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Mount Pleasant Operation

A JOINT VENTURE WITH JCDA Japan Coal Development Australia

Section 7

Environmental Assessment

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7 ENVIRONMENTAL ASSESSMENT

7.1 ENVIRONMENTAL RISK ASSESSMENT

An ERA has been undertaken to identify key potential environmental issues for further assessment in this EIS. The ERA workshop was conducted in November 2019 and was facilitated by a risk assessment specialist (Risk Mentor, 2020) (Appendix P).

The key potential environmental issues identified during the ERA workshop are summarised below and addressed in Sections 3 and 7, as well as in the relevant appendices to this EIS.

The risk assessment team consisted of representatives from:

- MACH;
- TAS;
- Wilkinson Murray;
- AGE Consultants;
- HEC;
- Hunter Eco;
- JAL;
- EnRiskS; and
- Resource Strategies.

Key potential environmental issues identified during the ERA workshop (Appendix P) were categorised into the following aspects:

- noise and blasting (Sections 7.3 to 7.6);
- air quality (Section 7.7);
- groundwater (Section 7.8);
- surface water (Section 7.9);
- biodiversity (Section 7.10);
- aquatic ecology (Section 7.11);
- Aboriginal cultural heritage (Section 7.12);
- historic heritage (Section 7.13);
- soil resources (Section 7.14);
- agricultural enterprises (Section 7.14);
- land contamination (Section 7.14);
- road transport (Sections 7.5 and 7.15);
- rail transport (Section 7.4);
- final landform (Section 3.17);
- visual landscape (Section 7.16);
- social (Section 7.17);
- economic (Section 7.18);
- human health risk (Section 7.20);
- geochemistry (Sections 3.9.3, 3.9.4 and 3.10.2); and
- waste management (Sections 3.9, 3.10 and 3.14).

In addition, the causal pathway groups in the Bioregional Assessment for the Hunter subregion (Herron *et al.*, 2018) were considered as part of the ERA process.

The risks associated with the potential environmental issues were ranked in accordance with the framework detailed in Australian/New Zealand Standard (AS/NZS) International Organization for Standardization (ISO) 31000:2018 *Risk Management - Guidelines*.

With the implementation of the proposed risk treatment measures, all of the potential issues identified were ranked within the 'Moderate – As Low As Reasonably Practicable' or 'Low-Tolerable' range by the risk assessment team (Appendix P).

Environmental mitigation (i.e. risk treatment) measures to be implemented for the Project are described where relevant in Section 7 and summarised in Attachment 9. Workshops (Plate 7-1) to address relevant environmental risks would continue to be undertaken periodically over the life of the Project as part of the MOP process.

Plate 7-1 Workshop at the Mount Pleasant Operation

7.2 CLIMATE AND TOPOGRAPHY

7.2.1 Climate

Long-term meteorological data for the region are available from nearby Commonwealth Bureau of Meteorology (BoM) meteorological stations (Figure 7-1 and Tables 7-1 and 7-2).

Short-term local meteorological data (from December 2016 onwards) are also available from the on-site M-WS4 weather station (Figure 7-1), which is operated in accordance with Development Consent DA 92/97 and EPL 20850.

M-WS4 monitors a number of meteorological parameters, including temperature, humidity, rainfall, wind speed and wind direction.

A summary of meteorological data in the vicinity of the Project relevant to the environmental studies in this EIS is provided below.

Rainfall Data and Statistics

Table 7-1 provides a summary of long-term rainfall data from regional BoM weather stations. The long-term average annual rainfall ranges from approximately 580 to 736 millimetres (mm), with the driest months being April, July and August and the wettest month typically being January.

Table 7-1 also provides a summary of rainfall data from M-WS4. The average annual rainfall recorded on-site for the period December 2016 to October 2020 is approximately 457.4 mm.

Evaporation Data and Statistics

Table 7-1 shows long-term pan evaporation data from the Scone SCS weather station. When compared to long-term average rainfall, the rate of evaporation exceeds rainfall on an annual average basis, as well as for all months.

Temperature Data and Statistics

Table 7-2 provides long-term average temperature data from several BoM weather stations. The long-term average monthly temperature ranges from a minimum of 3.4 degrees Celsius (°C) in July to a maximum of 31.9°C in January.

Table 7-2 also shows the monthly average minimum and maximum temperatures recorded at M-WS4 between December 2016 and October 2020. The minimum monthly average temperature is 5.8°C (July), while the maximum monthly average temperature is 30.0°C (February).

Humidity Data and Statistics

Table 7-2 shows long-term humidity data from the Scone SCS BoM weather station. The long-term annual average relative humidity is 69% at 9.00 am and 47% at 3.00 pm.

Wind Direction and Speed

As part of the Air Quality Assessment (TAS, 2020) (Appendix B), windroses were developed using wind direction and wind speed data from several weather stations in the region.

On an annual basis, prevailing winds at M-WS4 are typically along a north-northwest and north-west to a south-southeast axis, with little wind from the north-east or south-west (Appendix B). Such winds are typical of Hunter Valley conditions.

Temperature Inversions

Temperature inversions occur in the Mount Pleasant Operation area, particularly during the night-time in winter. The frequency of temperature inversions is described in the Noise and Blasting Assessment (Wilkinson Murray, 2020) (Appendix A).

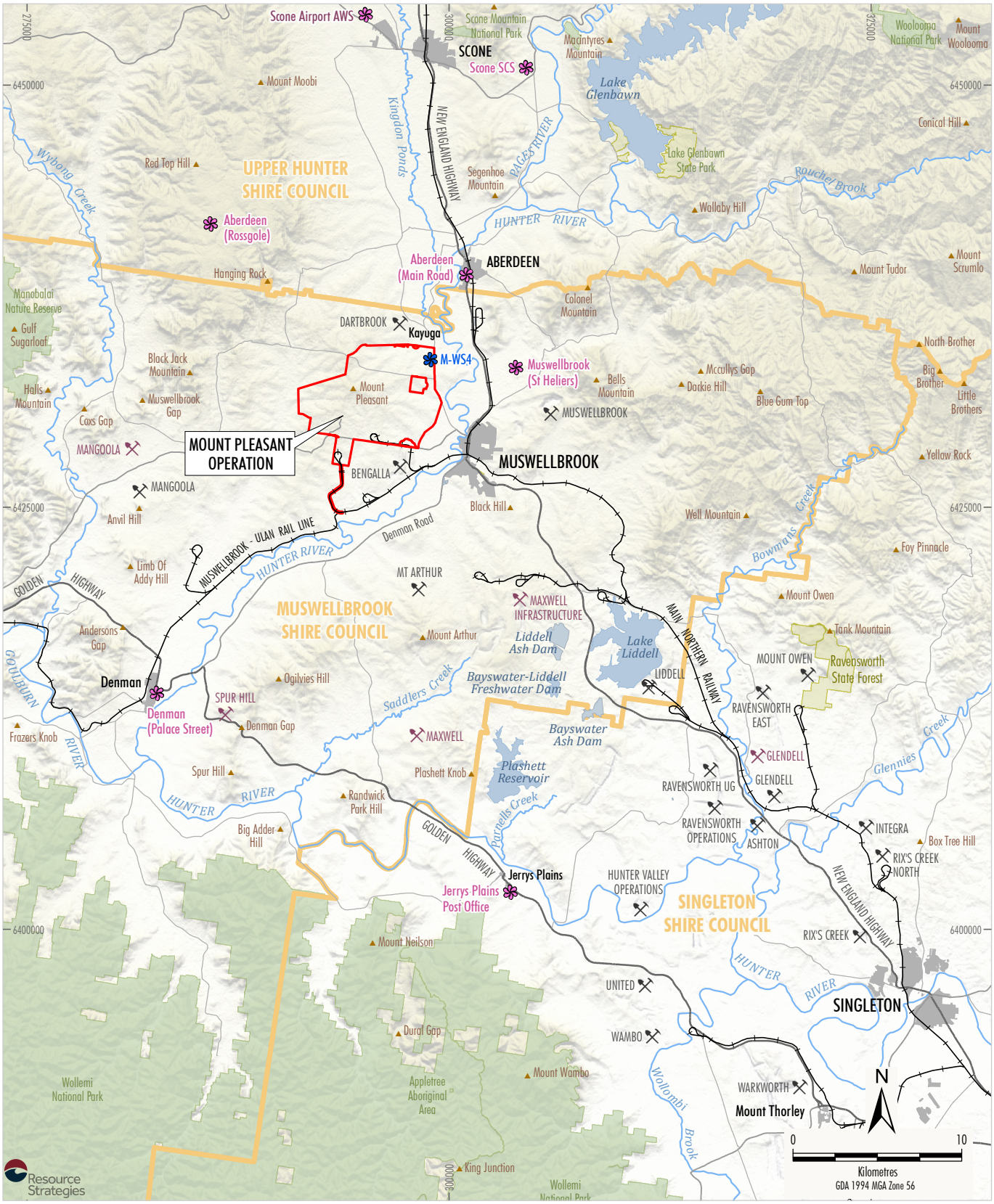
7.2.2 Topography

Existing Environment

Landforms in the vicinity of the Mount Pleasant Operation are characterised by the broad floodplain of the Hunter River surrounded by the undulating foothills and ridges of the surrounding terrain (Plate 7-2), including more elevated areas within Muswellbrook.

Elevations in the vicinity of the Mount Pleasant Operation range from approximately 360 m AHD at Mount Pleasant to approximately 140 m AHD at the existing Hunter River pump station.

Plate 7-2 Hunter River Floodplain Viewed from the Mount Pleasant Operation



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LEGEND

- Mining Operation
- Proposed Mining Operation (Application Lodged)
- Railway
- Local Government Boundary
- State Forest/Reserve
- National Parks and Wildlife Estate
- Mining Lease Boundary (Mount Pleasant Operation)
- BoM Meteorological Station
- Site Meteorological Station

Source: MACH (2020); NSW Spatial Services (2020); BoM (2020)

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Regional Meteorological Monitoring Sites

Figure 7-1

Table 7-1
Meteorological Data Summary – Rainfall and Evaporation

Period of Record	Long-term Average Monthly Rainfall (mm)						Short-term Average Monthly Rainfall (mm)	Average Monthly Pan Evaporation (mm)
	Scone SCS (61089) 1950 to 2019	Muswellbrook (St. Heliers) (61374) 1992 to 2020[1]	Aberdeen (Main Rd) (61000) 1894 to 2013	Aberdeen (Rossgole) (61065) 1926 to 2020[1]	Denman (Palace Street) (61016) 1926 to 2014	Jerrys Plains Post Office (61086) 1884 to 2014	On-site Weather Station (M-WS4) 2016 to 2020[1]	Scone SCS (61089) 1950 to 2019
January	81.8	59.7	73.5	88.2	72.2	77.1	31.4	217.0
February	73.4	63.8	62.2	81.0	66.5	73.1	56.4	173.6
March	53.1	61.7	51.6	69.1	54.2	59.7	97.0	151.9
April	38.6	37.4	40.2	51.7	40.1	44.0	32.4	108.0
May	45.2	41.9	41.5	49.9	36.3	40.7	20.2	71.3
June	45.8	50.1	44.5	56.2	42.4	48.1	22.4	48.0
July	35.8	38.6	40.6	43.9	38.8	43.4	23.2	58.9
August	38.2	38.1	36.5	43.6	34.7	36.1	21.6	86.8
September	38.1	45.5	39.1	47.3	38.9	41.7	24.0	120.0
October	56.3	43.3	49.3	62.2	48.0	51.9	55.5	158.1
November	62.5	71.8	50.9	68.8	55.5	61.9	34.9	186.0
December	67.2	60.8	66.1	77.1	64.6	67.5	38.6	223.2
Annual Average	**636.0 [636.0]**	**580.2 [612.7]**	**601.4 [596.0]**	**735.5 [739.0]**	**591.8 [592.2]**	**644.5 [645.2]**	**457.4**	**1606.0 [1602.8]**

Source: BoM, 2020; MACH, 2020f.

Note:

[1] Data available to end of October 2020.

[ ] Sum of average monthly records. Discrepancy with annual averages is based on BoM historical records.

Table 7-2
Meteorological Data Summary – Temperature and Humidity

Period of Record	Long-term Average Daily Temperature (°C)						Short-term Average Daily Temperature (°C)		Average Relative Humidity (%)	
	Scone SCS (61089)		Jerrys Plains Post Office (61086)		Scone Airport AWS (61363)		On-site Weather Station (M-WS4)		Scone SCS (61089)	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	9.00 am	3.00 pm
	1950 to 2019		1884 to 2014		1988 to 2020[1]		2016 to 2020[1]		1950 to 2019	
January	17.0	31.4	17.2	31.8	17.2	31.9	18.0	28.9	67	43
February	16.8	30.0	17.1	30.9	16.6	30.7	18.7	30.0	73	47
March	14.7	28.0	15.0	28.9	14.3	28.1	16.4	25.3	73	47
April	11.4	24.6	11.0	25.3	10.1	24.6	10.4	18.5	71	47
May	8.0	20.3	7.4	21.3	6.6	20.4	6.3	14.3	76	56
June	6.0	17.0	5.3	18.0	4.8	17.0	7.2	15.2	78	58
July	4.7	16.5	3.8	17.4	3.4	16.7	5.8	15.9	75	54
August	5.5	18.5	4.4	19.4	3.6	18.8	6.2	16.1	67	46
September	7.9	21.7	7.0	22.9	6.7	22.3	10.5	21.5	62	43
October	10.8	25.2	10.3	26.3	9.6	25.4	13.8	24.8	59	42
November	13.3	27.9	13.2	29.1	13.1	28.2	15.0	26.8	62	41
December	15.7	30.4	15.7	31.2	15.4	30.4	17.3	29.1	61	39
Annual Average	**11.0**	**24.3**	**10.6**	**25.2**	**10.1**	**24.5**	**12.1**	**22.2**	**69**	**47**

Source: BoM, 2020; MACH, 2020f.

Note:

[1] Data available to end of October 2020.

The Project is located within a mining precinct, with the Bengalla Mine located immediately to the south and Dartbrook Mine located immediately to the north (Figure 7-1). Land use other than mining in the vicinity of the Project includes grazing and a range of other agricultural enterprises (Section 7.14).

The Hunter River flows from the northern side of the Barrington Tops (Mount Royal Range), flowing through Muswellbrook and Singleton, before draining to the Pacific Ocean at Newcastle. The catchment has an overall size of 21,500 square kilometres (km²). The Hunter River and associated floodplain lie to the east of the Project.

The development of the approved Mount Pleasant Operation and associated open cut mining and waste rock emplacement has resulted in alteration to the site's pre-mining topography. Modified landforms include open cuts (Plate 7-3), the Eastern Out-of-Pit Emplacement, coal and topsoil stockpiles, the Fines Emplacement Area, water management dams and other infrastructure.

The existing/approved mine landforms of the Bengalla Mine to the immediate south of the Project and Mt Arthur Coal Mine further to the south also modify the topography in the vicinity of the Project.

Plate 7-3 Modified and Natural Landforms – Mount Pleasant Operation

The originally approved Mount Pleasant Operation final landform includes two final voids associated with the North Pit and South Pit open cuts and a smaller third final void located in a low-lying area between the two larger final voids (Section 2.2.10). The currently approved final landform (based on mining to December 2026 only) includes one final void in South Pit (Section 2.2.10).

Potential Impacts

The Project would alter the landforms and topography within the Project mining area. Some topographic changes would be temporary (e.g. temporary bund/drains) and some would be permanent (e.g. final mine landforms).

The Project would support the extraction of approximately 247 Mt of additional ROM coal by deepening part of the pit floor to access additional coal reserves, without significantly increasing the approved mine disturbance footprint (Section 3.1).

The Project would include the development of a single integrated waste rock emplacement landform that includes both in-pit and out-of-pit emplacement (the approved North West and South West Out-of-Pit Emplacements [Figure 1-3] would not be developed as part of the Project).

Waste rock mined during the development of the Project would continue to be placed within the approved Eastern Out-of-Pit Emplacement and used to backfill the mine void behind the advancing open cut operations. This would result in the topographic alterations of the Project being more concentrated in the eastern portion of the MLs. The integrated waste rock landform would be higher than the approved landform by approximately 40 m, with a more natural upper profile (Appendix M).

The integrated waste rock emplacement landform would continue to incorporate geomorphic design principles for hydrological stability, and varying topographic relief to be more natural in exterior appearance. At the cessation of mining for the Project, one final void would remain (Sections 3.12 and 3.17 and Attachment 8).

These changes, while altering the layout and extent of the existing/approved Mount Pleasant Operation, would generally be consistent with the nature and form of the approved mine landforms.

Further description of the proposed post-mining final landform for the Project is provided in Section 3.17 and Attachment 8.

A range of lesser topographic changes would be associated with the construction of roads, hardstands, water management infrastructure and erosion and sediment control features over the life of the Project.

An assessment of the likely visual impacts of the changes to landforms and topography associated with the Project is provided in Section 7.16 and Appendix M.

7.3 OPERATIONAL AND CONSTRUCTION NOISE

A Noise and Blasting Assessment for the Project was undertaken by Wilkinson Murray (2020) and is provided in Appendix A.

The operational and construction noise assessment was conducted in accordance with the NSW *Noise Policy for Industry* (NPfI) (EPA, 2017a) and in consideration of the *Interim Construction Noise Guideline* (NSW Department of Environment and Climate Change [DECC], 2009) and VLAMP (NSW Government, 2018b).

The Noise and Blasting Assessment (Appendix A) was peer reviewed by Glenn Thomas (Director, SLR). The peer review report is presented in Attachment 5.

A description of the existing noise environment, compliance, complaints and noise assessment criteria are provided in Section 7.3.1. Section 7.3.2 describes the potential operational and construction noise impacts of the Project, including cumulative impacts. Sections 7.3.3 and 7.3.4 outline mitigation and adaptive management measures for the Project, respectively.

Potential noise impacts from Project rail and road transport movements are described in Sections 7.4 and 7.5, and potential blast impacts are described in Section 7.6.

7.3.1 Existing Environment

Previous Noise Assessments

A number of noise assessments have previously been undertaken for the Mount Pleasant Operation, including for the 1997 EIS (ERM Mitchell McCotter, 1997a), Mod 1 (EMGA Mitchell McLennan, 2010), Mod 3 (Wilkinson Murray, 2017a) and Mod 4 (Wilkinson Murray, 2017b).

These noise assessments predicted noise levels generated by the Mount Pleasant Operation and compared the predicted levels to applicable noise criteria determined in consideration of background noise levels. The background noise levels determined for previous assessments are described in the Noise Management Plan (MACH, 2019a).

Background noise levels determined for previous assessments generally indicated low levels of background noise in rural areas, with elevated background noise identified in Muswellbrook and Aberdeen, along New England Highway and south-southwest of Muswellbrook.

The elevated background noise levels south-west of Muswellbrook (e.g. in the Racecourse Road area) may have been influenced by the presence of Bengalla Mine and Mt Arthur Coal Mine, which were both operating proximal to Muswellbrook when background noise measurements were undertaken for Mod 1.

The previous noise assessments for the Mount Pleasant Operation identified a number of privately-owned rural residences that were predicted to exceed the applicable Mount Pleasant Operation noise criteria.

The privately-owned rural residences that were predicted to exceed the applicable criteria were generally located on the Hunter River floodplain between the Mount Pleasant Operation and Muswellbrook, as well as rural lands to the north, north-east and south-west.

These predicted exceedances were reflected in noise-related conditions within Development Consent DA 92/97, including conditions that provide acquisition upon request rights for receivers with ‘significant’ predicted impacts, mitigation upon requested rights for ‘moderate’ predicted impacts and specific noise criteria for receivers with ‘negligible’ predicted impacts.

As at the time of writing, Development Consent DA 92/97 lists 30 privately-owned rural residences or parcels of land with acquisition upon request rights for significant noise or noise and air quality impacts, 20 privately-owned rural residences with mitigation upon request rights for moderate noise impacts and 12 privately-owned rural residences with specific noise criteria for negligible noise impacts.

Noise Management and Monitoring Regime

Noise management at the Mount Pleasant Operation is currently undertaken in accordance with the Noise Management Plan, which includes:

- noise mitigation measures and controls;
- the noise monitoring and reporting regime; and
- procedures for the management of exceedances and complaints.

The Noise Management Plan describes the comprehensive suite of planning controls and construction and operational controls that are implemented at the Mount Pleasant Operation to minimise noise emissions.

Planning controls implemented at the Mount Pleasant Operation include (MACH, 2019c):

- sound power testing of new operational mobile fleet, and sampling of mobile equipment and fixed plant annually to check noise performance;
- procurement of new and/or best available technology plant where reasonable and feasible to do so (including acoustic design of fixed plant, such as cladding) (Plate 7-4);
- periodically refining the Mount Pleasant Operation noise model by using noise monitoring data to assist with model calibration over the life of the mine;
- predictive meteorological and noise level forecasting to guide daily operations; and
- developing awareness and understanding of potential noise issues through site inductions for staff and contractors.

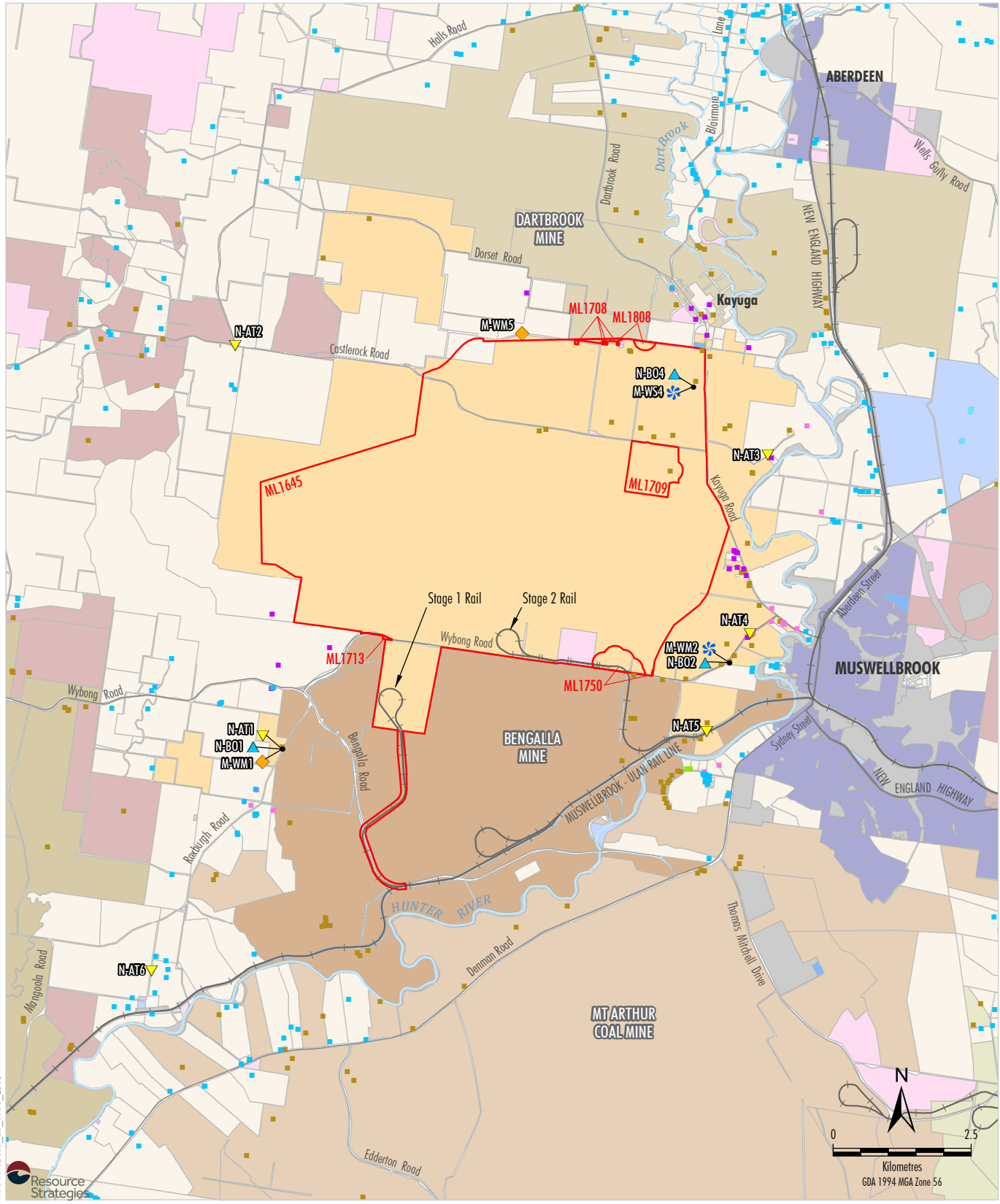
A number of proactive and reactive construction and operational noise management measures and controls are also implemented at the Mount Pleasant Operation where it is reasonable and feasible to do so, including (MACH, 2019c):

- mobile equipment operate in less exposed areas during the more sensitive evening/night period;
- vegetation clearance is limited to daytime hours;
- 'quackers' are used in place of reverse beepers on mobile equipment;
- noise suppression is provided on major operational mobile equipment;
- temporary cessation of work within an area, or of a particularly noisy piece of equipment, is considered when adverse meteorological conditions are present;
- all plant and machinery are maintained regularly to minimise noise generation; and
- all plant and machinery used on-site are operated in a proper and efficient manner (e.g. at correct speed) to minimise noise generation.

The Noise Management Plan describes the combination of operator-attended monitoring sites and continuous real-time monitors utilised in the noise monitoring program. Current attended and real-time noise monitoring locations in the vicinity of the Mount Pleasant Operation are shown on Figure 7-2.

While noise monitoring is generally focused to the east of the Mount Pleasant Operation towards Muswellbrook, noise monitoring is also undertaken to the north-east, north-west and south-west (Figure 7-2).

Plate 7-4 Example of Mitigated Fixed Plant at the Mount Pleasant Operation



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LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Mount Pleasant-controlled
- Bengalla-controlled
- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Other Mining/Resource-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1

Category of Rural Residence under DA92/97

- Mine-owned
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned

Monitoring Sites

- Noise Monitoring, Attended Noise
- Noise Monitoring, Real-time Noise Monitoring Site
- Weather Station
- Weather Mast

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

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

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Noise and Meteorological Monitoring Sites

Figure 7-2

The noise monitoring system provides real-time access to noise data and real-time target noise levels are set at each monitor based on the applicable noise criteria at the closest privately-owned receivers (MACH, 2019c).

Upon noise emissions reaching the identified trigger levels, an automated short messaging service (SMS) alarm is directed to key staff/operational personnel, who then implement the response protocol described in the Noise Management Plan.

The response protocol includes identifying the noise source. Upon determining that the Mount Pleasant Operation is audible and a significant contributor to total noise levels, meteorological and noise level forecasts for the shift are reviewed. A priority list of equipment for potential operational adjustments (e.g. relocating or shutting down equipment) is made, and if noise levels increase, equipment is progressively relocated or shut down as required until noise levels reduce appropriately (MACH, 2019c).

Details of the investigation into the cause of the alarm and the operational response implemented are recorded (MACH, 2019c).

Compliance and Complaints

To date, the obligation to meet the noise criteria specified in Development Consent DA 92/97 for privately-owned receivers has been achieved by MACH with the implementation of the Mount Pleasant Operation noise management strategy.

MACH reported compliance with relevant noise limits at the nearest privately-owned receivers during the most recent Independent Audit period between 26 November 2017 and 27 February 2020 (SLR, 2020). During the period February to September 2020, compliance with relevant noise limits was also reported in MACH's EPL 20850 compliance summary reports, with the exception of a small number of elevated noise levels recorded during April and July 2020 at monitoring locations N-AT3 and N-AT4. While notification of these elevated monitoring levels was made to both the EPA and the DPIE, subsequent investigations indicated no exceedance of relevant noise criteria had occurred at private receivers (Appendix A).

In the period January 2018 to September 2020, a total of 184 complaints relating to noise were received, including 32 in 2018, 97 in 2019 and 55 in the period January to September 2020.

In October 2019, the Mount Pleasant Operation began to record more detail in relation to the residential location of complainants. Of the 55 complaints recorded between October 2019 and September 2020, more than half (33) were from the Collins Lane/Kayuga Road area (where privately-owned receivers currently have acquisition upon request rights under Development Consent DA 92/97).

A summary of noise complaints received annually from 2017 to the end of September 2020, and further detail of the Mount Pleasant Operation complaints for the period October 2019 to September 2020, is provided on Figure 7-3.

MACH manages noise complaints in accordance with the Noise Management Plan. In some cases, site operations were adjusted to address the complaint, even though real-time noise monitoring did not indicate any exceedances of relevant noise criteria.

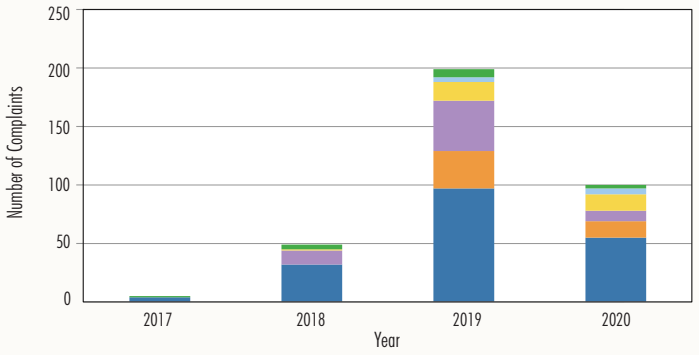
Noise Measurement and Description

The assessed noise levels presented in Appendix A and summarised in this section are expressed in A-weighted decibels (dBA). The logarithmic dBA scale simulates the response of the human ear, which is more sensitive to mid to high frequency sounds. Figure 7-4 provides information on common noise sources in dBA for comparative reference.

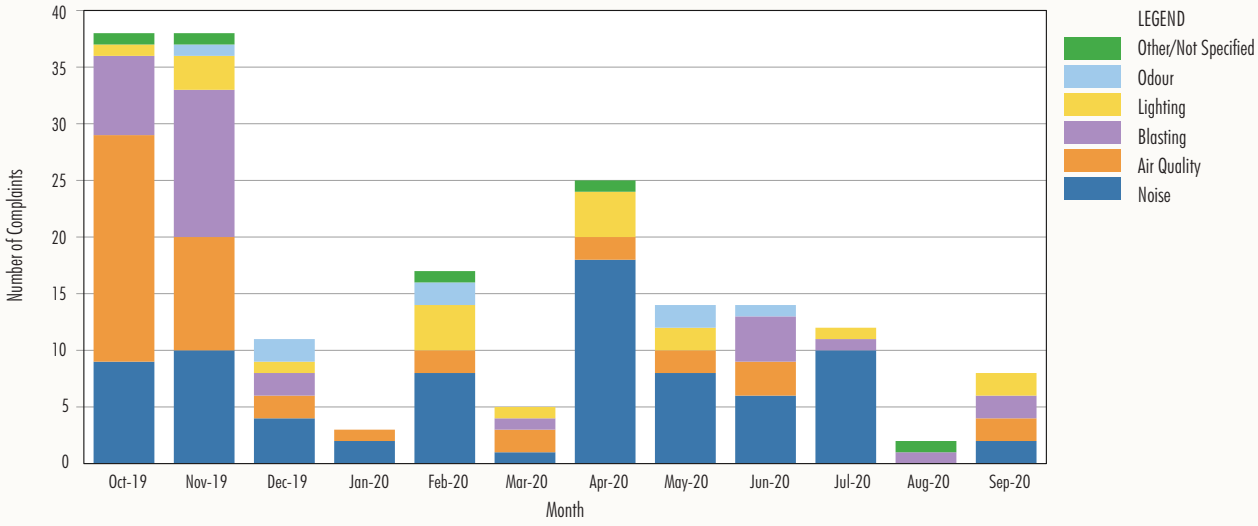
Hearing 'nuisance', for most people, begins at noise levels of about 70 dBA, while sustained (i.e. eight hours) noise levels of 85 dBA can cause hearing damage.

Measured or predicted noise levels are expressed as statistical noise exceedance levels (L_{AN}), which are the levels exceeded for a specific percentage (N) of the interval period. For example, L_{A10} is the noise level that is exceeded for 10% of the sampling period, and is also considered to be the average maximum noise level.

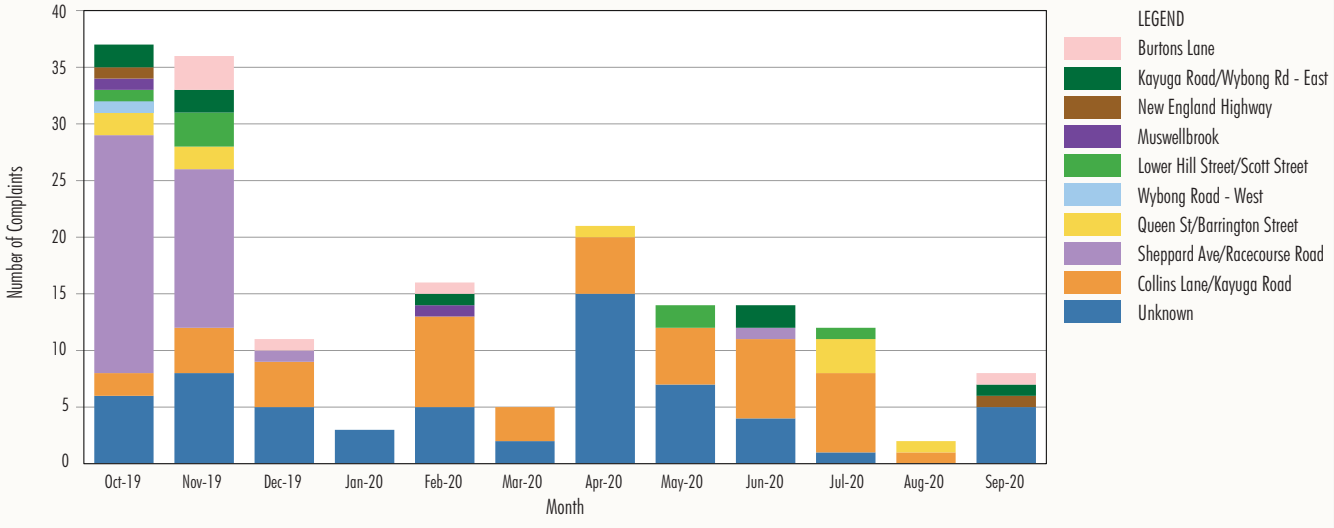
The equivalent continuous noise level (L_{Aeq}) refers to the steady sound level, which is equal in energy to the fluctuating levels recorded over the sampling period.



Complaint Category by Year



Complaint Type by Month



Complaint Location by Month

Resource Strategies

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Source: MACH (2020)

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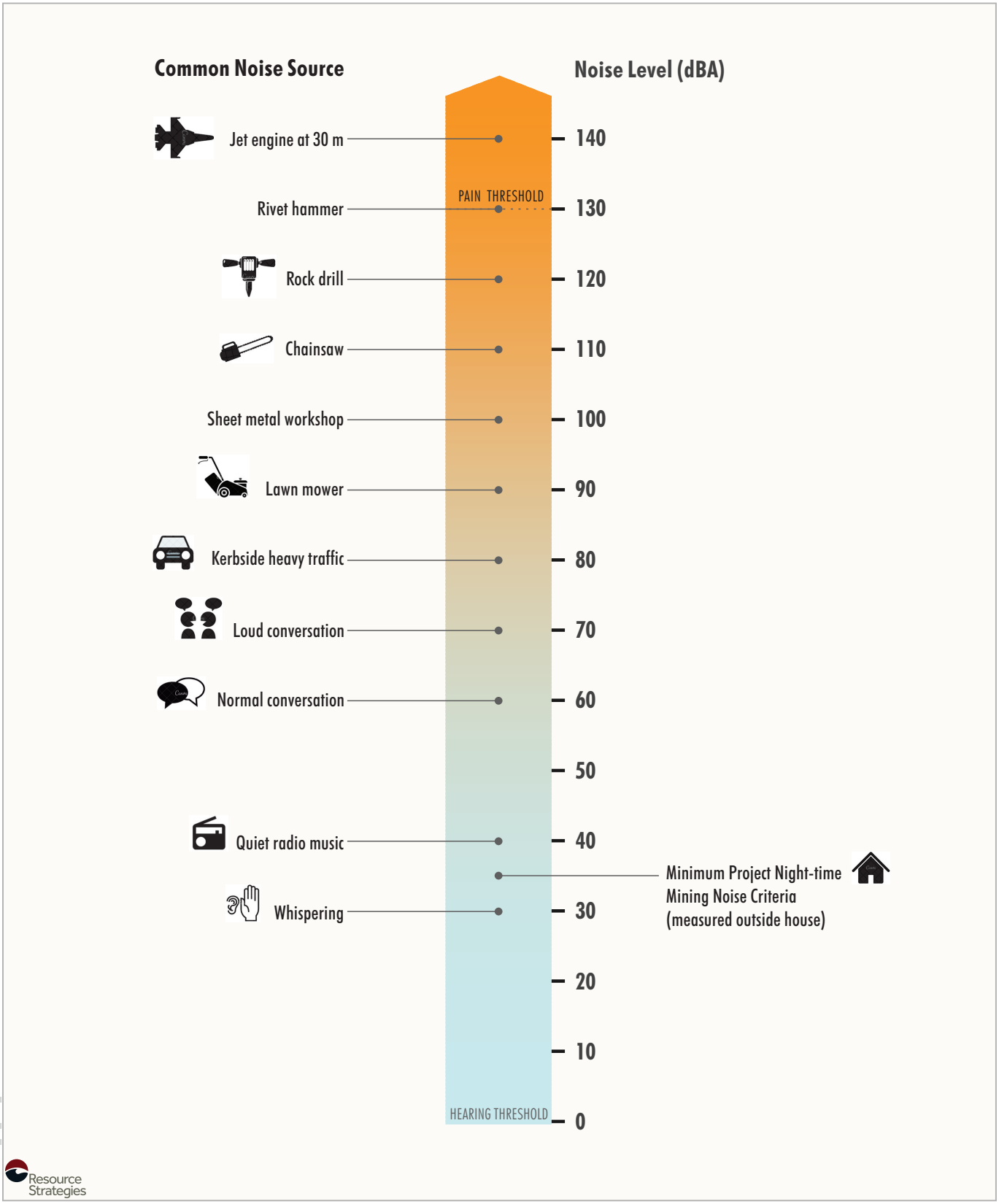
Complaints Summary

Figure 7-3



Source: After Safe Work Australia (2020)

Background Noise Levels

The Rating Background Level is the background noise level determined without the subject premises in operation, in accordance with the NPfI.

Given the local setting (i.e. proximity to the township of Muswellbrook, railways, major roads, agricultural enterprises, and neighbouring mines), the background noise environment in the vicinity of the Mount Pleasant Operation is complex.

To reflect this complexity, a number of Noise Assessment Groups (NAGs) were adopted in Development Consent DA 92/97 to account for variance in background noise levels. The Rating Background Levels for the current Mount Pleasant Operation NAGs are shown on Figure 7-5.

A contemporary background noise survey was carried out in September to October 2018 by Wilkinson Murray to determine if Rating Background Levels surrounding the Mount Pleasant Operation had changed compared to previous surveys (refer to *Previous Noise Assessments* subsection above). Wilkinson Murray conducted a further follow-up survey in August to September 2020 to obtain additional background noise levels on the western side of Muswellbrook (Appendix A).

Following the contemporary surveys, Wilkinson Murray (2020) determined Project NAGs based on the measured Rating Background Levels. The Project NAGs were informed by measurements taken at 20 background noise monitoring locations, the proximity to key major roads (New England Highway, Bridge Street, Aberdeen Street and Sydney Street), relevant LEP zoning and local topography.

A number of conservative assumptions were made in determining the extent of the Project NAGs, (Appendix A). Consistent with the NPfI, elevated background noise levels that had some potential to be affected by noise from the Mount Pleasant Operation were not used to determine the extent of the Project NAGs (Appendix A). The Project NAGs are shown on Figure 7-5.

Notably, the Project NAGs are less extensive than the current Mount Pleasant Operation NAGs, and the night-time Rating Background Level of 31 dBA for NAG 1 would generally coincide with a reduction of 1 to 3 dBA compared to the currently approved Mount Pleasant Operation night-time noise criteria for the same relevant receivers.

As such, a significant number of receivers surrounding the Mount Pleasant Operation would have lower (i.e. more stringent) evening and night-time noise criteria applied under the Project, than is currently the case for the approved Mount Pleasant Operation (Appendix A).

Notwithstanding, the daytime criteria have increased for the majority of receivers, due to the increased minimum daytime criteria defined in the NPfI (Appendix A). This is because the daytime period is recognised as being less sensitive to potential noise impacts (EPA, 2017a).

7.3.2 Potential Impacts

Operational Noise Criteria

The NPfI assessment procedure for industrial noise sources has two components (EPA, 2017a):

- controlling potential intrusive noise levels in the short-term for residences; and
- maintaining noise level amenity for particular land uses, for residences and other land uses.

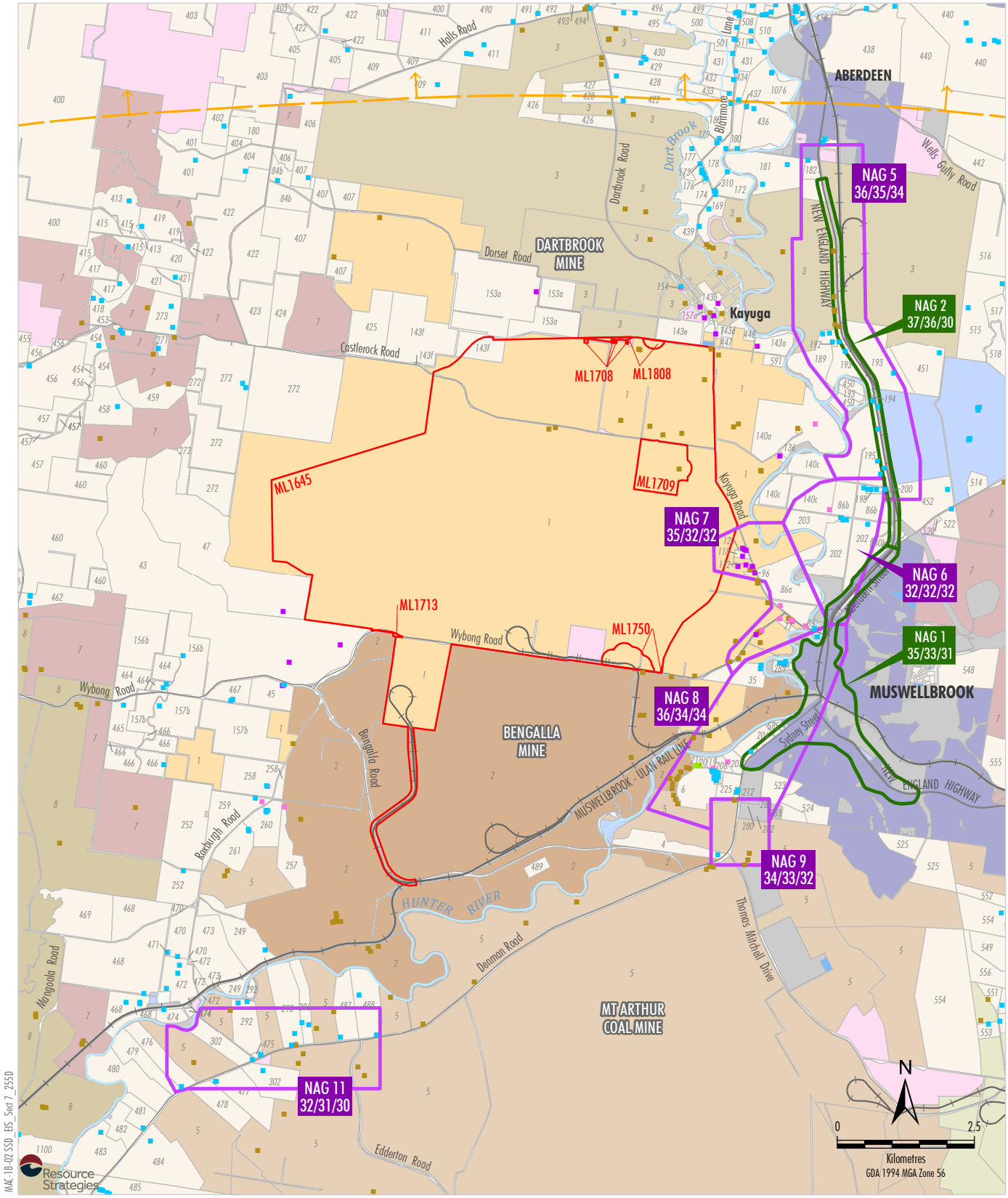
The NPfI prescribes detailed calculation routines for establishing Project-specific $L_{Aeq(15\ minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity criteria. The NPfI Project-specific intrusive and amenity assessment criteria for the Project (also known as Project noise trigger levels) are presented in Table 7-3.

As the applicable Project-specific intrusive criteria are the most stringent, Appendix A assesses Project-only noise levels against the intrusive criteria. Cumulative noise levels (i.e. from the Project and other mines) are assessed against the recommended amenity noise criteria level, which is at least 5 dBA greater than the Project-specific amenity level (as per Table 7-3).

Potential noise impacts on land uses other than residences are also assessable under the NPfI. Appendix A assesses potential Project noise levels at aged care facilities, schools, churches, accommodation, the St Heliers Correctional Centre and commercial premises. The relevant NPfI amenity criteria for these land uses are also provided in Table 7-3.

In those cases where the NPfI Project-specific noise assessment criteria are exceeded, it does not automatically follow that all people exposed to the noise would find the noise noticeable (Figure 7-4) or unacceptable.

Table 7-4 presents the methodology used for assessing operational noise against the NPfI Project-specific noise assessment criteria.



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Mount Pleasant-controlled
- Bengalla-controlled
- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Other Mining/Resource-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1

Category of Rural Residence under DA92/97

- Mine-owned
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned
- Current Mount Pleasant Operation Noise Assessment Group (NAG)
- Project Noise Assessment Group (NAG)
- 32/32/32 Rating Background Level for Day/Evening/Night
- Specific receivers not modelled

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

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

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MOUNT PLEASANT OPTIMISATION PROJECT

Current Mount Pleasant Operation and Project Noise Assessment Group Background Levels

Figure 7-5

Table 7-3
NPfI Project-specific Intrusive, Amenity and Cumulative Assessment Criteria (dBA)

Locality	Land Use	Intrusive $L_{Aeq(15\ minute)}$[a]			Amenity $L_{Aeq(period)}$[a]			Cumulative $L_{Aeq(period)}$[a]		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
NAG 1 (Muswellbrook)	Residential	40	38	36	45	40	35	50	45	40
NAG 2 (New England Highway)	Rural residential	42	41	35						
Other Privately-owned Land	Rural residential	40	35	35						
Any	Aged care	Intrusive noise criteria not applicable			50	45	40	55	50	45
	Accommodation				55	50	45	60	55	50
	School[b]				45	45	n/a	50	50	n/a
	Church[b]				50	50	n/a	55	55	n/a
	Correctional Centre				55	50	45	60	55	50
	Commercial[b]				65	n/a	n/a	70	n/a	n/a

Source: After Appendix A.

[a] Daytime 7.00 am to 6.00 pm (Monday to Saturday) and 8.00 am to 6.00 pm (Sunday and public holidays), Evening 6.00 pm to 10.00 pm, Night 10.00 pm to 7.00 am (Monday to Saturday) and 10.00 pm to 8.00 am (Sundays and public holidays).

[b] Amenity noise criteria apply when in use.

Table 7-4
Significance of Residual Noise Impacts and Potential Treatments

Residual Noise Exceeds NPfI Criteria By	Total Cumulative Industrial Noise Level	Significance of Residual Impact	Example of Potential Treatment
0 to 2 dBA	Not applicable	Negligible	The exceedance would not be discernible by the average listener and therefore would not warrant receiver-based treatment or controls.
3 to 5 dBA	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is ≤1 decibel (dB)	Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
3 to 5 dBA	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is >1 dB	Moderate	As for 'marginal', but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
>5 dBA	≤ recommended amenity noise level	Moderate	
>5 dBA	> recommended amenity noise level	Significant	May include suitable commercial agreement where considered feasible and reasonable.

Source: After EPA (2017a).

For the purposes of assessing potential noise impacts consistent with the VLAMP, exceedances can be separated into a Noise Management Zone (i.e. negligible, marginal or moderate impacts of 1 to 5 dBA above the criteria) and a Noise Affectation Zone (i.e. greater than 5 dBA above the criteria, with impacts considered to be significant).

The characterisation of residual noise impacts in the VLAMP is generally consistent with the NPfI (Table 7-4).

Operational Noise Modelling

The Environmental Noise Model was used by Wilkinson Murray (2020) to simulate the Project components using noise source information (i.e. indicative equipment sound power levels and locations) to predict noise levels at relevant receiver locations.

The Environmental Noise Model is compatible with the NPfI and has been previously accepted by the EPA and DPIE for use in environmental noise assessments, including at the Mount Pleasant Operation (Appendix A).

The model considers meteorological effects, surrounding terrain, distance from source to receiver and noise attenuation.

Assessment of Meteorological Conditions

The noise modelling completed for the Project is based on meteorological data obtained from an on-site meteorological station (M-WM2 – refer Figure 7-2) for the period 1 December 2016 to 31 August 2019. The meteorological data used includes wind speed, wind direction and stability class (Appendix A).

Wilkinson Murray (2020) assessed the meteorological data in accordance with Fact Sheet D of the NPfI to determine the significance of noise-enhancing meteorological conditions.

Based on the site-specific meteorological data, moderate-to-strong temperature inversions were not determined to be significant for the Project in accordance with the assessment methodology in the NPfI. Notwithstanding, temperature inversions were conservatively modelled as a component of night-time noise-enhancing meteorological conditions. Rather than modelling a moderate-to-strong temperature inversion with no wind component, a moderate-to-strong temperature inversion plus a wind of 0.5 m/s (source-to-receiver) was also conservatively adopted for all receivers (Appendix A).

Based on analysis conducted by Wilkinson Murray, these modelled adverse conditions are more noise-enhancing than the meteorological conditions determined and modelled for Mod 3 and Mod 4 under the previous assessment requirements.

Details on the analysis and meteorological conditions modelled are provided in Appendix A. Section 7.2 provides a summary description of meteorology and topography in the vicinity of the Project.

Noise Modelling Scenarios

Seven operational scenarios of the Project were selected in consideration of maximum potential noise emissions (e.g. to account for the maximum mobile equipment fleet and proximity to sensitive receptors in different localities) to evaluate potential noise impacts over the life of the Project (Appendix A):

- 2026 – Representative of Project mining activity continuing close to Muswellbrook, with a ROM coal extraction rate of 10.5 Mtpa as per the approved operations. The existing CHPP facilities are utilised, and there is a moderate amount of shielding provided by the Eastern Out-of-Pit Emplacement.
- 2028 – Representative of increased ROM coal extraction at a rate of 15.75 Mtpa and operation of the Stage 2a CHPP to process the additional ROM coal.
- 2031 – Representative of the Project's full extent to the north, with continuing ROM coal extraction at a rate of 15.75 Mtpa. Receivers to the east would benefit from further shielding provided by the Eastern Out-of-Pit Emplacement.
- 2034 – Representative of the first year of the Project peak ROM coal extraction rate of 21 Mtpa and operation of the Stage 2b CHPP to process the additional ROM coal.
- 2041 – Representative of peak mining activity (amount of ROM coal extracted and waste rock material handled) for the life of the Project.
- 2044 – Representative of peak mining activity for the western extent of the Project (extraction and handling rates have reduced compared to the peak in 2041).
- 2047 – Representative of mining further to the west, with significantly reduced extraction and handling rates. This scenario focuses on potential impacts to the south-west and north-west.

Indicative Project general arrangements for these scenarios are shown on Figures 3-4 to 3-10.

Assessment of Feasible and Reasonable Noise Mitigation Measures

MACH currently maintains operational noise levels consistent with the noise criteria described in Development Consent DA 92/97, through the implementation of the comprehensive suite of noise mitigation measures outlined in the Noise Management Plan (Section 7.3.1).

Increasing the ROM coal extraction rate for the Project from 10.5 Mtpa to 21 Mtpa has the potential to increase the noise levels experienced by receivers surrounding the Mount Pleasant Operation.

Wilkinson Murray (2020) and MACH conducted an investigation of potential reasonable and feasible noise mitigation measures for the Project, particularly in relation to night-time operations.

A number of iterative steps were undertaken to develop reasonable noise mitigation measures for the Project, including (Appendix A):

1. Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Project to identify the potential for noise exceedances.
2. Evaluation of primary noise sources and various combinations of noise management and mitigation measures to reduce receptor noise levels.
3. Review of effectiveness of these measures and assessment of their feasibility by MACH.
4. Adoption by MACH of an extensive suite of management and mitigation measures to reduce noise emissions associated with the Project.

The preliminary noise modelling indicated that increasing the ROM coal extraction rate to 21 Mtpa early in the life of the Project (i.e. when mining would still be close to Muswellbrook) would significantly increase noise impacts at proximal privately-owned receivers.

Modifications to the mine plan were then undertaken in conjunction with additional iterative noise modelling to improve acoustic performance, including:

- Staging the increases in ROM coal extraction, with the following phases (Section 3.6.3):
  - Project Establishment, with no increase in ROM coal extraction (i.e. 10.5 Mtpa);
  - Intermediate Phase, when the Eastern Out-of-Pit Emplacement would be sufficiently developed, the ROM coal extraction rate increased to 15.75 Mtpa;
  - Peak Production Phase, when the Eastern Out-of-Pit Emplacement would be further developed and the open cuts would have progressed further west, with the ROM coal extraction rate increased to up to 21 Mtpa; and
  - Ramp Down Phase, when the ROM coal extraction rate would decrease as the Project coal reserves are depleted and the Project final landform nears completion.
- Design of the integrated eastern waste rock landform to provide further shielding of operations to receivers in and around the township of Muswellbrook and village of Aberdeen, including advance development of a bund on the boundary of North Pit that would subsequently be incorporated with the integrated emplacement.

In addition to optimising the mine plan in consideration of potential noise impacts on privately-owned receivers, MACH would continue to implement the existing best practice noise management system for the Project, including:

- Continued implementation of noise suppression on all new major mobile equipment and acoustic design (e.g. cladding) of all fixed plant where reasonable and feasible (in addition to the continued use of noise-suppressed mobile equipment and acoustically designed fixed plant at the existing Mount Pleasant Operation).
- Continued use of the proactive and reactive noise management system, where mining operations are adjusted as required based on meteorological and noise level forecasting and real-time monitoring.

MACH has also evaluated and adopted a rail noise barrier within the Mount Pleasant Operation MLs, to reduce operational noise levels experienced at receivers to the south of the Mount Pleasant Operation.

In combination, the mitigation measures described above would significantly reduce the noise emissions of the Project, *albeit* at significant capital and operating cost to MACH.

In adopting the above noise mitigation strategy for the Project, MACH considered the potential magnitude and frequency of proactive and reactive operational adjustments that may be required in addition to the adopted mobile and fixed plant noise mitigation. For example, the mitigation adopted for the 2028 modelling scenario when operations expand to 15.75 Mtpa ROM coal includes shutting down up to two overburden extraction fleets (Plate 7-5) and some ancillary equipment during adverse meteorological conditions (Appendix A).

Operational adjustments of the scale adopted for the 2028 modelling scenario are anticipated to be required for approximately 4% of the night-time to maintain compliance with the predicted noise levels to the south-east.

Less intensive proactive and reactive operational adjustments, such as shutting down less fleet, temporarily pausing some ancillary equipment, or relocating mobile equipment, would also be required under some less adverse meteorological conditions in 2028.

It is noted that the most intensive mitigation measures would generally be required in the south-east and in the early years of the Project life (i.e. to approximately 2028). This highlights the effectiveness of the staged increases to ROM coal extraction rate as mining proceeds west and the waste rock emplacement landform to the east of the open cut provides additional shielding (Appendix A).

Given the above, the effectiveness of the existing best practice noise management system at the Mount Pleasant Operation, and the number of conservative assumptions that have been incorporated into the noise modelling, MACH is confident that proactive and reactive operational adjustments to maintain compliance with the predicted noise levels for the Project can be accommodated by the Project production schedule.

Plate 7-5 Example Overburden Fleet Operating at the Mount Pleasant Operation

A wide range of alternative reasonable and feasible noise mitigation measures would be available to MACH to achieve compliance with the noise levels predicted for the Project. Selection of the most reasonable and feasible options would be undertaken by MACH at the relevant time based on currently available technologies.

Low-frequency Noise Assessment

A low-frequency noise assessment was conducted for the Project to ascertain whether any receivers should be subject to a modifying factor correction due to dominant low-frequency content prior to comparing to the relevant Project noise criteria.

The low-frequency noise assessment examined likely noise levels at a selection of representative receivers in various catchment areas surrounding the Project based on overall ‘C’ weighted and ‘A’ weighted predicted noise levels.

Consistent with the results of other low-frequency desktop assessments of comparable operations, the comparison of ‘C’ weighted and ‘A’ weighted noise levels indicated the potential for unbalanced spectra (Appendix A). However, when the Project’s operational noise predictions were compared to the low-frequency noise threshold levels provided in Table C2 of the NPfI, Project predicted noise levels were within the relevant thresholds (Appendix A).

As such, the low-frequency noise assessment indicated it is unlikely that any of the receivers surrounding the Project would be subject to dominant low-frequency noise. Therefore, no modifying factor correction for low-frequency noise is warranted for the Project (Appendix A).

This is consistent with attended monitoring at the existing Mount Pleasant Operation, which has generally indicated measured noise levels do not contain dominant low-frequency noise (Appendix A).

Predicted Noise Levels

Modelling of the potential noise levels of the Project was undertaken for a significant number of potentially sensitive receivers.

To determine the receivers to be modelled, MACH commissioned a Muswellbrook-based surveying company to conduct a comprehensive receiver identification and verification study in early 2020.

Light Detection and Ranging (LiDAR) data was used to identify all structures in an area of approximately 440 km² centred on the Mount Pleasant Operation. For practical reasons, only the western outskirts of Muswellbrook and the southern outskirts of Aberdeen were included in the search area.

Over 4,400 structures were identified and characterised (e.g. as a residence, commercial premises, etc.) using remote sensing, aerial imagery and ground survey. Given the large number of structures identified, only those structures considered to be sensitive to noise impacts were modelled. Where potential receivers could not be categorically characterised, they were conservatively assumed to be residences (Appendix A).

In total, more than 900 receivers have been modelled, including over 650 privately-owned residences, as well as Council/State-owned residences, mine-owned residences, aged care facilities, commercial premises (including accommodation), schools, churches and heritage structures (Appendix A).

Key receivers modelled (i.e. privately-owned, Council/State-owned and mine-owned residences) are shown on Figures 7-6 to 7-8.

Project-only Noise Emissions

Indicative noise contours of maximum Project noise predictions, which occur during the 2026, 2034 and 2041 modelling scenarios, are presented on Figures 7-6 to 7-8. These figures illustrate that the Project 35 dBA and 36 dBA contours (i.e. typical privately-owned residence night-time noise criteria) are largely overlying mine-owned land, with the exception of portions of the Hunter River floodplain to the south-east, east and north-east of the Project.

The predicted noise impacts of the Project are summarised visually on Figure 7-9, while Table 7-5 provides a tabular summary of the predicted exceedances of the Project noise criteria based on maximum noise predictions for all modelled scenarios.

In summary, the operational noise assessment indicated the following (Table 7-5) (Appendix A):

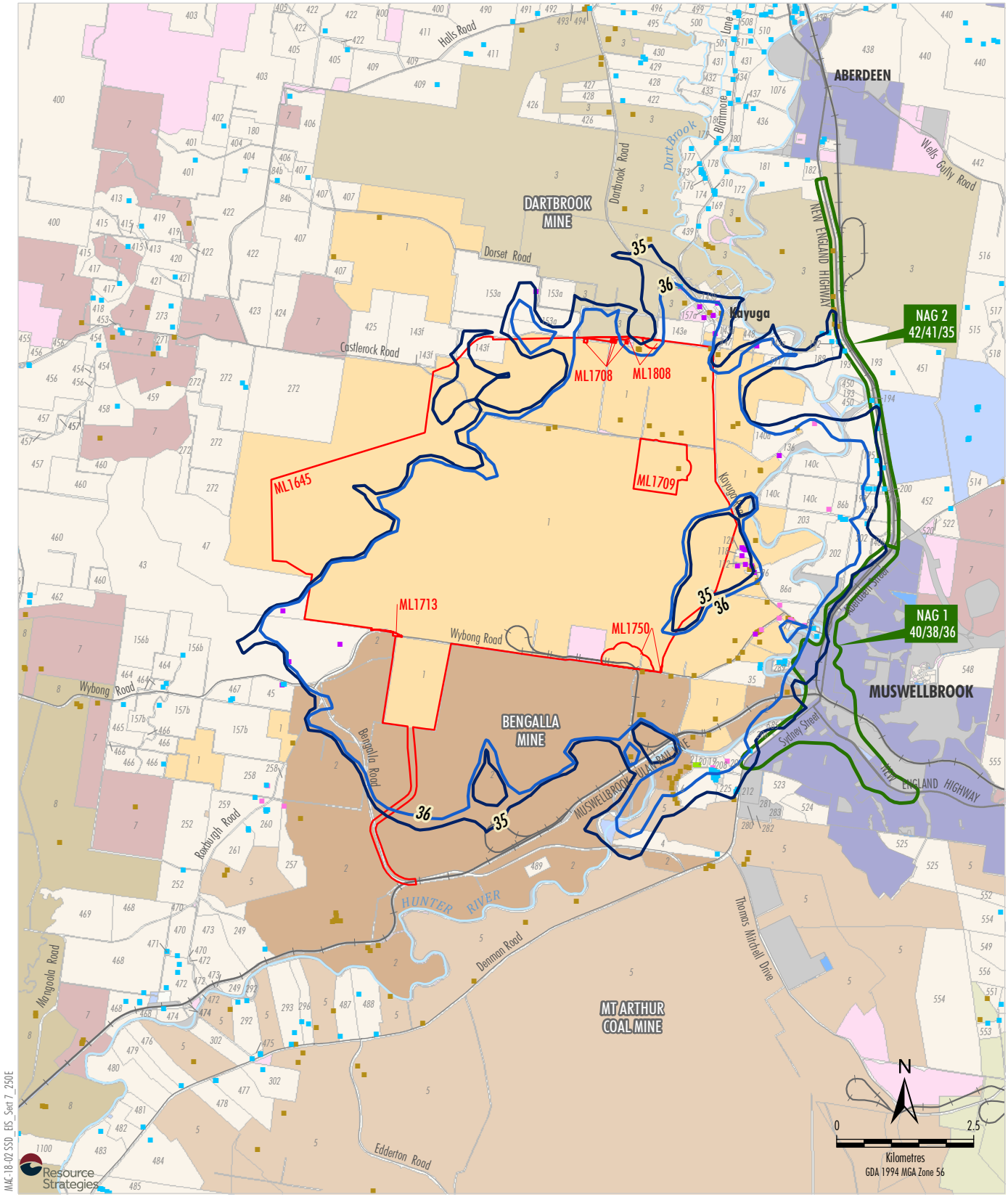
- During the daytime, operational noise levels (assessed under relevant meteorological conditions) are predicted to comply with the relevant Project noise criteria at all but one privately-owned receiver that is predicted to experience a negligible exceedance (i.e. 1 to 2 dBA above the Project noise criteria).
- During the evening, two receivers are predicted to experience negligible exceedances (i.e. 1 to 2 dBA above the Project noise criteria), five receivers are predicted to experience moderate exceedances (i.e. 3 to 5 dBA above the Project noise criteria) and one receiver is predicted to experience a significant exceedance (i.e. >5 dBA above the Project noise criteria).
- During the night-time, 52 receivers are predicted to experience negligible exceedances (i.e. 1 to 2 dBA above the Project noise criteria), 14 receivers are predicted to experience moderate exceedances (i.e. 3 to 5 dBA above the Project noise criteria) and 14 receivers are predicted to experience significant exceedances (i.e. >5 dBA above the Project noise criteria).

It is noted that all but three of the receivers predicted to experience moderate or significant exceedances are already subject to mitigation or acquisition upon request rights in Development Consent DA 92/97 for the approved Mount Pleasant Operation (refer Table 7-5).

In review of the results summarised in Table 7-5 and shown graphically on Figure 7-9, it is important to note:

- The Project receiver identification and verification exercise conservatively classified a number of structures as additional residential receivers that have not been previously modelled.
- The 80 receivers with predicted exceedances of the relevant Project noise trigger levels are on 65 properties (i.e. multiple potential residences have been modelled separately).
- While the total number of receivers with predicted noise impacts is similar to the approved Mount Pleasant Operation (Section 7.3.1), the number of receivers with moderate and significant exceedances has reduced, and the number with negligible exceedances has increased.

It is further noted that Project noise predictions at many of the receivers are lower than currently consented under Development Consent DA 92/97. However, the Project night-time criteria have also been lowered at many locations (Section 7.3.1), resulting in predicted negligible Project exceedances, even though, in practice, predicted Project noise levels would be lower than currently approved at the Mount Pleasant Operation.



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Mount Pleasant-controlled
- Bengalla-controlled
- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Other Mining/Resource-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1

Category of Rural Residence under DA92/97

- Mine-owned
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned
- Project Noise Assessment Group (NAG)
- 40/38/36 Default NAG Noise Criteria for Day/Evening/Night
- Noise Contour (35 dBA)
- Noise Contour (36 dBA)

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

Source: MACH (2020); NSW Spatial Services (2020); Wilkinson Murray (2020)

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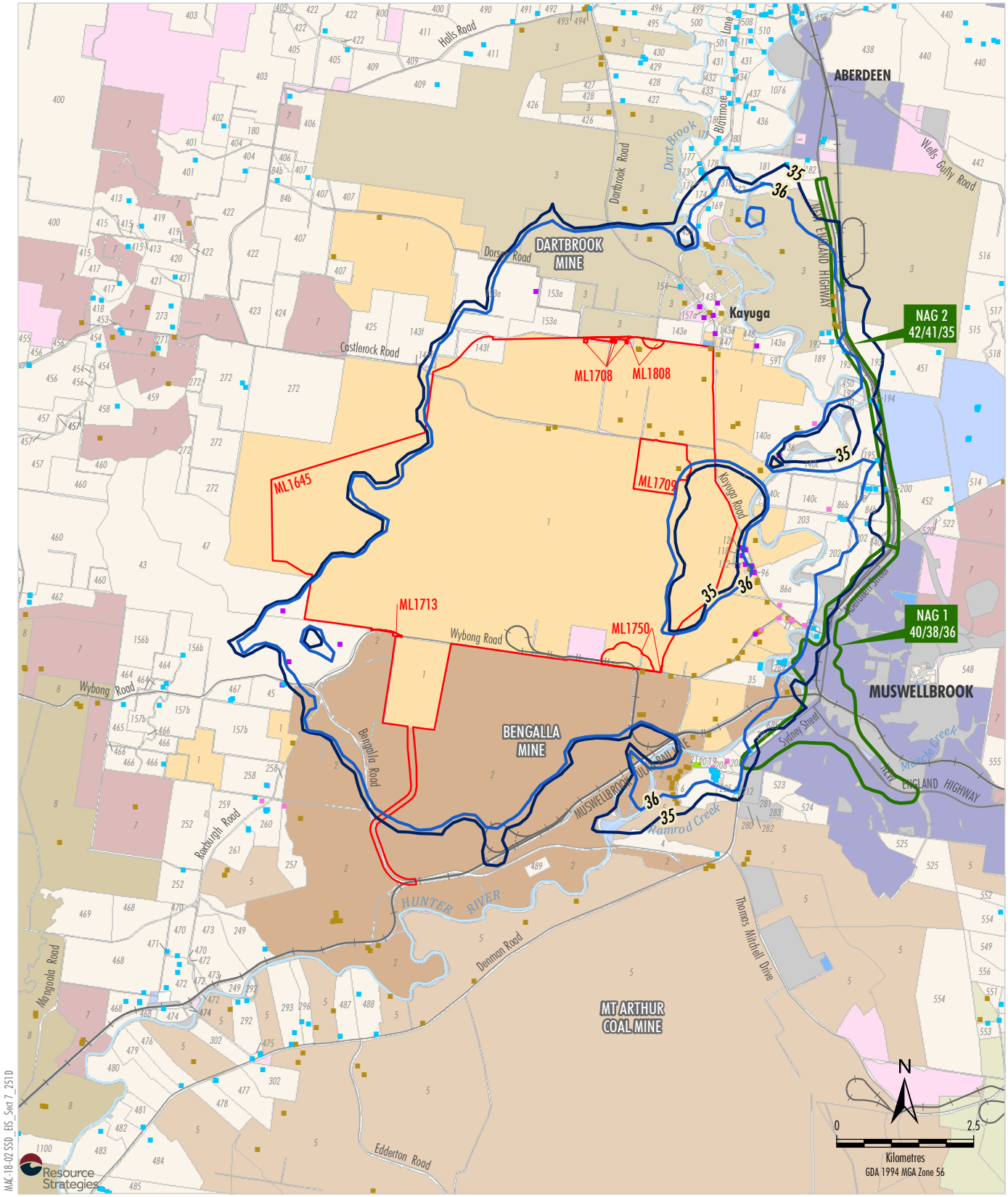
MOUNT PLEASANT OPTIMISATION PROJECT

Night Intrusive $L_{Aeq\ (15\ min)}$ Noise Contours 2026

Figure 7-6



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Mount Pleasant-controlled
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- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Other Mining/Resource-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1

Category of Rural Residence under DA92/97

- Mine-owned
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned
- Project Noise Assessment Group (NAG)
- 40/38/36 Default NAG Noise Criteria for Day/Evening/Night
- Noise Contour (35 dBA)
- Noise Contour (36 dBA)

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

Source: MACH (2020); NSW Spatial Services (2020); Wilkinson Murray (2020)

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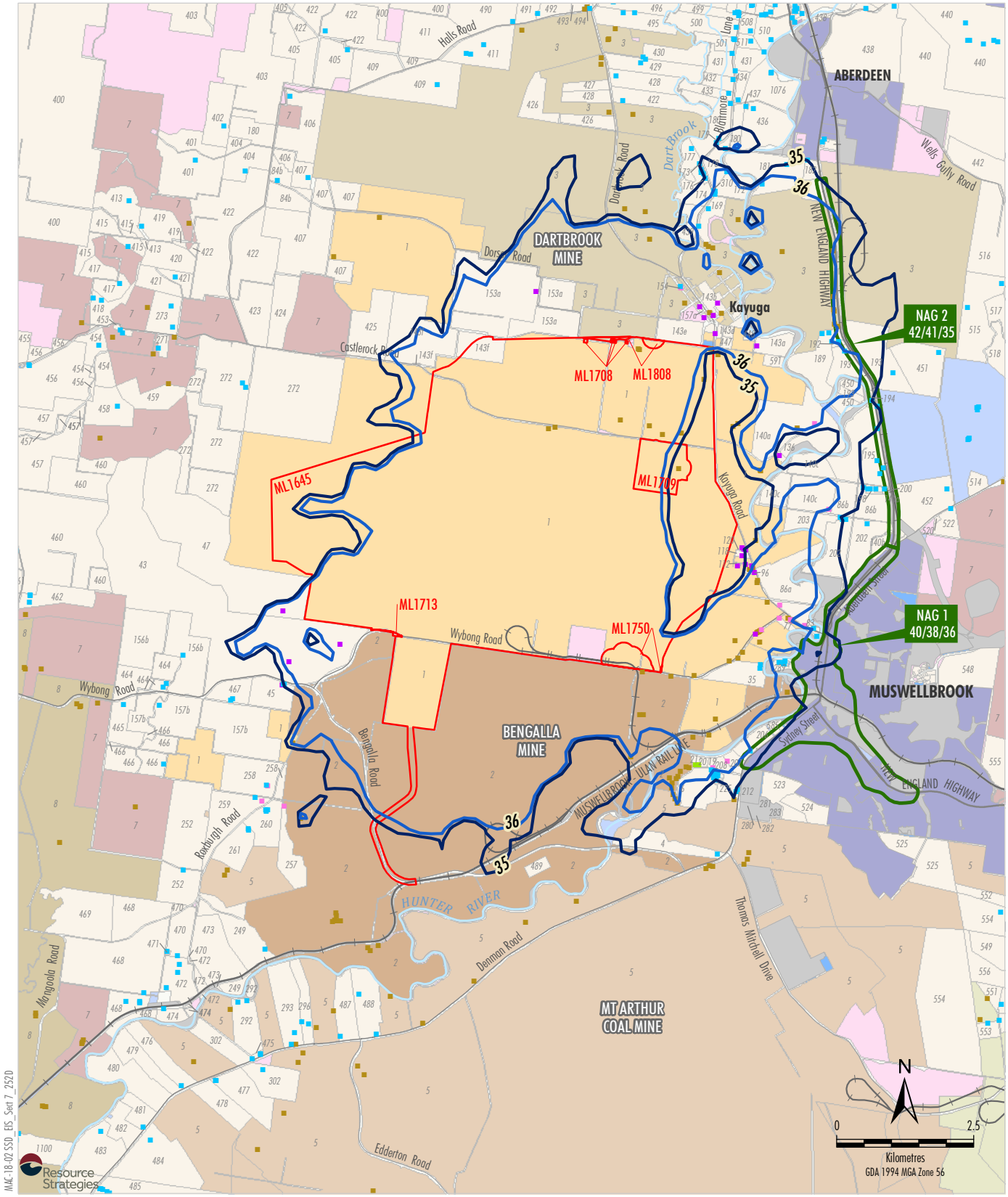
MOUNT PLEASANT OPTIMISATION PROJECT

Night Intrusive $L_{Aeq\ (15\ min)}$ Noise Contours 2034

Figure 7-7



LEGEND

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- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Other Mining/Resource-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1

Category of Rural Residence under DA92/97

- Mine-owned
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned
- Project Noise Assessment Group (NAG)
- 40/38/36 Default NAG Noise Criteria for Day/Evening/Night
- Noise Contour (35 dBA)
- Noise Contour (36 dBA)

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

Source: MACH (2020); NSW Spatial Services (2020); Wilkinson Murray (2020)

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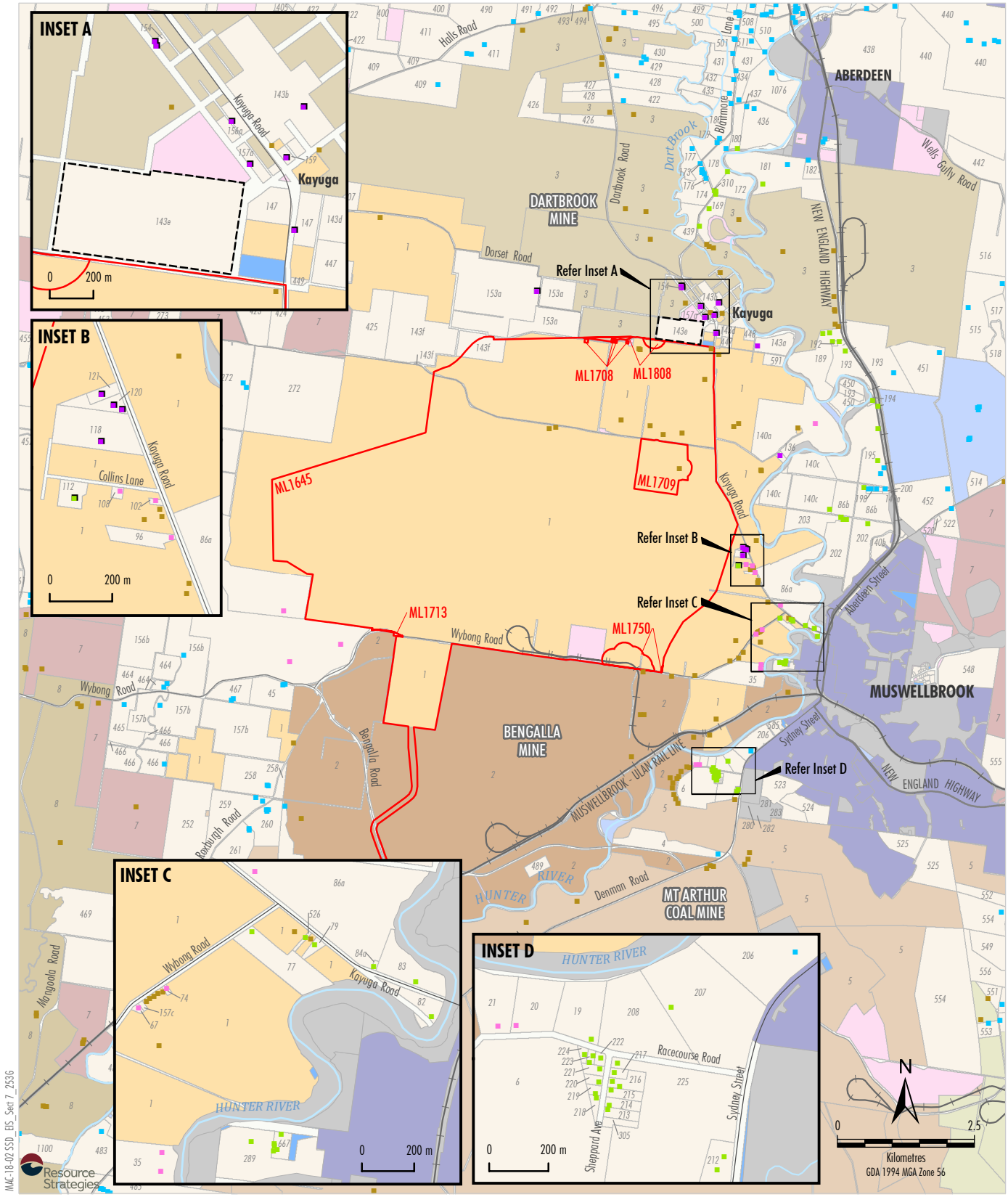
MOUNT PLEASANT OPTIMISATION PROJECT

Night Intrusive $L_{Aeq\ (15\ min)}$ Noise Contours 2041

Figure 7-8



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
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- Bengalla-controlled
- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Other Mining/Resource-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1
- Mine-owned Rural Residence

Predicted Project Noise Impacts

- Privately-owned Rural Residence with Significant Exceedance (>5 dBA above applicable criteria)
- Privately-owned Rural Residence with Moderate Exceedance (3-5 dBA above applicable criteria)
- Privately-owned Rural Residence with Negligible Exceedance (1-2 dBA above applicable criteria)
- Privately-owned Rural Residence with No Predicted Exceedance [1]

Predicted Project Air Quality Impacts

- Privately-owned Rural Residence with Air Quality Exceedance (Project-only 24 hour PM_{10} / Cumulative 24 hour $PM_{2.5}$)

Predicted Project Vacant Land Impacts

- Privately-owned Rural Property with Noise and Air Quality Exceedances

Source: MACH (2020); NSW Spatial Services (2020); TAS (2020); Wilkinson Murray (2020)

[1] All dwellings within NAG 1 are predicted to comply with applicable assessment criteria.

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MOUNT PLEASANT OPTIMISATION PROJECT

Project Noise and Air Quality Summary - Residences Predicted to Exceed Applicable Criteria

Figure 7-9

Table 7-5
Summary of Potential Operational Noise Exceedances at Privately-owned Receivers under Adverse Meteorological Conditions

Period	Noise Management Zone		Noise Affectation Zone
	Negligible Residual Impact	Moderate Residual Impact	Significant Residual Impact
	1 to 2 dBA above NPfI Criteria	3 to 5 dBA above NPfI Criteria	>5 dBA above NPfI Criteria
Daytime[1]	156a[4]	-	-
Evening[1]	147[4], 153a[4]	143b[4], 154[2], 154b, 157a[4], 159[4]	156a[4]
Night[1]	19[2], 77[2], 79[2], 82, 83, 84a[2], 86b, 112[4], 140c[2], 169, 171, 172, 172b, 172c, 180b, 181c, 189, 190, 191, 192, 193, 194, 195, 197, 202, 202b, 203[2], 203b, 203c, 207[2], 212, 212b, 213, 214, 215, 216, 216b, 217, 218, 219, 220, 221, 222, 223, 223b, 224, 225, 289, 310, 526[2], 547, 667a[6]	20[2,3], 21[2,3], 35, 35b, 43[5], 43b[5], 47[4], 67[4], 74[2], 86a[2], 96[4], 102[4], 108[4], 140a[2]	118[4], 120[4], 120c[4], 121[4], 136[4], 143a[4], 143b[4], 147[4], 153a[4], 154[2], 154b, 156a[4], 157a[4], 159[4]

Source: After Appendix A.

1 Daytime 7.00 am to 6.00 pm (Monday to Saturday) and 8.00 am to 6.00 pm (Sunday and public holidays), Evening 6.00 pm to 10.00 pm, Night 10.00 pm to 7.00 am (Monday to Saturday) and 10.00 pm to 8.00 am (Sundays and public holidays).

2 This receiver currently has the right to mitigation upon request in Development Consent DA 92/97 for potential noise impacts.

3 This receiver currently has the right to acquisition upon request in Development Consent DA 92/97 for potential air quality impacts. MACH is only required to acquire and/or install mitigation measures if acquisition and/or mitigation is not reasonably achievable under a separate approval for the Bengalla Mine.

4 This receiver currently has the right to acquisition upon request in Development Consent DA 92/97 for potential noise impacts.

5 This receiver currently has the right to acquisition upon request in Development Consent DA 92/97 for potential air quality and noise impacts.

6 Five structures were identified on one land parcel, and the structures could not be characterised by ground surveys. Based on aerial imagery, it appears only one structure may be a residence.

Table 7-6 illustrates that, for the majority of predicted negligible night-time noise exceedances, the criteria being applied is 1 to 3 dBA lower than the criteria applicable for the approved Mount Pleasant Operation. Eight receivers in the Blairmore Lane area north of Kayuga would have a negligible increase in predicted noise levels above current criteria.

When comparing the existing Mount Pleasant Operation operational night-time noise limits for the 670 modelled privately-owned residences to the limits that would apply should the Project be approved, Wilkinson Murray found (Appendix A):

- less than 5% of privately-owned residences modelled would have higher noise limits under the Project;
- more than 90% of modelled privately-owned residences would have Project noise limits equal to or less than the current Mount Pleasant Operation criteria; and
- for the bulk of receivers on the western outskirts of Muswellbrook, noise limits under the Project would be 1 to 3 dBA lower.

Assessment of Impacts on Privately-owned Land

Wilkinson Murray reviewed the relevant noise contours and land tenure information for the Project and concluded that one privately-owned property (property 143e) is predicted to experience exceedances of the relevant VLAMP noise criteria on greater than 25% of land on the property (Appendix A).

It is noted this land parcel currently has acquisition upon request rights for potential noise impacts in Development Consent DA 92/97 for the existing Mount Pleasant Operation.

Other Land Uses

Other (non-residential) land uses were assessed by Wilkinson Murray in accordance with the NPfI.

No exceedances of the relevant Project noise criteria were predicted at any applicable locations (e.g. churches, schools, commercial premises, etc.) (Appendix A).

Table 7-6
Comparison of Receivers with Predicted Negligible Night-time Exceedances to Current Development Consent DA 92/97 Criteria

Receivers with Predicted Negligible Exceedances where Predicted Project Noise Levels are				
Above Current Night-time Criteria	**Equal to Current Night-time Criteria**	**1 to 2 dBA Less than Current Night-time Criteria**	**3 dBA Less than Current Night-time Criteria**	**>3 dBA Less than Current Night-time Criteria**
169, 171, 172, 172b, 172c, 310, 180b and 181c	-	19[1], 189, 190, 191, 192, 193, 202, 202b, 207[1], 213, 214, 215, 216, 216b, 217, 218, 219, 220, 221, 222, 223, 223b, 224, 225 and 667a[2].	82, 83, 84a[1], 86b, 194, 195, 197, 203, 203b, 203c, 212, 212b, 289 and 547.	77[1], 79[1], 112[3], 140c[1] and 526[1]
Total: 8	Total: 0	Total: 25	Total: 14	Total: 5

1 This receiver currently has the right to mitigation upon request in Development Consent DA 92/97 for potential noise impacts.

2 Five structures were identified on one land parcel, and the structures could not be characterised by ground surveys. Based on aerial imagery, it appears only one structure may be a residence.

3 This receiver currently has the right to acquisition upon request in Development Consent DA 92/97 for potential noise impacts.

Cumulative Noise Emissions

Cumulative noise impacts resulting from the concurrent operation of the Project and the Bengalla Mine, Mt Arthur Coal Mine, Mangoola Mine and Dartbrook Mine were assessed against the NPfI recommended amenity criteria. The assessment considered the predicted noise levels from each of the other mining operations in the closest modelled years available to the Project scenarios, and accounted for the ceasing of operations in accordance with current approvals (Appendix A).

The methodology used for the cumulative assessment was to logarithmically add the respective night-time noise predictions during adverse meteorological conditions of each operation and compare the overall cumulative noise levels against the NPfI amenity criteria (Appendix A).

The assessment concluded that the majority of receivers with predicted exceedances of the recommended amenity criteria were as a result of other mining operations (i.e. the exceedance would occur without the presence of the Project). These receivers are located to the south-west of the Project, west of both the Bengalla Mine and Mt Arthur Coal Mine (Appendix A).

Some receivers were predicted to exceed the recommended amenity criteria due to the Project alone (receivers 143b, 147, 153a, 156a, 157a and 159). These receivers are predicted to exceed the Project noise criteria due to intrusive noise (Table 7-5), and are currently subject to acquisition upon request rights in Development Consent DA 92/97 for predicted noise impacts associated with the approved Mount Pleasant Operation (Appendix A).

A sensitivity analysis was also conducted that assumed operations at the Mt Arthur Coal Mine continue past the current approval period and is presented in Appendix A.

Sleep Disturbance

Wilkinson Murray has conducted an assessment of potential sleep disturbance impacts. A sleep disturbance criterion of L_{AFmax} 52 dBA has been adopted in accordance with the NPfI. The analysis indicated that all but one receiver (156a) would comply with the criterion. Receiver 156a is predicted to experience significant exceedances of the Project noise criteria due to intrusive noise, and is currently subject to acquisition upon request rights in Development Consent DA 92/97 for predicted noise impacts associated with the approved Mount Pleasant Operation (Appendix A).

Project night-time $L_{Aeq\ (15\ minute)}$ noise predictions were also reviewed against the 40 dBA maximum noise level event screening criterion. 14 receivers were predicted to experience exceedances of the 40 dBA maximum noise level event criterion (receivers 118, 120, 120c, 121, 136, 143a, 143b, 147, 153a, 154, 154b, 156a, 157a and 159) (Appendix A).

These receivers are all predicted to experience significant exceedances of the Project noise criteria due to intrusive noise. The receivers are also currently subject to acquisition upon request rights in Development Consent DA 92/97 for predicted noise impacts associated with the approved Mount Pleasant Operation, with the exception of receiver 154/154b (which is currently subject to mitigation upon request rights) (Appendix A).

Construction Noise

As the Mount Pleasant Operation is an existing operational coal mine, any construction and development activities would occur in conjunction with existing mining activities.

Wilkinson Murray identified that construction of the CHPP Stage 2a and 2b upgrades would largely be indistinguishable from operational mining and coal preparation activities given similar plant would be deployed and construction activities would occur in the same areas as operational activities. As such, construction of the CHPP Stage 2a upgrade was included in the 2026 operational modelling scenario (Appendix A).

The CHPP Stage 2b upgrade would occur in a period not covered by the Project's modelled scenarios (approximately 2032 to 2033). However, it is not anticipated that the noise during construction of the CHPP Stage 2b upgrade would be greater than that predicted for 2034, which includes the peak ROM coal production rate (Appendix A).

Noise associated with the progressive raises of the Fines Emplacement Area are also likely to be indistinguishable from operational mining noise. Construction fleet associated with development of the raises have therefore been included in the operational scenarios modelled where relevant (i.e. 2026, 2031 and 2041).

While development of additional major water storage dams for the Project (MWD2 and MWD3) would also likely be indistinguishable from operational noise to relevant receivers, these activities are not anticipated to occur in the modelled Project scenarios. As for the CHPP Stage 2b upgrade, it is expected that noise levels during such activities would not be greater than the noise levels predicted in the closest modelled Project scenario.

Development of the approved Northern Link Road with a revised alignment would provisionally occur in 2025. Noise associated with development of the Northern Link Road may be distinct from operational mining activities, as perceived by proximal receivers. However, development of the Northern Link Road has not been explicitly modelled, as (Appendix A):

- The closest privately-owned residential receivers that do not currently have acquisition upon request rights in Development Consent DA 92/97 would be at a distance of approximately 4 km from the works, where construction noise is likely to be inaudible.
- The revised alignment would not be significantly closer to privately-owned receivers.
- There would be no material change to the overall construction fleet that would be used for the Project, in comparison to the fleet that would be used if the Northern Link Road were to be developed as part of the approved Mount Pleasant Operation.
- Construction works would be conducted in accordance with the noise limits set for the Mount Pleasant Operation.

7.3.3 Mitigation Measures

Noise management measures for the Mount Pleasant Operation are described in the Noise Management Plan (Section 7.3.1) and would continue to be implemented for the Project.

These include the following planning controls (MACH, 2019c):

- sound power testing of new operational mobile fleet, and sampling of mobile equipment and fixed plant annually to check noise performance;
- procurement of new and/or best available technology plant where reasonable and feasible to do so (including acoustic design of fixed plant, such as cladding);
- periodically refining the Mount Pleasant Operation noise model by using noise monitoring data to assist with model calibration over the life of the mine;
- predictive meteorological and noise level forecasting to guide daily operations; and
- developing awareness and understanding of potential noise issues through site inductions for staff and contractors (Plate 7-6).

Plate 7-6 Contractor Induction at the Mount Pleasant Operation

Proactive and reactive construction and operational noise management measures and controls currently implemented at the Mount Pleasant Operation would also continue for the Project where it is reasonable and feasible to do so, including (MACH, 2019c):

- operating mobile equipment in less exposed areas during the more sensitive evening/night-time period;
- limiting vegetation clearance to daytime hours;
- using 'quackers' in place of reverse beepers on mobile equipment;
- provision of noise suppression on major operational mobile equipment;
- considering temporary cessation of work within an area, or of a particularly noisy piece of equipment, when adverse meteorological conditions are present;
- maintaining all plant and machinery regularly to minimise noise generation; and
- operating all plant and machinery used on-site in a proper and efficient manner (e.g. at correct speed) to minimise noise generation.

The Noise Management Plan would be reviewed and updated to address the Project, subject to the conditions of any Development Consent for the Project.

Other key Project noise mitigation measures include (Section 7.3.2):

- staging the increases in ROM coal extraction from 10.5 Mtpa to 15.75 Mtpa and then 21 Mtpa, as mining progresses west and the integrated eastern waste rock landform provides additional shielding;
- design of the integrated eastern waste rock landform to provide further shielding of operations to receivers in and around the township of Muswellbrook and village of Aberdeen, including advance development of a bund on the boundary of North Pit that would subsequently be incorporated with the integrated emplacement; and
- a rail noise barrier within the Mount Pleasant Operation MLs, to reduce operational noise levels experienced at receivers to the south of the Mount Pleasant Operation.

A wide range of alternative reasonable and feasible noise mitigation measures would be available to MACH to achieve compliance with the noise levels predicted for the Project. Selection of the most reasonable and feasible options would be undertaken by MACH at the relevant time based on currently available technologies and operational priorities.

Noise Management and Affectation Zones

The privately-owned receivers where noise emissions are predicted to exceed the Project noise criteria can be divided into a Noise Management Zone and a Noise Affectation Zone (Table 7-5).

Proposed management procedures for receivers in these zones, in addition to the mitigation and management measures described below, include:

- response to any community issues of concern or complaints, including discussions with relevant landowners;
- refinement of on-site noise mitigation measures and mine operating procedures;
- implementation of feasible and reasonable acoustic mitigation at relevant receivers (i.e. receivers with moderate and significant residual impact) upon request, in accordance with the VLAMP and any Development Consent for the Project; and
- entering into agreements with landowners (including acquisition for receivers identified to be in the Noise Affectation Zone, in accordance with any Development Consent for the Project).

Noise Management Plan

The Noise Management Plan would, as relevant, be revised for the Project to include the following (subject to any Development Consent conditions for the Project):

- The additional reasonable and feasible noise mitigation and operational management measures that would be adopted for the Project (Section 7.3.2).
- Updated locations for continuous operational noise monitoring to assist with noise management and operator attended compliance monitoring as mining progresses.

- Details of triggers for the Project real-time monitoring and management system. This would include trigger-based protocols incorporating review of prevailing meteorological conditions, identification of on-site noise levels and operational adjustments (including shutdowns), where necessary, to achieve the relevant Project Development Consent noise criteria.
- Details of any required revisions to the predictive meteorological forecasting system used as part of proactive noise management in conjunction with real-time monitoring.

7.3.4 Adaptive Management

When the real-time noise monitoring system indicates noise trigger levels are reached or exceeded, a message would be delivered to a MACH representative, alerting them to the elevated noise levels. The Project meteorological monitoring stations would allow personnel to evaluate the likely origin of the elevated noise levels (i.e. on-site or off-site sources) in conjunction with listening to the recorded audio files. Appropriate mitigation and response measures would then be implemented in accordance with the response protocol detailed in the Noise Management Plan.

Trigger levels and response procedures outlined in the Noise Management Plan would be updated for the Project (subject to any Development Consent conditions for the Project) (Section 7.3.3).

7.4 RAIL TRANSPORT NOISE

A Noise and Blasting Assessment for the Project was undertaken by Wilkinson Murray (2020) and is provided in Appendix A.

The rail transport noise assessment was conducted in accordance with the NSW *Rail Infrastructure Noise Guideline* (RING) (EPA, 2013). Consideration was also given to the VLAMP (NSW Government, 2018b).

A description of the existing rail transport noise management regime is provided in Section 7.4.1. Section 7.4.2 describes the potential rail transport noise impacts of the Project and Section 7.4.3 outlines mitigation measures and management for the Project.

7.4.1 Existing Environment

In accordance with Condition 7, Schedule 3 of Development Consent DA 92/97, MACH requires the provision of product train locomotives and rolling stock that are approved to operate on the NSW rail network in accordance with the noise limits in Sydney Trains' EPL 12208 and ARTC's EPL 3142.

As described in the Noise Management Plan, the Stage 2 rail spur has been designed in consideration of the potential for wheel and brake squeal.

The current design of the approved Stage 2 rail spur incorporates a 1.5 m rail noise barrier along a significant portion of the southern side of the rail spur near the Muswellbrook–Ulan Rail Line, which would reduce noise levels experienced at the most proximal privately-owned receivers.

7.4.2 Potential Impacts

Project Train Movements

The increase in transport of product coal from approximately 8.5 Mtpa to up to 17 Mtpa would require a corresponding increase in the currently approved annual average daily train movements.

The annual average daily train movements would increase from the currently approved three laden trains leaving the site per day to an average of 6.5 laden trains leaving the site per day at peak coal production. However, the maximum daily number of trains would increase only marginally, from the currently approved nine laden trains leaving the site per day to 10 laden trains per day (Section 3.8).

Rail Noise Assessment Criteria

The EPA's RING assessment trigger levels for additional rail traffic on an existing rail network (i.e. the Muswellbrook–Ulan Rail Line and Main Northern Railway) are presented in Table 7-7. It is noted these trigger levels are generally consistent with ARTC's EPL 3142 in regard to noise level goals for rail noise emissions.

Table 7-7
Network Rail Line Rail Infrastructure Noise Guideline Rail Noise Assessment Trigger Levels

Descriptor	Rail Noise Assessment Trigger Levels
Daytime/evening [$L_{Aeq(15\ hour)}$]	65 dBA
Night-time [$L_{Aeq(9\ hour)}$]	60 dBA
Maximum pass-by [$L_{Amax(95th\ percentile)}$]	85 dBA

Source: After Appendix A.

Appendix 3 of the RING deals with non-network rail lines on or exclusively servicing industrial sites. Where a non-network line extends beyond the boundary of the industrial premises, noise from that section of the track should be assessed against the recommended acceptable L_{Aeq} noise level from industrial sources for the relevant receiver type (Appendix A). The criteria for noise impacts associated with the Stage 2 rail spur between the Mount Pleasant Operation MLs and the Muswellbrook–Ulan Rail Line adopted for the assessment are lower (i.e. more stringent), as provided in Table 7-8.

Table 7-8
Non-network Rail Line Noise Assessment Criteria Adopted

Type of Receiver	Time of Day	Acceptable L_{Aeq} Noise Level
Rural residence	Day	50 dBA
	Evening	45 dBA
	Night	40 dBA

Source: After Appendix A.

The section of the Stage 2 rail spur within the Mount Pleasant Operation MLs and the Stage 2 rail loop were assessed cumulatively as part of on-site operational noise in accordance with the requirements of the NPfI (Section 7.3).

Predicted Rail Transport Noise Emissions

The rail noise assessment considered the potential rail noise emissions of the Mount Pleasant Operation non-network rail line (i.e. the Stage 2 rail spur) and portions of the Muswellbrook–Ulan Rail Line and Main Northern Railway (Appendix A).

Non-network Rail Line

The rail noise assessment of the Project non-network rail line identified two proximal privately-owned receivers (receivers 20 and 21) that are predicted to experience 'negligible' exceedances of the relevant RING criteria (EPA, 2013) (Table 7-8).

It is noted both receivers are predicted to experience 'moderate' exceedances of the Project intrusive noise criteria due to Project operational noise, and would therefore be afforded mitigation upon request rights for the Project (Section 7.3).

Network Rail Lines

Wilkinson Murray (2020) assessed cumulative train movements on the Muswellbrook–Ulan Rail Line and Main Northern Railway, including trains from the Project, other mining operations, agricultural freight and passenger trains (Appendix A).

The relative increase in rail noise levels was predicted to be up to 1.9 dB at night on the Muswellbrook–Ulan Rail Line and up to 0.7 dB at night on the Main Northern Railway. These levels are below the 2 dBA threshold described in the RING (Appendix A).

Wilkinson Murray (2020) calculated the offset distances required to meet the relevant rail noise criteria on both the Muswellbrook–Ulan Rail Line and Main Northern Railway (Muswellbrook junction to Antiene rail spur) (Appendix A). However, Wilkinson Murray (2020) notes the assessment is largely academic in nature, as the existing approved and proposed rail movements, as assessed in a recent rail noise assessment for the Maxwell Project (Wilkinson Murray, 2019), are approximately 50% more than the total rail movements (including the Project peak rail movements) estimated for 2034. This is because, based on current mine approvals, a number of coal mining operations in the region are likely to cease operation, prior to 2034.

Thus, rail noise levels that would be experienced by receivers proximal to the Muswellbrook–Ulan Rail Line and Main Northern Railway when the Project would reach its peak product coal transport rate would be expected to fall materially, relative to current rail noise levels (Appendix A).

7.4.3 Mitigation Measures

Rail transport noise management measures for the existing Mount Pleasant Operation are described in the Noise Management Plan (Section 7.4.1). This plan would be reviewed and updated to address the Project, subject to the conditions of any Development Consent for the Project.

MACH would continue to require the provision of product train locomotives and rolling stock (Plate 7-7) that are approved to operate on the NSW rail network in accordance with the noise limits in Sydney Trains' EPL 12208 and ARTC's EPL 3142.

Plate 7-7 Coal Train at the Mount Pleasant Operation

7.5 ROAD TRANSPORT NOISE

A Noise and Blasting Assessment for the Project was undertaken by Wilkinson Murray (2020) and is provided in Appendix A.

The road transport noise assessment was conducted in accordance with the NSW *Road Noise Policy* (RNP) (DECCW, 2011).

Sections 7.5.1 and 7.5.2 describe the existing road transport noise management regime and potential road transport noise impacts of the Project. Section 7.5.3 outlines mitigation measures and management for the Project and Section 7.5.4 describes adaptive management.

7.5.1 Existing Environment

Road transport at the Mount Pleasant Operation is managed in accordance with the existing Site Access Management Plan.

The Site Access Management Plan describes general road transport noise management and mitigation measures including compliance with speed limits and coordinating shift changes with the Bengalla Mine and Mangoola Coal to minimise cumulative traffic impacts.

7.5.2 Potential Impacts

Key Roads

The road transport noise assessment focuses on Wybong Road and Kayuga Road, as these are the roads most likely to be affected by noise generated by Project road transport movements (Appendix A).

The Project's relative contribution to total traffic would decrease rapidly on other roads, and Project road transport noise impacts on other roads are expected to be negligible (Appendix A).

Road Transport Noise Criteria

The RNP establishes criteria for the assessment of road transport noise in NSW (Appendix A). The total road transport noise criteria for residences are provided in Table 7-9.

Where exceedances of the road transport noise assessment criteria are predicted due to traffic-generating developments, the RNP states that an increase of up to 2 dB is considered to be barely perceptible (DECCW, 2011).

Table 7-9
Road Noise Policy Criteria for Residential Land Uses

Road Category	Roads	Type of Project and Land Use	Total Road Transport Noise Criteria ($L_{Aeq, 1 hr}$)	
			Day (7.00 am – 10.00 pm)	Night (10.00 pm – 7.00 am)
Local	Wybong Road Kayuga Road	Land use developments generating additional traffic on existing local roads	55 dBA	50 dBA

Source: After Appendix A.

Predicted Road Transport Noise Emissions

The methodology for the assessment of road noise was to:

- calculate existing road transport noise levels;
- calculate road transport noise levels in 2026 and 2036 corresponding to forecast Project and cumulative traffic movements; and
- compare these noise levels with the relevant RNP criteria.

The estimated Project and total peak hour traffic volumes used in the road transport noise assessment were determined by TTPP (2020) as part of the Road Transport Assessment (Appendix J).

The assessment years (i.e. 2026 and 2036) were selected as they correspond to the anticipated peak period for Project construction, and representative of longer-term average operational workforce, respectively (Appendix J).

The road transport noise assessment identified 19 receivers along Wybong Road and Kayuga Road (Plate 7-8) with predicted exceedances of the relevant road noise criteria during the assessed Project scenarios. However, 14 of those receivers are also predicted to exceed the relevant criteria in the absence of the Project (Appendix A).

The other five receivers (i.e. 43, 121, 156a, 159 and 526) are predicted to experience exceedances of the relevant criteria by up to 2 dB, due to incremental additional road transport movements associated with the Project (Appendix A). In accordance with the RNP, increases in road transport noise of this magnitude represent a minor impact (Appendix A).

It is noted receivers 121, 156a and 159 are predicted to experience 'significant' exceedances of the Project intrusive noise criteria due to Project operational noise, and would therefore be afforded acquisition upon request rights for the Project (Section 7.3). Receiver 43 is predicted to experience moderate exceedances of the Project intrusive noise criteria due to operational noise and would therefore be afforded mitigation upon request rights for the Project (Section 7.3).

7.5.3 Mitigation Measures

The existing Mount Pleasant Operation Site Access Management Plan (Section 7.5.1) would be reviewed and updated subject to the conditions of any Project Development Consent.

Consistent with the VLAMP, mitigation of road transport noise on the public road network is considered in the context of reducing noise from the source, rather than consideration of noise treatment at any affected receivers.

Project staff and contractors would be made aware of the potential for road transport noise impacts at proximal private residences through site-specific inductions and staff education programs to reinforce quiet driving.

7.5.4 Adaptive Management

The existing Site Access Management Plan for the Mount Pleasant Operation provides guidance for all vehicles accessing the site and would also be updated to apply to Project-generated traffic. The Site Access Management Plan would continue to be reviewed and updated as required over the life of the Project.

Plate 7-8 Kayuga Road

7.6 BLASTING

A Noise and Blasting Assessment for the Project was undertaken by Wilkinson Murray (2020) and is provided in Appendix A.

The blasting assessment was conducted in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* prepared by the Australian and New Zealand Environment Council (ANZEC) (1990).

A description of the existing blasting environment, compliance, complaints and blasting assessment criteria is provided in Section 7.6.1. Section 7.6.2 describes the potential blasting impacts of the Project and Section 7.6.3 outlines mitigation measures for the Project.

7.6.1 Existing Environment

Blast Management and Monitoring Regime

Blasting at the Mount Pleasant Operation is carried out at a maximum of one blast per day and five blasts per week averaged over a calendar year. Blasting is carried out between 9.00 am and 5.00 pm Monday to Saturday, inclusive.

Blast management at the Mount Pleasant Operation is undertaken in accordance with the Blast Management Plan (MACH, 2020c). The Blast Management Plan describes the blast monitoring regime and general blast management measures. It also describes the process for notifying landowners of upcoming blast events and reporting and complaint management procedures.

Blast management measures used at the Mount Pleasant Operation include (MACH, 2020c):

- conducting pre-blast assessments;
- public notification of upcoming blasts;
- where possible, coordinating the time of blasts with the timing of blasts at the Bengalla Mine, Mt Arthur Coal Mine, Dartbrook Mine, Mangoola Coal and Muswellbrook Coal Mine, to minimise the potential for cumulative blasting impacts;
- training all relevant personnel on blast-related obligations and explosives management;
- use of appropriate initiation and detonation systems and adherence to blast loading and initiation designs;
- use of adequate burden, stemming lengths and stemming material to confine explosives;

- designing all blasts to comply with airblast overpressure and ground vibration limits;
- monitoring of blasts at all prescribed locations;
- implementation of procedures to mitigate fumes for all blast events;
- calibration of site-specific blast models over time, using monitored data from previous blasting, to enable refinement and assessment for future blast events;
- development of a blast records system which captures sufficient information to allow appropriate characterisation and comparison of blasts and meteorological conditions;
- periodic review of blasting procedures to evaluate performance; and
- evaluation of new technology and alternative blasting methodologies.

In addition, Wybong Road, Kayuga Road and Castlerock Road are temporarily closed when blasting is carried out within 500 m of the road, in accordance with the Blast Management Plan. Temporary road closures are typically for a period of less than 20 minutes and no more than one closure per day. MSC is notified of the intention to blast, and the date and time of the planned road closure, in the week prior to blasting.

The Blast Management Plan also includes a Blast Fume Management Strategy to minimise the occurrence of blast fumes associated with blasting (Section 7.7.5).

Compliance and Complaints

From review of blast monitoring data between November 2017 and February 2020 (i.e. the most recent Independent Audit period), there were no exceedances of blast criteria during this period (SLR, 2020). As described in the Mount Pleasant Operation monthly environmental monitoring reports, there were also no exceedances of blasting criteria between March and August 2020.

In June 2020, a blast was fired in the late afternoon (approximately 4:40 pm) that resulted in a visible plume being emitted after the blast. Notification was made to both the EPA and DPIE of the event. Three complaints were received regarding the blast's visible plume. A blast investigation was conducted and as a result the mining contractor has amended pre-blast procedures to reduce the potential for a similar event to occur in future.

In the period 2018 to September 2020, a total of 64 complaints relating to blasting were received, including 12 in 2018, 43 in 2019 and nine in the period January to September 2020.

In October 2019, the Mount Pleasant Operation began to record more detail in relation to the location of complaints received. Of the 23 locations of complaints recorded between October 2019 and September 2020, 15 were located in the Sheppard Avenue/Racecourse Road area. MACH subsequently installed a temporary blast monitor in the area. No exceedances of relevant blast criteria were recorded in the Sheppard Avenue/Racecourse Road area while the monitor was installed. MACH intends to continue to relocate the mobile blast monitor to assist with the investigation of complaints.

MACH manages complaints in accordance with the Blast Management Plan. All complaints were investigated and follow-up contact was made with complainants where required.

Blast Measurement and Description

Overpressure (or airblast) is reported in linear decibels (dBL) and is the measurable effect of a blast on air pressure, including generated energy that is below the limit of human hearing. Ground vibration is the measurable movement of the ground surface caused by a blast and is measured in mm/s as vibration velocity.

Blasting Assessment Criteria

The ANZEC (1990) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* has been adopted by the EPA for assessing potential annoyance of privately-owned receivers from blast emissions during daytime hours, as listed below:

- The recommended maximum level for airblast is 115 dBL.
- Exceedances above the level of 115 dBL should be limited to no more than 5% of the total number of blasts in a 12-month period. The level should not exceed 120 dBL at any time.
- The recommended maximum level for ground vibration is 5 mm/s vibration velocity.
- Exceedances above the level of 5 mm/s should be limited to no more than 5% of the total number of blasts in a 12-month period. The level should not exceed 10 mm/s at any time.

For assessment of structural damage due to airblast overpressure, Australian Standard 2187.2-2006 *Explosives – Storage, Transport and Use – Part 2 Use of Explosives* (AS 2187.2) recommends a maximum airblast level of 133 dBL (Appendix A).

In accordance with AS 2187.2, Wilkinson Murray adopted a criterion of 10 mm/s as the conservatively low building damage vibration criterion, and a criterion of 50 mm/s for public infrastructure (Appendix A).

Based on studies completed by Casaday and Lehmann (1967) and Heggies Australia Pty Ltd (Heggies) (2006) into the effects of airblast overpressure and vibration on livestock animals, respectively, the following criteria were adopted for livestock:

- 125 dBL for airblast overpressure (Casaday and Lehmann, 1967).
- 200 mm/s for ground vibration (Heggies, 2006).

There are no criteria relating to the potential for structural and cosmetic damage to historic heritage sites from blasting vibration and airblast overpressure. However, vibration criterion of 10 mm/s and airblast overpressure criterion of 130 dBL were adopted for historic heritage sites in the blasting assessment (Appendix A).

Known Aboriginal cultural heritage sites at the Mount Pleasant Operation are not considered susceptible to impacts from blasting (as these sites do not have an inherent structural component) (MACH, 2019h).

There are also no significant natural features (e.g. cliff faces or caves) that would be susceptible to impacts from blasting at the Mount Pleasant Operation and, therefore, no blast predictions have been made for natural features or Aboriginal heritage sites.

7.6.2 Potential Impacts

The Noise and Blasting Assessment (Appendix A) includes an assessment of the potential impacts of on-site blasting for the Project. The potential impacts are described below and in Appendix A.

The removal of overburden (and interburden) material for the Project would be undertaken using a drill and blasting program. A mixture of ANFO (dry holes) and emulsion blends (wet holes) explosives would continue to be used for the Project. Blast sizes would range up to a Maximum Instantaneous Charge (MIC) of approximately 1,600 kilograms (kg).

Blast designs and sizes would vary over the life of the Project and would depend on numerous factors including the depth of coal seams and the design of open cut benches (Plate 7-9).

Consistent with the approved Mount Pleasant Operation, blasting for the Project would only occur between 9.00 am and 5.00 pm Monday to Saturday, inclusive. The number of blasts on-site for the Project would increase to up to two blasts per day and up to eight blasts per week averaged over any calendar year (unless additional blasts are required following misfires or for mine safety).

Project Blasting Assessment

In the absence of blast management measures, results indicate that with the proposed maximum blast MIC of 1,600 kg, there would be a range of potential exceedances of both overpressure and/or vibration criteria at nearby features, including privately-owned residences (Appendix A).

To meet the relevant blasting criteria, the proposed maximum MIC would be reduced for the Project when blasting within:

- 2,260 m of private receivers;
- 330 m of public infrastructure; and
- 1,010 m of historic heritage sites.

The blasting assessment indicates there would be no exceedances of relevant airblast or vibration criteria for livestock described above.

Plate 7-9 Blast Pattern – Mount Pleasant Operation

Flyrock

Flyrock is any rock material ejected from the blast site by the force of the blast. Flyrock has the potential to damage buildings and infrastructure and poses a risk to public safety. Flyrock is managed by appropriate blast design and execution in accordance with the Blast Management Plan.

7.6.3 Mitigation Measures

Blast management measures for the Mount Pleasant Operation are described in the Blast Management Plan (Section 7.6.1) and would continue to be implemented for the Project. This plan would be reviewed and updated to address the Project (e.g. updates with respect to any proximal infrastructure to the Project disturbance footprint), subject to the conditions of any Development Consent for the Project.

The maximum blast MIC would be up to approximately 1,600 kg. An example blast pattern in the Mount Pleasant Operation open cut is shown in Plate 7-9. Consistent with existing management measures, MACH would continue to vary the MIC (or other relevant blasting parameters) of blasts over the life of the Project according to the location of the blast and the proximity of nearby sensitive receivers, to minimise blasting effects at nearby privately-owned receivers. In addition, the MIC would be adjusted as required for blasts located in close proximity to other sensitive features (e.g. infrastructure) to maintain compliance with relevant vibration or airblast criteria.

MACH would monitor blasts occurring within 350 m of public infrastructure (including the Ausgrid 66 kV electricity transmission line located directly east of the Project) to ensure compliance is maintained.

Prior to blasting within 1,010 m of a historic heritage site, MACH would manage the site in accordance with the Historic Heritage Management Plan (e.g. archival recording) or lower the blast MIC as required.

If any Aboriginal cultural heritage sites are identified during the life of the Mount Pleasant Operation that are considered susceptible to impacts from blasting (e.g. grinding grooves), a monitoring program would be developed, implemented and included in a subsequent revision of the AHMP.

Wybong Road, Kayuga Road and Castlerock Road would continue to be temporarily closed during blasts within 500 m of the road. Dorset Road/Northern Link Road would also be temporarily closed during Project blasts within 500 m.

7.7 AIR QUALITY

An Air Quality Assessment has been prepared by TAS (2020) and is presented in Appendix B.

The Air Quality Assessment (Appendix B) has been guided by the requirements of the SEARs for the Project, including recommendations from the EPA and MSC.

The Air Quality Assessment (Appendix B) was peer reviewed by Katestone Environmental Pty Ltd. The peer review report is presented in Attachment 5.

Section 7.7.1 outlines the methodology for the Air Quality Assessment. A description of the air quality assessment criteria and existing environment in the vicinity of the Project is provided in Sections 7.7.2 and 7.7.3, respectively. Section 7.7.4 describes the potential air quality impacts of the Project, including cumulative impacts, while Sections 7.7.5 and 7.7.6 outline mitigation and adaptive management measures for the Project, respectively.

This section describes potential impacts of predicted emissions to air from the Project as assessed against criteria set to protect human health and amenity in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2017b) (the Approved Methods). The predicted emissions have also been assessed against the relevant criteria in the VLAMP.

7.7.1 Methodology

The assessment focuses on potential impacts associated with particulate matter generated by mining activities. Emissions of other pollutants, such as carbon monoxide, nitrogen dioxide and sulfur dioxide, also arise due to fuel combustion in mobile mining equipment. However, emissions of pollutants associated with fuel combustion are typically of such a low magnitude, and spread over such a large spatial extent, that ground-level concentrations are very low (Appendix B).

Potential emissions associated with blasting fumes have been considered in Section 7.7.4 and Project greenhouse gas emissions are described in Section 7.21 and Appendix S.

7.7.2 Applicable Criteria

Concentrations of Suspended Particulate Matter

Exposure to suspended particulate matter can result in adverse health impacts. The likely risk of these impacts to a person depends on a range of factors including the size, chemical composition and concentration of the particulate matter, and the existing health of the person (NSW Health and NSW Minerals Council, 2017).

Project mining activities have the potential to generate particulate matter (e.g. dust) emissions in the form of:

- total suspended particulate matter (TSP);
- particulate matter with an equivalent aerodynamic diameter of 10 micrometres (µm) or less (PM_{10}) (a subset of TSP); and
- particulate matter with an equivalent aerodynamic diameter of 2.5 µm or less ($PM_{2.5}$) (a subset of TSP and PM_{10}).

Relevant health-based air quality impact assessment criteria (i.e. criteria set at levels to reduce the risk of adverse health effects) for TSP, PM_{10} and $PM_{2.5}$, as specified by the EPA in the Approved Methods are provided in Table 7-10.

The air quality acquisition criteria specified in the VLAMP are also provided in Table 7-10, which are consistent with the current air quality criteria for the Mount Pleasant Operation in Development Consent DA 92/97.

Potential risks to human health are considered further in the Human Health Assessment (EnRiskS, 2020) (Appendix R), and are summarised in Section 7.20.

Dust Deposition

Particulate matter has the potential to cause nuisance (amenity) effects when it is deposited on surfaces.

The amenity criteria for the maximum increase in dust deposition and maximum total dust deposition, as specified by the EPA in the Approved Methods, consistent with the criteria in Development Consent DA 92/97 and the VLAMP, are provided in Table 7-11.

Environment Protection Licence 20850

Air quality criteria and other air quality related conditions stipulated in EPL 20850 are generally consistent with those described in Development Consent DA 92/97.

However, EPL 20850 also includes additional conditions (Conditions O3.4 to O3.9) requiring the majority of dust-generating activity at the Mount Pleasant Operation to be ceased under a specific combination of adverse weather conditions and measured PM_{10} levels at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network (UHAQMN) monitor.

Table 7-10
Criteria for Particulate Matter Concentrations

Pollutant	Averaging Period	Impact Assessment Criteria (µg/m³)[a]	Acquisition Criteria (µg/m³)[b]
TSP	Annual mean	90[c]	90[c]
PM_{10}	24-hour maximum	50[c]	50[d]
	Annual mean	25[c]	25[c]
$PM_{2.5}$	24-hour maximum	25[c]	25[d]
	Annual mean	8[c]	8[c]

Source: After Appendix B.

µg/m³ = micrograms per cubic metre.

[a] Approved Methods impact assessment criteria (EPA, 2017b).

[b] VLAMP acquisition criteria (NSW Government, 2018b).

[c] Criterion is cumulative (i.e. includes background concentrations and all other sources).

[d] Criterion is Project-only (with up to 5 allowable exceedances over the life of the development).

Table 7-11
Criteria for Dust Deposition (Insoluble Solids)

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual mean	2 g/m²/month	4 g/m²/month

Source: After Appendix B.
g/m²/month = grams per square metre per month.

These conditions represent a unique operational constraint on the Mount Pleasant Operation. MACH is not aware of any other coal mine in NSW with similar EPL operating conditions. Conditions O3.4 to O3.9 of EPL 20850 have therefore also been considered when developing the air quality monitoring programme and air quality management strategy for the Project.

7.7.3 Existing Environment

Air Quality Monitoring Programme and Air Quality Management

The existing Mount Pleasant Operation operates in accordance with an approved Air Quality and Greenhouse Gas Management Plan. The Plan describes the air quality monitoring programme and air quality management strategies for the approved mine.

Locations of current Mount Pleasant Operation air quality monitoring locations are shown on Figure 7-10. The monitoring programme consists of a combination of dust deposition gauges, HVAS and continuous real-time Palas Fidas monitors. Tapered Element Oscillating Microbalance (TEOM) monitors and Beta Attenuation Monitors have also been used on occasion to temporarily supplement the monitoring network. As TEOMs and Beta Attenuation Monitors have generally been used to temporarily replace Palas Fidas monitors, they are not shown on Figure 7-10.

While all air quality monitoring is used for demonstrating compliance with air quality impact assessment criteria, continuous real-time monitoring is also used as an air quality management tool to assist MACH with implementing proactive and reactive dust management actions to minimise potential air quality impacts from the existing Mount Pleasant Operation.

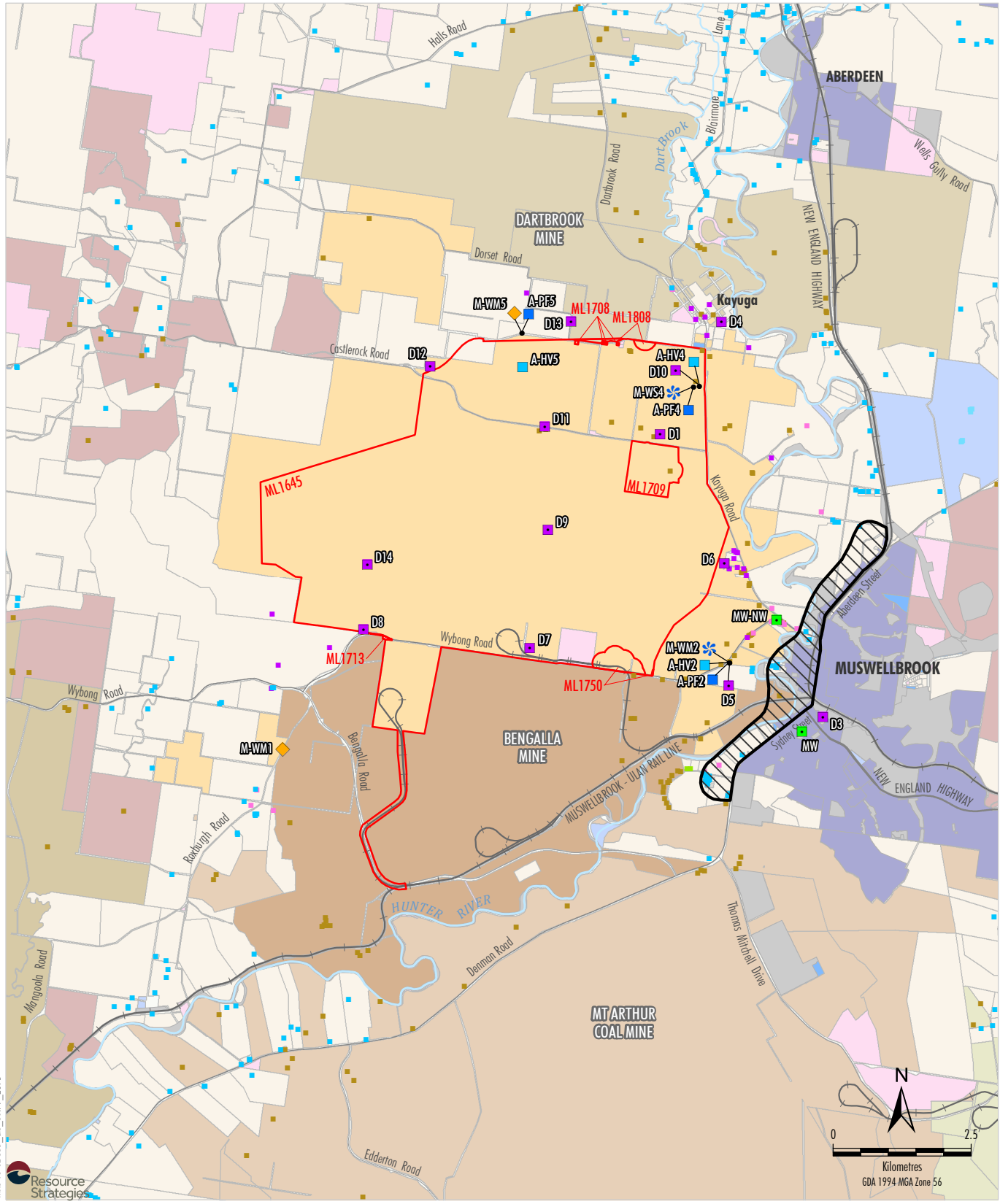
The air quality management strategy for the Mount Pleasant Operation, as described in the Air Quality and Greenhouse Gas Management Plan, includes:

- implementation of general dust mitigation measures (e.g. haul road watering) as part of operations to minimise potential dust emissions;
- predictive meteorological and air quality forecasting to guide daily operations;
- real-time air quality management (Plate 7-10) including the implementation of additional proactive and reactive dust mitigation measures to avoid potential non-compliances;
- implementation of preventative measures to reduce the potential for spontaneous combustion events (e.g. effective coal stockpile management); and
- implementation of preventative measures to reduce the potential for blast fumes.

MACH is currently investigating innovative methods to manage dust generation at the Mount Pleasant Operation with the University of Newcastle. This has included trials of LiDAR surveillance of site dust emissions, and the use of polymer dust suppressants on exposed areas.

The existing methods as well as reasonable and feasible new dust control technologies would continue to be investigated and, where relevant, implemented for the Project (Section 7.7.5).

Plate 7-10 Mount Pleasant Operation Management Control Room



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Mount Pleasant-controlled
- Bengalla-controlled
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- Mangoola-controlled
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- Mt Arthur-controlled
- Other Mining/Resource-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1

Category of Rural Residence under DA92/97

- Mine-owned
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned

Monitoring Sites

- Air Quality - High Volume Sampler
- Air Quality - Palas Fidas
- Dust Deposition Gauge
- Upper Hunter Air Quality Monitoring Network
- Weather Station
- Weather Mast
- Elevated Background Level $PM_{2.5}$ Analysis Zone

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

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

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MOUNT PLEASANT OPTIMISATION PROJECT

Air Quality and Meteorological Monitoring Sites

Figure 7-10

Existing Air Quality

TAS (2020) reviewed TSP, PM_{10}, $PM_{2.5}$ and dust deposition data from 39 air quality monitors in the vicinity of the Mount Pleasant Operation and the region, including monitors operated by MACH, neighbouring mines and the EPA as part of the UHAQMN. A detailed discussion of the background dust levels is provided in Appendix B.

The monitoring captures particulate matter from sources including existing active mining operations (e.g. the Mount Pleasant Operation and other mines), commercial and industrial sources (including power generation), agriculture, other localised particulate matter sources (e.g. wood heaters, vehicles using unsealed roads and wind erosion of exposed areas) and regional particulate matter sources (e.g. bushfires and dust storms) (Appendix B).

An overview of results of air quality monitoring undertaken at the Mount Pleasant Operation is provided below.

Concentrations of Suspended Particulate Matter

TSP, PM_{10} and $PM_{2.5}$ monitoring data have been collected on-site at the Mount Pleasant Operation using a HVAS for TSP, and TEOMs, Beta Attenuation Monitors and Palas Fidas monitors for PM_{10} and $PM_{2.5}$ (Figure 7-10). As TEOMs and Beta Attenuation Monitors have generally been used to temporarily replace Palas Fidas monitors, they are not shown on Figure 7-10.

Recorded annual average TSP, PM_{10} and $PM_{2.5}$ concentrations for 2017 to 2019 are provided in Table 7-12. There were no exceedances of relevant criteria at any private receivers when extraordinary events (e.g. dust storms and regional bushfire activity) were excluded. However, levels were generally higher in 2018 and 2019 due to drought conditions and associated extraordinary events (Appendix B).

Dust Deposition

Dust deposition monitoring data have been collected at 13 locations in the vicinity of the Mount Pleasant Operation since 2012. The locations of the dust deposition gauges are shown on Figure 7-10.

Table 7-13 presents the dust deposition levels recorded at each monitoring site for the period 2012 to 2019.

Dust deposition levels are typically highest near mining activity (i.e. D7). With the exception of gauges D6, D7, D8, D9 and D14, monitors recorded dust deposition levels below the relevant criterion of 4 g/m^2/month. The gauges that recorded levels above the criterion are either not considered representative of sensitive receivers (i.e. D7, D8, D9 and D14) or elevated dust deposition levels were attributed to local agricultural activity (i.e. D6) (Appendix B).

Background Air Quality for Assessment Purposes

The assessment of Project and cumulative annual average air quality impacts requires background non-mining particulate matter concentrations and dust deposition levels to be defined and added to dispersion modelling results for predicted Project and other local mining operations emissions.

Local mining operations that were active during the reference period (2012 to 2015) (including the Bengalla Mine, Mt Arthur Coal Mine, Mangoola Coal, Muswellbrook Coal Mine and the former Drayton Mine [now Maxwell Infrastructure]) were modelled.

The average difference between the modelled levels due to the local mining operations and measured particulate matter concentrations and dust deposition levels during the reference period was considered to be the contribution from background sources (i.e. excluding local mining operations).

The estimated background dust levels (excluding local mining operations) based on this analysis are presented in Table 7-14.

Given the high density of available PM_{10} monitors and presence of Muswellbrook (a large source of particulate matter emissions), spatially varying background dust levels have been applied to account for realistic variations across the modelling domain. These spatially varying PM_{10} levels are shown in Appendix B.

The assessment of potential cumulative air quality impacts was then based on (Appendix B):

- the background dust levels (excluding local mining operations);
- the estimated Project particulate matter emissions; and
- the estimated particulate matter emissions from relevant local mining operations (existing and proposed), reflecting anticipated changes to those mining operations over time.

Table 7-12
Annual Average TSP, PM_{10} and $PM_{2.5}$ Concentrations

Location[a]	TSP Concentration (µg/m³)			PM_{10} Concentration (µg/m³)			$PM_{2.5}$ Concentration (µg/m³)		
	2017	2018	2019	2017	2018	2019	2017	2018	2019
A-HV2 / A-PF2	52.9	89.6[b]	80.6[b]	17.4	23.4[b]	23.4[b]	5.1	6.1[b]	6.4[b]
A-HV4 / A-PF4	30.5	45.5[b]	46.7[b]	8.9	16.0[b]	16.3[b]	4.8	5.5[b]	5.4[b]
A-HV5 / A-PF5	25.4	43.7[b]	48.3[b]	-	15.4[b]	17.5[b]	-	5.2[b]	5.5[b]

Source: After Appendix B.

[a] Refer to Figure 7-10.

[b] Results exclude 'extraordinary events' (e.g. dust storms and bushfire activity).

Table 7-13
Annual Average Dust Deposition (Insoluble Solids) Levels (g/m²/month)

Location[a]	2012	2013	2014	2015	2016	2017	2018	2019
D1	1.4	1.2	1.3	1.0	1.3	1.3	1.6	2.4
D3	2.2	1.8	1.8	1.5	1.5	1.9	2.9	3.6
D4	1.6	1.3	1.6	2.4	1.5	1.4	1.8	2.5
D5	2.9	3.2	3.9	2.4	2.2	-	2.5	3.3
D6	2.2	3.3	3.7	2.5	2.3	2.6	3.2	**6.4**
D7	**13.0**	**11.5**	**12.3**	**5.8**	**6.8**	**-**	**8.5**	**7.6**
D8	3.4	**4.4**	3.7	3.0	3.7	**5.9**	3.9	**5.0**
D9	1.3	1.4	1.5	1.3	1.6	1.7	1.9	**4.3**
D10	2.0	-	1.0	0.8	1.1	1.3	1.5	1.8
D11	2.0	1.3	1.6	1.4	1.3	1.7	2.0	3.0
D12	1.1	0.7	1.0	0.8	0.7	0.9	1.5	1.5
D13	2.2	3.2	3.2	2.1	2.0	3.3	2.7	-
D14	2.4	3.0	3.4	2.2	3.2	2.5	3.7	**4.3**

Source: After Appendix B.

Note: Bold text indicates an exceedance of relevant dust deposition criteria of 4 g/m²/month.

[a] Refer to Figure 7-10.

Table 7-14
Estimated Background Dust Levels Excluding Local Mining Operations

Dust Metric	Averaging Period	Estimated Contribution	Unit
TSP	Annual	34.8	µg/m³
PM_{10}	Annual	Variable grid (approximately 4 to 14)[a]	µg/m³
$PM_{2.5}$	Annual	2.9	µg/m³
$PM_{2.5}$ (edge of Muswellbrook)	Annual	5.4	µg/m³
Dust Deposition	Annual	1.9	g/m²/month

Source: After Appendix B.

[a] Refer to Figure 6-10 of Appendix B.

In addition, local anthropogenic sources during colder months (e.g. wood heater emissions) significantly influence annual average $PM_{2.5}$ levels in the vicinity of Muswellbrook (Appendix B). Therefore, for more than 300 privately-owned receivers on the edge of Muswellbrook (Figure 7-10), a higher $PM_{2.5}$ background contribution of 5.4 µg/m³ was adopted to represent elevated non-mining background levels and provide a more conservative estimate of cumulative annual average $PM_{2.5}$ levels (Table 7-14 and Appendix B).

Privately-owned receivers more remote from Muswellbrook are not predicted to experience higher background annual average $PM_{2.5}$ levels from wood heaters, and a background contribution of 2.9 µg/m³ has been adopted (Table 7-14 and Appendix B).

Environmental Complaints History

Figure 7-3 provides a summary of environmental-related complaints for the Mount Pleasant Operation received between April 2017 and September 2020. Relevant to air quality, a total of 46 complaints were received, of which 32 were in 2019 and 14 were in 2020.

Further analysis of complaints between October 2019 and September 2020 identified the majority (i.e. more than 65%) occurred in October and November 2019, which coincides with peak drought conditions experienced in the region and accompanying dust storms and bushfire conditions.

All complaints received are investigated to determine the likely cause and, where relevant, identify appropriate mitigating actions, including modifying operations and adjustments to existing management/operational approaches.

As described above, monitoring at the Mount Pleasant Operation generally indicates compliance with the applicable air quality criteria has been achieved with the implementation of the site's comprehensive existing air quality management system.

Summary of Operational Shutdowns

As described in the *Mount Pleasant Operation 2019 Annual Review & Annual Rehabilitation Report* (MACH, 2020d), dust-generating activities were discontinued on a number of occasions in 2019 in accordance with Conditions O3.4 to O3.9 of EPL 20850. In 2019, shutdowns comprised a total of 468 hours (i.e. all items of major mobile equipment were shut down for 468 hours each).

In addition to ceasing operations due to elevated monitoring results in accordance with Conditions O3.4 to O3.9 of EPL 20850, operations were also ceased on a number of occasions in response to the generation of visible dust, for a total of 989 hours across four separate excavator fleets (i.e. approximately 247 hours on average per excavator) (MACH, 2020d).

Due to the easing of drought conditions in 2020, dust-related shutdowns reduced materially in the period January to October 2020. In this period, approximately 250 hours of excavator fleet shutdowns (across all excavator fleets, not an average per excavator) were recorded, inclusive of shutdowns in accordance with Conditions O3.4 to O3.9 of EPL 20850 and due to the generation of visible dust (MACH, 2020c).

7.7.4 Potential Impacts

Modelling Scenarios

Six Project scenarios were assessed for potential air quality impacts. These scenarios were selected to evaluate potential impacts at the nearest privately-owned receivers over the life of the Project (Appendix B):

- Scenario 1 (nominally 2026) – Representative of Project mining activity continuing close to Muswellbrook, with a ROM coal extraction rate of 10.5 Mtpa as per the approved operations.
- Scenario 2 (nominally 2028) – Representative of increased ROM coal extraction at a rate of 15.75 Mtpa and operation of the Stage 2a CHPP to process the additional ROM coal.
- Scenario 3 (nominally 2031) – Representative of the Project's full extent to the north, with continuing ROM coal extraction at a rate of 15.75 Mtpa.
- Scenario 4 (nominally 2034) – Representative of the first year of the Project peak ROM coal extraction rate of 21 Mtpa.
- Scenario 5 (nominally 2041) – Representative of peak mining activity (amount of waste rock material handled) for the life of the Project.
- Scenario 6 (nominally 2044) – Representative of peak mining activity for the western extent of the Project. Following this period, mining activity progressively decreases towards mine closure.

Indicative Project general arrangements for these scenarios are shown on Figures 3-4 to 3-9.

Emission Inventories

Air quality emission inventories were prepared for each scenario in consideration of the indicative Project activities for each year, including ROM coal extraction, construction activities, waste rock removal rates, haul distances/routes, active stockpile and pit areas and mobile equipment operating hours.

Consistent with the Approved Methods (EPA, 2017b), emission factors developed by the United States Environmental Protection Agency (US EPA) (1995 and updates), Australia's National Pollutant Inventory (NPI) documentation (Australian Government, 2012) and the EPA's *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone Environmental Pty Ltd, 2010) (the Best Practice Report) have been used to estimate the particulate matter emissions generated by the Project (Appendix B).

The major emission sources are predicted to be associated with the following activities (Appendix B):

- hauling of waste rock and ROM coal in trucks on unpaved roads (including diesel particulate emissions);
- handling and loading/unloading of waste rock, ROM coal and product coal;
- wind erosion of exposed areas; and
- dozer operations.

Emissions associated with construction activities would typically be contained to specific areas, be of limited duration and would not generate measurable off-site concentrations relative to Project operational activities (Appendix B).

Potential dust emissions associated with construction activities would be appropriately managed using best practice dust control measures (e.g. water sprays, progressive rehabilitation) in accordance with a construction management plan, as relevant.

Emission factors for dust generated by haul trucks sourced from the US EPA include both mechanically generated (i.e. wheel generated) and combustion emissions. However, emission controls applied are often only relevant to the mechanically generated portion of the emissions (e.g. surface treatments do not control combustion emissions). Therefore, surface treatment emission controls (e.g. watering haul roads [Plate 7-11]) have only been applied to the portion of total emissions that are mechanically generated (Appendix B).

A full description of the dispersion model methodology and emission inventories is provided in Appendix B.

Dispersion Modelling

The CALPUFF modelling system was used by TAS (2020) to assess potential air quality impacts associated with the Project in accordance with the EPA's *Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'* (TRC Environmental Corporation, 2011).

Plate 7-11 Water Truck Operating on Haul Roads at the Mount Pleasant Operation

CALPUFF is a multi-layer, non-steady-state puff dispersion model that is approved by the EPA (EPA, 2017b).

Further description of the meteorological and dispersion modelling, including the selection of a representative year of meteorological data, is provided in Appendix B.

Potential Project-only Impacts

Figures 7-11 to 7-13 show Project-only 24-hour PM_{10} concentrations for selected modelling scenarios which represent peak predicted Project emission levels (i.e. 2026, 2034 and 2041).

Air quality contour plots of the predicted Project-only 24-hour average PM_{10} and $PM_{2.5}$ concentrations and dust deposition levels for all modelling scenarios are provided in Appendix B.

24-hour Average PM_{10}

Exceedances of the Project-only 24-hour average PM_{10} criterion (50 µg/m³) were predicted at eight proximal privately-owned receivers; 143b, 147, 153a, 154, 154b, 156a, 157a and 159 (Appendix B).

Privately-owned receivers 154 and 154b currently have the right to mitigation upon request in Development Consent DA 92/97 due to potential noise impacts from the existing Mount Pleasant Operation and would also receive the right to acquisition on request for the Project.

All other privately-owned receivers that were predicted to exceed the Project 24-hour average PM_{10} criterion currently have the right to acquisition upon request in Development Consent DA 92/97 for potential noise impacts from the existing Mount Pleasant Operation and would retain this right for the Project.

24-hour Average $PM_{2.5}$

No exceedances of the Project-only 24-hour average $PM_{2.5}$ criterion (25 µg/m³) were predicted at any privately-owned receivers (Appendix B).

Assessment of Impacts on Privately-owned Land

TAS reviewed the relevant air quality contours and land tenure information for the Project and concluded that one privately-owned property (property 143e) is predicted to experience exceedances of the relevant VLAMP air quality criteria on greater than 25% of land on the property (Appendix B).

It is noted this land parcel currently has acquisition upon request rights for potential noise impacts in Development Consent DA 92/97 for the existing Mount Pleasant Operation.

Potential Cumulative Impacts

Air quality contour plots of the predicted cumulative TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition levels for all modelling scenarios are provided in Appendix B.

Annual Average TSP, PM_{10}, $PM_{2.5}$ and Dust Deposition

Four privately-owned receivers located to the south and south-west of the Project (adjacent to the Bengalla Mine) are predicted to experience exceedances of the relevant EPA cumulative assessment criteria for annual average TSP, PM_{10} or $PM_{2.5}$ concentrations or dust deposition levels due to the cumulative contributions from the Project, surrounding local mining operations and background levels (Appendix B).

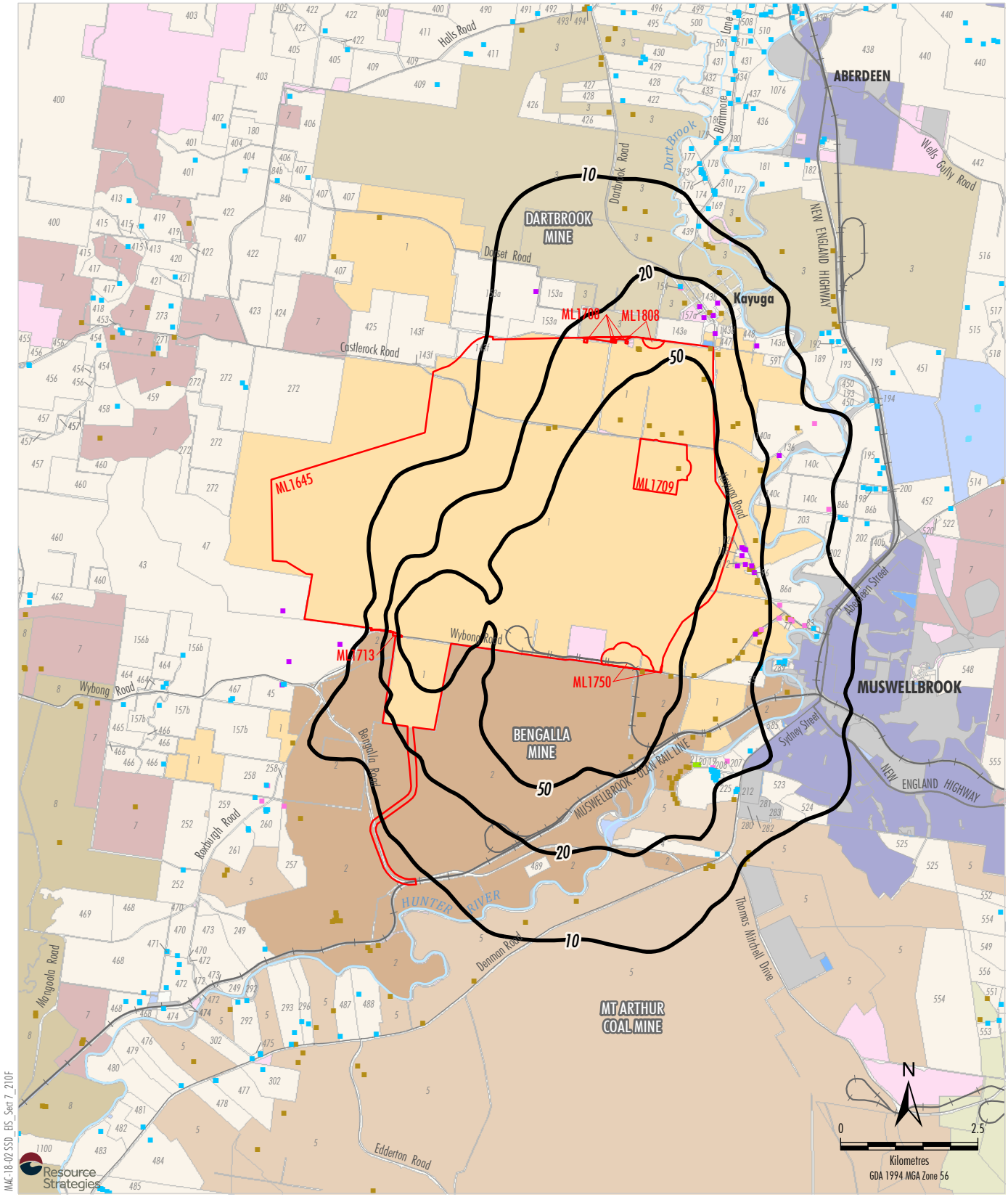
TAS identified that the predicted exceedances would occur with or without the Project and the Project would contribute approximately 1 to 2% to the total predicted levels at receivers. On this basis, it is considered the Project would not contribute to an exceedance of the relevant cumulative TSP, PM_{10}, $PM_{2.5}$ or dust deposition criteria at any of these receivers (Appendix B).

Notably, no exceedances of the relevant cumulative annual average $PM_{2.5}$ criterion (8 µg/m³) were predicted at any of the privately-owned receivers at the edge of Muswellbrook that were assessed with a conservative (i.e. higher) background annual average $PM_{2.5}$ level due to the known effects of wood heaters on air quality in town (Section 7.7.3 and Appendix B).

24-hour Average PM_{10} and $PM_{2.5}$

The EPA contemporaneous assessment method was applied by TAS to analyse the potential maximum cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations arising from the Project (Appendix B).

Without the implementation of reactive management measures, exceedances of both the EPA 24-hour average PM_{10} criterion (50 µg/m³) and $PM_{2.5}$ criterion (25 µg/m³) were predicted at a number of proximal privately-owned receivers due to the cumulative contributions from the Project, surrounding local mining operations and background levels (Appendix B).



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- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1

Category of Rural Residence under DA92/97

- Mine-owned
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned
- Project-only 24 hour PM_{10} Air Quality Contour ($\mu g/m^3$)

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

Source: MACH (2020); NSW Spatial Services (2020); TAS (2020)

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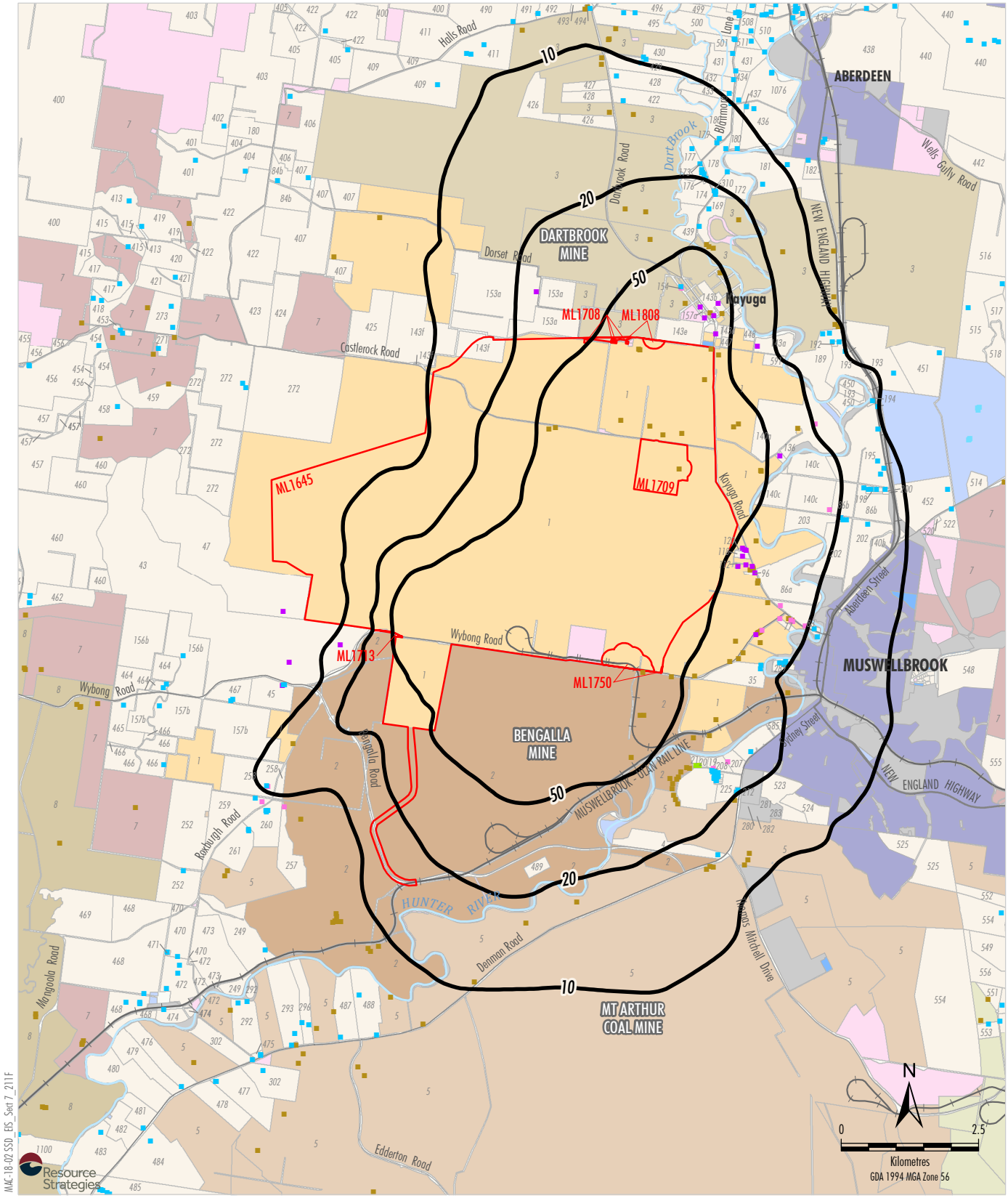
MOUNT PLEASANT OPTIMISATION PROJECT

Project 24 hour PM_{10} Air Quality Contours 2026

Figure 7-11



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- Privately-owned - Mitigation on Request
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- Project-only 24 hour PM_{10} Air Quality Contour ($\mu g/m^3$)

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

Source: MACH (2020); NSW Spatial Services (2020); TAS (2020)

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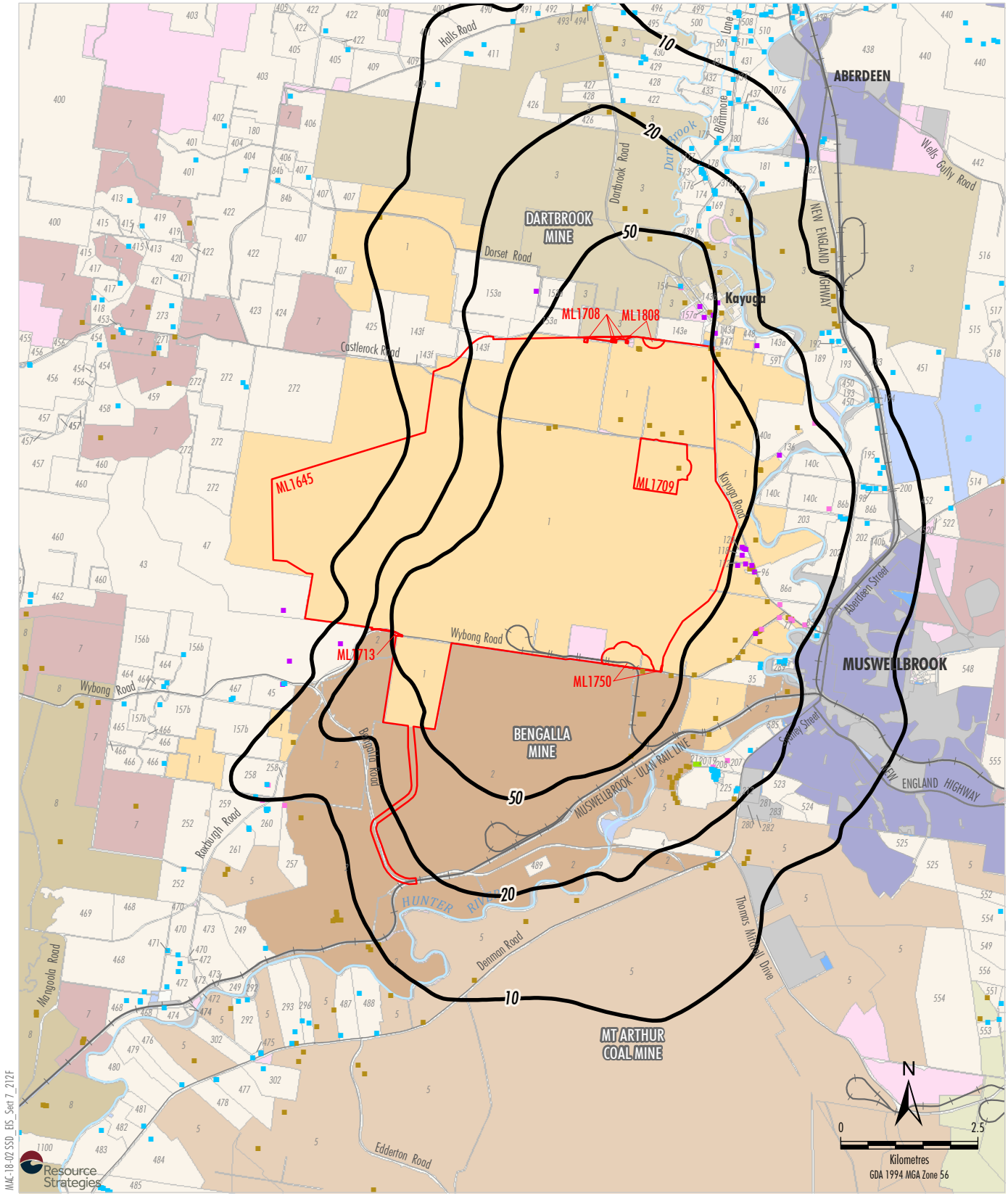
MOUNT PLEASANT OPTIMISATION PROJECT

Project 24 hour PM_{10} Air Quality Contours 2034

Figure 7-12



LEGEND

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- Other Privately-owned
- Project-only 24 hour PM_{10} Air Quality Contour ($\mu g/m^3$)

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

Source: MACH (2020); NSW Spatial Services (2020); TAS (2020)

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Project 24 hour PM_{10} Air Quality Contours 2041

Figure 7-13

However, with the continued application of the Mount Pleasant Operation reactive dust mitigation strategy and real-time air quality monitoring and management (Section 7.7.5), residual predicted cumulative 24-hour average emissions were as follows:

- No additional exceedances of the cumulative 24-hour average PM_{10} criterion were predicted at privately-owned receivers - noting eight proximal receivers are predicted to experience exceedances of the relevant criterion due to the Project alone.
- Five exceedances of the cumulative 24-hour average $PM_{2.5}$ criterion were predicted at the most proximal privately-owned receivers; 112, 118, 120, 120c and 121. These receivers currently have the right to acquisition upon request in Development Consent 92/97 due to potential noise impacts from the existing Mount Pleasant Operation.

Summary of Assessment of Particulate Matter and Dust Deposition Emissions

More than 900 receivers were considered in the Air Quality Assessment, of which TAS concluded 13 of the most proximal privately-owned receivers and one privately-owned vacant property would exceed applicable air quality criteria due to the Project (Figure 7-9) (Appendix B).

The results of modelling of predicted suspended particulate matter and dust deposition levels indicate that the Project's staged increases to ROM coal extraction rate would be effective in minimising potential air quality impacts to the majority of receivers surrounding the Mount Pleasant Operation (Appendix B).

Potential Blast Fume Emissions

Blasting activities have the potential to result in fugitive fume and particulate matter emissions. Particulate matter emissions from blasting are included in the dispersion modelling results (Appendix B).

Particulate matter emissions from blasting are controlled during operations by adequate stemming of the blast.

TAS (2020) has found that blasts undertaken after 3.00 pm have increased potential to result in adverse blast fume impacts beyond the Project boundary. If blasting is required during this time, potential off-site fume impacts would be minimised or avoided by implementation of a specific Trigger Action Response Plan (Section 7.7.5).

Measures to minimise or avoid imperfect blasts, which may result in oxides of nitrogen (NO_x) fumes being emitted, would continue to be implemented in accordance with the Mount Pleasant Operation Blast Management Plan and the *Code of Practice: Prevention and Management of Blast Generated NO_x Gases in Surface Blasting* (Australian Explosives Industry and Safety Group Inc., 2011).

Spontaneous Combustion

Spontaneous combustion events have the potential to release odour emissions. Potential spontaneous combustion events would be avoided or managed through the continued implementation of the existing Mount Pleasant Operation Spontaneous Combustion Management Plan (Section 7.7.5).

Coal Transport

Potential impacts from rail transportation of coal along the Project rail spur were considered by TAS (2020). Dust impacts from rail transportation of coal has been previously assessed for a peak of nine train movements per day in the *Mount Pleasant Operation Mine Optimisation Modification Air Quality and Greenhouse Gas Assessment* (TAS, 2017).

The Project would increase the approved maximum train movements per day from nine laden trains leaving the site per day to ten (Section 3.8). TAS concluded that there is a low risk of potential adverse air quality impacts associated with rail transportation of coal for the Project due to the increase in train movements (Appendix B).

7.7.5 Mitigation Methods

Comparison with Best Practice Mitigation Measures

In 2011, the EPA commissioned a review of methods to minimise coal mining particulate matter emissions (the Best Practice Report).

Best practice dust mitigation measures implemented for the Mount Pleasant Operation are detailed in the Air Quality and Greenhouse Gas Management Plan and were developed with reference to the recommendations of the Best Practice Report.

Key dust mitigation measures that would continue to be implemented for the Project, commensurate with the Best Practice Report, include:

- use of water to minimise emissions from drilling;
- minimising fall height of materials where practicable;

- application of water and regular maintenance of unsealed surfaces, including travel routes and work areas;
- enclosure of the ROM coal hoppers at the CHPP on three sides and activation of fogging sprays during unloading of ROM coal;
- conveyors and transfer points are enclosed and water sprays operated at transfer points, if required; and
- application of water to stabilise the surface of stockpiles and inactive exposed areas.

In addition to these physical dust mitigation measures, reactive operational mitigation strategies and management measures would continue to be implemented for the Project in accordance with EPL 20850 for the Mount Pleasant Operation.

These reactive strategies and measures include high dust concentration alarms, and modification of mining activities to reflect predicted and measured meteorological conditions. Relevant dust-generating operations are also ceased under relevant wind direction and dust level triggers described in Conditions O3.4 to O3.9 of EPL 20850.

Over the life of the Project, MACH would also continue to evaluate reasonable and feasible dust reduction technologies and apply these where relevant to minimise particulate matter emissions.

Real-time Air Quality Monitoring and Management

A number of meteorological monitoring stations currently operate within the region. MACH also operates an on-site meteorological station in addition to real-time air quality monitoring stations for the Mount Pleasant Operation (Figure 7-10).

The real-time monitoring network and associated trigger levels would be reviewed for the operation of the Project and any required updates detailed in the Mount Pleasant Operation Air Quality and Greenhouse Gas Management Plan.

Air Quality Management Plan

MACH would continue to implement the air quality mitigation and management measures, and predictive and real-time air quality management system and associated response protocols, detailed in the Air Quality and Greenhouse Gas Management Plan for the Mount Pleasant Operation.

The Air Quality and Greenhouse Gas Management Plan would be reviewed for the operation of the Project and, if required, revised to reflect any changes that arise.

Blast Management Plan

MACH would continue to implement the blast fume management measures detailed in the Blast Management Plan for the Mount Pleasant Operation, in accordance with the *Code of Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting* (Australian Explosives Industry and Safety Group Inc., 2011).

The Blast Management Plan would be reviewed for the operation of the Project and, if required, revised to reflect any changes that arise.

This would include a specific Trigger Action Response Plan for blasts that are required to be undertaken after 3.00 pm, which have increased potential to result in adverse blast fume impacts beyond the Project boundary (Section 7.7.4).

Spontaneous Combustion Management Plan

MACH would continue to implement the monitoring and management measures detailed in the Spontaneous Combustion Management Plan for the Mount Pleasant Operation, which would be reviewed for the operation of the Project and, if required, revised to reflect any changes that arise.

7.7.6 Adaptive Management

When the real-time air quality monitoring system indicates specified real-time trigger levels are reached or exceeded, a message would be delivered to a MACH representative, alerting them to the elevated short-term dust levels.

The Project meteorological monitoring stations would report wind conditions at the time, allowing personnel to evaluate the likely origin of the elevated dust levels (i.e. on-site or off-site sources) enabling appropriate mitigation and response measures (Plate 7-12) to be implemented in accordance with the response protocol detailed in the Air Quality and Greenhouse Gas Management Plan.

Project personnel would also undertake visual monitoring of stockpiles and exposed areas. In the event that any substantial dust plumes are observed, additional dust management measures would be implemented.

Plate 7-12 Haul Road Watering to Minimise Dust Emissions

Project air quality adaptive management measures would include response to any community issues of concern or complaints, including discussions with relevant landowners and/or refinement of on-site air quality mitigation measures and mine operating procedures.

7.8 GROUNDWATER

A Groundwater Assessment has been prepared by AGE Consultants (2020) and is presented in Appendix C. The Groundwater Assessment has been peer reviewed by Brian Barnett (co-author of the *Australian Groundwater Modelling Guidelines* [Barnett *et al*., 2012]) and the review report is presented in Attachment 5.

Section 7.8.1 provides a description of the methodology used for the groundwater assessment. Section 7.8.2 provides a description of the existing groundwater environment. Section 7.8.3 describes the potential impacts of the Project on groundwater. Sections 7.8.4 and 7.8.5 outline mitigation and adaptive management measures for the Project, respectively.

7.8.1 Methodology

The Groundwater Assessment (Appendix C) has been guided by the requirements of the SEARs for the Project, including recommendations from the DPIE – Water. The Groundwater Assessment has also been informed by the requirements of the following guidelines:

- *Australian Groundwater Modelling Guidelines* (Barnett *et al.*, 2012).
- *Murray-Darling Basin Commission (MDBC) Groundwater Flow Modelling Guideline* (Middlemis *et al.*, 2001).
- *NSW Aquifer Interference Policy* (AIP) (NSW Government, 2012b).
- *NSW State Groundwater Quality Protection Policy* (NSW Department of Land and Water Conservation [DLWC], 1998).
- *NSW State Groundwater Quantity Management Policy* (DLWC, 2002a).
- *NSW State Groundwater Dependent Ecosystems Policy* (DLWC, 2002b).

- *Significant impact guidelines 1.3: Coal seam gas and large coal mining developments—impacts on water resources* (Significant Impact Guidelines for Water Resources) (Commonwealth Department of the Environment [DotE], 2013).
- *Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals* (IESC, 2018) and associated explanatory notes, including:
  - *Uncertainty Analysis – Guidance for groundwater modelling within a risk management framework* (Middlemis and Peeters, 2018).
  - *Assessing Groundwater-Dependent Ecosystems* (Doody, Hancock and Pritchard, 2019).
  - *Deriving site-specific guideline values for physico-chemical parameters and toxicants* (Huynh and Hobbs, 2019).

The Groundwater Assessment (Appendix C) has considered the requirements of relevant water sharing plans under the WM Act including:

- *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016.*
- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009.*
- *Water Sharing Plan for the Hunter Regulated River Water Source 2016.*

7.8.2 Existing Environment

Groundwater Management and Monitoring

Groundwater monitoring and management at the Mount Pleasant Operation is currently undertaken in accordance with the Groundwater Management Plan and Surface and Ground Water Response Plan, which are both sub-plans of the Water Management Plan.

The Groundwater Management Plan outlines:

- the existing groundwater conditions and baseline data relevant to the Mount Pleasant Operation;
- groundwater impact assessment criteria and triggers;
- final void management measures;
- groundwater monitoring; and
- the process for review and improvement of environmental performance.

The Surface and Ground Water Response Plan includes:

- processes to deal with a groundwater-related complaint;
- the groundwater impact investigation protocol; and
- a response plan, in the event that an investigation conclusively attributes an adverse impact to an existing groundwater supply user to the Mount Pleasant Operation.

Appropriate contingency measures for an impact on a groundwater supply user may include:

- deepening the affected groundwater supply bore;
- construction of a new groundwater supply bore; or
- provision of an alternative water supply.

The Environmental Management System includes a Complaint Response Protocol to reply to community concerns that relate to groundwater and other matters. Complaints registers are made available on the MACH website.

One complaint was received in relation to potential groundwater impacts in 2019. Concerns were raised regarding potential blasting impacts to a bore, resulting in poor water quality and odour. MACH undertook an investigation into the complaint, including use of a down-bore camera and water quality testing. The investigation determined the poor water quality and odour were not attributable to impacts from the Mount Pleasant Operation.

No groundwater-related complaints have been received in 2020 (to October).

Baseline Groundwater Data

Baseline geological and groundwater data were reviewed and compiled from several sources as part of the Groundwater Assessment, including:

- Hunter Coalfield Regional Geology Map 100K (Glen and Beckett, 1993);
- MACH exploration geological data, logs and site geological model;

- publicly available geological and hydrogeological reports for the region, including reports for Bengalla Mine, Dartbrook Mine, Mt Arthur Coal Mine and Mangoola Coal;
- BoM Australian Groundwater Explorer (groundwater bore database);
- groundwater level and pressure data from groundwater monitoring programs and investigations undertaken for the Project and surrounding projects/operations (Figure 7-14);
- groundwater quality and chemistry data from the above monitoring programs, investigations and studies (Figure 7-14);
- groundwater investigation testwork (e.g. pumping tests); and
- other regional topographic mapping data.

The baseline groundwater data used for the Project include the results of a Project-specific groundwater investigation program, including:

- A transient electromagnetic survey (TEM survey) of the eastern extent of the Eastern Out-of-Pit Emplacement to test the resistivity of ground cover to a depth of approximately 40 m and assist in the delineation of the alluvial boundary (Groundwater Imaging, 2016). The TEM survey data was verified using data obtained during geological drilling and monitoring bore installation (Appendix C).
- Test drilling to investigate the depth and boundary of unconsolidated sediments along the eastern extent of the Eastern Out-of-Pit Emplacement (Environment and Natural Resource Solutions Pty Ltd [ENRS], 2018). The locations of the alluvial investigation drillholes were informed by the outcomes of the TEM survey and are shown on Figures 7-15 and 7-16.
- Installation of a number of additional groundwater monitoring bores in 2019 and 2020. The bore construction details and relevant hydrogeological information are summarised in *Mount Pleasant Operation – Drilling Report Nested Groundwater Bores* (ENRS, 2020).

Existing Groundwater Regime

A conceptual hydrogeological model of the existing groundwater regime has been developed by AGE Consultants (2020), based on review of the available baseline groundwater data and relevant water sharing plans.

The two main groundwater systems identified by AGE Consultants (2020) are (Figure 7-17):

- alluvium associated with the Hunter River and Sandy Creek; and
- Permian strata that host the coal measures.

The Project coal resource is located in the Permian Wittingham Coal measures of the Singleton Supergroup. Lithologies comprise mostly sandstones, siltstones and coal measures with minor conglomerates and tuffs.

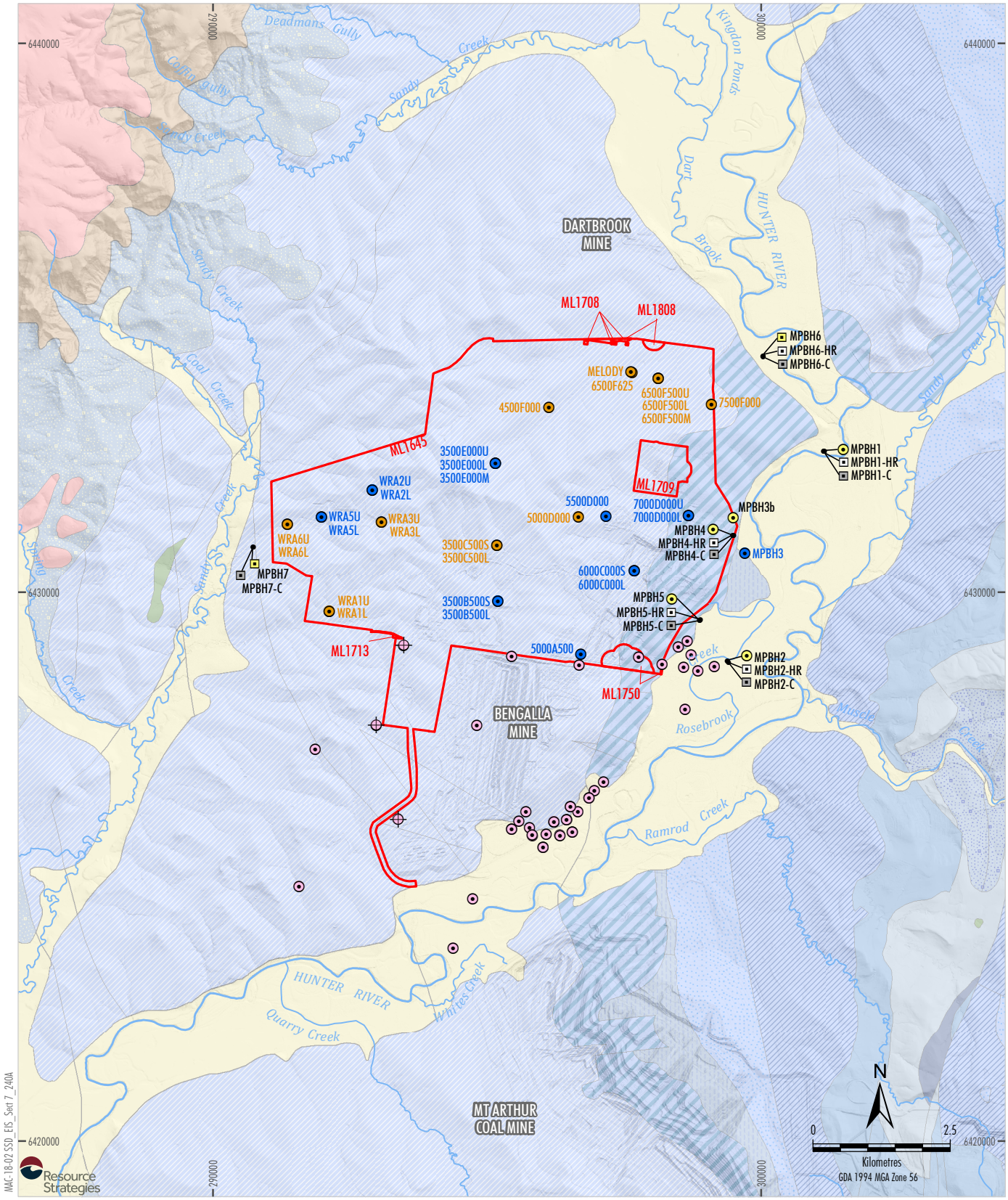
The Project coal resource is wholly located within the Sydney Basin-North Coast Groundwater Source, regulated under the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016* (Figure 7-17).

The coal seams are recognised as the main aquifer zones within the hard rock groundwater system, providing storage and transmission within cleats and joints. The interburden is mainly comprised of sandstones and siltstones with very low permeabilities and porosities, which limits the rate of groundwater transmission. The interburden zones often act as aquitards, effectively impeding or constraining the vertical exchange of groundwaters (Appendix C).

Higher aquifer pressures within the coal measures and a regional gradient towards the alluvium result in pressure driving groundwater movement towards the Hunter River. It is likely groundwater seeps naturally from the hard (fractured and porous) rock groundwater system into the alluvial groundwater system (Appendix C).

Alluvial sediments associated with the Hunter River and Sandy Creek are located to the east and west of the Project, respectively (Figure 7-14).

Alluvial sediments associated with the Hunter River are divided into two groundwater sources. Alluvial sediments located beneath water front land (that is land within 40 m of the top of the high bank of the Hunter River) fall within Management Zone 1A (Hunter River from Glenbawn Dam to Goulburn River Junction) of the Hunter Regulated River Water Source, which is regulated under the *Water Sharing Plan for the Hunter Regulated River Water Source 2016* (Figure 7-17). Other alluvial sediments associated with the Hunter River in the vicinity of the Project fall within the Upstream Glennies Creek Management Zone of the Hunter Regulated River Alluvial Water Source, which is regulated under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* (Figure 7-17).



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)

Newly Established Mount Pleasant Monitoring

- Standpipe - Coal Seam
- Standpipe - Interburden
- Standpipe - Alluvium

Mount Pleasant Monitoring

- Standpipe
- Standpipe - Alluvium
- Standpipe - Historical

Bengalla Monitoring

- Bengalla Standpipe
- Bengalla Vibrating Wire Piezometer

Source: MACH (2020); Bengalla Mining Company (2015); NSW Spatial Services (2020)

Note: Refer to Figure 3-2 for regional geology legend.

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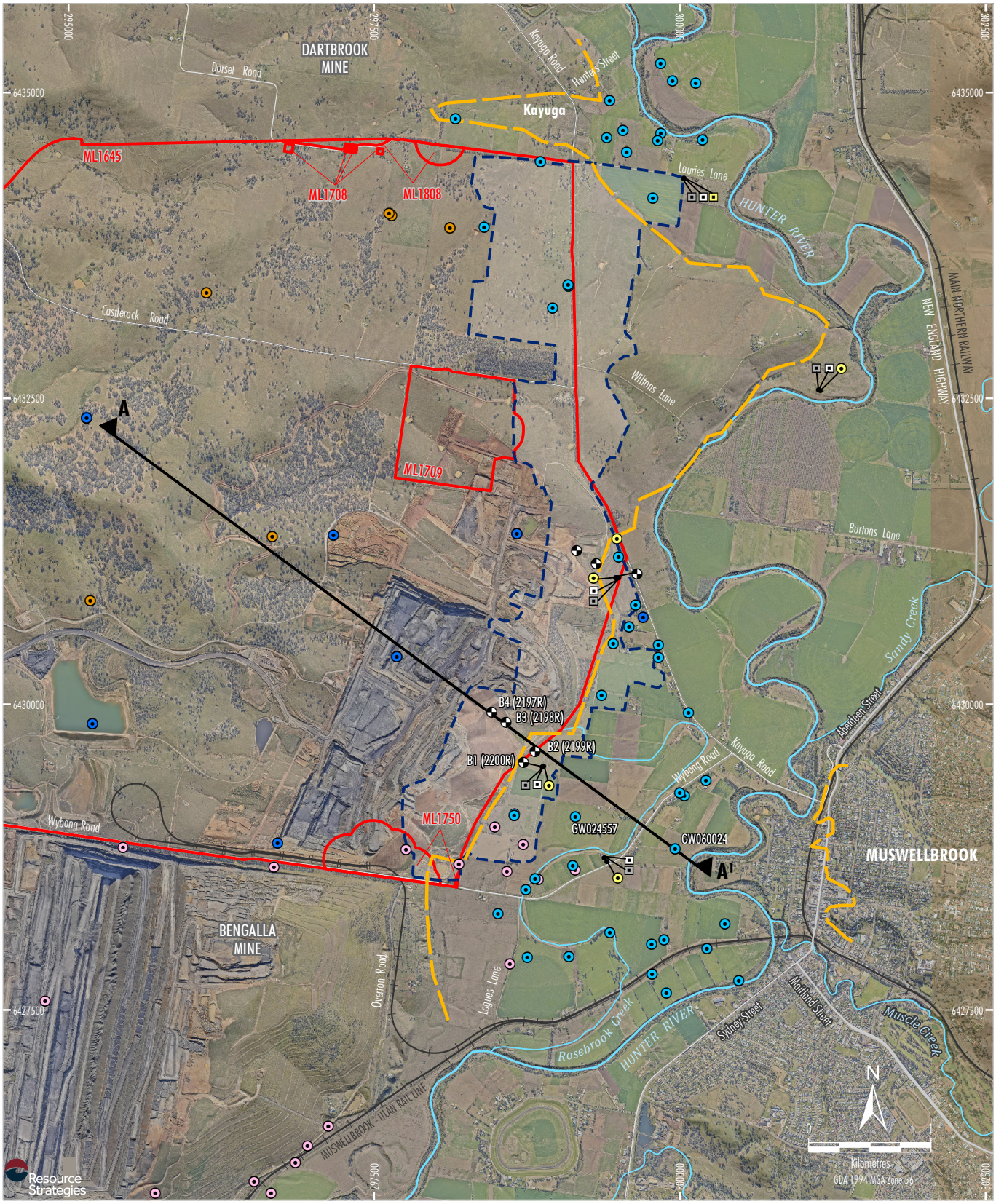
Groundwater Monitoring Locations

Figure 7-14



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LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Extent of TEM Survey
- Interpreted Extent of Alluvium
- Cross-section Location
- WaterNSW Groundwater Bore
- Alluvial Investigation Drillhole

Newly Established Mount Pleasant Monitoring

- Standpipe - Coal Seam
- Standpipe - Interburden
- Standpipe - Alluvium

Mount Pleasant Monitoring

- Standpipe
- Standpipe - Alluvium
- Standpipe - Historical

Bengalla Monitoring

- Bengalla Standpipe

Refer Figure 7-16 for cross-section.

Source: MACH (2020); NSW Spatial Services (2020); Water NSW (2020); Bengalla Mining Company (2015)
Orthophoto: MACH (July 2020)

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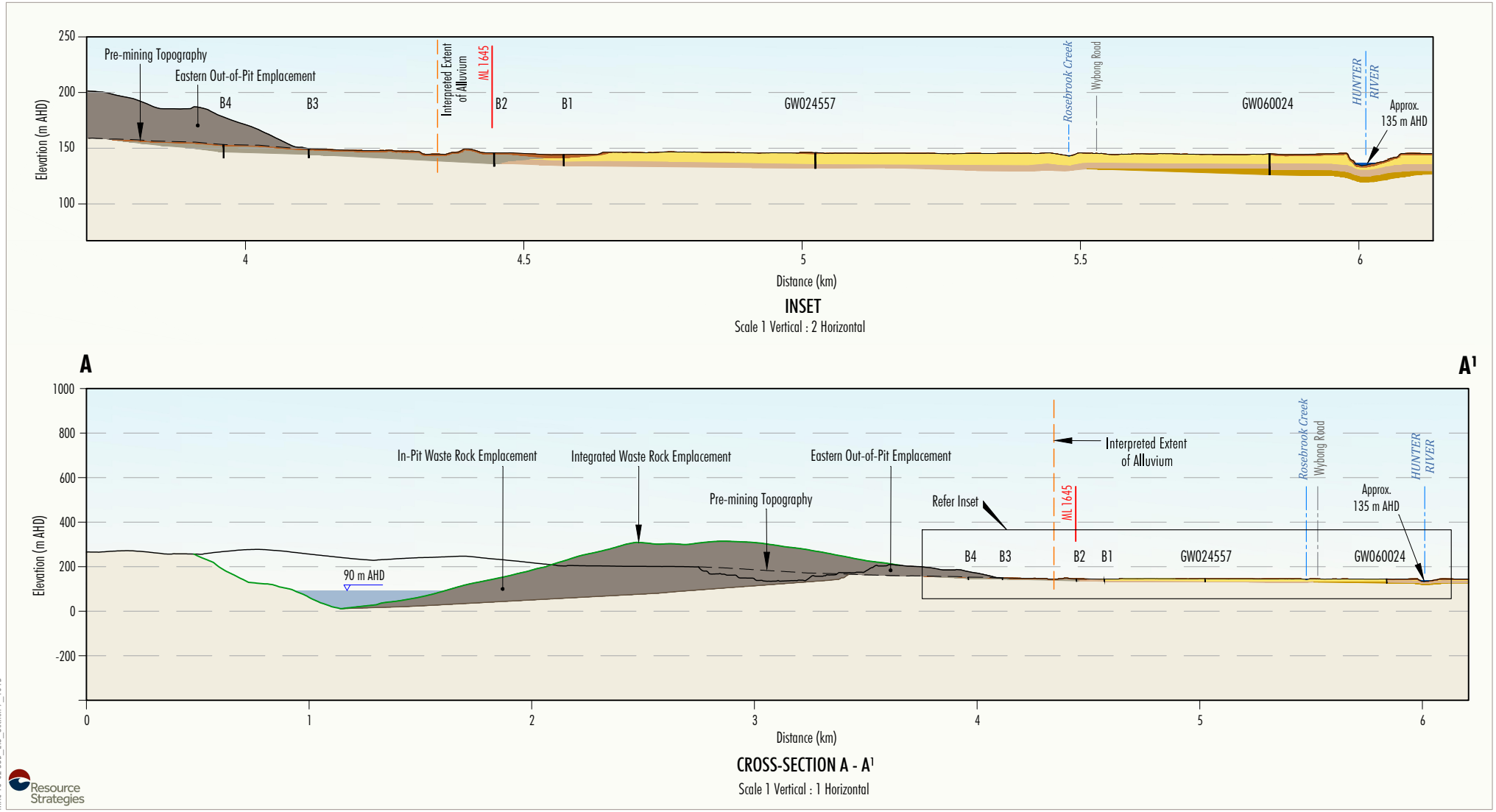
MOUNT PLEASANT OPTIMISATION PROJECT

Interpreted Extent of Alluvium

Figure 7-15



LEGEND

- Pre-mining Topography
- Existing Surface (July 2020)
- Conceptual Project Final Landform Surface
- Waste Rock Emplacement
- Final Void Waterbody
- Silt
- Clay
- Sand/Loam
- Gravel
- Clayey Gravel

Refer Figure 7-15 for cross-section location and Figure 3-17 for Conceptual Final Landform.

Source: MACH (2020); AGE (2020); Water NSW (2020); ENRS (2019)

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Interpreted Extent of Alluvium
Cross-section A - A1

Figure 7-16

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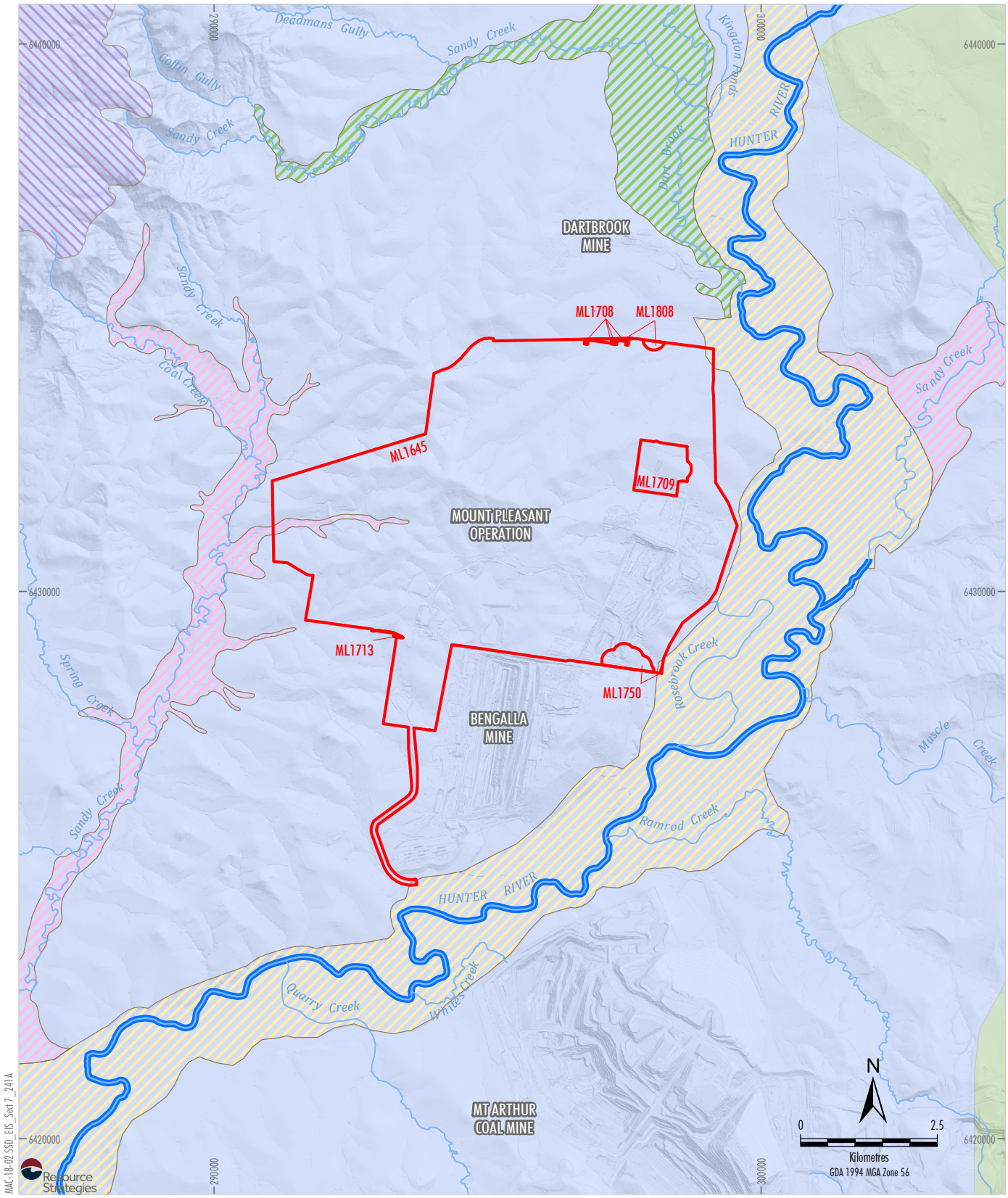

LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)

Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016

- Liverpool Ranges Basalt Coast
- New England Fold Belt Coast
- Sydney Basin - North Coast

Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009

- Unnamed Alluvium within Dart Brook Water Source
- Hunter Regulated River Alluvial Water Source
- Unnamed Alluvium within Muswellbrook Water Source

Water Sharing Plan for the Hunter Regulated River Water Source 2016

- Hunter Regulated River Water Source

Source: NSW Spatial Services (2020); Water NSW (2020)

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Relevant Groundwater Sources

Figure 7-17

Alluvial sediments associated with Sandy Creek fall within the Muswellbrook Water Source, which is regulated under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* (Figure 7-17).

The Hunter River alluvium is the most productive aquifer in the region and comprises surficial silts and clays overlying basal sands and gravels up to approximately 20 m in depth (Appendix C). The basal sands and gravels are thickest along the alignment of the Hunter River, thinning out toward the edges of the extent of mapped alluvium.

DPIE – Water has classified the alluvium associated with the Hunter River, including along Sandy Creek and Dart Brook as 'highly productive', although in reality yields and water quality can vary considerably (Appendix C).

The thick sequences of permeable sands and gravels in the Hunter River alluvium are considered 'highly productive' in accordance with the AIP. The edge of the Hunter River alluvium primarily consists of silts and clays that are largely unsaturated and considered 'less productive' (Figure 7-16).

Groundwater Recharge and Discharge

Recharge to the groundwater systems occurs from rainfall and runoff infiltration, lateral groundwater flow and some leakage from surface water sources (e.g. regulated flows in the Hunter River) (Appendix C).

Groundwater discharge occurs via evapotranspiration from shallow water tables, groundwater pumping (primarily for irrigation and potable water supply) and minor short duration baseflow events after significant rainfall (Appendix C).

Groundwater Use

Groundwater use in the vicinity of the Project is regulated by the NSW Government, with two water sharing plans regulating the volumetric allocation of groundwater to each user.

The extent of each regional groundwater source is shown on Figure 7-17.

The Permian hard rock groundwater associated with the Sydney Basin-North Coast Groundwater Source is mapped as 'less productive' in accordance with the AIP (DPI – Water, 2012).

MACH has conducted a census of privately-owned groundwater bores in the vicinity of the Mount Pleasant Operation (Appendix C). The census involved:

- Characterisation of existing groundwater bores through collation and review of the WaterNSW registered bore database and other regional information (e.g. 1:25,000 topographic maps).
- Site visits with local landholders to confirm the location and use of groundwater bores on their property.
- Opportunistic collection of baseline data where practical (e.g. water levels and basic water quality parameters).

Groundwater bores, wells and springs identified on privately-owned land during the census are shown on Figure 7-18. A number of bores were also visited on mine-owned land during the census (e.g. monitoring bores). WaterNSW records are shown for properties that were not visited (e.g. due to distance from the Mount Pleasant Operation).

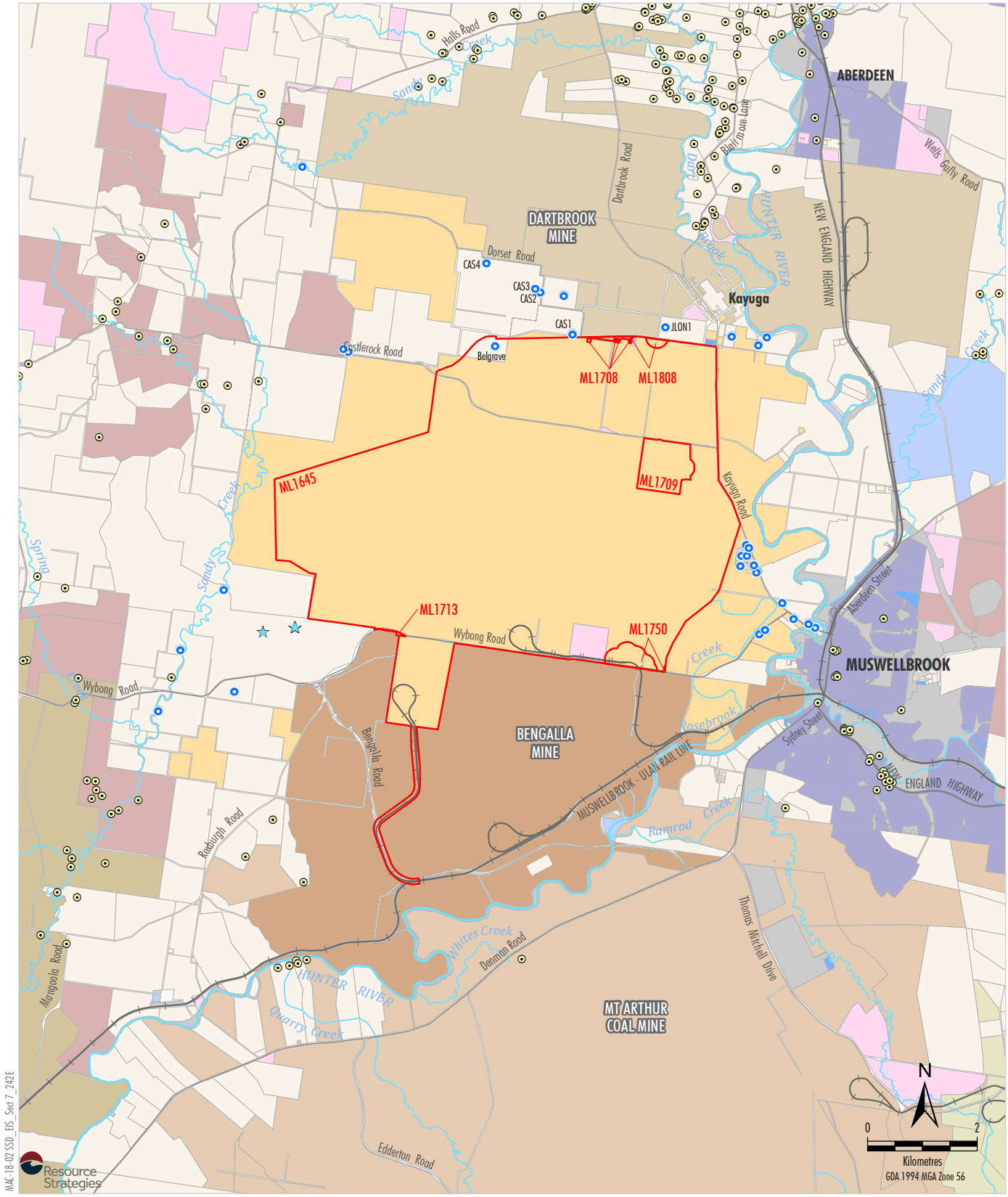
Groundwater Quality

An analysis of water quality attributes of groundwater at the Project and surrounds is provided in Appendix C, including analysis of the following attributes:

- physico-chemical indicators – pH, electrical conductivity (EC), total dissolved solids (TDS);
- major ions – calcium, magnesium, potassium, sodium, chloride, sulphate;
- total alkalinity as calcium carbonate ($CaCO_3$), bicarbonate (HCO_3) and carbonate ion (CO_3); and
- metal and metalloid concentrations.

Salinity is a key constraint to water management and groundwater use and can be described by EC. Baseline groundwater salinity is analysed in Appendix C. In summary:

- Groundwater quality within and surrounding the Mount Pleasant Operation is highly variable but generally poor.
- The Permian groundwater is typically only suitable for livestock and irrigation of some salt tolerant crops.
- Groundwater in the Hunter River alluvium has a lower average salinity than the underlying coal measures and could therefore be applied to a broader range of beneficial uses.



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LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Mount Pleasant-controlled
- Bengalla-controlled
- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Other Mining/Resource-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1
- Bore/Well on Privately-Owned Land (Bore Census)
- Spring on Privately-owned Land (Bore Census)
- Water NSW Record

Source: MACH (2020); Water NSW (2020); NSW Spatial Services (2020)

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Groundwater Bores, Wells and Springs Identified during the Bore Census

Figure 7-18

Groundwater chemistry is characterised according to the abundances and types of dissolved ions in a water sample. The proportions of dissolved ions in the water often reflects the origin of the water and interactions with geological strata that includes dissolution and precipitation of minerals. Dissolved ions types can be useful in classifying groundwater and assisting in the development of conceptual models of groundwater migration (Appendix C).

Water within the Permian coal measures is generally dominated by sodium, potassium and chloride resulting in classification as a sodium chloride type water. Groundwater in the alluvium could principally be classified as a magnesium carbonate type water with predominantly calcium and bicarbonate ions present in samples (Appendix C).

Most of the metal concentrations fall within the acceptable guidelines for irrigation and livestock use in both alluvial and Permian coal measures. Alluvial groundwater tends to have lower concentrations of dissolved metals and so falls under the more stringent acceptable limits for human drinking water for more of the analytes (e.g. aluminium, arsenic, lead) than does the groundwater in the Permian coal measures (Appendix C).

7.8.3 Potential Impacts

Groundwater Model

The Groundwater Assessment prepared by AGE Consultants (2020) has evaluated the potential impacts of the Project on groundwater resources using a numerical regional groundwater model.

The numerical regional groundwater model incorporates the Dartbrook Mine and Bengalla Mine.

The eastern boundary of the model is defined by the outcrop of the Maitland Group units on the flanks of the Muswellbrook Anticline, which underly the coal measures and are below the deepest mined seam of the Mount Pleasant Operation (Appendix C).

The Mt Ogilvie Fault forms the western boundary of the model. The Mt Ogilvie Fault has a maximum throw of about 200 m to the west of the Mount Pleasant Operation, transitioning to a ‘roll-over’ or monocline south of the Hunter River (Appendix C).

The model domain is discretised into 20 layers, with an unstructured Voronoi mesh that facilitates refinement of the model grid in key areas (Appendix C).

The regional groundwater model was calibrated using a range of data sources including:

- groundwater levels recorded from the Mount Pleasant Operation groundwater monitoring program;
- groundwater levels recorded from the nearby mining operation monitoring programs;
- groundwater levels measured during the Bore Census;
- NSW Government groundwater level monitoring records;
- vertical groundwater level differences; and
- temporal groundwater level differences.

Overall, the calibration of the numerical groundwater model showed generally good agreement to the comprehensive groundwater data (Appendix C). Brian Barnett in the peer review of the Groundwater Assessment concluded the calibration of the groundwater model is acceptable (Attachment 5).

The numerical groundwater model was considered suitable to simulate the potential impacts of the Mount Pleasant Operation (incorporating the Project) as well as the cumulative impacts with Dartbrook Mine and Bengalla Mine.

Groundwater Inflows

The total groundwater inflows to the open cut are predicted to peak in the order of 303 megalitres per year (ML/year) in the 2034-35 water year (Appendix C).

The maximum predicted inflow for the Mount Pleasant Operation (incorporating the Project) is less than the maximum predicted inflow originally predicted for the approved Mount Pleasant Operation of 1.9 ML/day or 690 ML/year (PPK, 1997). This is considered to be due to material desaturation of the Permian strata by the neighbouring Dartbrook and Bengalla Mines, as well as improvements in groundwater modelling since the original water management study was prepared in 1997 (Appendix C).

The maximum predicted inflow for the Mount Pleasant Operation (incorporating the Project) (approximately 300 ML) is only marginally higher than the maximum predicted inflow that would occur during the currently approved life of the Mount Pleasant Operation (approximately 270 ML in the 2024-25 water year).

Porous Rock Groundwater System

As mining operations progress, the open cut acts as a localised groundwater sink. This would cause a change in groundwater flow direction and, in some places, a localised reversal of flow direction.

There would also be a change in hydraulic properties where the waste rock is subsequently used to backfill the mine voids. As waste rock would have a higher permeability than natural rock material (associated with the porous rock groundwater system), there would be associated reductions in localised hydraulic gradients.

Numerical modelling conducted as part of the Groundwater Assessment predicts a substantial reduction in potentiometric head in the deeper porous rock groundwater system in the immediate vicinity of the open cut (Appendix C).

Recovery of the groundwater water table and pressures within the porous rock groundwater system is predicted to occur over many decades following the cessation of mining (Appendix C).

Alluvial Groundwater System

Limited drawdown is predicted in the Hunter River alluvium as the majority of the target seams subcrop west of the alluvium extent (Appendix C).

The Mount Pleasant Operation (incorporating the Project) is predicted to result in only limited drawdown in the alluvium to the north of the Project, near the existing Dartbrook Mine. This is due to the Edderton Seam subcrop, which extends beneath the alluvium in the north (Appendix C).

The Project would result in negligible drawdown in the Sandy Creek alluvium (Appendix C).

Final Void

At the completion of mining, the Project final landform would include a final void located on the western side of the Project mining area.

Once mining operations cease, groundwater inflows to the final void would no longer be collected and pumped out, and as a result, the void would gradually begin to fill with water. Water in other on-site operational storages may also be transferred to the final void to facilitate decommissioning and rehabilitation.

Inflows into the final void would comprise incident rainfall, runoff within the final void catchment area and groundwater. The catchment area of the final void would be defined by permanent perimeter bunds, diversion channels and/or embankment walls.

Final void water recovery analyses have been conducted as part of the Surface Water Assessment (HEC, 2020) (Appendix D). The assessment is based on predicted groundwater inflows developed as part of the Groundwater Assessment (Appendix C).

At the equilibrium water level (90 m AHD) (Figure 7-16), the void would act as a groundwater sink, drawing groundwater from the *in situ* strata, Eastern Out-of-Pit Emplacement and Fines Emplacement Area towards the final void (Appendix C).

Groundwater Quality

Key components of the Project that could affect groundwater quality are as follows (Appendix C):

- continuation of open cut mining;
- co-disposal of coarse and dewatered fine rejects with waste rock as part of ROM waste rock operations;
- continued development of the Eastern Out-of-Pit Emplacement; and
- continued development of the Fines Emplacement Area, including the construction of additional downstream embankment raises (lifts).

As mining progresses, the void would act as a groundwater sink, preventing interaction between the open cut and the surrounding natural groundwater systems. Therefore, there would be no groundwater quality impact associated with the Project open cut (Appendix C).

The original water management study prepared for the Mount Pleasant Operation (PPK, 1997) predicted some seepage of water from the approved final landform to the surrounding natural groundwater system, including (Appendix C):

- Seepage from the Fines Emplacement Area towards the Sandy Creek alluvium.
- Seepage from the Eastern Out-of-Pit Emplacement to the adjacent Hunter River alluvium.

During operations, the Fines Emplacement Area would be managed in accordance with the Mount Pleasant Operation Fines Emplacement Plan (ATC Williams, 2018). With the implementation of the Fines Emplacement Plan, the potential impacts on groundwater quality during the operation of the Fines Emplacement Area is predicted to be negligible (Appendix C).

The Project involves the deepening and continued operation of the open cut pit in a westerly direction. As a result, the final void would be located closer to the Fines Emplacement Area, drawing seepage towards the void as opposed to the Sandy Creek alluvium. The increased depth of the final void would also increase the hydraulic gradient from the Eastern Out-of-Pit Emplacement towards the final void, reducing the potential for seepage towards the Hunter River alluvium (Appendix C). The predicted final void equilibrium level (approximately 90 m AHD) is well below the elevation of the Hunter River (approximately 135 m AHD).

The potential for seepage from the proposed final landform has been assessed using groundwater model outputs and the semi-analytical particle tracking software MODPATH (Pollock, 2016). The MODPATH analysis demonstrates that seepage from the Fines Emplacement Area and Eastern Out-of-Pit Emplacement is predicted to primarily report to the Project and Bengalla Mine final voids (Appendix C).

Based on the above, the Project is considered to have a negligible impact on groundwater quality in the natural groundwater system (Appendix C).

Surface Water Resources

The existing surface water resources and their characteristics (i.e. streamflow and water quality) are described in Section 7.9.2.

The Groundwater Assessment (Appendix C) included examination of the stream-aquifer (surface water-groundwater) interaction status of the Hunter River and Sandy Creek.

The groundwater model simulation demonstrates that the total reduction in baseflow to the watercourses due to the Mount Pleasant Operation (incorporating the Project) would be minimal (Appendix C).

The potential effects of baseflow reductions on flows in the Hunter River and Sandy Creek are described in Section 7.9.3.

Groundwater Users

The Groundwater Assessment presents drawdown predictions for all bores identified during the Project bore census.

For the purposes of drawdown predictions, bores were assigned to groundwater model layers (water bearing strata) based on recorded licensing information, bore location, mapped geological outcrop (e.g. the extent of the alluvial aquifer) and recorded bore depths (Appendix C).

A total of six bores on private property are predicted to experience drawdown exceeding 2 m due to cumulative impacts from the Mount Pleasant Operation (incorporating the Project) and neighbouring mines (Appendix C).

Two of the private bores, CAS3 and JLON1, are understood to already be dry. A further three bores: CAS1, CAS2 and CAS4 that are projected to experience more than 2 m drawdown due to Mount Pleasant Operation are not currently in use (Appendix C).

Existing monitoring undertaken at CAS1 and CAS4 as part of the Dartbrook Mine groundwater monitoring programme indicates these bores have already experienced approximately 15 m drawdown due to the operation of the Dartbrook Mine (Appendix C).

The Belgrave bore in the north-west of ML 1645 (Figure 7-18) is the only location that is active and not dry, and predicted to experience more than 2 m drawdown due to Mount Pleasant Operation (Appendix C).

The Belgrave bore has been monitored by Dartbrook Mine since 2000. Monitoring data collected from the Belgrave bore indicates (AQC Dartbrook Management, 2020):

- the Belgrave bore recorded a decline in groundwater levels in response to mining between 2004 and 2006;
- pH has fluctuated between 6.6 and 9.2; and
- EC has ranged from approximately 5,000 microsiemens per centimetre (µS/cm) to 12,500 µS/cm.

The Belgrave bore is accessing regolith material associated with the 'less productive' Sydney Basin-North Coast Groundwater Source. The maximum predicted cumulative drawdown at the base is 7.7 m (3.3 m due to the Mount Pleasant Operation incorporating the Project). This is less than drawdowns historically experienced at the bore due to the Dartbrook Mine (approximately 20 m) (Appendix C).

Groundwater Dependent Ecosystems

Potential groundwater dependent ecosystems (GDEs) are discussed in Section 7.11 and Appendices C, E and F.

Climate Change and Groundwater

Climate change is discussed in Appendix C, including the potential groundwater impacts of the Project in the context of global climate change.

The climate change model scenario indicates that the sensitivity of modelled mine water inflows to climate change is significantly lower than the model's sensitivity to other factors (Appendix C).

Potential Impacts on Matters of National Environmental Significance

As the existing Mount Pleasant Operation already operates under an EPBC Act Approval (EPBC 2011/5795), consideration of potential impacts on MNES is focused on the incremental impacts of the proposed action.

Potential Impacts on Hydrological Characteristics

The Significant Impact Guidelines for Water Resources (DotE, 2013) provide the following guidance on potential impacts of an action on hydrological characteristics:

> *A significant impact on the hydrological characteristics of a water resource may occur where there are, as a result of the action:*
>
> *a) changes in the water quantity, including the timing of variations in water quantity*
>
> *b) changes in the integrity of hydrological or hydrogeological connections, including substantial structural damage (e.g. large scale subsidence)*
>
> *c) changes in the area or extent of a water resource where these changes are of sufficient scale or intensity as to significantly reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes.*

Groundwater modelling completed for the Project indicates (Appendix C):

- minimal drawdown (less than 2 m) in the 'highly productive' Hunter River alluvium and Sandy Creek alluvium; and
- negligible changes to baseflow in the Hunter River and Sandy Creek.

Accordingly, it is unlikely that the Project would result directly or indirectly in a substantial change in the hydrology of groundwater resources.

Potential Impacts on Water Quality

The Significant Impact Guidelines for Water Resources (DotE, 2013) provide the following guidance on potential impacts of an action on water quality:

> *A significant impact on a water resource may occur where, as a result of the action:*
>
> *a) there is a risk that the ability to achieve relevant local or regional water quality objectives would be materially compromised, and as a result the action:*
>
> *i. creates risks to human or animal health or to the condition of the natural environment as a result of the change in water quality*
>
> *ii. substantially reduces the amount of water available for human consumptive uses or for other uses, including environmental uses, which are dependent on water of the appropriate quality*
>
> *iii. causes persistent organic chemicals, heavy metals, salt or other potentially harmful substances to accumulate in the environment*
>
> *iv. seriously affects the habitat or lifecycle of a native species dependent on a water resource, or*
>
> *v. causes the establishment of an invasive species (or the spread of an existing invasive species) that is harmful*
>
> *vi. to the ecosystem function of the water resource, or*
>
> *b) there is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives), or*
>
> *c) high quality water is released into an ecosystem which is adapted to a lower quality of water.*

As described above, the Groundwater Assessment for the Project concludes there would be no deterioration in groundwater quality as a result of mining, including in the long-term (Appendix C).

Therefore, the Project would not have a significant impact on groundwater quality.

Consideration of Cumulative Impacts

The Significant Impact Guidelines for Water Resources require the action to be:

> *considered with other developments, whether past, present or reasonably foreseeable developments.*

The potential impacts described above are based on predictions from the Groundwater Assessment (Appendix C) that include the cumulative impacts of the Project, the approved Mount Pleasant Operation, Dartbrook Mine and Bengalla Mine.

Cumulative groundwater drawdown contours showing the magnitude and water table pattern caused by coincident mining at nearby operations and the Project are presented in Appendix C.

The cumulative effects are limited to the Permian coal measures and are largely restricted to the area in the immediate vicinity of the Project and nearby operations (Appendix C).

Consideration of Potential for Significant Impact

Based on the assessment presented above, the proposed action under the EPBC Act would not result in significant changes to the quantity or quality of water available to third party users or the environment (Appendix C).

The proposed action would not have a significant impact on water resources (Appendix C).

7.8.4 Licensing, Mitigation Measures and Monitoring

Groundwater Licensing

The predicted annual groundwater volumes required to be licensed over the life of the Project and post-mining are summarised in Table 7-15. Project groundwater licensing requirements are described in Appendix C.

MACH holds sufficient licences to account for the take from each water source, with the exception of 13 ML/year of predicted take from the Dart Brook Water Source, which is regulated under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009*. MACH would be readily able to acquire this entitlement given:

- The modest licence deficit of 13 ML/year represents a very small fraction of the overall entitlement available in the Dart Brook Water Source (approximately 30,000 units).
- Water access licences in the Dart Brook Water Source are actively traded, with 2,697 units permanently transferred in the 2019-2020 water year.

Water Management Plan

The existing Water Management Plan, including the Groundwater Management Plan and the Surface and Ground Water Response Plan, would be revised to reflect the Project and the requirements of any associated water licences (subject to the conditions of any Development Consent for the Project).

Groundwater Monitoring

The existing groundwater monitoring network, as described in the Groundwater Management Plan, is considered adequate for providing information on the dynamics of the groundwater hydraulics and offers an adequate basis for groundwater model calibration and verification (Appendix C).

Consistent with AGE Consultants' (2020) recommendations, MACH would add the following bores to the monitoring network for the Project:

- replacement bores for those that have been destroyed (i.e. those within the mining footprint);
- additional alluvial bores:
  - one to the north-east of the Mount Pleasant Operation (where greater than 2 m alluvial drawdown is predicted as a result of the Project);
  - an additional bore to the east to monitor for drawdown and potential seepage;
- an additional shallow groundwater bore in the vicinity of the potential Type 3 terrestrial GDE (Section 7.11);

Table 7-15
Summary of Groundwater Sources in the Vicinity of the Project

Water Sharing Plan	Water Source	Existing MACH Licences (units)	Total Licensing Requirement (ML/year)	
			During Mining	Post-Mining
Water Sharing Plan of the Hunter Regulated River Water Source 2016	Management Zone 1A (Hunter River from Glenbawn Dam to Goulburn River Junction) of the Hunter Regulated River Water Source	961 (High Security) 2,937 (General Security)	27	32
Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009	Upstream Glennies Creek Management Zone of the Hunter Regulated River Alluvial Water Source	285	27	34
	Muswellbrook Water Source	41	2	6
	Dart Brook Water Source	Nil	6	13
Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016	Sydney Basin-North Coast Groundwater Source	730	247	44 (547)*

Source: After Appendix C.

* The post mining take from the Sydney Basin-North Coast Groundwater Source is 44 ML/year when considering incidental flows from external groundwater systems only (e.g. in-tact Permian hard rock adjacent to the mined out pit shell). Seepage from the Eastern Out-of-Pit Emplacement and backfilled waste rock increases the total groundwater inflows to the void to 547 ML/year (i.e. due to increased recharge to the relatively permeable waste rock material).

- a vibrating wire piezometer to the west of the Mount Pleasant Operation to capture pressure changes in relevant Permian units; and
- private bores in the potential areas of impact (dependent on landowner agreement).

Numerical Model and Water Balance Review

The numerical model developed and used for the Groundwater Assessment (Appendix C) would be used as a management tool for the periodic review and calibration of predicted groundwater impacts through the life of the Project.

The results of the groundwater monitoring program would inform progressive refinement of the numerical model. Revised outputs from the numerical model would be reported in the Annual Review, as relevant over the life of the Project and used to inform regular site water balance reviews (Section 7.9.5).

7.8.5 Adaptive Management

Contingency Measures

Consistent with the requirements of the AIP, MACH would continue to implement appropriate contingency measures for Project related drawdown greater than 2 m at any relevant private or public groundwater bores.

The contingency measures developed for the existing/approved Mount Pleasant Operation are described in Section 7.8.2 and would continue to be implemented for the Project.

Trigger Action Response Plans

The AIP requires development of remedial actions for impacts greater than those that were predicted as part of the relevant approval.

Water level and water quality triggers (EC and pH) have been developed as part of the Water Management Plan for the Mount Pleasant Operation. The Water Management Plan would be reviewed and updated as necessary to reflect Project Development Consent requirements. In the event groundwater monitoring (Plate 7-13) identifies an exceedance of an established trigger, MACH would implement a response plan in accordance with the Water Management Plan.

Groundwater Monitoring and Review

The observed groundwater levels would be reviewed against the model predictions on an annual basis. A suitably qualified hydrogeologist would determine when water levels deviate significantly from that predicted by the groundwater model and determine the reason for this deviation.

The review would consider the impact of mining, and other factors that could result in varying water levels including climatic conditions, rainfall recharge and pumping from privately-owned bores and/or other mining operations.

The Groundwater Assessment (Appendix C) used hydrogeological information to understand and characterise the groundwater regime. During the Project, additional hydrogeological data would be collected, including details on lithology, groundwater intersection and intersection of structures (i.e. faults and dykes). The additional hydrogeological data would be stored and made available as required for future groundwater investigations and/or updates to the model.

Plate 7-13 Groundwater Monitoring Bore

7.9 SURFACE WATER

A Surface Water Assessment has been prepared for the Project by HEC (2020) and is presented in Appendix D.

Section 7.9.1 provides a description of the methodology used for the surface water assessment. Section 7.9.2 provides a description of the existing surface water environment. Section 7.9.3 describes the potential impacts of the Project on surface water. Sections 7.9.4 and 7.9.5 outline mitigation and adaptive management measures for the Project, respectively.

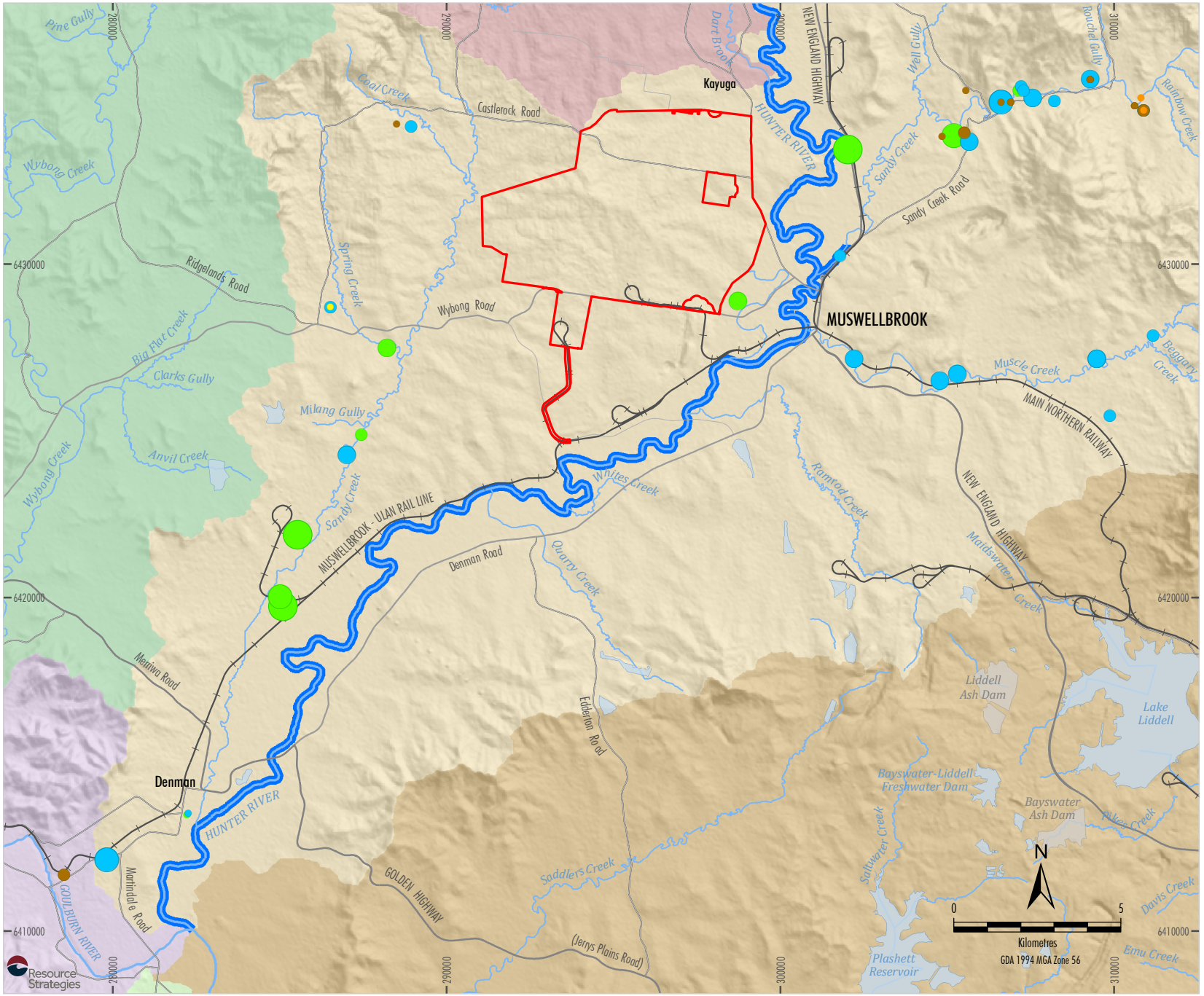
7.9.1 Methodology

The Surface Water Assessment (Appendix D) has been guided by the requirements of the SEARs for the Project, including recommendations from the DPIE – Water, EPA, OEH and MSC. The Surface Water Assessment has also been guided by the requirements of the following guidelines and policies:

- *Upper Hunter Strategic Regional Land Use Plan* (NSW Government, 2012a).
- *Hunter-Central Rivers Catchment Action Plan 2013–2023* (NSW Catchment Management Authority, 2013).
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council [ANZECC] and Agriculture and Resource Management Council of Australia and New Zealand [ARMCANZ], 2000) (ANZECC & ARMCANZ Guideline).
- *Managing Urban Stormwater Soils and Construction – Volume 2E Mines and Quarries* (DECC, 2008).
- *Managing Urban Stormwater, Soils and Construction* (Landcom, 2004).
- *Floodplain Development Manual: The Management of Flood Liable Land* (NSW Government, 2005).
- *Significant impact guidelines 1.3: Coal seam gas and large coal mining developments—impacts on water resources* (DotE, 2013a).

The Surface Water Assessment (Appendix D) has also considered the requirements of the relevant water sharing plans under the WM Act including (Figure 7-19):

- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009.*
- *Water Sharing Plan for the Hunter Regulated River Water Source, 2016.*



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Relevant Surface Water Sources

Figure 7-19

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7.9.2 Existing Environment

Regional Hydrology

The Mount Pleasant Operation is located within the catchment of the Hunter River. The Hunter River catchment has an overall size of 21,500 km^2, and includes the city of Newcastle and the major towns of Singleton and Muswellbrook. The Hunter River (Plate 7-14) is the main drainage feature within the catchment, rising on the northern side of the Barrington Tops (Mount Royal Range) and flowing south and then east through Muswellbrook and Singleton, before draining to the Pacific Ocean at Newcastle.

Plate 7-14 Hunter River

Source: (Appendix F).

The Hunter River contains a number of significant tributaries upstream of Muswellbrook, including the Pages and Isis Rivers, as well as the Middle, Dart, Stewarts, Moonan and Rouchel Brooks.

The Hunter River is defined as a 'Major Regulated River', meaning that it contains a number of water storages constructed along its length, which are operated to supplement river flow (DPI – Water, 2016). These water storages include the Glenbawn Dam and the Glennies Creek Dam.

The Glenbawn Dam is located approximately 16 km north-east of the Mount Pleasant Operation. The dam mainly serves as a flood mitigation measure for the surrounding area, as well as for supplying water to surrounding agriculture and industries. The dam has a current capacity of 750,000 ML, with potential for an additional 120,000 ML during flood events (WaterNSW, 2018a). Glennies Creek Dam is approximately 37 km south-east of the Mount Pleasant Operation and has a capacity of 283,000 ML (WaterNSW, 2018b).

Local Hydrology

The local drainage network in the vicinity of the Mount Pleasant Operation is shown on Figure 7-20.

The local drainage network is generally characterised by steep gullies which drain from the surrounding hills into the flat alluvial plains adjacent to the Hunter River.

The main drainage feature in the vicinity of the Mount Pleasant Operation is the Hunter River which flows in a southerly direction approximately 1 km to the east of the Mount Pleasant Operation.

There are a number of ephemeral drainage lines which traverse the Mount Pleasant Operation area and drain into the Hunter River. The eastern portion of the mining area drains via Rosebrook Creek (Plate 7-15), as well as other unnamed drainages.

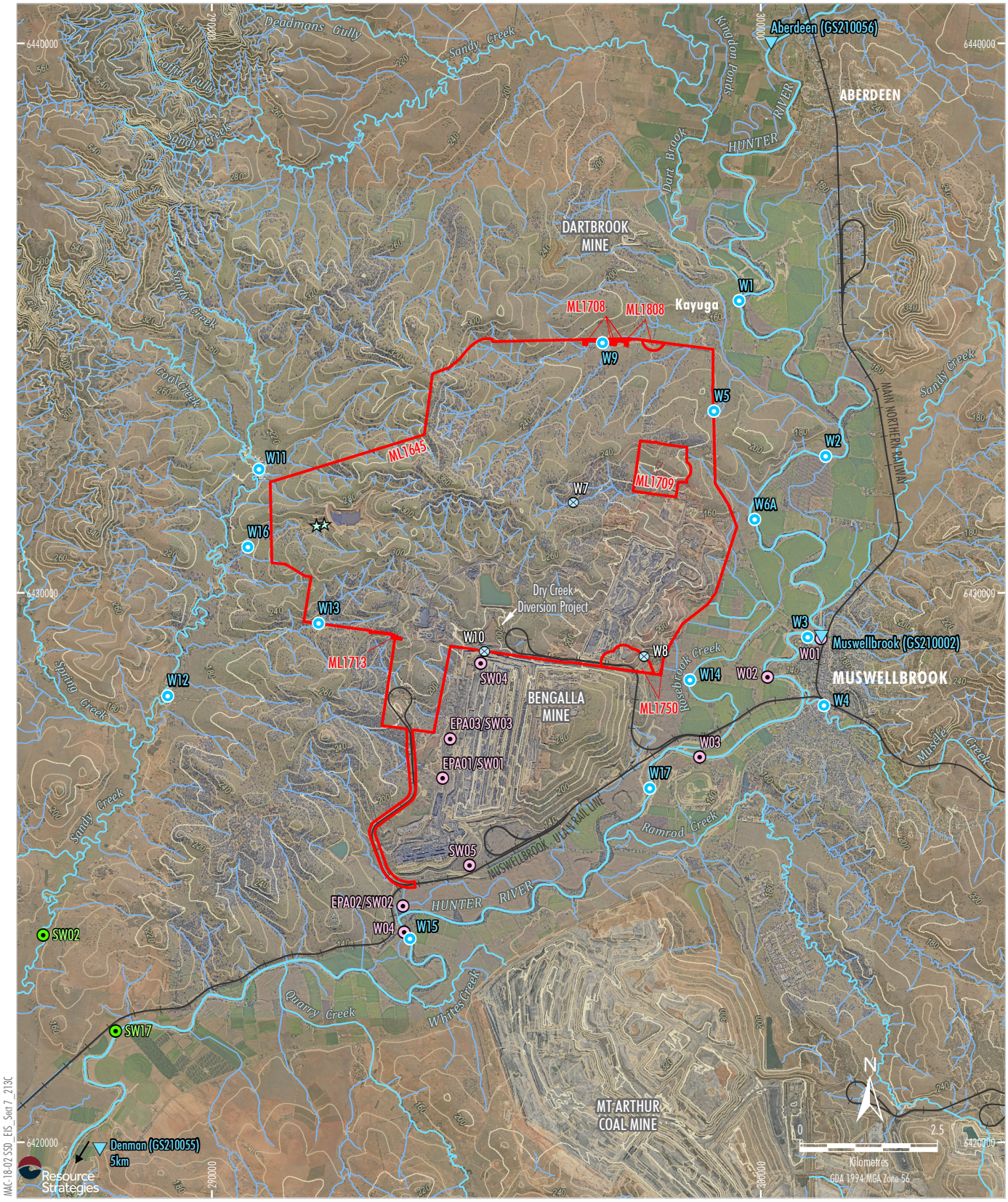
Plate 7-15 Rosebrook Creek

Source: Appendix F.

Areas in the south and west of the mining area drain via an unnamed drainage line (sometimes referred to as Dry Creek) and Sandy Creek (Plate 7-16) respectively, both of which are tributaries of the Hunter River.

Plate 7-16 Sandy Creek

Source: Appendix F.



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LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- DPIE Water Gauging Station

Mt Pleasant Monitoring

- Surface Water Monitoring Site
- Historical Surface Water Monitoring Site
- V-notch Weir

Mangoola Monitoring

- Surface Water Monitoring Site

Bengalla Monitoring

- Surface Water Monitoring Site

Source: MACH (2020); NSW Department of Primary Industries - Water (2016); Bengalla Mining Company (2015); Mangool Coal Operations Pty Ltd (2014); NSW Spatial Services (2020)
Orthophoto: MACH (2020)

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Surface Water Monitoring Locations

Figure 7-20

As evident in Plate 7-15 for much of the time the local ephemeral drainage lines are dry, generally only flowing for short periods following prolonged rainfall.

Surface Water Management and Monitoring

Mount Pleasant Operation

Surface water management and monitoring at the Mount Pleasant Operation is currently undertaken in accordance with the Site Water Balance, Erosion and Sediment Control Plan, Surface Water Management Plan and Surface and Ground Water Response Plan, which are components of the Water Management Plan.

The Site Water Balance describes the water management system at the Mount Pleasant Operation, tracks site water storage requirements through current water balance model predictions and outlines the on-site responsibilities with regard to the site water balance (e.g. monitoring of site water usage).

The Erosion and Sediment Control Plan outlines the erosion and sediment control strategy for the Mount Pleasant Operation including erosion and sediment control measures, design criteria and provisions for reporting on the effectiveness and performance of the system.

The Surface Water Management Plan outlines:

- the existing surface water conditions and baseline flow and water quality data relevant to the Mount Pleasant Operation;
- surface water impact assessment criteria and triggers;
- surface water management measures; and
- surface water monitoring.

The Surface and Ground Water Response Plan includes:

- trigger action response plans for potential downstream impacts on flow, water quality and stream health;
- processes to deal with a surface water-related complaint;
- a surface water impact investigation protocol; and
- a response plan, in the event that an investigation conclusively attributes an adverse impact on an existing surface water supply user to the Mount Pleasant Operation.

No surface water related complaints have been received in 2019 or 2020 (to the end of October).

As described in the Surface and Ground Water Response Plan, appropriate contingency measures for an impact on a private surface water supply user may include:

- notifying local landholders;
- providing an alternative water source for the duration of water quality impact caused by the incident/non-compliance;
- reviewing and refining the Surface Water Management Plan;
- reviewing and refining processes for inspection, maintenance and siting of water management infrastructure (e.g. dams, pipelines, pumps);
- repairing, replacing, or constructing new or enlarged water management infrastructure; and
- developing and implementing a training package specifically related to the cause of the incident/non-compliance.

The Environmental Management Strategy includes a Complaint Response Protocol to respond to community concerns that relate to surface water and other matters.

Other Mines

The Bengalla Mine's Dry Creek Diversion Project diverts the unnamed drainage line that drains the south of the Mount Pleasant Operation (Figure 7-20). The Dry Creek Diversion Project includes a clean water dam north of Wybong Road, a pump station and pipeline used to direct water around the Bengalla Mine and a protective contour levee to release water from the pipeline into an unnamed tributary of the Hunter River.

Bengalla Mining Company monitors a number of unnamed drainage lines and the Hunter River, downstream of the Mount Pleasant Operation. Relevant monitoring information from the Bengalla Mine has been considered in the Surface Water Assessment (Appendix D).

Part of Mangoola Coal's mining operations are also located within the Sandy Creek catchment. Accordingly, Mangoola Coal undertakes surface water and stream health monitoring in Sandy Creek. Relevant monitoring information has been considered in the Surface Water Assessment (Appendix D).

Baseline Surface Water Data

HEC (2020) has accessed relevant data from MACH and data made available by Commonwealth and State government agencies, including:

- rainfall and evaporation records from the BoM weather stations;
- rainfall records from the Mount Pleasant Operation weather station;
- DPIE – Water gauging station flow data on the Hunter River (Figure 7-20);
- water quality data from Mount Pleasant Operation, Bengalla Mine and Mangoola Coal monitoring sites (Figure 7-20); and
- water usage and water quality data from the Mount Pleasant Operation water management systems.

Flow Regime

The streams in the Mount Pleasant Operation area have ephemeral flow regimes (i.e. a very short flow duration during storm events only).

A summary of samples collected from local drainages in the Mount Pleasant Operation area is provided in Table 7-16. This indicates that, with the exception of Sandy Creek, the local surface water drainage systems were dry between 83% (site W13) and 100% (site W14) of the time that monitoring was undertaken.

Rosebrook Creek (site W14) has been dry each time it has been sampled, with 36 dry samples collected monthly since October 2017.

DPIE – Water monitor flow in the Hunter River (Plate 7-17) at three gauging stations in the vicinity of the Mount Pleasant Operation (Figure 7-20). Data from these gauging stations is summarised in Table 7-17. All three gauging stations monitor flow continuously.

Under current catchment conditions (since the construction of Glenbawn Dam was completed in 1958), the Hunter River is perennial, with a minimum flow rate at Aberdeen of approximately 13 ML/day (Table 7-17).

Flow duration curves since 1988 for each gauge are shown on Figure 7-21. These flow duration curves indicate that flow in the Hunter River is fairly consistent immediately upstream and downstream of the Mount Pleasant Operation, with some variation primarily due to periods of missing data.

Surface Water Quality

Figure 7-20 shows existing regional and local surface water quality monitoring sites and sampling locations in the vicinity of the Project. The water quality results from these locations are presented in Appendix D and summarised below.

Default guideline values for water quality were developed as part of the ANZECC & ARMCANZ (2000) Guideline.

The *Australian New Zealand Water Quality Guidelines* (Australian and New Zealand Guidelines [ANZG], 2018) have been developed to progressively supersede the ANZECC & ARMCANZ (2000) Guidelines. Where updated default guideline values are yet to be published under the ANZG (2018) Guidelines, adoption of the ANZECC & ARMCANZ (2000) Guideline default values is recommended (Appendix D).

Regional Surface Water Quality Data

Water quality data for the Hunter River is available from DPIE – Water gauging stations at Aberdeen (GS 210056), Muswellbrook (GS 210002) and Denman (GS 210055).

Daily average EC values recorded on the Hunter River upstream of the Mount Pleasant Operation (GS 210056) have ranged between 5 and 774 µS/cm, with 70% of the recorded data exceeding the default guideline value of 350 µS/cm for upland rivers in NSW. The EC levels increase with distance downstream on the Hunter River, ranging between 119 and 1,178 µS/cm at Denman (GS 210055) (Appendix D).

Grab sample records for each of the DPIE – Water gauging stations are discussed in Appendix D. In summary (Appendix D):

- The water quality in the Hunter River is predominately neutral to alkaline, although slightly acidic conditions have been recorded previously at Muswellbrook (GS 210002).
- Consistent with the daily average EC records, the grab samples indicate that EC in the Hunter River increases with distance downstream on the Hunter River.
- A maximum total iron concentration of 98 mg/L was recorded at Muswellbrook (GS 210002), with 3% of all samples exceeding the total iron default guideline value for primary industries (10 mg/L).

Table 7-16
Flow Frequency of Local Drainages

Site[1]	Location	Number of Samples	Number of Dry Samples	Frequency of Samples with Water Present
W5	Unnamed drainage line	235	231	1.7%
W7[2]	Unnamed drainage line	233	231	0.9%
W8[2]	Unnamed drainage line	204	171	16.2%
W9	Unnamed drainage line	238	225	5.5%
W10[2]	Dry Creek	201	200	0.5%
W13	Unnamed drainage line	36	30	16.7%
W14	Rosebrook Creek	36	36	0.0%
W16	Unnamed drainage line	7	1	85.7%

Source: Appendix D.

1 Refer Figure 7-20 for locations of monitoring sites.

2 Note these monitoring locations have since been disturbed by mining activities and are therefore no longer monitored.

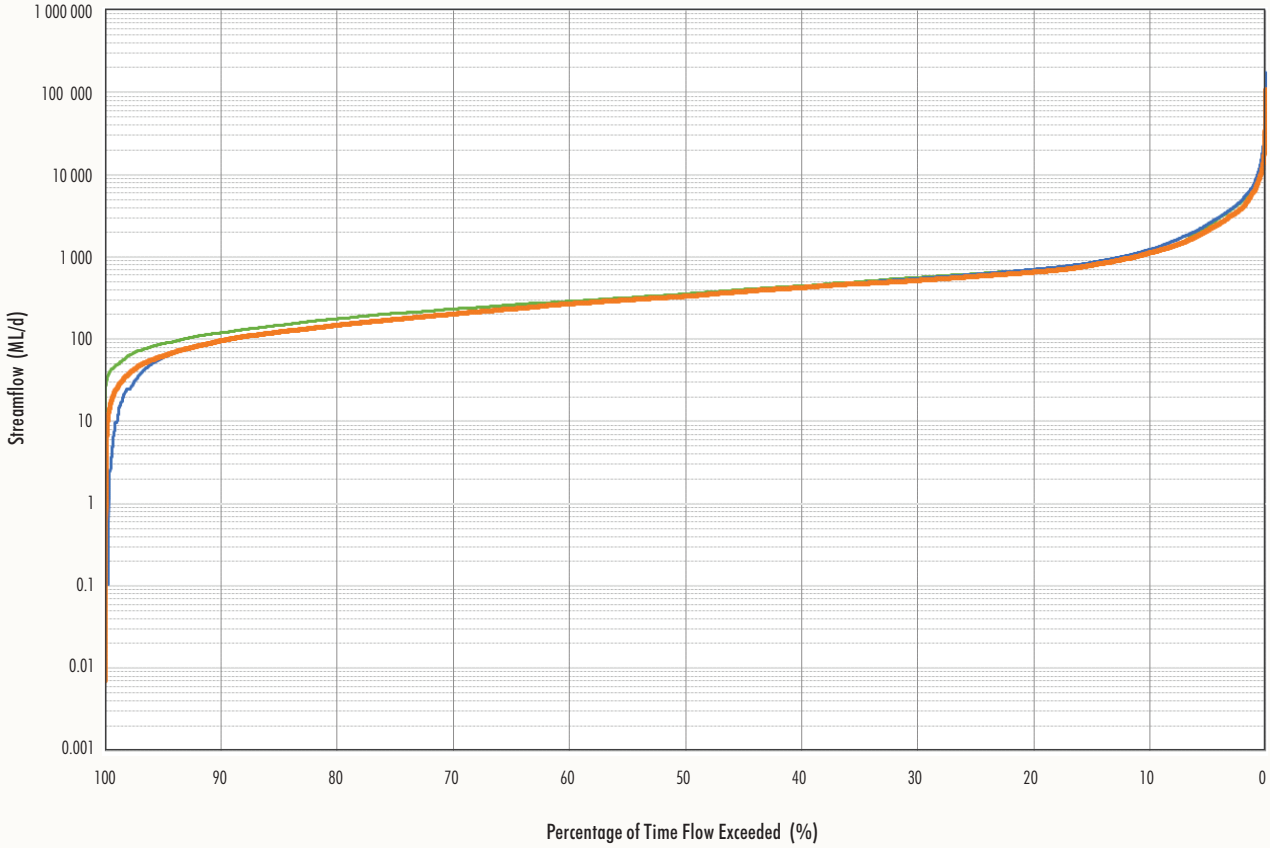
Table 7-17
Hunter River Streamflow

Monitoring Site	Monitoring Commenced	Percentage of Days with Data	Catchment Area (km^2)	Daily Flow (ML/day)*		
				Minimum	Median	Maximum
Aberdeen (GS210056)	1959	67%	3,090	13.3	359	99,042
Muswellbrook (GS210002)	1906	69%	4,220	0	343	175,831
Denman (GS210055)	1908	82%	4,530	0	336	109,287

* ML/day = Megalitres per day.

Source: Appendix D.

Plate 7-17 Hunter River at Kayuga Bridge



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Resource Strategies

LEGEND
- Aberdeen
- Muswellbrook
- Denman

Source: HEC (2020)

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Hunter River Flow Duration Curves

Figure 7-21

- The median and maximum total zinc concentrations recorded at Muswellbrook (GS 210002) and the maximum concentration recorded at Denman (GS 210055) exceeded the default guideline value for aquatic ecosystems.
- The median and maximum concentrations of phosphorus recorded at all sites exceeded the aquatic ecosystems default guideline value.

Local Surface Water Quality Data

Results of the water quality monitoring undertaken by MACH for sites on the Hunter River, Sandy Creek and Muscle Creek are discussed in Appendix D and summarised below.

The sampling results from the Hunter River indicate (Appendix D):

- The Hunter River from monitoring site W1 (upstream) to monitoring site W15 (downstream) ranges from slightly acidic to alkaline.
- The maximum pH values recorded at sites W2 and W6A were recorded prior to commencement of operations at the Mount Pleasant Operation.
- Total aluminium concentrations recorded at various sites on the Hunter River (upstream and downstream of the Mount Pleasant Operation) exceeded the default guideline value.

The maximum concentrations of total zinc and total copper recorded at all sites on the Hunter River exceeded the default guideline value.

- The maximum concentration of total lead recorded at site W2 exceeded the default guideline value and was recorded prior to the commencement of operations at the Mount Pleasant Operation.

The sampling results from Sandy Creek and Muscle Creek indicate (Appendix D):

- The pH in tributaries of Sandy Creek and Muscle Creek ranged from slightly acidic to alkaline.
- Higher EC values were recorded in Muscle Creek and Sandy Creek compared with sites in the Hunter River, with a maximum EC value of 8,410 µS/cm recorded at site W11 (Sandy Creek, upstream of the Mount Pleasant Operation).
- All records of total aluminium at site W4 on Muscle Creek and the maximum concentration recorded at site W12 on Sandy Creek exceeded the default guideline value.
- The maximum concentration of total zinc and total copper recorded at all sites on Muscle Creek and Sandy Creek exceeded the default guideline value.

The sampling results from the unnamed tributaries in the vicinity of the Project are summarised in Appendix D.

Water Management System

MACH monitors water quality in on-site water management storages in accordance with the Water Management Plan. Results of the water quality monitoring undertaken by MACH for the on-site water storages are discussed in Appendix D and summarised below.

The sampling results from the on-site water storages indicate (Appendix D):

- pH ranges between acidic and alkaline with the median value indicating alkaline conditions in all site storages except MW15 (in-pit).
- EC ranged between 189 µS/cm at MW7 (EDMIA) and 6,750 µS/cm at MW15 (in-pit).
- Total suspended solids ranged between less than 5 mg/L at MW3 (HWD) to 1,340 mg/L at MW2 (SD3), while oil and grease concentrations were low in all storages (5 mg/L or less).
- The concentrations of total cadmium, total mercury, total selenium and total silver were at or below the limit of detection in all site storages.
- A maximum concentration of 0.012 mg/L total arsenic was recorded at MW15 (in-pit) while the remainder of site storages recorded a total arsenic concentration at or below the limit of detection.
- Total aluminium concentrations ranged between 0.02 mg/L (MW5 and MW10) and 15.9 mg/L (MW2), total iron between the limit of detection (MW3, MW5, MW10 and MW15) and 9.7 mg/L (MW11), total manganese between 0.003 mg/L (MW8) and 3.3 mg/L (MW15) and total zinc between the limit of detection and 0.033 mg/L (MW11). The remainder of total metals were generally recorded at low concentrations in all storages.

A minimum value of pH 3.6 was recorded in-pit and is likely reflective of temporary, localised acid generating conditions (e.g. exposure of the Wynn Seam in the open cut) (Appendix D).

Surface Water Users

Hunter Regulated River Water Source

The Hunter River is a Major Regulated River, with flows regulated by Glenbawn Dam and Glennies Creek Dam. The Mount Pleasant Operation is located adjacent to the Hunter Regulated River Water Source Management Zone 1A, which extends from Glenbawn Dam to the Goulburn River confluence.

A summary of the water access licences in the Hunter Regulated River Water Source is provided in Table 7-18.

Muswellbrook Water Source

The Project is located wholly within the Muswellbrook Water Source, which is regulated under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009*.

The locations of water access licences in the Muswellbrook Water Source are shown on Figure 7-19 and summarised in Table 7-19.

Table 7-18
Hunter Regulated River Water Source – Water Access Licences

Category	Number of WALs	Total Shares
Domestic and stock	165	1,569
Domestic and stock (domestic)	60	144
Domestic and stock (stock)	21	103
Local water utility	5	10,832
Major utility (power generation)	1	36,000
Regulated river (general security)	827	128,544
Regulated river (high security)	156	21,740
Supplementary water	240	48,519

Source: NSW Water Register (2020).
WAL = water access licence.

Table 7-19
Muswellbrook Water Source – Water Access Licences

Category	Number of WALs	Total Shares
Aquifer	14	1169
Domestic and stock	15	81
Domestic and stock [domestic]	2	2
Domestic and stock [stock]	1	5
Unregulated river	24	636

WAL = water access licence.

There are two unregulated river licences located downstream of the Project on Sandy Creek:

- Water access licence 18701 has a total entitlement of 28 units and is located on land owned by Mangoola Coal, approximately 9 km downstream of ML 1645.
- Water access licence 18700 has a total entitlement of 5 units and is located in Denman, approximately 23 km downstream of ML 1645.

Flooding

The easternmost extent of the Mount Pleasant Operation mine landform is located outside of the 1% Annual Exceedance Probability (AEP) flood extent for the Hunter River (Appendix D). The potential for the mine landform to result in changes to flood depth, extent or velocity in the vicinity of the Mount Pleasant Operation is considered to be negligible (Appendix D).

Once constructed, the approved rail spur would cross the Hunter River floodplain, within the 1% AEP flood extent. The rail infrastructure has been designed to meet a range of flood risk management performance criteria, as defined in the Water Management Plan.

7.9.3 Potential Impacts

The potential impacts of the Project on surface water resources are described in Appendix D and summarised below.

Water Management System

The water management system for the Project is described in Section 3.11, and has been designed to comply with accepted best practice principles for mine site water management.

The objectives and design criteria of the Project site water management system would be to:

- protect the integrity of local and regional water resources;
- separate runoff from undisturbed, rehabilitated and mining-affected areas;
- design and manage the system to operate reliably throughout the life of the Project in all seasonal conditions, including both extended wet and dry periods;
- provide water for use in mining operations that is of sufficient volume and quality;
- maximise the re-use of water on-site; and
- manage groundwater inflows and CHPP process water on-site.

Key elements of the water management system comprise (Section 3.11):

- mine water storages;
- up-catchment runoff controls (e.g. temporary diversions);
- sediment and environmental dams;
- the Hunter River pump station; and
- other supporting infrastructure, including various pipelines and pumps.

Flow Regime

Catchment Excision During Mining

During active mining operations, the mine water management system would continue to capture runoff from areas that would have previously flowed to the receiving waters of the Hunter River and Sandy Creek.

The maximum area excised by the Project from the Hunter River catchment at the confluence with Dry Creek is estimated at 24.1 km^2 in Year 2047, equating to 0.55% of the total catchment area. This represents a modest increase to the total area excised by the originally approved Mount Pleasant Operation (20.1 km^2). With a mean annual flow volume of 287,102 ML in the Hunter River at Muswellbrook (GS 210002), the maximum reduction in mean annual flow due to the Project is estimated at 1,570 ML (0.55%). This represents a small and likely indiscernible impact to flow in the Hunter River (Appendix D).

The maximum area excised by the Project from the Sandy Creek catchment is estimated at 2.5 km^2 in 2041, equating to 5.3% of the total catchment area of Sandy Creek at Wybong Road. This is less than the predicted maximum area excised by the original approved Mount Pleasant Operation, which included two separate staged Fines Emplacement Areas in the Sandy Creek Catchment. MACH's Fines Emplacement Area is a single storage with staged downstream lifts and upstream clean water diversions, which reduces the area captured in the water management system (Appendix D).

The maximum area excised by the Project from Rosebrook Creek catchment is estimated at 12 km^2, equating to 63% of the total catchment area of Rosebrook Creek. The Project would result in no incremental change to the catchment of Rosebrook Creek relative to the currently approved mine life (2026), as mining is proposed to continue westwards, further up-catchment of Rosebrook Creek (i.e. the additional area that would be mined for the Project would otherwise drain to the mine water management system [Appendix D]).

The Dry Creek catchment has been heavily modified by the Bengalla Mine Dry Creek Project and is no longer a natural surface water system. While a moderate reduction in the catchment yield of Dry Creek is predicted based on the catchment area excised by the Project (maximum 20% reduction), the reduction in total flow volume is not considered material given the heavily modified nature of Dry Creek downstream of the Project (Appendix D).

Catchment Excision Post-mining

The Project maximum catchment excision would reduce post-mining, as rehabilitated areas are allowed to flow off-site. Residual catchment excision would be associated with areas of the final landform that drain to the final void rather than to the Hunter River (Section 3.17).

Post closure, the area excised from the Hunter River catchment would reduce to 8.1 km^2, which is estimated to equate to a reduction of 0.18% of the mean annual flow (525 ML). This is less than would have been excised by the original approved final landform for the Mount Pleasant Operation, given much of the original final landform drained internally, towards the various final voids (Appendix D).

Following rehabilitation, the catchment draining to Sandy Creek would be restored (i.e. no catchment is anticipated to be excised from Sandy Creek in the final landform) (Appendix D).

Post-closure, a 20% reduction of the pre-mining Rosebrook Creek catchment is estimated due to the Project (Appendix D). This would be very similar to the catchment reduction associated with the approved Mount Pleasant Operation.

Baseflow

Changes in groundwater-derived baseflow have been predicted by AGE Consultants (2020) for the Hunter Regulated River Water Source and the Hunter Unregulated and Alluvial Water Sources.

A maximum of 27 ML/year baseflow reduction is predicted during mining for the Hunter Regulated River Water Source and a maximum total of 8 ML/year for Sandy Creek and Dart Brook (Appendix D).

The total predicted reduction in baseflow from the Hunter River and its tributaries during mining (35 ML/year) amounts to approximately 0.01% of the 287,102 ML mean annual total flow in the Hunter River at Muswellbrook (GS 210002) (Appendix D).

Post-closure, the total predicted baseflow reduction from the Hunter River water source (51 ML/year) amounts to approximately 0.02% of the 287,102 ML mean annual total flow in the Hunter River at Muswellbrook (GS 210002).

Surface Water Flow

Accounting for both the predicted reduction in catchment yield and baseflow, the total reduction during mining (1,604 ML/year) amounts to approximately 0.56% of the mean annual total flow in the Hunter River at Muswellbrook (Appendix D).

Post-mining, the total reduction (576 ML/year) amounts to approximately 0.2% of the mean annual total flow at this location (Appendix D).

These forecast flow reductions represent a small and likely indiscernible impact to flow in the Hunter River at Muswellbrook during the Project and post-closure (Appendix D).

Surface Water Quality

Storage Overflows

The conceptual design of the proposed sediment dams has been undertaken in accordance with the Landcom (2004) and DECC (2008) guidelines (Appendix D). These guidelines provide for sediment dams to overflow (or discharge) when rainfall exceeds the design criteria of the dams (Appendix D).

Overflow from the sediment dams is predicted to occur during high rainfall events only. During these periods, the concentration of environmentally significant constituents in the sediment dams is likely to be low as inflow from catchment surface runoff would predominate over baseflow (seepage). This is supported by groundwater analysis by AGE Consultants (2020), which demonstrates the majority of seepage from the Eastern Out-of-Pit Emplacement would report to the Project and Bengalla Mine open cuts (Appendix D).

An average annual volume of 66 ML is predicted to overflow to Rosebrook Creek from sediment dams SD1 to SD7 based on the median model results and up to 125 ML based on the 95th percentile model results. An average annual volume of 66 ML overflow from sediment dams SD1 to SD7, based on the median model results, amounts to approximately 0.04% of the 181,000 ML median annual total flow in the Hunter River at Muswellbrook (GS 210002).

An average annual volume of 125 ML overflow from sediment dams SD1 to SD7, based on the 95th percentile model results, amounts to approximately 0.02% of the 732,200 ML 95th percentile annual total flow in the Hunter River (Appendix D).

The average EC of overflow from the sediment dams to Rosebrook Creek is predicted at 394 µS/cm based on the median model results. This EC value is within the range of baseline EC values recorded for local and regional surface water systems and is less than the threshold for 'saline water' defined in the HRSTS (400 µS/cm) (Appendix D).

HEC (2020) has undertaken a detailed review of water quality constituents likely to be present in the overflow water from sediment dams. This review indicates (Appendix D):

- The level of constituents in SD1 and SD3 following rainfall events is generally within the range of levels recorded in the Hunter River during the corresponding period.
- The concentrations of total manganese, total nickel and total arsenic in SD1 and SD3 have also been consistently below the relevant default guideline values.
- The constituents present in the sediment dams during overflow periods are likely to be highly diluted by incident rainfall and flow in the Hunter River, and therefore the impact of sediment dam overflow on downstream water quality is expected to be negligible.

No overflows are predicted to Sandy Creek based on the surface water modelling (Appendix D).

A very low risk of overflow from ED3 to Dry Creek is predicted based on all model results. The percentage of annual overflow days from ED3 to Dry Creek is estimated at 0.84% based on model simulations, which is less than the 1% AEP spill risk design criterion (i.e. ED3 is predicted to spill only once in more than 100 years). The constituents present in ED3 during overflow periods would be highly diluted and therefore the impact of overflow from ED3 on downstream water quality is expected to be negligible (Appendix D).

Controlled Releases to the Hunter River

Controlled releases undertaken for the Project under the HRSTS would comprise a very small component of the flow in the Hunter River (as governed by the discharge rules of the HRSTS) and dilution would be substantial (Appendix D).

The average annual Hunter River release volume is predicted to be 469 ML based on the median model results. This compares with the median annual total flow in the Hunter River at Muswellbrook (GS 210002) of approximately 181,000 ML, meaning the forecast maximum median discharge represents 0.26% of the recorded median annual river flow (Appendix D).

Similarly, an average annual release volume of 909 ML based on the 95th percentile model results is predicted. This compares with a 95th percentile annual flow recorded in the Hunter River at Muswellbrook (GS 210002) of approximately 732,200 ML, meaning the forecast 95th percentile discharge represents approximately 0.12% of the recorded 95th percentile annual river flow (Appendix D).

The 95th percentile annual release volume of 909 ML is comparable to the predicted 95th percentile annual release volume predicted for the approved Mount Pleasant Operation (Appendix D).

HEC (2020) has undertaken a detailed assessment of the concentration of key constituents in the Hunter River downstream of the discharge, based on the simulated release volumes for the Project and the water quality data available for the Mount Pleasant Operation.

The assessment focused on constituents with a water quality objective and constituents which were recorded above the limit of detection in the MWD (i.e. turbidity, total manganese, total nickel and total aluminium). The assessment determined (Appendix D):

- The median levels of turbidity and total aluminium recorded in the Hunter River exceed the water quality objectives under baseline conditions.
- The maximum levels of turbidity, total manganese and total aluminium recorded in the MWD are lower than the median levels recorded in the Hunter River and, as such, the level of these constituents is not expected to increase as a result of release from the Mount Pleasant Operation to the Hunter River.
- The maximum concentration of total nickel recorded in the MWD was higher than the maximum concentration recorded in the Hunter River, potentially due to elevated levels of Nickel that naturally occur in the local catchment (as observed at monitoring sites W8 and W16).
- During mining, a slight increase in the total nickel concentration in the Hunter River may occur under high release conditions. Notwithstanding, the total nickel concentration is expected to remain below the water quality objective.

Final Void

The accumulation of surface runoff combined with groundwater inflows would result in the formation of a pond of water in the void which would rise until the average rate of inflow is balanced by evaporation from its surface.

HEC (2020) has simulated the long-term behaviour of the final void. Groundwater inflows were modelled using a storage level versus flow relationship developed from the groundwater model by AGE Consultants (2020).

The simulated water level in the final void reaches a maximum of approximately 90 m AHD, which is more than 110 m below the spill level (i.e. the final void waterbody would be contained under all climate scenarios) (Appendix D).

Cumulative Impacts

The Mount Pleasant Operation is situated immediately to the south of Dartbrook Mine and immediately to the north of Bengalla Mine and in the vicinity of the Muswellbrook Coal Mine, Mt Arthur Coal Mine and Mangoola Coal.

These mines operate in a highly regulated water system with licensing of water take undertaken in accordance with the WM Act and release of water undertaken in accordance with the HRSTS, the relevant Development Consent and the EPL for each site.

Due to the highly regulated system in which the Mount Pleasant Operation and adjacent mines operate, the cumulative impacts on the Hunter River due to the Project are expected to be negligible (Appendix D).

The Mangoola Coal mine area is partially located in the Sandy Creek catchment downstream of the Mount Pleasant Operation.

The maximum area of the Sandy Creek catchment to be excised by Mangoola Coal is estimated at 3.14 km^2 in 2021 which equates to approximately 2.3% of the total catchment area of Sandy Creek. The maximum area of the Sandy Creek catchment to be excised by the Project is approximately 2.5 km^2 (Appendix D).

Mangoola Coal and the Project would result in a cumulative maximum reduction of 3.9% of the total catchment area of Sandy Creek to the confluence with the Hunter River, which is less than would otherwise have occurred under the originally approved Mount Pleasant Operation (Appendix D).

No overflow from the Fines Emplacement Area or other water management structures to Sandy Creek is predicted to occur. As such, it is highly unlikely that the Project would result in additional impacts to the water quality of Sandy Creek.

Matters of National Environmental Significance

A delegate of the Commonwealth Minister determined on 26 August 2020 that the proposed action is a “controlled action” and therefore the action requires approval under the EPBC Act.

The elements of the Project which require EPBC Act approval exclude activities that are already approved under the existing EPBC Act approval (which largely mirrors the project approved under the original EIS). Therefore, the consideration of potential impacts on MNES is focused on the incremental impacts of the Project relative to the original EPBC Act approval.

Potential Impacts on Hydrological Characteristics

The Significant Impact Guidelines for Water Resources provide the following guidance on potential impacts of an action on hydrological characteristics:

> *A significant impact on the hydrological characteristics of a water resource may occur where there are, as a result of the action:*
>
> *a) changes in the water quantity, including the timing of variations in water quantity*
>
> *b) changes in the integrity of hydrological or hydrogeological connections, including substantial structural damage (e.g. large scale subsidence)*
>
> *c) changes in the area or extent of a water resource where these changes are of sufficient scale or intensity as to significantly reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes.*

The Project would result in the following changes relative to the originally approved Mount Pleasant Operation:

- A reduction in the area captured from the Sandy Creek catchment.
- No incremental change in the area captured from the Rosebrook Creek catchment.
- A negligible increase in the area captured from the Hunter River catchment.

Water pumped from the Hunter River for Project water supply would continue to be extracted in accordance with MACH’s existing water access licences entitlements (Appendix D). It is noted that mining uses of Hunter River regulated flows represented 8% of total flows in 2018, relative to 65% for other water uses (Appendix I).

Therefore, the Project is not considered to have a significant impact on surface water hydrology (Appendix D).

Potential Impacts on Water Quality

The Significant Impact Guidelines for Water Resources provide the following guidance on potential impacts of an action on water quality:

> *A significant impact on a water resource may occur where, as a result of the action:*
>
> *a) there is a risk that the ability to achieve relevant local or regional water quality objectives would be materially compromised, and as a result the action:*
>
> i. *creates risks to human or animal health or to the condition of the natural environment as a result of the change in water quality*

ii. substantially reduces the amount of water available for human consumptive uses or for other uses, including environmental uses, which are dependent on water of the appropriate quality

iii. causes persistent organic chemicals, heavy metals, salt or other potentially harmful substances to accumulate in the environment

iv. seriously affects the habitat or lifecycle of a native species dependent on a water resource, or

v. causes the establishment of an invasive species (or the spread of an existing invasive species) that is harmful to the ecosystem function of the water resource, or

b) there is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives), or

c) high quality water is released into an ecosystem which is adapted to a lower quality of water.

The conceptual design of the proposed sediment dams has been undertaken in accordance with the Landcom (2004) and DECC (2008) guidelines (Appendix D).

Controlled releases of water to the Hunter River would continue to be undertaken in accordance with the HRSTS and relevant EPL conditions (Appendix D).

The Project is not predicted to result in any discernible deterioration in water quality in Sandy Creek, Rosebrook Creek or the Hunter River. Therefore, the Project is not considered to have a significant impact on surface water quality (Appendix D).

Consideration of Cumulative Impacts

The Significant Impact Guidelines for Water Resources require the action to be:

> *considered with other developments, whether past, present or reasonably foreseeable developments.*

Consideration of cumulative impacts is presented in Appendix D, including:

- Consideration of potential cumulative impacts of the Project and Mangoola Coal on the Sandy Creek catchment.
- Consideration of potential cumulative impacts in the Hunter River catchment, which is a highly regulated water system with various regulatory frameworks established to manage cumulative impacts.

The Project's incremental contribution to any potential cumulative impacts on surface water quality, flow or availability are expected to be negligible (Appendix D).

Consideration of Potential for Significant Impact

Based on the assessment presented above, the action would not result in significant changes to the quantity or quality of water available to third party users or the environment as described in the Significant Impact Guidelines for Water Resources. Accordingly, the action would not have a significant impact on water resources on a local, regional, state or national scale.

7.9.4 Mitigation Measures and Monitoring

Surface Water Licensing

MACH would comply with water licensing requirements under the WM Act over the life of the Project.

Water Management Plan

The existing Water Management Plan would be reviewed and revised to incorporate the Project subject to the conditions of any Development Consent for the Project.

The Water Management Plan describes the operational site water management system and would include provisions for review of the site water balance, erosion and sediment controls, surface water (and groundwater) monitoring and management.

The Water Management Plan would describe the water management protocols and response procedures for the water management system that would be adhered to throughout the operation of the Project.

Erosion and Sediment Control

The Erosion and Sediment Control Plan would be reviewed and updated for the Project (i.e. to address additional surface disturbance areas and relevant construction activities) subject to the conditions of any Development Consent for the Project.

The Erosion and Sediment Control Plan identifies activities that could cause soil erosion and generate sediment and describes the specific controls (including locations, function and structure capacities) to minimise the potential for soil erosion and transport of sediment off-site.

Surface Water Management and Monitoring

The existing surface water monitoring program, which is included in the Surface Water Management Plan, would be retained for the Project and updated (i.e. with respect to monitoring parameters and frequency) subject to the conditions of any Development Consent for the Project.

The surface water monitoring program would be updated to include the full suite of analytes considered in the Geochemistry Assessment (Appendix K).

Water quality monitoring would continue to be undertaken in accordance with the ANZECC and ARMCANZ (2000) guidelines and the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (NSW Department of Environment and Conservation [DEC], 2004).

7.9.5 Adaptive Management

Surface and Ground Water Response Plan

The existing Surface and Ground Water Response Plan, which is included in the Water Management Plan for the Mount Pleasant Operation, would be reviewed and revised for the Project subject to the conditions of any Development Consent for the Project.

The Surface and Ground Water Response Plan would describe any additional measures and procedures that would be implemented over the life of the Project to respond to any potential exceedances of surface water related criteria and contingent mitigation, compensation, and/or offset options if downstream surface water users are adversely affected by the Project.

Water Balance

The water consumption requirements and water balance of the system would fluctuate based on varying climatic conditions and as the extent of the mining operation changes over time.

Review and progressive refinement of the site water balance would continue to be undertaken periodically over the life of the Project to record the status of inflows (water capture), storage and consumption (e.g. CHPP usage, Fines Emplacement Area return water, dust suppression and discharges) and to optimise water management performance.

MACH would adaptively apply supplementary water management measures during low rainfall periods to maintain water supply.

This may include:

- Use of chemical dust suppressants to reduce haul road dust suppression water requirements.
- Obtaining additional water access licences.
- Sourcing water from other external sources, such as excess mine water from the adjoining mines (i.e. Dartbrook and Bengalla Mines). Should this water sharing be undertaken, it would be subject to MACH and other relevant parties obtaining all necessary secondary approvals.

7.10 TERRESTRIAL ECOLOGY

A BDAR containing a terrestrial ecology assessment and Biodiversity Offset Strategy has been prepared for the Project by Dr Colin Driscoll (Hunter Eco) (2021) and is presented in Appendix E.

A description of the methodology relevant to the assessment of terrestrial ecology is provided in Section 7.10.1, and a description of the existing environment is provided in Section 7.10.2. Section 7.10.3 provides an assessment of the potential impacts of the Project on terrestrial ecology, while Sections 7.10.4 and 7.10.5 describe measures to mitigate impacts of the Project and adaptive management, respectively. Section 7.10.6 describes the proposed Biodiversity Offset Strategy.

7.10.1 Methodology

Biodiversity Development Assessment Report

The BDAR (Appendix E) was prepared in accordance with the SEARs for the Project and relevant State and Commonwealth requirements. The NSW *Biodiversity Assessment Method* (BAM) (OEH, 2017) was applied.

The BDAR (Appendix E) assesses the estimated Additional Disturbance Area of Project extensions, including two alternative alignments of the western section of the revised Northern Link Road (Figure 1-4). Option 1 is the currently preferred option as it skirts the ML boundary and would have a clearance area of approximately 27.4 ha of native vegetation. Option 2 is the less preferred option and would have a clearance area of approximately 23.3 ha of native vegetation (including approximately 10.3 ha of native vegetation outside of the approved surface development area). Only one of these options would be developed, with the final alignment to be selected based on detailed engineering design and any associated land access constraints.

The BDAR (Appendix E) provides an assessment of the impacts on Commonwealth threatened species and communities for EPBC 2020/8735, relating directly to the alternative of the revised Northern Link Road alignments (the Action) as described in Section 3.5.2.

A portion of the approved surface development area of the Mount Pleasant Operation would be relinquished (not cleared) as part of the Project. These areas were referred to as the 'land swap option' in the SEARs but are collectively assessed as the Relinquishment Area in the BDAR (Appendix E).

Extensive flora and fauna surveys have been conducted in the vicinity of the Project, most recently in 2018, 2019 and 2020 by Hunter Eco (2020) and Future Ecology (2020). These survey reports are included in the BDAR (Appendix E) and the relevant methodology is summarised below.

Baseline Flora Report

Hunter Eco (2020) assessed a study area encompassing the Project Additional Disturbance Area and surrounds for the following:

- native vegetation;
- occurrence of threatened ecological communities listed under the BC Act and EPBC Act;
- vegetation integrity; and
- presence of threatened flora species and populations.

The flora surveys were undertaken across multiple seasons in accordance with the BAM (OEH, 2017) and the *Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (DPIE, 2020b).

The surveys by Hunter Eco (2020) included sampling of vegetation integrity plots, collection of rapid data points, identification of PCTs and targeted searches for threatened ecological communities, species and populations.

Hunter Eco (2020) also reviewed the results of previous flora surveys conducted by ERM Mitchell McCotter (1997a), Cumberland Ecology (2006, 2007, 2009a, 2010 and 2015a), Eco Logical Australia (ELA) (2016) and Hunter Eco (2017a and 2017b).

A detailed description of the flora survey methodology undertaken for the Project is provided in Attachment A of Appendix E.

Baseline Fauna Survey Report

Future Ecology (2020) undertook targeted searches for threatened fauna species listed under the BC Act and/or EPBC Act that were known, or likely to occur, in the Project Additional Disturbance Area and surrounds.

This included searches for 'species credit species', which are threatened species or components of species habitat that are identified in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020c) as requiring assessment for 'species credits'.

The fauna surveys were undertaken across multiple seasons in accordance with the BAM (OEH, 2017), '*Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method* (OEH, 2018) and the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020c).

Fauna survey techniques included habitat assessments, diurnal bird surveys, call-playback, spotlighting, Elliott trapping, cage trapping, hair tubes, camera trapping, nest boxes, harp trapping, mist netting, ultrasonic bat detection, roost searches, Koala (*Phascolarctos cinereus*) scat searches and Spot Assessment Technique surveys, reptile active searches, pitfall trapping, funnel trapping and opportunistic observations (Future Ecology, 2020).

Future Ecology (2020) also reviewed the results of previous fauna surveys conducted by ERM Mitchell McCotter (1997a), Cumberland Ecology (2006, 2009a and 2010) and ELA (2017a and 2017b).

A detailed description of the methodology employed by Future Ecology (2020) is provided in Attachment B of Appendix E.

7.10.2 Existing Environment

Landscape Features

The majority of the Project Additional Disturbance Area has been cleared and used for agricultural grazing purposes for well over 100 years. The landforms in the Project Additional Disturbance Area comprise undulating hills on open paddock grazing land. The area is drained by a number of intermittent creeks and unnamed ephemeral drainage lines. Drainage features in the vicinity of the Project are described in Section 7.9.2 and shown on Figure 7-20.

There are no Areas of Outstanding Biodiversity Value listed under the NSW *Biodiversity Conservation Regulation, 2017* (BC Regulation) associated with the Project, or defined potential flyways for migratory species listed under the EPBC Act that pass over the Project Additional Disturbance Area (Appendix E).

Native Vegetation and Threatened Ecological Communities

Seven PCTs were identified within the Project Additional Disturbance Area and surrounds (Figure 7-22) (Appendix E). Several of these PCTs were present in both woodland form and derived native grassland (DNG) form (Plates 7-18 and 7-19).

Due to former and present land use, the Project Additional Disturbance Area is mostly DNG with some fragmented native woodland/forest vegetation. Areas without native vegetation comprise cropping/grazing, waterbodies (dams), disturbed land, dwellings, local roads and existing infrastructure.

Plate 7-18 Grey Box x White Box Grassy Woodland (PCT 483)
Source: Hunter Eco (2020).

Plate 7-19 Derived Native Grassland (PCT 483)
Source: Hunter Eco (2020).

Despite the degraded nature of the vegetation present (compared to the woodland/forest that was once present), most of the vegetation to be cleared in the Project Additional Disturbance Area comprises two threatened ecological communities listed under the BC Act (Figure 7-22) (Appendix E).

Threatened Flora Species and Populations Listed Under the BC Act

One threatened flora species has been recorded during recent surveys, namely Tiger Orchid (*Cymbidium canaliculatum*). This species is a component of the *Cymbidium canaliculatum* population in the Hunter Catchment Endangered Population under the BC Act (Hunter Eco, 2020) (Figure 7-23) (Appendix E).

Threatened Fauna Species Listed Under the BC Act

Future Ecology (2020) recorded a number of threatened fauna species listed under the BC Act that are 'ecosystem credit species' (i.e. species that can be predicted to be present based on a habitat assessment) within or adjoining the Project Additional Disturbance Area as detailed in Attachment B of Appendix E.

Two 'species credit species' (as defined by the *BioNet Threatened Biodiversity Data Collection*) (DPIE, 2020c) were present in habitat located either within or adjoining the Project Additional Disturbance Area during the present surveys, namely the Striped Legless Lizard (*Delma impar*) and Squirrel Glider (*Petaurus norfolcensis*) (Future Ecology, 2020) (Figure 7-23) (Appendix E).

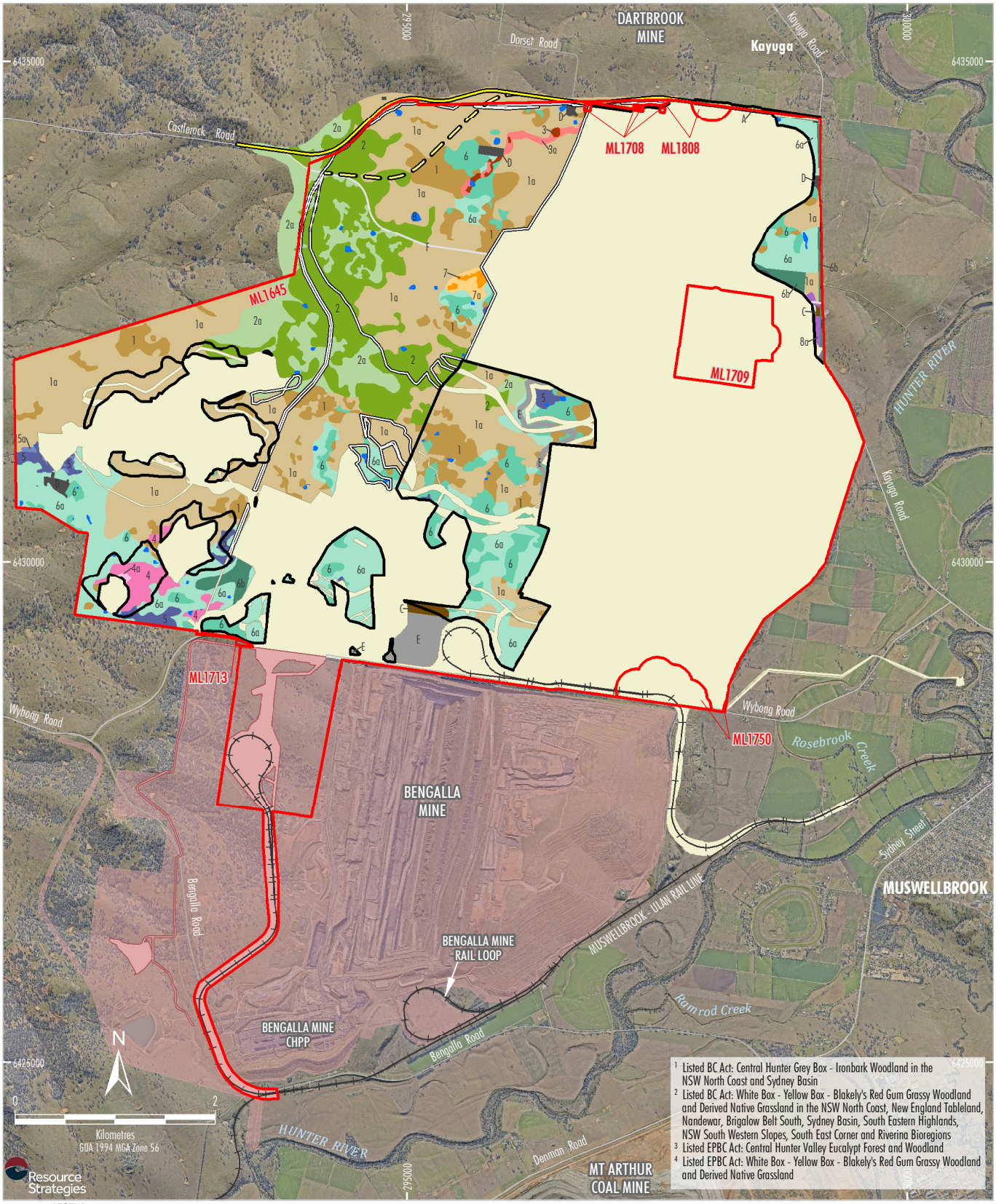
Habitat polygon maps were prepared for these species, in accordance with the BAM (OEH, 2017) and are provided in Appendix E. A 'species polygon' shows the area of suitable fauna species habitat for a 'species credit species', in circumstances where a survey confirms the species is present or likely to use the habitat.

Introduced Flora

Of the 253 flora species identified during surveys, 78 species were weeds, including 18 species recognised as High Threat Exotics (Hunter Eco, 2020) (Attachment A of Appendix E).

Introduced Fauna

Of the 176 fauna species recorded during the surveys, 13 species were introduced (Future Ecology, 2020) (Attachment B of Appendix E).



[1] Listed BC Act: Central Hunter Grey Box - Ironbark Woodland in the NSW North Coast and Sydney Basin
[2] Listed BC Act: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions
[3] Listed EPBC Act: Central Hunter Valley Eucalypt Forest and Woodland
[4] Listed EPBC Act: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland

LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Project Continuation of Existing/Approved Surface Development (DA92/97)
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Existing/Approved Mount Pleasant Operation Infrastructure within Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Approximate Additional Disturbance of Project Extensions
- Approved Disturbance Area to be Relinquished
- Northern Link Road Option 1 Centreline*
- Northern Link Road Option 2 Centreline

Grassy Woodlands

- 1 Grey Box x White Box Grassy Woodland (PCT483) [2, 4]
- 1a Derived Native Grassland (PCT483) [2, 4]
- 2 Grey Box x White Box - Spotted Gum Grassy Woodland (PCT483) [2, 4]
- 2a Derived Native Grassland (PCT483) [2, 4]
- 3 Forest Red Gum Grassy Open Forest (PCT618) [2, 4]
- 3a Derived Native Grassland (PCT618) [2, 4]
- 4 Narrow-leaved Ironbark - Grey Box Grassy Woodland (PCT1691) [1, 3]
- 4a Derived Native Grassland (PCT1691)

Dry Sclerophyll Forests (Shrub/grass sub-formation)

- 5 Spotted Gum - Narrow-leaved Ironbark Woodland (PCT1602) [3]
- 5a Derived Native Grassland (PCT1602)
- 6 Narrow-leaved Ironbark Shrubby Forest (PCT1605) [3]
- 6a Derived Native Grassland (PCT1605)
- 6b Plantation (PCT1605)
- 7 White Box - Narrow-leaved Ironbark - Blakely's Red Gum (PCT1606) [2, 4]
- 7a Derived Native Grassland (PCT1606) [2, 4]

Dry Sclerophyll Forests (Shrubby sub-formation)

- 8a Derived Native Grassland (PCT1655)

Other

- A Cropping/Grazing
- B Dam
- C Disturbed
- D Dwellings
- E Infrastructure
- F Local Roads

Source: MACH (2020); Hunter Eco (2020); NSW Spatial Services (2020); Department of Planning and Environment (2016) Orthophoto: MACH (2020)

* Preferred alignment subject to landholder access.

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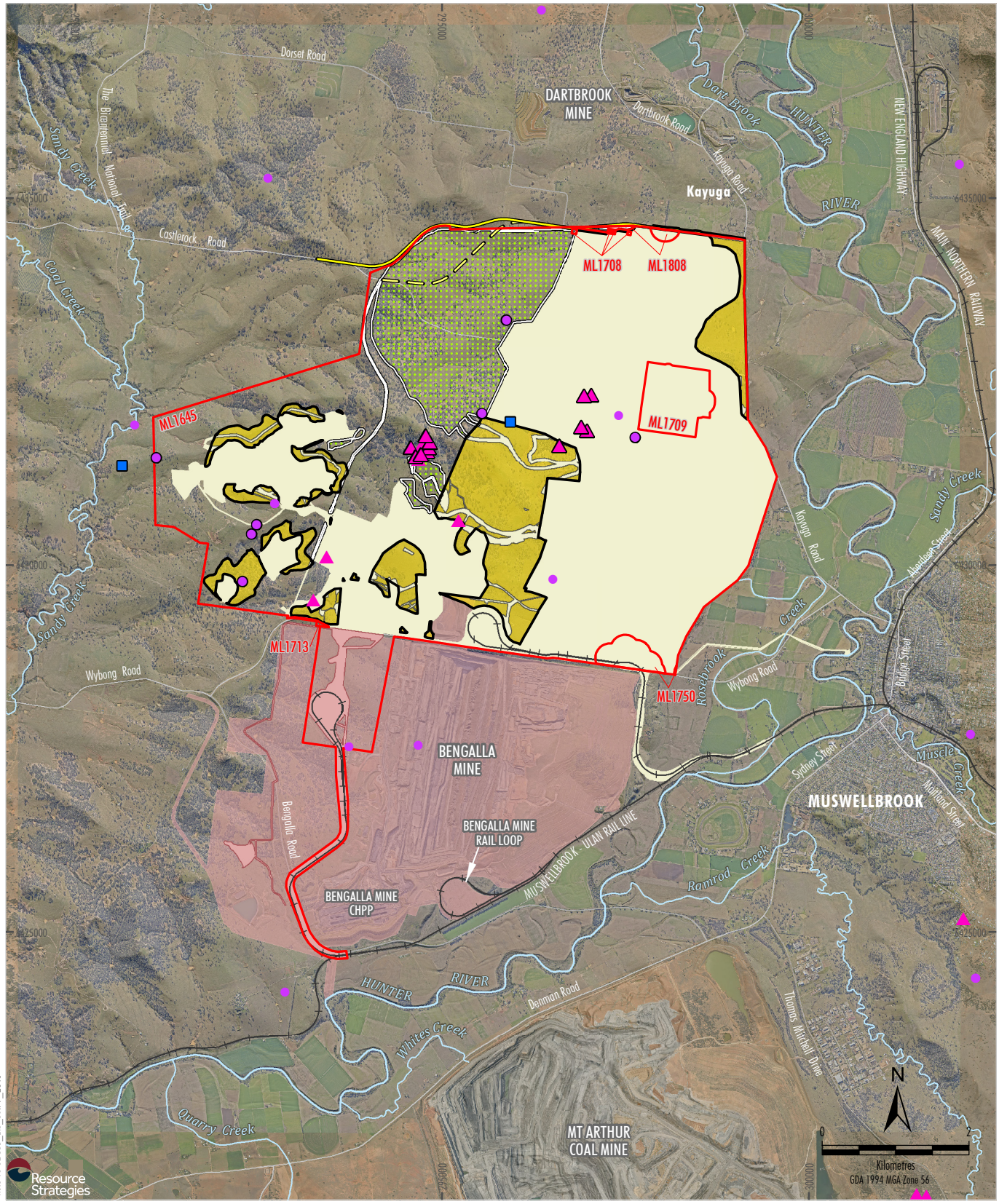
MOUNT PLEASANT OPTIMISATION PROJECT

Vegetation Mapping

Figure 7-22



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Project Continuation of Existing/Approved Surface Development (DA92/97)
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Existing/Approved Mount Pleasant Operation Infrastructure within Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Approximate Additional Disturbance of Project Extensions
- Approved Disturbance Area to be Relinquished
- Northern Link Road Option 1 Centreline*
- Northern Link Road Option 2 Centreline

Survey / Database

Threatened Species

- Striped Legless Lizard
- Squirrel Glider
- Tiger Orchid (*Cymbidium canaliculatum* population in the Hunter Catchment)

Survey Record Sources: Future Ecology (2020a, 2020b); Eco Logical Australia (2017b)
Database Record Sources: ALA (2020); DPIE (2020)

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

* Preferred alignment subject to landholder access.

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Species Credit Species Relevant to the Project

Figure 7-23

Threatened Species and Ecological Communities Listed Under the EPBC Act

Two threatened fauna species listed under the EPBC Act were recorded during the surveys by Future Ecology (2020) within or adjoining the Action area, namely the Striped Legless Lizard and Grey-headed Flying-fox (*Pteropus poliocephalus*) (Appendix E).

One additional threatened fauna species listed under the EPBC Act was previously recorded, namely the White-throated Needletail (*Hirundapus caudacutus*). This species is an aerial bird that is not associated with native vegetation in the Action area (Appendix E).

One threatened ecological community listed under the EPBC Act was identified within the Action area, comprising PCTs 483, 618 and 1606 (Figure 7-22) (Appendix E).

7.10.3 Potential Impacts

The potential direct and indirect impacts of the Project on terrestrial ecology have been assessed in the BDAR (Appendix E). The potential impacts and measures to avoid and minimise them are described below.

Measures to Avoid and Minimise Impacts

Avoidance and minimisation of potential biodiversity impacts have been considered in the site selection, design, construction, operation and rehabilitation for the Project, where practical.

A number of measures to avoid and minimise impacts on biodiversity are currently implemented at the Mount Pleasant Operation, and these would be continued for the Project.

Site Selection

The Project involves an expansion of the existing approved and operating open cut within the Mount Pleasant Operation MLs. The new mining areas associated with the Project are largely contiguous with the existing approved and operating open cut, thereby minimising disturbance areas that would otherwise be associated with a separate mine.

Project Design

At a broad level, the Project has been designed to avoid or minimise impacts on biodiversity values through (Appendix E):

- maximising re-use and expansion of existing infrastructure;
- maximising infilling of existing infrastructure areas (existing disturbed areas) avoiding the need for a larger development envelope;
- placement of new infrastructure within the extent of approved disturbance areas in lieu of infrastructure no longer required; and
- optimising the capacity of the existing Fines Emplacement Area by employing contemporary emplacement methodology.

Construction and Operation

Progressive vegetation and soil clearing would be undertaken ahead of the advancing open cuts and a vegetation clearing protocol would be implemented. The vegetation clearing protocol includes best practice measures to avoid accidental clearance of vegetation to be retained.

Relinquishment Area

In addition to the measures described above, development within a number of existing approved disturbance areas would be forgone (not cleared) which would reduce the residual biodiversity impacts from the Project.

The BAM Calculator was applied to the Relinquishment Area to calculate the biodiversity credits that would otherwise need to be offset if the clearance were to occur. These biodiversity credits were applied to the overall credit requirement for the Project Additional Disturbance Area and used to calculate the residual biodiversity impacts.

Rehabilitation

A mixture of pasture and woodland would be established in the final land use following decommissioning and rehabilitation of Project infrastructure to minimise long-term impacts to vegetation and habitat.

Direct Impacts

The Project would result in the clearance of approximately 458.8 to 475.9 ha of native vegetation (depending on the Northern Link Road option). This area is mostly DNG (approximately 303.4 to 315.4 ha, 66.10% to 66.3%) with some native woodland/forest (approximately 155.4 to 160.5 ha, 33.7% to 33.9%) (Table 7-20) (Appendix E).

The total amount of native vegetation to be disturbed for the Project Additional Disturbance Area is slightly less than the total amount of native vegetation within the Relinquishment Area (approximately 484.9 to 497.9 ha) (Appendix E). Although less native vegetation would be cleared overall, it is recognised that there would be a net additional impact (approximately 66.2 ha) on three PCTs that are less represented in the Relinquishment Area (namely, PCTs 1691, 1602 and 1605) (Appendix E).

After applying the measures to avoid and/or minimise impacts on biodiversity values described above, there would be a net benefit on native vegetation and habitat because of (Appendix E):

- less clearance of native vegetation compared to the current approved mine;
- less clearance of *Box-Gum Woodland CEEC*[1];
- less clearance of habitat for the Striped Legless Lizard and Squirrel Glider compared to the current approved mine; and
- less clearance of Tiger Orchids compared to the current approved mine.

A number of measures to mitigate residual impacts on biodiversity would be implemented (Section 7.10.4).

Cumulative Impacts

Cumulative impacts are considered to be the total impact on the environment that would result from the incremental impacts of the Project in addition to past, present and reasonably foreseeable planned developments that may interact with Project impacts (Appendix E).

Development of the existing Mount Pleasant Operation commenced in 2016 and mining operations commenced in 2017. The approximate extent of existing/approved surface development for the Mount Pleasant Operation is 2,825 ha and involves the clearance of approximately 1,262 ha of native vegetation.

Other key proposed or approved projects that may potentially interact with, or have potential cumulative impacts with, the Project include:

- Bengalla Mine (approximately 890 ha of native vegetation clearance) (Cumberland Ecology, 2013 and 2015b);
- Mangoola Coal (approximately 2,261 ha of native vegetation clearance) (Umwelt, 2006 and 2010; NSW Department of Planning [DoP], 2009)[2];
- Mt Arthur Coal Mine (approximately 1,219 ha of native vegetation clearance) (Cumberland Ecology, 2009b; Hunter Eco, 2013);
- West Muswellbrook Project proposed open cut mine (indeterminant); and
- Dartbrook Mine (indeterminant).

In addition to potential cumulative adverse impacts, the approved and proposed activities at the Mount Pleasant Operation also have potential cumulative benefits in the form of offset areas. Existing offset areas for the Mount Pleasant Operation comprise 12,875 ha on a number of biodiversity management areas with a combined area of 15,590 ha.

The Biodiversity Offset Strategy for the Project is described in Section 7.10.6.

Indirect Impacts

Indirect impacts on habitat and vegetation (e.g. increased risk of fire and introduction of pest species) are assessed in Appendix E. Measures to mitigate and manage potential indirect impacts are described in Section 7.10.4.

[1] Equivalent to the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions Critically Endangered Ecological Community (CEEC) listed under the BC Act and the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the EPBC Act.

[2] It is also noted that the Mangoola Coal Continued Operations Project is currently being assessed by the NSW Government. If approved, some 356 ha of woodland or open forest and 214 ha of DNG would be impacted (Umwelt, 2019).

Table 7-20
Plant Community Types within the Project Additional Disturbance Area

Vegetation Zone	Vegetation Community (Hunter Eco, 2021) (Attachment A of Appendix E)	PCT ID	Area (ha)	
			Project Additional Disturbance Area Including Road Option 1	Project Additional Disturbance Area Including Road Option 2
Grassy Woodlands				
Western Slopes Grassy Woodlands				
1	Grey Box x White Box Grassy Woodland[1]	483	44.9	44.5
1a	Derived Native Grassland[1]	483 DNG	158.4	150.8
2	Grey Box x White Box – Spotted Gum (SG) Grassy Woodland[1]	483 SG	13.3	8.7
2a	Derived Native Grassland[1]	483 SG DNG	11	6.8
Coastal Valley Grassy Woodlands				
3	Forest Red Gum Grassy Open Forest[1]	618	0.2	0.2
4	Narrow-leaved Ironbark – Grey Box Grassy Woodland[2,3]	1691	16.3	16.3
4a	Derived Native Grassland	1691 DNG	0.9	0.9
Dry Sclerophyll Forests (Shrub/grass sub-formation)				
Hunter-Macleay Dry Sclerophyll Forests				
5	Spotted Gum – Narrow-leaved Ironbark Woodland[3]	1602	7	7
North-west Slopes Dry Sclerophyll Woodlands				
6	Narrow-leaved Ironbark Shrubby Forest[3]	1605	66.6	66.6
6a	Derived Native Grassland	1605 DNG	140.7	140.6
6b	Plantation	1605 Plantation	11.6	11.5
7	White Box – Narrow-leaved Ironbark – Blakely's Red Gum[1]	1606	0.6	0.6
7a	Derived Native Grassland[1]	1606 DNG	1.9	1.8
Dry Sclerophyll Forests (Shrubby sub-formation)				
Western Slopes Dry Sclerophyll Forests				
8a	Derived Native Grassland	1655 DNG	2.5	2.5
	Total Woodland/Forest		**160.5**	**155.4**
	Total Derived Native Grassland		**315.4**	**303.4**
	Total Native Vegetation		**475.9**	**458.8**
	Total Cropping/Grazing/Dam/Disturbed/ Dwellings/Infrastructure/Local Roads		**29.6**	**27.2**
	Total Area		**505.5**	**486**

1 *Box-Gum Woodland CEEC.*

2 *Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions Endangered Ecological Community* (herein referred to as *Central Hunter Grey Box – Ironbark Woodland EEC listed under the BC Act*).

3 *Central Hunter Valley Eucalypt Forest and Woodland CEEC* covered by EPBC 2011/5795.

Prescribed Biodiversity Impacts

The BC Regulation identifies actions that are prescribed as impacts to be assessed under the NSW Biodiversity Offsets Scheme. 'Prescribed biodiversity impacts' are defined in the BC Regulation.

An assessment of 'prescribed biodiversity impacts' in relation to the Project is provided in Appendix E and summarised below.

Impacts on Habitat Resources Other Than Native Vegetation

There are no karst, caves or cliffs or other areas of geological significance on, or in the vicinity of, the Project. No areas with rock crevices occur, therefore the Project would not impact rock crevices.

Rocky areas providing potential habitat for the Striped Legless Lizard are present (Appendix E). The Project would not result in the loss of any mapped rocky areas.

No indirect impacts are likely to occur on the rocky areas outside of the Project Additional Disturbance Area.

No human-made structures or areas of non-native vegetation that provide habitat for threatened species would be adversely impacted by the Project (Appendix E).

Habitat Fragmentation

There are no defined woodland corridors evident, however, it is possible that woodland areas facilitate the movement of species in the landscape. All threatened species and communities known to occur in the area are likely to benefit from the current level of connectivity (Appendix E).

The Relinquishment Area is predominantly a single, contiguous, large area of native vegetation, whereas the Project Additional Disturbance Area comprises many dissected areas around the existing mine infrastructure. Sufficient habitat connectivity would remain around the Project Additional Disturbance Area such that no threatened species are likely to become isolated as a result of the Project (Appendix E). Clearance would also be followed by progressive rehabilitation.

Fauna Movement

The Project is not likely to impact well-defined movement patterns for any particular threatened species (Appendix E).

Water Quality, Water Bodies and Hydrological Processes That Sustain Threatened Species and Threatened Ecological Communities

The Project is not likely to significantly impact water quality, water bodies or hydrological processes that are known to sustain a threatened species or ecological community listed under the BC Act (Appendix E).

Vehicle Strike

As described in Section 3.5.2, the Project would involve the revised alignment and development of the Northern Link Road that would connect Dorset Road and Castlerock Road.

Vehicle strike of animals is possible, however, it is not expected to be of a magnitude that would threaten the local persistence of any species (Appendix E). It is also noted that the Northern Link Road would be developed by the approved Mount Pleasant Operation, irrespective of the Project (Figure 1-3).

Measures to mitigate the potential for vehicle strikes for the Project are described in Section 7.10.4.

Serious and Irreversible Impacts

Under the BC Act, a determination of whether an impact is serious and irreversible must be made for 'potential Serious and Irreversible Impact (SAII) entities' identified in the BAM Calculator. There is one 'potential SAII entity' relevant to the Project, namely the *Box-Gum Woodland CEEC*.

In total, approximately 213.4 to 230.3 ha of the *Box-Gum Woodland CEEC* would be cleared due to the Project Additional Disturbance Area (depending on the Northern Link Road option), comprising mostly DNG (approximately 74%) (Appendix E).

In accordance with the DPIE (2019a) *Guidance to assist a decision-maker to determine a serious and irreversible impact*, Hunter Eco (2021) concluded that the Project is unlikely to have a serious and irreversible impact on the *Box-Gum Woodland CEEC* (Appendix E).

Koala Habitat Assessment Under State Environmental Planning Policy (Koala Habitat Protection) 2020

No core Koala habitat (defined by the *Koala Habitat Protection State Environmental Planning Policy [Koala Habitat Protection] 2020* [Koala Habitat Protection SEPP]) occurs in the Project Additional Disturbance Area or surrounds. The Koala was not detected during the 2018 and 2019 surveys by Future Ecology (2020) and it has not been previously recorded within the Project area or surrounds during past studies. Measures to manage potential impacts on biodiversity (including potential Koala habitat) are provided in Section 7.10.4.

Commonwealth Assessment

The Action would result in the clearance of approximately 23.3 to 27.4 ha of native vegetation (approximately 17.3 to 21.4 ha of DNG [74.2% to 78.1%] and 6 ha of woodland/forest [21.9% to 25.8%]) (depending on the Northern Link Road option) (Table 7-20) (Appendix E).

As part of the Action, a portion of the original revised road alignment approved under EPBC 2011/5795 would no longer be constructed. This area is referred to as the Western Link Road Relinquishment Area and consists of approximately 14 ha of native vegetation (approximately 9 ha of DNG and 5 ha of native woodland/forest) (Appendix E).

The Action is to be assessed under the Bilateral Agreement with NSW, therefore the BDAR (Appendix E) provides an assessment of potential impacts (in accordance with the supplementary SEARs dated 2 October 2020) to the threatened species and communities listed under the EPBC Act.

Biodiversity credits associated with the Western Link Road Relinquishment Area have been applied to the credit requirement for the *Box-Gum Woodland CEEC* within the Action area.

Based on the information available in the EPBC Act Referral, DAWE considered that the Action is likely to have a significant impact on the:

- *Box-Gum Woodland CEEC;*
- Striped Legless Lizard;
- Swift Parrot (*Lathamus discolor*); and
- Regent Honeyeater (*Anthochaera phrygia*).

Based on the outcomes of the BDAR, it is considered unlikely that the Project would have a material adverse impact on the threatened woodland birds or *Box-Gum Woodland CEEC*. Based on applicable guidance materials (SEWPaC, 2011; DotE, 2013) it is conservatively considered that the Action is likely to have a significant impact on the Striped Legless Lizard in the short to medium-term, however, the population would persist (Appendix E).

The impacts would be offset in accordance with the NSW Biodiversity Offsets Scheme.

7.10.4 Mitigation Measures

Existing impact avoidance and mitigation measures for the Mount Pleasant Operation would continue to be implemented for the Project. Measures to mitigate impacts from the Project are outlined in Table 7-21.

MACH would implement other measures that are relevant to reducing potential indirect impacts on biodiversity, such as managing potential noise, air quality, groundwater and surface water impacts, as described in Sections 7.3.3, 7.4.3, 7.5.3, 7.7.5, 7.8.4 and 7.9.4 and Table 7-21.

The Project disturbance areas would be progressively rehabilitated throughout the life of the mine as described in Attachment 8.

The proposed Biodiversity Offset Strategy for predicted impacts to ecology as a result of the Project is detailed in Section 7.10.6.

7.10.5 Adaptive Management

The existing MOP would be updated to include the Project (including the vegetation clearance protocol and rehabilitation measures) in consultation with the relevant government agencies, and in accordance with the relevant rehabilitation and mine closure guidelines.

The MOP would also detail rehabilitation methods and requirements, including target PCTs that would be established in rehabilitation (Attachment 8).

The Biodiversity Management Plan would, as relevant, be revised for the Project (subject to the conditions of the Development Consent for the Project).

Table 7-21
Measures to Mitigate and Manage Potential Impacts

Potential Impact	Mitigation Measures	Techniques	Timing/Frequency
Clearing of Native Vegetation and Habitat	Biodiversity Measure 1 – Vegetation Clearance Protocol	Delineation of approved native vegetation clearing areas and acquiring a Ground Disturbance Permit prior to any ground disturbance activities being carried out on-site.	Prior to/during native vegetation clearance.
		Pre-clearance survey conducted by an appropriately trained and suitably qualified and/or experienced person(s) prior to native woodland/forest vegetation clearing.	
		Re-use of trees containing features with the potential to provide significant habitat (i.e. numerous suitable hollows) for nesting threatened birds, hollow-dwelling bats and/or arboreal mammals and provision for seed collection during clearance activities, wherever practicable.	
		Management strategies to minimise impacts of ground disturbance on fauna during clearing activities.	
	Biodiversity Measure 2 – Rehabilitation and Revegetation	Continuation of the Mount Pleasant Operation rehabilitation program that has been designed to establish an appropriate ground strata, understorey, sub-canopy and canopy within areas of the Mount Pleasant Operation final landform.	Over the life of the Project.
		Re-use habitat features salvaged from site/surrounding areas.	
		Undertake topsoil spreading, establishment and management (including application of soil ameliorants where required).	
		Target species composition and vegetation structure which is characteristic of surrounding native vegetation.	
	Biodiversity Measure 3 – Tiger Orchid Relocation	Salvage the Tiger Orchid prior to disturbance and relocate to proximal, suitable habitats in non-disturbance areas, carried out under the supervision of the Environmental Superintendent by an appropriately qualified and/or experienced person(s) using accepted techniques.	During and following native vegetation clearance.
Indirect Impacts on Native Vegetation and Habitat	Biodiversity Measure 4 – Weed Management	Weed control, including physical removal and/or chemical spraying using herbicides.	Over the life of the Project.
		Machinery hygiene protocols for all machinery working in/around the Mount Pleasant Operation area.	
		Management of cattle movement.	
		Use of erosion and sediment control measures to control nutrient/weed migration.	
		Regular inspections and maintenance of topsoil stockpiles.	
	Biodiversity Measure 5 – Animal Pest Management	Management of animal pest species using a range of pest control measures including destruction of habitat, trapping, targeted shooting programs and baiting.	
	Biodiversity Measure 6 – Speed Limits	Low speed limits imposed on all vehicles using the mine roads and tracks.	
		Vehicle access limited to haul roads, access roads and tracks wherever possible.	
	Biodiversity Measure 7 – Bushfire Prevention and Control Measures	Slashing of vegetation along roads and internal tracks which are used as fire trails and maintaining firebreaks where required.	
		Controlled burns under the advice of the NSW Rural Fire Service (RFS) and maintenance of a network of water supply points to assist the NSW RFS with logistical support.	
		Maintenance of fire-fighting equipment (i.e. water carts, graders and bulldozers).	
		Emergency response procedures in the event of a bushfire and reporting of any incidence of unplanned bushfire.	

7.10.6 Biodiversity Offset Strategy

Existing Biodiversity Offsets

The Mount Pleasant Operation has already offset the approved biodiversity impacts of the mine, with the establishment of major biodiversity offsets of some 12,875 ha on a number of properties with a combined area of 15,590 ha (Figure 7-24).

These properties have been subject to management since 2012 in accordance with an Offset Management Plan (MACH, 2020a). Management activities include weed control, pest animal control, strategic grazing, revegetation, infrastructure improvement, sustainable agriculture and fire management.

The Mount Pleasant Operation Development Consent DA 92/97 was granted in December 1999, prior to the implementation of offsetting policies in NSW. While no biodiversity offsets were required for the original development under Development Consent DA 92/97, biodiversity offsets were established for the existing/approved Mount Pleasant Operation under the Commonwealth approval (EPBC 2011/5795).

Project Biodiversity Offset Strategy

The Project Biodiversity Offset Strategy has been developed to address the potential residual impacts on biodiversity values associated with the Project in accordance with the offset rules under the NSW Biodiversity Offsets Scheme (as required by the SEARs for the Project).

The benefits on biodiversity values as a result of not clearing the Relinquishment Area outweigh the net additional impacts on biodiversity values of the Project Additional Disturbance Area, because the Relinquishment Area is larger, with a greater area of vegetation which is of a higher conservation status under the BC Act (Appendix E).

The sub-sections below describe how the Project Biodiversity Offset Strategy addresses both NSW and Commonwealth biodiversity offset requirements.

NSW Offset

Tables 7-22 and 7-23 provide a comparison of biodiversity credits associated with the Relinquishment Area against the credits associated with the Project incorporating either Northern Link Road options. Application of the Relinquishment Area results in an excess of between 6,530 and 6,591 ecosystem credits (depending on the Northern Link Road option).

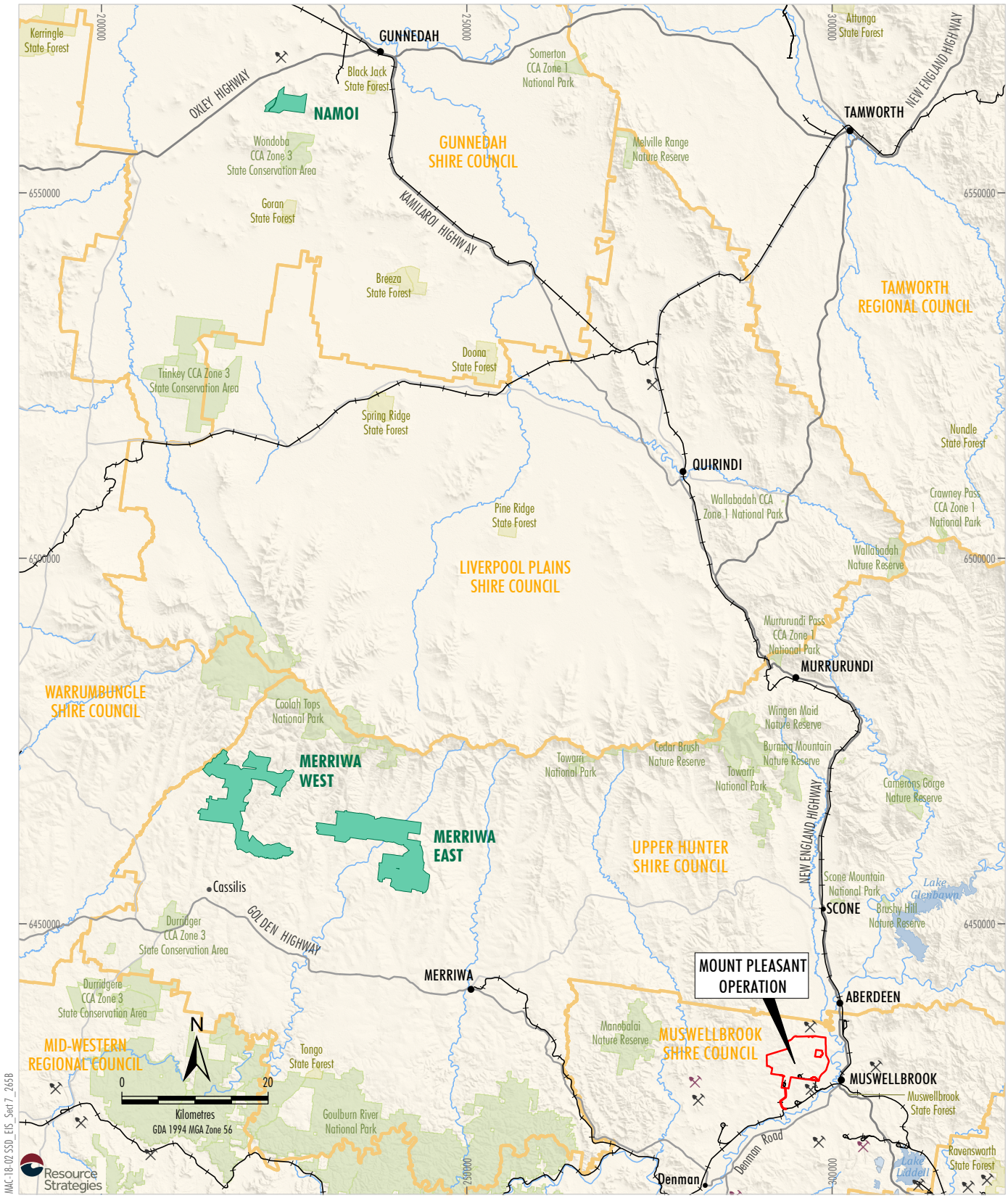
Although less native vegetation would be cleared overall, it is recognised that there would be a net additional impact on three PCTs (namely, PCTs 1691, 1602 and 1605). Table 7-23 shows an excess of 2 credits for the Tiger Orchid, between 2,729 and 2,797 credits for the Striped Legless Lizard and between 3,056 and 3,130 credits for the Squirrel Glider (depending on the Northern Link Road option).

MACH is of the view that no ecosystem or species credits should be required for the Project (other than the Northern Link Road Commonwealth offset described below) because:

- biodiversity offsets for the approved Mount Pleasant Operation have already been established under EPBC 2011/5795;
- like-for-like credits from the Relinquishment Area have been applied to the ecosystem credits associated with the Project Additional Disturbance Area (Table 7-22);
- an excess of between 6,530 and 6,591 ecosystem credits (depending on the road option) would be forfeited for PCTs that do not match like-for-like credits;
- MACH proposes to forgo development (clearance) of native vegetation in the Relinquishment Area, which would reduce impacts on a larger and more contiguous area of a CEEC listed under the BC Act and EPBC Act;
- if the 'variation rules' concept was applicable to this Project, excess credits of the same formation could reduce the residual credit requirement for PCTs 1602 and 1605, neither of which are threatened under the BC Act (Appendix E); and
- as described in Section 7.10.3 and Attachment 8, MACH has commenced rehabilitation and revegetation activities at the Mount Pleasant Operation. It is proposed that an equivalent area of PCTs 1605 and 1602 cleared in the Project Additional Disturbance Area (Table 7-20) would be established in rehabilitation areas.

It is noted that the DPIE may or may not require MACH to retire biodiversity credits as it sees fit, as a condition of any Development Consent for the Project.

MACH also anticipates the NSW Government would condition the continuation of the existing EPBC 2011/5795 Mount Pleasant Operation biodiversity offsets under any Project Development Consent.



LEGEND

- Mining Operation
- Proposed Mining Operation (Application Lodged)
- Local Government Area
- State Forest
- National Parks and Wildlife Estate
- Mining Lease Boundary (Mount Pleasant Operation)
- Existing Biodiversity Management Area (including Offset Areas)

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

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Existing Biodiversity Management Areas

Figure 7-24

Table 7-22
Comparative Project Ecosystem Credits

Veg Zone	Vegetation Community (Hunter Eco, 2020) (Attachment A of Appendix E)	PCT ID	Project Credits		Relinquishment Area Credits
			NSW Assessment Area with Road Option 1	NSW Assessment Area with Road Option 2	
1	Grey Box x White Box Grassy Woodland[1]	483	1,793	1,863	-1,622
1a	Derived Native Grassland[1]	483 DNG	0	0	-2,068
2	Grey Box x White Box – Spotted Gum Grassy Woodland[1]	483 SG	452	320	-4,589
2a	Derived Native Grassland[1]	483 SG DNG	0	2	-306
3	Forest Red Gum Grassy Open Forest[1]	618	8	8	-98
3a	Derived Native Grassland	618 DNG	0	0	-97
4	Narrow-leaved Ironbark – Grey Box Grassy Woodland[2]	1691	434	434	0
4a	Derived Native Grassland	1691 DNG	0	0	0
5	Spotted Gum – Narrow-leaved Ironbark Woodland	1602	168	168	-9
6	Narrow-leaved Ironbark Shrubby Forest	1605	1,556	1,556	-696
6a	Derived Native Grassland	1605 DNG	0	0	-200
6b	Plantation	1605 Plantation	295	294	0
7	White Box – Narrow-leaved Ironbark – Blakely's Red Gum[1]	1606	16	16	-47
7a	Derived Native Grassland[1]	1606 DNG	28	27	0
8a	Derived Native Grassland	1655 DNG	0	0	0
		Total	**4,750**	**4,688**	**-9,732**

1 *Box-Gum Woodland CEEC.*

2 *Central Hunter Grey Box – Ironbark Woodland EEC listed under the BC Act.*

Table 7-23
Comparative Project Species Credits

Scientific Name	Common Name	Conservation Status[1]		Project Credits		Relinquishment Area Credits
		BC Act	EPBC Act	NSW Assessment Area with Road Option 1	NSW Assessment Area with Road Option 2	
Cymbidium canaliculatum	Tiger Orchid (*Cymbidium canaliculatum* population in the Hunter Catchment)	EP	-	2	2	-4
Delma impar	Striped Legless Lizard	V	V	4,595	4,527	-7,324
Petaurus norfolcensis	Squirrel Glider	V	-	4,571	4,497	-7,627

1 Conservation status under the BC Act and/or EPBC Act (current as at January 2021). EP = Endangered Population; V = Vulnerable.

Commonwealth Offset

MACH would address the Commonwealth offset requirement through a combination of the following options, consistent with the NSW Biodiversity Offsets Scheme under the Bilateral Agreement:

- application of like-for-like biodiversity credits from the Western Link Road Relinquishment Area; and
- retirement of residual biodiversity credits for relevant EPBC Act listed threatened species and ecological communities as required by the EPBC Act.

These credits would be associated with the following EPBC Act listed threatened species and communities:

- *Box-Gum Woodland CEEC*; and
- Striped Legless Lizard.

Table 7-24 provides a summary of the total EPBC Act credits required for threatened species and communities associated with vegetation and habitat within the Action area, after application of the Western Link Road Relinquishment Area.

7.11 AQUATIC ECOLOGY

An Aquatic Ecology Assessment has been prepared for the Project by Bio-Analysis (2020) and is presented in Appendix F. The assessment of potential impacts on aquatic ecology and GDEs draws on information and assessments in the following technical reports prepared for the Project:

- BDAR (Appendix E);
- Groundwater Assessment (Appendix C); and
- Surface Water Assessment (Appendix D).

Section 7.11.1 provides a description of the methodology used for the Aquatic Ecology Assessment. Section 7.11.2 provides a description of the existing aquatic ecology environment. Section 7.11.3 describes the potential impacts of the Project on aquatic ecology. Section 7.11.4 outlines mitigation measures, management and monitoring for the Project.

7.11.1 Methodology

Aquatic Ecology

The Aquatic Ecology Assessment (Appendix F) was prepared in accordance with the SEARs as well as relevant State and Commonwealth requirements, including the FM Act, EPBC Act and the *Policy and Guidelines for Fish Habitat Conservation and Management* (2013 update) (DPI, 2013).

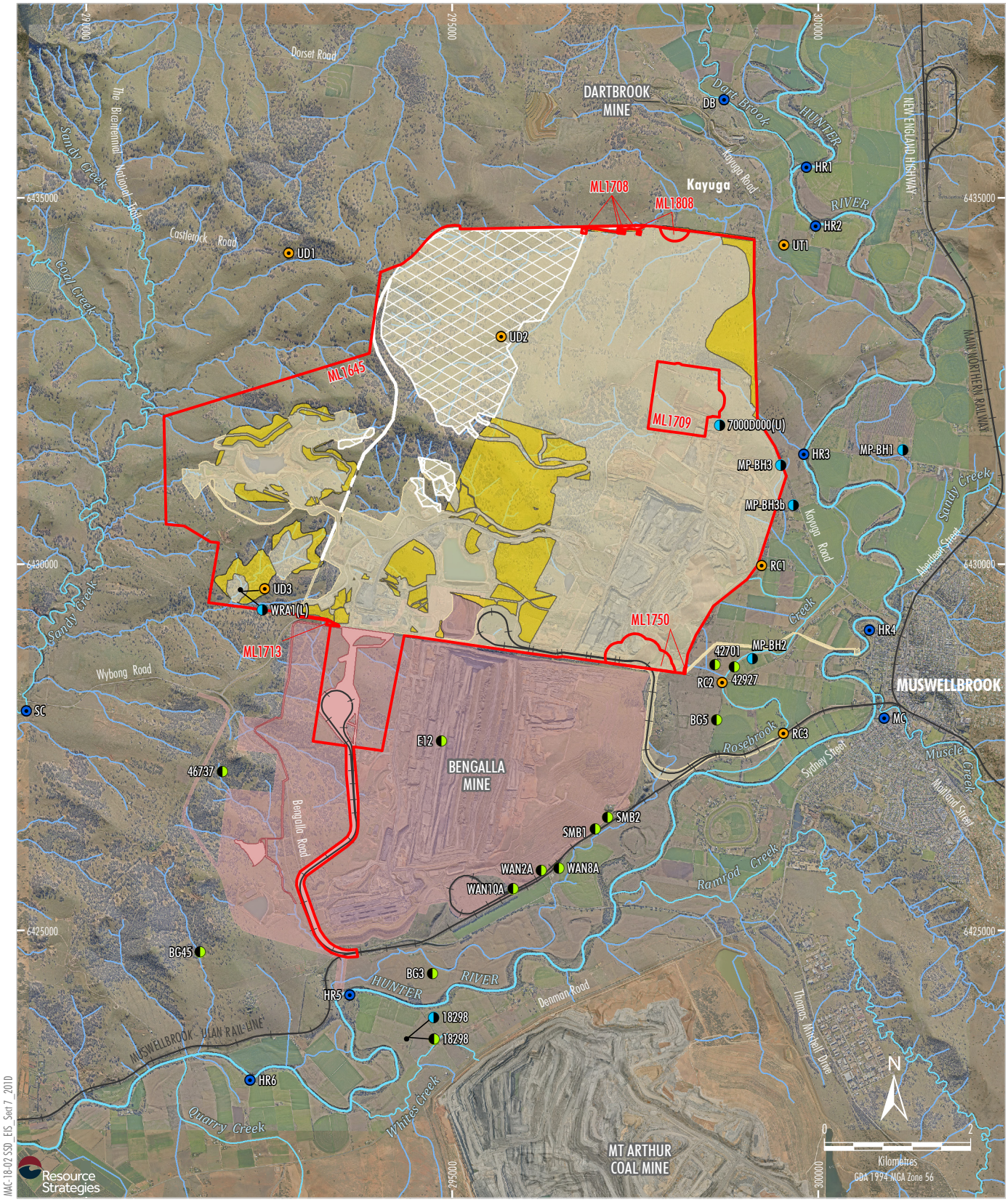
The Aquatic Ecology Assessment has also been informed by the following:

- stream health monitoring undertaken for the Mount Pleasant Operation (Figure 7-25);
- publicly available reports from aquatic ecology assessments completed in the region;
- aquatic ecology studies previously completed in the vicinity of the Project;
- database searches of the species occurring in the area, including the *NSW BioNet Atlas* (DPIE, 2020d), *Fisheries NSW Spatial Data Portal* (DPI, 2020) and *Online Zoological Collections of Australian Museums* (OZCAM, 2020);
- existing mapping of the aquatic ecological values in the vicinity of the Project from the *Fisheries NSW Spatial Data Portal* (DPI, 2020); and
- water quality data from the Mount Pleasant Operation monitoring programme, monitoring programmes for surrounding mining operations and other publicly available databases (e.g. WaterNSW real-time monitoring network).

Table 7-24
Application of the BAM to EPBC Act Listed Threatened Species and Communities

Species/Communities	Credits to be Offset	
	Northern Link Road Option 1	Northern Link Road Option 2
Box-Gum Woodland CEEC	**44** (11 credits of PCT 483 SG, 4 credits of PCT 618, 8 credits of PCT 1606 and 21 credits of PCT 1606 DNG)	**95** (63 credits of PCT 483, 4 credits of PCT 618, 8 credits of PCT 1606 and 20 credits of PCT 1606 DNG)
Striped Legless Lizard (*Delma impar*)	**293**	**225**

After: Appendix E.



LEGEND

Existing Mine Elements

- Mining Lease Boundary (Mount Pleasant Operation)
- Approximate Extent of Existing/Approved Surface Development (DA92/97)
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Existing/Approved Mount Pleasant Operation Infrastructure within Bengalla Mine Approved Disturbance Boundary (SSD-5170)

Additional/Revised Project Elements

- Approved Disturbance Area to be Relinquished
- Approximate Additional Disturbance of Project Extensions

Aquatic Ecology Survey Sites

- Habitat Assessment Site
- Stream Health Sample Site

Stygofauna Survey Sites

- Bore Sampled for Stygofauna by Bio-Analysis (2020)
- Bore Sampled for Stygofauna by Eco Logical Australia (2013)

Source: MACH (2020); Bio-Analysis (2020); Eco Logical Australia (2013); NSW Spatial Services (2020)
Orthophoto: MACH (2020)

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MOUNT PLEASANT OPTIMISATION PROJECT

Aquatic Ecology and Stygofauna Sampling Sites

Figure 7-25

Additional aquatic ecology surveys including habitat assessments were also undertaken for the Project between 26 and 28 November 2018 (Figure 7-25). Aquatic habitat condition (including water quality parameters), aquatic flora, aquatic macroinvertebrates, fish and stygofauna were surveyed (Appendix F).

Sampling of habitat condition was conducted according to the Australian River Assessment System (AUSRIVAS) (Turak *et al.*, 2002). AUSRIVAS and the Riparian, Channel and Environmental (RCE) inventory (Peterson, 1992) provide an index of habitat condition, which enables a comparison of habitat quality between sites. Sites with a high RCE score (up to 52, or 100%) indicate that the riparian zone is unmodified by human activity, while those with a low score have been substantially modified (Appendix F).

Macroinvertebrates collected were assigned a Stream Invertebrate Grade Number-Average Level (SIGNAL) score based on Chessman (2003). The SIGNAL score indicates how sensitive an invertebrate family is to disturbance and is used as an indication of aquatic habitat health (Appendix F).

Groundwater Dependent Ecosystems

An integrated assessment of GDEs has been undertaken as part of the Aquatic Ecology Assessment (Appendix F), Groundwater Assessment (Appendix C) and BDAR (Appendix E). The assessment has been undertaken in accordance with:

- the SEARs for the Project;
- the WM Act and relevant water sharing plans;
- *Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals* (IESC, 2018);
- *Assessing Groundwater Dependent Ecosystems: IESC Information Guidelines Explanatory Note [Consultation Draft]* (Doody, Hancock and Pritchard, 2018);
- *NSW State Groundwater Dependent Ecosystems Policy* (DLWC, 2002b); and
- *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* (NOW, 2012b).

In 2012, ELA (2013) undertook sampling for stygofauna at thirteen bores and wells in the vicinity of the Bengalla Mine (ELA, 2013) (Figure 7-25).

In 2020, Bio-Analysis (2020) undertook additional sampling for stygofauna in the vicinity of the Project. Sample sites were selected based on the likelihood of having suitable stygofauna habitat (Figure 7-25).

7.11.2 Existing Environment

Regional Setting

The Mount Pleasant Operation is located within the Hunter River catchment (Section 7.9). The Hunter River flows in a southerly direction approximately 1 km to the east of the Mount Pleasant Operation.

The local drainage network is generally characterised by steep gullies which drain from the surrounding hills into the flat alluvial plains adjacent the Hunter River.

Aquatic Ecology

Aquatic Habitat

A total of fifteen sites (Figure 7-25) were assessed, with six aquatic ecology survey sites located along the Hunter River, three sites on Rosebrook Creek (Plate 7-20), three sites on unnamed tributaries and one site on each of Dart Brook (Plate 7-21), Muscle Creek and Sandy Creek (Plate 7-22) (Appendix F).

The section of the Hunter River east of the Project is generally characterised by a series of continuous, slow flowing pools up to approximately 30 m wide and greater than 1 m deep. The riparian zone along the Hunter River has been heavily degraded, largely due to historical clearing of vegetation, bank erosion and invasion by introduced plant species (Appendix F).

Plate 7-20 Rosebrook Creek Aquatic Ecology Sampling Site RC3
Source: Appendix F.

Plate 7-21 Dart Brook Aquatic Ecology Sampling Site DB
Source: Appendix F.

Plate 7-22 Sandy Creek Aquatic Ecology Sampling Site SC
Source: Appendix F.

The macrophyte species present in the Hunter River have a wide distribution and are abundant in similar aquatic habitats elsewhere in south-eastern Australia (Appendix F).

RCE scores for the Hunter River indicate it is typically in good condition (Appendix F).

Rosebrook Creek was dry at the time of survey and its channel had been colonised by pasture grasses. The banks of the creek were almost entirely cleared of trees and riparian vegetation and there was evidence that livestock regularly grazed and trampled the stream bank and channel. Habitat for aquatic fauna, such as rocks, snags and aquatic macrophytes, were largely absent (Appendix F).

Dart Brook was sampled at a road crossing approximately 1 km upstream from the confluence with the Hunter River (Figure 7-25). This section of the stream consisted of pools up to approximately 5 m wide and 1.5 m deep. RCE scores recorded for Dart Brook indicate it is in moderate condition (Appendix F).

Sandy Creek was sampled adjacent to Wybong Road (Figure 7-25). At the time of sampling there was no flow and the water appeared stagnant. RCE scores recorded for Sandy Creek indicate it is in relatively poor condition (Appendix F).

Aquatic Macroinvertebrates

Macroinvertebrates are animals that do not possess a spinal column and are visible to the naked eye.

A total of 51 taxa have been recorded from pool edge habitat at the Mount Pleasant Operation stream health monitoring sites sampled between spring 2017 and spring 2019. The number of taxa observed was less on all occasions than would be expected from undisturbed AUSRIVAS reference sites (Appendix F). The SIGNAL values also indicate that macroinvertebrate assemblages have consistently been dominated by pollution-tolerant taxa (Appendix F).

Analyses examining the composition of macroinvertebrate assemblages indicated that Freshwater shrimps (*Atyidae sp.*) have been less abundant at the tributary sites compared to the Hunter River sites and *vice versa* for the Non-biting midges (*Chironominae sp.*) (Appendix F).

Freshwater shrimps are generally found in well-oxygenated, fast-flowing waters while chironomid larvae can be collected in a range of habitats including polluted, stagnant and saline waters. Dominance of chironomids assemblages at the tributary sites is not surprising given relatively saline environments with little flow (Appendix F).

Fish

Ten species of fish (including two introduced species) have been collected at the Mount Pleasant Operation stream health monitoring sites. To date, mosquito fish (*Gambusia holbrooki)* and long-finned eels (*Anguilla reinhardtii*) were the most widespread and abundant species (Appendix F).

Low numbers of Australian bass (*Macquaria novemaculeata*) have commonly been collected at the Hunter River sites and in Dart Brook. Goldfish (*Carassius auratus*) and freshwater mullet (*Myxus petardi*) were also collected in the spring 2017 survey, but not in subsequent surveys (Appendix F).

Freshwater shrimps, freshwater prawns (*Palaemonidae*) and mosquito fish were also caught in dip nets whilst sampling aquatic macroinvertebrates (Appendix F).

All of the fish species recorded have been recorded during previous fish surveys of the Hunter River (Appendix F).

No threatened species of fish listed under the FM Act, BC Act, or the EPBC Act were recorded.

One endangered species listed under the FM Act, the southern purple-spotted gudgeon (*Mogurnda adspersa*), and one endangered population listed under the FM Act, the Darling River hardyhead (*Craterocephalus amniculus*) population, were identified as having the potential to occur downstream of the Project (Appendix F).

Groundwater Dependent Ecosystems

GDEs are ecosystems that rely upon groundwater for their continued existence. GDEs may be completely dependent on groundwater (i.e. obligate GDEs), such as aquifer GDEs, or may access groundwater intermittently to supplement their water requirements (i.e. facultative GDEs), such as riparian tree species in arid and semi-arid areas (Doody, Hancock and Pritchard, 2018).

The *Australian Groundwater-Dependent Ecosystems Toolbox* (Richardson *et al.*, 2011) defines three main types of GDEs:

- Type 1: Subterranean ecosystems, including cave and aquifer ecosystems.
- Type 2: Aquatic ecosystems that rely on the surface expression of groundwater, including surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs.
- Type 3: Terrestrial ecosystems that rely on the subsurface presence of groundwater.

No high priority GDEs listed in the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009* are in the vicinity of the Project. Wappinguy Spring, approximately 40 km to the north-west of the Project area, is the closest high priority GDE listed in the Hunter water sharing plans (Appendix C).

The *Groundwater Dependent Ecosystem Atlas* (GDE Atlas) was developed by the BoM as a national dataset of Australian GDEs to inform groundwater planning and management (BoM, 2018). The Atlas contains information about three types of ecosystems defined in the *Australian Groundwater-Dependent Ecosystems Toolbox*.

GDEs derived in the GDE Atlas are mapped according to the following classifications:

- High potential for groundwater interaction.
- Moderate potential for groundwater interaction.
- Low potential for groundwater interaction.

The GDE Atlas identifies the following potential aquatic GDEs in the vicinity of the Project (Figure 7-26) (Appendix C):

- Aquatic habitat within the Hunter River is mapped as having high potential for groundwater interaction.
- The majority of remnant terrestrial vegetation in the vicinity of the Project is mapped as having low potential for groundwater interaction.

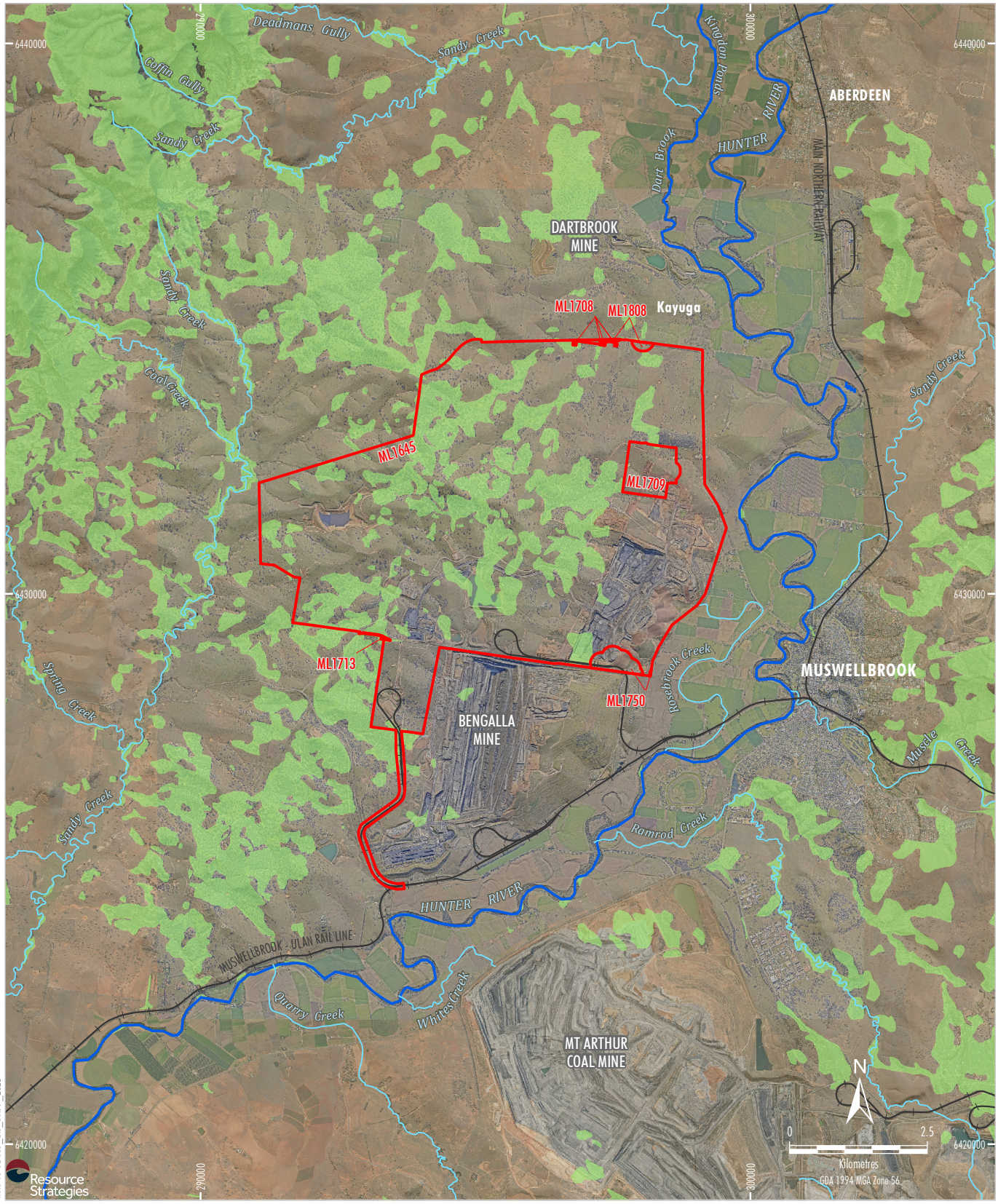
Detailed vegetation mapping was conducted for the Project by Hunter Eco (2021). The mapping showed the majority of vegetation is DNG due to historical land clearing, with remnant and regrowth forest and woodland occurring in isolated areas. Remnant forest and woodland areas are primarily associated with grassy woodland communities, with some dry sclerophyll forests.

Hunter Eco (2021) determined that approximately 3 ha of *Forest Red Gum Grassy Open Forest* vegetation community (PCT 618) could potentially be a facultative groundwater user on the basis that (Appendix E):

- Dominant tree species were Forest Red Gum (*Eucalyptus tereticornis*), Yellow Box (*Eucalyptus melliodora*) and Grey Box x White Box hybrid (*Eucalyptus moluccana* x *Eucalyptus albens*).
- This vegetation community is restricted to drainage lines, which suggests it favours areas of higher moisture content.
- The streamlines are ephemeral, but the eroded and incised stream beds indicate that there are periods of significant stormwater flow that could recharge aquifers and result in a temporarily elevated groundwater level.

The location of the potentially groundwater dependent *Forest Red Gum Grassy Open Forest* vegetation community is shown on Figure 7-27 and illustrates it is in the Project Relinquishment Area.

The depth to groundwater in the vicinity of *Forest Red Gum Grassy Open Forest* vegetation community has historically fluctuated by approximately 10 m due to drawdown influence from the Dartbrook Mine (Appendix C). The persistence of the community with this variation in groundwater elevation supports the observation that this community may access groundwater on a facultative basis (Appendix C).



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)

Potential Aquatic Groundwater Dependent Ecosystems

- High Potential GDE

Potential Terrestrial Groundwater Dependent Ecosystems

- Low Potential GDE

Source: MACH (2020); BoM Atlas (2019); NSW Spatial Services (2020)
Orthophoto: MACH (2020)

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Potential Groundwater Dependent Ecosystems - BoM Atlas Mapping

Figure 7-26

7.11.3 Potential Impacts

Aquatic Habitat Clearance

A number of small ephemeral drainage lines would be cleared for the Project, including the upper reaches of Rosebrook Creek. No habitat along the Hunter River would be removed as a result of the Project (Appendix F).

There would be a reduction in habitat available to aquatic flora and fauna as a result of the removal of drainage lines. However, these habitats do not provide any sufficient permanent habitat for aquatic biota as flow likely only occurs during heavy rainfall events (Appendix F).

The drainage lines to be impacted provide low aquatic ecosystem value to aquatic flora and fauna. These habitats are highly unlikely to provide habitat for the threatened southern purple spotted gudgeon and Darling River hardyhead (Appendix F).

All aquatic flora and fauna species detected in the vicinity of the Project during the field surveys were common to the region, and none were listed threatened species under the FM Act, BC Act, or EPBC Act. Therefore, the Project is expected to have negligible impacts on aquatic ecology at a regional scale (Appendix F).

Changes to Water Quality and Flow

Potential impacts of the Project on surface water quality and flow have been assessed by HEC (2020) (Appendix D and Section 7.9.3).

Based on HEC's findings, and in consideration of the poor habitat rating for the local ephemeral drainage lines, including the upper reaches of Rosebrook Creek, there would be negligible change to the aquatic ecology as a result of predicted changes to surface water flow or quality (Appendix F).

Key Fish Habitat

The Project would not result in the removal of any Key Fish Habitat (Appendix F).

Threatened Aquatic Biota

No aquatic species of conservation significance listed under the EPBC Act, BC Act or FM Act have been recorded for the Project (Appendix F).

Assessments of significance were undertaken for the southern purple-spotted gudgeon and Darling River hardyhead species in accordance with the FM Act and the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DPI, 2008). These assessments determined that the Project is unlikely to significantly impact these species (Appendix F).

Groundwater Dependent Ecosystems

The following potential GDEs have been identified in the vicinity of the Project (Section 7.11.2):

- The Hunter River is identified as a potential Type 2 aquatic GDE based on the BoM GDE Atlas.
- Approximately 3 ha of Forest Red Gum Grassy Open Forest (PCT 618) in the Project Relinquishment Area has been identified as a potential Type 3 terrestrial GDE.
- Stygofauna were collected from bores accessing the Hunter River alluvium.

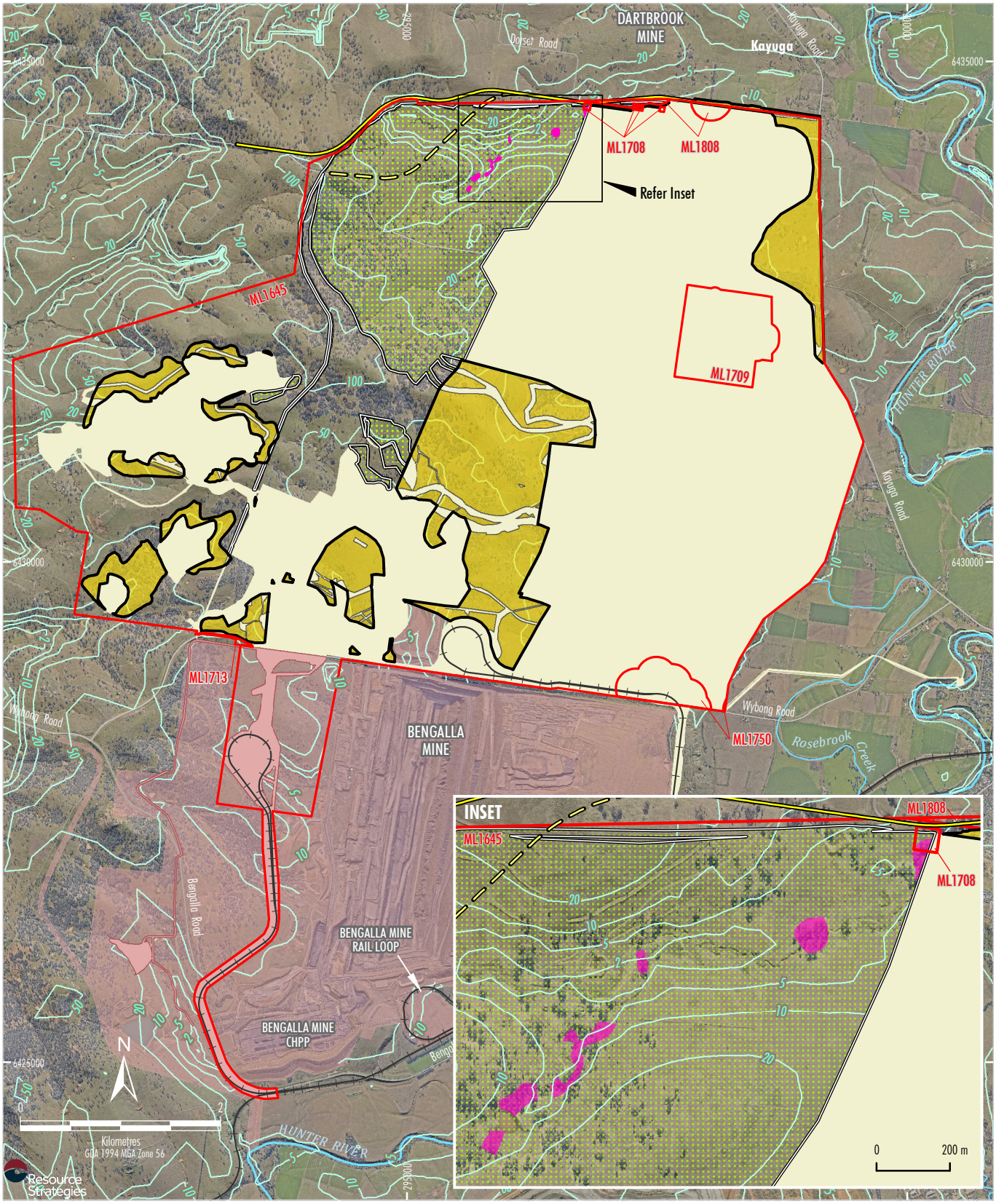
The predicted peak reduction in baseflow to the Hunter River due to the Project is 32 ML/year, which is negligible relative to the total flows in the Hunter River (greater than 100,000 ML/year on average) (Appendix C).

During mining, the predicted drawdown in the vicinity of the *Forest Red Gum Grassy Open Forest* (PCT 618) is negligible. Larger drawdowns are predicted during the post-mining recovery period. However, these are not anticipated to impact the condition of the vegetation community on the basis that the community only accesses groundwater on a facultative basis and has persisted despite being subject to groundwater drawdowns from previous mining activities (Appendix C).

All of the stygofauna taxa collected in the vicinity of the Project are prevalent elsewhere in the Hunter Valley. There is no significant drawdown predicted along the Hunter River alluvium and therefore potential impacts to these stygofauna populations are predicted to be negligible (Appendix C).

7.11.4 Mitigation Measures and Monitoring

A key outcome from planning the design of the Project is that MACH propose to forgo development (clearance) of native vegetation within the Relinquishment Area which would reduce the residual biodiversity impacts from the Project (Section 7.10).



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Project Continuation of Existing/Approved Surface Development (DA92/97)
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Existing/Approved Mount Pleasant Operation Infrastructure within Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Approximate Additional Disturbance of Project Extensions
- Approved Disturbance Area to be Relinquished
- Northern Link Road Option 1 Centreline*
- Northern Link Road Option 2 Centreline
- Depth to Groundwater Contour (m)

Potential Groundwater Dependent Ecosystems

- Forest Red Gum Grassy Open Forest (PCT618)

Source: MACH (2020); Hunter Eco (2020); AGE (2020); NSW Spatial Services (2020); Department of Planning and Environment (2016) Orthophoto: MACH (2020)

* Preferred alignment subject to landholder access.

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Groundwater Dependent Vegetation

Figure 7-27

Mitigation measures relevant to groundwater and surface water are described in Sections 7.8 and 7.9, respectively. These measures are designed to manage water quality and flow in the vicinity of the Project and, therefore, are relevant to mitigating potential impacts on aquatic ecology.

Groundwater monitoring would be undertaken in the vicinity of the *Forest Red Gum Grassy Open Forest* (PCT 618) to confirm any impact to the vegetation community remains negligible (Appendix C).

Stream health, including assessment of habitat, water quality, aquatic macroinvertebrates and fish, would continue to be monitored regularly as part of the existing Stream Health Monitoring Program over the life of the Project. Any significant change in stream health as determined by stream health trigger levels at or immediately downstream of the Project would be investigated to determine the source of the change.

7.12 ABORIGINAL HERITAGE

An ACHA has been prepared for the Project by SEA (2020) and is presented in Appendix G.

A description of the methodology relevant to the assessment of Aboriginal heritage is provided in Section 7.12.1. A description of Aboriginal heritage (archaeological and cultural) in the vicinity of the Project and the consultation undertaken is provided in Section 7.12.2. Section 7.12.3 describes the assessment of the Project with respect to potential impacts on Aboriginal heritage, while Section 7.12.4 outlines the proposed mitigation measures that have been developed in consultation with the RAPs.

7.12.1 Methodology

The ACHA for the Project has been undertaken in accordance with the SEARs for the Project, the *National Parks and Wildlife Act, 1974*, the *National Parks and Wildlife Regulation, 2019* and the following guidelines:

- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a);
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011a);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b);
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010c); and
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites [Australia ICOMOS], 2013).

Aboriginal Cultural Heritage Assessment

The ACHA (Appendix G) incorporates information from previous assessments, the results of the Project field survey, re-assessment of known Aboriginal heritage sites and consultation with the Aboriginal community, including:

- a detailed description of the methods implemented and results from extensive fieldwork and archaeological and cultural investigations previously undertaken by archaeologists and representatives of the Aboriginal community at the Mount Pleasant Operation and surrounds;
- results of a comprehensive review and re-assessment of known Aboriginal sites within and in the vicinity of the Mount Pleasant Operation and the Project;
- results of archaeological and cultural surveys conducted by archaeologists, a social anthropologist and representatives of the Aboriginal community for the Project during 2019 and 2020;
- the outcomes of consultation with the Aboriginal community regarding archaeological and cultural heritage values; and
- a detailed description of the consultation undertaken for the Project from 2017 to 2020.

Following distribution of the draft ACHA to RAPs for consultation, SEA also commissioned Environmental & Cultural Services (2020) to conduct a further assessment of intangible Aboriginal cultural values. The Aboriginal Cultural Values Report (Environmental & Cultural Services, 2020) is presented in Appendix G, and was prepared based on:

- review of relevant background resources, including various ethnographic data, heritage registers and relevant literature;
- consultation with selected RAPs via telephone interviews and emails; and
- consultation data analysis.

The key steps involved in the preparation of the ACHA (Appendix G) and associated consultation are described below.

7.12.2 Existing Environment

Aboriginal History

The nature of organisation of Aboriginal groups within the Hunter Valley is unclear, due to the limited ethnohistorical records and the immense disruption to traditional culture that had occurred by the time the available ethnohistorical observations were made. Boundaries between groups may have also fluctuated over time (Appendix G).

Early tribal maps indicate the Project is located around the possible boundary of the Wonnarua[3] people and Geawegal people. The territory of the Wonnarua is known to comprise the Upper Hunter region, from a few miles above Maitland west to the Dividing Range and south to the Darkinjung on the divide north of Wollombi (Tindale, 1974). The area occupied by the Geawegal people was reported to have included Muswellbrook, Aberdeen and Scone (Tindale, 1974).

Other sources recognised that much of the Upper Hunter region was occupied by the Kamilaroi tribe, with some authors suggesting they were occupying as far south as Wollombi Brook (Brayshaw, 1986).

Miller (1985) also recorded that the Wonnarua were closely affiliated with the Kamilaroi, however formed a separate tribe that occupied a territory including the Project. Miller (1985) also suggested that the Gringai and Geawegal are clans of the Wonnarua, and raised the possibility that the Awabakal people, who inhabited the coast around Newcastle and Lake Macquarie, were a sub-group of the Wonnarua (Appendix G).

There remains a vibrant Aboriginal population in the region today which takes an active interest in the management of their heritage (Appendix G).

Zones of Aboriginal Occupation

SEA (2020) identified that the majority of the Project is located in a context that is distant from higher order water sources. Occupation in the vicinity of the Project is therefore more likely to have related to hunting and gathering activities, along with transitory movement between locations and procurement of stone materials, and have been generally of a low intensity (Appendix G).

Small portions of the Project are located adjacent to the Hunter River, within what could be classified as a primary resource zone. Within this area, additional types of occupation involving encampments, events of longer duration or involving larger numbers of people may have occurred (Appendix G).

Previous Archaeological Investigations

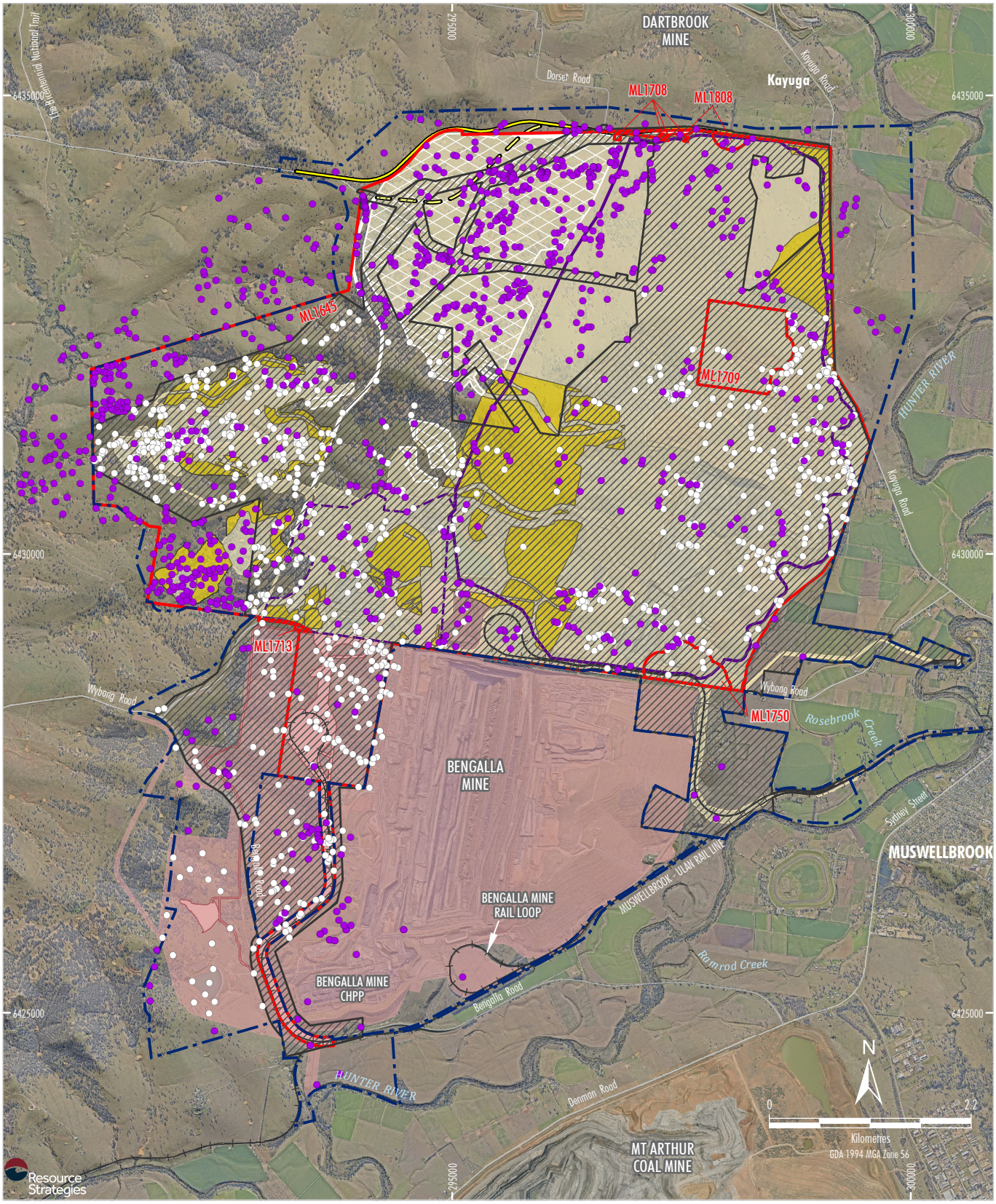
Extensive previous Aboriginal heritage surveys and assessments have been undertaken across the Project Additional Disturbance Area and surrounds. The majority of the Project Additional Disturbance Area has been subject to previous Aboriginal heritage surveys and assessments.

The majority of the Project is also covered by the existing AHIPs, namely AHIPs #C0002092, #C0002053 and #C0004783 that authorise Aboriginal heritage disturbance activities of the approved Mount Pleasant Operation (Figure 7-28). As evident on Figure 7-28, the majority of the infill disturbance associated with the Project Additional Disturbance Area is subject to existing AHIPs.

The Aboriginal heritage investigations and surveys undertaken in the immediate area include:

- *Survey Supplement Archaeological Survey and Assessment Dartbrook 66 kV Proposed Transmission Line* (Effenberger, 1993).
- *A Report on an Archaeological Survey of the Proposed Optic Fibre Route from Castle Rock to Muswellbrook, Upper Hunter, NSW* (Ruig, 1993).

[3] It is understood that both “Wonnarua” and “Wanaruah” have been used to describe population groups in different contexts. The spelling variations can be attributed to oral histories and limited written documentation that identifies traditional population groups and sub-communities. The Wanaruah language group was reportedly the largest in the region pre-European settlement.



LEGEND

Existing Mine Elements

- Mining Lease Boundary (Mount Pleasant Operation)
- Approximate Extent of Existing/Approved Surface Development (DA92/97) [1]
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Existing/Approved Mount Pleasant Operation Infrastructure within Bengalla Mine Approved Disturbance Boundary (SSD-5170) [1]

Additional/Revised Project Elements

- Approved Disturbance Area to be Relinquished [2]
- Approximate Additional Disturbance of Project Extensions [1]
- Northern Link Road Option 1 Centreline [3]
- Northern Link Road Option 2 Centreline
- Approximate Extent of Project Open Cut and Waste Rock Emplacement Landforms
- Revised Infrastructure Area Envelope
- Development Application Area
- Existing AHIP Areas (AHIPs #C0002053, #C0002092, #C0004783)
- Known Salvaged Site [4]
- Other Recorded Aboriginal Heritage Site [4]

NOTES

1. Excludes some incidental Project components such as water management infrastructure, access tracks, topsoil stockpiles, power supply, temporary offices, other ancillary works and construction disturbance.
2. Subject to detailed design of Northern Link Road alignment.
3. Preferred alignment subject to landholder access.
4. Includes 41 sites subsequently reassessed not to be Aboriginal Sites.

Source: MACH (2020); NSW Spatial Services (2020); National Trust of Australia (1985); Department of Planning and Environment (2016)
Orthophoto: MACH (2020)

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Location of Known Aboriginal Heritage Sites and Existing AHIP Areas

Figure 7-28

- *Mt Pleasant Coal Lease, Near Muswellbrook, NSW: Archaeological survey for Aboriginal sites* (Rich, 1995).
- *Mt Pleasant Mine EIS North-West Emplacement Area Archaeological Investigations* (ERM Mitchell McCotter, 1996).
- *Mt Pleasant Mine EIS Fine Rejects Emplacement Area Archaeological Investigations* (ERM Mitchell McCotter, 1997b).
- *Aboriginal Heritage Assessment: Mount Pleasant Block 1* (HLA-Envirosciences, 2007).
- *Mount Pleasant Indigenous Archaeological Assessment Stage 2* (McCardle Cultural Heritage Management, 2007).
- *Aboriginal Cultural Survey Stage 3 Mount Pleasant, NSW* (Roberts, 2007).
- *Coal & Allied Stage 4 Mount Pleasant Aboriginal Cultural and Heritage Report* (Anderson, 2007).
- *Technical Advisor Report: Cultural Heritage Investigations Stage 5 Mount Pleasant Mine, Hunter Valley* (Scarp Archaeology, 2009).
- *Mount Pleasant Mine, Hunter Valley Stage 6* (Scarp Archaeology, 2012).
- *Mount Pleasant Project Modification Aboriginal Cultural Heritage Assessment* (Central Queensland Cultural Heritage Management, 2010).
- *Technical Advisor Report: Cultural Heritage Investigations, Conveyor Easement Survey, Mount Pleasant Mine, Hunter Valley* (Scarp Archaeology, 2010a).
- *Cultural Heritage Investigation of the Mount Pleasant Over Land Conveyor - Additional Assessment, Hunter Valley, Muswellbrook LGA* (Scarp Archaeology, 2015).
- *Technical Advisor Report: Cultural Heritage Investigations of the Proposed Broomfield Aboriginal Cultural Heritage Conservation Area for the Mount Pleasant Coal Mine, Hunter Valley, Muswellbrook LGA* (Scarp Archaeology, 2010b).
- *Aboriginal Cultural Heritage Assessment Report for the Mount Pleasant Coal Mine (DA 92/97) 2016 Aboriginal Heritage Impact Permit Application* (Cameron and Deacon, 2016).
- *Mount Pleasant Operation Rail Modification – Aboriginal Cultural Heritage Assessment* (Niche, 2017).
- *Report on Aboriginal Heritage Due Diligence Assessment of Proposed Water Supply Pipeline at Mount Pleasant Operation, Hunter Valley, NSW* (Kuskie, 2016).
- *Aboriginal Objects Due Diligence Assessment Mount Pleasant Operations ETL Realignment Muswellbrook, NSW* (Niche, 2019a).
- *Aboriginal Objects Due Diligence Assessment Mount Pleasant Operations Clean Water Diversion Muswellbrook, NSW* (Niche, 2019b).
- Various scarred tree reassessments undertaken for the Mount Pleasant Operation (Kuskie 2017a, 2017b, 2017c and 2019; Burns, 2017a, 2017b and 2017c; Global Soil Systems, 2019).
- Various archaeological assessments, and surveys and salvages undertaken for the Bengalla Coal Mine (Rich, 1993; Environmental Resources Management Australia, 2007a; White, 1998; AECOM, 2013, 2017).
- Various archaeological salvage reports (Environmental Resources Management Australia, 2007b; ENSR Australia Pty Ltd [ENSR Australia], 2008; RPS, 2018; Kuskie, 2020).
- On-going salvage, investigations and Aboriginal heritage management activities at the Mount Pleasant Operation.

A detailed description of the history of Aboriginal heritage investigations at the Mount Pleasant Operation and surrounds is provided in Appendix G.

Aboriginal Heritage Conservation Areas

As part of the approved Mount Pleasant Operation, Aboriginal Heritage Conservation Areas were proposed to the west of the mine. The currently approved and proposed Aboriginal Heritage Conservation Areas include the following:

- Stage 1 approved Aboriginal Heritage Conservation Area A: approximately 329 ha as a guaranteed conservation area for the 2016-2020 development at the Mount Pleasant Operation.
- Stage 2 provisional Aboriginal Heritage Conservation Area C: approximately 235 ha to be considered as a conservation area for the post-2020 development at the Mount Pleasant Operation.

- Stage 3 provisional Aboriginal Heritage Conservation Area B: approximately 150 ha as a potential future conservation area subject to further consideration[4].

MACH intends to develop alternative options for the Mount Pleasant Operation provisional Conservation Areas B and C to manage potential land use conflicts.

Heritage Register Searches

Searches of the following heritage registers and planning instruments were undertaken:

- Aboriginal Heritage Information Management System (AHIMS) database;
- *Muswellbrook Local Environmental Plan 2009*;
- *Aboriginal and Torres Strait Islander Heritage Protection Act, 1984*;
- *Commonwealth Heritage List and National Heritage List (via the Australian Heritage Database)*; and
- NSW *State Heritage Register*.

A thorough review and comparison of the Aboriginal heritage databases previously maintained by Rio Tinto Coal Australia (RTCA) was also undertaken.

A total of approximately 1,924 known Aboriginal heritage sites[5] and/or potential archaeological deposits (PADs) were identified. These sites predominantly included open artefact sites[6] (approximately 95% of the sites), with lesser occurrences of scarred trees, artefact scatters with PADs, isolated artefacts with PADs and a spiritual place.

Searches of the heritage registers and planning instruments did not identify any further listed Aboriginal heritage sites.

Community Consultation

Consultation for the Project was undertaken in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010a) and the NSW *National Parks and Wildlife Regulation, 2009*.

A total of 88 Aboriginal stakeholders registered an interest and were consulted in relation to the Project ACHA process. A detailed account of the consultation process (including consultation records and a detailed consultation log) for the Project is provided in Appendix G. Consultation with the RAPs regarding the existing Mount Pleasant Operation has been extensive and involved various methods including public notices, on-site meetings, written and verbal correspondence and archaeological survey attendance.

Additional information regarding consultation undertaken with the Aboriginal community is provided in Section 6 (Table 6-6).

Survey Methodology

The archaeological surveys undertaken for the Project focused on portions of the Project Additional Disturbance Area that had not been subject to the previous Aboriginal heritage survey, assessments and AHIPs.

Some small areas (i.e. portions of the proposed Northern Link Road) were unable to be accessed during the field surveys due to private property access restrictions. These areas of the Project would be subject to additional inspection with RAPs present prior to any planned surface disturbance.

During the survey and throughout the consultation process, representatives of the RAPs were asked to identify any areas of cultural significance or any cultural values relevant to the area. All cultural comments relating to the Project and/or wider region were recorded and are included in Appendix G.

Summary of Archaeological Findings

A total of approximately 1,736 tangible Aboriginal heritage sites were identified (including the extent of the approved Mount Pleasant Operation), of which approximately 810 sites are known to have been managed (i.e. salvaged/impacted) under the currently approved Mount Pleasant Operation (MACH, 2019i). Many of the identified sites are located within the existing AHIP areas (AHIPs #C0002053, #C0002092 and #C0004783) that authorise impacts on heritage values associated with the approved Mount Pleasant Operation (Figure 7-28).

[4] Aboriginal Heritage Conservation Area B is located outside of the Project Additional Disturbance Area.

[5] This excludes 41 sites that have previously been reported, however, subsequent reassessment has determined that they do not comprise Aboriginal objects.

[6] The term 'open artefact site' refers to both artefact scatters and isolated finds.

The heritage significance of the known Aboriginal heritage sites identified within the Project area can be summarised as follows (Table 7-25) (Appendix G):

- 399 were assessed as being of low scientific significance;
- 13 were assessed as being of low-moderate scientific significance;
- 17 were assessed as being of moderate scientific significance;
- 6 were assessed as being of moderate-high scientific significance; and
- 1 was assessed as being of high scientific significance.

SEA (2020) also noted the specific scientific significance of approximately 250 sites was not documented in the previous assessments (i.e. uncertain) (Appendix G).

The potential for other types of Aboriginal heritage evidence (e.g. grinding grooves, rock shelter and bora/ceremonial sites) was assessed as being typically low to very low, or negligible (Appendix G).

No sites or places associated with ceremonies, spiritual/mythological beliefs or traditional knowledge, which date from the pre-contact period and have persisted until the present time, or places associated with historical associations which date from the post-contact period were identified (Appendix G).

A detailed description of each of the Aboriginal heritage sites identified in the ACHA is provided in Appendix G. The distribution of known Aboriginal heritage sites is presented on Figure 7-28.

Cultural Values Assessment

Contemporary cultural values have been identified by the RAPs during the course of the ACHA and the previous Aboriginal heritage assessments (Appendix G).

Environmental & Cultural Services (2020) also highlighted key cultural heritage themes associated with the Mount Pleasant Operation and the surrounding landscape, including the important cultural connections held by Aboriginal people today to the ancestral past through archaeological objects, such as open artefact sites.

Table 7-25
Summary of Relevant Known Aboriginal Heritage Sites

Site Type	Assessed Significance	Number of sites
Open Artefact Site[a]	High	1
	Moderate-high	2
	Moderate	17
	Low-moderate	13
	Low	399
	Uncertain	249[b]
	Not Assessed	1,042[c]
Scarred Tree	Moderate-high	4
	Not Assessed	8[c]
Spiritual Place	Uncertain	1[b]
Total		1,736[d]

Source: After Appendix G.

[a] The term 'open artefact site' refers to both artefact scatters and isolated finds.

[b] Remain *in situ* and may be subject to potential impacts from the Project. Assessment of the specific significance of these sites may be warranted in relation to determining the most appropriate management strategy under the Project AHMP (Section 7.12.4).

[c] Further consideration of significance is not considered to be warranted, as these sites are known to have been approved for disturbance by either the existing AHIPs or the approved existing Mount Pleasant Operation, or have already been managed (i.e. salvaged/impacted) under the approved Mount Pleasant Operation.

[d] Includes approximately 810 sites that are known to have been managed (i.e. salvaged/impacted) under the currently approved Mount Pleasant Operation, or within the existing approved Mount Pleasant Operation disturbance footprint.

Environmental & Cultural Services (2020) also identified the following cultural values associated with Wanaruah people today:

- the historic resistance of Wanaruah ancestors to colonisation is valued;
- the past acts are an integral part of contemporary Wanaruah cultural identity and form part of people's attachment to place;
- the customary right to care for and make decisions about one's traditional land is important; and
- the ongoing cultural use of natural resources across the landscape is an important cultural practice.

Environmental & Cultural Services (2020) did not identify any specific sites or areas of cultural significance that require Aboriginal Place Declaration under the *National Parks and Wildlife Act, 1974,* or scheduling as an Aboriginal Heritage Conservation Area in the Muswellbrook LEP under the EP&A Act (Appendix G).

7.12.3 Potential Impacts

Direct Impacts

SEA (2020) assessed the potential changes in impacts associated with the Project on Aboriginal heritage sites, and how this compared with the impacts of the existing approved Mount Pleasant Operation. Potential changes in impacts can be summarised as follows (Appendix G):

- 95 sites would have reduced impact;
- 1,145 sites would have no change in impact;
- 19 sites would have no change, or increased impacts; and
- 89 sites would have increased impacts.

In addition, approximately 272 sites, which are located within the Project Relinquishment Area may have no change, or decreased impacts. Another approximately 211 sites may have no change, or increased impacts, subject to final engineering design of Project ancillary development (Appendix G).

Where practicable, ancillary development would be located to avoid or minimise potential impacts to known Aboriginal heritage sites (Section 7.12.4).

As evident on Figure 7-28, more known heritage sites are located within the Project Relinquishment Area than are within the proposed Project Additional Disturbance Area (Appendix G).

Environmental & Cultural Services (2020) did not identify any specific sites or cultural areas that require specific mitigation recommendations (Appendix G).

Indirect Impacts

Possible causes of indirect impacts to Aboriginal heritage sites in close proximity to the Project may include:

- potential impacts associated with blasting-induced vibration;
- accidental disturbance by peripheral activities; and
- continuation of existing land-use practices, including pastoral/rural use of land and maintenance works.

Open artefact scatters and isolated artefacts are not considered to be particularly sensitive to potential indirect impacts (e.g. blasting vibration) and the potential indirect impacts on these sites would be limited.

There are no known Aboriginal heritage sites that are considered susceptible to Project impacts from blasting (e.g. cave or overhang sites or grinding grooves) (Appendix A).

Cumulative Impacts

A consideration of the potential cumulative impacts associated with the Project, including the approved Mount Pleasant Operation, has been undertaken and is presented in Appendix G. This assessment includes consideration of the known and potential Aboriginal heritage resources that may be impacted by the Mount Pleasant Operation and surrounding projects.

The Project would not cause, within a regional context, a loss of heritage resources that could be viewed as being very rare or unique, or unlikely to exist elsewhere (Appendix G).

Therefore, SEA (2020) concluded that the cumulative impacts of the Project on Aboriginal heritage would be very low within a regional context.

7.12.4 Mitigation Measures

The mitigation, management and monitoring measures detailed below have been developed in consultation with the RAPs, in consideration of the cultural and archaeological significance of the Aboriginal heritage sites predicted to be impacted, and the cultural significance of the area.

SEA (2020) provided recommended management measures for each known Aboriginal heritage site of relevance to the Project.

Aboriginal Heritage Management Plan

The currently approved Mount Pleasant Operation AHMP would be replaced by a new AHMP prepared to include provisions relating to the Project, and to specify the policies and actions required to manage Aboriginal heritage consistent with the conditions of any Project Development Consent.

The Project AHMP would be formulated by an appropriately qualified heritage practitioner with expertise in Aboriginal heritage and would be prepared in consultation with RAPs and Heritage NSW. The Project AHMP would be developed prior to any works associated with the Project that would harm Aboriginal cultural heritage sites. A summary of measures expected to be included in the AHMP and implemented over the life of the Project are provided below. Further detail is provided in Appendix G.

Surface Disturbance

For those areas where Aboriginal heritage sites would be subject to direct surface disturbance as a result of the Project, a number of mitigation measures and management strategies have been identified, including the following (Appendix G):

- Continued implementation of a Ground Disturbance Permit process, as detailed in the approved Mount Pleasant Operation AHMP.
- All potential direct disturbance areas (e.g. for ancillary infrastructure) that have not yet been subject to systematic survey sampling would be subject to supplementary survey.
- Progressive surface collection of Aboriginal objects/sites potentially impacted by surface development.
- Test excavation, broad area hand excavation and surface scrapes with localised hand excavation for relevant open artefact sites detailed in Appendix G.
- consideration of the location of known Aboriginal heritage sites during final detailed engineering designs of road realignments and ancillary infrastructure.
- Implementation of a protocol for surface disturbance works to reduce the risk of accidental damage to known and unknown Aboriginal cultural heritage sites.
- For any possible scarred trees that may be subject to surface disturbance, verification of the precise location of the tree, the nature of the scar and a reassessment of significance would occur[7].
- Following final design of relevant Project elements, determine significance of sites in the disturbance area not previously assigned a significance rating, to determine the most appropriate management strategy under the Project AHMP.

Management strategies for identified Aboriginal heritage sites and cultural areas/values that could potentially be impacted by ancillary works are detailed in Appendix G and would be reflected in the updated AHMP.

General Measures

A number of general management measures have also been formulated in consultation with the RAPs to mitigate potential impacts, including (Appendix G):

- Documenting all heritage mitigation measures and management strategies undertaken for the Project with reference to relevant Heritage NSW guidelines.
- Providing reports to relevant stakeholders, such as the DPIE, Heritage NSW and RAPs, within appropriate timeframes.
- Curation of all heritage evidence salvaged under the Project in an appropriate manner, as determined in consultation with the RAPs and Heritage NSW during preparation of the revised AHMP.
- Implementation of site-specific precautionary measures, such as informing relevant staff and contractors of the nature and location of heritage items and the need to avoid impacts, potentially along with temporary fencing and demarcation, would be implemented for known Aboriginal heritage sites in close proximity to Project works.

[7] The management of any scarred trees confirmed to be of Aboriginal origin would be undertaken in accordance with an approved Project AHMP.

- Investigation and assessment of alternative conservation measures for the provisional Aboriginal Conservation Areas B and C for the existing approved Mount Pleasant Operation in consultation with the RAPs.
- Heritage awareness training of all relevant contractors and staff engaged for the Project who may have interactions with Aboriginal heritage, prior to commencing work on-site. The current training package at the Mount Pleasant Operation would be reviewed in consultation with the RAPs.
- Continuing to update and maintain the Mount Pleasant Operation Aboriginal Site Database established for the Project regularly, with copies of data made available to any RAPs and the updated database made available to Heritage NSW for their records.
- Lodging Aboriginal Site Impact Recording Forms in a timely manner with Heritage NSW for any site that is subject to salvage or development impacts.
- Lodging Aboriginal Site Recording Forms in a timely manner with Heritage NSW for any previously unrecorded Aboriginal heritage evidence that is identified during the course of operations and/or further heritage assessments over the life of the Project.
- Ongoing consultation with the RAPs over the life of the Project, including Aboriginal representation during archaeological fieldwork (e.g. salvage of artefacts prior to disturbance).
- Permitting access for Aboriginal community representatives for cultural purposes to known sites or areas within MACH-owned land upon request, subject to safety and operational requirements at the time.
- Developing a communication protocol that describes notification and response times between MACH and the RAPs on site Aboriginal heritage matters.
- Provisions would be included in the AHMP to guide the management of any previously unrecorded Aboriginal heritage sites that may be identified during future investigations or works.
- Should any skeletal remains be detected, ceasing relevant Project work immediately and reporting the find. Subject to the NSW Police requiring no further involvement, the management of any Aboriginal skeletal remains would be determined in consultation with the DPIE, Heritage NSW and the RAPs.

7.13 HISTORIC HERITAGE

A Historical Heritage Assessment for the Project was undertaken by Extent (2020) and is presented as Appendix H.

A description of the methodology relevant to the assessment of non-Aboriginal heritage is provided in Section 7.13.1. A description of existing non-Aboriginal heritage in the vicinity of the Project is provided in Section 7.13.2. Section 7.13.3 describes the potential impacts of the Project, while Section 7.13.4 outlines management measures, and monitoring.

7.13.1 Methodology

The assessment was prepared in consideration of the relevant principles and articles contained in (but not limited to) (Appendix H):

- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS, 2013);
- *NSW Heritage Manual* (NSW Heritage Office and NSW Department of Urban Affairs and Planning [DUAP], 1996);
- *Assessing Heritage Significance* (NSW Heritage Office, 2001); and
- *Statements of Heritage Impact* (NSW Heritage Office, 2002).

7.13.2 Existing Environment

Historical Overview

By the time the Hunter Region was opened for settlement in 1822, a series of government policies relating to the granting of land were in place (Appendix H). These policies gave rise to the influx of free settlers and immigrants who arrived in the Hunter Region with a view to obtaining private land holdings and developing it for mixed farming and small-scale pastoral industries (Perry, 1963).

The early European settlement of Muswellbrook fits within the broader historical pattern of the early regional settlement and industrial development of the Hunter Region (Appendix H).

By the mid-nineteenth century, Muswellbrook's population had grown considerably in response to increased trade, the opening of the railway in 1869, and the increased availability of land under *The Crown Lands Acts* of 1861.

Agriculture, pastoralism and coal mining were a feature of early life in the Muswellbrook district. For most of the nineteenth century, wool was initially the dominant industry, followed by cattle and sheep grazing, small-scale agriculture, and the breeding of horses (Appendix H).

Towards the end of the nineteenth century, the introduction of milking machines and tractors led to the mechanisation of farming, which in turn created a pivotal increase in productivity (Appendix H).

Further discussion on the early European settlement and pastoral history of relevance to non-Aboriginal heritage items in the vicinity of the Project is provided in Appendix H.

Heritage Register Searches

Extent completed historic and archival research and a review of heritage registers, including searches of the following (Appendix H):

- World Heritage List.
- NSW State Heritage Register.
- Former Register of the National Estate.
- National Trust Register.
- National Heritage List.
- Commonwealth Heritage List.
- Schedules of the Muswellbrook LEP.
- Relevant Section 170 Heritage and Conservation Registers.
- Australian Institute of Architects (AIA) Register of Significant 20th Century Buildings.
- Former *Hunter Regional Environmental Plan 1989 (Heritage)*[8].

Searches of the World Heritage List, National Heritage List, Commonwealth Heritage List, NSW State Heritage Register and the AIA Register of Significant 20th Century Buildings identified no registered sites located within, or adjacent to, the Project (Appendix H).

Sites with identified heritage value in the vicinity of the Project listed in the Muswellbrook LEP included four historic heritage sites located in broader Muswellbrook area, including (Appendix H):

- Negoa Homestead;
- Kayuga Bridge;
- Overdene (Overton) Homestead; and
- Kayuga Cemetery.

A search of the National Trust Register (a non-statutory register) also identified four registered items in the vicinity of the Project (one of which is also included in the Section 170 Heritage and Conservation Register), including (Appendix H):

- Negoa Homestead;
- Overdene (Overton) Homestead;
- Old Kayuga Cemetery; and
- Muswellbrook-Jerry Plains Landscape Conservation Area.

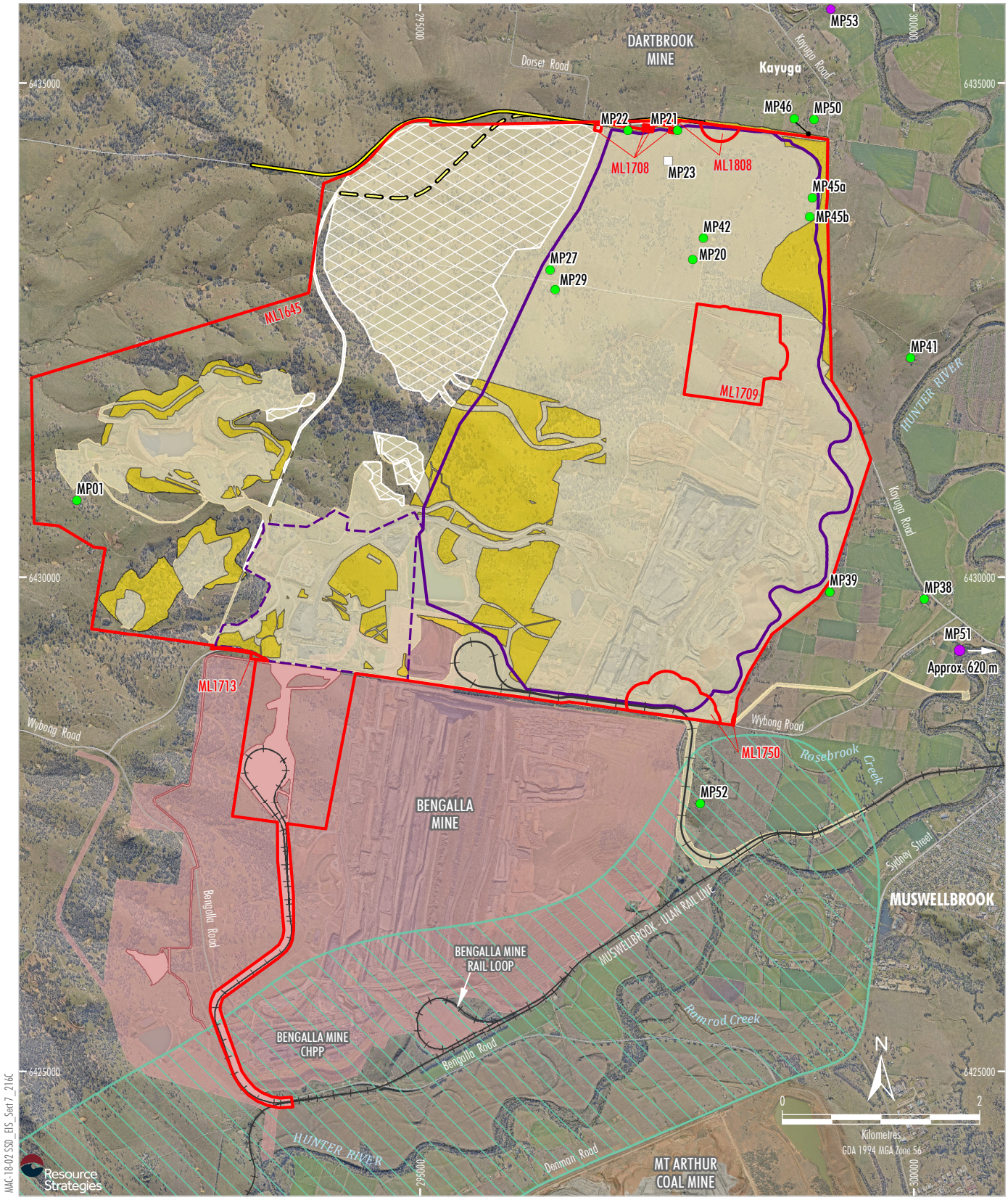
The Muswellbrook-Jerrys Plains Landscape Conservation Area (Figure 7-29) was registered by the National Trust of Australia (NSW) in 1985. This listing is not recognised in either the Muswellbrook LEP or the Singleton LEP (Appendix H). A National Trust heritage assessment listing has no legislative effect and gives rise to no statutory obligations.

Previous Investigations

A detailed historic heritage study was undertaken by Veritas Archaeology & History Service (VAHS) (2014) for the Mount Pleasant Operation. This study identified some 55 historic heritage sites within the Development Consent DA 92/97 boundary and immediate surrounds.

The identified sites including a lime kiln, sandstone quarry, sheds, stockyards and fences, windmills, hut sites, school and church sites, a butter factory, a slaughter house, a surveyor's mark, farm and house sites, homesteads and a cemetery; ranging in antiquity from the 1830s to the 1970s.

[8] The *Hunter Regional Environmental Plan 1989 (Heritage)* was repealed on 5 August 2016; however, items listed in this document have been considered for completeness.



LEGEND

Existing Mine Elements

- Mining Lease Boundary (Mount Pleasant Operation)
- Approximate Extent of Existing/Approved Surface Development (DA92/97) [1]
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Existing/Approved Mount Pleasant Operation Infrastructure within Bengalla Mine Approved Disturbance Boundary (SSD-5170) [1]

Additional/Revised Project Elements

- Approved Disturbance Area to be Relinquished [2]
- Approximate Additional Disturbance of Project Extensions [1]
- Northern Link Road Option 1 Centreline [3]
- Northern Link Road Option 2 Centreline
- Approximate Extent of Project Open Cut and Waste Rock Emplacement Landforms
- Revised Infrastructure Area Envelope
- Muswellbrook-Jerrys Plains Landscape Conservation Area
- Site of Interest

Historic Heritage Sites

- Local Significance
- State Significance

NOTES

1. Excludes some incidental Project components such as water management infrastructure, access tracks, topsoil stockpiles, power supply, temporary offices, other ancillary works and construction disturbance.
2. Subject to detailed design of Northern Link Road alignment.
3. Preferred alignment subject to landholder access.

Source: MACH (2020); NSW Spatial Services (2020); National Trust of Australia (1985); Department of Planning and Environment (2016) Orthophoto: MACH (2020)

MACHEnergy

MOUNT PLEASANT OPTIMISATION PROJECT

Relevant Historic Heritage Sites

Figure 7-29

Two of the identified sites were considered to be of State significance, comprising the Kayuga Bridge and the Kayuga Cemetery (VAHS, 2014). Both of the sites are located outside of the Development Consent DA 92/97 boundary.

The remainder of the sites were considered to be of some local heritage interest, however, 14 of these previously identified sites do not meet the threshold for local heritage significance (Extent, 2020).

Bengalla Mine has also developed a Historic Heritage Management Plan for the management of heritage items within and adjacent to Bengalla Mine in accordance with Development Consent (SSD-5170). The Historic Heritage Management Plan includes management measures and the Conservation Management Plan for site MP52, Overdene. Site MP52 has been assessed to be of a local heritage significance (Extent, 2020).

Project Investigation

In addition to a desktop assessment and review of previous investigations, additional site investigations were conducted by Extent (2020).

Heritage Items of Relevance to the Project

As a result of the heritage register searches, review of the previous historic heritage investigations and the site investigation, Extent identified 14 places of local heritage significance (Figure 7-29 and Table 7-26). Two places of State heritage significance were also identified within the broader area (Sites MP51 and MP53).

Kayuga Bridge (Site MP51) has been assessed to be of a State historic heritage significance (Table 7-26) and comprises a bridge and a roadway carried on cross girders covered with a timber deck. The bridge is the second oldest lattice bridge in NSW and represents the significant structures of the colonial period between 1881 to 1893. MACH has an existing commitment for mine-related traffic to avoid using the bridge. Site MP51 would not be directly impacted by the Project.

Kayuga Cemetery (Site MP53) has also been assessed to be of a State historic heritage significance (Table 7-26). Site MP53 is the oldest cemetery in the Upper Hunter and had three periods of use, including the convict period (1831 – 1842), Scottish settlers and labourers, and conditional purchase settlers and labourers (post-1861). Site MP53 would not be directly impacted by the Project.

For a full description of each place, refer to Appendix H.

7.13.3 Potential Impacts

Potential Direct Impacts

Of the 14 identified sites of local heritage significance, seven sites have the potential to be directly impacted by the Project (Figure 7-29). These include:

- MP20 Kayuga Coal Mine;
- MP21 Kayuga School;
- MP22 Smith's Clear Farm;
- MP27 Thorndale;
- MP29 Lynch’s;
- MP42 Fibbins; and
- MP45(a-b) Casey: Clenmore and Edgeway.

These sites are also located within the approved Mount Pleasant Operation surface development area (Figure 7-29). Direct impacts to these sites would be appropriately mitigated by implementing management measures consistent with the recommendations of Extent (2020) (Section 7.13.4).

Site MP01 Broomfield is located outside of the proposed Project disturbance footprint (Figure 7-29). However, the site may potentially experience direct or indirect impacts associated with the Project ancillary development. Ancillary development is subject to final engineering design, and where practicable, would be located to avoid the site.

Potential Indirect Impacts

Extent (2020) also considered potential indirect impacts of the Project to the following sites:

- MP01 Broomfield;
- MP38 Rosebrook;
- MP41 Negoa;
- MP46 Kayuga Recreation Ground;
- MP50 Waitomo;
- MP51 Kayuga Bridge;
- MP52 Overdene (Overton); and
- MP53 Kayuga Cemetery.

These sites have been assessed for potential indirect impacts relating to blasting (building damage), air quality, acoustic, visual amenity and altered ‘use’ of the site.

Table 7-26
Relevant Historic Heritage Sites

Site Number	Historic Heritage Site	Identified in Historic Heritage Register?	Summary Description	Significance	Located within Project Area
MP01	Broomfield	No	A homestead with a weatherboard home, coach house/museum, a shed of timber and corrugated iron, a shelter, a small hut with extensions, two large stable complexes and a shearing shed.	Local	Yes[1]
MP20	Kayuga Coal Mine	No	A disturbed collection of debris, with the visible extant features including the remains of timber posts, collapsed timber lined shaft entrances, exposed coal fines and broken bricks.	Local	Yes
MP21	Kayuga School	No	A series of depressions, partly soil-covered remnants of brick walls, circular brick kerbs/wells at ground level and drains.	Local	Yes
MP22	Smith's Clear Farm	No	A derelict homestead with a number of outbuildings (four sheds).	Local	Yes
MP27	Thorndale	No	A farm house constructed in the early 1870s with several derelict outbuildings.	Local	Yes
MP29	Lynch's	No	Dilapidated and weathered dwelling clad with ironbark weatherboards on a sawn timber frame with timber piers and a shed.	Local	Yes
MP38	Rosebrook	No	A farm site with the modified remains of an early homestead. It comprises of a two-storey sandstone homestead with a narrow, steep-roofed lean-to, a cellar, a billiard room and other outbuildings.	Local	No
MP39	Rosebrook Quarry	No	The site presents as a quarry, located west of the Rosebrook homestead.	Local	No
MP41	Negoa Homestead	Yes	A single-storied brick homestead in good condition with a corrugated metal hipped roof, with a two roomed cellar underneath the building.	Local	No
MP42	Fibbins	No	A farm site with the remains of a house, a brick chimney and ancillary structures.	Local	Yes
MP45 (a-b)	Casey: Clenmore and Edgeway	No	MP45(a): a farm site with a homestead surrounded by verandahs and a detached two-room kitchen. There are also various other ancillary farm structures. MP45(b):a large debris pile of timber and brick material used in the construction of the previous house.	Local	Yes
MP46	Kayuga Recreation Ground	No	A timber hall structure with gabled ends, a lean-to section and boarded up windows on the eastern side.	Local	No
MP50	Waitomo House	No	A four-bedroom house constructed of a sawn timber frame, mounted in timber piers and clad with a 'modern' style weatherboard.	Local	No
MP51	Kayuga Bridge	Yes	A two-span, single lane continuous steel and iron lattice truss bridge with an overall length of 162 m. The bridge is indicative of a significant structure of the colonial period.	State	No
MP52	'Overdene' (Overton)	Yes	A 19th century five-room sandstone homestead with a central hall, brick chimneys and verandah extending around the east and south sides. The homestead has undergone a program of conservation to stabilise the physical fabric.	Local	No
MP53	Kayuga Cemetery	Yes	The site is the oldest cemetery in the Upper Hunter, with the first known burial in 1831.	State	No

After: Appendix H.

[1] Site MP01 Broomfield is located outside of the Project disturbance footprint.

Any potential indirect impacts would be avoided or mitigated by implementing management measures recommended by Extent (2020) (Section 7.13.4).

Cumulative Impacts

The Project would result in demolition of six homesteads of local heritage significance, removing these from the Mount Pleasant cultural landscape (Appendix H).

Many of the features that contribute to the Mount Pleasant cultural landscape, including the homesteads to be disturbed, are of poor condition (Appendix H). Extent (2020) noted that the Project has an opportunity to have a positive effect of recording these features through the recommended photographic archival recording (Appendix H).

There would be negligible impact on the broader setting of the Muswellbrook-Jerrys Plains Landscape Conservation Area (Appendix H).

Extent (2020) assessed the cumulative historical heritage impacts of the Project to be low (Appendix H).

7.13.4 Management and Monitoring

Management measures for the identified historic heritage sites would be described in a Historical Heritage Management Plan to be developed for the Project.

Specific management measures for each historic heritage site, which would potentially experience direct or indirect impacts associated with the Project are provided in Table 7-27 and are further discussed in Appendix H.

Additionally, archaeological investigation would be undertaken at site MP23 Devine's (no historical heritage significance) and site MP27 Thorndale (local heritage significance) due to anecdotal reports of potential child burials at these locations (Appendix H). In the unlikely event that grave cuts, or unusual features including human remains, are identified, site work would stop immediately in the vicinity and the relevant authorities (including the NSW Police) would be notified immediately.

No specific management measures are proposed for the remainder of the sites that are not considered to be of historic heritage significance (Appendix H). However, some of these items may be of interest to local collectors, and prior to Project disturbance, may be offered to local historical groups.

7.14 AGRICULTURAL AND LAND RESOURCES

An Agricultural and Land Resources Assessment (MACH, 2020g) for the Project is provided in Appendix I.

The Agricultural and Land Resources Assessment includes a Soil Resource Assessment for the Project that was undertaken by GT Environmental (2020) (Attachment 1 of Appendix I). The assessment also draws on the findings from other technical reports prepared for the Project (e.g. noise, air quality, water, transport, visual and economic [Appendices A, B, C, D, J, M and O]).

A description of the existing agricultural resources in the vicinity of the Project is provided in Section 7.14.1. Section 7.14.2 describes the potential impacts of the Project on agricultural resources and Section 7.14.3 summarises mitigation measures and management for the Project.

7.14.1 Existing Environment

Regional Agricultural Overview

The Hunter region is the leading regional economy in NSW. The Hunter region population is approaching 1 million people and supports major sectors that include agriculture, coal mining, tourism, defence, energy and transport (Appendix I).

Within the Hunter region, the Upper Hunter is recognised as a major supplier of coal, energy, wine and thoroughbred horses, to national and international markets (Appendix I).

Employment in agriculture, forestry and fishing (which also includes horse breeding and horse studs) plays less of a role in the Muswellbrook LGA (7%) and Singleton LGA (4%), but is important in the Upper Hunter LGA, where 19% of people were employed in agriculture in 2016 (Appendix I).

Employment in tourism-related industries accounted for approximately 7% of employment in Muswellbrook LGA, 8% in Singleton LGA, and 6% in the Upper Hunter LGA (Appendix I).

The thoroughbred horse breeding industry is focused around Scone in the Upper Hunter Shire and includes a highly integrated concentration of horse breeding facilities and related infrastructure covering thoroughbred and stock horse breeding centres and numerous other equine developments and support services, such as a specialised veterinary centre (Appendix I).

Table 7-27
Key Proposed Management Measures for Relevant Historic Heritage Sites

Site Number[1]	Historic Heritage Site	Key Proposed Management Measures[2]
MP01	Broomfield	• Retain *in situ* if practicable and make the structures safe and weather-proof. • Conduct archival recording prior to demolition.
MP20	Kayuga Coal Mine	• Conduct archaeological investigations prior to disturbance, provided it is safe to do so. • For those areas identified as unsafe to undertake archaeological investigations, it is appropriate for works to proceed without the need for further inputs from an archaeologist.
MP21	Kayuga School	• Conduct archaeological investigations prior to disturbance.
MP22; MP29; MP42; MP45(a-b)	Smith's Clear Farm; Lynch's; Fibbins; Casey: Clenmore and Edgeway	• Conduct archival recording prior to demolition.
MP27	Thorndale	• Conduct archival recording prior to demolition. • Conduct archaeological investigations prior to disturbance, due to the existing of potential anecdotal reports of child burials. Should the investigations indicate no possible location of a grave(s), it is appropriate for the works to proceed without further input from the engaged archaeologist.
MP38	Rosebrook	• Prepare a Conservation Management Plan and retain *in situ*. • Undertake archaeological analysis prior to any significant ground disturbance. • All blasting activities would be designed and managed in accordance with the Blast Management Plan.
MP41	Negoa Homestead	• Update and finalise the draft Conservation Management Plan (Extent, 2018) and retain *in situ*. • All blasting activities would be designed and managed in accordance with the Blast Management Plan. • Consult with a suitably qualified archaeologist prior to conducting any ground disturbance.
MP46	Kayuga Recreation Ground	• All blasting activities in the vicinity of the site would be designed and managed in accordance with the Blast Management Plan.
MP50	Waitomo House	• Retain *in situ* and conserve within an appropriate setting. • Consult with a heritage professional in relation to any proposed alterations and additions to the house. • All blasting activities would be designed and managed in accordance with the Blast Management Plan. • If *in situ* retention is not practicable, conduct archival recording prior to demolition.
MP51	Kayuga Bridge	• Continue to observe MACH's existing commitment relating to the use of the Kayuga Bridge. • All blasting activities would be designed and managed in accordance with the Blast Management Plan. • Given the management of the site remains the responsibility of RMS, no further measures are required.
MP52	'Overdene' (Overton)	• Maintain and conserve *in situ* in accordance with the existing Conservation Management Plan (AECOM and Hansen Bailey, 2015), noting that the site is located on Bengalla Mine owned land.
MP53	Kayuga Cemetery	• All blasting activities would be designed and managed in accordance with the Blast Management Plan. • Given the management of the site remains the responsibility of the MSC, no further measures are required.

After: Appendix H

1 The site number correlates with the numbers presented on Figure 7-29.

2 Refer to Appendix H for additional details regarding the management measures recommended by Extent (2020).

The Coolmore and Godolphin Woodlands Studs are recognised as "central players" and the "epicentre" of the thoroughbred breeding industry in the Hunter Valley (Hunter Thoroughbred Breeders Association, 2019). These two studs are located in the Muswellbrook LGA, approximately 20 km south of the Project. The existing Bengalla Mine and Mt Arthur Coal Mine are located between the two studs and the Project (Appendix I).

Muswellbrook Shire is also home to a significant proportion of the wine industry in the Upper Hunter Region. Many of the larger wineries are centred in and around the township of Denman (Appendix I).

Agricultural Land Use in the Vicinity of the Project

MACH currently leases non-mining MACH-owned agricultural land to original landowners or other local farmers for ongoing productive use, and this practice would continue for the Project. This agricultural land is subject to a number of uses including cattle grazing, dairying, turf farming, stock horse breeding, and fodder cropping (Appendix I).

A range of agricultural enterprises are also located on private land in the vicinity of the Mount Pleasant Operation and the Project. Proximal private agricultural land is largely subject to cattle grazing in the north and west, and a variety of more intensive land uses on the Hunter River floodplain to the east (including dairy farming and irrigated cropping) (Appendix I).

The *Upper Hunter Country Touring Map* (Hunter Valley Visitor Centre, 2015) does not identify any tourism sites in the immediate vicinity of the Mount Pleasant Operation. The nearest identified tourist sites are:

- Hunter Belle Cheese and Karoola Wetlands in and around Muswellbrook, approximately 3 km east of the Mount Pleasant Operation;
- the recreation area, river walk, golf course and horse facilities in and around Aberdeen, approximately 5 km north of the Mount Pleasant Operation; and
- Muswellbrook Race Course, located approximately 2.5 km to the south-southeast of the Mount Pleasant Operation.

There are no viticulture enterprises within the immediate vicinity of the Project. With respect to equine industries, the most proximal horse stud is located on MACH-owned land to the east of the Mount Pleasant Operation and produces stock horses.

Critical Industry Clusters

The Regional Land Use Plan recognises two agricultural CICs in the Upper Hunter, including:

- the Equine CIC, which is focused on producing thoroughbred horses for the racing industry (although it also includes horse agistment and breeding horses for other purposes); and
- the Viticulture CIC, which is focused primarily on wine production, along with associated tourism.

Potential impacts on equine and viticulture enterprises have been considered as part of relevant specialist studies and are summarised in Appendix I.

Soil Resource Assessment

A Soil Resource Assessment has been prepared for the Project by GT Environmental (2020) and is provided in Attachment 1 of the Agricultural and Land Resources Assessment (Appendix I).

The Soil Resource Assessment includes:

- Identification of soil management units in accordance with the *Australian Soil Classification* (Isbell, 2002).
- Assessment of land and soil capability (LSC Class) in accordance with *The Land and Soil Capability Assessment Scheme – Second Approximation* (OEH, 2012).
- Assessment of agricultural suitability in accordance with *Agricultural Land Classification, Agfact AC.25* (NSW Agriculture, 2002).

The outcomes of these assessments are presented in Appendix I and summarised below.

The land mapped within the Project Additional Disturbance Area and Relinquishment Area has been mapped as LSC Class 3 and 4 (i.e. moderate to high capability land with limitations for high-impact land uses such as cropping, high-intensity grazing and horticulture). The primary limiting factor in these areas is slope (Appendix I).

The Project Additional Disturbance Area and Relinquishment Area are mapped as Agricultural Suitability Class 3 (grazing land or land well suited to pasture improvement). This is consistent with the existing and historical land use in these areas (Appendix I).

Land Contamination Context

A Land Contamination Assessment has been undertaken by JBS&G (2020) in accordance with *Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land* and is included in Appendix L.

The Land Contamination Assessment concludes (Appendix L):

- there is a low potential for gross or widespread contamination as a result of historical and/or current site uses;
- the area is suitable for the Project (i.e. no contamination has been identified which would make the land unsuitable for the Project); and
- existing, localised sources of potentially contaminated media include tenanted residences, potential chemical storage within sheds, and some collapsed structures and residual stockpiles.

7.14.2 Potential Impacts

Agricultural Resources

The Project proposes extraction of additional coal reserves within Mount Pleasant Operation MLs and would be supported by the use and augmentation of existing and approved infrastructure at the Mount Pleasant Operation.

The Project would result in no significant increase in total land disturbance compared to the existing approved Mount Pleasant Operation, due to the relinquishment of an approved disturbance area in the north-west. The Project Additional Disturbance Area and Relinquishment Area are both mapped as Class 3 (grazing land or land well-suited to pasture improvement) (Appendix I).

There is no NSW Government-mapped BSAL or CIC land within the Project Additional Disturbance Area. Part of the Relinquishment Area intersects a lot classified as Equine CIC. The proposed Northern Link Road Option 1 would traverse this same lot. The proposed Northern Link Road Option 1 is not considered to significantly impact the Equine CIC (Appendix I).

The forgone agricultural gross margin due to the Mount Pleasant Operation (incorporating the Project) is approximately $22.8 million in net present value (NPV) terms (Appendix O). The total incremental forgone gross margin associated with the Project is approximately $5.5 million in NPV terms (Appendix O). The forgone value of agricultural production should any additional Project biodiversity offset areas be required is not expected to be significant (Appendix O).

No equine or viticulture enterprises have been identified in the EIS assessments that would experience material adverse direct impacts as a result of the Project that are not already occurring with the approved Mount Pleasant Operation (Appendix I).

Further discussion of potential direct and indirect impacts of the Project on regional equine and viticulture enterprises is provided in Appendix I and Section 8.

Land Contamination

Potential land contamination risks associated with the Project were identified as part of the PHA (MACH, 2020e) (Section 7.19 and Appendix Q) and include leaks/spills, fires and explosions associated with the transport, storage and use of hydrocarbon and chemicals.

7.14.3 Mitigation Measures

Agricultural Resources

MACH has approached the design of this Project and its relationship with nearby agricultural enterprises with the following aims:

- being open to the feedback of nearby agricultural enterprises on the existing impacts of the Mount Pleasant Operation;
- facilitating ongoing agricultural production on available MACH-owned lands (Plate 7-23) and the productive use of MACH water resources that are not presently required for mining; and
- incorporating staging in the Project design to reduce potential incremental Mount Pleasant Operation impacts on nearby residences, including proximal agricultural enterprises.

Soil resources would be managed in accordance with the recommendations in the Soil Resource Assessment (Attachment 1 of Appendix I). Rehabilitation methods, including the management of Mount Pleasant Operation and the Project soil resources, are described in Attachment 8.

Plate 7-23 Agricultural Land in the Hunter River Floodplain

Land Contamination

General measures to reduce the potential for contamination of land would include the following:

- The transportation, handling and storage of all dangerous goods for the Project would be conducted in accordance with the requirements of the NSW *Work Health and Safety Regulation*, *2017* (or its latest equivalent).
- Dangerous goods required for the Project would be transported in accordance with State legislation.
- On-site consumable storage areas would be designed with appropriate bunding.
- Fuel and explosive storage areas would be regularly inspected and maintained.
- The response to any accidental spills or ground contamination would be assessed on a case-by-case basis and remediated in accordance with a Spill Response Procedure.
- Emergency response procedures would be enacted as required under a Pollution Incident Response Management Plan.

In addition, if the areas potentially containing contaminated media are disturbed and/or developed by the Project, an assessment and management (inclusive of a hazardous materials survey for former structures) of the identified contamination items would be undertaken (Appendix L).

As part of the decommissioning phase of rehabilitation, a Land Contamination Assessment would be undertaken. Any contaminated soils would be removed and the area remediated in accordance with the NSW *Contaminated Land Management Act, 1997* (Attachment 8).

7.15 ROAD TRANSPORT

A Road Transport Assessment for the Project has been undertaken by TTPP (2020) and is presented in Appendix J.

Section 7.15.1 provides a description of the methodology used for the Road Transport Assessment (Appendix J). A description of the existing road network and traffic environment in the vicinity of the Project is provided in Section 7.15.2. Section 7.15.3 provides an assessment of the potential impacts of the Project on the road network in the vicinity, while Sections 7.15.4 and 7.15.5 outline applicable mitigation and adaptive management measures for road transport.

7.15.1 Methodology

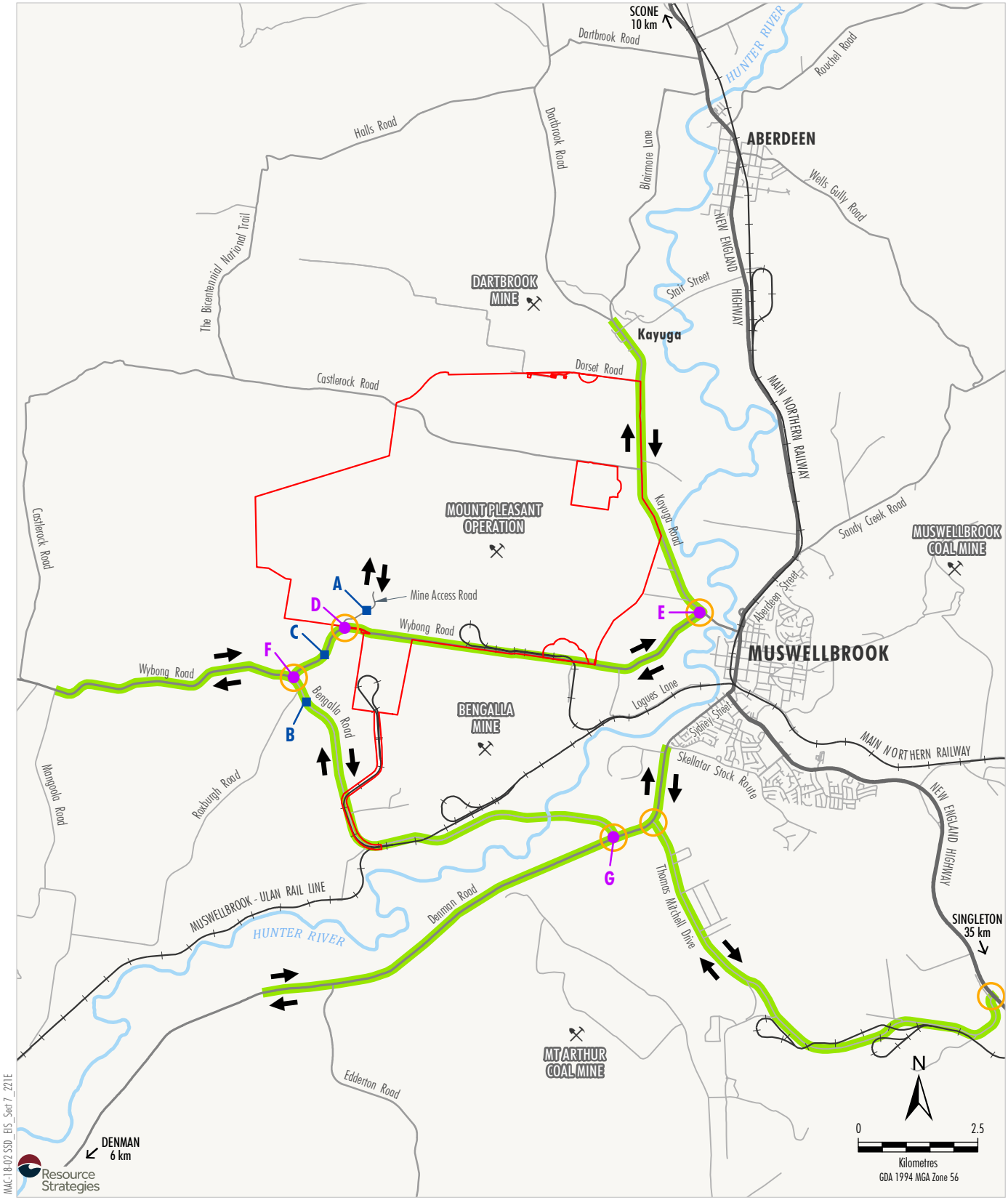
The Road Transport Assessment (Appendix J) was conducted in accordance with the *Guide to Traffic Generating Developments* (NSW Roads and Traffic Authority [RTA], 2002). Reference is also made to applicable Australian Standards and Austroads guidelines where relevant.

7.15.2 Existing Environment

Road Network

The following key roads are of relevance to the Project (Figure 1-2 and 7-30):

- New England Highway (Highway 9, Route A15) – the main north-south link through the Hunter Region, connecting Muswellbrook and Newcastle, and extending between Hexham and the Queensland border.
- Golden Highway (Highway 27, Route B84) – a road link between the New England Highway and the Newell Highway near Dubbo.
- Denman Road (Main Road 209) – forms the primary connection between Denman and Muswellbrook and provides an additional road link between the Golden Highway and New England Highway.
- Bengalla Road (a local road) – a road link between Denman Road south of Muswellbrook and Merriwa Road (Golden Highway) at Sandy Hollow and provides vehicular access to Bengalla Mine (Plate 7-24).



LEGEND

- Mining Operation
- Mining Lease Boundary (Mount Pleasant Operation)
- Road Safety Audit Route
- Road Intersection Assessment Location
- Project Road Intersection Survey Location
- Project Tube Count Survey Location
- Key Mid Block Assessment Location

Source: TTPP (2020); NSW Spatial Services (2020)

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MOUNT PLEASANT OPTIMISATION PROJECT

Local Road Network and Traffic Survey and Assessment Locations

Figure 7-30

Plate 7-24 Bengalla Road

- Wybong Road (a local road) – a road link between Kayuga Road north-west of Muswellbrook and Merriwa Road (Golden Highway) at Sandy Hollow, and provides access to the Mount Pleasant Operation (Plate 7-25).
- Kayuga Road (a local road) – a road link between Aberdeen Street on the western side of the Main Northern Railway, Muswellbrook and Kayuga.
- Blairmore Lane and Dartbrook Road (local roads) – road links between Kayuga Road and the New England Highway north of Aberdeen.
- Thomas Mitchell Drive (a local road) – provides a link between Denman Road and the New England Highway to the south of the Muswellbrook township. This road provides a bypass of Muswellbrook for some traffic and access to the Muswellbrook Industrial Area, Mt Arthur Coal Mine and Maxwell Infrastructure (former Drayton Mine).
- The alignment of the approved Northern Link Road would be revised for the Project (Section 3.5.2). If the Project is approved, development of the Northern Link Road would provisionally occur in 2025.

MACH maintains parts of Bengalla Road and Wybong Road in accordance with the Mount Pleasant Operation Maintenance Management Plan.

A corridor for a future bypass of Muswellbrook (the Muswellbrook Bypass) is included in Muswellbrook's LEP, and preserves a route to the east of Muswellbrook from south of Muscle Creek Road to north of Sandy Creek Road. Construction of the Muswellbrook Bypass is anticipated to occur in 2027 (RMS, 2018).

Existing Mine Access Routes

The main access to the mine site and administration office is provided from the sealed Mount Pleasant Operation Mine Access Road via Wybong Road (Figure 7-30).

A second mine access road to the Stage 1 rail corridor and associated infrastructure south of Wybong Road is also located off Wybong Road. This access will no longer be used after the approved Stage 2 rail infrastructure is commissioned and Stage 1 rail infrastructure is decommissioned.

In consultation with the MSC, ancillary site accesses from local roads are also used for environmental monitoring, general land management, exploration activities and local deliveries.

Mount Pleasant Operation ROM coal is transported by rail from the on-site CHPP to domestic customers or the Port of Newcastle for export.

Plate 7-25 Wybong Road

Existing Traffic Volumes and Roadway Capacity

Available Annual Average Daily Traffic volume data since 2015 from TfNSW was reviewed for the key roads of relevance to the Project (as listed above) (Appendix J).

In addition, traffic surveys were undertaken in February 2020 along key roads in the immediate vicinity of the Project. Project traffic survey locations are shown on Figure 7-30 and surveyed traffic volumes are summarised in Table 7-28. Classification of light and heavy vehicles was based on the Austroads Vehicle Classification System.

Intersection Turning Movements

To examine the existing performance of key intersections of relevance to the Project, vehicle turning movements were also recorded between 6.00 am and 6.00 pm on Wednesday 27 November 2019 at the intersections of:

- Mount Pleasant Operation Mine Access Road and Wybong Road (Site D);
- Wybong Road and Kayuga Road (Site E);
- Wybong Road and Bengalla Road (Site F); and
- Bengalla Road and Denman Road (Site G).

The locations of the Project intersection surveys are shown on Figure 7-30.

Road Safety

A review of TfNSW road crash data of the key roads for the five-year period from 1 July 2014 to 30 June 2019 was undertaken by TTPP as a component of the Road Transport Assessment. Over the investigation period, a total of 60 crashes occurred, resulting in three fatalities, 15 people being seriously injured, and 32 people being moderately injured (Appendix J).

Review of the data found that the most common type of crashes (over 60%) involved single vehicles leaving the carriageway, known as run-off-road crashes. This is consistent with the TfNSW Centre for Road Safety (2019), which found that in rural road environments in Australia, run-off-road crashes were the most likely.

In accordance with the SEARs, a Road Safety Audit was conducted as part of the Road Transport Assessment (Appendix J) in accordance with the *Guidelines for Road Safety Audit Practices* (RTA, 2011) and relevant Austroads guides.

The Road Safety Audit reviewed the existing conditions on main Project access routes (Figure 7-30) to identify any existing issues relating to the road environment which might constitute a road safety risk of relevance to the Project.

Table 7-28
Surveyed Average Two-Way Weekday Traffic Volumes

Site[1]	Road and Location	Surveyed Average Weekday			
		AM Peak (vehicles per hour)	PM Peak (vehicles per hour)	Total (vehicles per day)	Percent Heavy
A	Mount Pleasant Operation Mine Access Road	128	84	888	17.3%
B	Bengalla Road south-east of Wybong Road	222	179	2,010	18.7%
C	Wybong Road north of Bengalla Road	164	125	1,349	15.0%

Source: After Appendix J

[1] Refer to Figure 7-30.

The audit did not highlight any particular concerns regarding the basic characteristics of the Project access routes that might adversely impact road safety and did not identify any specific road safety issues at or near the existing intersection of Wybong Road and the Mount Pleasant Operation Mine Access Road (Appendix J).

The Road Safety Audit did identify a number of items with a medium or low risk rating which may be appropriately addressed as part of regular maintenance and planning by MSC and/or TfNSW as the relevant roads authorities (Appendix J). However, this is not required for the Project to proceed.

7.15.3 Potential Impacts

Potential impacts of the Project on traffic generation, roadway capacity and safety are assessed in Appendix J and summarised below. These potential impacts have been assessed in the context of anticipated future background traffic growth.

Project Traffic Generation

Two traffic scenarios (2026 [Year 4], representative of the peak construction workforce, and 2036 [Year 14], representative of the average operational workforce during the Peak Production Phase) were investigated to determine the potential impact of the Project on the local road network, having regard to the expected workforce and production schedule for the Project and the variation in the Project and other traffic volumes throughout the life of the Project.

Table 7-29 summarises the estimated predicted Project daily vehicle movements for each scenario (weekday traffic in both directions), including workforce movements, visitors and deliveries.

Note that some construction works are scheduled to occur in 2036 (Year 14), and therefore shuttle buses to transport the construction workforce for these activities have been assessed in this scenario.

Cumulative Traffic Sources

There are a number of traffic sources in the vicinity of the Project that may contribute to existing and/or future traffic volumes that have been considered in the Road Transport Assessment (Appendix J), including:

- the existing Mount Pleasant Operation;
- Bengalla Mine;
- Mangoola Coal;
- Maxwell Underground Project;
- Maxwell Solar Project;
- Mt Arthur Coal Mine;
- Dartbrook Mine; and
- West Muswellbrook Project.

Reasonably foreseeable changes in traffic volumes associated with the above developments have been accounted for in the baseline level for traffic (i.e. the level of traffic expected regardless of the Project).

In order to be conservative, the assessment has accounted for continued operation of the Mt Arthur Coal Mine beyond its currently approved mine life of 2026, and re-assessment of traffic movements associated with the existing Mount Pleasant Operation as part of the assessed incremental Project traffic.

The Northern Link Road would generally not be used by the Mount Pleasant Operation or Project-related traffic and would have negligible impact on general traffic conditions on the Project access roads, providing only local area access.

Table 7-29
Predicted Project[1] Two-Way Weekday Traffic Volumes (vehicles per day)

Scenario	Light Vehicles	Heavy Vehicles	Buses	Total
2026 (Construction)	384	68	88	540
2036 (Operations)	716	24	12	752

Source: After Appendix J.
[1] Forecast additional vehicle trips above 2020 levels.

The planned construction of the Muswellbrook Bypass to the east of Muswellbrook would primarily serve those vehicles currently travelling through Muswellbrook along New England Highway and is not expected to make a significant impact on general traffic conditions on the Project access routes to the west of Muswellbrook (Appendix J).

The Road Transport Assessment applies a background growth rate to account for general population and industrial growth and changes in population or travel behaviour (Appendix J).

A background growth rate of 1% per annum was applied to all roads excluding the Mount Pleasant Operation Mine Access Road. These rates are based on MSC (2015b) *Muswellbrook Mine Affected Roads Stage 1 – Road Network Plan* and RMS (2018) *New England Highway Muswellbrook Bypass Options Report*.

Cumulative Future Traffic Volumes

Table 7-30 presents the total predicted cumulative future traffic volumes on the surveyed key site access roads proximal to the Project, incorporating Project traffic, traffic from other key developments and estimated background traffic growth. These predictions are made away from intersections (i.e. midblock).

The cumulative future traffic volume predictions and associated Level of Service assessment focused on key site access roads proximal to the Project which were considered to be most likely to be impacted (Appendix J). Predicted incremental Project traffic contributions within the wider road network are provided in Appendix J.

The Austroads (2020) *Guide to Traffic Management Part 3: Traffic Studies and Analysis* provides guidelines for the capacity and performance of two lane, two-way rural roads. Austroads (2020) define Levels of Service as a qualitative measure describing the operational conditions within a traffic stream (in terms of speed, travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety) as perceived by drivers and/or passengers.

Level of Service A provides the best traffic conditions, with no restrictions on desired travel speed or overtaking. Levels of Service B to D describe progressively worse traffic conditions, with Level of Service E for traffic conditions that are at or close to capacity, with virtually no freedom to select desired speeds or manoeuvre in the traffic stream.

Table 7-31 summarises existing and predicted peak hour midblock Levels of Service on the key surveyed access routes with and without the Project.

Overall, peak hour midblock Levels of Service on key surveyed access roads would remain satisfactory with the Project, when considered cumulatively with background growth and impacts from other developments in the region (Appendix J).

Peak Hour Intersection Performance

The peak hour performance of key intersections with total predicted future traffic volumes (including the surveyed intersections, Thomas Mitchell Drive and Denman Road and Thomas Mitchell Drive and the New England Highway) were forecast using SIDRA INTERSECTION 9 (SIDRA), which is an analysis program that determines the characteristics of intersection operating conditions, including the degree of saturation, average delays and Levels of Service.

From the SIDRA analyses, the key intersections are predicted to operate at good Levels of Service with spare capacity and acceptable delays to vehicles, with the exception of the intersection of Thomas Mitchell Drive and Denman Road, which is predicted to operate at a satisfactory Level of Service in 2026, but deteriorate thereafter (Appendix J).

The intersection of Thomas Mitchell Drive and Denman Road has previously been identified as requiring upgrades to accommodate future demands, in the absence of the Project. Upgrading the Thomas Mitchell Drive and Denman Road intersection is the subject of Condition 47(c) of Project Approval 09_0062 for the Mt Arthur Coal Mine. It is understood the upgrade will be completed by the end of 2026 (Appendix J).

Table 7-30
Predicted Cumulative Two-Way Weekday Traffic Volumes (vehicles per day)

Site[1]	Road and Location	Surveyed (2020)		2026		2036	
		Total	Percent Heavy	Total	Percent Heavy	Total	Percent Heavy
A	Mount Pleasant Operation Mine Access Road	888	17%	1,428	22%	1,640	12%
B	Bengalla Road south-east of Wybong Road	2,010	19%	2,619	21%	2,975	16%
C	Wybong Road north of Bengalla Road	1,349	15%	1,932	19%	2,232	12%

Source: After Appendix J.

[1] Refer to Figure 7-30.

Table 7-31
Predicted Peak Hour Two-Way Midblock Levels of Service in 2026

Site[1]	Road and Location	2026				2036			
		Inbound		Outbound		Inbound		Outbound	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Without Project									
A	Mount Pleasant Operation Mine Access Road	B	A	A	B	-	-	-	-
B	Bengalla Road south-east of Wybong Road	B	A	A	B	A	A	A	A
C	Wybong Road north of Bengalla Road	B	A	A	B	A	A	A	A
With Project									
A	Mount Pleasant Operation Mine Access Road	**C**	A	A	**C**	**C**	A	A	**B**
B	Bengalla Road south-east of Wybong Road	**C**	A	A	**C**	**C**	A	A	**C**
C	Wybong Road north of Bengalla Road	**C**	A	A	**C**	**C**	A	A	**C**

Source: After Appendix J.

AM Peak = 6.00 am to 7.00 am, PM Peak = 4.00 pm to 5.00 pm.

Note: Shaded cells indicates change in Level of Service.

[1] Refer to Figure 7-30.

Existing main road treatments at other key intersections generally meet or exceed those required as determined by application of the relevant Austroads guide (Appendix J).

Road Safety Review

The review of the road crash history of key roads surrounding the Project did not identify any causation factors associated with the existing road network that may be exacerbated by the Project's increased traffic demands (Appendix J).

Consistent with the outcomes of the Road Safety Audit (Appendix J) there were no particular road safety concerns along Project access routes that might adversely impact road safety.

The Project would have minimal impact on both delays to road traffic and safety at railway level crossings as the major railway crossings are grade separated (Appendix J).

Oversize Vehicles and Deliveries

Consistent with the existing Site Access Management Plan for the Mount Pleasant Operation, the movement of any oversize or overmass vehicles associated with the Project would be conducted in accordance with relevant permits obtained under the *Additional Access Conditions Oversize and overmass heavy vehicles and loads* (TfNSW, 2020), and any other licences and escorts as required by regulatory authorities (Appendix J).

Dangerous Goods

The transportation, handling and storage of all dangerous goods at the Project would be conducted in accordance with the requirements of the *Storage and Handling of Dangerous Goods – Code of Practice 2005* (WorkCover, 2005). Dangerous goods required for the Project would be transported in accordance with relevant legislation.

7.15.4 Mitigation Measures

The Road Transport Assessment (Appendix J) concluded that the existing road network can satisfactorily accommodate the forecast traffic demands resulting from the Project without any specific additional road upgrade requirements.

The Northern Link Road would be designed and constructed consistent with Austroads (2017) *Guide to Road Design* requirements, and in consultation with MSC.

MACH contributes to the maintenance of local roads under the control of the MSC under a Voluntary Planning Agreement for the Mount Pleasant Operation. It is anticipated that a new Voluntary Planning Agreement would be negotiated with the MSC as an outcome of the Project.

7.15.5 Adaptive Management

The existing Site Access Management Plan for the Mount Pleasant Operation provides guidance for all vehicles accessing the site and would also apply to Project-generated traffic. The Site Access Management Plan would continue to be reviewed and updated as required over the life of the Project.

7.16 VISUAL AND LANDSCAPE CHARACTER

A Visual and Landscape Assessment has been prepared for the Project by VPA (2020), and is provided in Appendix M.

A description of the methodology relevant to assessing the potential visual impacts of the Project is provided in Section 7.16.1. A description of the existing environment is provided in Section 7.16.2. Section 7.16.3 provides an assessment of the potential visual impacts of the Project, while Section 7.16.4 describes measures to mitigate impacts of the Project.

7.16.1 Methodology

Direct Visual Impacts

The potential visual impacts of the Project were assessed by evaluating the level of potential visual effect in the context of the visual sensitivity of relevant potential receivers.

Visual effect is a measure of the level of visual contrast and integration of the Project with the existing landscape.

Visual sensitivity is a measure of how critically a change to the existing landscape is viewed from various areas, and is a function of both land use and distance to the Project (e.g. individuals generally view changes to the visual setting of their dwelling more critically than changes to the visual setting of the broader setting in which they travel or work).

VPA has developed matrices for determining visual effect and visual sensitivity based on the visual properties of a development, the proportion of view occupied (proportion of the primary view zone), proximity, and land use sensitivity. These matrices are provided in Appendix M.

Potential levels of visual impact resulting from a combination of differing visual effect and receiver sensitivity are provided in the matrix in Table 7-32.

Table 7-32
Visual Impact Matrix

Visual Effect \ Viewer Sensitivity	H	M	L	VL
H	H	H/M	M/L	M/L
M	H/M	M	M/L	L
L	M/L	M/L	L	VL
VL	L	VL	VL	VL

Source: Appendix M.
H – High.
M – Moderate.
L – Low.
VL – Very Low.

Indirect or Dynamic Impacts

Potential indirect or dynamic visual impacts (collectively referred to as dynamic landscape impacts) have previously been identified as a key issue during the assessment of the mining developments in the vicinity of the Project.

Dynamic landscape assessment refers to the collective evaluation of people's perceptions as they move through the landscape. Dynamic landscape assessment focuses on the perceptual and aesthetic characteristics of a landscape, including visual, sound, smell, touch/feel, preferences, associations and memories (Appendix M).

Whilst dynamic landscape assessment considers each of these inputs to a receptor's perception of the landscape, it is accepted that sight is the most dominant sensory input (Appendix M).

Individual perception varies between individuals and can, therefore, be difficult to assess. In the *Social impact assessment guideline for State significant mining, petroleum production and extractive industry development*, DP&E (2017) state the following with respect to assessing perceptions of adverse impacts:

> *When considering perceptions of adverse impacts on amenity, an evaluation must be made of the reasonableness of those perceptions. This evaluation involves 'the identification of evidence that can be objectively assessed to ascertain whether it supports a factual finding of an adverse effect on amenity…': Telstra Corporation Ltd v Hornsby Shire Council [2006] NSWLEC 133.*

Accordingly, the assessment of perceptions in the dynamic landscape assessment draws, in part, on the assessment of potential adverse effects on amenity undertaken by other specialists (Appendix M).

7.16.2 Existing Environment

MACH manages visual impacts of the approved Mount Pleasant Operation in accordance with a Visual Impact Management Plan (2019g), which describes screen plantings, visual bunds, lighting controls and other visual treatments.

Visual Catchment

For the purposes of assessing the potential visual impacts of the Project, VPA (2020) defined a primary visual catchment (Figure 7-31).

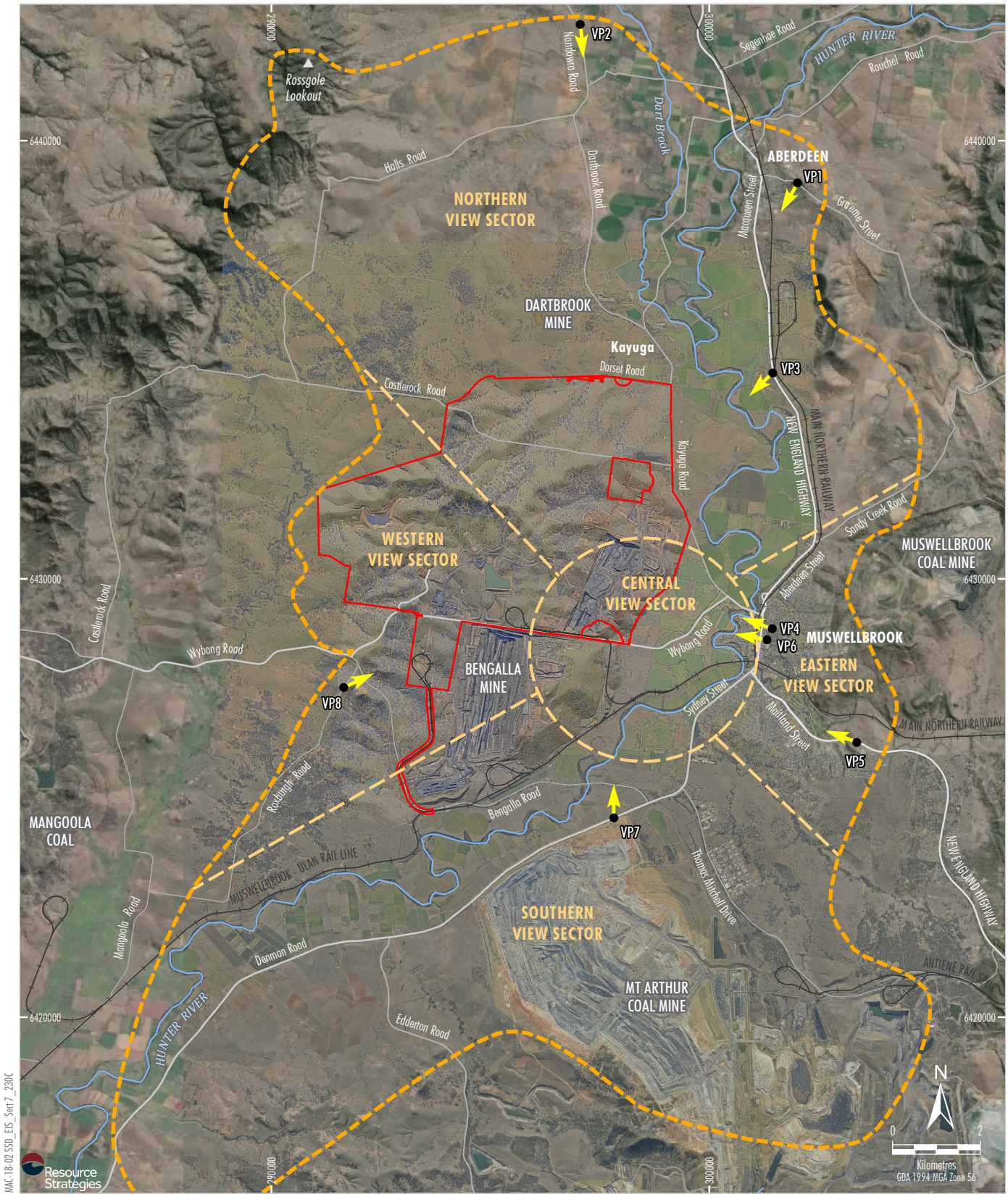
The primary visual catchment is defined by the topography including (Appendix M):

- adjacent foothills to the south-west through to the north-west;
- the surrounding ranges and foothills directly north; and
- north-east of Aberdeen, the ranges running north-south to the east of the New England Highway.

The primary visual catchment is further defined by Muswellbrook and adjacent hills to the east and by the existing Mt Arthur Coal Mine to the south (Appendix M).

The primary visual catchment has been divided into the following visual sectors adopted for previous visual assessments for the approved Mount Pleasant Operation (Figure 7-31) (Appendix M):

- the Central Sector that includes the rural foothills and Hunter River floodplain immediately to the east of the existing Mount Pleasant Operation and west of Muswellbrook;
- the Northern Sector that includes the foothills and northern Hunter River floodplain, the town of Aberdeen, and Kayuga;
- the Eastern Sector that includes the town of Muswellbrook and adjoining foothills;
- the Southern Sector that includes the foothills and mine areas south of the Project and southern Hunter River floodplain; and
- the Western Sector that includes the foothills in the vicinity of Wybong Road.



LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Primary Visual Catchment Boundary
- View Sector Boundary
- Viewpoint

Source: MACH (2020); VPA (2020); NSW Spatial Services (2020)
Orthophoto: MACH (2020); Esri, DigitalGlobe (2020)

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MOUNT PLEASANT OPTIMISATION PROJECT

Viewpoints and Visual Simulation Locations

Figure 7-31

Project Surrounds

The Project open cut operations would remain in the Mount Pleasant Operation MLs and would not significantly increase the approved mine disturbance footprint. The Project would also be supported by the use and augmentation of existing Mount Pleasant Operation infrastructure (Plate 7-26).

The visual landscape surrounding the Project is strongly defined by the Hunter River floodplain and contains strongly modified landscapes characterised by existing mining activities and supporting infrastructure (including the approved Mount Pleasant Operation) surrounded by agricultural and pastoral land uses and remnant woodland along the Hunter River floodplain and surrounding foothills (Appendix M).

The approved Mount Pleasant Operation is in the early operational phase, therefore altering the visual character in the east of the MLs from pastoral grazing to mining (Appendix M).

The Mount Pleasant Operation consists of active mining areas and an associated Eastern Out-of-Pit Emplacement. The waste rock emplacement is the most visually prominent Project component from off-site areas to the north, east and south. The CHPP and other infrastructure are visually evident only from a limited number of locations to the south and west (e.g. Wybong Road), where existing views of mining operations dominate the visual setting.

MACH implements accelerated progressive rehabilitation of the existing waste rock emplacement to minimise the potential extent and duration of visual effects of the approved Mount Pleasant Operation. The effectiveness of the progressive rehabilitation strategy is demonstrated on Figure 7-32 (Plate 7-27).

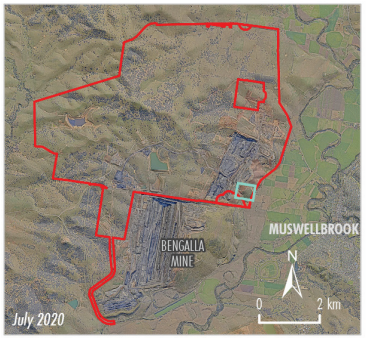
Visual Character Units

VPA defined a number of visual character units (VCUs) in the vicinity of the Project based on distinct areas of visual uniformity (Appendix M). The VCUs within the primary visual catchment include:

- town areas VCU (e.g. Muswellbrook);
- Hunter River floodplain VCU;
- horse studs VCU;
- foothills VCU;
- surrounding ranges VCU; and
- existing mining, power generation and industrial VCU.

Within the Hunter River floodplain VCU is a sub-unit comprising several horse studs and their associated rural residential land uses. The horse studs create a specific visual character (Appendix M).

Plate 7-26 Existing Mount Pleasant Operation Infrastructure



LEGEND
Mining Lease Boundary
(Mount Pleasant Operation)
Rehabilitation Progression Area

Source: MACH (2020)

MACHEnergy

MOUNT PLEASANT OPTIMISATION PROJECT

Rehabilitation Progression
Drone Photographs
September 2019 - October 2020

Figure 7-32

MAC-18-02 SSD_EIS_Sect 7_006D

Resource Strategies

Plate 7-27 Mount Pleasant Operation Landforms Viewed from the Hunter River Floodplain

The existing mining, power generation and industrial VCU occupies a significant part of the primary visual catchment and is visually dominant as the viewer moves through the landscape (Appendix M).

A detailed description of the relevant VCUs within the areas surrounding the Project is provided in Appendix M.

7.16.3 Potential Impacts

Direct Visual Impacts

Visual analysis was conducted for the following locations in order to characterise views of the Project from key local vantage points (Figure 7-31):

- Aberdeen (Location 1);
- Nandowra Road (Location 2);
- New England Highway (Locations 3 and 5);
- Muswellbrook (Locations 4 and 6);
- Denman Road (Location 7); and
- Roxburgh Road (Location 8).

All of the visual simulation results are presented in Appendix M, and a summary of the visual sensitivity, effect and impact of the Project at key receptors is provided below. A summary of the potential visual impacts of the Project in the context of the approved Mount Pleasant Operation is provided in Table 7-33.

Muswellbrook

Visual simulations were prepared for the following vantage points within Muswellbrook (Figure 7-31):

- the intersection of St Heliers Street and Sowerby Street (e.g. an elevated residential location within Muswellbrook) (Location 4) (Figure 7-33);
- Hill Street adjacent a local church, primary school and local shopping centre car park (Location 6); and
- New England Highway on the southern outskirts of Muswellbrook (Location 5) (Figure 7-34).

Many elevated parts of Muswellbrook already have direct views onto the most visible components of the approved Mount Pleasant Operation (Figures 7-33 and 7-34). Areas that would have views to the Project are typically already subject to high visual impacts from the approved Mount Pleasant Operation (Appendix M).

The development of the integrated waste rock emplacement landform and associated increase in scale and elevation may introduce additional viewpoints within Muswellbrook (e.g. in areas of lower elevation). The visual impacts would remain high in Muswellbrook during construction and operation of the Project, reducing to moderate/low in the long-term (Appendix M).

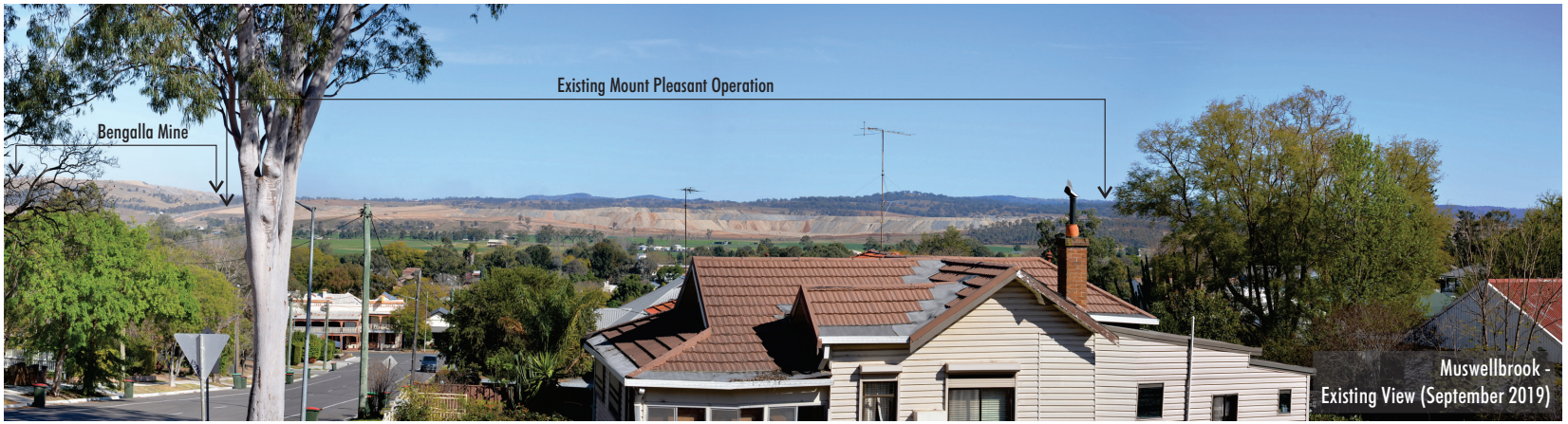
Table 7-33
Summary of Visual Impacts

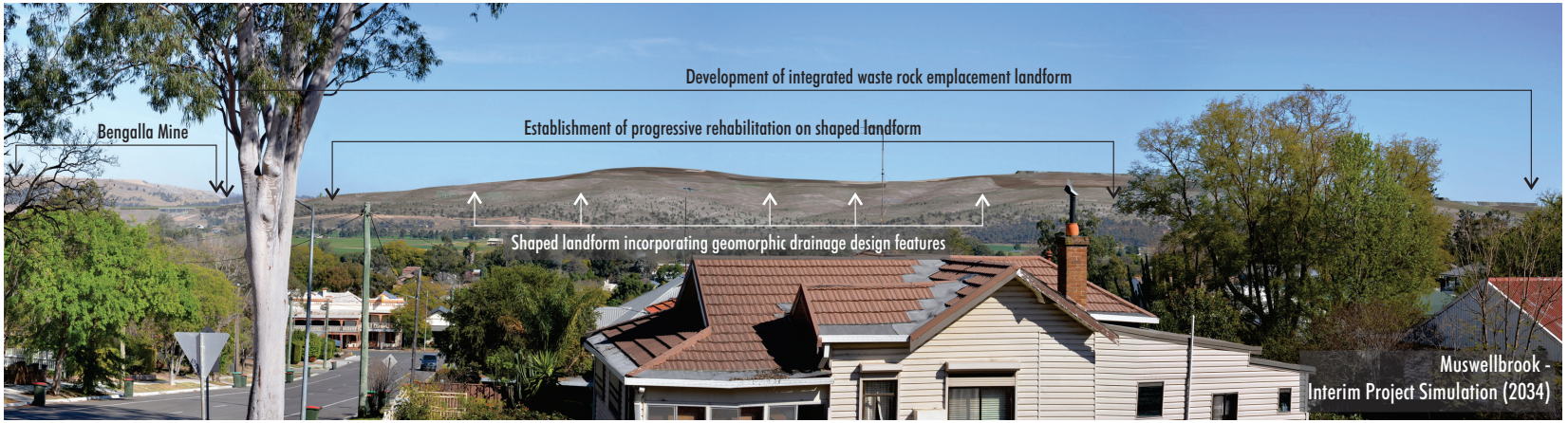
Receiver	Visual Sensitivity	Representative Visual Effect		Visual Impact		
		During Project	Long-term	Approved	During Project	Long-term
Central Sector						
Rural Residences	H	H	L	H	H	M/L
Horse Studs (Abbey and Balmoral Park)*	H	H	L	H	H	M/L
Muswellbrook Racecourse	H	H	L	H	H	M/L
Sydney Road*	M	H	L	H/M	H/M	M/L
Kayuga Road	M	H	L	H	H/M	M/L
Wybong Road	M/L	H	L	H/M	M	L
Racecourse Road*	M/L	H	L	M/L	M	L
Rural Land	L	H	L	L	M/L	L
Northern Sector						
Momberi-Scone Rural Landscape	L	M	VL	L	M/L	L/VL
Aberdeen	H/M	M	VL	H	H/M	L
Rural Residences	H	H	VL	H	H	L
Horse Studs	Nil	Nil	Nil	Nil	Nil	Nil
Rossgole Lookout*	M	L	VL	M/L	M/L	VL
New England Highway	M	H	VL	H	H/M	VL
Northern Railway Line	M	H	VL	H	H/M	VL
Rural Land	L	L	VL	L	L	VL
Eastern Sector						
Muswellbrook	H	H	L	H	H	M/L
Rural Residences	H	H	L	H	H	M/L
New England Highway	H	M	L	H	H/M	M/L
Northern Railway Line	H	L	L	H	M/L	M/L
Southern Sector						
Heritage-listed Homesteads*	H/M	M	VL	M	H/M	M/L
Edinglassie Stud	H/M	L	VL	M	M/L	L
Other Horse Studs*	Nil	Nil	Nil	Nil	Nil	Nil
Tourist Features*	Nil	Nil	Nil	Nil	Nil	Nil
Muswellbrook-Jerrys Plains Landscape Conservation Area	M	M	VL	M	M	VL
Rural Residences	H/M	M	VL	M	H/M	M/L
Denman Road*	M	L	VL	M	M/L	L
Thomas Mitchell Drive*	L	L	VL	L	L	L
Rural Land	L	M	VL	L	M/L	VL
Western Sector						
Rural Residences	H	H	L	M	H	L
Wybong Road	M/L	H	L	M	H/M	L
Roxburgh Road	M/L	H	L	L	M	L
Rural Land	L	H	L	L	M/L	VL

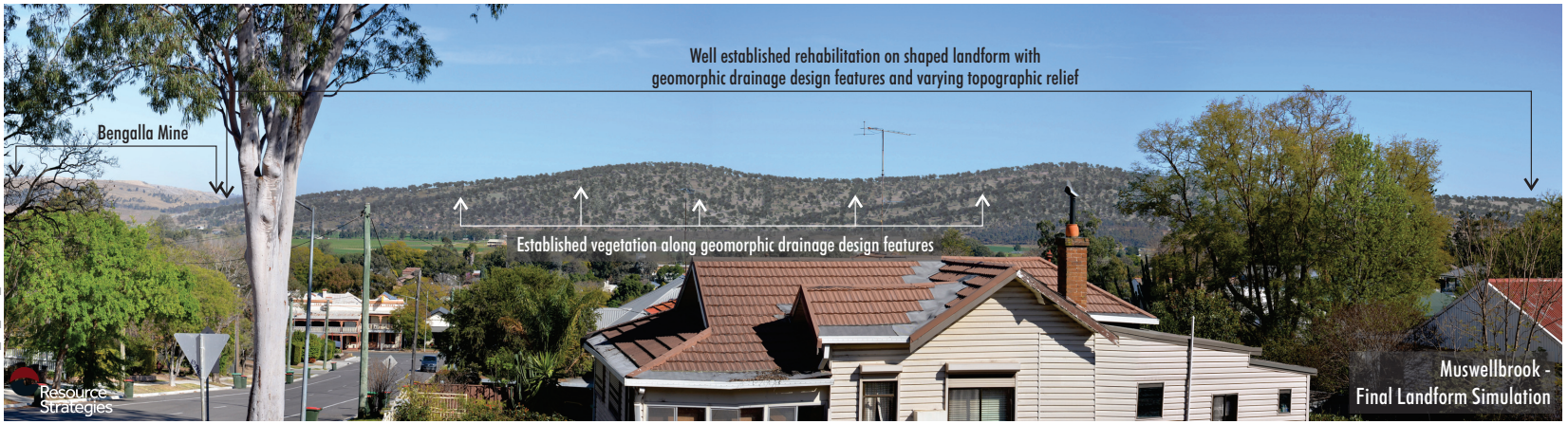
Source: Appendix M.

* Receptors that were not assigned a visual impact as part of the previous visual assessments for the approved Mount Pleasant Operation, that have been assigned a visual impact for direct comparison with the Project.

H – High, M – Moderate, L – Low, VL – Very Low.







Source: VPA (2020)

MACHEnergy

MOUNT PLEASANT OPTIMISATION PROJECT

Visual Simulation Results
Muswellbrook
(Location 4)

Figure 7-33

MAC-18-02 SSD_EIS_Sect7_003A

Resource Strategies

Source: VPA (2020)

MACHEnergy

MOUNT PLEASANT OPTIMISATION PROJECT

Visual Simulation Results
New England Highway
(Location 5)

Figure 7-34

MAC-18-02 SSD_EIS_Sect 7_002A

Aberdeen

A visual simulation has been prepared for Graeme Street, Aberdeen (an elevated position within Aberdeen) (Location 1) (Figure 7-35).

The approved Mount Pleasant Operation can be viewed from some elevated locations within Aberdeen (Appendix M) (Figure 7-35).

Previous assessments determined that the approved Mount Pleasant Operation would result in high visual impacts on viewing locations within Aberdeen. The visual impacts during construction and operation of the Project on viewing locations within Aberdeen would continue to be high/moderate, reducing to low in the long-term (Appendix M).

New England Highway

Visual simulations were prepared for the following vantage points along the New England Highway:

- an elevated position north of Muswellbrook and approximately 3 km south of Aberdeen (Location 3); and
- an elevated position south-east of Muswellbrook (Location 5) (Figure 7-34).

The approved Mount Pleasant Operation is visible from a number of locations along the New England Highway and was determined to have high visual impacts (Appendix M) (Figure 7-34).

Within the Northern Sector, the visual impacts of the Project on the New England Highway during construction and operation would continue to be high/moderate, and would reduce to very low in the long-term (Appendix M).

Within the Eastern Sector, the visual impacts of the Project on the New England Highway during construction and operation would continue to be high/moderate and would reduce to moderate/low in the long-term (Appendix M).

The *New England Highway Muswellbrook Bypass Options Report* (RMS, 2018) describes various options for the proposed Muswellbrook Bypass, with the most likely option to the east of Muswellbrook. It is anticipated that the visual impacts of the Project from the Muswellbrook Bypass would be similar to visual impacts along the existing alignment of the New England Highway (Appendix M).

Northern Railway Line

The approved Mount Pleasant Operation is visible along the Northern Railway Line and was previously determined to have high visual impacts from the railway (Appendix M).

Within the Northern Sector, the visual impacts of the Project on the Northern Railway Line during construction and operation would be high/moderate, and would reduce to very low visual impacts in the long-term (Appendix M). Within the Eastern Sector, the visual impacts on the Northern Railway Line during construction and operation of the Project and in the long-term would be moderate/low (Appendix M).

Heritage-listed Homesteads

In the Northern Sector, the approved Mount Pleasant Operation would have high visual impacts on the Kayuga Homestead. The Project would continue to have high visual impacts on Kayuga Homestead during construction and operation, reducing to low in the long-term (Appendix M).

In the Southern Sector, the approved Mount Pleasant Operation was predicted to have high visual impacts on the Edinglassie and Rous Lench Homesteads. The Bengalla Mine now partially obscures potential views of the Project from Edinglassie and Rous Lench Homesteads, resulting in a reduction in the expected visual impacts to high/moderate during construction and operation, reducing to moderate/low in the long-term (Appendix M).

Kayuga Road

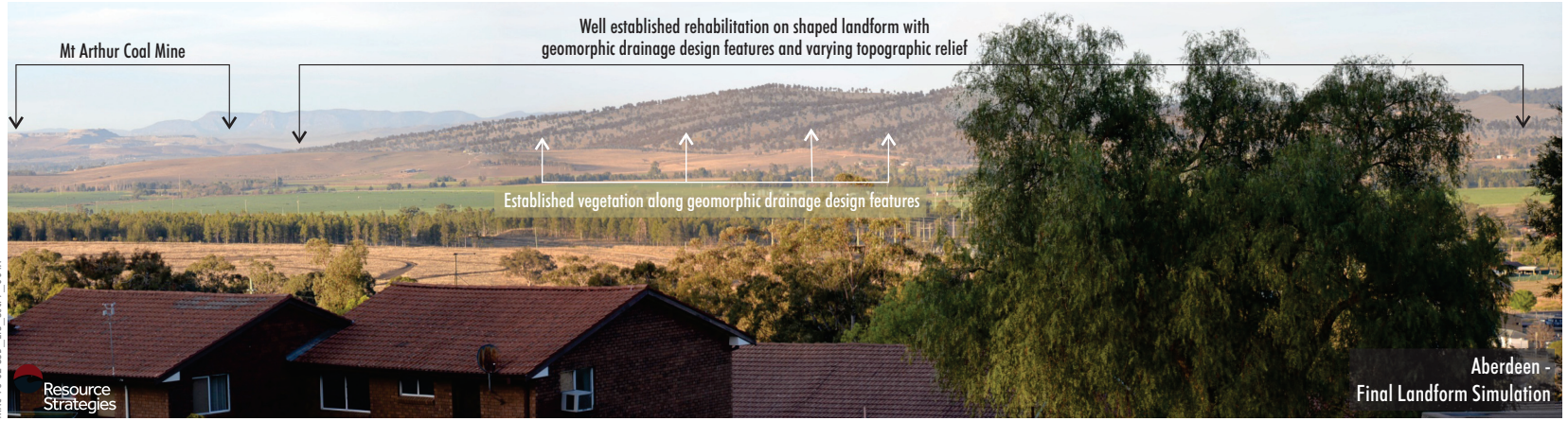
The visual impact of the approved Mount Pleasant Operation on Kayuga Road is high. The Project would have high/moderate visual impacts on users of Kayuga Road, that would reduce to moderate/low in the long-term (Appendix M).

Wybong Road

The visual impact of the approved Mount Pleasant Operation on Wybong Road is high/moderate. The Project would have moderate visual impacts on users of Wybong Road, that would reduce to low in the long-term (Appendix M).

Denman Road

A visual simulation was prepared for a vantage point along Denman Road that provides a representative view of the Project for the Southern Sector (Location 7) (Figure 7-36).



Source: VPA (2020)

MACHEnergy

MOUNT PLEASANT OPTIMISATION PROJECT

Visual Simulation Results
Aberdeen
(Location 1)

Figure 7-35

Note:
Directly south of this viewpoint (behind viewer) is the Mt Arthur Coal Mine with existing views of the visual bund and mining operations.

Source: VPA (2020)

MACHEnergy

MOUNT PLEASANT OPTIMISATION PROJECT
Visual Simulation Results
Denman Road
(Location 7)

Figure 7-36

MAC-18-02 SSD_EIS_Sect7_005A

Resource Strategies

The approved Mount Pleasant Operation was previously determined to have moderate visual impacts on Denman Road in the Southern Sector (Appendix M).

The visual impacts on Denman Road during construction and operation of the Project would be moderate/low, reducing to low in the long-term (Appendix M).

Roxburgh Road

A visual simulation was prepared for a vantage point along Roxburgh Road that provides a representative view of the Project for the Western Sector (Location 8) (Appendix M).

The approved Mount Pleasant Operation was previously determined to have low visual impacts on Roxburgh Road in the Western Sector (Appendix M).

The visual impacts on Roxburgh Road during construction and operation of the Project would increase to moderate, reducing to low in the long-term (Appendix M).

Rural Residences

There would be varying levels of visual impacts of the Project on rural residences in all view sectors (Appendix M).

Table 7-33 provides a summary of the expected visual impacts on proximal rural residences for each view sector. Generally, during construction and operation the Project would involve the continuation of high and moderate visual impacts (consistent with the approved Mount Pleasant Operation), and would reduce to moderate and low in the long-term (Appendix M).

Visual simulations at Locations 1 to 8 indicate the range of views that are currently available of the Mount Pleasant Operation and the potential views of the Project from multiple vantage points.

Rossgole Lookout

The Rossgole Lookout (Figure 7-31) has a broad sweeping overview of Aberdeen to Muswellbrook within the primary visual catchment. The approved Mount Pleasant Operation was expected to have moderate/low visual impacts at the Rossgole Lookout, that would continue for the Project during construction and operation (Appendix M).

It should be noted that existing views from Rossgole Lookout include a number of mining operations and the increased proportion of the view occupied by the Project would be minor (Appendix M).

Muswellbrook – Jerrys Plains Landscape Conservation Area

Views from the Muswellbrook – Jerrys Plains Landscape Conservation Area would remain consistent with the approved Mount Pleasant Operation (i.e. views from most of this area of the Mount Pleasant Operation would be obscured by Bengalla Mine, Mt Arthur Coal Mine and other intervening topography) (Appendix M).

Previous assessments determined that the approved Mount Pleasant Operation would result in moderate visual impacts on the Muswellbrook – Jerrys Plains Landscape Conservation Area. During construction and operation of the Project, there would continue to be moderate visual impacts, and would reduce to very low in the long-term (Appendix M).

Momberi – Scone Rural Landscape

Previous assessments determined that the approved Mount Pleasant Operation would result in low visual impacts on the Momberoi – Scone Rural Landscape. During construction and operation of the Project, there would be moderate/low visual impacts on viewing locations within Momberoi – Scone Rural Landscape, that would reduce to low or very low in the long-term (Appendix M).

Horse Studs

There are two horse studs within the Central Sector, namely the Abbey Thoroughbreds and Balmoral Park Thoroughbred Studs, with both determined to have high visual impacts from the approved Mount Pleasant Operation. The visual impacts of the Project during construction and operation would continue to be high and would reduce to moderate/low in the long-term (Appendix M).

There is one stud within the Southern Sector, namely the Edinglassie Stud, that was determined to have moderate visual impacts from the approved Mount Pleasant Operation. The visual impacts of the Project during construction and operation would be moderate/low due to the screening by the landforms of the Bengalla Mine and would reduce to low in the long-term (Appendix M).

There would be no views of the Project from Monarch, Coolmore and Godolphin Woodlands, Kelvinside, Segenhoe and Yarraman Park Studs and, therefore, there would be no visual impacts at these more remote locations (Plate 7-28) (Appendix M).

Night-lighting

There are two types of lighting effects that could be generated by the Project: direct light effects and diffuse light effects (Appendix M).

Direct light effects occur when the light source is directly visible and would be experienced if there is a direct line of sight between the light source and the viewpoint (Appendix M).

Diffuse light effects relate to the general night-glow that results from light of sufficient strength being reflected into the atmosphere. Diffuse light effects could create a local focal point that would vary with distance and atmospheric conditions such as fog, low clouds and/or dust particles, which all reflect light (Appendix M). Both of these light effects are observed in the existing environment surrounding the Mount Pleasant Operation (Appendix M).

Generally, most operational areas would remain screened from direct views due to the Eastern Out-of-Pit Emplacement and the Bengalla Mine. Direct lighting effects from headlights of haul trucks and flashing safety lights of smaller vehicles are currently intermittently visible at night from elevated viewing locations where lines of sight are above the intervening topography (Appendix M).

Vehicle headlights would be visible along the upper elevations of the Project integrated waste rock emplacement landform when mobile equipment is operating at night. The Project would extend the duration of direct lighting effects until the completion of rehabilitation. However potential impacts associated with direct light effects of the Project would be similar to the approved Mount Pleasant Operation (Appendix M).

A number of mining operations, power stations, residences and agricultural activities in the vicinity of the Project already contribute to diffuse light effects (sky glow).

It is expected that the potential diffuse light effects of the Project would extend further north in comparison to the existing levels creating more localised visual impacts. However, the nature of the diffuse light effects would be consistent with the approved effects of the approved Mount Pleasant Operation and the existing effects of other developments in the vicinity of the Project (e.g. Bengalla Mine and Mt Arthur Coal Mine).

The Siding Springs Observatory is located approximately 195 km to the north-west of the Project. As such, the Project is within the Dark Sky Region (i.e. within 200 km radius of the Siding Spring Observatory), as defined in the *Dark Sky Planning Guideline* (DP&E, 2016a). There are a number of light sources between the Project and the Siding Springs Observatory, which may contribute to sky glow at the Siding Springs Observatory.

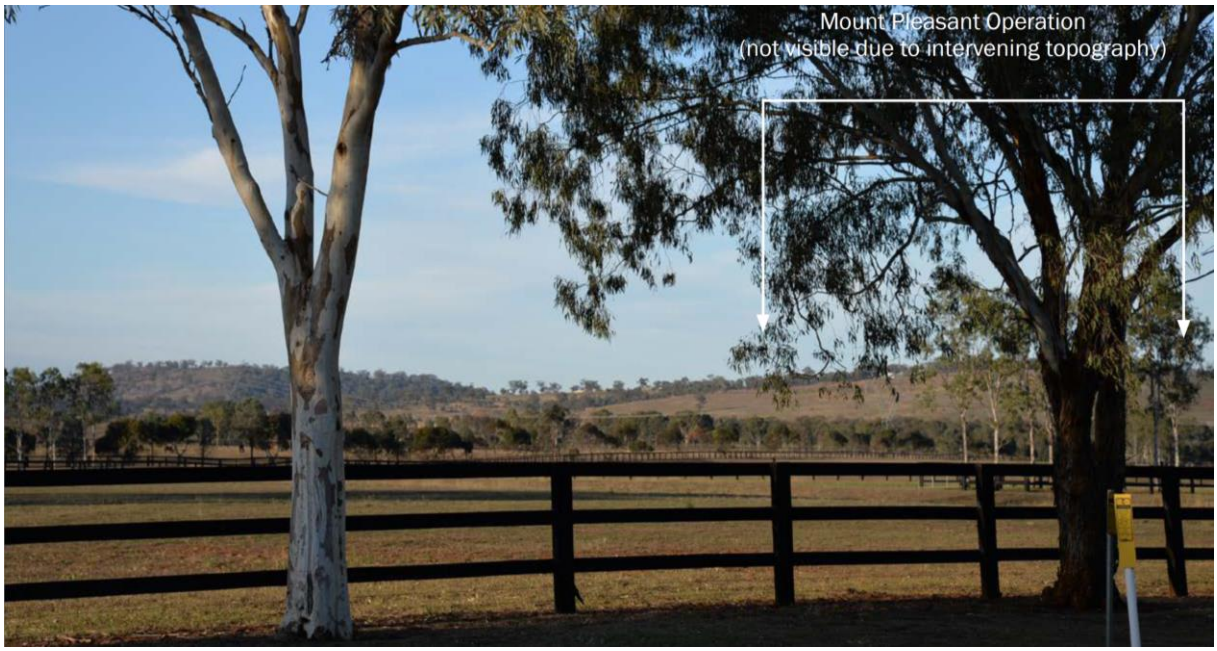


Plate 7-28 Indicative View from Horse Stud along Rouchel Road

Source: Appendix M.

Any potential impact associated with night-lighting required for the Project (i.e. for safety reasons) would be similar to those for the approved Mount Pleasant Operation. These potential impacts would be practically minimised through the implementation of mitigation measures in consideration of *AS/NZS 4282:2019 – Control of the Obtrusive Effects of Outdoor Lighting* (Section 7.16.4).

With the implementation of these measures for the Project, the visual impact of night-lighting on sensitive receivers would continue to be similar to that of the approved Mount Pleasant Operation (Appendix M).

Dynamic Landscape Impacts

The key receptors considered particularly sensitive to potential dynamic landscape impacts of the Project on the local landscape include:

- Muswellbrook and Aberdeen;
- regional horse studs; and
- rural residences.

Dynamic landscape assessment takes into account human perceptions of the landscape (beyond sight) through sound, smell and touch (Section 7.16.1 and Appendix M).

The dynamic landscape assessment in Appendix M focused on three components:

- ephemeral effects, such as noise, dust and smell;
- visual experiences at regional and sub-regional scale; and
- knowledge-based perception.

Ephemeral Effects

VPA considered the assessment outcomes of the Noise and Blasting Assessment and the Air Quality Assessment in relation to potential noise, vibration, dust and odour effects at sensitive receivers (Appendices A and B).

On the basis of these assessments and in the context of the approved Mount Pleasant Operation, VPA concluded that the impact on the perception of the landscape is not expected to change with the Project, however the Project would result in a continuation or extension of the existing noise impacts and potentially infrequent, temporary odour impacts (Appendix M).

Visual Experiences at Sub-regional and Regional Scale

The effects on a viewer's perceptions, gained accumulatively from moving away from a particular location can affect dynamic landscape impacts. Such views (memories) can become part of a visual diary, generally within the primary visual catchment (Appendix M).

In the sub-regional context, the expansion in scale and elevation of the integrated waste rock emplacement landform associated with the Project are considered to be consistent with extensive existing mining landscapes within the region.

This is apparent from the presence of, and views into, existing mining operations within the sub-region. From the New England Highway north of Muswellbrook, there are more distant views into the approved Mount Pleasant Operation, Bengalla Mine and Mt Arthur Coal Mine and close proximity views of infrastructure at the Dartbrook Mine. The views from Denman Road generally include the existing Mt Arthur Coal Mine and Bengalla Mine (Appendix M).

On a regional scale, the Project is experienced when arriving from the south-east via Singleton and Muswellbrook along the New England Highway, from the south via Denman Road or from the north via Scone and Aberdeen. These road journeys expand the current experience of regional open cut coal mines (Appendix M).

For individuals flying into the region (e.g. Scone Airport), there would be a 'bird's eye' view of the Project, in the context of the broader region, including existing large-scale open cut mines proximal to the Project (Appendix M).

Aerial views show the extensive landscape changes due to mining operations within the Hunter Valley that would be experienced from Broke to Muswellbrook. In consideration of the extensive landscape changes in this region, the Additional Disturbance Area would be minimal as these would be offset by the Relinquishment Area in the north-west of the approved Mount Pleasant Operation (Appendix M).

Knowledge-based Perception

Perceptions on the basis of knowledge gained by reading, hearing and/or seeing reports on previous, existing and proposed activities have an effect on personal perceptions. This perception input goes beyond any consideration of visual perception, as it is based on all inputs that create a knowledge base of a landscape setting and the developments within the setting (Appendix M).

Knowledge gained through public information would create an overarching awareness of the Project and would include (Appendix M):

- memories of historical land uses or projects;
- perceptions of open cut mining impacts;
- viewing media related to the Project; and
- stakeholder engagement.

Such knowledge gained through public information would create an overarching awareness of this Project, including the existing Mount Pleasant Operation. However, it is unlikely that the increased awareness of the Project would change the dynamic landscape impacts in the context of the existing, approved Mount Pleasant Operation (Appendix M).

Summary

Individual perception varies between individuals and, therefore, can be difficult to assess.

It is noted that there would be some people who would continue to have an existing adverse perception of mining activity, no matter how low the impacts or how informative the educational inputs. This impact is not necessarily tied to one's experience of the actual landscape and can create an adverse perception in those that have not even experienced the area (Appendix M).

VPA concluded that the dynamic landscape impact of the Project on the landscape and the extended duration of those impacts over time in the context of existing land use patterns at the regional, subregional and local scales would be moderate (Appendix M).

7.16.4 Mitigation Measures

There are various visual mitigation measures incorporated into the design of the Project. These include:

- location of additional Project major infrastructure to the west of the integrated waste rock emplacement landform which significantly reduces the visibility of mine infrastructure components from key public vantage points;
- progressive development of the integrated waste rock emplacement to screen development of the open cut, infrastructure and haul roads;
- design of the integrated waste rock emplacement landform to incorporate geomorphic drainage design principles for hydrological stability, and varying topographic relief to be more natural in exterior appearance;
- accelerated progressive rehabilitation of the integrated waste rock emplacement landform (Figure 7-32); and
- use of compatible tones for building and cladding colours in forest tones (such colours would include tonal variations of existing colours) to assist in assimilating infrastructure components into the setting.

MACH would conduct ongoing consultation with local stakeholders over the life of the Project to identify any issues in relation to visual impacts on surrounding sensitive viewing locations. Following further consultation with the stakeholders, additional measures that are reasonable and feasible may be implemented to increase visual mitigation at specific sensitive viewer locations.

Additional mitigation measures for reducing visual impacts that may be adopted for the Project are described below.

On-site Treatments

On-site management measures and treatments for the open cut mining areas would include:

- Protect and maintain existing trees and vegetation screening outside of the open cut mine clearing zone by creating vehicle and machinery exclusion zones.
- Create on-site stockpiles for mulched vegetation and appropriate topsoil storage to maintain viability of soil for rehabilitation works.
- Provide additional reasonable and feasible tree screening at key on-site locations on an as-needed basis in accordance with the Mount Pleasant Operation Visual Impact Management Plan.

Off-site Treatments

Off-site treatments may include roadside and residential planting. Off-site treatments have been previously implemented for the approved Mount Pleasant Operation along Wybong Road, Kayuga Road and Dorset Road.

Project off-site mitigation measures may include the development of additional roadside or at-receiver tree screens in accordance with the Mount Pleasant Operation Visual Impact Management Plan.

In consultation with local private landholders this may include reasonable and feasible treatments (e.g. planting of additional site-specific tree screens) at the most proximal privately owned residences with direct views of the Project (e.g. residences within 1 km of mine landforms on Kayuga Road and Collins Lane).

Night-lighting

All external lighting associated with the Project would comply with *AS/NZS 4282:2019 – Control of the Obtrusive Effects of Outdoor Lighting*, including the minimisation of light spill through the following:

- Appropriate direction of lights (including consideration of mounting heights).
- Where feasible, use of shielded fittings.
- Use of anti-reflective paint to minimise light spill surfaces.
- Upward light spill would be minimised and lighting would generally be directed either downwards, or away from the potentially sensitive receptors (e.g. Muswellbrook).
- Night-lighting would be restricted to the minimum required for operational and safety requirements to avoid over-lighting.
- Where feasible, energy efficient lighting would be used for any new fixed lighting installed.
- Where floodlights are required, asymmetric beams would be used.
- Where feasible, fixed lights would not be directed towards reflective surfaces.
- Lighting would potentially use warm white colours for fixed lighting, where available and if compliant with industrial lighting standards.

7.17 SOCIAL AND COMMUNITY INFRASTRUCTURE

A SIA was prepared for the Project by JAL (2020) that considers the potential impacts of the Project on social values, population and community infrastructure (Appendix N).

A description of the methodology undertaken for the SIA (Appendix N) is presented in Section 7.17.1. A summary of the assessed social impacts of the existing Mount Pleasant Operation is provided in Section 7.17.2. Key potential Project impacts on social values, employment and population are summarised in Section 7.17.3. Proposed mitigation and adaptive management measures are provided in Sections 7.17.4 and 7.17.5, respectively.

7.17.1 Methodology

The SIA was prepared in accordance with the SEARs and the *Social impact assessment guideline for State significant mining, petroleum production and extractive industry development* (DP&E, 2017) (Appendix N).

JAL (2020) assessed the potential social impacts associated with the existing approved Mount Pleasant Operation, the Project proceeding and the Project not proceeding.

Community Consultation

The SIA (Appendix N) was informed by consultation undertaken by MACH since commencement of operation at the Mount Pleasant Operations in 2017, preparation of the Social Impact Assessment Scoping Report (JAL, 2019) and relevant Project specialist assessments (Appendices A to S).

JAL engaged with a range of stakeholders to ascertain views on existing cumulative and potential incremental Project social impacts during the Project scoping stage, including (JAL, 2019):

- the Mount Pleasant Operation CCC;
- Mount Pleasant Operation ACDF;
- MSC;
- UHSC;
- Denman, Aberdeen, Muswellbrook and Scone Healthy Environment Group;
- Wonnarua Nation Aboriginal Corporation;
- Wanaruah LALC;
- Muswellbrook Chamber of Commerce; and
- a selection of nearby residents and landholders.

Additional consultation undertaken by JAL for the Project SIA is summarised in Table 7-34. A summary of findings from this consultation and background research is provided in Table 7-35. Further details are presented in Appendix N.

Table 7-34
Summary of Social Impact Assessment Stakeholder Engagement and Consultation

Stakeholder[1]	Online Community Survey	Engagement Method
Mount Pleasant Operation Groups	✓	• Interviews with CCC and the ACDF.
Near Neighbours	✓	• Interviews with local residents; including local agricultural enterprises.
Native Title Holders	✓	• Interview with the Wonnarua Nation Aboriginal Corporation.
Aboriginal Stakeholders	✓	• Interview with the Wanaruah LALC.
Environmental/Community Groups	✓	• Interviews with Denman, Aberdeen, Muswellbrook, Scone Healthy Environment Group and Friends of the Upper Hunter.
Industry Groups	✓	• Interview with the Muswellbrook Chamber of Commerce.
Local Business	✓	• Interview with a nearby business not directly linked to the Mount Pleasant Operation.
Local Suppliers	✓	• Interviews with nearby businesses that supply products / services to the Mount Pleasant Operation.
State Government Departments/Agencies	✓	• Interviews with social infrastructure providers, including DPIE, NSW Police, NSW RFS and NSW Ambulance.
Mount Pleasant Operation Workforce	✓	• Workforce survey to understand the existing social environment and potential social impacts of the Project proceeding or not proceeding.
Local Councils	x	• Interviews with MSC, Upper Hunter Shire Council and Singleton Council.
Other Interested Parties	x	• Letters were received from three additional interested stakeholders.

Source: After Appendix N.

[1] Those stakeholders who did not wish to be identified are not listed in this table. Further information regarding the consultation undertaken with these stakeholders is detailed in Appendix N.

Table 7-35
Summary of Key Local and Regional Social Impact Assessment Baseline Findings

Social Aspect	Key Local and Regional Baseline Findings
Housing Profile	• The Upper Hunter is known for its fluctuating housing markets. • The housing market in the Upper Hunter is currently on a slow upturn, which is often associated with increasing housing prices. • At June 2020, there were approximately 40 properties in Muswellbrook, 8 properties in Upper Hunter and 38 properties in Singleton available for rent. • In the Mount Pleasant Operation workforce survey, a large portion (74%) of the survey participants indicated they live in in their own home, and 25% indicated they are currently renting.
Community Services and Facilities	• The majority of community services in the region accessed by the Mount Pleasant Operation workforce are located in Muswellbrook, Upper Hunter and Singleton LGAs. • In 2018, Muswellbrook and Upper Hunter LGAs had five General Practitioners (GPs) each (1 full-time equivalent GP per approximately 983 and 991 people, respectively). Singleton LGA had eight GPs (1 full-time equivalent GP per approximately 1,154 people). • Enrolment numbers at public schools in the region reported a mix of trends between 2004 and 2018. • At August 2020, Muswellbrook LGA had 11 childcare centres/services, of which five had vacancies. • The ACDF has provided funding for various education programmes in the region. • The local area is part of the NSW RFS Hunter Valley Rural Fire District. • The community survey had a high number of responses (34% of all respondents and 28% of non-workers/non-suppliers) that indicated the Mount Pleasant Operation had no impact on community services.

Table 7-35 (continued)
Summary of Key Local and Regional Social Impact Assessment Baseline Findings

Social Aspect	Key Local and Regional Baseline Findings
Quality of the Living Environment	• There is a relatively high concentration of mining operations in the Upper Hunter region, leading to the potential for cumulative impacts. • Key amenity impacts identified by the community survey respondents included dust, noise, visual, and water. • Community members residing within Muswellbrook LGA were more likely to raise dust, noise and visual impacts as negative issues for the Mount Pleasant Operation, compared to those living outside the Muswellbrook LGA.
Local Economy	• The Mount Pleasant Operation is widely regarded as having had a positive impact on employment opportunities and the local economy as a result of engaging local suppliers and local spending. • Some local residents/businesses of Muswellbrook have experienced additional costs and "time lost" due to managing environmental impacts.
Health and Wellbeing	• Some people who participated in engagement process indicated concerns over asthma-related health impacts. Asthma prevalence in children and adults were found to have generally declined between 2002 and 2019 in Muswellbrook, Singleton and Upper Hunter LGAs (HealthStats NSW, 2020). • Other community members have reported increased stress, solastalgia[1] and eritalgia[2].

Source: After Appendix N.

1 A form of mental or existential distress caused by environmental change.

2 A form of mental or existential distress caused by the loss of anticipated future.

Community Survey

As part of the SIA, a community survey was undertaken. The community survey was designed to enable a broad range of community members to participate in consultation and seek community members' views about potential impacts and opportunities associated with the Mount Pleasant Operation, and the Project proceeding or not proceeding (Appendix N).

A link to the survey was sent to the stakeholders who participated in the SIA consultation program for distribution within their networks.

The survey was made available online and was also advertised through the following:

- MACH Website;
- Hunter River Times;
- Muswellbrook Chronicle;
- letterbox drop of DL flyers to Muswellbrook LGA[9] and Aberdeen; and
- SMS and emails sent to people and organisations on MACH's consultation database.

Some 126 members of the community completed the community survey (Appendix N).

Workforce Survey

As part of the SIA (Appendix N), a workforce survey was also undertaken to obtain information regarding the existing Mount Pleasant Operation workforce, and to seek their views about potential impacts and opportunities of the Project proceeding or not proceeding.

The survey was made available online, and was distributed to employees at the Mount Pleasant Operation (including contractors[10]) through internal communication channels.

Some 157 members of the existing Mount Pleasant Operation workforce completed the survey (Appendix N).

7.17.2 Existing Environment

In the late 1990s to the early 2010s, coal mining was the dominant industry in Muswellbrook which employed a significant number of people. Following the coal downturn in 2012 and 2013, some mine workers and their families left Muswellbrook, leaving a gap in the housing market which was filled by some people on lower incomes. Since then, the coal industry has continued to grow in the region (Appendix N).

9 This included Denman.

10 This included Thiess and Sedgman employees.

Employee Residential Distribution

In March 2020, approximately 33% of the Mount Pleasant Operation employees (Plate 7-29) resided in the Muswellbrook LGA, while approximately 21% and 16% resided in Singleton LGA and Upper Hunter LGA, respectively. Approximately 25% resided elsewhere in NSW, and approximately 4% resided outside of NSW.

Area of Social Influence

The SIA defines the area of social influence of the Project as a geographical area extending from Murrurundi in the north to Newcastle in the south-east and to Merriwa in the west (Appendix N).

For the purposes of the SIA, potential impacts were considered at two broad levels (Appendix N):

- Local (i.e. proximal to the mine, Muswellbrook and surrounding villages and towns).
- Regional (i.e. Muswellbrook LGA, Upper Hunter LGA and Singleton LGA).

Impacts of the Approved Mount Pleasant Operation

JAL (2020) assessed the social impacts of the existing approved Mount Pleasant Operation and other regional mining operations as including the following:

- employment opportunities (positive);
- impacts on housing (positive and negative);
- impacts on traffic (negative);
- impacts on health and wellbeing (positive and negative);
- impacts on community services and facilities (positive and negative);
- impacts on the quality of the living environment, including amenity and visual impacts (positive and negative);
- socio-economic impacts (positive and negative);
- impacts on recreation (positive and negative);
- cultural impacts, including Aboriginal and agricultural culture (positive and negative); and
- impacts on families and communities (positive and negative).

Social impacts related to the approved Mount Pleasant Operation are reported to be experienced differentially, with people within the same geographical area experiencing both positive and negative impacts simultaneously. Negative social impacts are being experienced by people in close geographical proximity to the current operation, while positive social impacts are experienced generally over the same and wider geographical area (Appendix N).

Plate 7-29 Employees at the Mount Pleasant Operation

It is also noted that the social impacts of the approved Mount Pleasant Operation are experienced cumulatively with other major projects (e.g. Bengalla Mine and Mt Arthur Coal Mine) and proposed or approved major projects, planned closure of the Liddell and Bayswater Power Stations, natural conditions (e.g. prolonged drought conditions) and COVID-19 (Appendix N).

7.17.3 Potential Impacts

JAL (2020) assessed the potential impacts of the Project as a continuation of the social impacts currently being experienced from the Mount Pleasant Operation. Negative social impacts would continue to be experienced by people in close geographical proximity to the current operation, while positive social impacts would continue to be experienced generally over the same and wider geographical area (Appendix N).

A number of the potential impacts identified for the Project were also considered to already occur due to the existing nearby mining operations, and cumulative social impacts would continue to occur in combination with the Project (Appendix N).

The potential impacts are described further below and cumulative impacts of the Project with other operational, proposed or approved major projects in the region are described in Appendix N.

The potential social impacts and opportunities associated with the Project not proceeding have also been considered in Appendix N.

The potential economic impacts of the Project are described in Section 7.18 and Appendix O.

Way of Life

The Project would extend the life of the Mount Pleasant Operation and, therefore, any associated existing impacts on wellbeing and quality of life that are perceived in the local community (Appendix N).

Employment

As described in Section 3.16, the Project operational workforce (at full development) would increase to an estimated peak of 830 full-time personnel, a maximum increase of approximately 450 personnel [11] from the workforce of the approved Mount Pleasant Operation. Over the life of the Project, the average operational workforce would be approximately 600 people.

Construction and development activities would also require monthly peaks of up to approximately 400 personnel in Years 4 and 5 with smaller monthly peaks of up to 300 people anticipated during Years 10 and 11.

The Project would increase the availability and longevity of direct employment at the Mount Pleasant Operation. The Project would also provide continued indirect employment opportunities through MACH's continued support of local businesses. This increased employment would help maintain a stable economic base in the region (Appendix N).

Population

Given the staged expansion of existing mining activities and the consequent staged increase of the Project workforce numbers, the additional workforce associated with the Project would be unlikely to result in any significant change to population (Appendix N).

Predicted population growth associated with the Project is detailed in Table 7-36.

Table 7-36
Predicted Population Growth Associated with the Project

	LGA	2026	2036	2041
Estimated additional people[1]	Muswellbrook	177	174	104
	Upper Hunter	86	85	51
	Singleton	115	111	66
Estimated population change in the LGA	Muswellbrook	1%	1%	1%
	Upper Hunter	1%	1%	1%
	Singleton	<1%	<1%	<1%

Source: Appendix N.

1 Includes employees and their families.

11 As at mid-2020 the Mount Pleasant Operation employed 440 full-time equivalent people. For the purpose of the Social Impact Assessment, the previously estimated maximum full-time equivalent operational workforce of the Mount Pleasant Operation (380 people) was conservatively retained for assessment purposes.

Housing

While most of the workforce is expected to continue to live locally (i.e. Muswellbrook, Singleton and Upper Hunter LGAs), the Project increases in workforce would include some additional demand for housing.

The Project would contribute to the maintenance of housing and rental prices in the region for an additional 22 years.

While this may positively impact homeowners and investors due to increased property value, it may also negatively impact low-income households in the region by reducing their ability to access the private rental market (Appendix N).

Access

The Project would continue to use the existing site access to the Mount Pleasant Operation. Heavy vehicle deliveries would be required to continue using Bengalla Road and Wybong Road. The Project may also continue to proportionally contribute to existing congestion on the New England Highway.

JAL (2020) identified that Project traffic may continue to cause a portion of stakeholders frustration and certain people may continue to change their travel times to avoid the peaks in traffic on shift changes due to mining related traffic in the region.

The potential impacts of the Project on traffic generation, roadway capacity and safety are assessed further in Appendix J and are summarised in Section 7.15.

Health and Wellbeing

Some nearby landholders who participated in engagement activities raised a number of causes of stress and anxiety as a result of the existing Mount Pleasant Operation and the Project. These predominantly related to stress and anxiety caused by permanent changes to the landscape, leading to loss of homeliness, change in connection to land or place, and distress caused by environmental change (i.e. solastalgia) (Appendix N).

Other stakeholders who participated in engagement activities also highlighted their personal experience regarding the amenity impacts associated with the existing Mount Pleasant Operation[12]. The key amenity concerns raised during the engagement process were associated with continued air quality, noise, blasting and lighting-related impacts. These impacts are expected to continue with the Project (Appendix N).

The Project would also continue to support the wellbeing of employees and their families through continued provision of employment (Appendix N).

Community Services and Facilities

The Project would maintain, and potentially increase, the current levels of demand upon community services and facilities (e.g. health care services, emergency services, childcare, education centres, etc.) associated with the Mount Pleasant Operation for an additional 22-year period.

JAL (2020) considered that the Project could result in lowered accessibility to community services and facilities due to the increased demand, however, the Project also represents a potential positive stimulus to demand for infrastructure and services. The Project may also maintain or increase participation and support for local community groups, including the RFS (Appendix N).

The Project would also continue to contribute to the local community services and facilities through ongoing payments under a Voluntary Planning Agreement with MSC, and other sponsorships and community contributions (Appendix N).

Surroundings

Some people who participated in the engagement activities expressed concerns regarding amenity impacts such as noise, blasting, air quality and visual impacts from the existing Mount Pleasant Operation (Appendix N).

The Project is not considered to alter the intensity of the social impacts reportedly experienced as a result of the Project's amenity impacts; rather, they would be experienced for an additional 22 years (Appendix N).

Project impacts associated with noise are assessed in Sections 7.3, 7.4 and 7.5, while, air quality and visual amenity are assessed in Sections 7.7 and 7.16, respectively.

[12] The feedback was also based on the stakeholders' families and friends experiences, as well as the stakeholders' knowledge regarding the potential health impacts of coal mining industry from media.

The Project also represents a potential opportunity to achieve positive outcomes with continued management of the biodiversity offset areas (Appendix N).

Recreation

Consultation identified some concerns regarding the continued impacts on the Muswellbrook Race Club due to visual impacts (Appendix N). The visual impacts on the Muswellbrook Race Club are expected to decrease progressively, as the Eastern Out-of-Pit Emplacement is developed and rehabilitation is undertaken (Sections 7.16 and 8, Appendix M).

The Project would provide for continuation of funding and support for various local recreation clubs and events (Section 6 and Appendix N).

Culture

Potential Project impacts and opportunities associated with Aboriginal and agricultural cultural values have been considered as part of the SIA (Appendix N).

Aboriginal Culture

Continued change to the land as a result of ongoing mining operations at the Mount Pleasant Operation, and therefore subsequent impact on connection to country, was the key issue of concern for representatives of the Aboriginal groups who participated in engagement activities (Appendix N).

The Project would also provide continued opportunity to practice Aboriginal culture and land management activities (e.g. cool burns) and participate in rehabilitation at the Mount Pleasant Operation. The Project would also provide for continuation of the ACDF or a similar Aboriginal community development organisation that is active in the community (Appendix N).

Agricultural Culture

As the Project is an extension of an existing Mount Pleasant Operation, it would likely continue to contribute to a changed sense of place from a predominately rural and agricultural area to inclusion of mining activity (Appendix N).

The Project may also contribute to a decreased proportion of people working in the agricultural sector due to competition for employees (Appendix N). The Project would also provide continuation of biodiversity offset area management and provide continued support of agricultural business in the vicinity of the Project (Appendix N).

Community Cohesion

The SIA identified that mining activities have impacted the level of community cohesion in the region (Appendix N).

Consultation identified that impacts to community cohesion were particularly due to the following:

- continued loss of rural communities associated with families relocating out of the region due to land acquisition;
- tension between the mining and agricultural industries; and
- community division between community members who are supportive of, or against, mining.

The Project may contribute to the continuation of community tensions as described above (Appendix N).

Cumulative

The potential cumulative impacts of the Project and other operational, proposed or approved major projects within the region have been considered in Appendix N.

The key factors contributing to cumulative impacts include the following (Appendix N):

- The existing social impacts associated with the approved Mount Pleasant Operation would continue to be experienced cumulatively with the Project.
- Liddell Power Station would close in 2023 with rehabilitation activities anticipated to occur subsequently. Bayswater Power Station is planned to close in 2035.
- Mt Arthur Coal Mine, Mangoola Coal and Bengalla Mine are approved to operate until 2026, 2029 and 2039, respectively. Upon closure, employment of operational workforce at these mines would cease.
- Regional and retail development, as well as population growth in the Lower Hunter Valley has reportedly been drawing people and their economic spend away from the Upper Hunter region. This may also be encouraging more people to remain living in the Lower Hunter Valley, rather than relocating to the Upper Hunter.
- The region is known to have been experiencing various positive and negative impacts associated with major road infrastructure in the area (e.g. Hunter Expressway and Golden Highway upgrade).

- The Upper Hunter region has experienced prolonged drought conditions for the past three years, which have reportedly caused negative social impacts separately to the mining projects in the region (e.g. reduced or removed income). The drought conditions have also caused cumulative negative environmental impacts (e.g. dust) with the approved surrounding mining operations.

7.17.4 Mitigation Measures

MACH would continue to work with local government and the community to minimise potential social impacts of the Project and maximise potential opportunities.

A number of mitigation and management strategies have been identified and would be implemented by MACH, including the following key strategies (Appendix N):

- Continue to work with the neighbouring landholders and people from surrounding villages and communities to develop engagement methods that suit them and that are reasonable and feasible.
- Continue to engage with stakeholders who are directly impacted and interested organisations to develop, implement and review environmental management measures that are reasonable and feasible.
- Support for the agricultural industry through, for example, supporting continuation of agriculture on MACH-owned land that is not required for mining operations, or temporary trading of water licences for periods the licences are not required by MACH.
- Continue to work with the Upper Hunter Mining Dialogue to understand the impacts the mining industry is having on the region (e.g. air quality work), and participate/advocate for developing and implementing management strategies for material impacts from an industry perspective.
- Working with the main contractors on site (i.e. mining services and coal processing) to identify ways to prioritise local employment (existing population) and develop strategies for people to relocate to Muswellbrook, Singleton, and Upper Hunter LGAs.
- Include local residential workforce as a Key Performance Indicator in procurement processes for main contractors with associated management, monitoring and reporting.
- Provide information regarding the Project workforce and the associated predicted housing demand to the local councils on a regular basis.
- Develop strategies to employ, train and upskill people from the local area who are unemployed.
- Continue to deliver positive social impacts for Aboriginal people with connections to the land and waters on which the Project is located by supporting on-country land management (such as cool burns) and involvement in rehabilitation programs.
- Engage with stakeholders regarding mine closure planning and how the Project can contribute to the Upper Hunter long-term transition from coal mining and power generation.

In addition to the strategies summarised above, MACH has commenced negotiation with the MSC regarding a revision of the existing Mount Pleasant Operation Voluntary Planning Agreement for the Project (Section 6).

Social impact management measures and enhancement measures for positive impacts would be described in a Social Impact Management Plan to be developed for the Project (subject to Development Conditions applied to the Project).

7.17.5 Adaptive Management

Social impacts associated with the Project would be monitored throughout the Project life to elevate the effectiveness of the Social Impact Management Plan.

An appropriate monitoring framework would be established as part of the Social Impact Management Plan, which may include (Appendix N):

- Continued positive community engagement in accordance with MACH's various community engagement mechanisms and strategies.
- Regular completion of workforce and/or community surveys.
- Implementation of the existing monitoring programs established as part of the various approved Mount Pleasant Operation management plans under Development Consent DA 92/97 as modified by the Project Development Consent.

- Review of human resource and complaints data.
- Review and consideration of feedback received through an established dialogue with relevant stakeholders including local community groups (including Aboriginal groups), neighbouring residents, community service and facility providers, and local suppliers.
- Evaluation of the ACDF, or a similar Aboriginal community development organisation that is active in the community.

The Social Impact Management Plan would be regularly reviewed, and if necessary revised, throughout the Project life.

7.18 ECONOMIC EFFECTS

An Economic Assessment for the Project was undertaken by AnalytEcon (2021) and is presented in Appendix O.

A description of the methodology undertaken for the Economic Assessment is provided in Section 7.18.1. A summary of the existing regional economies is provided in Section 7.18.2. The potential impacts of the Project on the regional and NSW economies are described in Section 7.18.3, while mitigation measures are provided in Section 7.18.4.

7.18.1 Methodology

The Economic Assessment was prepared in accordance with the *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Government, 2015) and the *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (DP&E, 2018).

The Economic Assessment is primarily concerned with the 'net benefits' of a proposal for the local region and NSW in terms of specific indicators, such as employment and income.

The local region assessment was conducted at two different scales (Figure 7-37):

- The Upper Hunter Statistical Area Level 3 region (the SA3 Region); and
- The Muswellbrook, Upper Hunter and Singleton LGAs (the Project Region).

The SA3 Region was selected in accordance with the *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Government, 2015).

The Project Region was also adopted as it better aligns with the place of residence of the local Project workforce and, therefore, better captures the potential direct and flow-on economic effects associated with the Project (2020).

AnalytEcon (2021) has conducted a cost-benefit analysis to evaluate the potential net benefits of the Project to NSW (Appendix O).

The assessment of flow-on effects in the local region and NSW is based on input-output modelling developed by AnalytEcon (2021).

7.18.2 Existing Environment

Mining; agriculture, forestry and fishing; retail trade; and health care and social assistance are the largest sectors from an employment perspective in the SA3 Region and Project Region (Appendix O).

The mining and agriculture, forestry and fishing sectors are of greater relative importance to the regional economies than to the NSW economy from an employment perspective (Appendix O).

Approximately 49% of the existing Mount Pleasant Operation workforce reside in the SA3 Region, and approximately 70% reside in the Project Region (Appendix O).

7.18.3 Potential Impacts

Net Benefit for NSW

The Economic Assessment indicates the Project would result in a total net benefit to the NSW economy of $855 million in NPV terms, inclusive of estimated costs for environmental externalities and internalisation of environmental management costs by MACH. The estimated net benefit of the Project for NSW consists of royalties of $684 million in NPV terms and NSW's share of company income tax of $172 million in NPV terms (Appendix O).

Sensitivity analysis undertaken shows that the Project would generate significant net benefits to the NSW economy under a range of circumstances (Appendix O).

LEGEND

- Mining Operation
- Proposed Mining Operation (Application Lodged)
- Highway
- Principal Road
- Railway
- Local Government Area
- Upper Hunter SA3 Region
- Project Region
- Mining Lease Boundary (Mount Pleasant Operation)

Source: MACH (2020); Australian Bureau of Statistics (2020); NSW Spatial Services (2020)

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Upper Hunter SA3 Region and Project Region

Figure 7-37

MAC-18-02 SSD_EIS_Sect 7_220C

Employment and Income

The Project would allow for the employment of up to 830 full-time equivalent personnel at the Mount Pleasant Operation. The average Project operational workforce between 2023 and 2048 would be in the order of approximately 600 full-time equivalent on-site personnel (Appendix O).

Construction activities would be undertaken at various times over the life of the Project (Figure 3-11). The full-time equivalent workforce required for construction and development activities is anticipated to have monthly peaks of approximately:

- 100 people in Year 3 (including development of Northern Link Road) (annual average approximately 44 people);
- 400 people in Years 4 and 5 (including construction of the Stage 2a CHPP infrastructure components) (annual average approximately 200 people); and
- 300 people in Years 10 and 11 (including for construction of the Stage 2b CHPP infrastructure components) (annual average approximately 130 people).

The Project is projected to result in the following incremental direct employment impacts (i.e. in addition to the approved Mount Pleasant Operation) associated with the operational workforce (Appendix O):

- SA3 Region – approximately 261 direct full-time equivalent jobs per annum; and
- Project Region – approximately 376 direct full-time equivalent jobs per annum.

The Project operational employment would result in incremental disposable income of approximately $98 million and $132 million in NPV terms in the SA3 Region and Project Region, respectively (Appendix O).

The Project is also projected to result in the following incremental indirect employment impacts associated with related upstream or downstream industries (Appendix O):

- SA3 Region – approximately 186 indirect full-time equivalent jobs per annum; and
- Project Region – approximately 267 indirect full-time equivalent jobs per annum.

These incremental indirect employment opportunities would result in incremental disposable income of approximately $42 million and $57 million in NPV terms in the SA3 Region and Project Region, respectively (Appendix O).

The Project is therefore projected to generate the following combined incremental direct and indirect employment benefits (Appendix O):

- SA3 Region – approximately 447 full-time equivalent jobs per annum resulting in incremental disposable income of $140 million in NPV terms; and
- Project Region – approximately 643 full-time equivalent jobs per annum resulting in incremental disposable income of $189 million in NPV terms.

On a NSW basis, the Project is projected to generate, on average, an additional 444 full-time equivalent indirect jobs per annum over the life of the Project. The projected growth in indirect employment would be accompanied by an increase in disposable income in NSW of approximately $276 million in NPV terms (Appendix O).

Value Added

Value added is the additional value of goods and services that are newly created in an economy, and that are available for domestic consumption or for export (Appendix O).

The Project is projected to generate incremental direct value added benefits in NSW of approximately $1.4 billion in NPV terms (Appendix O).

The Project is also projected to generate incremental indirect value added benefits of approximately $346 million in NPV terms in other industries in NSW (Appendix O).

End of Project Life

The Project would allow for the continued operation of the Mount Pleasant Operation that would stimulate demand in the regional and NSW economies leading to increased employment (Plate 7-30) and value added (Appendix O). Cessation of the mining operations would result in a contraction in regional economic activity.

The magnitude of the regional economic impacts from cessation of the Project would depend on a number of interrelated factors, including the movements of workers and their families, alternative development opportunities and economic structure and trends in the regional economy at the time.

Plate 7-30 Mount Pleasant Operation Workforce

7.18.4 Mitigation Measures

A Mine Closure Plan would be developed for the Project in consultation with relevant regulatory authorities and community stakeholders. The Mine Closure Plan would be developed over the Project life, and would include consideration of amelioration of potential adverse socio-economic effects due to the reduction in employment at Project closure (Section 7.17.4).

7.19 HAZARD AND RISK

A PHA has been conducted by MACH (2020e) to evaluate the potential hazards associated with the Project (Appendix Q).

Section 7.19.1 provides a description of the methodology used for the PHA. Potential incidents and hazards identified for the Project are described in Section 7.19.2. Proposed preventative and control measures to address potential hazards, including those measures currently implemented at the Mount Pleasant Operation, are described in Section 7.19.3.

7.19.1 Methodology

The PHA has been conducted in accordance with the general principles of risk evaluation and assessment outlined in the NSW Government document *Multi-level Risk Assessment* (NSW Department of Planning and Infrastructure [DP&I], 2011) and has been documented in general accordance with *Hazardous Industry Planning Advisory Paper No. 6: Hazard Analysis* (DoP, 2011a).

The PHA also addresses the requirements of SEPP 33 within the *Applying SEPP 33: hazardous and offensive development application guidelines* (DoP, 2011b).

Consistent with the requirements of the SEARs, the PHA addresses potential hazards relating to bushfire risks, interactions with nearby prescribed dams and the handling and use of dangerous goods.

In addition, potential geotechnical hazards and associated Project design requirements have been assessed by GeoTek Solutions (2020) (Attachment 13). Key geotechnical design criteria are described in Attachment 8.

7.19.2 Hazard Identification and Risk Assessment

The potential hazards for the Project include the continued handling and storage of hydrocarbons, chemicals, explosives and liquid and non-liquid wastes (Appendix Q).

In accordance with DP&I (2011), the PHA specifically covers the risks from fixed installations. As such, the main focus of the assessment was on-site storages, coal stockpile areas, water management structures and fine reject storage.

Notwithstanding, some additional risks relating to mining operations (e.g. blasting, highwall slumping and unplanned/unauthorised movement of mobile equipment off-site) were identified and included in the PHA (Appendix Q).

Although transportation is not covered by the *Multi-level Risk Assessment* (DP&I, 2011), potential risks associated with on-site rail movements were also considered.

The following generic classes of incidents were identified:

- spill/leak;
- fire;
- explosion;
- excessive vibration or overpressure;
- flyrock;
- unauthorised movement of mobile plant;
- theft;
- pit slope failure;
- water or fine reject storage embankment failure;
- malfunction of equipment/mine infrastructure;
- malicious acts/terrorism; and
- release of disease/biological pathogen.

These incident classes were applied to the Project component areas to identify scenarios, for which treatment measures were developed (Appendix Q).

Following identification of the potential hazards associated with the Project, a qualitative assessment of the risks to people, property and the environment associated with the Project was undertaken (Appendix Q). Assessed risks were compared to qualitative risk assessment criteria developed in accordance with AS/NZS ISO 31000:2018 *Risk Management – Guidelines* and *Hazardous Industry Planning Advisory Paper No. 4: Risk Criteria for Land Use Safety Planning* (DoP, 2011c).

An assessment of the combination of the consequence and probability rankings concluded that the overall risk rankings for the identified hazards would be low, and therefore tolerable (Appendix Q). Given the proposed risk treatment measures, no potential scenarios with significant off-site consequences were identified (Appendix Q).

Bushfire Regime

The Project is located in the jurisdiction of the Muswellbrook Bush Fire Management Committee (BFMC), which includes the Muswellbrook LGA. A bushfire risk management plan has been prepared by the Muswellbrook BFMC (2011).

The bushfire season in the Muswellbrook BFMC area is generally from September to March (Muswellbrook BFMC, 2011).

The bushfire season in the Muswellbrook BFMC area generally coincides with the north-west to westerly winds, accompanied by high daytime temperatures and low relative humidity. Some bushfires are also caused by dry lightning storms (Muswellbrook BFMC, 2011).

The major sources of bushfire ignition include: lightning strikes from summer storms; fire spreading from private properties; and accidental ignition events in rural areas or along rail and road corridors (Muswellbrook BFMC, 2011).

Major fire activity in the vicinity of the Project has occurred on a number of occasions since 1939. The most recent uncontrolled bushfire event of some potential relevance to the Project area was located to the south of Muswellbrook in 1993 (Muswellbrook BFMC, 2011).

Bushfire Hazards

Any uncontrolled bushfires originating from Project activities may present potentially serious impacts to the village of Aberdeen, the town of Muswellbrook, Bengalla Mine, Mt Arthur Coal Mine, Mangoola Coal, the locality of Kayuga and rural properties in the vicinity of the Project.

Similarly, fires originating in nearby grassland, or rural areas, could pose a significant risk to the Project infrastructure and staff, contractors and equipment.

The degree of potential impact would vary with climatic conditions (e.g. temperature, humidity and wind), location of the bushfire and the quantity of available fuel. Depending upon climatic conditions, intensive agricultural production (including extensive areas of irrigated production) along the Hunter River floodplain would act as a mitigation to potential bushfire movement between the eastern and western sides of the Hunter River.

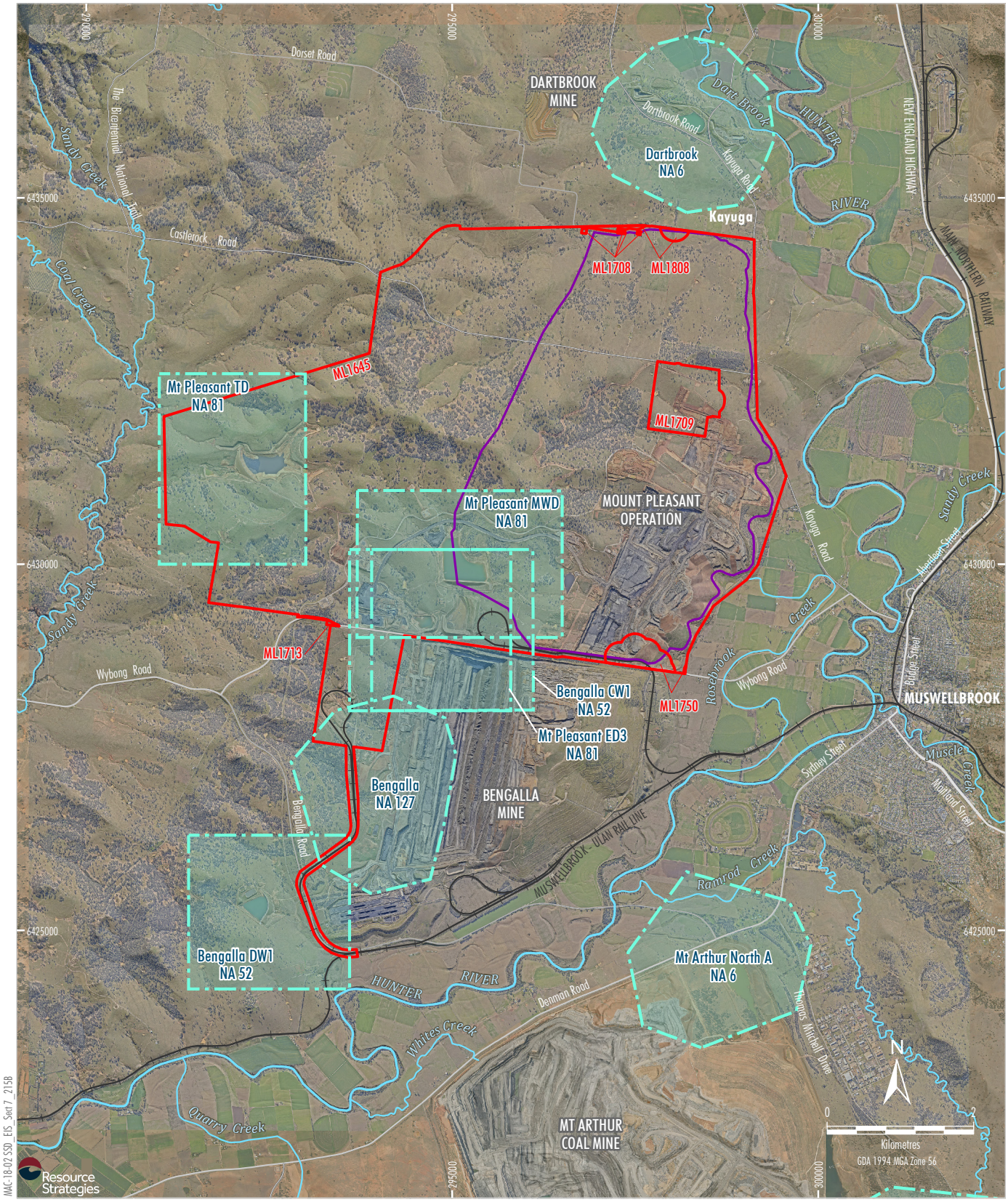
The continuation and expansion of open cut activities for the Project could increase the potential for fire generation. However, given the range of management measures currently in place for the Mount Pleasant Operation, which would continue for the Project (Section 7.19.3), it is unlikely that there would be an increase in fire frequency resulting from the Project.

Declared Dams

The following existing dams at the Mount Pleasant Operation, and Bengalla Mine dams located in the Project Development Application Area, are 'declared dams' under the *Dams Safety Act, 2015*:

- Mount Pleasant ED3;
- Mount Pleasant MWD;
- Mount Pleasant TD (Fines Emplacement Area);
- Bengalla CW1; and
- Bengalla DW1.

Open cut mining for the Project would occur in the declared notification areas for Mount Pleasant ED3, Mount Pleasant MWD and Bengalla CW1 (Figure 7-38). In addition, the approved Mount Pleasant Discharge Dam (not yet constructed), authorised under Bengalla Mine SSD-5170, is located within the notification area of Bengalla DW1.



LEGEND

Mining Lease Boundary (Mount Pleasant Operation)

Approximate Extent of Project Open Cut and Waste Rock Emplacement Landforms

Dam Notification Area

Source: MACH (2020); Dams Safety NSW (2020); NSW Spatial Services (2020)
Orthophoto: MACH (2020)

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Declared Dam Notification Areas

Figure 7-38

The Project would also optimise the use of the existing Mount Pleasant Operation Fines Emplacement Area, including development of a series of downstream embankment lifts over the life of the Project (Section 3.5.4). MACH would continue to consult with Dams Safety NSW on these works, and develop the Fines Emplacement Area to manage associated hazards and risks to the satisfaction of Dams Safety NSW.

Continued rehabilitation activities and the development of new infrastructure would also occur in the declared notification areas for Mount Pleasant ED3, Mount Pleasant MWD and Bengalla CW1 over the life of the Project.

Dangerous Goods

Of the hazardous materials handled and/or stored at the existing Mount Pleasant Operation (Section 3.15), only petrol is classified as a dangerous good in accordance with the criteria in the *Australian Code for the Transport of Dangerous Goods by Road or Rail* (ADG Code) (National Transport Commission, 2017).

7.19.3 Hazard Prevention and Mitigation Measures

MACH has a safety management system to manage risks to health and safety in accordance with the requirements of the *Work Health and Safety (Mines and Petroleum Sites) Act, 2013* and the *Work Health and Safety (Mines and Petroleum Sites) Regulation, 2014*. MACH would continue to meet these obligations for the Project.

A number of hazard controls, including mitigation and management measures, are described in existing management plans that would be reviewed and revised for the Project, for example:

- Water Management Plan, including:
  - Surface Water Management Plan;
  - Groundwater Management Plan;
  - Site Water Balance;
  - Erosion and Sediment Control Plan; and
  - Surface and Ground Water Response Plan.
- Pollution Incident Response Management Plan.
- Bushfire Management Plan.
- Spontaneous Combustion Management Plan.
- Blast Management Plan.
- Waste Management Plan.
- Maintenance Management Plan.

The following hazard control and mitigation measures would be adopted for the Project:

- **Maintenance** – Ongoing and timely maintenance of all mobile and fixed plant equipment in accordance with the recommended maintenance schedule of the original equipment manufacturer, and consistent with maintenance schemes required by relevant legislation.
- **Staff Training** – Equipment operators and drivers would be trained and (where appropriate) licensed for their positions. Only personnel who are appropriately licensed to undertake skilled and potentially hazardous work would be permitted to do so.
- **Engineering Structures** – Mining and civil engineering structures would be constructed in accordance with the applicable Australian Standards, codes and guidelines. Where applicable, MACH would obtain the necessary licences and permits for the construction of engineering structures.
- **Contractor Management** – All contractors employed by MACH would be required to operate in accordance with the relevant Australian Standards and NSW legislation.
- **Water Management** – As reported in Appendix D, water management structures would be constructed to generally separate runoff from disturbed areas and undisturbed areas.
- **Coal Stockpile Management** – Coal stockpiles would be monitored and managed to reduce the potential for spontaneous combustion.
- **Storage Facilities** – Storage and usage procedures for potentially hazardous materials (e.g. hydrocarbons, chemicals and explosives) would be followed. The storage and usage procedures would continue to be consistent with Australian Standards and relevant legislation. A register would be kept up-to-date with the chemicals and dangerous goods stored on-site.
- **Emergency Response** – Emergency response procedure systems and manuals would continue to be implemented.

- **Waste Management System** – Waste would continue to be managed in consideration of general waste management principles (reduce, re-use, recycle). Waste disposal measures and a waste monitoring programme are described in the Waste Management Plan.

Bushfire Hazards

Bushfire risk mitigation measures employed by MACH under the existing Bushfire Management Plan (Narla Environmental, 2020) would continue for the Project.

Specific mitigation measures to reduce bushfire risk would include:

- ensuring adequate buffer zone between activities and potential fuel sources;
- reviewing and maintaining asset protection zones and control lines;
- slashing of vegetation three times a year, before, during and after the bushfire danger period;
- minimising potential ignition risks (e.g. hot works, clearing, fuel and exhaust fires) within vegetated areas (or if required, implementing appropriate operating procedures such as work restrictions on days of higher fire danger risk and requiring fire control equipment on hand);
- maintaining high level of employee/contractor awareness in relation to bushfire risk (e.g. toolbox talks); and
- ensuring water carts are readily available within the operations area and water fill points are available in accessible locations near existing infrastructure.

Declared Dams

MACH would continue to operate the existing declared dams under the NSW *Dams Safety Act, 2015* for the Project, including construction and inspection requirements.

MACH would continue to consult with Dams Safety NSW regarding the management of declared dams operated by MACH (including the Mount Pleasant ED3, Mount Pleasant MWD and Mount Pleasant TD [Plate 7-31]) and also meet Dams Safety NSW requirements applicable to any Project works within Bengalla Mine's CW1 and DW1 notification areas.

Dangerous Goods

On-site petrol usage would continue to be minor and petrol engine vehicles would continue to be fuelled off-site.

Control and mitigation measures for the handling and storage of hazardous materials for the Project are described above and would be documented in the above-described management plans.

Plate 7-31 Mount Pleasant Operation Fines Emplacement Area

7.20 HUMAN HEALTH

A Human Health Assessment has been prepared for the Project by EnRiskS (2020) and is presented in Appendix R.

Section 7.20.1 provides a description of the methodology used for the Human Health Assessment (Appendix R). Section 7.20.2 provides a summary of the existing community health data of the population in the vicinity of the Project. Section 7.20.3 describes the potential health impacts associated with the Project. Section 7.20.4 outlines mitigation measures for the Project.

7.20.1 Methodology

The Human Health Assessment (Appendix R) for the Project has been undertaken in accordance with the *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards* published by the Environmental Health Standing Committee (enHealth, 2012) under the Commonwealth Department of Health.

The assessment also considers relevant guidance documents and standards published by the NSW Government, National Environment Protection Council (NEPC), National Health and Medical Research Council (NHMRC), US EPA, European Union (EU) and World Health Organisation (WHO).

The Human Health Assessment (Appendix R) provides an assessment of potential impacts to community health in relation to:

- exposure to suspended particulate matter and deposited dust generated by the Project, based on the data and conclusions in the Air Quality Assessment (Appendix B);
- exposure to environmental noise, and blast overpressure and vibration generated by the Project, based on the data and conclusions in the Noise and Blasting Assessment (Appendix A); and
- potential changes to water availability and water quality due to the Project, based on the data and conclusions in the Groundwater Assessment and Surface Water Assessment (Appendices C and D).

Assessment of what constitutes an acceptable risk level is recognised as a complex issue. Calculated incremental risks at individual receivers have been compared to the acceptance criteria outlined in EPA (2017) for carcinogenic risks, which are inferred to apply to risks associated with exposure to suspended particulate matter (Appendix R).

7.20.2 Existing Environment

The health of the community is influenced by a complex range of factors including age, socio-economic status, social capital, behaviours, lifestyle (e.g. smoking, poor diet, lack of exercise), beliefs, life experiences, country of origin, genetic predisposition, access to health and social care, and environmental factors (Appendix R).

The population in the vicinity of the Project is relatively small and health data is not available that specifically relates to this population (Appendix R).

EnRiskS (2020) reviewed available population and health data for the Muswellbrook and Upper Hunter LGAs and for the Hunter New England Health District. The populations of Muswellbrook and Upper Hunter LGAs represent approximately 3% of the total population in the Hunter New England Health District, which covers an area of approximately 132,000 km² (Appendix R).

The reviewed data included published data from 2010 which was compiled as part of a NSW Health (2010) review of the variation in respiratory and cardiovascular diseases and cancer among residents in the Hunter New England Health District.

The NSW Health (2010) review could not establish whether differences observed in some health statistics could be attributable to air pollution or any other specific cause (including lifestyle factors).

The population and health data reviewed by EnRiskS (2020) suggests some of the population in the vicinity of the Project may be more vulnerable to health-related impacts, compared to the general population of NSW. The underlying reasons for this increased vulnerability are expected to be complex and may include the broad range of interactive factors described above.

7.20.3 Potential Impacts

Exposure to Suspended Particulate Matter

Potential health impacts associated with cumulative suspended particulate matter concentrations was raised as a concern by MSC and other local stakeholders (Attachment 1 and Appendix N).

Particulate matter is a widespread air pollutant that has, and will always be, present in air. Further background on suspended particulate matter is provided in Section 7.7, including the classification of particulate matter into PM_{10} and $PM_{2.5}$ based on particle size.

Overview of Potential Health Effects

The potential health effects as a result of exposure to suspended particulate matter depends on a range of factors, including the size, structure and composition of the particulate matter, and the general health of the person (NSW Health and NSW Minerals Council, 2017).

Adverse health effects associated with exposure to particulate matter have been well studied and reviewed by Australian and International agencies (Appendix R). This research has included: population-based epidemiological studies in large urban areas in North America, Europe and Australia; investigations into particles in the respiratory tract; animal and cellular toxicity studies; and studies on inhalation toxicity by human volunteers (NEPC, 2010).

There have been clear associations determined between health effects and exposure to fine particulate matter (<2.5 µm, $PM_{2.5}$) and, to a lesser extent, coarser particulate matter (e.g. PM_{10}). The potential health effects associated with exposure to particulate matter vary widely, although the respiratory and cardiovascular systems are considered to be the most affected (Appendix R).

Cumulative Concentrations of Suspended Particulate Matter

EnRiskS (2020) assessed cumulative exposures to $PM_{2.5}$ and PM_{10} by comparing the predicted total concentrations in the air (from all sources, including the Project) to the current air quality standards and goals presented in the AQ NEPM.

The 2025 goals established by the AQ NEPC for $PM_{2.5}$ concentrations are similar to, and slightly more conservative (health protective) than, those provided by the WHO, EU and the US EPA (Appendix R).

The AQ NEPM guidelines for PM_{10} are similar to those established by the WHO and EU, and are significantly lower than the 24-hour average guideline available from the US EPA (Appendix R).

Based on review of the cumulative predictions for $PM_{2.5}$ and PM_{10}, EnRiskS (2020) did not identify any receivers with potential impacts of health concern that were not already identified in the Air Quality Assessment as exceeding VLAMP criteria (Section 7.7 and Appendix B).

As described in Section 7.7, all of the properties with predicted exceedances of the relevant particulate matter criteria in the Approved Methods and VLAMP are within approximately 1 km of the Mount Pleasant Operation MLs, and are currently subject to acquisition upon request in Development Consent DA 92/97, with the exception of receivers 154 and 154b (receiver 154 currently has mitigation upon request rights, and receiver 154b is an adjoining, newly identified receiver).

Incremental Risk of Exposure to Suspended Particulate Matter from the Project

The Human Health Assessment (Appendix R) adopted robust, published, quantitative relationships (known as 'exposure-response relationships') to correlate changes in $PM_{2.5}$ or PM_{10} concentrations due to the Project with potential changes in health indicators. The methodology adopted by EnRiskS (2020) has been presented by the WHO (Ostro, 2004).

EnRiskS (2020) considered potential incremental effects that may be associated with predicted Project dust emissions using the following parameters (Appendix R):

- The calculated incremental risk of health effects for individual receivers in relation to particular health indicators, such as hospitalisations for respiratory or cardiac conditions.
- The calculated total increase in the number of the health-related cases in the population per year, which is also known as the population health incidence value. This considers both the incremental risk at each receiver and the number of potentially affected people.

The above parameters are calculated using the following information and assumptions (Appendix R):

- The baseline incidence of the health indicators that are relevant to the population in the vicinity of the Project.
- Exposure-response relationships for the relevant health indicators based on referenced, published studies outlined in Appendix R.

- The estimated changes in $PM_{2.5}$ and PM_{10} concentrations modelled by TAS (2020), which incorporate a number of conservative assumptions (e.g. rainfall was not incorporated into the modelling and the use of conservative emission rates).
- An assumption that people remain at home (or on their property) all day, every day for a lifetime, and the Project changes in air quality remain the same for a lifetime (resulting in conservative risk calculations).
- For changes in the population health incidence value, an assumption that nearby receivers have household characteristics that are equivalent to the Muswellbrook LGA averages.

In relation to potential health risks associated with exposure to suspended particulate matter generated by the Project, EnRiskS (2020) concluded:

- The calculated incremental risks are low and acceptable for privately-owned residences located in, and on the outskirts of, Muswellbrook.
- The calculated change in population health incidence values would be very low and would never be measurable within the population in the vicinity of the Project.
- In some areas in close proximity to the Project, there are a number of individual receivers where incremental risks associated with particulate matter ($PM_{2.5}$) impacts are elevated and considered potentially unacceptable in the absence of Project proactive/reactive dust mitigation measures.
- With the continued implementation of Project proactive/reactive dust mitigation measures, four receivers were identified (receivers 112, 154, 154b and 153a) where incremental risks associated with dust ($PM_{2.5}$) impacts are elevated and considered potentially unacceptable. These receivers are located between approximately 200 m and 1 km from the Mount Pleasant Operation MLs.

The receivers where incremental risks have been identified as elevated and potentially unacceptable are a subset of those identified in the Air Quality Assessment (Appendix B) with potential exceedances of relevant air quality criteria (Section 7.7) (i.e. no additional health risks have been identified).

As described above, receiver 154 currently has mitigation upon request rights in Development Consent DA 92/97 for potential noise impacts and receiver 154b is an adjoining, newly identified receiver. Receivers 112 and 153a currently have acquisition upon request rights in Development Consent DA 92/97 for potential noise impacts.

Potential Noise and Blasting Health-related Risks

EnRiskS (2020) concluded that, based on the predicted noise levels and proposed mitigation measures described in the Noise and Blasting Assessment (Appendix A), the potential for adverse health impacts within the off-site community associated with blasting or noise generated as a result of the Project is considered to be negligible.

Potential Surface Water and Groundwater Health-related Risks

EnRiskS (2020) concluded that, based on the assessments undertaken of potential groundwater and surface water impacts due to the Project (Appendices C and D), the potential for adverse health impacts within the off-site community associated with impacts to groundwater and surface water as a result of the Project is considered to be negligible.

7.20.4 Mitigation Measures

EnRiskS (2020) does not recommend any specific mitigation measures for potential health-related impacts beyond the recommendations adopted from other specialist studies, including:

- Implementation of the dust mitigation measures described in the Air Quality and Greenhouse Gas Management Plan, as amended for the Project (including the continued use of general dust mitigation measures such as watering and reactive/proactive dust mitigation measures), and any construction management plans prepared for specific construction activities, as relevant.
- Implementation of the mitigation measures described in the Noise Management Plan, as amended for the Project (including continued use of sound attenuation on all major mobile plant and acoustic design of fixed plant, where reasonable and feasible, the Project's staged increase to ROM coal extraction and the continued use of the proactive/reactive noise management system).

- Implementation of the mitigation measures described in the Blast Management Plan, as amended for the Project.
- Implementation of the mitigation measures described in the Water Management Plan, as amended for the Project.

It is anticipated that receivers 154, 154b, 112 and 153a would be afforded acquisition upon request rights under the VLAMP should the Project be approved (Section 7.7).

7.21 GREENHOUSE GAS EMISSIONS

An assessment of the potential greenhouse gas emissions and climate change impacts of the Project, and potential impacts of climate change on the Project, is provided in Appendix S. The assessment is supported by a Greenhouse Gas Calculations report prepared by TAS (2021). A summary of the assessment is provided below.

The following sub-sections provide:

- a description of relevant greenhouse gas policies (Section 7.21.1) and greenhouse gas emission scopes (Section 7.21.2);
- a quantitative assessment of potential direct and indirect greenhouse gas emissions of the Project and comparison of the Project emissions to Australian and NSW greenhouse gas emissions (Section 7.21.3);
- a summary of mitigation and abatement measures (Section 7.21.4);
- a summary of potential impacts of climate change on the Project (Section 7.21.5); and
- a summary of adaptive management measures (Section 7.21.6).

Further consideration of greenhouse gas emissions from the Project in the context of the *Paris Agreement* and ESD is provided in Sections 8.3.5 and 8.4.1 and Appendix S.

7.21.1 Relevant Greenhouse Gas Policies

Global

The international framework addressing greenhouse gas emissions, and the global response to climate change, commenced with adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992.

Two of the most important progressions of the UNFCCC were adopted at the third Conference of the Parties (in 1997) and 21st Conference of the Parties (in 2015), with the adoption of the *Kyoto Protocol* and the *Paris Agreement*, respectively.

The *Kyoto Protocol* entered into force in 2005 and imposed limits on the greenhouse gas emissions of developed countries listed in Annex 1 to the UNFCCC, with an initial commitment period of 2008 to 2012 (UNFCCC, 2020). The UNFCCC requires parties to submit national inventories of greenhouse gas emissions and report on steps taken to implement the *Kyoto Protocol* (UNFCCC, 2020).

The goal of the *Paris Agreement* is to limit global temperature increases to well below 2°C above pre-industrial levels (UNFCCC, 2020).

National

As Australia is a party to the *Kyoto Protocol* and the *Paris Agreement*, the potential impacts of greenhouse gas emissions from all Australian sources are collectively managed at a national level, through initiatives implemented by the Commonwealth Government.

The Commonwealth Government has also committed to reducing greenhouse gas emissions by 26 to 28% below 2005 levels by 2030, as part of the *Paris Agreement* (Commonwealth of Australia, 2015).

The Emissions Reduction Fund is the centrepiece of a suite of Commonwealth Government policies designed to incentivise business and other entities to adopt better technologies and practices to reduce greenhouse gas emissions (Commonwealth of Australia, 2017). In addition, a range of policies including the Safeguard Mechanism, the Renewable Energy Target and the National Energy Productivity Plan have been implemented to help Australia meet its greenhouse gas commitments (Commonwealth of Australia, 2017).

In 2019, the Australian Government also announced the Climate Solutions Package, including a Climate Solutions Fund, to deliver Australia's 2030 greenhouse gas emissions reduction target.

The Commonwealth *National Greenhouse and Energy Reporting Act, 2007* (NGER Act) is a national framework for reporting greenhouse gas emissions, energy production and energy consumption by corporations. The greenhouse gas emissions and energy data reported under the NGER Act is used by the Commonwealth Government in compiling Australia's national greenhouse gas emission inventory to meet its reporting obligations under the UNFCCC.

The Safeguard Mechanism, which was established through the NGER Act, aims to ensure that greenhouse gas emission reductions purchased through the Emissions Reduction Fund are not undermined by increases in greenhouse gas emissions in other sectors. The Safeguard Mechanism sets a baseline level of emissions for facilities that emit over 100,000 tonnes of carbon dioxide equivalent (t CO_2-e) per year. If a facility exceeds its baseline level, it is generally required to surrender Australian carbon credit units, equivalent to the exceedance, to the Clean Energy Regulator. There are other mechanisms by which a facility can manage baseline exceedance, including applying for multi-year monitoring periods and exemptions for exceptional circumstances (e.g. natural disasters or criminal activity unrelated to the liable entity). The baseline currently set for the Mount Pleasant Operation is 663,971 t CO_2-e (Clean Energy Regulator, 2020a).

New South Wales

The NSW Government has released the *NSW Climate Change Policy Framework* (OEH, 2016), which commits NSW to the 'aspirational long-term objective' of achieving net-zero emissions by 2050.

The DPIE published the Net Zero Plan in March 2020, which describes how, over the next decade, the NSW Government intends to work towards its objective of achieving net zero emissions by 2050 (DPIE, 2020a). This includes a commitment from the NSW Government to conduct reporting under the Net Zero Plan (e.g. reporting on greenhouse gas emissions reductions achieved, forecasts and economic impact analyses), in addition to reporting of greenhouse gas emissions under the NGER Act.

7.21.2 Greenhouse Gas Emission Scopes

The *Greenhouse Gas Protocol* (GHG Protocol) (World Business Council for Sustainable Development [WBCSD] and World Resources Institute [WRI], 2020) contains methodologies for assessing and calculating greenhouse gas emissions. The GHG Protocol provides standards and guidance for companies and other organisations preparing greenhouse gas emission inventories. It covers the accounting and reporting of the six greenhouse gases covered by the *Kyoto Protocol*.

Under the GHG Protocol, the establishment of operational boundaries involves identifying emissions associated with an entity's operations, categorising them as direct or indirect emissions, and identifying the scope of accounting and reporting for indirect emissions.

Three 'Scopes' of emissions (Scopes 1, 2 and 3) are defined for greenhouse gas accounting and reporting purposes.

Scope 1 – Direct Greenhouse Gas Emissions

Direct greenhouse gas emissions are defined as those emissions that occur from sources that are owned or controlled by the entity (WBCSD and WRI, 2015). Direct greenhouse gas emissions are those emissions that are principally the result of the following types of activities undertaken by an entity, including:

- Generation of electricity, heat or steam – these emissions result from combustion of fuels in stationary sources (e.g. boilers, furnaces, turbines).
- Physical or chemical processing – most of these emissions result from manufacture or processing of chemicals and materials (e.g. the manufacture of cement, aluminium, adipic acid and ammonia, or waste processing).
- Transportation of materials, products, waste, and employees – these emissions result from the combustion of fuels in entity owned/controlled mobile combustion sources (e.g. trucks, trains, ships, aeroplanes, buses and cars).
- Fugitive emissions – these emissions result from intentional or unintentional releases (e.g. equipment leaks from joints, seals, packing, and gaskets; methane emissions from coal mines and venting, hydrofluorocarbon emissions during the use of air conditioning and refrigeration equipment; and methane leakages from gas transport) (WBCSD and WRI, 2020).

Scope 2 – Electricity Indirect Greenhouse Gas Emissions

Scope 2 emissions are a category of indirect emissions that account for greenhouse gas emissions associated with the generation of purchased electricity consumed by the entity.

Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (WBCSD and WRI, 2020). Scope 2 emissions physically occur at the facility where electricity is generated (WBCSD and WRI, 2020). Entities report the emissions associated with the generation of purchased electricity consumed in its owned or controlled equipment or operations as Scope 2.

Scope 3 – Other Indirect Greenhouse Gas Emissions

Scope 3 emissions are those emissions that are the consequence of the activities of an entity, but which arise from sources not owned or controlled by that entity. Some examples of Scope 3 emissions provided in the GHG Protocol are those from the extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services (WBCSD and WRI, 2020).

The GHG Protocol notes that reporting Scope 3 emissions can result in double counting of emissions. For example, greenhouse gas emissions from the burning of coal to produce energy are the Scope 3 emissions of the mines approved to produce the coal, as well as the Scope 1 emissions of the businesses that burn the coal to generate electricity. Those emissions will also be the Scope 2 emissions of the businesses that purchase the electricity.

7.21.3 Quantitative Assessment of Potential Greenhouse Gas Emissions

Greenhouse Gas Emissions Estimation Methodology

Project direct and indirect greenhouse gas emissions have been estimated by TAS (2021) using published emission factors from the *National Greenhouse Accounts Factors* (NGA Factors) (Commonwealth Department of Industry, Science, Energy and Resources [DISER], 2020), where possible.

Where NGA Factors were not available (e.g. for rail and ship transport), greenhouse gas emissions have been estimated based on emission projections for the same activities for similar projects. Fugitive emissions have been calculated using site-specific emission data.

The NGA Factors provide greenhouse gas emission factors for carbon dioxide, methane and nitrous oxide. Emission factors are standardised for each of these greenhouse gases by being expressed as carbon dioxide equivalent (CO_2-e) based on their Global Warming Potential. This is determined by the differing periods that greenhouse gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation (e.g. methane has a Global Warming Potential 28 times that of carbon dioxide) (DISER, 2020).

Project Greenhouse Gas Emissions

Key potential Project greenhouse gas emission sources considered in the greenhouse gas emission estimates and their respective scopes include:

- direct emissions from the combustion of diesel at the Project, including during decommissioning (Scope 1);
- direct emissions from the consumption of oil and grease at the Project, including during decommissioning (Scope 1);
- direct emissions from the use of explosives (Scope 1);
- release of stored carbon in vegetation resulting from land clearing (Scope 1);
- fugitive emissions that result from the extraction of coal (Scope 1);
- emissions from the consumption of purchased electricity used at the Project (Scope 2);
- upstream emissions from the extraction, production and transport of fuel burned for the generation of electricity consumed, and the electricity lost in delivery in the transmission and distribution network (Scope 3);
- upstream emissions attributable to the extraction, production and transport of diesel consumed at the Project (Scope 3);
- upstream emissions attributable to the extraction, production and transport of oil and grease consumed at the Project (Scope 3);
- downstream emissions from the combustion of diesel used during domestic rail transport and shipping (Scope 3) (Plate 7-32); and
- downstream third-party emissions from the combustion of product coal from the Project (Scope 3).

Scope 1

The total Scope 1 (direct) emissions over the life of the Project are estimated to be approximately 12.0 million tonnes of carbon dioxide equivalent (Mt CO_2-e), which is an average of approximately 0.45 Mt CO_2-e per year during operations (Appendix S).

Scope 2

The total Scope 2 (indirect) emissions over the life of the Project are estimated to be approximately 2.17 Mt CO_2-e, with an average of approximately 0.08 Mt CO_2-e per year (Appendix S).

Plate 7-32 Rail Transport of Product Coal from the Mount Pleasant Operation

If the Australian emissions intensity of electricity generation reduces over time, Scope 2 emissions from the Project would be expected to reduce accordingly.

Scope 3

The total Scope 3 (indirect) emissions over the life of the Project are estimated to be approximately 860 Mt CO_2-e, which is an average of approximately 33.1 Mt CO_2-e per year during operations (Appendix S).

Project Greenhouse Gas Emissions Intensity

The estimated Scope 1 and 2 greenhouse gas emissions intensity of the Project emissions is estimated to be approximately 0.03 million tonnes of carbon dioxide equivalent per million tonnes of run-of-mine coal (Mt CO_2-e/Mt ROM coal) (Appendix S).

This compares favourably with other coal mining operations in the Hunter Valley, which have estimated greenhouse gas emission intensities ranging from 0.03 to 0.07 Mt CO_2-e/Mt ROM coal. The low greenhouse gas emissions intensity is related to the relatively low strip ratios at the Mount Pleasant Operation, which also lowers the cost of coal production (Appendix S).

Potential Impacts of Greenhouse Gas Emissions on the Environment

The estimated annual average and maximum annual Scope 1 greenhouse gas emissions of the Project are within the Mount Pleasant Operation's current Safeguard Mechanism baseline emissions value of approximately 0.664 Mt CO_2-e.

It is acknowledged that the Mount Pleasant Operation's Safeguard Mechanism baseline value may change over time in accordance with the provisions of the NGER Act and the applicable rules and regulations (Clean Energy Regulator, 2020b).

Notwithstanding, it is anticipated that MACH's implementation of various mitigation measures to minimise the overall generation of greenhouse gas emissions from the Project (Section 7.21.4) would result in greenhouse gas emissions being maintained within any varied Safeguard Mechanism baseline emissions value. Otherwise, MACH would be required to purchase Australian carbon credit units for any exceedance of the baseline value.

The Project's Scope 1 and Scope 2 emissions have together been estimated at approximately 0.54 Mt CO_2-e per year during operations. This is a relatively small contribution to Australian emissions, representing approximately 0.4% of the estimated total greenhouse gas emissions in NSW from 2017 (131.5 Mt CO_2-e) and approximately 0.1% of Australia's annual greenhouse gas emissions from 2017 (534.7 Mt CO_2-e) (Appendix S).

The Project greenhouse gas emissions would make some contribution to global greenhouse gas emissions. The Project's contribution to climate change, including the associated environmental impacts, would be in proportion with its contribution to global greenhouse gas emissions.

The Project's Scope 1 and 2 emissions would be significantly less than the Scope 3 emissions produced by customers using Project product coal. The estimated Scope 3 emissions would represent approximately 0.065% of the total anthropogenic greenhouse gas emissions globally (excluding land use change) in 2017 (Appendix S). It is anticipated that a significant majority of the Scope 3 emissions from the use of Project coal would occur overseas.

Under the *Paris Agreement*, each Party is required to prepare, communicate and maintain Nationally Determined Contributions (NDCs) that will contribute to the long-term goals of the *Paris Agreement* (UNFCCC, 2020).

Scope 3 emissions from the use of Project coal in overseas customer countries would be managed in accordance with customer countries commitments under the *Paris Agreement* (detailed in Appendix S) and would not contribute to Australian greenhouse gas emissions or factor into Australian greenhouse gas reduction targets.

Any small quantities of Project product coal sold on the domestic market (e.g. to AGL's Bayswater Power Station) would likely be substituting or augmenting supply from existing coal sources. It is therefore anticipated these emissions would not increase Australia's current greenhouse gas emissions.

If the Project does not proceed, global demand for coal could be satisfied by other sources and, therefore, there would not be a corresponding reduction in global greenhouse emissions in the atmosphere. The Project's relatively low greenhouse gas emissions intensity and low cost of production (due to relatively low strip ratios) means that it would remain competitive in the global coal market. If the Project does not proceed, and therefore does not produce high-quality thermal coal, the existing and future demand for coal is likely to be satisfied by lower-quality (and thus more emissions-intensive) coal, which means that more coal would need to be burned to meet the same energy needs, resulting in higher greenhouse gas emissions.

Potential environmental costs associated with Project greenhouse gas emissions have also been considered in the Economic Assessment (Appendix O).

7.21.4 Project Greenhouse Gas Mitigation Measures

Existing greenhouse gas mitigation and management measures implemented at the Mount Pleasant Operation in accordance with the Air Quality and Greenhouse Gas Management Plan would continue for the Project.

As diesel fuel consumption represents more than half of estimated direct emissions, the existing measures are generally focused on minimising greenhouse gas emissions through the efficient use of diesel, by:

- optimising the design of haul roads to minimise the distance travelled;
- minimising the re-handling of material (i.e. coal, overburden and topsoil); and
- maintaining the mobile fleet in good operating order.

As part of the Project, MACH would review and update existing direct (Scope 1) greenhouse gas minimisation measures at the Mount Pleasant Operation, including consideration of the fuel efficiency in mobile fleet items. The Mount Pleasant Operation Air Quality and Greenhouse Gas Management Plan would be updated to incorporate the Project, subject to conditions of any Development Consent for the Project.

In addition, MACH would investigate whether it is reasonable and feasible to also reduce Scope 2 greenhouse gas emissions associated with on-site electricity use (e.g. evaluation of sourcing a proportion of site electricity from renewable sources) (Plate 7-33).

7.21.5 Potential Impacts of Climate Change on the Project

Due to the inherent uncertainties associated with climate change projections, the potential impacts of climate change on the Project cannot be determined with a high degree of confidence.

Notwithstanding, climate change projections indicate average temperatures are likely to rise in the vicinity of the Project, and extreme temperature events may increase in frequency. This suggests that bushfire activity may become more prevalent in the region. In addition, rainfall has the potential to both increase and decrease, particularly seasonally, with heavier rainfall events likely to become more frequent.

MACH's Bushfire Management Plan includes a range of measures to reduce the potential for the ignition of bushfires, as well as minimising potential impacts of bushfires on the Mount Pleasant Operation.

The potential implications of climate change with regard to rainfall (e.g. prolonged dry periods and storm surges) have also been considered in the Project Groundwater Assessment (Appendix C) and the Project Surface Water Assessment (Appendix D).

7.21.6 Adaptive Management

MACH would manage its contribution to Australian greenhouse gas emissions inventories through reporting under the NGER Act, as well as any other government initiatives implemented to manage emissions at the national level.

Under the NGER Act, relevant sources of greenhouse gas emissions and energy consumption must be measured and reported on an annual basis, allowing major sources and trends in emissions/energy consumption to be identified.

MACH has considered the key potential climate change risks to the Project (namely increased frequency of bushfires, water reliability during dry periods and storm surges) in the design of the Project. MACH would continue to assess climate change risks on an ongoing basis via implementation of an adaptive management approach.

This would include conducting climate change risk assessments in consideration of the DPIE's *Guide to Climate Change Risk Assessment for NSW Local Government* (DPIE, 2019b) and implementing appropriate risk treatment strategies. Potential climate change risks to be assessed would include the example risks published by the OEH in the *Guide to Climate Change Risk Assessment for NSW Local Government* (OEH, 2011b).

Plate 7-33 Solar Powered Equipment at the Mount Pleasant Operation