>Demolition work was carried out in accordance with AS 2601-2001.</p>
Protection of Public Infrastructure (Condition 11, Schedule 2)	<p>11. Unless the Applicant and the applicable authority agree otherwise, the Applicant must:</p> <p>(a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and</p> <p>(b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development,</p> <p><u>Note: This condition does not include matters that are expressly provided for in the conditions of this consent, such as the maintenance of public roads.</u></p>	<p>Yes</p> <p>During the reporting period, mine affected properties were vacated and their electricity was disconnected. This included removal of associated power poles and wires services.</p> <p>MACH Energy incurred the full costs of these removals.</p>
Operation of Plant and Equipment (Condition 12, Schedule 2)	<p>12. The Applicant must ensure that all plant and equipment used on site, or to transport coal from the site, is:</p> <p>(a) maintained in a proper and efficient condition; and</p> <p>(b) operated in a proper and efficient manner.</p>	<p>Yes</p> <p>All plant and equipment in use at the MPO is regularly serviced in accordance with the relevant Industry & Investment NSW Mining Design Guidelines, to ensure plant and equipment is maintained in suitable condition. All plant and equipment are operated in a proper and efficient manner.</p>

3.3 ACTIVITIES FORECAST FOR THE NEXT REPORTING PERIOD

The following construction activities are forecast to be undertaken during the 2020 reporting period:

- finalisation of permanent Flocculant and Magnetite system;
- relocation of the 66-kilovolt (kV) powerline;
- commencement of Rail Loop, Train Load-Out and Hunter River Pump Station relocation; and
- progressive rehabilitation of temporary construction areas and mining areas.

The following mining-related activities are forecast to be undertaken during the 2020 reporting period:

- continuation of steady-state coal extraction within Pits A, B, C and D;
- continued mine development into Pits E and F;
- ongoing modifications and upgrades to the CHPP;
- completion of associated dams and drains to manage sediment control and water infrastructure in the new pits; and
- progressive rehabilitation to final landform profiles.

Further information regarding proposed construction and mining activities in 2020 is provided in the approved MOP/RMP.

4 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

A reconciliation of the actions required by the DPIE, the previous Annual Review and actions taken in response by MACH Energy during the reporting period are outlined in Table 7.

Table 7
Actions Required by the DPIE and 2018 Annual Review

Action	Requested by	Action Taken by Operator	Section Reference
<i>Clearly specify the reporting period for the Site Water Balance (i.e. water reporting period or Annual Review Period)</i>	DPIE	The reporting period for the Site Water Balance are specified in the section within this Annual Review.	Section 6.5
<i>Provide a comparison of the reported Site Water Balance with the previous reporting period and relevant predictions in the Environmental Impact Statement (EIS) and Environmental Assessments (EAs)</i>	DPIE	The comparison has been added to the Site Water Balance section within this Annual Review.	Section 6.5
<i>Provide a status update for the incomplete action from the 2017 Independent External Audit</i>	DPIE	Status update for the incomplete actions from the 2017 Independent External Audit is provided in the Independent Environmental Audit section within this Annual Review.	Section 9
<i>Include a summary of any official cautions or warning letters, penalty notices or prosecution proceedings by any regulatory agency, as per Section 11 of the Annual Review Guideline</i>	DPIE	A summary of an official caution received from the EPA is provided in the non-compliances section within this Annual Review.	Section 10.2

5 ENVIRONMENTAL PERFORMANCE

5.1 METEOROLOGY

Meteorological monitoring was undertaken during the reporting period at the mine meteorological station along Kayuga Road (M-WS4) and Wybong Road (M-WM2) (Figure 3). Data collected included 10 minute, hourly and 24 hourly wind speed, wind direction, sigma, temperature, humidity, solar radiation and rainfall measurements. Data collected during the reporting period has been summarised for rainfall, temperature and wind in the following subsections. M-WS4 has been utilised for this summary as the original meteorological station at the MPO.

5.1.1 RAINFALL

During the reporting period, 357.1 millimetres (mm) of rain was recorded over 29 wet days at the MPO weather station M-WS4. The highest daily rainfall was 83.3 mm on 30 March 2019.

There was a slight reduction in the cumulative rainfall and the number of wet days for the reporting period in comparison to the 2018 reporting period (372.0 and 37 days, respectively).

The monthly rainfall distribution, number of wet days and cumulative rainfall is summarised in Table 8. Monthly rainfall records and cumulative rainfall over the reporting period are shown in Chart 1.

5.1.2 TEMPERATURE

During the reporting period, the maximum temperature recorded at the MPO weather station M-WS4 was 42.4 degrees Celsius (°C) (1 February) and the minimum temperature recorded was -3.5°C (22 June). Monthly minimum and maximum temperatures derived from hourly temperature measurements are presented in Table 9. Daily mean temperatures are shown in Chart 2.

5.1.3 WIND SPEED AND DIRECTION

During the reporting period, the majority of prevailing winds were from the south-southeast and north-west. Only a very minor percentage of winds were generated from the south-west and almost none were generated from the north-east. This is consistent with trends observed in previous Annual Reviews (Coal & Allied, 2014, 2015 and 2016; MACH Energy, 2017b; MACH Energy, 2018b; and MACH Energy, 2019). An annual wind rose is presented in Chart 3.

Table 8
Rainfall Summary 2019

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Rainfall (mm)	25.2	31.6	144.8	0	25.9	5.3	6.1	18.0	39.4	11.4	31.2	18.2
Cumulative Rainfall (mm)	25.2	56.8	201.6	201.6	227.5	232.8	238.9	256.9	296.3	307.7	338.9	357.1
Wet Days*	4	2	8	0	2	0	1	3	3	1	3	2

Note:

* Wet days are classified as days receiving rainfall greater than 2 mm.

Table 9
Temperature Summary 2019

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum Temperature (°C)	17.4	15.6*	9.7**	3.9**	0.5	-3.5	-1.9	-1.0	3.8	6.3	7.6	11.1
Maximum Temperature (°C)	41.1	42.4*	37.0**	33.2**	22.7	20.6	18.6	23.9	30.0	34.2	35.3	42.1

Note:

* and ** Indicates temperature data taken from the Muswellbrook NW: Upper Hunter Air Quality Monitoring Network Monitor and Bureau of Meteorology (Scone Airport), respectively, due to technical issues with M-WS4.

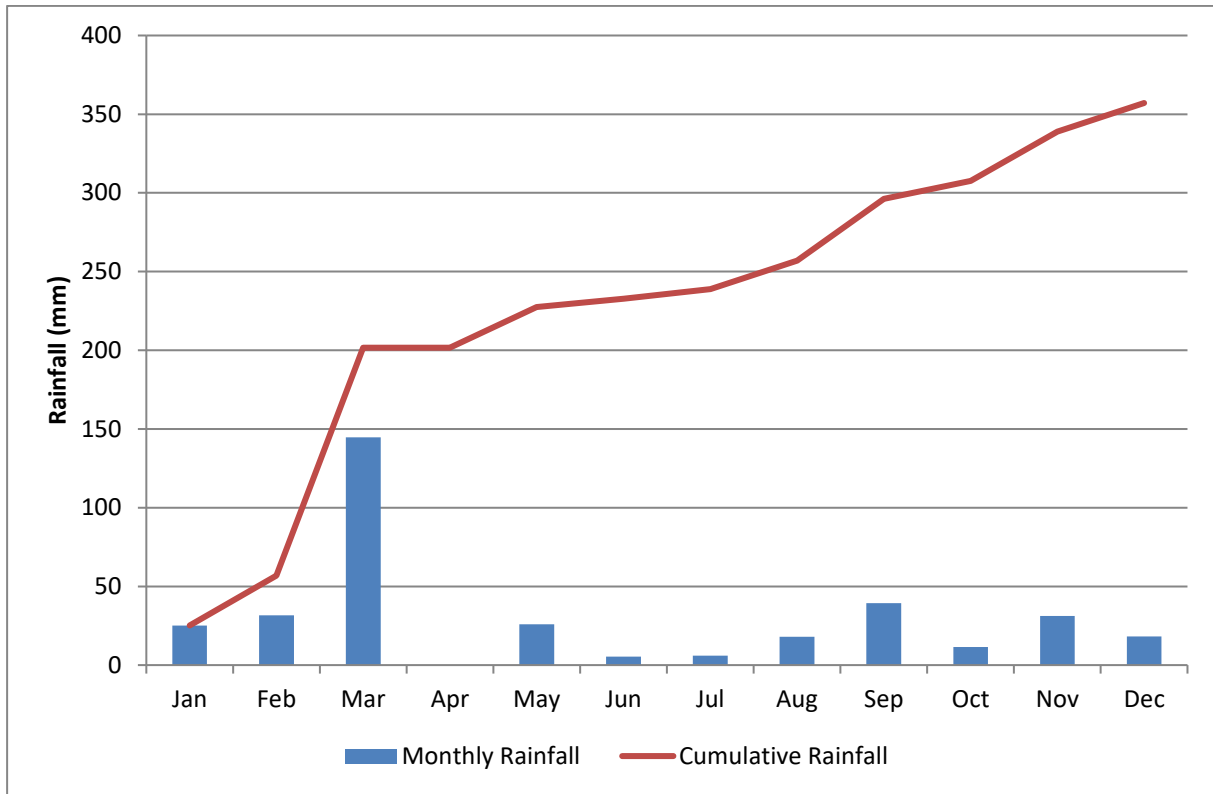


Chart 1: MPO Monthly and Cumulative Rainfall 2019

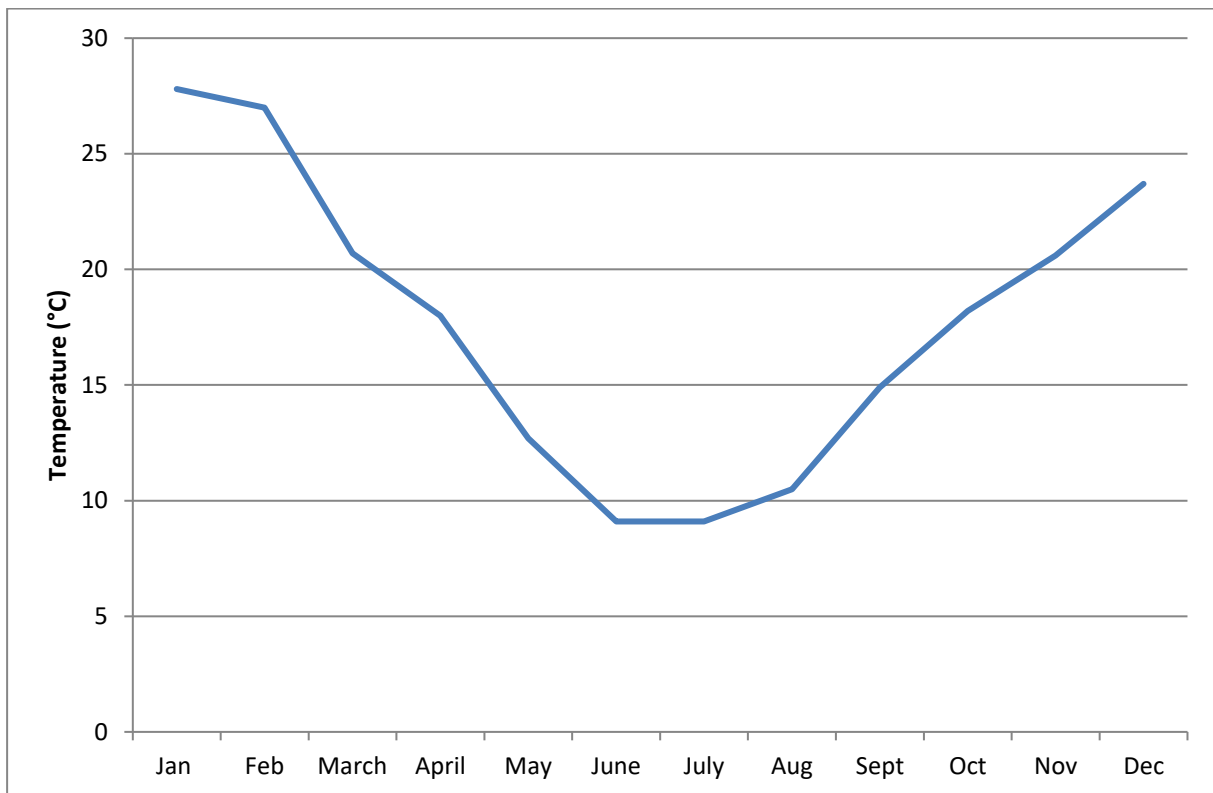


Chart 2: MPO Monthly Mean Temperature 2019

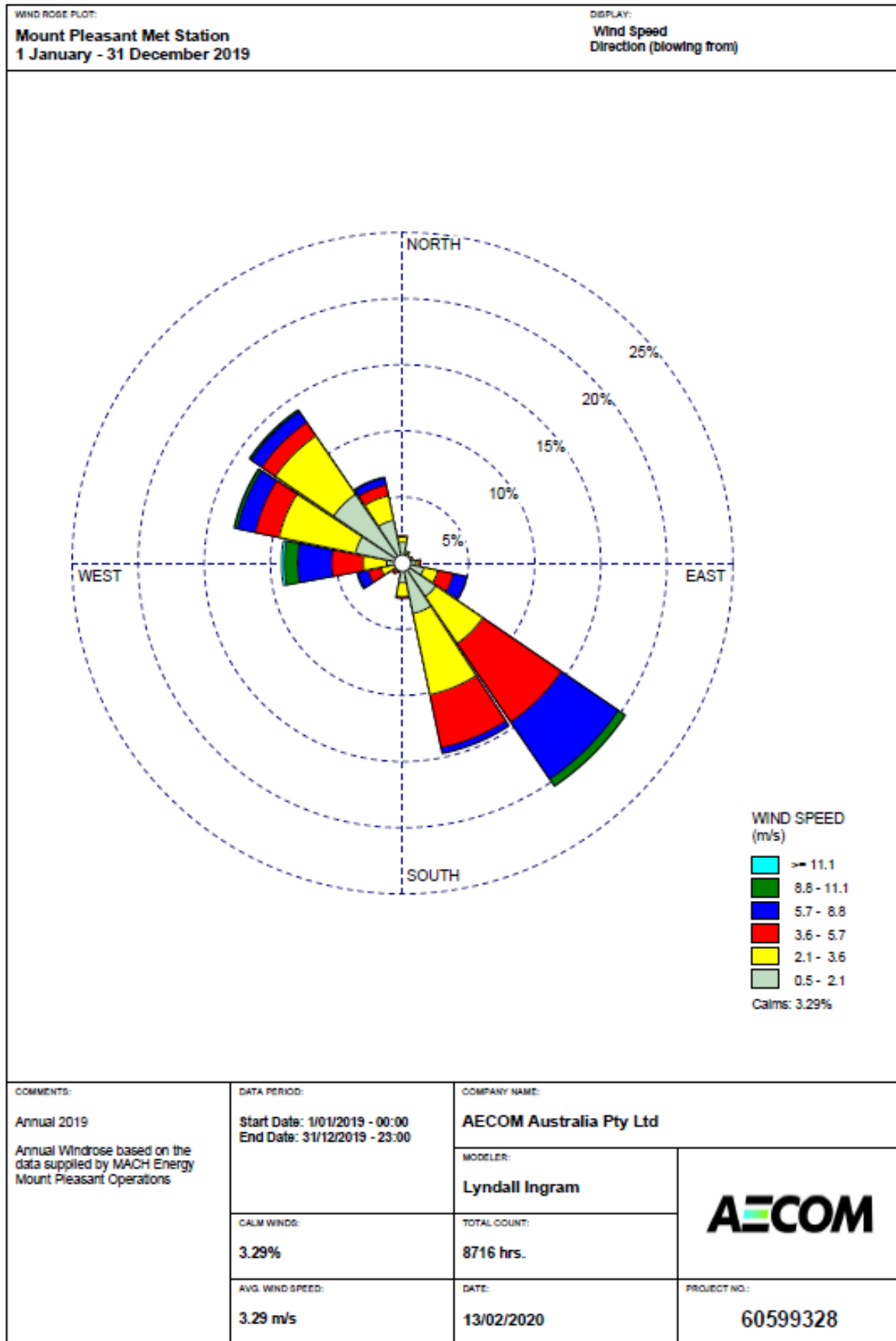


Chart 3: MPO Annual Wind Rose 2019

5.2 NOISE

Key noise criteria for the MPO are defined in Tables 3 and 5 of Development Consent DA 92/97 (Conditions 3 and 5, Schedule 3) and EPL 20850 (Condition P1.3). Additional noise conditions relating to land acquisition, noise mitigation upon request, rail noise, noise monitoring and preparation of the NMP are also detailed in these approval documents.

5.2.1 APPROVAL CRITERIA AND MANAGEMENT PLAN REQUIREMENTS

Development Consent DA 92/97 and EPL 20850

The Noise Impact Assessment Criteria defined in Table 3 of Development Consent DA 92/97 (Condition 3, Schedule 3) is provided in Table 10.

Table 10
Noise Impact Assessment Criteria (dBA)

Location	Day	Evening	Night	
	L _{Aeq} (15min)	L _{Aeq} (15min)	L _{Aeq} (15min)	L _{A1} (1min)
68, 74	43	42	42	45
86a	42	42	42	45
35, 35b, 77	42	41	41	45
79, 80a, 140c, 526	41	41	41	45
289	41	40	40	45
84a, 139, 154, 203, 257, 258a	40	40	40	45
83	40	39	39	45
86b, 140a, 202, 259	39	39	39	45
198, 202b	38	38	38	45
260, 261	37	37	37	45
169, 272	36	36	36	45
NAG 5 - All privately-owned land	41	40	39	45
NAG 6 - All privately-owned land	37	37	37	45
NAG 7 - All privately-owned land	40	37	37	45
NAG 8 - All privately-owned land	41	39	39	45
NAG 9 - All privately-owned land	39	38	37	45
NAG 11 - All privately-owned land	37	36	35	45
All other privately-owned land	35	35	35	45

Source: Development Consent DA 92/97 and EPL 20850.

Notes: dBA = A-weighted decibels.

L_{Aeq} = A-weighted equivalent continuous noise level.

The cumulative noise criteria defined in Table 5 of Development Consent DA 92/97 (Condition 5, Schedule 3) are provided in Table 11.

Table 11
Approval Criteria for Cumulative Noise (dBA)

Location	Day	Evening	Night
	L _{Aeq} (period)	L _{Aeq} (period)	L _{Aeq} (period)
NAG 8, 9	55	45	40
All other privately-owned land	50	45	40

Note: L_{Aeq}(period) = equivalent continuous noise level over a measured period.

Noise criteria and other noise related conditions stipulated in EPL 20850 are generally consistent with those prescribed in Development Consent DA 92/97.

Noise Management Plan

MACH Energy revised the NMP during the reporting period in response to the MOD 4 approval (16 November 2018) in accordance with Condition 4, Schedule 5 of Development Consent DA 92/97. The NMP was approved on 31 October 2019.

The NMP describes the following construction and operational noise controls to be implemented to limit construction and operational noise:

- Plant will operate in less exposed areas during the more sensitive evening/night period.
- Vegetation clearance will be limited to daytime hours.
- 'Quackers' will be used in place of reverse beepers.
- Noise suppression will be provided on major operational mobile plant.
- Temporary cessation of work within an area, or from a particularly noisy piece of equipment, will be considered when adverse weather conditions are present.
- All plant and machinery used on-site will be maintained regularly to minimise noise generation.
- All plant and machinery used on-site will be operated in a proper and efficient manner (e.g. at correct speed) to minimise noise generation.
- Regular communication and updates will be provided to local residents on the status and nature of site construction and operational activities.
- In the event of a complaint from a local resident, MACH Energy will implement the complaints response process.

The following performance indicators are specified in the NMP to track the performance of the MPO:

- effective implementation of the Real-time Response Protocol for noise;
- results of operator attended noise monitoring, conducted and assessed in accordance with the *NSW Industrial Noise Policy* (EPA, 2000) and *Noise Policy for Industry* (NPfI) as relevant, are compliant with the noise criteria in Table 11; and
- complaints are minimised and appropriate management actions are implemented following receipt of a complaint.

5.2.2 PERFORMANCE DURING THE REPORTING PERIOD

Operator attended Noise Monitoring

Operator attended monitoring was undertaken monthly by Global Acoustics Pty Ltd during the 2019 reporting period, in accordance with the NMP and EPL 20850. Operator attended monitoring was undertaken at seven locations selected to represent privately-owned receivers surrounding the MPO, as shown on Figure 3 and Table 12.

Table 12
Noise Monitoring Locations

Monitoring Location				Justification
Site ID	Description	Easting	Northing	
N-AT1	South-west of the MPO	291465	6427182	Representative of dwellings to the south-west
N-AT2	North-west of the MPO	290608	6434490	Representative of dwellings to the north-west
N-AT3	East of the MPO	300270	6432503	Representative of dwellings to the north-east and east (e.g. NAG 5)
N-AT4	South-east of the MPO	299947	6429264	Representative of dwellings to the east (i.e. NAGs 6 and 7)
N-AT5	South-east of the MPO	299161	6427503	Representative of dwellings to the south-east (i.e. NAGs 8 and 9)
N-AT6	South-west of the MPO	289092	6423155	Representative of dwellings to the south-southwest (e.g. NAG 11)
N-AT7 ¹	North of the MPO	298710	6435240	Representative of dwellings to the north

¹ Temporary monitoring at N-AT7 commenced January 2019 in order to better represent receptors north of the site. This location is not required in accordance with the approved MPO NMP and is used for management purposes only.

During the reporting period, MACH Energy complied with all statutory conditions relating to noise. A summary of the noise monitoring results recorded during the reporting period are presented in Appendix A.

Monitoring was undertaken in accordance with EPL 20850 and Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise'.

All applicable $L_{Aeq(15min)}$ measured noise levels attributable to the MPO were compliant with the relevant noise criteria from Development Consent DA 92/97 and EPL 20850 during the reporting period. Results of the operator attended noise monitoring for each monitoring round during the reporting period are available in the monthly reporting on the MACH Energy website (<https://machenergyaustralia.com.au/mount-pleasant/documentation/>).

Real-time Noise Monitoring

Real-time monitoring systems were installed at three locations in November 2016 prior to construction work commencing on-site (Figure 3). Real-time noise monitoring was undertaken at these three locations (N-BO1, N-BO2 and N-BO4) 24 hours per day, seven days per week for the duration of the reporting period. This real-time noise monitoring was not used to assess compliance with noise criteria, but instead was used for ongoing performance assessment and to assist in avoiding potential non-compliances.

During the reporting period, a number of real-time noise monitoring triggers occurred, which prompted the implementation of real-time response management actions where these were related to mining noise at MPO, consistent with the Real-time Response Protocol outlined in the NMP.

Complaints

A total of 100 noise-related complaints were received by MACH Energy during 2019 (see Complaints Summary 2019: <https://machenergyaustralia.com.au/mount-pleasant/documentation/>). In response to the complaints, the noise monitors were reviewed and the External Relations Manager (ERM) organised the cessation of noise-intensive works where necessary. In all cases, the ERM made further contact with the complainant to provide an update of the noise activities. All noise monitoring results for the reporting period were compliant.

5.2.3 TRENDS AND KEY MANAGEMENT IMPLICATIONS

Noise levels from the MPO continued to comply with the relevant criteria at all monitoring sites during the operator-attended monitoring surveys in 2019.

No environmental performance or management issues arose in regard to noise during the reporting period.

Noise-related complaints increased in 2019 compared to 2018 due to the expansion of the mining footprint, commencement of 24/7 operations and continued progression of the mining operations.

5.2.4 IMPLEMENTED OR PROPOSED MANAGEMENT ACTIONS

All noise management measures outlined in the NMP and summarised in Section 5.2.1 were undertaken during the reporting period. In particular, MACH Energy implemented the following specific management measures:

- real-time noise monitoring was continued at the three real-time noise monitoring locations and the Real-time Response Protocol was implemented where appropriate; and
- following an update of the EPL 20850 (October 2018), operator attended noise monitoring changed from being undertaken quarterly to monthly in 2019.

5.3 BLASTING

Airblast overpressure and ground vibration assessment criteria for the MPO are defined in Table 7 of Development Consent DA 92/97 (Condition 10, Schedule 3) and EPL 20850 (Conditions L3.1, L3.2, L3.3, L3.4, L3.5 and L3.6). Additional conditions relating to blasting hours and frequency, property inspections and investigations, monitoring locations, measurement methodology, operating conditions and preparation of the BMP, are also detailed in these approvals.

During the reporting period, an updated BMP was prepared by MACH Energy in accordance with Condition 17, Schedule 3 of Development Consent DA 92/97. The BMP was approved on 14 January 2019.

5.3.1 APPROVAL CRITERIA AND MANAGEMENT PLAN REQUIREMENTS

Development Consent DA 92/97 and EPL 20850

A summary of the approval criteria for blasting is included in Table 13.

Table 13
Assessment Criteria for Blasting

Location	Airblast Overpressure (dB[Lin Peak])	Ground Vibration (mm/s)	Allowable Exceedance
Residence on privately-owned land	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months
Historic heritage sites	-	10	0%
All public infrastructure	-	50	0%

Source: Table 7 of Development Consent DA 92/97 (Condition 10, Schedule 3).

Note: mm/s = millimetres per second; dB = decibels.

Conditions L3.3, L3.4, L3.5 and L3.6 of EPL 20850 contain the same blasting assessment criteria for residences on privately-owned land as specified in Table 14. However, EPL 20850 requires that monitoring does not exceed these criteria at monitoring site B-VOC rather than at all residences on privately-owned land (Figure 4).

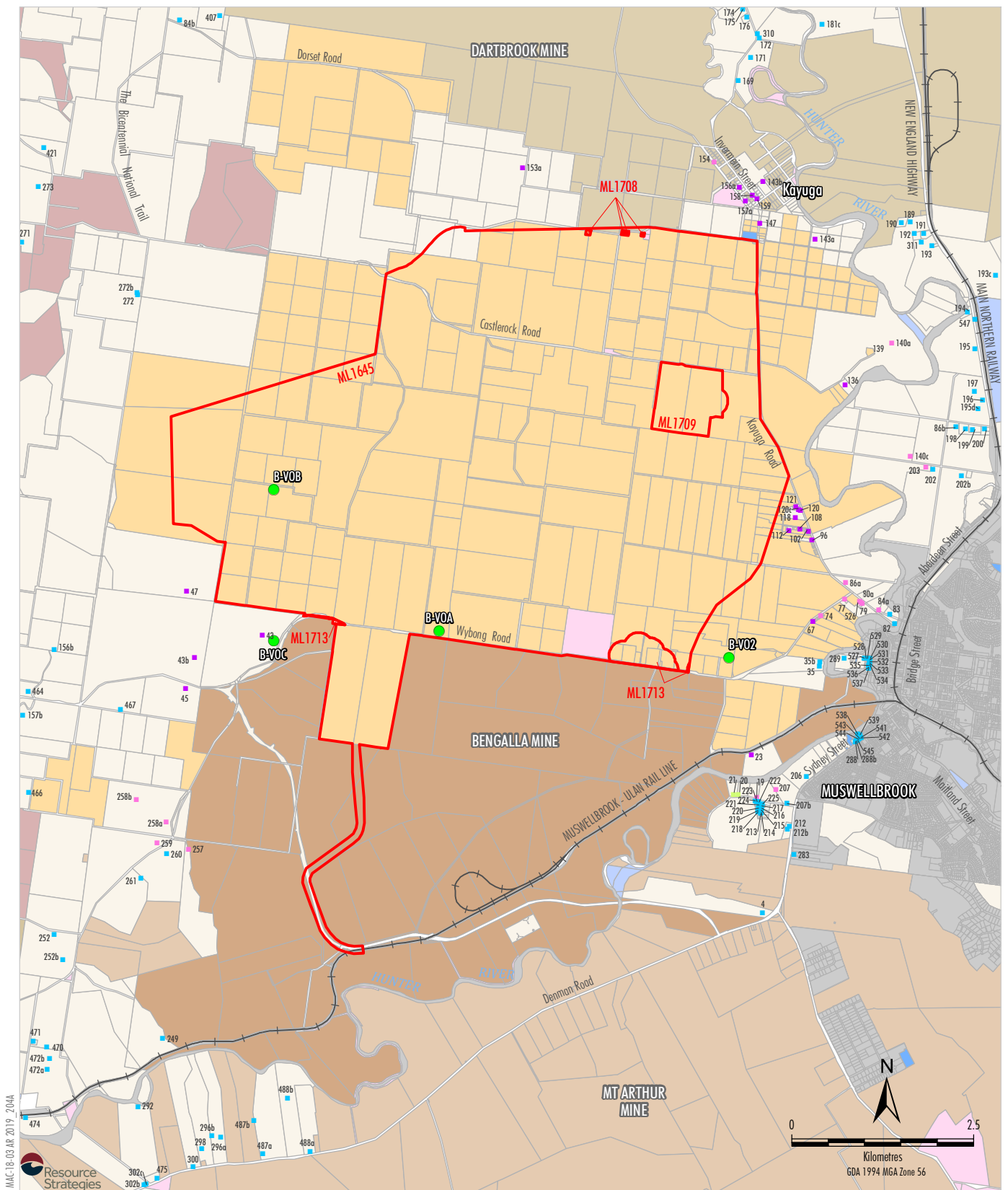
Airblast overpressure, ground vibration and fume monitoring were conducted for every blast event at the blast monitoring sites shown on Figure 4.

5.3.2 PERFORMANCE DURING THE REPORTING PERIOD

A total of 67 blasts occurred during the reporting period as shown in Appendix B. All recorded blast measurements were in accordance with the relevant blasting criteria (Section 5.3.1). A comparison of MPO's blast performance against the MOD 3 predictions is summarised in Table 14.

While Table 14 provides a comparison of MOD 3 predictions to the airblast overpressure and ground vibration levels recorded in 2019 at a number of sensitive receivers located around the MPO, the majority of the sensitive receivers are located significant distances from the blast monitors. It is therefore difficult to draw conclusions regarding how the recorded levels compare to the MOD 3 predictions. Monitor B-VOC, however, is located in close proximity to Receiver 43 and therefore the MOD 3 predictions and the levels recorded at B-VOC can be realistically compared.

The slight differences in recorded and predicted levels at Receiver 43/B-VOC may be due to a difference in site conditions, compared to the empirical data used to establish the predictions. Blast monitoring data will continue to be collected and a site-specific empirical prediction model will continue to be refined to assist blast planning and performance review.



- LEGEND**
- Mining Lease Boundary
 - Privately-owned Residence - MPO Acquisition on Request
 - Privately-owned Residence - MPO Mitigation/Acquisition on Request *
 - Privately-owned Residence - MPO Mitigation on Request
 - Other Privately-owned Residence
 - Blasting (Vibration/Overpressure)

- Mount Pleasant-controlled
- Bengalla-controlled
- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter Excluded Zones

Source: MACH Energy (2020); NSW Spatial Services (2019)

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MOUNT PLEASANT OPERATION
Blast Monitoring Sites

* MPO Mitigation on Request - rail noise. MPO is only required to acquire and/or install air quality mitigation measures at this property if acquisition and/or mitigation is not reasonably achievable under a separate approval for the Bengalla Mine.

Figure 4

Table 14
Comparison of MOD 3 Predictions and 2019 Raw Monitoring Data

Closest Receiver ID	MOD 3 Predictions		Closest Blast Monitoring Site to Land Holder	Maximum Recorded Level in 2019	
	Airblast Overpressure (dBL [in Peak])	Ground Vibration (mm/s)		Airblast Overpressure (dBL [in Peak])	Ground Vibration (mm/s)
43	111.6 to 112.4	0.9 to 1.4	B-VOC	117.8	2.48
272	111.1 to 111.2	0.5 to 0.6	B-VOC	117.8	2.48
153	111.3 to 111.5	0.6 to 0.8	B-VOA	111.1	3.70
147	111.3 to 111.8	0.7 to 1	B-VO2*	124.5	3.85
136	111.7 to 112.8	0.9 to 1.6	B-VO2*	124.5	3.85
121	112.6 to 115.7	1.5 to 3.7	B-VO2*	124.5	3.85
112	112.8 to 116.4	1.6 to 4.3	B-VO2*	124.5	3.85
67	112.9 to 115.4	1.6 to 3.5	B-VO2*	124.5	3.85
23	113.3 to 115.2	1.9 to 3.3	B-VO2*	124.5	3.85

Source: Table 8-1 of MPO MOD 3 Noise & Blasting Assessment.

Note: mm/s = millimetres per second; dB = decibels.

* B-VO2 is located a significant distance from the nearest sensitive receivers and therefore elevated vibration and/or overpressure levels at this monitor do not indicate an exceedance of the applicable criteria. MACH proposes to relocate B-VO2 approximately 1,350m to the east of its current position to more accurately represent the nearest private residential receivers.

Complaints

A total of 39 blasting-related complaints were received by MACH Energy during 2019 (see Complaints Summary 2019: <https://machenergyaustralia.com.au/mount-pleasant/documentation/>). In response to the complaints, blasting activities were reviewed for compliance with compliance limits. All blasting results for the reporting period were compliant with blasting criteria (Section 5.3.1). Following the investigation, the ERM made further contact with the complainant to provide an update of the blasting activities.

5.3.3 TRENDS AND KEY MANAGEMENT IMPLICATIONS

There were 67 blasts recorded during 2019, compared with 92 in 2018. Air blast overpressure and ground vibration levels recorded during 2019 generally increased in 2019 due to the expansion of the mining footprint and the increase in the depth of mining operations within Pit A. All blasts complied with Development Consent DA 92/97 and EPL 20850.

All blasting activities from the MPO complied with the relevant criteria during the reporting period in 2019.

Blasting-related complaints increased in 2019 compared to 2018 due to the increased ROM coal extraction and the development of the mining footprint.

5.3.4 IMPLEMENTED OR PROPOSED MANAGEMENT ACTIONS

Notifications of upcoming blasts were provided on MACH Energy's and Muswellbrook Shire Council's websites. In addition, MACH Energy notified private landholders or residents who expressed an interest in being informed of the MPO blasting schedule and were, therefore, on the MPO pre-blast notification register.

Any blasts within 500 m from Wybong, Kayuga, Castlerock and Dorset Roads triggered the road closure and implementation of relevant mitigation measures. In 2019, nine road closures occurred on Wybong Road due to blasting activities within Pit A. Zero road closures on Kayuga, Castlerock and Dorset Roads occurred.

In order to more accurately represent the nearest private residential receivers to the MPO, MACH Energy will propose a relocation of site B-VO2 approximately 1,350 m east of its current position during 2020.

All appropriate steps to reduce dust generation from blasting and ensure best practice blasting techniques were undertaken in accordance with the MPO Blast Management Plan. MACH Energy will continue to implement these measures.

5.4 AIR QUALITY

Air quality criteria for the MPO are presented in Tables 8, 9 and 10 of Development Consent DA 92/97 (Condition 20, Schedule 3) and EPL 20850 (Condition O3.5). Additional conditions relating to operating conditions, greenhouse gas emissions, odour, acquisition criteria and preparation of the AQGGMP are also provided in Development Consent DA 92/97 and EPL 20850.

5.4.1 APPROVAL CRITERIA AND MANAGEMENT PLAN REQUIREMENTS

Development Consent DA 92/97

In accordance with Condition 20, Schedule 3 of Development Consent DA 92/97, MACH Energy must ensure that all reasonable and feasible avoidance mitigation measures are employed so that particulate matter emissions generated by the MPO do not exceed the criteria summarised in Table 15 at any residence on privately-owned land (excluding land subject to acquisition upon request for potential air quality impacts).

Table 15
Approval Criteria for Particulate Matter

	Pollutant	Averaging Period	^d Criterion
Long-term Impact Assessment Criteria	TSP	Annual	^a 90 µg/m ³
	PM ₁₀	Annual	^a 25 µg/m ³
	PM _{2.5}	Annual	^a 8 µg/m ³
	Deposited Dust ^d	Annual	^b 2 g/m ² /month ^a 4 g/m ² /month
Short-term Impact Assessment Criteria	PM ₁₀	24 hour	^b 50 µg/m ³
	PM _{2.5}	24 hour	^b 25 µg/m ³

Source: Development Consent DA 92/97 (Condition 20, Schedule 3).

Note: TSP = Total Suspended Particulates;

PM₁₀ = particulate matter less than or equal to 10 micrometres in diameter;

PM_{2.5} = particulate matter less than or equal to 2.5 micrometres in diameter;

µg/m³ = micrograms per cubic metre; g/m²/month = grams per square metre per month.

^a Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

^b Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

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

^d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Secretary.

Environment Protection Licence 20850

Air quality criteria and other air quality related conditions stipulated in EPL 20850 are generally consistent with those prescribed in Development Consent DA 92/97, with the exception of Conditions O3.4 to O3.9, which state:

O3 Dust

...

O3.4 The licensee must cease all dust generating activities during adverse conditions being the occurrence of both the adverse wind conditions set out in Condition O3.5 (b) and the adverse PM₁₀ concentrations set out in Condition O3.5(c).

O3.5 For the purpose of Condition O3.4 the following definitions apply.

- (a) 'dust generating activities' means drilling, blasting, earthworks, construction activities, all hauling activities on unsealed haul roads, all overburden and coal extraction operations including loading and dumping activities and grader, loader, dozer and dragline operations.
- (b) 'adverse wind conditions' means a rolling 1-hour average wind direction between 250 degrees and 340 degrees (inclusive) measured at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitor. Australian Standard AS3580.14-2014 is to be used to calculate the rolling 1 hour average wind direction.
- (c) 'adverse PM₁₀ concentrations' means a rolling 24-hour average PM₁₀ concentration of equal to or greater than 44 micrograms per cubic metre measured at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitoring station.
- (d) Operation of watercarts is permitted at all times.
- (e) Activities within the Coal Handling and Preparation Plant and Materials Handling Area, including run-of-mine (ROM) coal, product coal handling (including dozer/loader operations) and train loading operations as identified in blue on plan titled 'Mt Pleasant Coal Mine Materials Handling Area Dust Exclusion Zone General Arrangement' drawing number MP001-0000-GEN-DRG-0026 (EPA ref Doc19/282883) are not included as dust generating activities provided all automated dust suppression spray systems at the ROM hopper, conveyor transfer points and product stockpiles are in use, at least one water cart is in use on the ROM stockpile and an adjustable hood is lowered onto rail wagons loadings.

O3.6 Shutdown of dust generating activities required by Condition O3.4 must be completed within 1 hour of receiving data that triggers action required by Condition O3.4.

O3.7 The licensee may resume dust generating activities at the premises when:

- (a) adverse wind conditions as defined in Condition O3.5(b); or
- (b) adverse PM₁₀ concentrations as defined in Condition O3.5(c)

are not measured for a minimum time period of 1 hour from the time that cessation of dust generation activities is completed.

O3.8 At any time when there is no access to the meteorological data or PM₁₀ data from the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitoring station, definitions of 'adverse wind conditions' and 'adverse PM₁₀ concentrations' in condition O3.5 are replaced with :

- 'adverse wind conditions' means a rolling 1-hour average wind direction between 245 and 345 degrees (inclusive) measured at Monitoring Point No. 11, identified in condition P1.3
- 'adverse PM₁₀ concentrations' means a 24-hour average PM₁₀ concentration of equal to or greater than 44 micrograms per cubic metre measured at the Monitoring Point No. 1, identified in condition P1.3

Note: If at any time, there is no access to the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitoring station and to either 1-hour average wind direction data from monitoring point 11 or PM₁₀ data from monitoring point 1 the licensee must cease dust generating activities at the premises.

O3.9 For the purpose of condition O3.5 (e), dust suppression systems must be operated in a manner to ensure that there is no visible dust emissions emitted from the premises.

Air Quality and Greenhouse Gas Management Plan

MACH Energy prepared an AQGGMP during the reporting period, which was approved on 24 May 2019. The AQGGMP was revised to reflect the approval of MOD 3 and 4 and update the real-time response triggers to align with the amended dust conditions within EPL 20850 (approved 1 May 2019) described above.

The AQGGMP outlines the reasonable and feasible mitigation and management measures adopted at the MPO in accordance with Condition 20, Schedule 3 of Development Consent DA 92/97. The reasonable and feasible mitigation measures include:

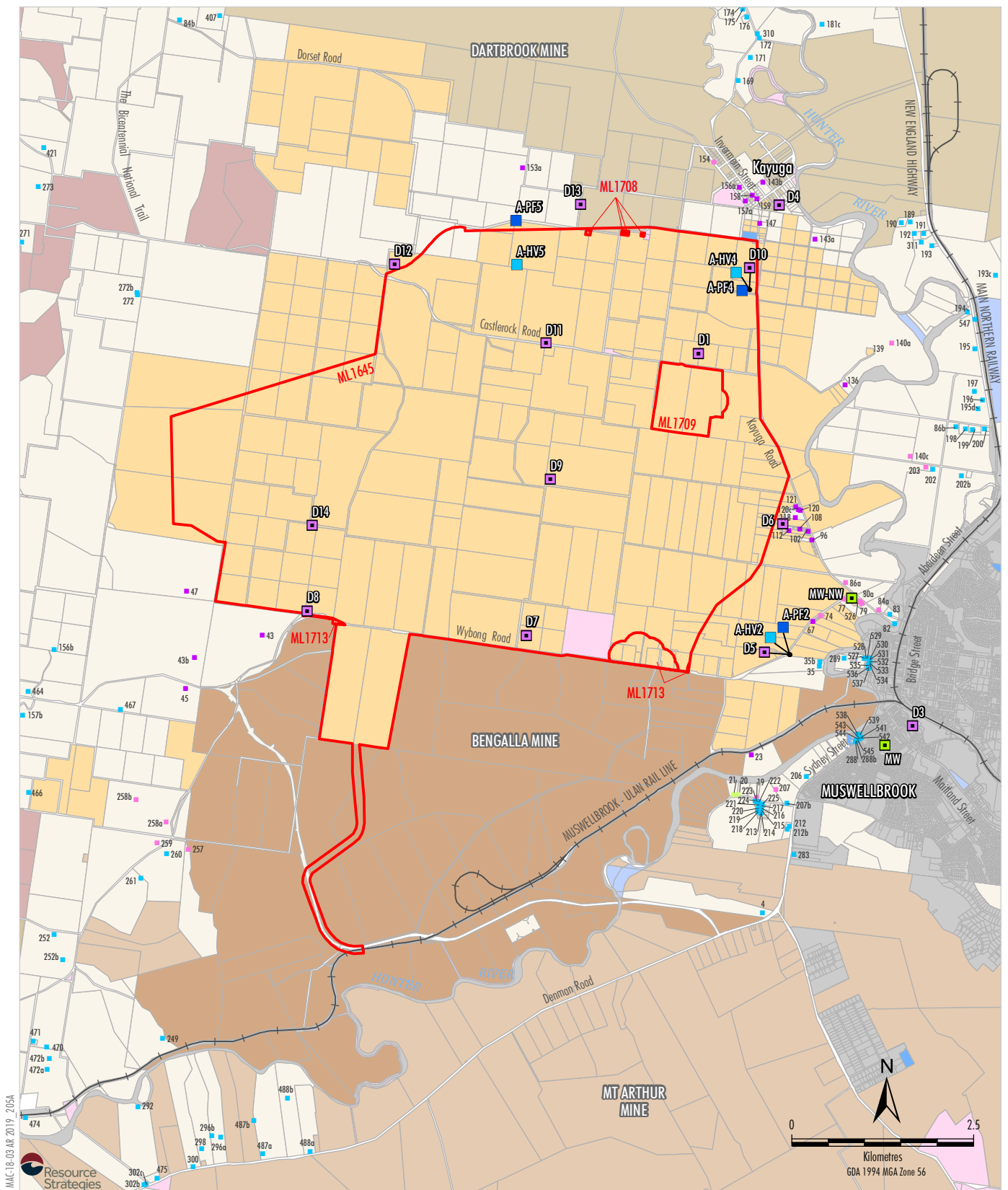
- specific management measures for adverse weather conditions (e.g. ceasing all dust generating activities during specific weather conditions as required by Conditions O3.4 to O3.9 of EPL 20850);
- general dust management measures (e.g. use of water carts to minimise wheel-generated dust);
- the use of predictive modelling to assist in day-to-day planning;
- real-time response protocols with tiered management actions based on several alert levels;
- odour and fume management measures;
- greenhouse gas emission reduction strategies; and
- cumulative air quality management, including a protocol for communication with representatives of other mining operations.

5.4.2 PERFORMANCE DURING THE REPORTING PERIOD

Dust Deposition

During the reporting period, dust deposition levels were collected at 13 dust deposition gauges situated around the MPO boundary (Figure 5). The gauges were sited in accordance with AS 3580.1.1:2007 and analysed for mass of total insoluble matter and ash in accordance with AS 3580.10.1-2003.

Annual average levels of insoluble solids (i.e. dust deposition) are presented in Chart 4. Chart 5 provides a comparison between annual average dust deposition levels at each of the monitoring sites from 2014 to 2019.



- LEGEND**
- Mining Lease Boundary
 - Privately-owned Residence - MPO Acquisition on Request
 - Privately-owned Residence - MPO Mitigation/Acquisition on Request *
 - Privately-owned Residence - MPO Mitigation on Request
 - Other Privately-owned Residence
 - Monitoring Sites
 - Air Quality - High Volume Sampler
 - Air Quality - Palas Fidas
 - Dust Deposition Gauge
 - Upper Hunter Air Quality Monitoring Network
 - Mount Pleasant-controlled
 - Bengalla-controlled
 - Dartbrook-controlled
 - Mangoola-controlled
 - Muswellbrook Coal-controlled
 - Mt Arthur-controlled
 - Crown
 - The State of NSW
 - Muswellbrook Shire Council
 - Privately-owned Land
 - Muswellbrook and Upper Hunter Excluded Zones

Source: MACH Energy (2020); NSW Spatial Services (2019)

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Air Quality Monitoring Sites

* MPO Mitigation on Request - rail noise. MPO is only required to acquire and/or install air quality mitigation measures at this property if acquisition and/or mitigation is not reasonably achievable under a separate approval for the Bengalla Mine.

Figure 5

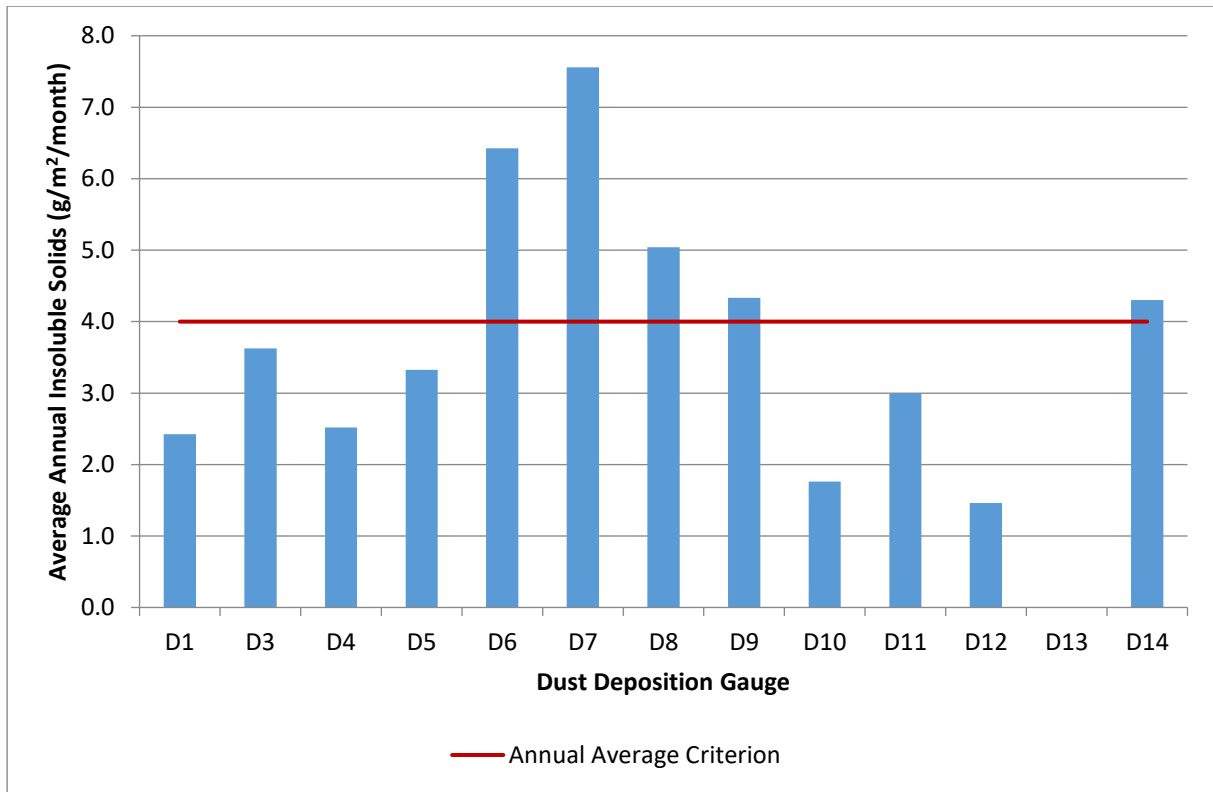


Chart 4: 2019 Annual Average Insoluble Solids

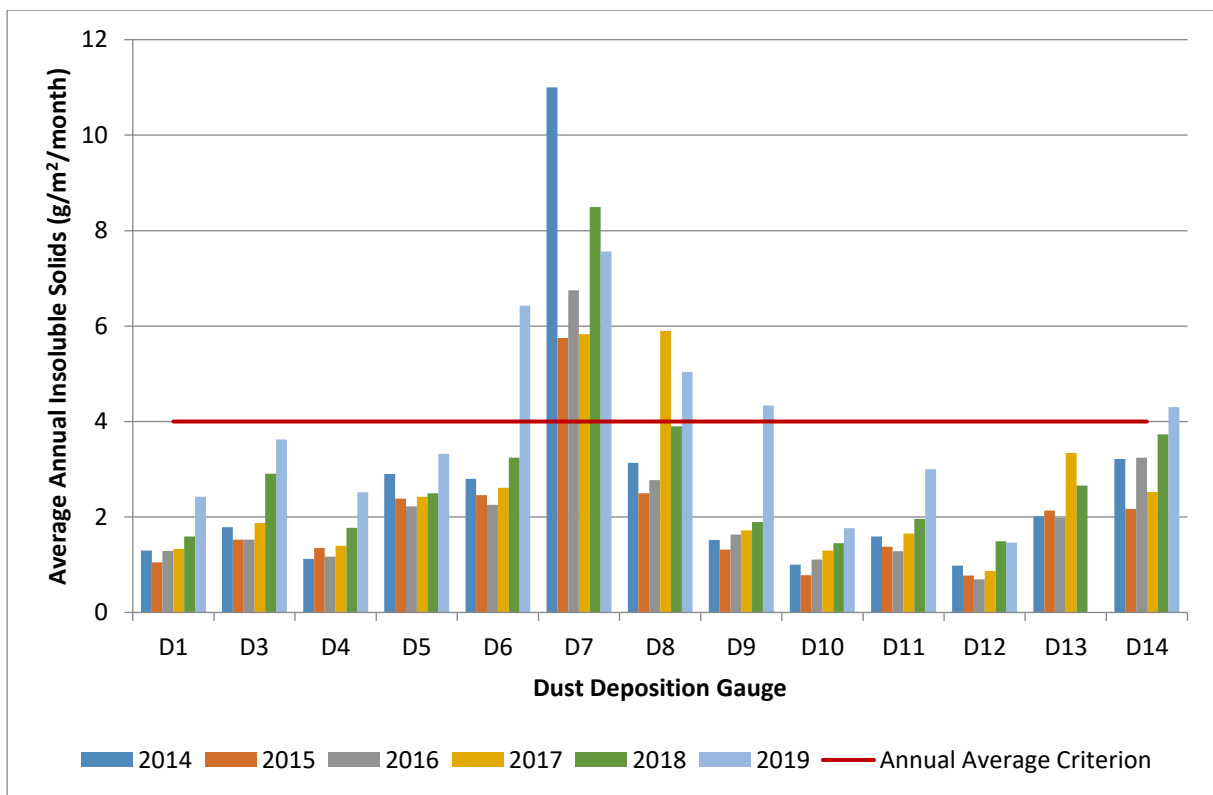


Chart 5: 2014 - 2019 Annual Average Insoluble Solids

PM₁₀ and PM_{2.5}

Palas Fidas monitoring systems were installed at three locations (Figure 5) in late 2016. The Palas Fidas systems collected PM₁₀ and PM_{2.5} data continuously, which was averaged over 24 hours (Chart 6 and Chart 7) and annually (Chart 8 and Chart 9). One of the Palas Fidas units (APF4) was temporarily replaced by a tapered element oscillating microbalance (TEOM) unit from late 2018 to 25 June 2019. In addition, APF2 was temporarily replaced by a Beta Attenuation Monitor from 19 February to 19 March 2019.

The data presented excludes 'extraordinary events', consistent with Condition 20, Schedule 3 of Development Consent DA 92/97. A total of 57 'extraordinary event' days in 2019 were advised by the DPIE, with the majority associated with bushfire activity and some dust storms/regional dust events. MACH notes that air quality levels in the vicinity of the MPO may have been materially affected by regional dust or bushfire events that occurred on other days. For example, the *Air Quality Monitoring Network Upper Hunter Summer 2018-19 seasonal newsletter* (OEH, 2019) indicates bushfire smoke led to exceedances of the 24 hour average PM₁₀ benchmark in Muswellbrook on 16 and 17 January 2019, however these days were not included in the 'extraordinary event' days advised by DPIE. Notwithstanding, MACH has conservatively adopted only the 'extraordinary event' days advised by the DPIE when presenting monitoring data in this Annual Review. Results inclusive of 'extraordinary events' are provided in Appendix C for completeness.

During the reporting period, it was identified that PM_{2.5} monitoring results were consistently higher than would be expected. An investigation (with co-located TEOM monitoring) determined that the calibration factor being applied to the raw PM_{2.5} and PM₁₀ measurements was incorrect (i.e. was overstating particulate levels). A letter describing the investigation and outcomes is provided in Appendix D. The data presented in this document therefore applies the new calibration factors determined for PM_{2.5} and PM₁₀. Consistent with advice from the technical specialist who conducted the investigation, the new calibration factors have also been applied to data from previous years (including the 2018 data presented in this Annual Review).

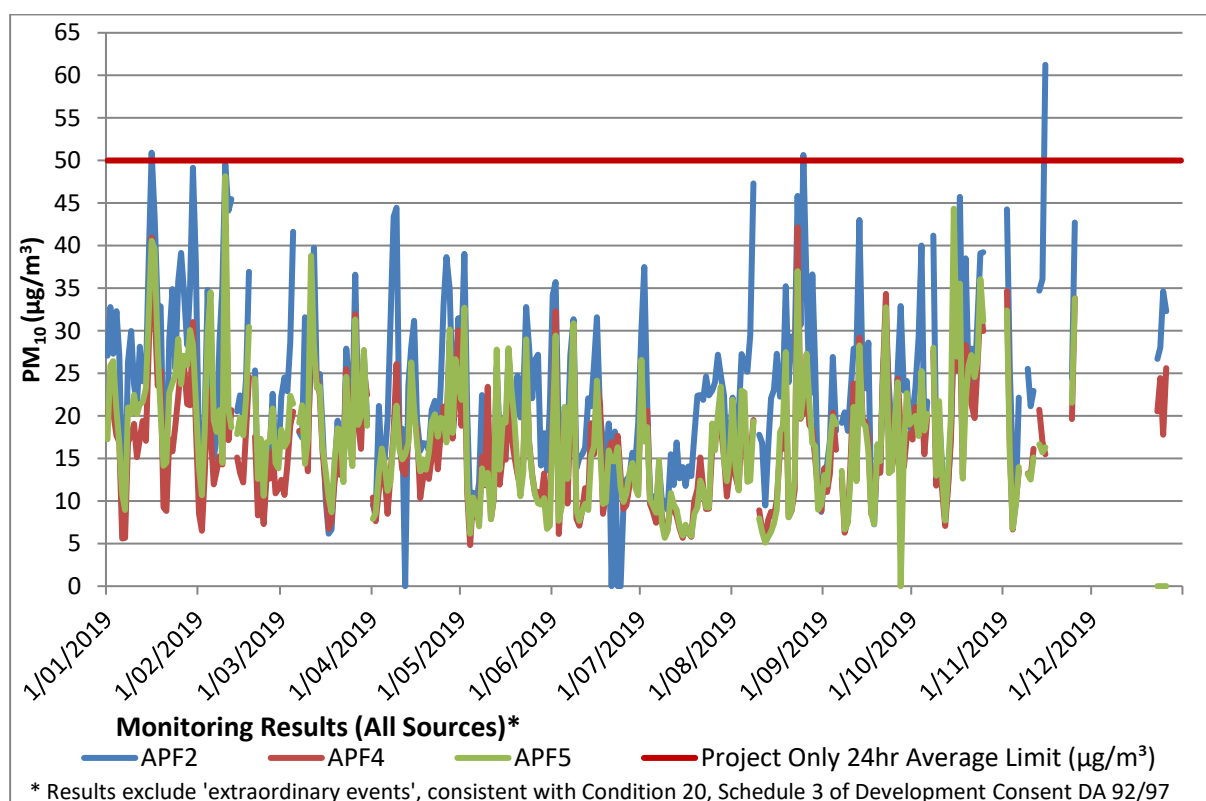


Chart 6: 24 hour Average PM₁₀ Levels

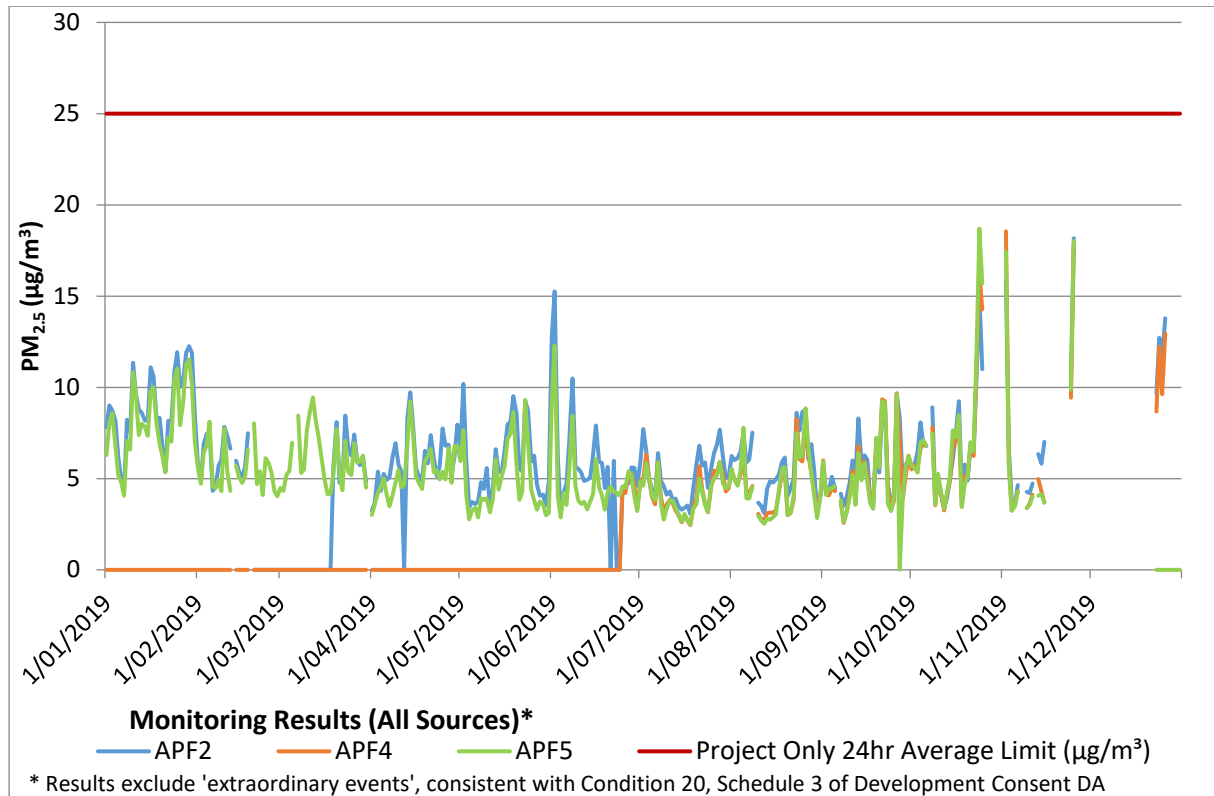


Chart 7: 24 hour Average $\text{PM}_{2.5}$ Levels

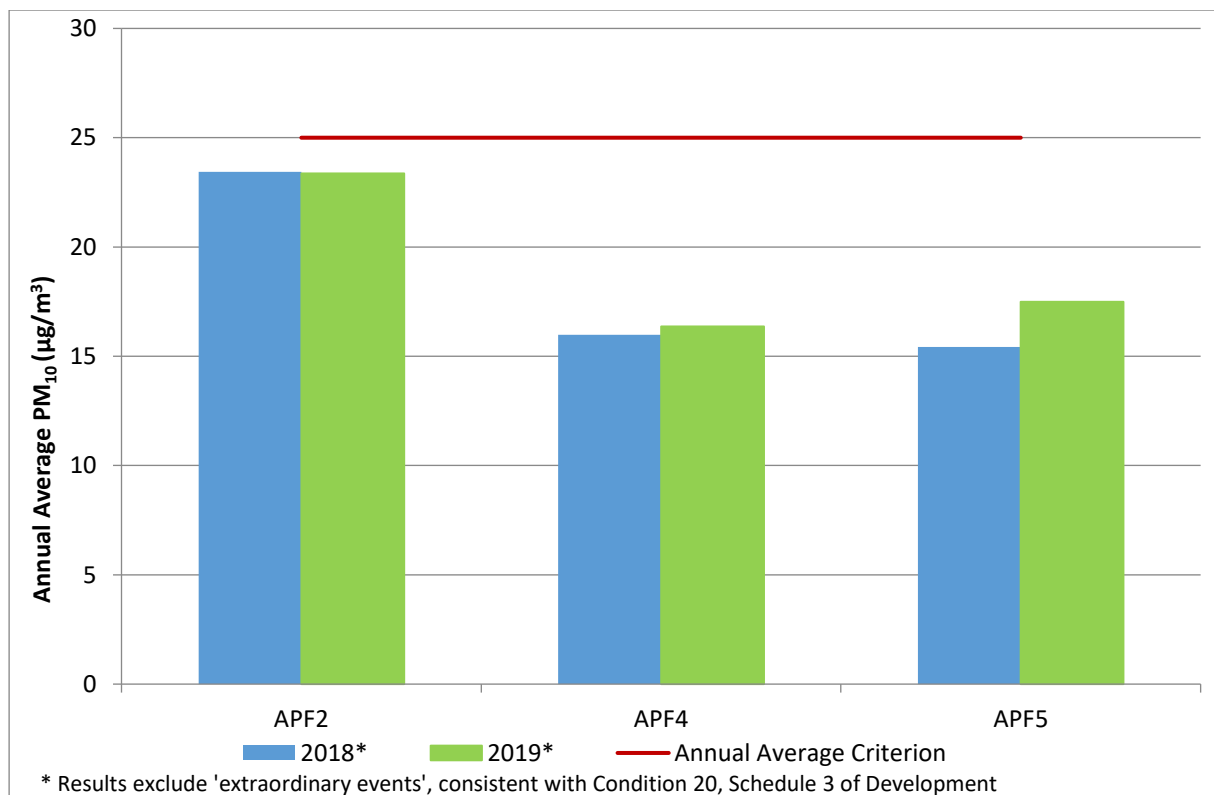


Chart 8: Annual Average PM_{10} Levels

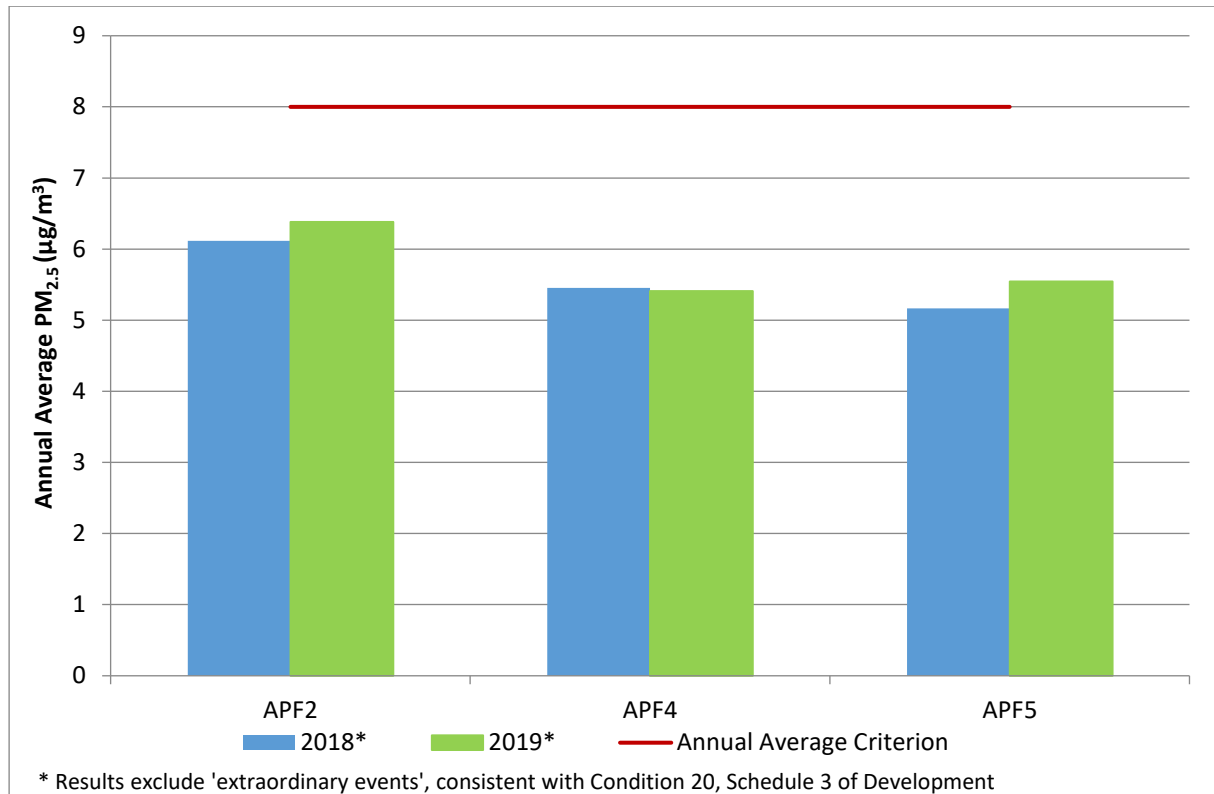


Chart 9: Annual Average PM_{2.5} Levels

Total Suspended Particulate

TSP levels were recorded at the three High Volume Air Sampler (HVAS) systems (A-HV2, A-HV4 and A-HV5) located adjacent to the three Palas Fidas monitors (Figure 5). These HVAS systems were sited in conjunction with the Palas Fidas monitors in late 2016. Annual average TSP levels are presented in Chart 10.

Note the data presented excludes 'extraordinary events', consistent with Condition 20, Schedule 3 of Development Consent DA 92/97. Results inclusive of 'extraordinary events' are provided in Appendix C for completeness.

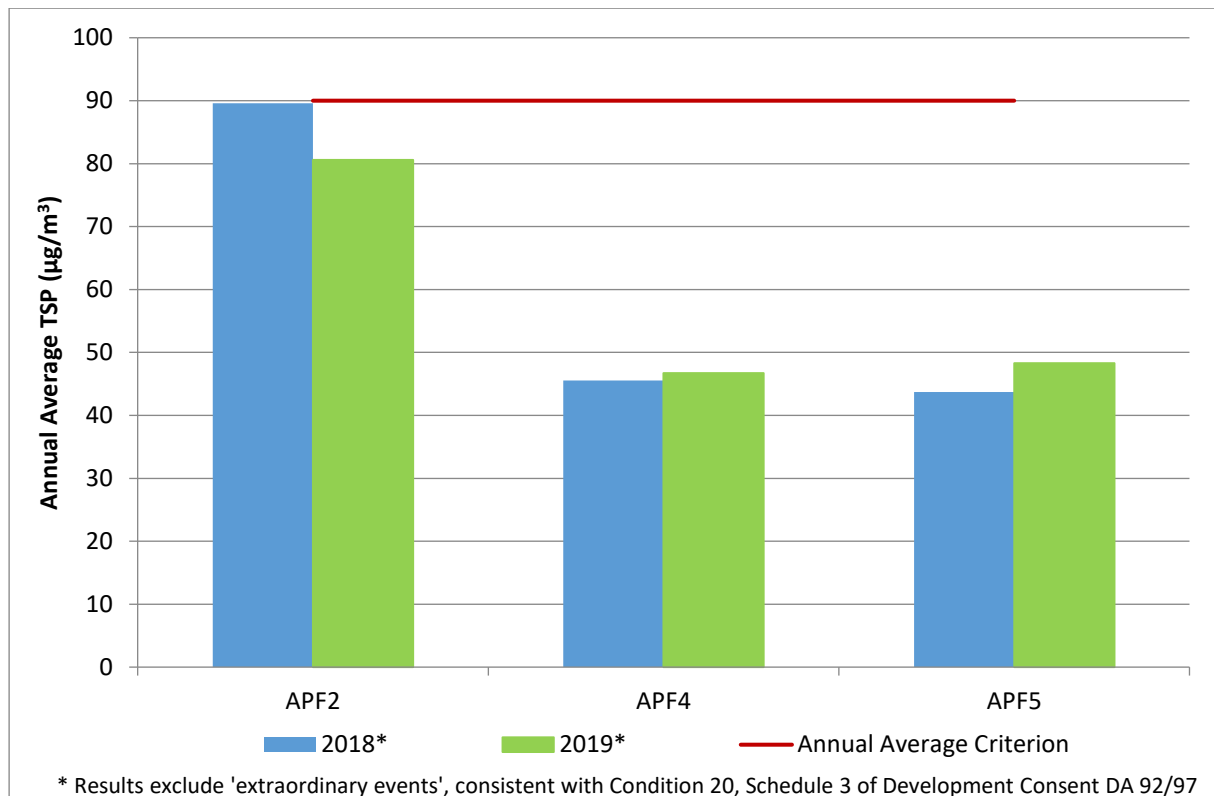


Chart 10: Annual Average TSP Levels

5.4.3 TRENDS AND KEY MANAGEMENT IMPLICATIONS

Management Measures

In accordance with Conditions O3.4 and O3.5 of EPL 20850, all dust generating activities at the MPO must be ceased when specific adverse conditions are identified at the on-site meteorological station and/or at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitor.

Dust generating activities were discontinued on a number of occasions during 2019 in accordance with Conditions O3.4 and O3.5 of EPL 20850, for a total of 468 hours (i.e. all items of major mobile equipment were shut down for 468 hours each in accordance with Conditions O3.4 and O3.5 of EPL 20850).

In addition to ceasing operations due to elevated monitoring results in accordance with Conditions O3.4 and O3.5 of EPL 20850, operations were ceased on a number of occasions in response to the generation of visible dust, for a total of 989 hours across four excavator fleets (i.e. approximately 247 hours on average per excavator).

Dust Deposition

Dust deposition levels increased between 2018 and 2019 at most dust deposition gauges at the MPO. The increase in dust deposition levels is likely to have been influenced, at least in part, by the persistent drought conditions in NSW throughout 2019. Annual average levels of deposited dust were recorded above the Long-term Impact Assessment Criteria of 4 g/m²/month at D6, D7, D8, D9 and D14.

D7 is located within the MPO boundary between the MPO and Bengalla Mine operations (Figure 5). Due to its proximity to the northern boundary of the Bengalla Mine main pit, D7 is heavily influenced by both the MPO and the Bengalla Mine operations. Therefore, whilst this site has continued to be monitored, it is not used to assess compliance or to represent residential receivers in the area.

D8 and D14 are located to the west of the MPO mining area and are considered representative of the nearest privately-owned residences to the south-west, which are subject to acquisition upon request for potential air quality impacts (Figure 5). In accordance with Condition 20, Schedule 3 of Development Consent DA 92/97, the annual average dust deposition criterion does not apply at such residences. Given the significant distance to the closest privately-owned residences without acquisition upon request rights for potential air quality impacts (Figure 5), it is considered unlikely the criterion would be exceeded at those residences.

D9 is located in the centre of Mining Lease 1645, close to the MPO mining area and a significant distance from any privately-owned residences (Figure 5). This dust deposition gauge is therefore not considered representative of any privately-owned residences.

D6 recorded a marked increase in dust levels from 2018 to 2019, with a significant increase in recorded levels during the period between September and November 2019 (where dust deposition levels were approximately 13.9 g/m²/month on average). D6 is located to the east of the MPO mining area (Figure 5). D5 is located at a similar distance from the MPO mining area, also to the east (Figure 5). As D5 is located further to the south than D6, it is downwind of the MPO for a greater percentage of time (i.e. as the prevailing winds are typically from the north-west and south-southeast (refer Section 5.1.3). During the period of significantly elevated dust deposition levels at D6, it is estimated D5 was downwind of the MPO approximately 50 per cent (%) of the time, with D6 downwind of the MPO approximately 30% of the time. However, during that period, dust deposition levels at D5 were approximately 3.2 g/m²/month on average. Given that the levels recorded at D5 were below the annual average criterion, this suggests that the elevated dust levels at D6 may be unrelated to MPO activities (e.g. potentially due to local agricultural activities). It is noted that paddocks in the vicinity of the D6 monitor are used for livestock and due to the drought, the condition of the paddocks have been found to be poor and without ground cover.

PM₁₀ and PM_{2.5}

The measured 24-hour average PM₁₀ levels on applicable days (i.e. days not considered to be 'extraordinary events') were generally below the Project-only criterion during the reporting period, with the exception of three elevated readings at APF2. Two of the readings (16 January and 25 August) were less than 51 µg/m³ and on both occasions APF2 was not downwind of the MPO for more than 10% of the time. Therefore, the likelihood that the contribution from the MPO was greater than the 50 µg/m³ criterion on those days is very low, and the elevated measurements on these days are not considered exceedances of the applicable criterion.

The largest elevated PM₁₀ reading was recorded on 15 November, with a daily reading of 61.2 µg/m³. While this day was not specifically identified as an 'extraordinary event' day, it occurred during the period of bushfire activity in late 2019. Notably, the following eight days were identified as 'extraordinary event' days due to bushfire activity in the region. This elevated reading was reported in the November Monthly Environmental Monitoring Report and was attributed to bushfire activity (MACH Energy, 2018a). Analysis of measured concentrations and wind directions throughout the day (i.e. upwind/downwind analysis) indicates the contribution from the MPO at APF2 was likely in the order of 33 µg/m³. Given the potential for the cumulative levels recorded to have been affected by bushfire activity, and the results of this upwind/downwind analysis, it is likely the contribution from the MPO was less than the applicable 50 µg/m³ criterion. Further, all reasonable and feasible dust avoidance and mitigation measures were employed. This included hot-seating water carts, suspension of bulk shaping operations, relocating activities to less exposed areas and approximately three hours of downtime. In accordance with Condition 20, Schedule 3 of Development Consent DA 92/97, this elevated reading is therefore not considered a non-compliance.

Chart 6 shows that PM₁₀ levels fluctuated at the three monitors throughout the year, with no apparent trends other than APF2 generally recording higher levels than APF4 and APF5. Chart 8 indicates annual average PM₁₀ levels were generally consistent between 2018 and 2019. Review of the recorded data inclusive of 'extraordinary event' days, however, indicates annual average PM₁₀ levels increased materially in 2019, likely due to the significant bushfire activity in late 2019 (refer Charts C1 and C3 in Appendix C).

Real-time monitoring of PM_{2.5} was undertaken during the reporting period at the three Palas Fidas monitors (Figure 5). The measured cumulative 24 hour average PM_{2.5} levels on applicable days (i.e. days not considered to be 'extraordinary events') were below the relevant criteria during the reporting period.

Chart 7 shows that PM_{2.5} levels fluctuated at the three monitors throughout the year, with no apparent trends other than a general increase in levels from late October, likely due to the significant bushfire activity. Chart 9 indicates annual average PM_{2.5} levels were generally consistent between 2018 and 2019. Review of the recorded data inclusive of 'extraordinary event' days, however, indicates annual average PM_{2.5} levels increased materially in 2019, due to the significant bushfire activity in late 2019 (refer Charts C2 and C4 in Appendix C).

Total Suspended Particulate

The annual average TSP levels based on the measured TSP levels on applicable days (i.e. days not considered to be 'extraordinary events') were compliant with the annual average TSP criterion during the reporting period.

Similar to PM₁₀ and PM_{2.5}, review of the recorded data inclusive of 'extraordinary event' days indicates annual average TSP levels increased materially in 2019, likely due to the significant bushfire activity in late 2019 (refer Chart C5 in Appendix C), though no other trends are apparent.

MOD 3 predictions for air quality were modelled for three scenarios during the mine life (i.e. Year 2018, Year 2021 and Year 2025). Monitored annual average levels of insoluble solids were generally higher than the MOD 3 Scenario 1 predictions. Annual average PM_{2.5} levels in 2019 were above the MOD 3 predicted levels, while PM₁₀ levels were generally consistent with the MOD 3 predictions. Annual average TSP concentrations recorded at monitoring site A-HV2 were above the predicted TSP concentration for Scenario 1 in MOD 3.

The inconsistencies observed between the monitoring results and the MOD 3 predictions are likely to be due to differences in background air quality levels (e.g. due to the prolonged drought conditions experienced in NSW in 2019 and significant bushfire activity – even with 'extraordinary event' days removed where applicable). In addition, there is inherent uncertainty associated with predictive modelling (e.g. activities may not occur in the same location, or at the same magnitude, as anticipated when developing predictive models). Further, the sensitive receptors (residences) are generally not located immediately adjacent the nearest monitoring sites (e.g. monitoring sites may be located closer to mining activity).

5.4.4 IMPLEMENTED OR PROPOSED MANAGEMENT ACTIONS

All appropriate steps to reduce dust generation were undertaken in accordance with the MPO AQGGMP, consistent with Condition 20, Schedule 3 of Development Consent DA 92/97. MACH Energy will continue to implement these dust mitigation measures.

Site inductions undertaken in the reporting period included consideration of air quality requirements to ensure employee and contractor awareness of potential dust impacts, especially with respect to the nearest sensitive receptors.

5.5 BIODIVERSITY

During the reporting period, an updated BMP was prepared by MACH Energy in accordance with Condition 32, Schedule 3 of Development Consent DA 92/97. The BMP was approved on 14 January 2019.

5.5.1 APPROVAL CRITERIA AND MANAGEMENT PLAN REQUIREMENTS

MACH Energy implements biodiversity management actions in accordance with the approved BMP. In order to ensure appropriate management actions are applied and to evaluate the vegetation and fauna habitat condition at the MPO, the BMP implements a Biodiversity Monitoring Program. The program includes the following components:

- weed monitoring;
- vertebrate pest monitoring;
- monitoring of access; and
- rehabilitation monitoring.

5.5.2 IMPLEMENTED OR PROPOSED MANAGEMENT ACTIONS

In 2019, the following biodiversity related management actions were undertaken:

- Weed control measures carried out by Enright Land Management and other contractors on various properties within MPO and adjoining properties. Weeds found on the properties were sprayed or manually removed. These included Boxthorn, Prickly Pear, Creeping Acacia and St Johns Wort.
- Pest control measures implemented by Enright Land Management and other contractors on various properties within the MPO and adjoining properties. These included aerial shooting and wild dog baiting.
- Pre-clearance surveys undertaken by MACH Energy Environmental Advisor and/or an ecologist consultant (Narla Environmental or Umwelt) including:
 - surveys for Pit E/F prior to commencement of mining undertaken in April 2019;
 - survey for clean water diversion drainage infrastructure in November 2019; and
 - surveys undertaken prior to disturbance as part of all Ground Disturbance Permits (GDPs) throughout 2019;
- Clearing supervision was undertaken by a MACH Energy Environmental Advisor and/or an ecologist consultant (Narla Environmental or Umwelt), which included fauna management (i.e. spotter catching) and habitat tree felling supervision.
- No threatened fauna species were recorded during clearing activities.
- The Tiger Orchid (*Cymbidium canaliculatum*) translocation report (Narla Environmental, 2019) was finalised.
- Snake awareness toolbox talks were undertaken in Spring 2019
- Annual, bi-annual and regular monitoring was carried out by MACH Energy.

5.6 HERITAGE

MACH Energy manages Aboriginal heritage on-site in accordance with Aboriginal Heritage Impact Permits (AHIPs) (i.e. AHIPs #C0002053, #C0002092 and #C0004783) issued by the Biodiversity and Conservation Division (BCD) within DPIE (former Office of Environment and Heritage [OEH]), and in accordance with the approved AHMP, prepared in accordance with Condition 36, Schedule 3 of Development Consent DA 92/97.

Following approval of MOD 4 of Development Consent DA 92/97, MACH Energy submitted an AHIP application to include the entirety of the MOD 4 disturbance footprint during the reporting period. The AHIP application was prepared in consultation with the Registered Aboriginal Parties (RAPs) and OEH in March 2019. AHIP #C0004783 was approved by OEH on 11 June 2019 and prompted the update of the AHMP. The latest version of the AHMP was approved on 31 October 2019.

5.6.1 APPROVAL CRITERIA AND MANAGEMENT PLAN REQUIREMENTS

During the reporting period, all Aboriginal heritage management activities were carried out in accordance with the AHMP. The AHMP contains a range of management measures related to recording and surface collection, archaeological excavation, artefact analysis, artefact management, scarred tree removal, archaeological salvage, archaeological monitoring, and an Aboriginal conservation strategy.

5.6.2 IMPLEMENTED OR PROPOSED MANAGEMENT ACTIONS

During the reporting period, the following on-ground management measures relevant to heritage (Aboriginal and historic heritage) were undertaken at the MPO:

- A scar tree reassessment was undertaken by Dr. Mark Burns of GSS Environmental. It was concluded that none of the 19 previously assessed scar trees were of Aboriginal cultural origin.
- Archaeological salvage for Aboriginal artefacts was undertaken within AHIP #C0002092 area in January and February 2019.
- The MPO Aboriginal Site Database and Geographic Information System (GIS) data were revised and updated. This included reassessment of all Aboriginal site recorded across multiple MPO data sets, GIS data, original reports, mapping and the Aboriginal Heritage Information Management System data.
- The annual meeting with RAPs was undertaken to provide a general update on the management of Aboriginal Heritage in July 2019.
- Commencement of suitable arrangements to provide appropriate long-term security for the Aboriginal Heritage Conservation Area (Area A).
- Commencement of conservation management works at the Negoa Homestead including structural works and removal of non-heritage components.

During the next reporting period, MACH Energy anticipates undertaking the following heritage works:

- MOD 4 Aboriginal artefact salvage within AHIP #C0004783 area to commence in 2020 prior to construction.
- Continue to progress appropriate long-term security for the Aboriginal Heritage Conservation Area (Area A).
- Continue to undertake appropriate conservation management works at the Negoa Homestead.

5.7 EXPLORATION

MACH Energy completed a pre-production drilling program in 2019 within the proposed three-year mining footprint, with 70 boreholes being drilled in ML 1645 and ML 1709 during the reporting period. Drilling was undertaken using the water injection method, which generates minimal dust and noise emissions. The majority of boreholes were located within the open cut/overburden emplacement area footprint and involved open hole (non-core) drilling. Further pre-production drilling programs will continue in 2020.



Plate 1: 2019 Archaeological Salvage within AHIP C0002092

5.8 WASTE

Operational waste data was collected during the reporting period by Remondis Australia and is presented in Table 16.

The WasteMP contains management measures on waste storage, segregation, transport and disposal, as well as provisions for waste monitoring. The latest version of the WasteMP was approved by DPIE on 14 January 2019.

5.9 TOPSOIL MANAGEMENT

During the reporting period, topsoil stockpiles were located adjacent to active disturbance areas and areas to be rehabilitated, as shown on Figure 6. A total of approximately 1,358,400 m³ of topsoil was stored in stockpiles during the reporting period. This, in accordance with the MOP/RMP, is approximately 269,005 m³ ahead of topsoil budgeted for the end of the MOP Period (30 June 2020). A topsoil register with individual volumes for each stockpile is kept and maintained on-site.

Topsoil is stripped ahead of disturbance activities and where possible, placed onto rehabilitation areas immediately. Where it is impractical to respread topsoil immediately, topsoil is stockpiled and sign posted, and seeded with a cover crop (e.g. native grass and trees). Where a stockpile will be in place for greater than six months the stockpile will be ripped, seeded with a cover crop (e.g. native grass and trees) to maintain seed reserves and microbial soil associations.

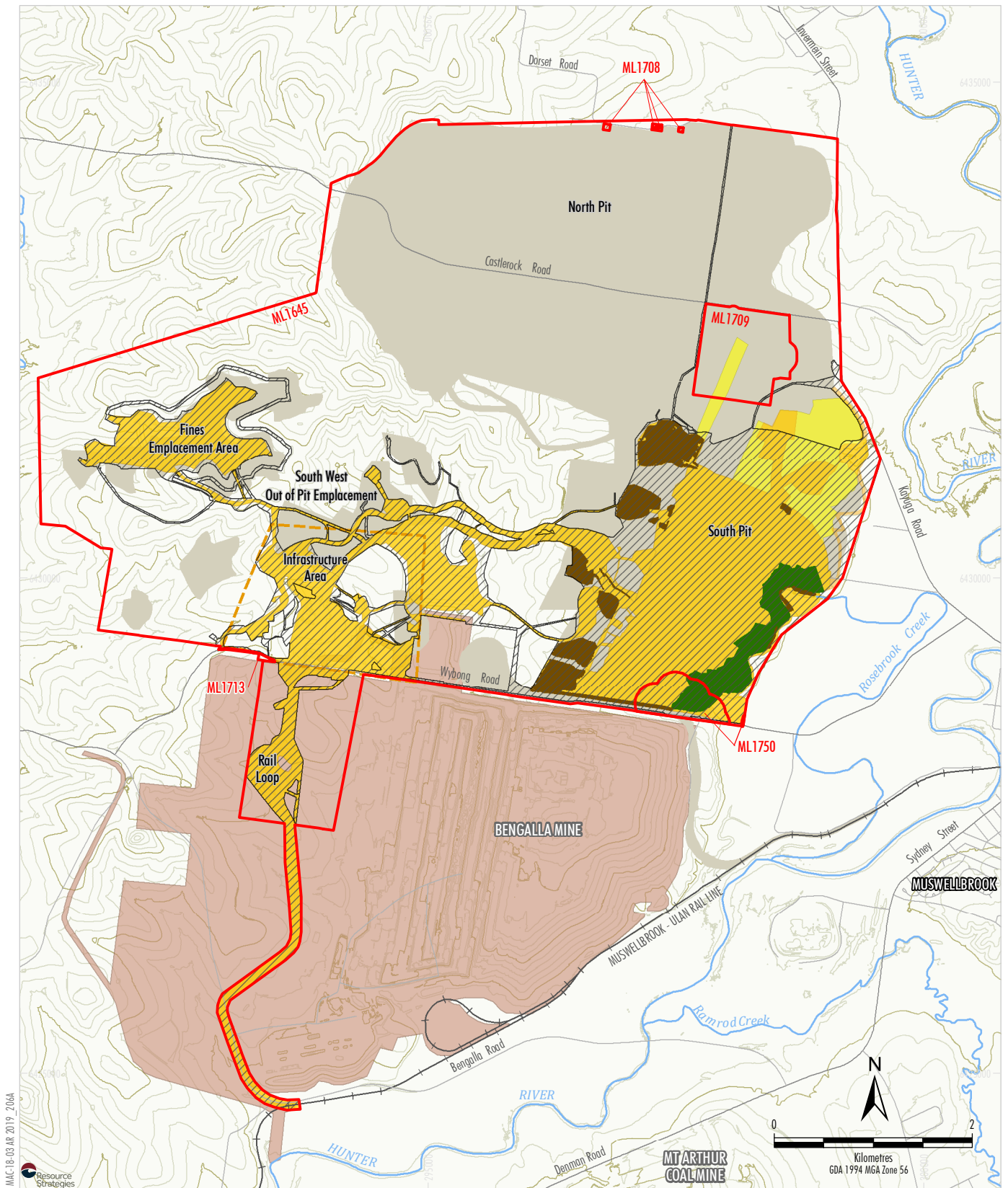
Table 16
MPO Waste Data

Waste	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
General Waste (t)	33.01	28.44	19.22	15.02	27.92	18.10	71.18	25.54	22.79	31.25	20.75	29.39	4342.59
Asbestos ¹ (t)	0	0	0	0	0	0	0	0	0	0	0	0	0
Recycled Waste (t)	18.82	24.34	6.90	12.66	13.16	18.65	23.25	29.68	28.58	40.14	31.66	22.85	270.66
Liquid Effluent (kL)	45	68.50	76.40	87	75	105	96	108	56.5	85.5	80	72	954.90

Note:

t = tonnes; kL = kilolitres.

¹ Asbestos is managed in accordance with an internal Asbestos Control Plan. All asbestos removal work is handled with appropriate respiratory protective equipment and is supervised by a competent person approved by SafeWork NSW. Asbestos is transported off-site and disposed of at a lawful disposal facility licensed by EPA.



IMAC:18-03 AR 2019_206A



LEGEND

- Mining Lease Boundary
- Infrastructure Area Envelope
- MOP Footprint +
- End 2019 Active Disturbance Area
- End 2019 Topsoil Stockpile Location
- End 2019 Rehabilitation Area
- 2020 Forecast Additional Disturbance Area
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)

Notes:

- * Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, off-site coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, other ancillary works and construction disturbance.
- + Mount Pleasant Operation Mining Operations Plan and Rehabilitation Management Plan (July 2019)

Source: MACH Energy (2020); NSW Spatial Services (2019); Department of Planning & Environment (2016)

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Topsoil Stockpile Locations

Figure 6

Plate 2 provides an example topsoil stockpile at the MPO. Further descriptions of topsoil stockpile management options are outlined in the approved MOP/RMP.



Plate 2: Example Topsoil Stockpile

5.10 VISUAL AMENITY AND LIGHTING

During the reporting period, an updated VIMP was prepared by MACH Energy in accordance with Condition 47, Schedule 3 of Development Consent DA 92/97. The VIMP was approved on 31 October 2019.

The VIMP describes MACH Energy's management approach to minimising visual amenity and lighting impacts on surrounding receivers.

Visual landscaping activities were undertaken during the reporting period. These included:

- tree screen infill planting (9,826 trees) along key roads with views of the MPO such as Kayuga; Wybong and Dorset roads;
- commencement of the extension of visual barrier fencing along Wybong Road adjacent to the CHPP;
- tree planting along the main MPO access road;
- tree planting along the south eastern extent of Mining Lease 1645;
- implementation of visual bunding/tree screen planting along the CHPP Road on the western edge of the ROM coal storage area; and
- general maintenance of the abovementioned areas.

Due to abnormally dry conditions in 2019, visual landscaping growth and survival rates were lower than targeted.

A total of 17 visual-related complaints were received by MACH Energy during 2019 (see Complaints Summary 2019: <https://machenergyaustralia.com.au/mount-pleasant/documentation/>). In response to each complaint, an investigation was triggered. Following the investigation, the External Relations Manager made further contact with the complainant to provide an update on how MACH Energy has addressed the issue of the complaint.

5.11 CONTAMINATED LAND

No contaminated land that posed a potential or material threat to the environment was encountered during the reporting period.

5.12 SPONTANEOUS COMBUSTION MANAGEMENT

Inspections of coal stockpiles for spontaneous combustion were undertaken regularly. There were two spontaneous combustion events at the MPO during the reporting period.

The first spontaneous combustion event occurred on the ROM coal storage area during a night shift on 3 February 2019. An exclusion zone and the affected coal were isolated, spread and compacted until the affected coal was remediated.

The second spontaneous combustion event was reported during a night shift on 5 December 2019 at the Pit D dump. The carbonaceous material was tipped between 9 – 14 October; however, strong westerly winds triggered self-heating. The area was remediated by capping of the material.

6 WATER MANAGEMENT

During the reporting period, an updated WMP was prepared by MACH Energy in accordance with Condition 28, Schedule 3 of Development Consent DA 92/97. The WMP was approved on 31 October 2019.

The WMP includes the following monitoring network (Figure 7):

- 17 surface water monitoring locations (W1 – W17); and
- five stream health monitoring locations (Hunt 585, Hunt 854, Hunt 571, Hunt 506 and Sandy 1).

Mining activities in 2019 were undertaken in accordance with the erosion and sediment control provisions of the approved WMP.

There were no water discharges from the MPO in 2019. Any future discharges of mine water will be undertaken in accordance with Development Consent DA 92/97 (Condition 26, Schedule 3), Development Consent SSD-5170 (i.e. Bengalla Mine's Development Consent) and EPL 20850.

6.1 SURFACE WATER

6.1.1 APPROVAL CRITERIA

Surface Water Quality

Surface water monitoring is undertaken monthly and/or event based at 17 locations (Figure 7) for pH, EC, Total Suspended Solids (TSS) and TDS. Water samples are also collected quarterly at these sites for laboratory analysis.

Establishment of the baseline conditions of key watercourses prior to the commencement of coal extraction was undertaken through surface water monitoring. Monitoring data has been reviewed against site-specific surface water quality triggers, developed using the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand [ANZECC & ARMCANZ], 2000).

Trigger levels have not been established for sites upstream of the MPO (i.e. W1 and W4) because these cannot be affected by the MPO. Sites located on the Hunter River and the unnamed drainage line (monitored adjacent to Wybong Road) (i.e. W2, W6 and W8) contain sufficient data to develop trigger levels (with the exception of TDS trigger levels for these sites). Some sites (i.e. W5, W7, W8, W9 and W10) are located on ephemeral drainage lines that are frequently dry and do not have sufficient data to develop site-specific trigger levels. ANZECC & ARMCANZ (2000) default trigger levels for these sites have been adopted, until such time as sufficient data is available to develop site-specific triggers.

W17 has been assigned preliminary trigger values from the Bengalla Water Management Plan (BMC, 2017). MACH Energy has established preliminary triggers at this site as it is the only site downstream of MPO's footprint on the Hunter River that is not also downstream of the Bengalla Mine footprint. MACH Energy therefore considers this site particularly important for assessing potential surface water impacts associated with the MPO (i.e. in the absence of any potential influence from Bengalla Mine).

Trigger levels for the remaining water monitoring sites (i.e. W11-W16 [Figure 7]) will also be established once sufficient monitoring data has been collected at these sites.

The site-specific trigger levels are listed in Table 17.

Table 17
Surface Water Quality Trigger Levels

Site	pH	EC (µS/cm)	TSS (mg/L)
	20 th – 80 th Percentile Trigger Levels	80 th Percentile Trigger Level	80 th Percentile Trigger Level
Site Specific Trigger Levels			
W2	7.8 – 8.3	539	18
W6A*	7.8 – 8.4	496	19
W8	6.9 – 7.6	318	672
Default Trigger Levels[^]			
W5	6.5 – 7.5	350	-
W7	6.5 – 7.5	350	-
W8	6.5 – 7.5	350	-
W9	6.5 – 7.5	350	-
Bengalla Mine Trigger Levels[#]			
W17	6.5 – 8.1	650	40

Note:

µS/cm = microsiemens per centimetre and mg/L = milligrams per litre.

* Due to safe access no longer being available at site W6, triggers developed for this site will now be used at the new monitoring location W6A, approximately 500 m downstream of W6, as described in Section 7.3.

[^] Default trigger levels are based on the ANZECC & ARMCANZ (2000) guideline values for upland rivers in south-east Australia. ANZECC & ARMCANZ (2000) does not provide guideline values for TSS.

[#] Preliminary trigger values have been sourced from the Bengalla Water Management Plan (BMC, 2017), which have been established from baseline data for monitoring sites adjacent to W17 (e.g. Bengalla sites W01, W02 and W03), as well as the ANZECC & ARMCANZ (2000) guideline.

Trigger levels are not regarded as assessment criteria, rather they are used as an indicator of potential impacts and to initiate investigations into the surface water quality as reported by the monitoring program.

An investigation is triggered when both:

- a water quality indicator at a downstream receiving water monitoring location is above (or outside the range of) the trigger levels for three consecutive sampling events; and
- a water quality indicator at a downstream receiving water monitoring location is above (or below in event of a trigger of the lower pH limit) the indicator of the corresponding upstream monitoring location (where such a monitoring location exists) sampled on the same day.

The majority of sites are located on ephemeral drainage lines and therefore do not regularly experience flow for sampling. During the reporting period, sites W5, W7, W9, W13 and W14 had insufficient water for monthly manual sampling and therefore either do not have full datasets or have no data presented in Section 6.1.2. Sites W8 and W10 have been mined through and no longer exist.

Stream Health

Stream health monitoring continued during the reporting period at four sites outlined in the WMP located on the Hunter River (Hunt 585, Hunt 854, Hunt 571 and Hunt 506), as well as five additional sites located on Sandy Creek (Sandy 1) and the Hunter River (HR1, HR2, HR5, HR6) (Figure 7). Two rounds of monitoring were undertaken during the reporting period, in May 2019 (autumn) and November 2019 (spring).

Stream health is monitored bi-annually during spring and autumn using the Australian River Assessment System (AusRivAS) aquatic invertebrate monitoring protocol. In addition to the aquatic macro invertebrate sampling, monitoring also includes: fish observations, site water quality, stream condition and presence of aquatic and riparian edge plants.

Trigger levels have been developed at two of the Hunter River stream health monitoring sites, as outlined in Table 18.

Table 18
Stream Health Trigger Levels

Site ID	Baseline Band of Impairment Score	Trigger Level (O/E Taxa)
Hunt 571	B	0.54
Hunt 854	A	0.84

O/E = Observed/Expected.

Should a measured O/E taxa value at a particular site deteriorate below the range for its baseline band of impairment score at two successive monitoring rounds, the stream health investigation protocol (refer to the WMP) would be initiated.

6.1.2 PERFORMANCE DURING THE REPORTING PERIOD

Surface Water Monitoring

Surface water monitoring for the reporting period has been split into three groups:

- monitoring in the Hunter River (sites W1, W2, W3, W6A, W15 and W17);
- monitoring in Sandy, Muscle and Rosebrook Creeks (sites W4, W11, W12, W13, W14 and W16); and
- monitoring in other ephemeral creeks and gullies.

When there is no data available (e.g. due to prolonged dry conditions), charts are not presented in the following sub-sections.

Monitoring sites W16 and W17 were established in late 2019 and monitoring at the sites did not commence during the reporting period. Sites W16 and W17 are therefore not presented in the following sub-sections. Water quality at sites W16 and W17 will be reported in future Annual Reviews once monitoring commences.

Additional event-based monitoring was carried out in April, resulting in two monitoring records instead of one (1 April and 26 April).

Hunter River

Monitored pH values for the Hunter River monitoring sites during the reporting period are shown in Chart 11. Additionally, a comparison between 2017, 2018 and 2019 pH values is provided in Chart 12.

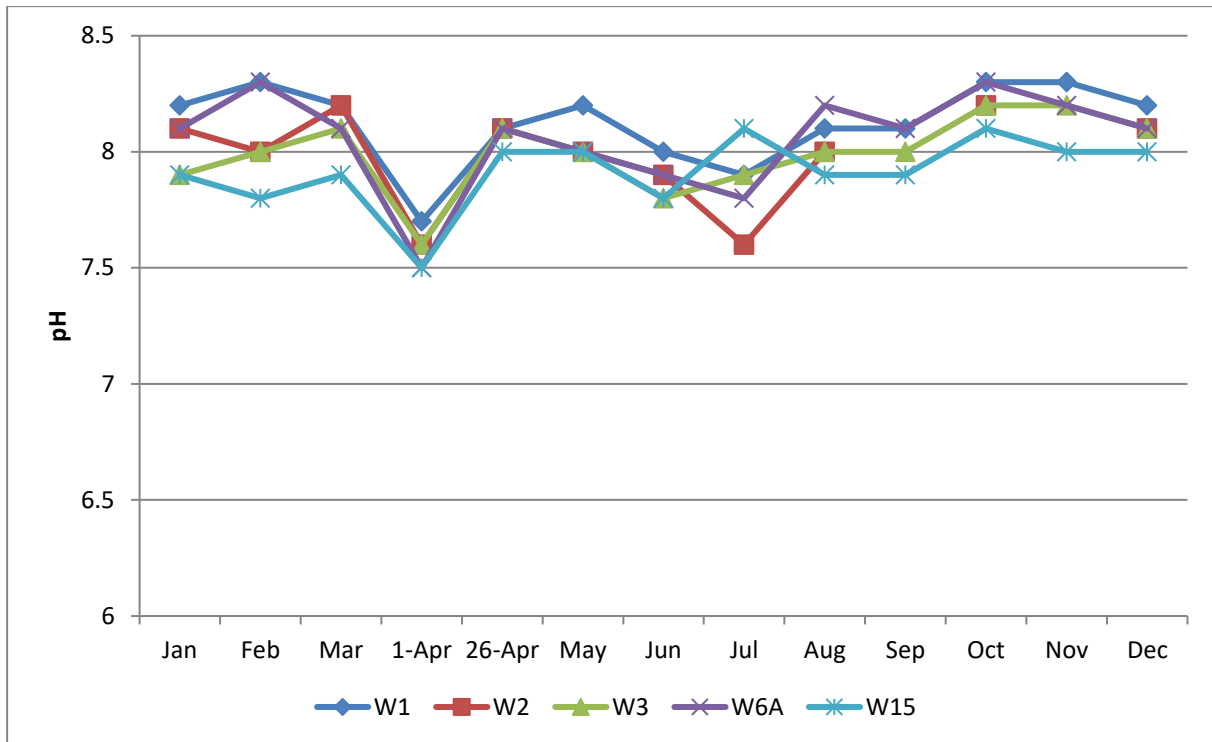


Chart 11: Hunter River pH Levels 2019

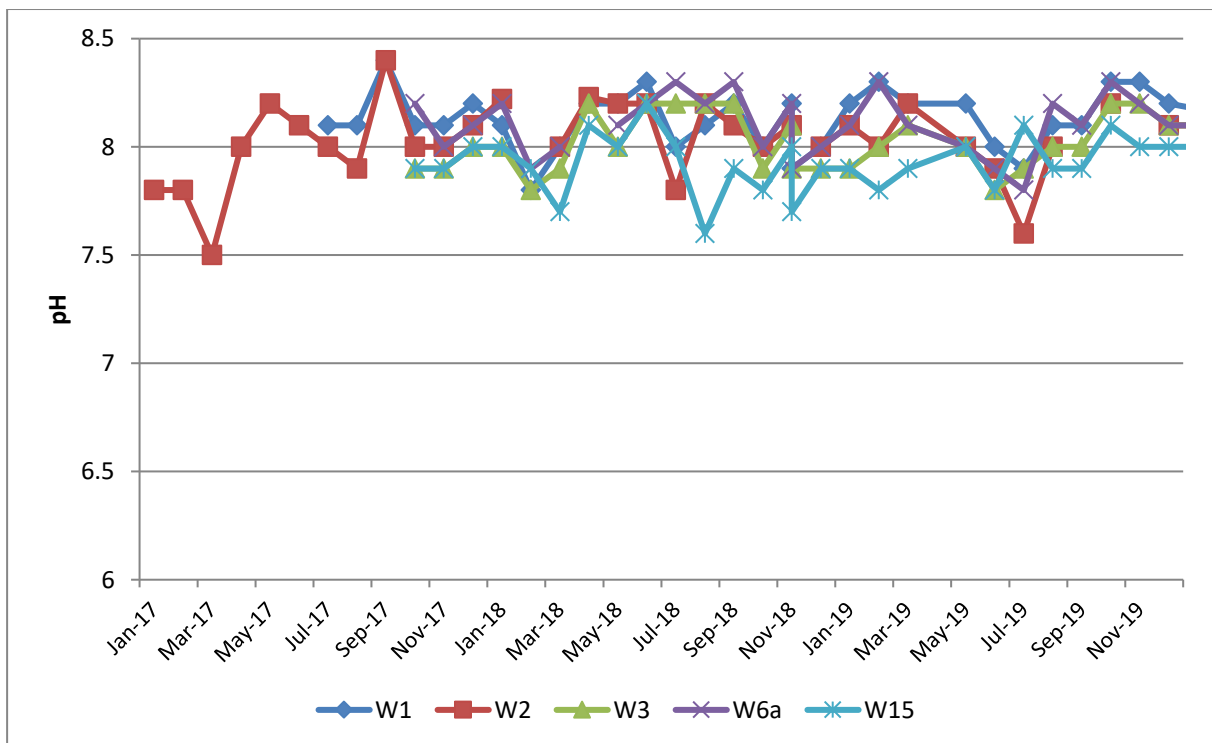


Chart 12: Hunter River pH Levels 2017 – 2019

EC values for the 2019 monitoring period are shown in Chart 13. Additionally, a comparison between 2017, 2018 and 2019 EC values is provided in Chart 14.

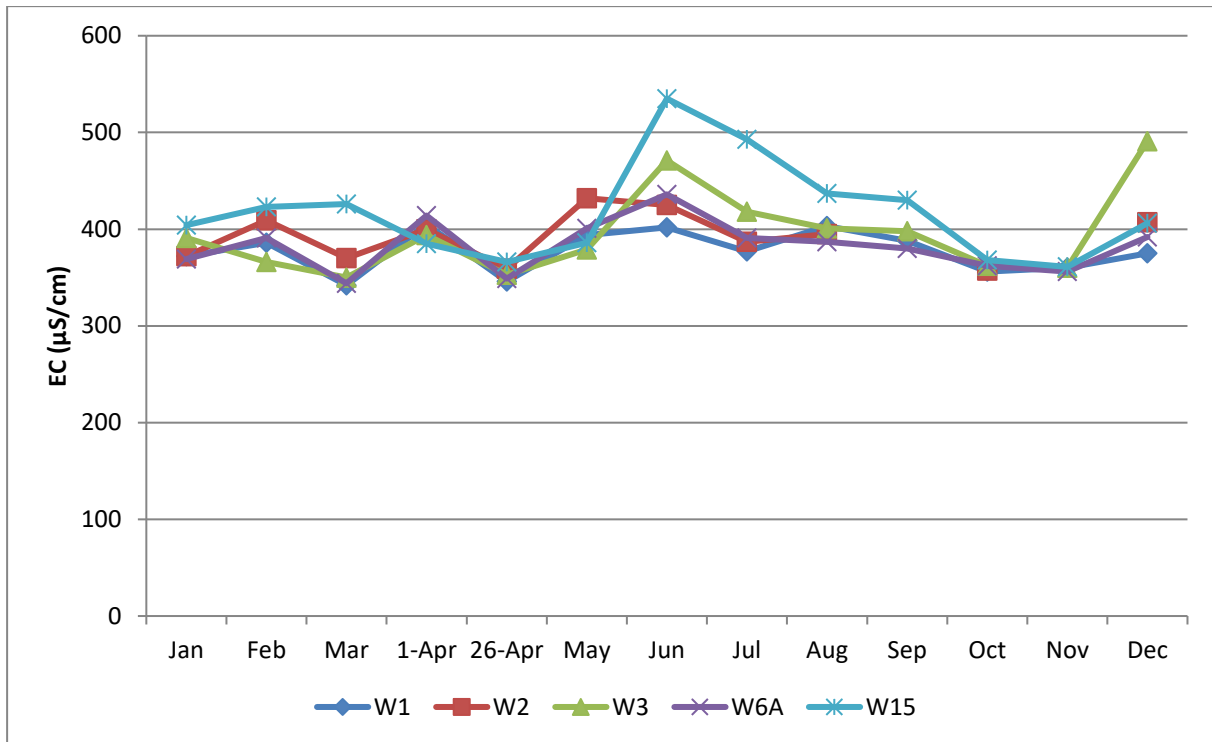


Chart 13: Hunter River EC Levels 2019

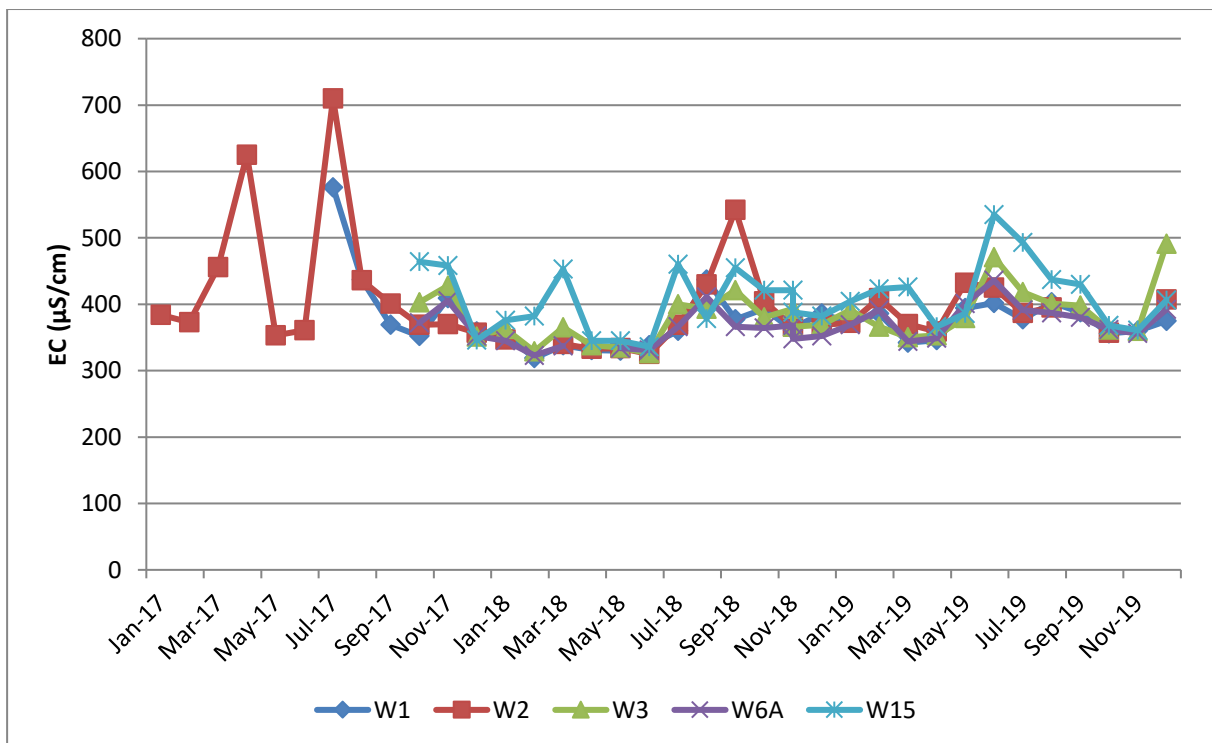


Chart 14: Hunter River EC Levels 2017 – 2019

TSS values for the 2019 monitoring period are shown in Chart 15. Additionally, a comparison between 2017, 2018 and 2019 TSS values is provided in Chart 16.

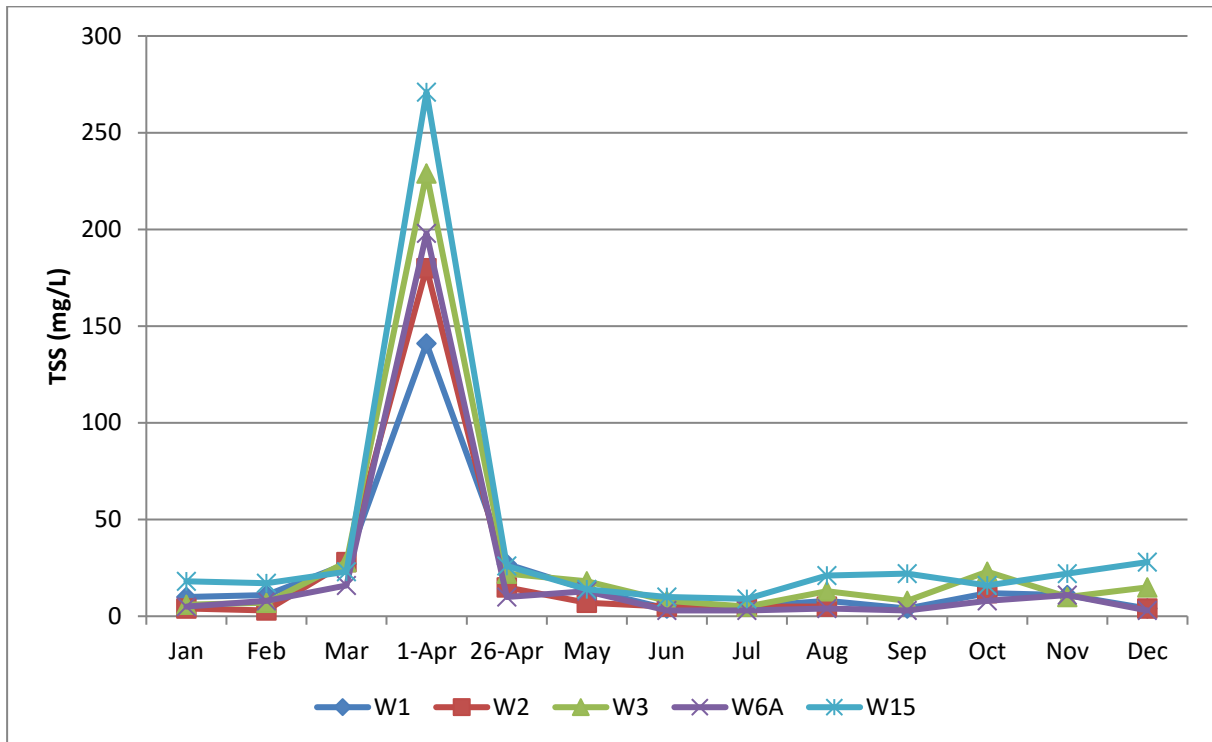


Chart 15: Hunter River TSS Levels 2019

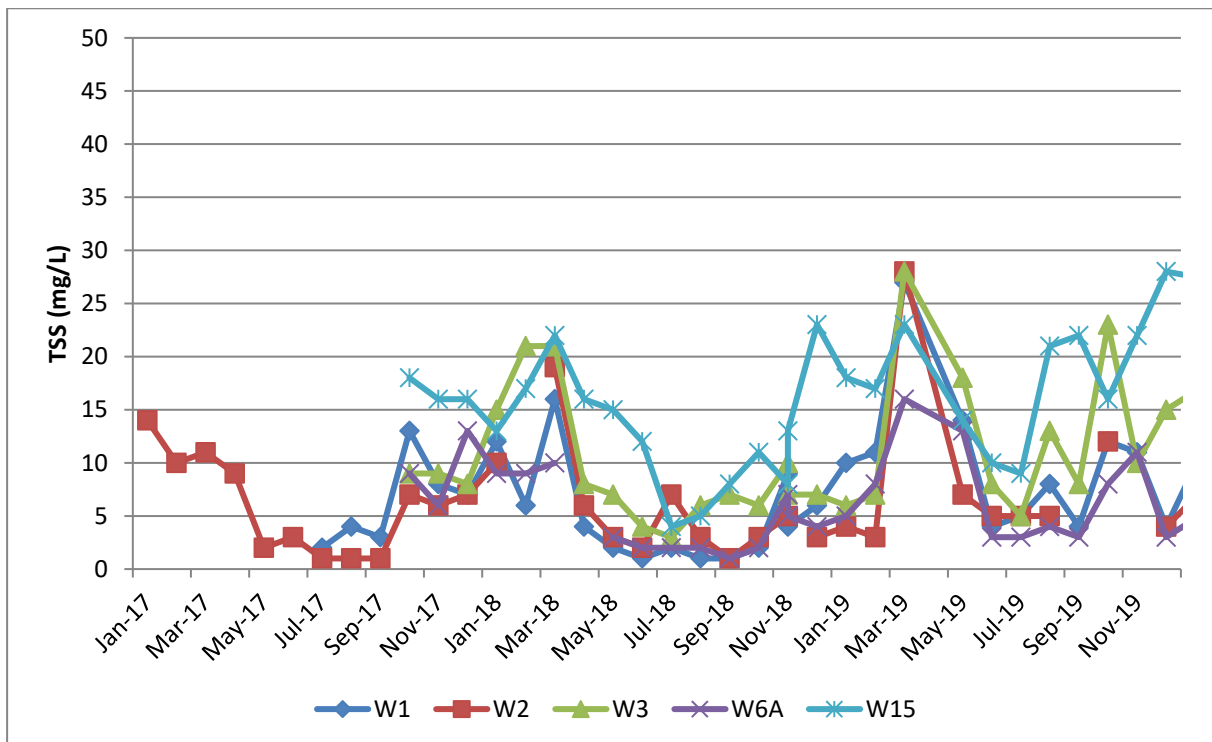


Chart 16: Hunter River TSS Levels 2017 – 2019

TDS values for the 2019 monitoring period are shown in Chart 17. Additionally, a comparison between 2017, 2018 and 2019 TDS values is provided in Chart 18.

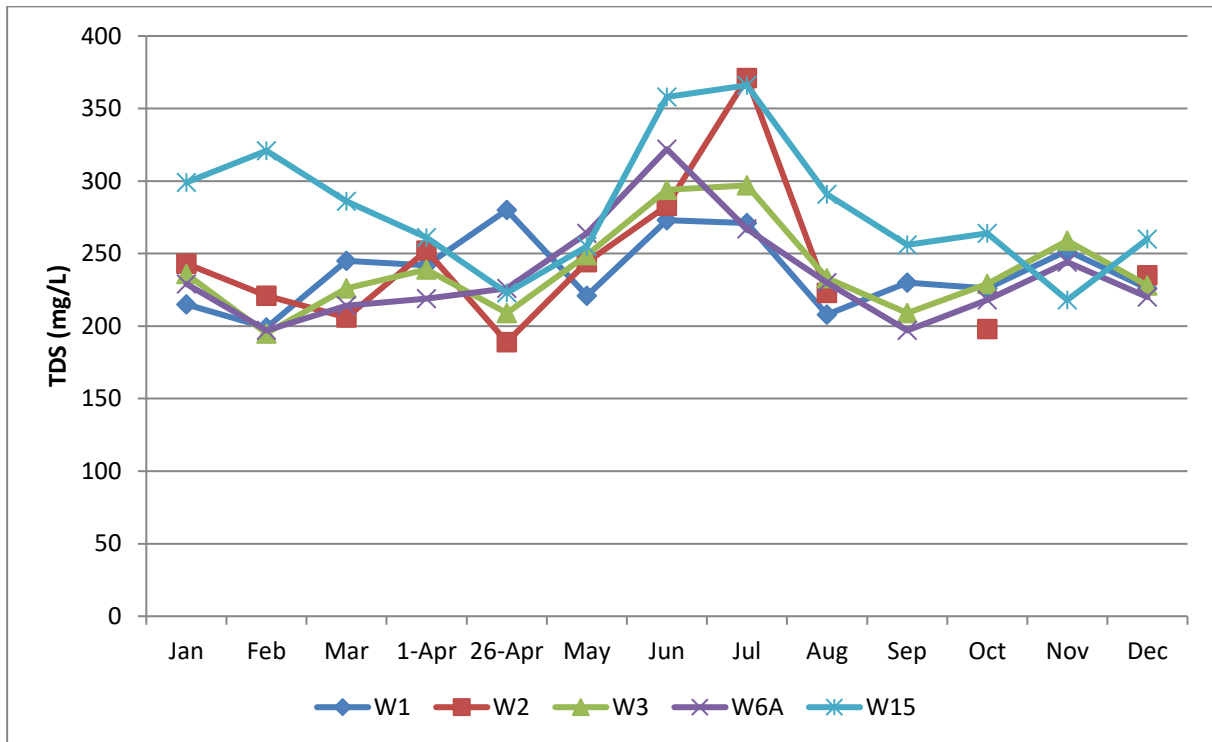


Chart 17: Hunter River TDS Levels 2019

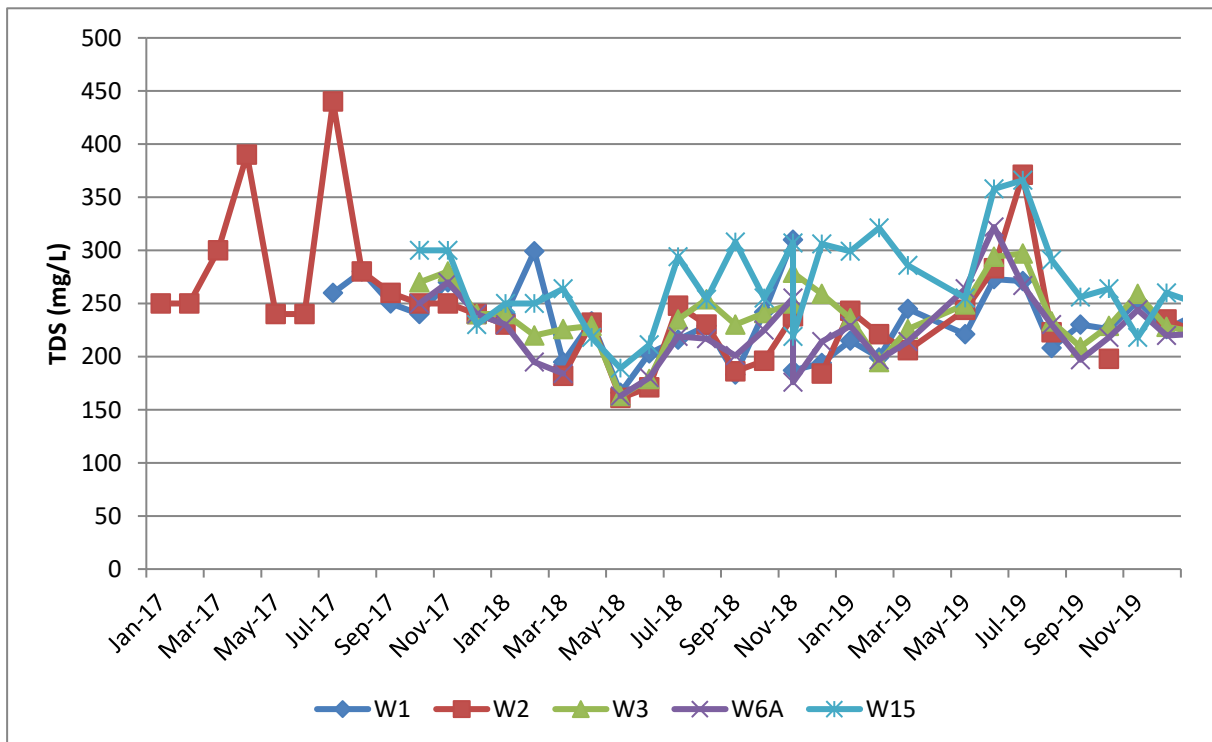


Chart 18: Hunter River TDS Levels 2017 – 2019

Sandy, Muscle and Rosebrook Creeks

Monitored pH values for the Sandy, Muscle and Rosebrook Creek monitoring sites during the reporting period are shown in Chart 19. Additionally, a comparison between 2017, 2018 and 2019 pH values is provided in Chart 20.

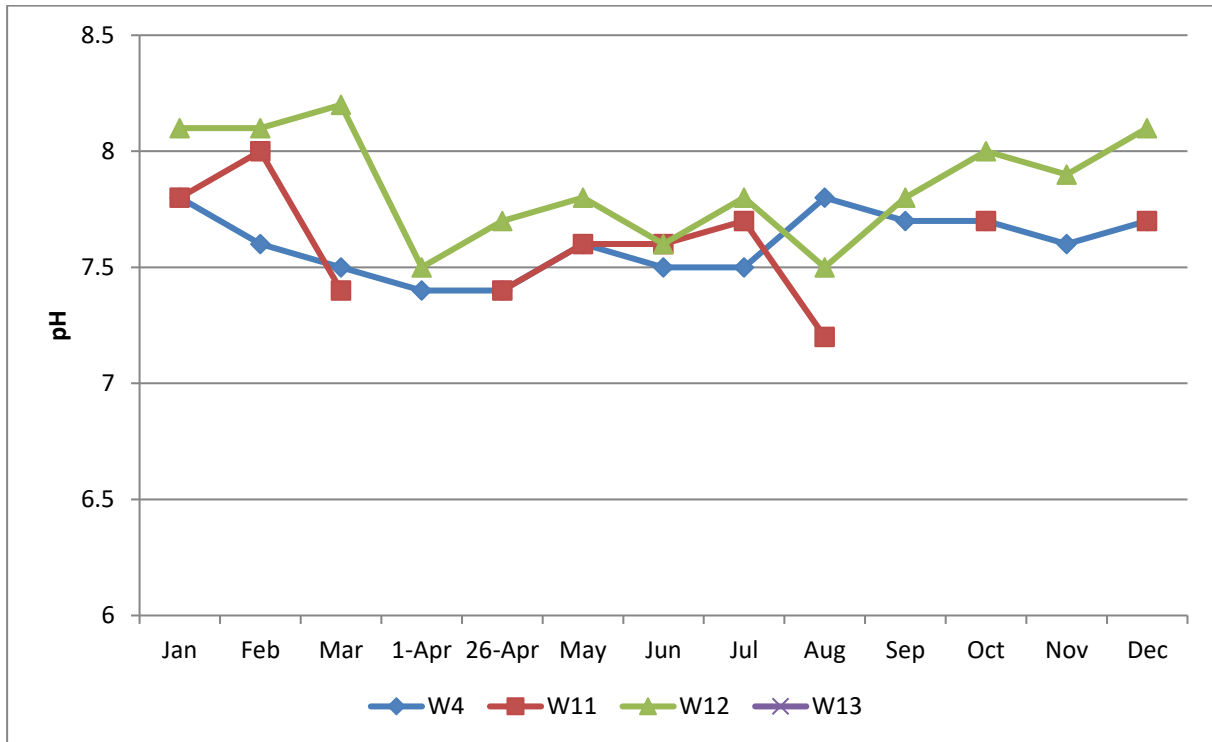


Chart 19: Sandy, Muscle and Rosebrook Creeks pH Levels 2019

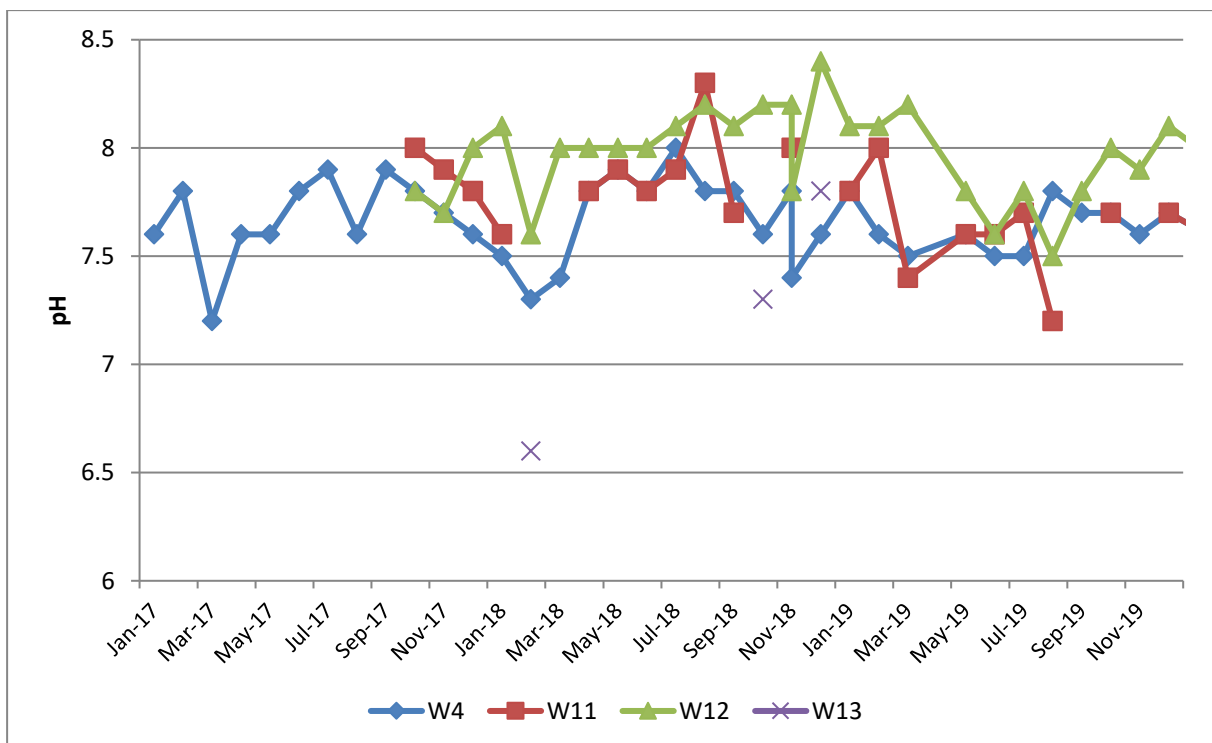


Chart 20: Sandy, Muscle and Rosebrook Creeks pH Levels 2017 – 2019

EC values for the 2019 monitoring period are shown in Chart 21. Additionally, a comparison between 2017, 2018 and 2019 EC values is provided in Chart 22.

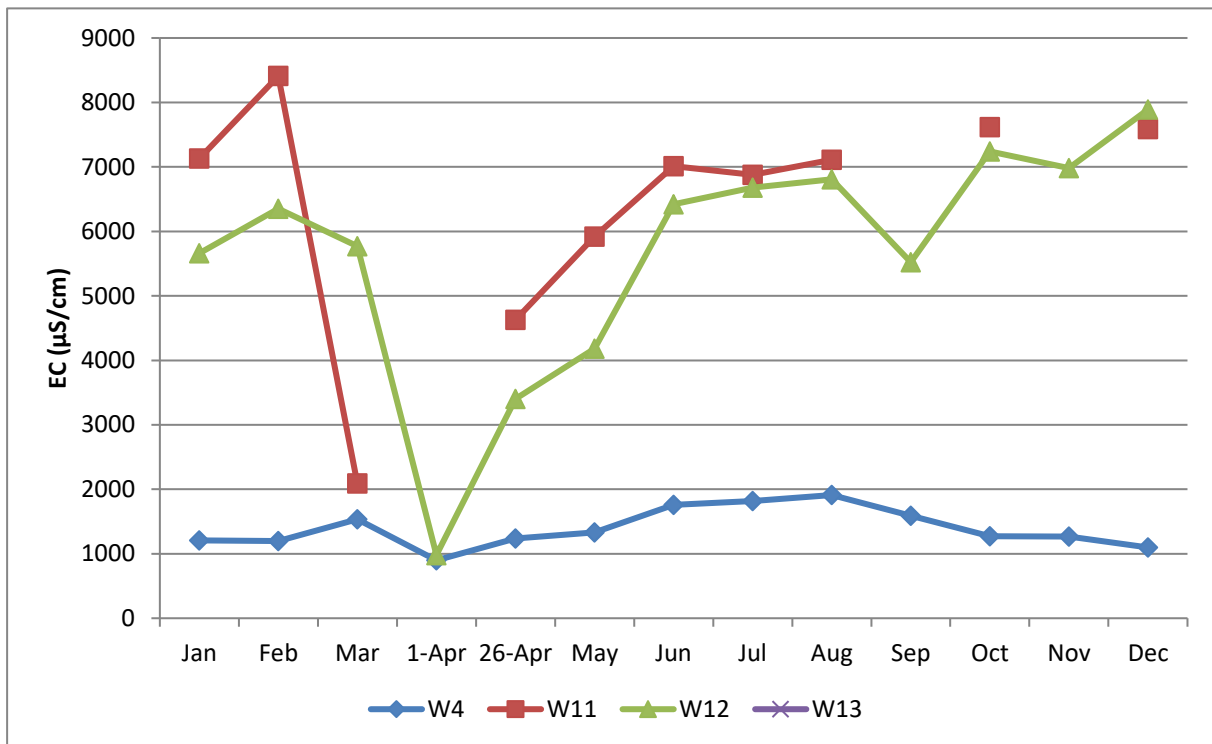


Chart 21: Sandy, Muscle and Rosebrook Creeks EC Levels 2019

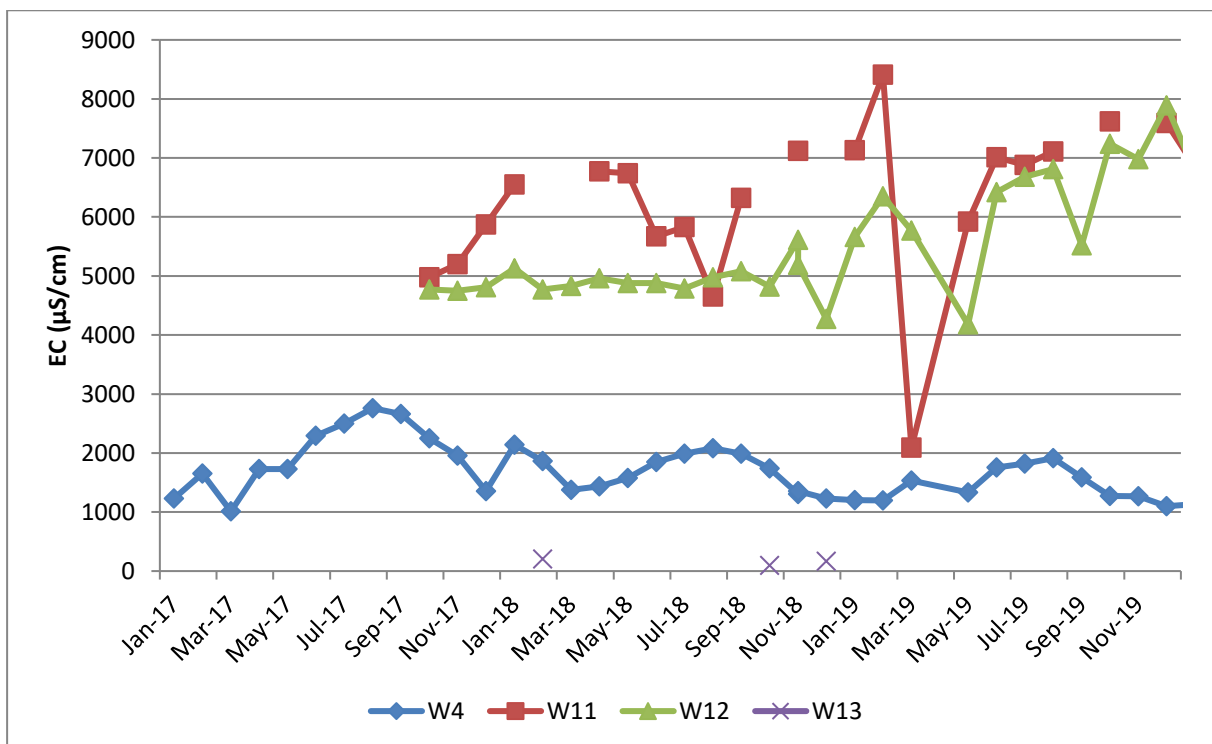


Chart 22: Sandy, Muscle and Rosebrook Creeks EC Levels 2017 – 2019

TSS values for the 2019 monitoring period are shown in Chart 23. Additionally, a comparison between 2017, 2018 and 2019 TSS values is provided in Chart 24.

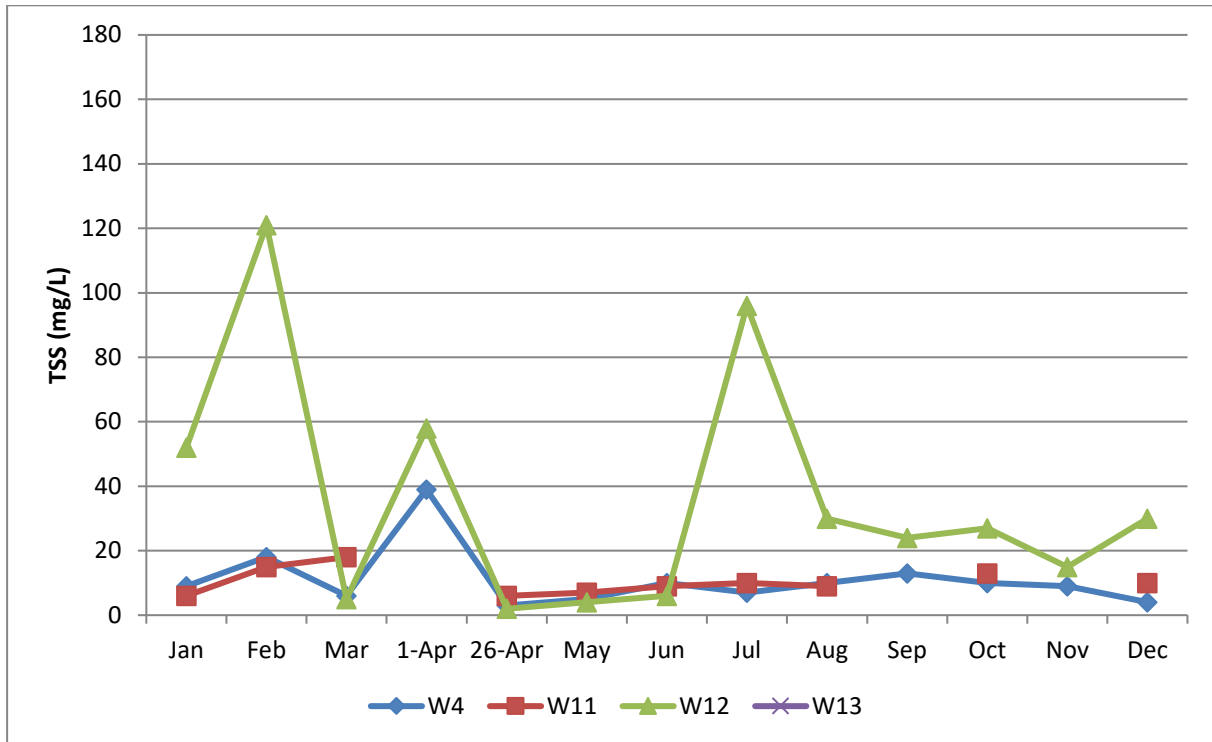


Chart 23: Sandy, Muscle and Rosebrook Creeks TSS Levels 2019

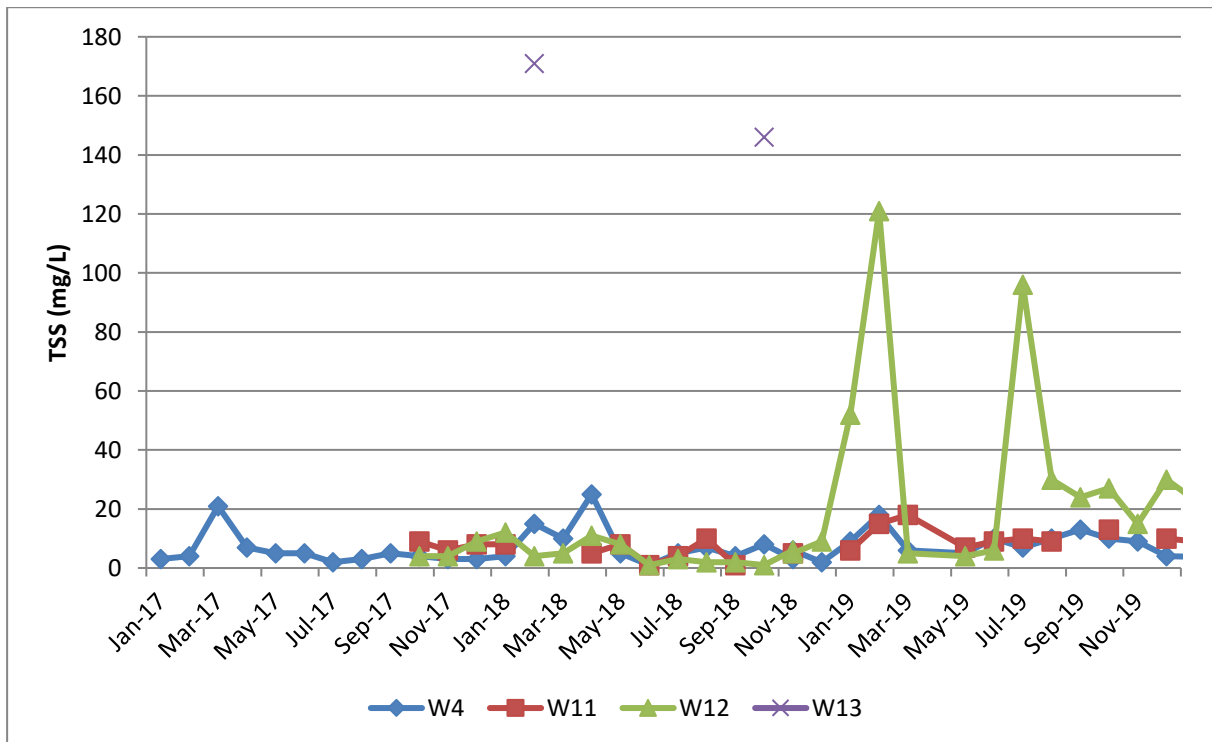


Chart 24: Sandy, Muscle and Rosebrook Creeks TSS Levels 2017 - 2019

Recorded TDS values for the 2019 monitoring period are shown in Chart 25. Additionally, a comparison between 2017, 2018 and 2019 TDS values is provided in Chart 26.

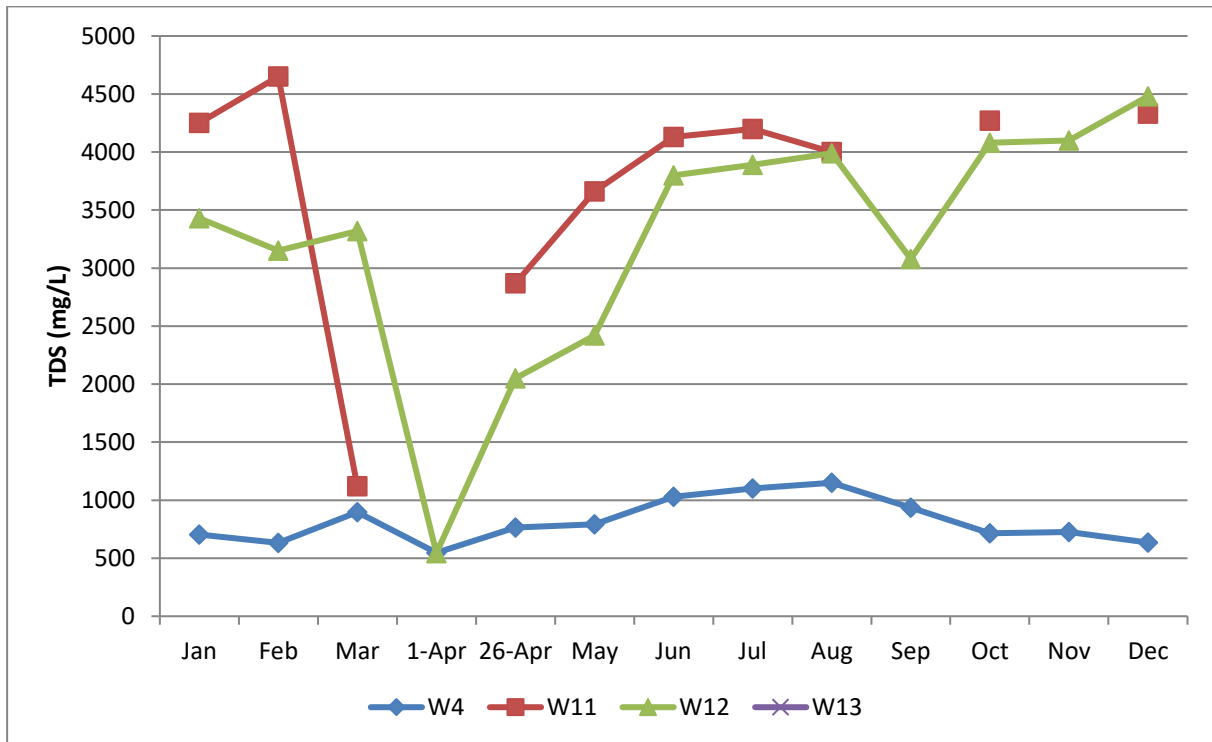


Chart 25: Sandy, Muscle and Rosebrook Creeks TDS Levels 2019

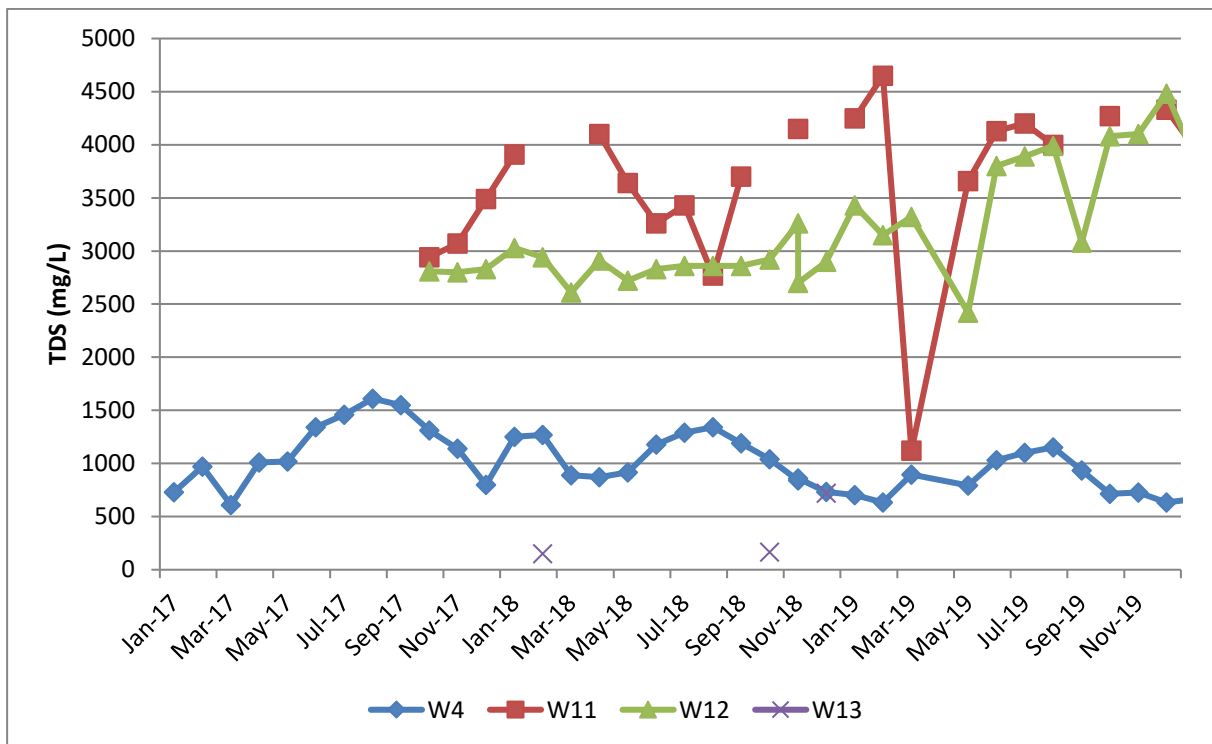


Chart 26: Sandy, Muscle and Rosebrook Creeks TDS Levels 2017–2019

6.1.3 TRENDS AND KEY MANAGEMENT IMPLICATIONS

Surface Water Monitoring

Hunter River Sites (W1, W2, W3, W6A & W15)

During the reporting period, pH levels at the Hunter River sites ranged from 7.6 to 8.3. The Hunter River sites stayed within their relevant pH investigation trigger levels, with the exception of one slightly lowered reading at site W2 during July 2019. Only site W2 has been consistently monitored for water quality since 2017. A comparison with 2017 and 2018 pH levels shows that pH levels have stayed consistently between 7.5 and 8.4 to date.

EC monitoring results for sites W2 and W6A were stable and stayed within the relevant trigger levels. W3 remained relatively consistent, with the exception of one elevated reading in December 2019. EC at W15 also remained relatively consistent throughout the reporting period, with the exception of an elevated reading in June 2019. EC values at W15 decreased in July 2019 and stayed consistently low for the remainder of the reporting period.

TSS levels at the Hunter River sites were consistently low over the reporting period and stayed within the relevant trigger levels with the exception of elevated readings on 1 April 2019, due to a heavy rainfall event on 30 March 2019. TDS levels for all Hunter River sites generally fluctuated between approximately 200 mg/L and 365 mg/L.

Sandy, Muscle and Rosebrook Creek Sites (W4, W11, W12, W13 & W14)

Monitored pH values during the reporting period at the Sandy, Muscle and Rosebrook Creek sites ranged from 7.2 to 8.2. Only site W4 has been consistently measured for water quality since 2017. Monitoring since 2017 shows generally consistent values of pH for site W4.

EC monitoring results at site W4 remained consistent during the reporting period, fluctuating between approximately 1,000 and 2,000 $\mu\text{S}/\text{cm}$. EC levels in site W11 were generally consistent with EC levels recorded since 2017, with the exception of one lowered reading in March 2019. W11 is located upstream of the MPO and therefore it is reasonable to assume that the lowered EC levels observed in site W11 was not due to MPO activities. EC levels observed in site W12 were consistent with the EC levels observed in site W11.

TSS values were generally consistent in sites W4, W11 and W12 during the reporting period. Three samples with high TSS were observed in site W12 in February, April and July 2019. However, the samples were taken from a shallow and turbid pool and/or following rainfall events.

TDS values generally stayed consistent throughout the reporting period at the Sandy, Muscle and Rosebrook Creek sites, and generally correlated with the trend recorded for EC levels at the sites.

The 2017 – 2019 trends for pH and TSS for site W4 were generally consistent with observations made in the EIS (ERM Mitchell McCotter, 1997). EC and TDS levels at site W4 have increased since recordings made in the EIS. This site is located on Muscle Creek within Muswellbrook, upstream of the MPO and therefore any increase is not associated with MPO activities. This site has naturally occurring salts in surrounding soils and rocks, and data from previous annual reviews indicates that large fluctuations at this site are not unusual (Coal & Allied, 2016; MACH Energy, 2017b; MACH Energy, 2018b).

Stream Health Monitoring

The Autumn 2019 Stream Health Monitoring Report was prepared following the May 2019 monitoring round. The findings of the report were as follows:

- Sites within Dart Brook, Muscle Creek and Sandy Creek indicate these catchments have been degraded by historical land use. Water quality data, particularly elevated salinity, reflects the condition of their catchments.
- Results from the AusRivAS analyses indicate that macroinvertebrate assemblages at all of the sites sampled were dominated by pollution-tolerant taxa.
- Measurements taken up to the present survey (Autumn 2019) indicate that additional degradation of water quality has not occurred since MPO-related construction and operation began.
- There was considerable improvement in aquatic macroinvertebrates results possibly related to the recent rainfall within the catchment area.
- Diversity measured at the time of the autumn 2019 survey was similar to that measured in spring 2017 suggesting that the condition of aquatic habitat has not changed substantially since commencement of the MPO.
- Species composition of fish sampled in Autumn 2019 was comparable with that observed in previous surveys.
- Data from Spring 2017 to Autumn 2020 will be used to refine stream health performance indicators.
- Overall, examination results from the 2019 autumn survey found that condition of aquatic habitat and assemblages of aquatic macroinvertebrates and fish was similar to the baseline survey.

The Spring 2019 Stream Health Monitoring Report was prepared following the October 2019 monitoring round. The findings of the report were as follows:

- Sites within Dart Brook, Muscle Creek and Sandy Creek indicate these catchments have been degraded by historical land use. Water quality data, particularly elevated salinity, reflects the condition of their catchments.
- No aquatic species of conservation significance were recorded at the monitoring sites.
- Results from the AusRivAS analyses indicate that macroinvertebrate assemblages at all of the sites sampled were dominated by pollution-tolerant taxa.
- The aquatic macroinvertebrate fauna in the Hunter River and its tributaries appears to have experienced some degree of environmental stress prior to, and hence independent to, construction and operation of the MPO.
- The current drought in NSW is likely to have contributed to the lowered stream health results presented in the report.
- The condition of aquatic habitat and assemblages of aquatic macroinvertebrates and fish was similar to the baseline survey.
- Despite the decline in band levels between the autumn and spring 2019 surveys, formal analysis did not detect any statistically significant change that could indicate an impact associated with the MPO.

The stream health trigger levels established within the SWMP were exceeded on each of the five sampling occasions in spring 2017; spring and autumn 2018; and spring and autumn 2019. These consecutive exceedances trigger the stream health investigation protocol in accordance with the SGWRP. However, as previously stated in the Spring and Autumn 2019 Stream Health Monitoring Reports prepared by Bio-Analysis Pty Ltd, the investigation is not considered warranted as:

- the trigger levels developed within the SWMP are based on historical data presented in Hose and Turak (2004), which were collected on one sampling occasion at the sites;
- the MPO has been a nil discharge site in accordance with EPL 20850 throughout the monitoring period;
- external influences including rural and urban run-off and flow regulations are likely to have impacted aquatic biota within the monitoring sites since the baseline survey was carried out; and
- seasonal variation of the structure of assemblages of macroinvertebrates occurred (Stark and Phillips, 2009).

MACH Energy will continue to monitor stream health during autumn and spring in future monitoring periods. As recommended, the corresponding data from these monitoring rounds will be used to refine the trigger levels for the existing stream health monitoring sites.

6.2 GROUNDWATER

6.2.1 APPROVAL CRITERIA AND MANAGEMENT PLAN REQUIREMENTS

Groundwater monitoring is undertaken at a network of bores which are broadly distributed across the MPO area (Figure 7) and which cover all major hydrogeological units.

Groundwater monitoring includes:

- manually monitoring of water levels on a quarterly basis;
- quarterly sampling of pH and EC;
- annual sampling of a suite of laboratory parameters; and
- regular groundwater inflows as recorded from flow meters or recording of pumping times and rates.

Groundwater trigger levels have been developed for the MPO, based on the NSW Aquifer Interference Policy and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000). These trigger levels include standing water level (SWL) triggers for the eastern groundwater sites, and EC and pH for all sites, as presented in the WMP.

Beneficial use categories have been assigned to each monitoring bore based on its 80th percentile baseline EC and the EC ranges specified in the WMP. Should a measured EC value exceed the beneficial use quality range EC for a particular bore at three successive monitoring rounds (as defined in the WMP), the groundwater investigation protocol, as detailed in the SGWRP, would be initiated.

Following the trigger of the Groundwater Quality Response Protocol in 2018, EC trigger levels for 6500F500 M&L, 4500F500 and 5500D000 and pH trigger levels for all groundwater monitoring sites were updated during the reporting period, as presented in the WMP.

The pH trigger levels were updated to apply a single trigger range of 6 – 8.5. This decision was made as the proposed 20th to 80th percentile trigger ranges proved to be too narrow and resulted in exceedances of the triggers under neutral pH conditions. The adopted range of 6 – 8.5 pH units is consistent with the pH recommended by ANZECC & ARMCANZ (2000) to prevent corrosion of infrastructure associated with the groundwater, as well as the recommend range for drinking water as outlined in the Australian Drinking Water Quality Guidelines (National Health and Medical Research Council [NHMRC] & National Resource Management Ministerial Council [NRMCC], 2011).

At any bore where a monitored pH value is outside the applicable baseline range at three successive monitoring rounds, the groundwater investigation protocol would be initiated.

6.2.2 PERFORMANCE DURING THE REPORTING PERIOD

Monitoring bores are split into three categories:

- Groundwater Central Bores: representative of the hard rock aquifer (3500B500L&S, 3500C500L&S, 4500F000, 5500D000, 5000D000, 6000C000L&S, 6500F500L, M&U, 7000D000L&U, 7500F000, 6500F625 and Melody).
- Groundwater Eastern Bores: representative of the alluvial aquifer (MPBH1, MPBH2, MPBH3b, MPBH4 and MPBH5).
- Groundwater Western Bores: representative of the hard rock aquifer in, or in the vicinity of, the Fine Rejects Dam (WRA1L, WRA1U, WRA2L, WRA2U, WRA3L, WRA3U, WRA5L, WRA5U, WRA6L and WRA6U).

Bores 3500B500L&S, 6000C000L&S and WRA2L&U were decommissioned prior to the reporting period. Notwithstanding, the data collected from these bores during previous years has been included to assist with trend analysis.

The results of monitoring SWL (measured in metres below ground level [mbgl]), EC and pH from 2014 to 2019 for the groundwater central bores are shown in Charts 27, 28 and 29 respectively.

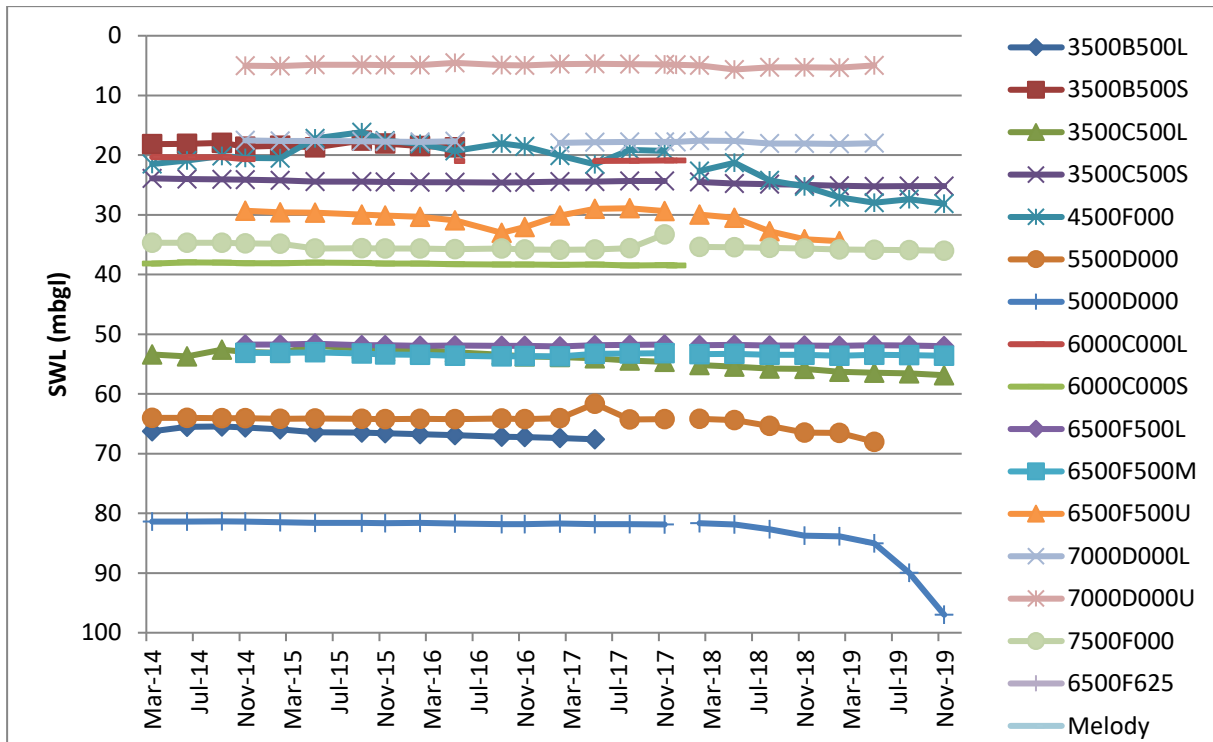


Chart 27: Groundwater Central Bores SWL 2014 – 2019

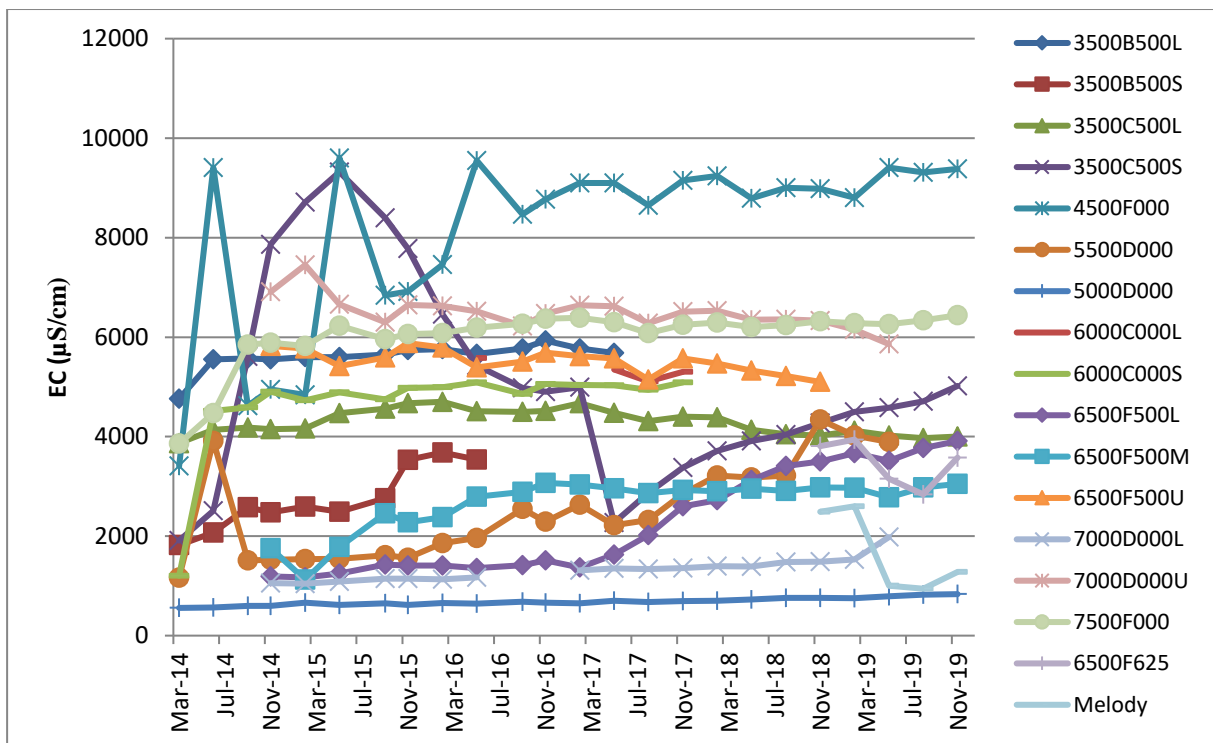


Chart 28: Groundwater Central Bores EC 2014 – 2019

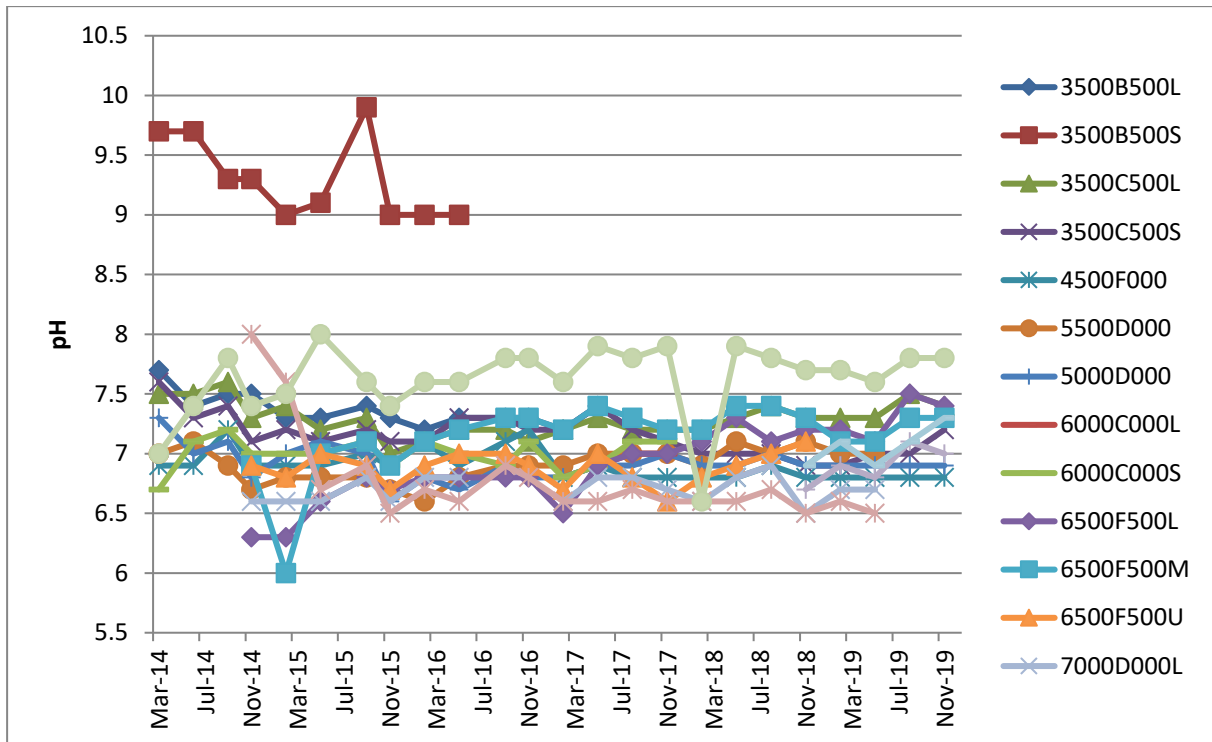


Chart 29: Groundwater Central Bores pH 2014 - 2019

The results of monitoring SWL, EC and pH from 2014 to 2019 for the groundwater eastern bores are shown in Charts 30, 31 and 32 respectively.

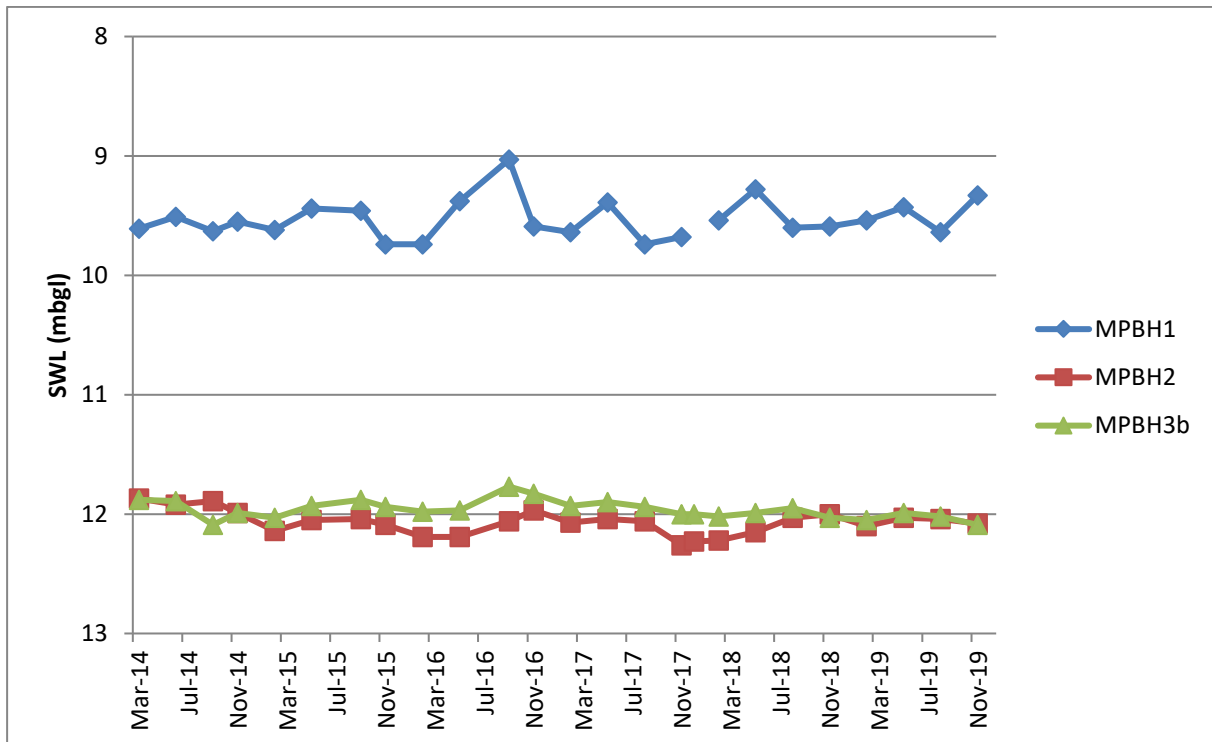


Chart 30: Groundwater Eastern Bores SWL 2014 - 2019

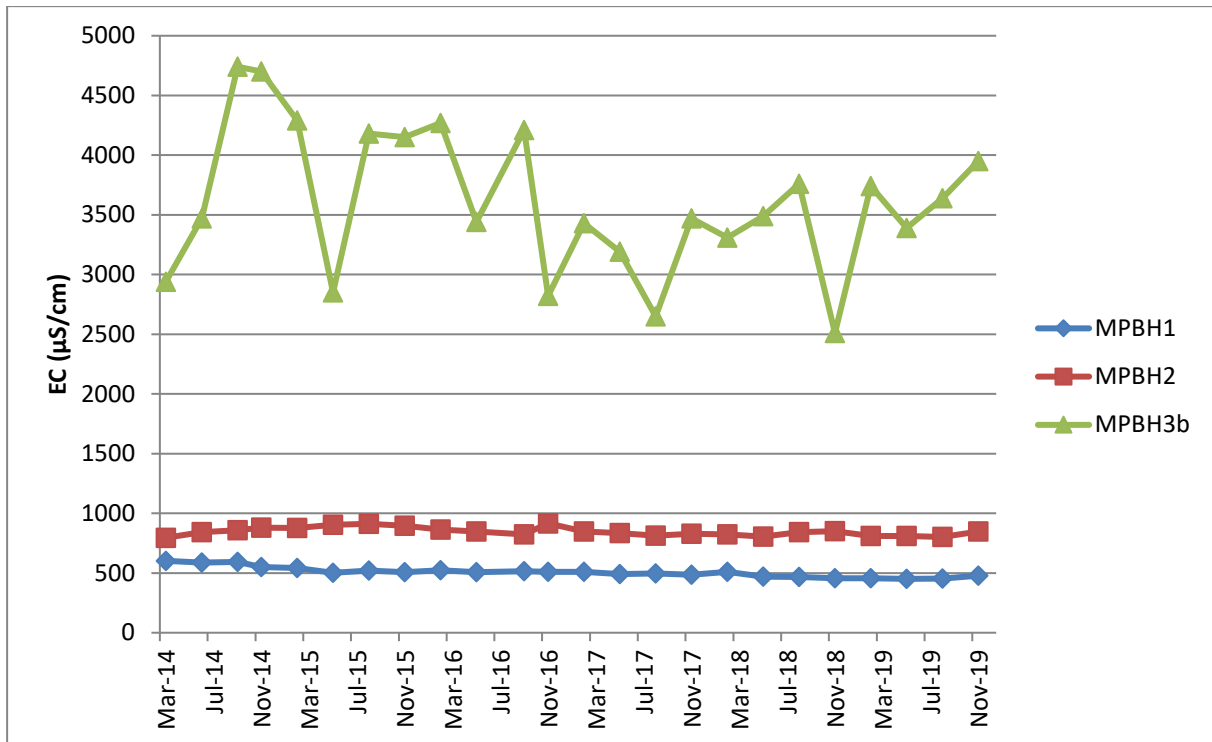


Chart 31: Groundwater Eastern Bores EC 2014 - 2019

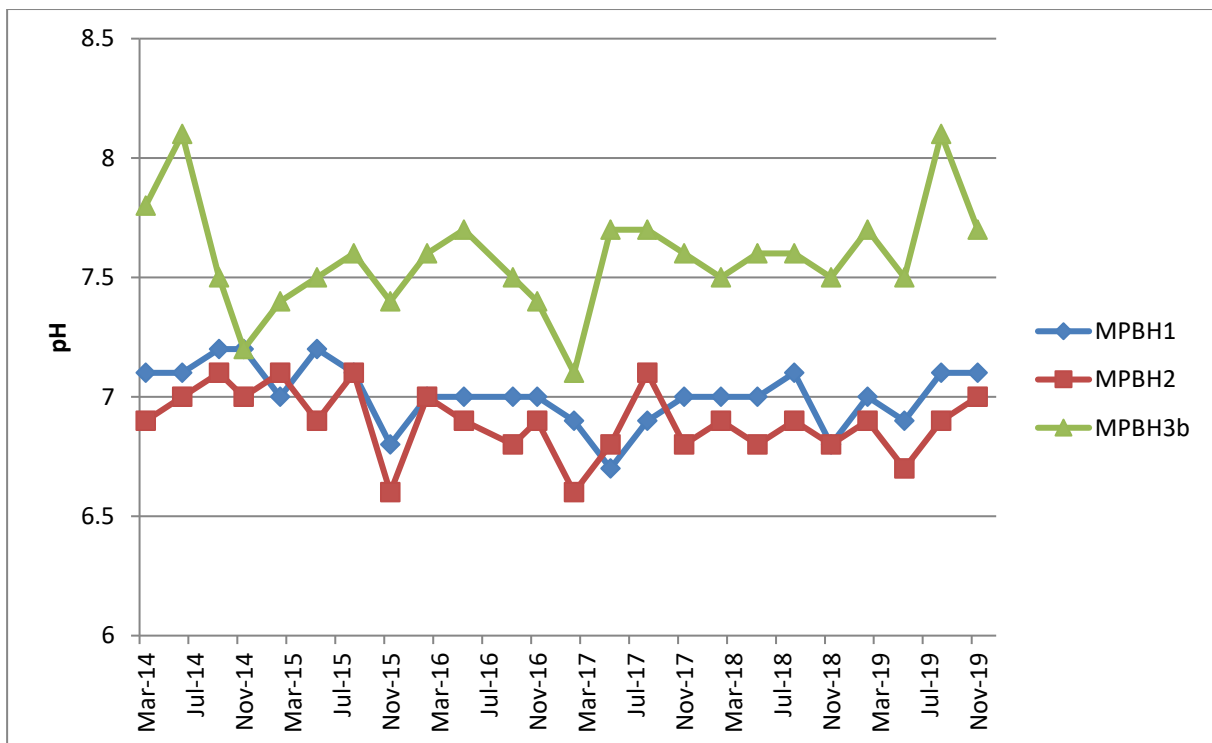


Chart 32: Groundwater Eastern Bores pH 2014 - 2019

The results of monitoring SWL, EC and pH from 2014 to 2019 for the groundwater western bores are shown in Charts 33, 34 and 35 respectively.

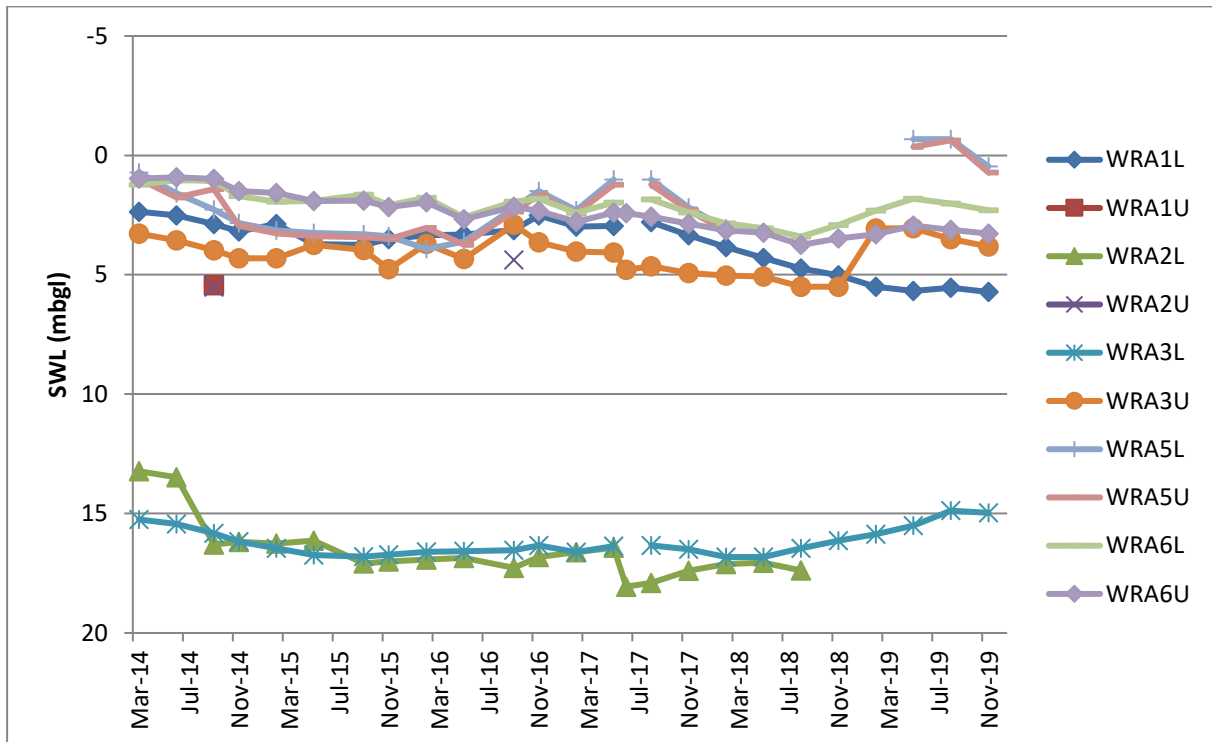


Chart 33: Groundwater Western Bores SWL 2014 - 2019

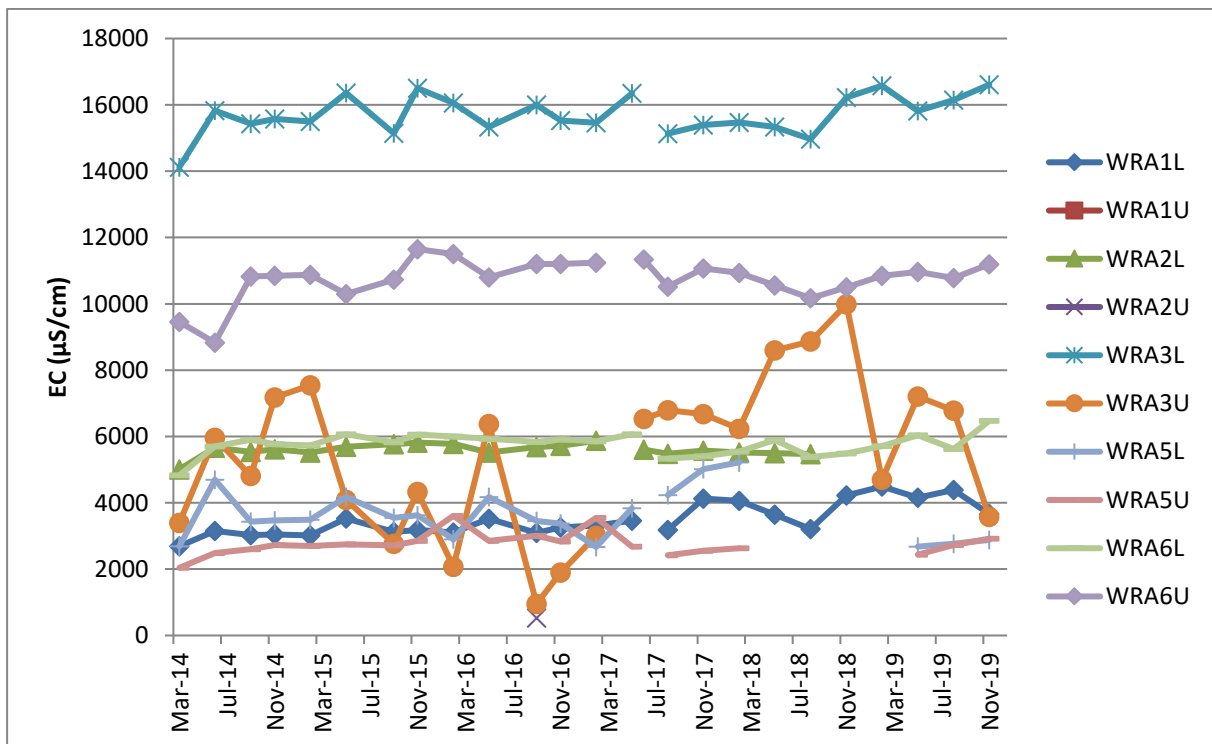


Chart 34: Groundwater Western Bores EC 2014 - 2019

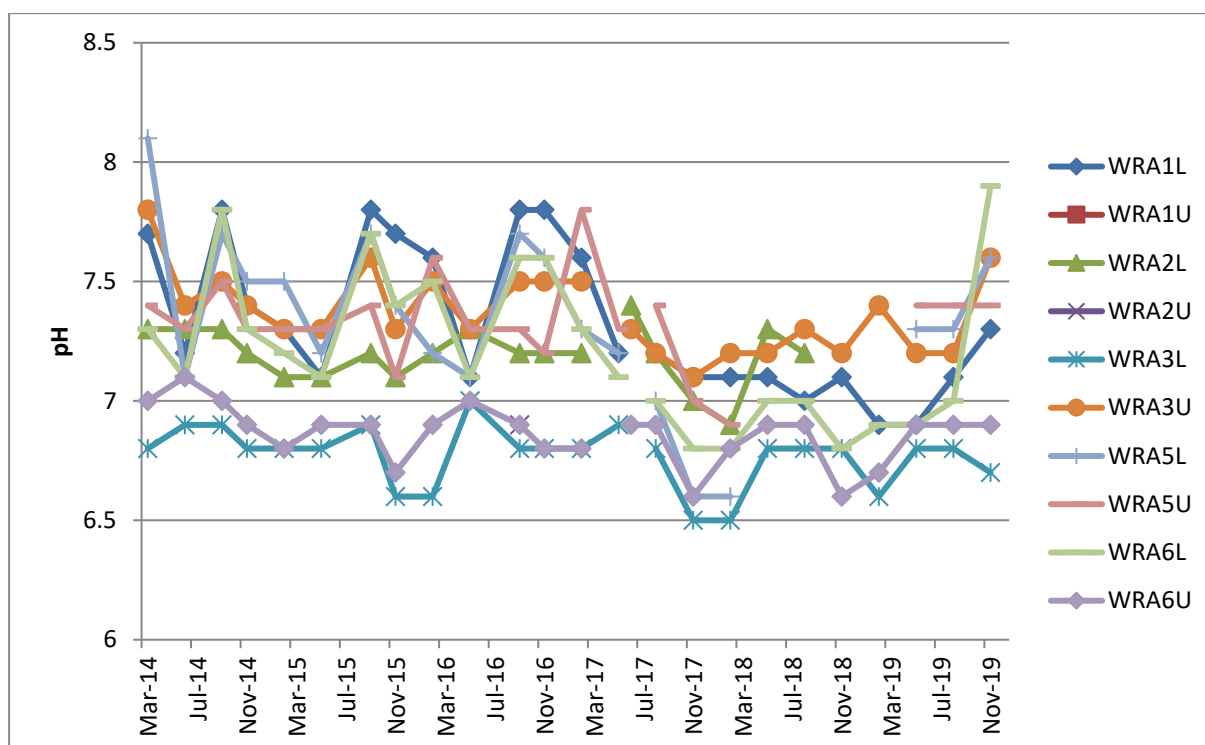


Chart 35: Groundwater Western Bores pH 2014 – 2019

During the reporting period, sites 3500B500L and 3500B500S continued to be blocked on all monitoring rounds. Monitoring was also not undertaken at 6000C000L due to insufficient water levels, and at 6000C000S, due to disturbance. Limited samples were taken in site 6500F500U and no samples were taken in site WRA1U during the reporting period due to dry conditions. Additionally, site 5500D000 was decommissioned before August 2019.

Sites MPBH4 and MPBH5 were newly added to the monitoring program during the reporting period and monitoring at the sites commenced on February 2019. Nonetheless, SWL was not measured in site MPBH4 due to incorrect survey information and monitoring at MPBH5 was not undertaken due to insufficient water levels during the reporting period. Installation of the additional monitoring bores to the north-east and to the west of the MPO commenced in 2019. Monitoring at these sites will commence in 2020.

Western groundwater monitoring sites WRA1U and WRA2L&U continued to be too dry to sample during any monitoring rounds in the reporting period.

6.2.3 TRENDS AND KEY MANAGEMENT IMPLICATIONS

Monitored SWLs have stayed generally consistent from 2014 – 2019. SWL monitoring results remained generally consistent at all sites for the central and eastern bores. This is with the exception of site 5000D000, where a decrease in water levels has been observed since May 2019. Site 5000D000 monitors the hard rock to the west of the open cut pit and therefore this decline is to be expected.

Consistent with trends observed in the 2016, 2017 and 2018 Annual Reviews (MACH Energy, 2017b; MACH Energy, 2018b; MACH Energy, 2019), the majority of EC values for the central bores have trended slightly upwards (Chart 28). This is with the exception of sites 6500F625 and Melody, which declined in mid-2019. EC levels in site 6500F625 have since returned to the same levels recorded prior to the reporting period, while monitored EC at Melody rose slightly during the reporting period. EC levels at site 3500C500S, which peaked in May 2015, continued to increase during the reporting period.

Monitored EC values remained within historic ranges for the eastern bore sites.

EC values remained generally within historic ranges during the reporting period (Chart 34). Continuing from trends observed in the 2015, 2016, 2017 and 2018 Annual Reviews (Coal & Allied, 2016; MACH Energy, 2017b; MACH Energy, 2018b; MACH Energy 2019), site WRA3U showed the most variation during the reporting period. Long term trends at the western bores indicate that yearly fluctuations in EC are most common at the western bores compared to the eastern and central bores (Coal & Allied, 2016; MACH Energy, 2017b; MACH Energy, 2018b). Sites WRA6U and WRA3L showed higher EC levels than other western bores during the reporting period, which is consistent with recent years.

Consistent with trends observed in the 2015, 2016, 2017 and 2018 Annual Reviews (Coal & Allied, 2016; MACH Energy, 2017b; MACH Energy, 2018b; MACH Energy, 2019), the pH values for the majority of sites have generally remained within the pH range of 6.5 to 8.0 during the reporting period.

As described in Section 6.2.1, trigger levels have been developed as part of the approved WMP for EC and pH for all groundwater bores. As defined in Appendix 5 of the WMP (i.e. the SGWRP), monitored values outside the range of trigger levels for three consecutive monitoring rounds initiate the groundwater investigation protocol.

MPO complied with all SWL and pH criteria presented in the WMP during the reporting period. Samples taken in site 5000D000 were outside the trigger levels for EC for two consecutive monitoring rounds (August and November 2019). Should the EC levels at site 5000D000 be exceeded in the next monitoring round, the Groundwater Quality Response Protocol will be triggered in accordance with the SGWRP. The remainder of the MPO groundwater monitoring sites complied with the EC criteria presented in the WMP during the reporting period.

6.3 HUNTER RIVER SALINITY TRADING SCHEME DISCHARGES

MACH Energy has 20 credits under the Hunter River Salinity Trading Scheme (HRSTS), however, no discharges to the Hunter River occurred during the reporting period.

6.4 WATER TAKE

A total of 622.9 megalitres (ML) of water was taken from Hunter Regulated River Water Source for use at the MPO during the water reporting period (1 July 2018 – 30 June 2019) (Table 19). This was 58.8 ML less than the previous water reporting period. This is likely due to the initial filling of the dam infrastructure during the previous period and subsequent emptying throughout the reporting period, due to dam optimisation works undertaken and delays in expected CHPP demands.

Table 19
MPO Water Take

Water Sharing Plan	Water Licence Number	Entitlement	Total Pumping (ML)
Hunter Regulated River Water Source	1230	8	623
	1259	33	
	1227	99	
	1258	5	
	992	75	
	7808	36	
	702	267	
	1260	5	
	993	265	
	1308	15	
	604	183	
	605	8	
	677	24	
	1338	18	
	662	9	
	663	16	
	10775	243	
	41438	455	
	638	3	
	639	134	
	879	224	
	880	124	
	1113	366	
	973	3	
	974	210	
	975	8	
	988	156	
	989	8	
	1307	38	
	1229	480	

Note: ML = megalitres

* several temporary licences were also used during the reporting period.

6.5 SITE WATER BALANCE

The Site Water Balance for the reporting period (i.e. 1 January 2019 to 31 December 2019) is provided in Table 20 below in comparison to the 2018 site water balance.

Table 20
MPO Annual Water Balance

	2018	2019
Water Sources	Volume (ML/yr)	Volume (ML/yr)
Surface Water Runoff	855.6*	837.7*
Groundwater	17	7
Fine Rejects Bleed Water	0	0
Hunter River Pumping (via WALs)	682	623
Water Usage	Volume (ML/yr)	Volume (ML/yr)
CHPP Demand	0	0
Dust Suppression (Haul Road and Stockpiles)	1028	757
Vehicle Wash Demand	37	35
Water Loss	Volume (ML/yr)	Volume (ML/yr)
Discharge to Hunter River (via HRSTS)	0	0
Evaporation	254	790
Non Sediment Dam Spillage	0	0
Sediment Dam Spillage	0	0

Note: ML/yr = Megalitres per year.

* This volume is calculated based on the initial five-year mine plan site water balance and adjusted accordingly with calculated rainfall over the reporting period(s)

The site water balance for the reporting was generally consistent with the previous reporting period. Dust suppression was reduced during the reporting period in comparison to 2018, likely due to the initial excessive dust suppression requirements during construction and continuation of early stages of mining operations in 2018. There was an increase in evaporation in the reporting period potentially due to meteorological conditions (i.e. drought) and the spread of volume of water stored on site at different dam infrastructure to facilitate the dam optimisation works.

Recorded site water balance for the reporting period was generally consistent with MOD 3 predictions with the exception of the proportions of both Fine Rejects Bleed Water and CHPP demand. This was due to commissioning of the wash modules throughout the period.

The initial five year mine plan site water balance for the MPO was undertaken in 2019. The site water balance will be updated prior to the end of this period (i.e. end 2024) and earlier as required.

7 REHABILITATION

Proposed rehabilitation activities for the MPO are defined in the approved MOP/RMP, which has been developed to also meet the requirements for an RMP (Condition 56, Schedule 3 of Development Consent DA 92/97).

Details of the activities completed during the reporting period are outlined in Section 3.1. At the end of the reporting period, the total mine disturbance area was approximately 895 hectares (ha), which was 125 ha less than the forecast disturbance area. The total rehabilitation area was approximately 50 ha, which was around 80 ha less than the rehabilitation area forecasted in the 2018 Annual Review. This was predominantly due to unsuitable meteorological conditions for bulk shaping and revegetation activities including severe drought, adverse air quality conditions (i.e. 57 'extraordinary event' days as discussed in Section 5.4) and noise-amplifying conditions (i.e. temperature inversions).

Whilst the rehabilitation area during the reporting period was approximately 80 ha less than that which was forecasted during the previous period, it is to be noted that the MPO at the time of reporting is on schedule to meet rehabilitation targets set out in the approved MOP/RMP by the end of the term (30 June 2020).

Table 21 summarises the approximate disturbance and rehabilitation areas from the 2018 and 2019 reporting periods and provides an estimate of the forecast areas for the 2020 reporting period.

Table 21
Rehabilitation Status

Mine Area Type	Previous Reporting Period (ha Actual)	This Reporting Period (ha Actual)	Next Reporting Period (ha Forecast)
	2018	2019	2020
Total Mine Footprint ^{1,6}	701	895	980
Total Active Disturbance ^{2,6}	698.8	834	916
Land being prepared for Rehabilitation ³	3	39.4	53.7
Land under active rehabilitation ⁴	8.0	7.5	53.7
Completed rehabilitation ⁵	0	0	0

¹ Total mine footprint includes all areas within a mining lease that either have posed at some point in time, or continue to pose, a rehabilitation liability due to mining and associated activities. As such, it is the sum of total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem establishment, ecosystem development and relinquished lands (as defined in DRG MOP Guidelines).

² Total active disturbance includes all areas ultimately requiring rehabilitation, such as: on-lease exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpile areas, access tracks and haul roads, active mining areas, overburden emplacements (active/unshaped/in or out-of-pit), and the Fines Emplacement Area (active/unshaped/uncapped).

³ Land being prepared for rehabilitation includes the sum of mine disturbed land that is under the following rehabilitation phases – decommissioning, landform establishment and growth medium development (as defined in DRG MOP Guidelines).

⁴ Land under active rehabilitation includes areas under rehabilitation and being managed to achieve relinquishment - includes the following rehabilitation phases as described in the DRG MOP Guidelines – 'ecosystem and land use establishment' (area seeded OR surface developed in accordance with final land use) and 'ecosystem and land use sustainability' (revegetation assessed as showing signs of trending towards relinquishment OR infrastructure development).

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

⁶ Includes topsoil stockpiles.

Rehabilitation of the Eastern Out of Pit Emplacement continued in 2019. Approximately 7.5 ha was rehabilitated (Plate 3), which included:

- bulk and detailed re-shaping of overburden material to final landform;
- installation of habitat features such as stag trees and rock piles;
- topsoil spreading to a minimum depth of 100 mm;
- gypsum application at a rate of 10 tonnes per hectare (t/ha);
- deep ripping/tining along the contour of the final landform;
- direct/hand seeding of EEC tree/shrub/grass indicative species plus an additional grass cover crop; and
- planting of approximately 1,000 native trees per hectare.

Rehabilitation areas were subject to ongoing weed and pest control measures throughout the reporting period to facilitate and promote successful vegetation establishment.



Plate 3: Eastern Out of Pit Emplacement Rehabilitation

Figure 2 shows the extent of active disturbance and rehabilitated areas at the end of the reporting period, as well as the forecast disturbance areas proposed in 2020.

The final land use goals for the MPO (as outlined within the MOP/RMP) are as follows:

- successful design and rehabilitation of landforms to ensure structural stability, revegetation success and containment of wastes; and
- post-mining land use compatible with surrounding land uses.

The conceptual final landform across the MPO is an undulating, free draining and less 'engineered' landform with an optimum post-mining land capability that supports grassland and woodland vegetation communities, as per the approved MOD 4 and current MOP/RMP. The MSC, the community and other stakeholders have indicated their preference for a landform that further integrates with the surrounding landscape.

During the reporting period, several former residential dwellings were demolished, and associated hazardous materials were removed and disposed off-site in accordance with the WMP.

7.1 EROSION AND SEDIMENT MANAGEMENT

General erosion and sediment management measures were undertaken during the reporting period in accordance with the erosion and sediment control provisions of the approved WMP and included:

- installation and management of sediment fencing around disturbance areas of soil stockpiles and sediment dams;
- construction diversion drains and bunds, and Sediment Dam 4; and
- regular inspections of the completed dams and erosion and sediment control structures.

7.2 BUSHFIRE MANAGEMENT

The main objectives of bushfire management at the MPO are to minimise the risk of bushfires and to rapidly control any outbreaks that might occur. Control measures are in place to:

- minimise potential spreading of bushfires in and around the MPO;
- protect people, property and assets;
- protect areas of heritage value; and
- protect threatened fauna and/or flora.

The control measures implemented to prevent and manage bushfires focus on minimising the amount of fuel available at the MPO and its surrounding land. These measures include:

- slashing of vegetation along roads and internal tracks that are used as fire trails and assist in dividing the site into control zones;
- the use of livestock to reduce pasture-based fuel loads on land suitable for grazing; and
- maintaining a network of water supply points to assist the NSW Rural Fire Service with logistical support.

During the reporting period, a range of activities were undertaken in respect to fire preparation in accordance with the Bushfire Management Plan, including:

- maintenance of property, boundary and roadside firebreaks;
- monthly inspections of the firebreaks and firefighting equipment at MPO during the fire season; and
- the use of livestock to reduce pasture-based fuel loads on land suitable for grazing.

There were no major outbreaks of fire at the MPO during the reporting period.

7.3 REHABILITATION MONITORING

Various ecological works were undertaken at the MPO during the reporting period, including as part of the GDP process, and as part of flora and fauna surveys and assessments in support of a proposed State Significant Development (SSD) application. These works included mapping vegetation communities, searching for threatened flora species, communities and populations, and detailed floristic data collection at numerous survey plots.

During the reporting period, a draft Rehabilitation Monitoring Manual for the MPO was prepared, which includes detailed monitoring methodologies that will be undertaken to measure rehabilitation performance. The 2019 rehabilitation monitoring program was undertaken in September 2019 and included monitoring of analogue and the MPO rehabilitation sites. The MPO adopts a systems-based approach to rehabilitation monitoring (e.g. use of Ecosystem Function Analysis [Tongway and Ludwig, 2011]) to determine progress towards a self-sustaining ecosystem, including comparison to the analogue sites.

The rehabilitation research program at the MPO aims to incorporate management practices that have resulted from industry research into the establishment of woodland and grassland communities across mined landscapes, in particular in the Hunter Valley region.

MACH Energy is collaborating with the University of Newcastle on several rehabilitation related research projects including:

- a research project that aims to convert fines material into suitable topsoil material; and
- a research project that analyses MPO topsoil characteristics for input into the SIBERIA software program that supports geomorphic landform design modelling.

During the reporting period the aforementioned programs were commenced and thus at this stage the outcomes are not yet known.

Further information regarding MPO rehabilitation monitoring methodologies is provided in the approved MOP/RMP.

7.4 LAND MANAGEMENT

Landscape management included removal, erection and general maintenance of fence lines in the MPO.

During the reporting period, extensive tree planting was undertaken along the visual tree screen and other areas in accordance with the VIMP, to assist in shielding the site as outline in Section 5.10. Growth rates of the planted trees have been lower than the standard rate due to ongoing drought conditions in the area. General maintenance of these areas was also carried out throughout the reporting period.

Weed and pest control measures undertaken during the reporting period are outlined in Section 5.5.2. Topsoil management is discussed in Section 5.9.

8 COMMUNITY

MACH Energy's approach to community relations is focused on extending and strengthening the relationships that MACH Energy representatives have already formed with the local community.

MACH Energy released a community newsletter in May 2019 and December 2019 outlining the community activities undertaken during the reporting period. MACH Energy plans to continue to release regular community newsletters in the next reporting period to inform stakeholders/interested parties of activities at the MPO.

During the reporting period, MACH Energy undertook community relations in four key areas: communication, consultation and engagement, community development, and relationships with the local Aboriginal community. These activities are outlined in detail in the following sections.

8.1 COMMUNICATION

A number of points of communication have been established with the community. Members of the local community are encouraged to engage MACH Energy in the way that proves most convenient for them.

MACH Energy maintains a website (<https://machenergyaustralia.com.au/>) which is used to provide information to stakeholders and interested parties about the operation and environmental performance of the MPO. Information provided on the website includes key environmental management documentation, monthly environmental monitoring reports, an environmental complaints register (which is updated on a monthly basis) and CCC meeting minutes.

MACH Energy maintains a Community Hotline (1800 886 889), which is dedicated to the receipt of community complaints, enquiries or information. The Community Hotline is publicly advertised in a variety of MACH Energy's public communication tools and is available during operating hours (i.e. 24/7), to receive any complaints or enquiries from anyone seeking information about the MPO. Communication received from the hotline is recorded in a Community and Stakeholder Engagement Database. This database records all necessary information regarding the nature of the communication, and if necessary, any action taken by MACH Energy as a result of the communication.

A total of 240 community complaints were received during the reporting period (see Complaints Summary 2019: <https://machenergyaustralia.com.au/mount-pleasant/documentation/>) compared with 113 complaints received during the last reporting period. The community complaints for 2019 reporting period related to:

- air quality (75);
- noise (100);
- blasting (39);
- water (1);
- visual (17); and
- others (8) (related to lighting plant, mine vehicles' use of Wybong and Roxburgh Road, safety and acquisition).

Most of the complaints were received via the Community Hotline, however some complaints were made directly to the ERM, the Environmental Superintendent, the Land and Property Superintendent, the DPIE, and the EPA.

While air quality-related complaints were predominant during the last reporting period, the highest number of complaints received in 2019 were noise-related.

Complaints regarding blasting also increased in 2019 in comparison to 2018. It is common for the total number of complaints to increase as a mining project transitions from the construction phase to the operational phase, particularly with transition to 24/7 operation and an increase in ROM coal extraction. Additionally, dust-related complaints may have been exacerbated by the severe drought conditions observed in 2019.

Thorough investigations were undertaken in response to all complaints. For noise-, air quality- and blasting-related complaints, real-time monitors were reviewed and alarms were examined. Following the investigation, the ERM made contact with the complainant in a timely manner to describe the MPO activities that may have been causing the issue and the response/s from MACH Energy. Activities were modified or ceased where necessary.

8.2 CONSULTATION AND ENGAGEMENT

A CCC is administered by MACH Energy MPO, with a membership comprised of an independent chair, and appropriate representation from MACH Energy and the general community. The CCC is operated in general accordance with the *Community Consultative Committee Guidelines* (DPIE, 2016).

In 2019, the CCC met four times during March, June, October and December, three of which included a site tour. The October 2019 meeting included a tour to the MPO Offset Management Areas (Commonwealth EPBC Approval 2011/5795) in Merriwa and Cassilis NSW. These meetings provided regular updates about the MPO, as well as an avenue to discuss aspects of the MPO that concerned community stakeholders. General discussions from these meetings related to:

- general overview of MPO progress;
- progress of CHPP construction;
- current status of approvals, management plans, modifications and supporting environmental documents;
- environmental monitoring and management;
- progress of land management activities at the MPO; and
- updates on communities' sponsorship, events, interactions and initiatives.

MACH Energy invites a range of its team members to present updates to the committee as direct contact enhances the two-way communication between both parties.

Full meeting minutes for the 2019 CCC meetings are provided on the MACH Energy website (<https://machenergyaustralia.com.au/mount-pleasant/documentation/>).



Plates 4 & 5: The CCC visit the recently restored (by MACH Energy) Llangollen Shearing Shed at Cassilis (Plate 4) and the CCC pictured following their meeting at the Merriwa CWA (Plate 5)

8.3 COMMUNITY DEVELOPMENT

As part of acquisition of the MPO, MACH Energy has maintained the Aboriginal Community Development Fund (ACDF) developed by Coal & Allied. The fund was a community benefit specified in the Native Title Agreement made with the Wonnarua People in 2005. Since its commencement in 2006, the ACDF has contributed more than \$4 million into projects that benefit the Upper Hunter Valley Aboriginal community.

Since the acquisition, the MPO representatives have joined the existing ACDF community members to administer funds, manage its current projects and to seek-out new partnerships. An example of some of the key partnerships that were maintained during the reporting period as part of the ACDF are presented in Table 22.

**Table 22
Aboriginal Community Development Fund Partnerships**

Partner	Description
The Gundi Program	The Gundi Program was launched in 2011 and is even stronger in 2020. Gundi aims to help Aboriginal inmates gain trade skills in custody and secure jobs once released. The Gundi Program builds housing for remote communities, offices and ablution blocks for many local companies. The Gundi Program provides building qualifications and work experience for inmates whilst in custody.
Polly Farmer Foundation – Enrichment Centre	Graham (Polly) Farmer Foundation assists aspiring Aboriginal students who have the capacity to complete school, but potentially in the absence of additional support, are unlikely to do so. Project staff work closely with students to provide them with intensive and targeted support throughout their secondary schooling.
Ungooroo Health Program for Muswellbrook & Singleton	The ACDF funding enables Ungooroo Aboriginal Corporation to address the current gaps in Health Service provision for Aboriginal people in the Muswellbrook & Singleton area. With a focus on addressing gaps in mental health and cycles of care in addressing chronic disease management.
Adult Aboriginal Dental Program	A program established in October 2018 to ensure all adult Aboriginals in the Upper Hunter have access to free dental care.

The MPO sponsored NAIDOC Week 2019 Singleton and Muswellbrook activities in conjunction with the ACDF, which celebrated Aboriginal and Torres Strait Islander peoples' history, culture and achievements across Australia. The funds were distributed across a range of activities, from primary schools through to the Upper Hunter NAIDOC Week Awards (MACH Energy, 2018d).

The two offices and one-bathroom facility, which were constructed through the Gundi Program, were purchased for the MPO by the mining services contractor Thiess. The buildings were installed during the reporting period and officially opened during the NAIDOC Week 2019.

8.4 RELATIONSHIPS WITH LOCAL ABORIGINAL COMMUNITY

MACH Energy works closely with the local Aboriginal community, including undertaking regular consultation with the RAPs. MACH Energy maintains a contact register, containing up to date contact details for the 84 RAPs, and is committed to maintaining ongoing consultation with these RAPs throughout the life of the MPO.

As outlined in Section 5.6.2, during 2019 archaeological salvages were carried out under AHIP #C0002092 in accordance with the ACHMP (Plate 6). RAPs had a strong presence in these salvage activities.



Plate 6: NAIDOC Week activities with MACH Energy, Thiess, Sedgman and visiting contractors

9 INDEPENDENT ENVIRONMENTAL AUDIT

No Independent Environmental Audit (IEA) was undertaken during the reporting period.

Notwithstanding, the IEA Report prepared following the IEA undertaken in late 2017 and submitted to DPIE on 18 May 2018 included recommendations for improvement. A summary of the IEA recommendations addressed during the reporting period and the actions taken by MACH Energy in response to these recommendations are provided in Table 23.

Table 23
Summary of the Outstanding Actions from the 2017 Independent Environmental Audit
Recommendations and MACH Energy's Responses

Item No.	Recommendation	MACH Energy Response
Development Consent DA 92/97		
3.28	<p>Water Management Plan</p> <p>Regularly updated Progressive Erosion and Sediment Control Plans are recommended for Rail Loop area as observation of controls in the area, and discussion with Environmental Superintendent are indicative of improvements that could be made in the area. Clean and dirty catchment confluence points should be a high priority for development of management strategy.</p> <p>An audit of sediment basins by a soil conservationist is believed to have been undertaken; recommendations for improvement should be implemented as soon as practicable.</p> <p>Basin markers (and marking of sediment storage zone) to be installed as soon as is practicable. Upon implementation, photographs of these points can assist in demonstrating compliance with discharge criteria.</p>	<p>As construction/improvement of the Rail Loop progressed, MACH Energy prepared progressive erosion and sediment control plans to achieve Managing Urban Stormwater - Soils and Construction Landcom (2004) standards. Clean and dirty water confluence points continued to be a high priority for the control plans and construction.</p> <p>Sediment basin audits were undertaken progressively on-site at least quarterly and triggered by the commencement of new areas of construction and rainfall events, with the recommendations from these audits implemented progressively. Basin levels were also monitored regularly.</p> <p>Action items from soil conservationist / ESC specialist site audit have been undertaken throughout 2019 following audit completion in February. Some outstanding action items are either partially complete or are planned to commence in 2020.</p> <p>Basin markers have been installed in sediment dams.</p>

In accordance with Condition 9, Schedule 5 of Development Consent DA 92/97, MACH Energy is required to commission, commence and pay the full cost of the next IEA by 25 November 2020.

10 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

10.1 ENVIRONMENTAL INCIDENTS

No reportable incidents occurred in 2019.

10.2 NON-COMPLIANCES

A summary of non-compliances during the reporting period, and if applicable, the actions taken in response to the non-compliances, is outlined in Table 24.

Table 24
Compliance Summary

Approval Document Reference	Condition	Observation	Action/Comment								
EPL 20850 Condition M2.2	<p><i>Air Monitoring Requirements</i></p> <p>POINT 1,2</p> <table> <tr> <th>Pollutant</th><th>Units of measure</th><th>Frequency</th><th>Sampling Method</th></tr> <tr> <td>PM10</td><td>Milligrams per cubic metre</td><td>Continuous</td><td>Special Method 1</td></tr> </table> <p><i>Note: Special Method 1 requires the Licensee to undertake the monitoring of PM10 concentrations in strict accordance with the manufacturer's operating manual supplied with the continuous monitoring equipment, or any updated versions as published by the manufacturer.</i></p>	Pollutant	Units of measure	Frequency	Sampling Method	PM10	Milligrams per cubic metre	Continuous	Special Method 1	PM ₁₀ was not monitored continuously at EPL Point 1 and EPL Point 2 during the reporting period, with capture rates being 97.5% and 99.5%, respectively. Equipment malfunction, power outage and equipment servicing were the primary cause of data loss. No pollution or environmental harm occurred as a result of the non-compliance.	MACH Energy have engaged a specialist environmental monitoring consultant to analyse and verify PM ₁₀ data on a monthly basis.
Pollutant	Units of measure	Frequency	Sampling Method								
PM10	Milligrams per cubic metre	Continuous	Special Method 1								
EPL 20850 Condition O3.6	<p><i>Shutdown of dust generating activities required by Condition O3.4 must be completed within 1 hour of receiving data that triggers action required by Condition O3.4.</i></p>	In accordance with Condition O3.4 – O3.6 of EPL 20850, a dust shutdown was triggered at 11:32 am on 24 October 2019. It was identified that haul trucks continued to haul coal from the mine to the ROM coal storage area until 12:50 pm. It was noted one haul truck did not park up and cease activity until 12:34 pm. No environmental harm occurred due to the event and no elevated dust results were recorded due to the trucks operating during this time.	MACH Energy undertook an Incident Cause Analysis Method (ICAM) Investigation. This resulted in a changed management in applicable internal procedures.								

11 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Key activities to be completed during the next reporting period include:

- revision of the BMP to revise the location of monitoring location B-V02 (Section 5.3.4);
- update of the MOP/RMP;
- continue to progress action items from the erosion and sediment control internal audit in February 2019;
- continue progressive rehabilitation of final landform profiles;
- continued operational improvements to minimise potential noise and air quality impacts;
- commencement of the rail loop and train load out relocation, as per MOD 4;
- commencement of Hunter River Pipeline relocation, as per MOD 4;
- continuation of coal washing and generation/emplacement of fine reject material;
- increasing coal export volumes/rates and associated train movements;
- completion of associated dams and drains to manage sediment control and water infrastructure in the new pits;
- IEA to occur in accordance with Schedule 5, Condition 9 of Development Consent DA 92/97;
- trigger levels for surface water monitoring sites W11-W16 to be established; and
- pH trigger levels for surface water monitoring sites W2 and W6A to be reviewed and updated if necessary.

12 REFERENCES

- Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.
- Bengalla Mining Company Pty Ltd (2017) Water Management Plan
- Coal & Allied Operations Pty Ltd (2014) *Mount Pleasant Project Annual Review 2013*.
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- Department of Planning and the Environment (2015b) *Independent Audit Guidelines*.
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APPENDIX A
NOISE MONITORING SUMMARY 2019

Table A1
L_{Aeq,15minute} Attended Noise Monitoring Summary 2019

Monitoring Location/Period		Jan ¹	Feb ²	Mar ³	Apr ⁴	May ⁵	Jun ⁶	Jul ⁷	Aug ⁸	Sep ⁹	Oct ¹⁰	Nov ¹¹	Dec ¹²
N-AT1	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	NM	IA	IA	NM	<30 dBA	IA	IA	IA	NM	<25 dBA	NM
N-AT2	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	IA	IA	NM	IA	IA	IA	IA	25	<20 dBA	IA	<20 dBA
N-AT3	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	IA	IA	IA	IA	<30 dBA	NM	<30 dBA	IA	IA	33	NM
N-AT4	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	<30 dBA	IA	IA	IA	42 dBA	IA	<25 dBA	IA	IA	34	<30 dBA
N-AT5	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	IA	IA	IA	IA	<30 dBA	IA	<30 dBA	IA	IA	37	NM
N-AT6	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	NM	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N-AT7	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	IA	IA	IA	IA	<35 dBA	IA	IA	IA	IA	-	-

Note:

dBA = A-weighted decibels.

IA = Inaudible.

NM = Not measurable.

■ Indicates criteria were not applicable at the time due to meteorological conditions at the time of measurement.

Measurements undertaken on the following dates:

1: 29 and 30 January. 2: 26 February. 3: 26 March. 4: 17 April. 5: 22 May. 6: 6 June. 7: 4 July. 8: 28 August. 9: 26 and 27 September. 10: 21 October. 11: 21 November. 12: 18 December.

Table A2
L_{A1,1minute} Attended Noise Monitoring Summary 2019

Monitoring Location/Period		Jan ¹	Feb ²	Mar ³	Apr ⁴	May ⁵	Jun ⁶	Jul ⁷	Aug ⁸	Sep ⁹	Oct ¹⁰	Nov ¹¹	Dec ¹²
N-AT1	Night	IA	-	IA	IA	NM	41	IA	IA	IA	NM	32	NM
N-AT2	Night	IA	-	IA	NM	IA	IA	IA	IA	32	<20 dBA	IA	<20 dBA
N-AT3	Night	IA	-	IA	IA	IA	<35 dBA	NM	<30 dBA	IA	IA	38	NM
N-AT4	Night	IA	-	IA	IA	IA	49	IA	<30 dBA	IA	IA	40	38
N-AT5	Night	IA	-	IA	IA	IA	40	IA	<30 dBA	IA	IA	42	NM
N-AT6	Night	NM	-	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N-AT7	Night	IA	-	IA	IA	IA	<35 dBA	IA	IA	IA	IA	-	-

Note:

dBA = A-weighted decibels.

IA = Inaudible.

NM = Not measurable.

■ Indicates criteria were not applicable at the time due to meteorological conditions at the time of measurement.

Measurements undertaken on the following dates:

1: 29 and 30 January. 2: 26 February. 3: 26 March. 4: 17 April. 5: 22 May. 6: 6 June. 7: 4 July. 8: 28 August. 9: 26 and 27 September. 10: 21 October. 11: 21 November. 12: 18 December.

Table A3
Cumulative Mining Noise Monitoring Summary 2019

Monitoring Location/Period		Jan ¹	Feb ²	Mar ³	Apr ⁴	May ⁵	Jun ⁶	Jul ⁷	Aug ⁸	Sep ⁹	Oct ¹⁰	Nov ¹¹	Dec ¹²
N-AT1	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	Nil	Nil	IA	Nil	35	Nil	Nil	Nil	38	Nil	Nil
N-AT2	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
N-AT3	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	Nil	Nil	IA	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
N-AT4	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	Nil	Nil	IA	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
N-AT5	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	Nil	Nil	IA	Nil	38	Nil	Nil	Nil	Nil	Nil	Nil
N-AT6	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	NM	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
N-AT7	Day	IA	-	-	-	-	-	-	-	-	-	-	-
	Night	IA	Nil	Nil	IA	Nil	<35 dBA	Nil	Nil	Nil	Nil	-	-

Note:

dBA = A-weighted decibels.

IA = Inaudible.

NM = Not measurable.

Indicates criteria were not applicable at the time due to meteorological conditions at the time of measurement.

Measurements undertaken on the following dates:

1: 29 and 30 January. 2: 26 February. 3: 26 March. 4: 17 April. 5: 22 May. 6: 6 June. 7: 4 July. 8: 28 August. 9: 26 and 27 September. 10: 21 October. 11: 21 November. 12: 18 December.

APPENDIX B
BLASTING SUMMARY 2019

Appendix B – Blast Monitoring Summary

MPO Blast Monitoring Results – 2019

Date Fired	Time Fired	Vibration BVOA	Overpressure BVOA	Vibration BVOC	Overpressure BVOC	Vibration BVO2	Overpressure BV02
4/1/19	13:28	0.900 mm/s	90.9 DBL	0.280 mm/s	98.9 DBL	0.390 mm/s	99.0 DBL
9/1/19	15:15	0.730 mm/s	97.4 DBL	0.420 mm/s	92.6 DBL	0.510 mm/s	100.9 DBL
10/1/19	14:30	0.070 mm/s	107.9 DBL	0.030 mm/s	102.9 DBL	0.510 mm/s	99.3 DBL
16/1/19	14:30	2.660 mm/s	100.3 DBL	1.480 mm/s	93.0 DBL	1.860 mm/s	102.9 DBL
18/1/19	10:15	3.700 mm/s	101.4 DBL	2.480 mm/s	99.2 DBL	0.280 mm/s	85.5 DBL
23/1/19	13:52	0.670 mm/s	99.3 DBL	0.380 mm/s	103.6 DBL	0.880 mm/s	107.9 DBL
01/02/19	13:14	1.350 mm/s	106 DBL	0.970 mm/s	114.9 DBL	1.190 mm/s	105.1 DBL
07/02/19	13:00	0.600 mm/s	97.4 DBL	0.320 mm/s	87.5 DBL	0.630 mm/s	105.0 DBL
13/02/19	13:01	1.590 mm/s	100.5 DBL	0.550 mm/s	90.9 DBL	1.910 mm/s	103.5 DBL
21/02/19	15:01	0.390 mm/s	105.2 DBL	0.440 mm/s	96.9 DBL	1.020 mm/s	105.8 DBL
28/02/19	15:21	1.270 mm/s	98.1 DBL	0.800 mm/s	97.6 DBL	2.050 mm/s	104.0 DBL
8/03/2019	10:13	0.920 mm/s	101.2 DBL	0.460 mm/s	94.6 DBL	0.580 mm/s	110.2 DBL
15/03/19	13:16	1.240 mm/s	108 DBL	0.760 mm/s	99.2 DBL	1.510 mm/s	111.3 DBL
20/03/19	13:06	1.100 mm/s	99 DBL	0.320 mm/s	95.2 DBL	0.700 mm/s	104.5 DBL
22/03/19	12:48	0.950 mm/s	92.7 DBL	0.650 mm/s	91.4 DBL	0.890 mm/s	101.0 DBL
29/03/19	09:36	0.340 mm/s	96.5 DBL	0.140 mm/s	95.5 DBL	0.710 mm/s	106.3 DBL
4/04/2019	13:00	0.320 mm/s	107.6 DBL	0.110 mm/s	104.8 DBL	0.360 mm/s	109.0 DBL
11/04/2019	13:01	0.460 mm/s	99.6 DBL	0.290 mm/s	99.4 DBL	0.820 mm/s	100.5 DBL
17/04/2019	13:06	0.780 mm/s	96.5 DBL	0.800 mm/s	92.9 DBL	3.820 mm/s	107.0 DBL
2/5/2019	13:06	0.740 mm/s	101.6 DBL	0.650 mm/s	94.2 DBL	3.070 mm/s	113.4 DBL
3/5/2019	11:05	0.920 mm/s	95.3 DBL	0.950 mm/s	90.9 DBL	2.720 mm/s	106.9 DBL
9/5/2019	13:15	0.910 mm/s	95.0 DBL	0.730 mm/s	92.6 DBL	1.760 mm/s	103.4 DBL
14/5/2019	13:26	0.360 mm/s	99.3 DBL	0.310 mm/s	101.8 DBL	1.110 mm/s	109.5 DBL
22/5/2019	13:05	0.170 mm/s	97.2 DBL	0.220 mm/s	93.4 DBL	0.380 mm/s	100.3 DBL
23/5/2019	13:02	0.100 mm/s	85.5 DBL	0.050 mm/s	86.8 DBL	0.270 mm/s	93.6 DBL

Date Fired	Time Fired	Vibration BVOA	Overpressure BVOA	Vibration BVOC	Overpressure BVOC	Vibration BVO2	Overpressure BV02
28/5/2019	09:37	1.170 mm/s	103.2 DBL	0.460 mm/s	103.6 DBL	0.810 mm/s	109.8 DBL
30/5/2019	13:14	0.580 mm/s	101.1 DBL	0.200 mm/s	106.4 DBL	1.070 mm/s	104.0 DBL
6/06/2019	13:11	0.360 mm/s	99.3 DBL	0.180 mm/s	98.3 DBL	0.630 mm/s	104.8 DBL
13/06/19	13:05	0.630 mm/s	111.1 DBL	0.210 mm/s	111.2 DBL	0.740 mm/s	113.3 DBL
14/06/19	13:09	0.340 mm/s	96.2 DBL	0.160 mm/s	90.0 DBL	0.680 mm/s	106.1 DBL
21/06/19	13:59	0.830 mm/s	106.3 DBL	0.380 mm/s	102.0 DBL	1.460 mm/s	117.3 DBL
26/06/19	13:04	0.280 mm/s	99.9 DBL	0.100 mm/s	98.4 DBL	0.300 mm/s	103.1 DBL
15/07/19	09:10	0.610 mm/s	106.6 DBL	0.320 mm/s	109.6 DBL	0.570 mm/s	117.7 DBL
17/07/19	09:00	0.570 mm/s	96.0 DBL	0.280 mm/s	83.4 DBL	0.500 mm/s	107.0 DBL
19/07/19	09:00	0.590 mm/s	87.3 DBL	0.300 mm/s	100.9 DBL	1.010 mm/s	103.9 DBL
26/07/19	13:04	0.270 mm/s	93.6 DBL	0.110 mm/s	88.6 DBL	0.670 mm/s	103.2 DBL
30/07/19	12:58	0.880 mm/s	101.3 DBL	0.370 mm/s	99.6 DBL	1.860 mm/s	105.8 DBL
31/07/19	12:58	0.190 mm/s	92.0 DBL	0.070 mm/s	98.4 DBL	0.350 mm/s	102.4 DBL
12/08/19	13:12	0.840 mm/s	98.6 DBL	0.390 mm/s	90.8 DBL	1.500 mm/s	114.3 DBL
15/08/19	13:09	0.650 mm/s	98.0 DBL	0.300 mm/s	103.5 DBL	1.310 mm/s	106.5 DBL
20/08/19	09:05	0.470 mm/s	98.1 DBL	0.130 mm/s	92.5 DBL	0.680 mm/s	106.1 DBL
23/08/19	12:56	1.430 mm/s	98.9 DBL	0.860 mm/s	94.9 DBL	1.860 mm/s	111.0 DBL
27/08/19	13:03	0.500 mm/s	98.2 DBL	0.400 mm/s	98.7 DBL	0.630 mm/s	95.7 DBL
29/08/19	15:07	0.210 mm/s	100.6 DBL	0.060 mm/s	102.3 DBL	0.140 mm/s	102.9 DBL
05/09/19	15:00	0.150 mm/s	91.6 DBL	0.090 mm/s	91.4 DBL	0.330 mm/s	97.3 DBL
10/09/19	13:05	0.300 mm/s	90.1 DBL	0.100 mm/s	94.1 DBL	0.450 mm/s	98.2 DBL
13/09/19	13:10	1.350 mm/s	95.9 DBL	0.460 mm/s	95.3 DBL	1.210 mm/s	108.7 DBL
26/09/19	13:00	0.430 mm/s	86.5 DBL	0.180 mm/s	96.2 DBL	0.890 mm/s	94.4 DBL
03/10/19	12:05	0.660 mm/s	96.3 DBL	0.280 mm/s	93.0 DBL	0.860 mm/s	112.0 DBL
04/10/19	09:03	0.400 mm/s	88.6 DBL	0.240 mm/s	81.7 DBL	0.500 mm/s	97.6 DBL
11/10/19	12:10	0.210 mm/s	106.3 DBL	0.240 mm/s	95.1 DBL	0.400 mm/s	90.6 DBL
15/10/19	15:06	0.330 mm/s	95.5 DBL	0.180 mm/s	89.6 DBL	0.750 mm/s	105.2 DBL
21/10/19	12:04	1.000 mm/s	104.0 DBL	0.370 mm/s	99.2 DBL	1.830 mm/s	124.5 DBL

Date Fired	Time Fired	Vibration BVOA	Overpressure BVOA	Vibration BVOC	Overpressure BVOC	Vibration BVO2	Overpressure BV02
24/10/19	11:04	1.850 mm/s	96.7 DBL	0.730 mm/s	99.6 DBL	3.850 mm/s	109.0 DBL
25/10/19	11:18	0.170 mm/s	103.0 DBL	0.070 mm/s	105.6 DBL	0.400 mm/s	102.8 DBL
29/10/19	14:04	0.280 mm/s	100.9 DBL	0.060 mm/s	93.9 DBL	0.220 mm/s	111.2 DBL
11/11/19	13:10	0.520 mm/s	90.7 DBL	0.260 mm/s	91.9 DBL	1.350 mm/s	101.7 DBL
14/11/19	13:45	0.510 mm/s	91.7 DBL	0.290 mm/s	101.5 DBL	1.520 mm/s	107.3 DBL
20/11/19	13:44	0.820 mm/s	101.9 DBL	0.830 mm/s	103.4 DBL	4.500 mm/s	106.4 DBL
20/11/19	13:44	0.180 mm/s	96.7 DBL	0.170 mm/s	102.9 DBL	0.340 mm/s	104.8 DBL
26/11/19	09:20	0.900 mm/s	99.0 DBL	0.250 mm/s	117.8 DBL	0.650 mm/s	110.7 DBL
29/11/19	12:06	1.180 mm/s	96.0 DBL	0.990 mm/s	95.2 DBL	5.110 mm/s	108.7 DBL
4/12/19	09:15	0.230 mm/s	94.2 DBL	0.080 mm/s	101.5 DBL	0.610 mm/s	100.7 DBL
9/12/19	13:01	0.680 mm/s	94.0 DBL	0.180 mm/s	90.4 DBL	1.040 mm/s	98.7 DBL
13/12/19	12:12	0.410 mm/s	100.5 DBL	0.330 mm/s	93.8 DBL	1.070 mm/s	105.2 DBL
18/12/19	01:05	0.520 mm/s	93.7 DBL	0.200 mm/s	86.5 DBL	0.610 mm/s	97.6 DBL
19/12/19	09:38	0.170 mm/s	91.8 DBL	0.110 mm/s	83.2 DBL	0.330 mm/s	96.5 DBL

APPENDIX C
PM_{2.5}, PM₁₀ AND TSP LEVELS INCLUSIVE OF 'EXTRAORDINARY EVENTS'

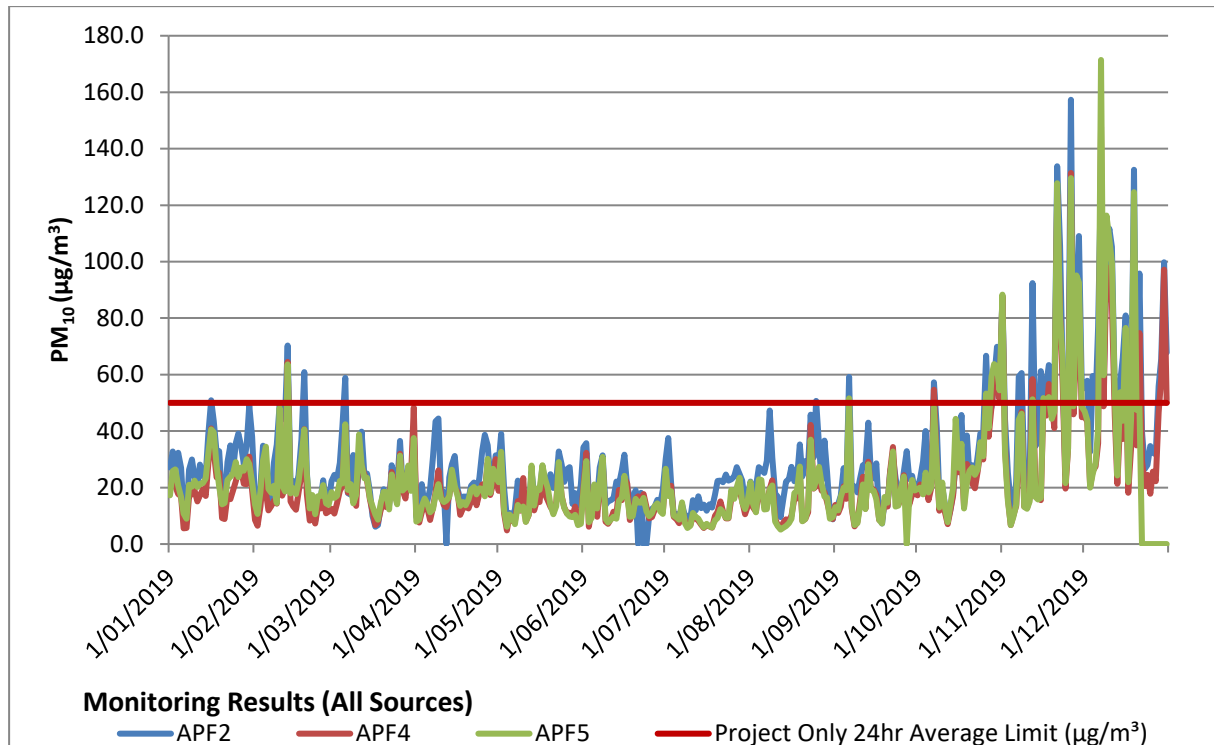


Chart C1: 24-hour Average PM₁₀ Levels Inclusive of 'Extraordinary Events'

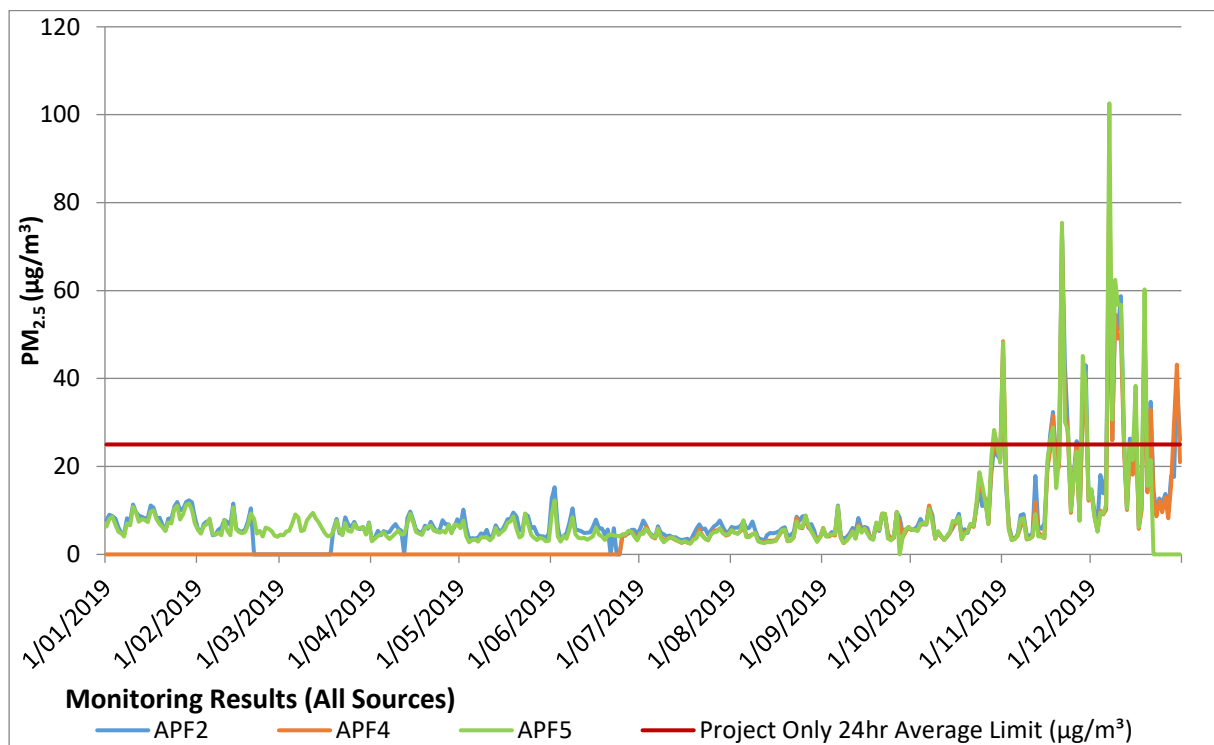


Chart C2: 24-hour Average PM_{2.5} Levels Inclusive of 'Extraordinary Events'

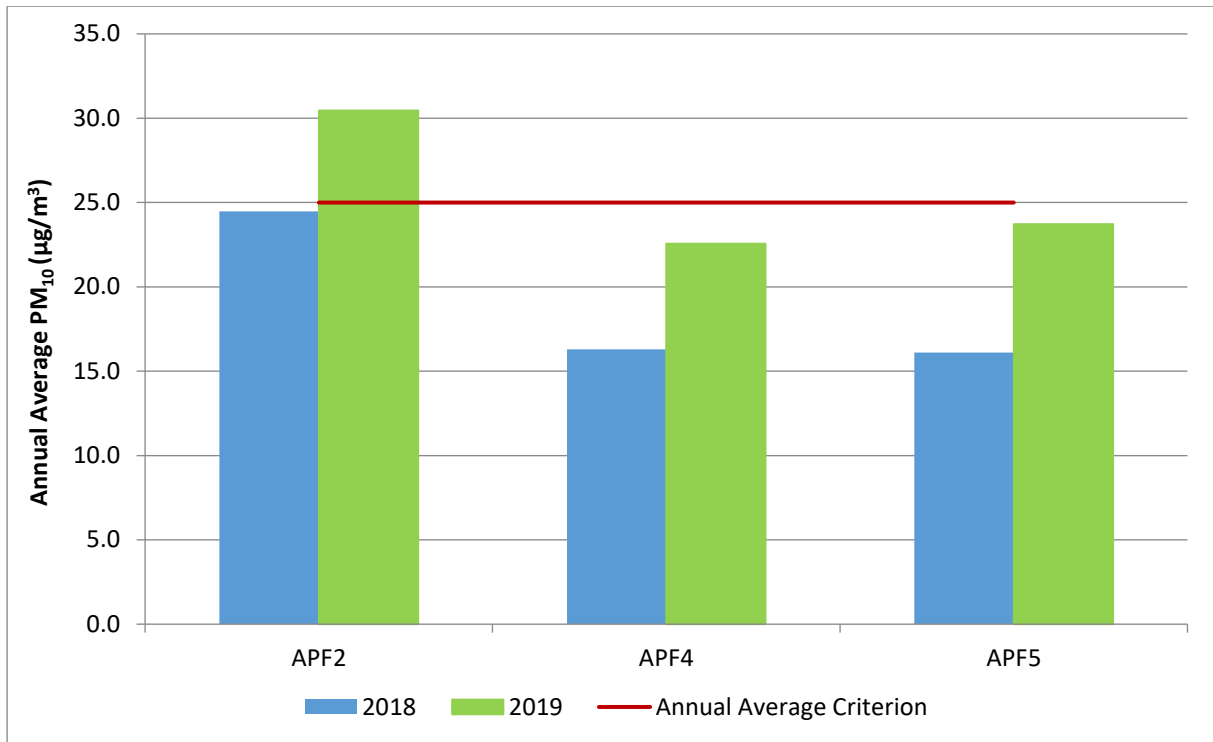


Chart C3: Annual Average PM₁₀ Levels Inclusive of 'Extraordinary Events'

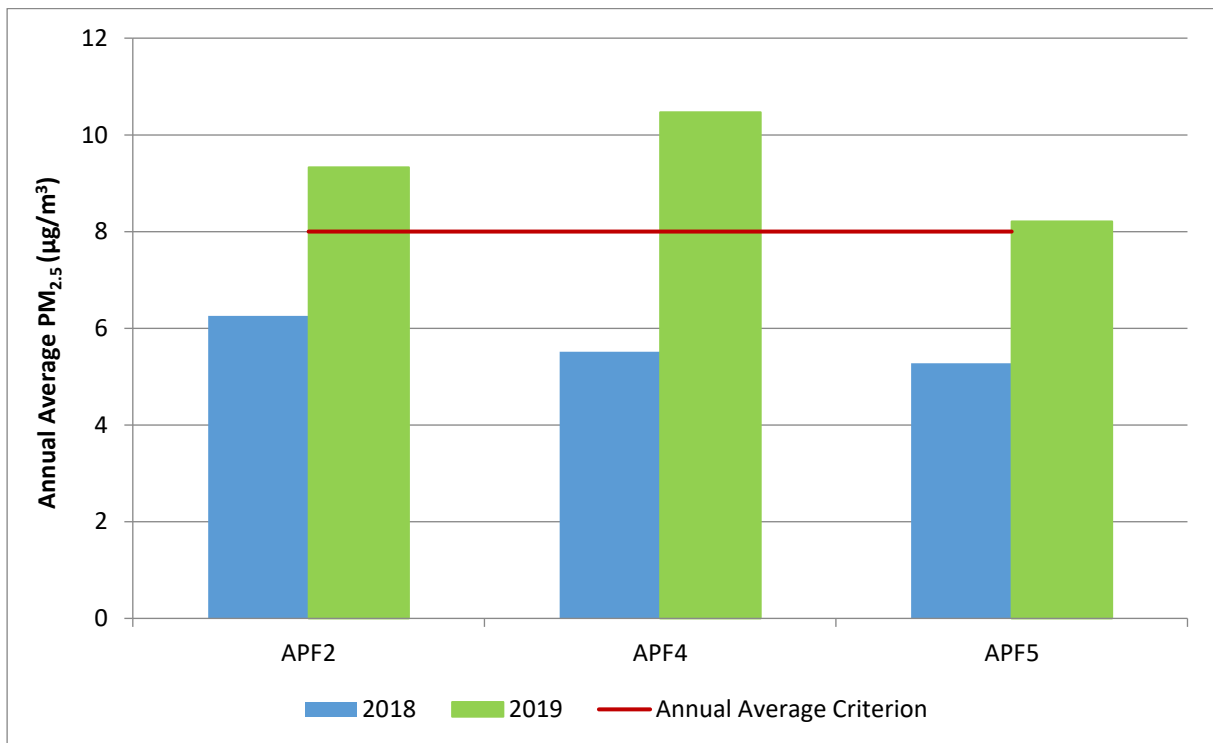


Chart C4: Annual Average PM_{2.5} Levels Inclusive of 'Extraordinary Events'

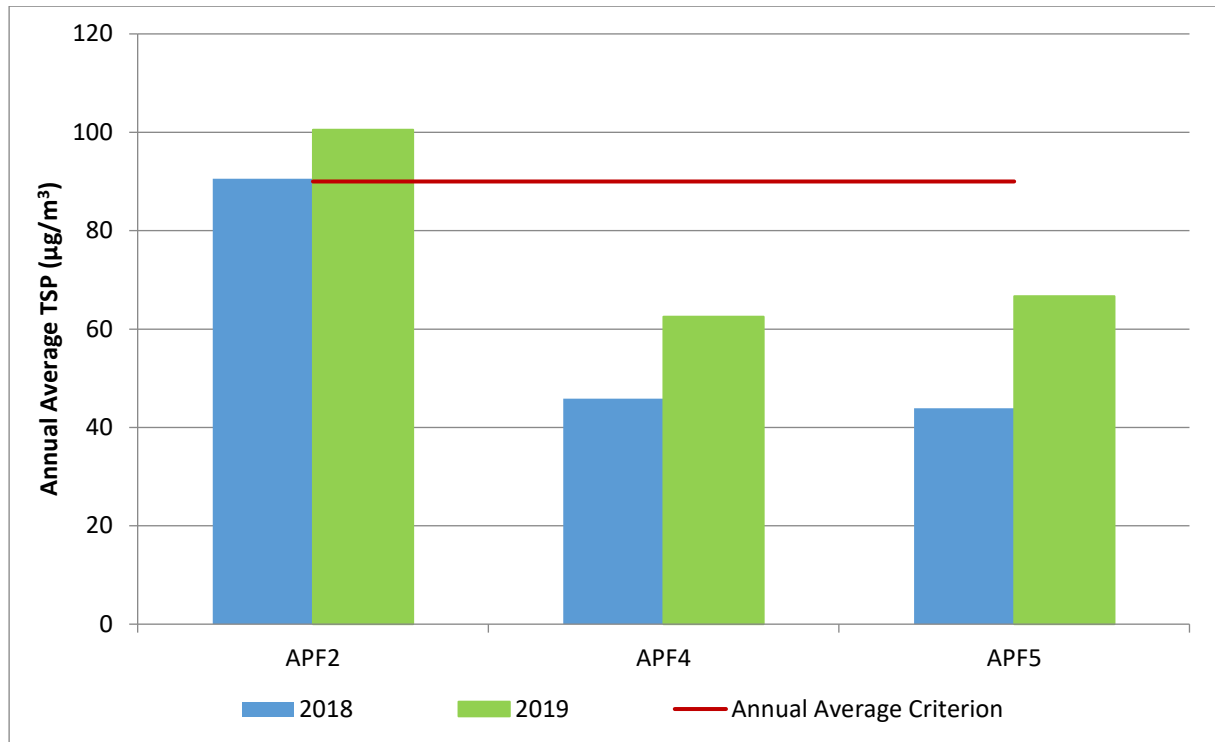


Chart C5: Annual Average TSP Levels Inclusive of 'Extraordinary Events'

APPENDIX D
PM_{2.5} AND PM₁₀ CALIBRATION FACTOR ADJUSTMENT ADVICE



Suite 2B, 14 Glen Street Eastwood,
NSW 2122
Phone: 02 9874 2123
Fax: 02 9874 2125
Email: info@airsciences.com.au
Web: www.airsciences.com.au
ACN: 151 202 765 | ABN: 74 955 076 914

6 March 2020

Chris Masters
Environmental Advisor
Mach Energy Australia
Via email: chris.masters@machenergy.com.au

RE: Mount Pleasant - Palas Fidas Particulate Monitor Calibration

Dear Chris,
Todoroski Air Sciences has conducted a review of the co-located Palas Fidas and Tapered Element Oscillating Microbalance (TEOM) data collected during a monitoring campaign conducted at Mount Pleasant.

The TEOM monitoring was conducted by Carbon Based Environmental from 23 January 2020 to 7 February 2020. The TEOM monitor was co-located with the mine's A-PF2 Palas Fidas monitor. The purpose of the TEOM monitoring campaign was to provide a reference standard measurement of PM_{2.5} and PM₁₀ to be used to verify the results recorded by the Palas Fidas monitors, which were suspected to be reporting excessively high PM_{2.5} measurements, but was reading valid trends. The results could also be used to re-set the calibration of the Palas Fidas, and potentially correct the historical measurements reported using the current calibration setting.

Figure 1 presents a comparison of the data from the A-PF2 monitor (as downloaded from the Airodis Ecotech website) and the co-located TEOM monitor during the monitoring campaign. The data show that the A-PF2 monitor recorded significantly higher PM_{2.5} levels than the TEOM monitor. The data confirm suspicion that the readings were excessively high. The PM₁₀ levels recorded by the A-PF2 monitor were more similar to the TEOM data, however they were also generally higher than the TEOM levels.

The A-PF2 monitor has a single calibration factor applied for both PM_{2.5} and PM₁₀ (this includes an offset value and multiplicative factor) which, as the data show, is unsuitable for continued use at this site. The existing calibration factor on A-PF2 is as follows:

$$\text{Calibrated value} = \text{Raw value} * 1.1 + 2.9$$

The existing calibration factor was removed in order to determine new site specific calibration factors (offsets and scaling factors) for PM_{2.5} and PM₁₀ for the machine. This involved comparing the hourly raw PM_{2.5} and PM₁₀ A-PF2 data to the TEOM dataset to determine suitable calibration equations. It is noted however that the scaling factor is dependent on the offset (i.e. the zero of the instrument), so should the zero of the

instrument change, the scaling factor would need to be adjusted accordingly. **Table 1** below presents a range of the determined calibration scaling factors to be used with different offsets.

Table 1: A-PF2 calibration offset and scaling factors

PM _{2.5}		PM ₁₀	
Offset	Factor	Offset	Factor
-2	0.7741	-2	1.0205
-1.5	0.7526	-1.5	1.0077
-1	0.7311	-1	0.9949
-0.5	0.7096	-0.5	0.9821
0	0.6881	0	0.9694
0.5	0.6666	0.5	0.9566
1	0.645	1	0.9438
1.5	0.6235	1.5	0.931
2	0.602	2	0.9183
2.5	0.5805	2.5	0.9055
3	0.559	3	0.8927
3.5	0.5375	3.5	0.8799
4	0.5159	4	0.8671
4.5	0.4944	4.5	0.8544
5	0.4729	5	0.8416

Equations for determine an appropriate scaling factor for any discrete offset (zero) are shown below.

$$\text{Scaling factor (PM}_{2.5}\text{)} = \text{offset} * -0.04303 + 0.68807$$

$$\text{Scaling factor (PM}_{10}\text{)} = \text{offset} * -0.02556 + 0.96937$$

Calibrated results

Figure 2 presents a comparison of the data from TEOM monitor and the A-PF2 monitor with the calculated calibration factors for PM_{2.5} and PM₁₀ respectively. The offsets for these k-factors were determined based on a line of best fit of the data. The calibration factors selected are presented below.

$$\text{Calibrated PM}_{2.5} \text{ value} = \text{Raw value} * 0.60068 + 2.02997$$

$$\text{Calibrated PM}_{10} \text{ value} = \text{Raw value} * 0.87502 + 3.67931$$

The data show that with the calibration factors applied, the A-PF2 data more closely match the TEOM data for both PM_{2.5} and PM₁₀.

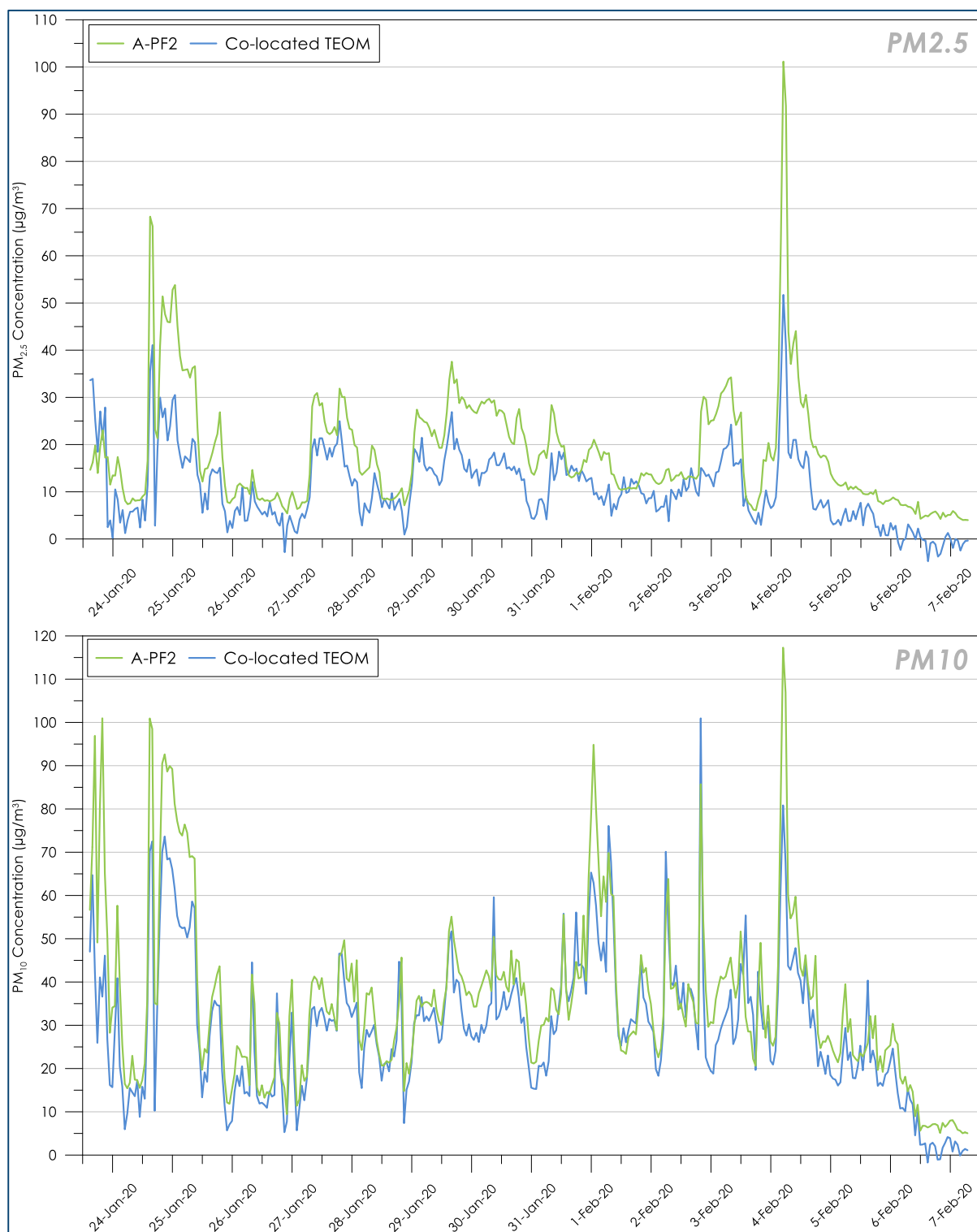


Figure 1: A-PF2 and co-located TEOM data

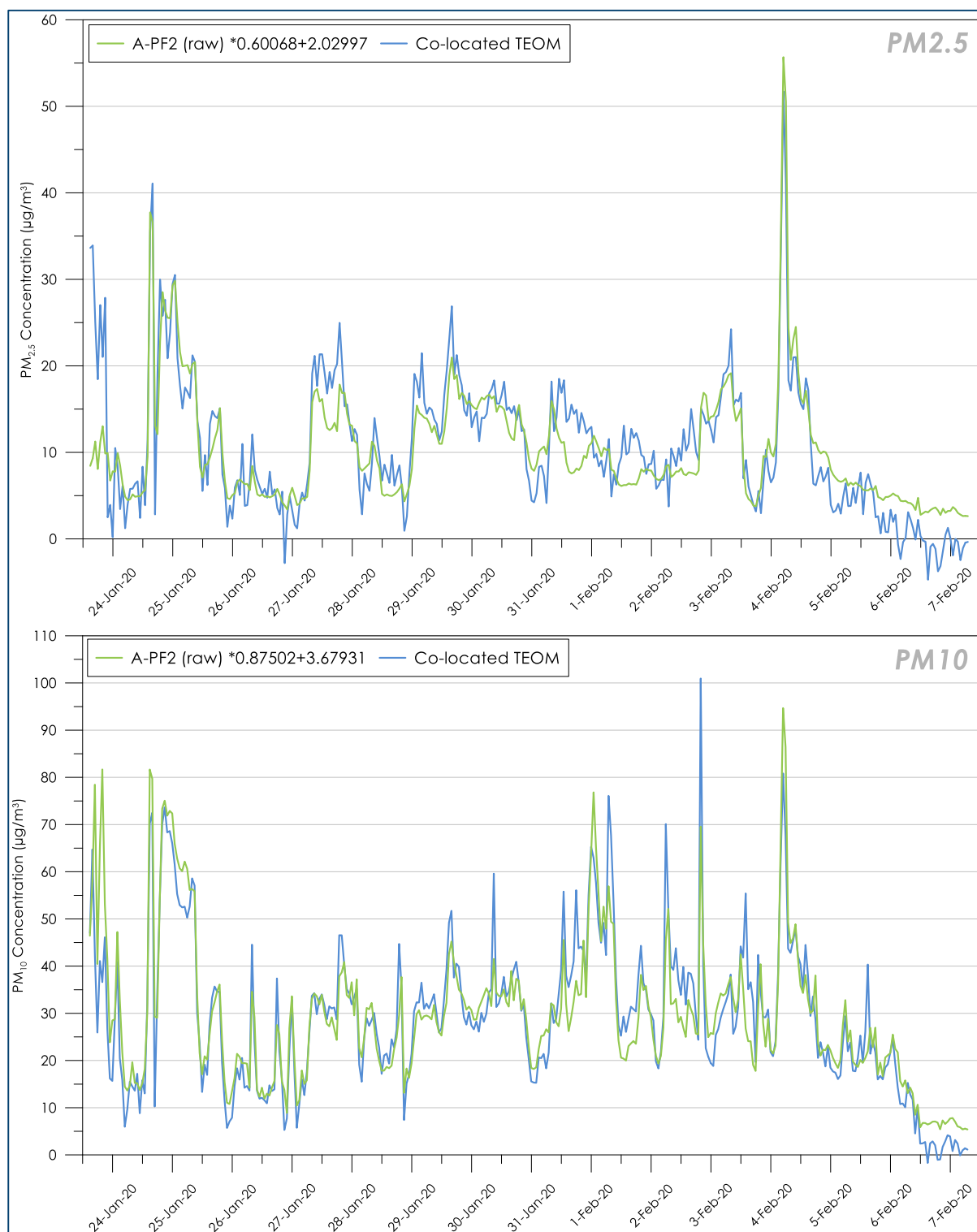


Figure 2: A-PF2 (k-factors applied) and co-located TEOM data

Recommendations

Based on our analysis, the new site specific calibration (k) factors result in more realistic reported data.. It is recommended that Ecotech remove the existing k-factor on the instrument and apply the new k-factors for PM_{2.5} and PM₁₀ of:

Calibrated PM_{2.5} value = Raw value *0.60068+2.02997

Calibrated PM₁₀ value = Raw value *0.87502+3.67931

Should the offset (zero) of the machine be changed during maintenance, then the scaling factor would also need to be adjusted accordingly.

These factors can then be applied to all three Palas Fidas monitors at Mount Pleasant.

Yours faithfully,
Todoroski Air Sciences



Aleks Todoroski



Dan Kjellberg

