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Dear Ms Annadale

Mount Pleasant Operation (DA 92/97)
Approval of Noise, Biodiversity, Aboriginal Heritage, Visual Impact and Water Management Plans

I refer to your submission by emails, dated 12 and 25 September 2019, of revised versions of management plans (MPs) for the Mount Pleasant Operation coal mine. The Secretary has approved the following submitted plans:

- Noise MP (condition 9 of schedule 3);
- Biodiversity MP (condition 32 of Schedule 3);
- Aboriginal Heritage MP (condition 36 of Schedule 3);
- Visual Impact MP (condition 47 of Schedule 3); and
- Water MP (condition 28 of Schedule 3), including a:
  - Site Water Balance;
  - Erosion and Sediment Control Plan;
  - Surface Water MP;
  - Groundwater MP; and
  - Surface and Ground Water Response Plan.

If you require any further information, please contact Colin Phillips.

Yours sincerely

31/10/19

Steve O'Donoghue
Director Resource Assessments
as the Secretary's nominee

MACHEnergy

MOUNT PLEASANT OPERATION

WATER MANAGEMENT PLAN

Document ID:	MP001-0000-ENV-PLN-0006		
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1 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton (Figure 1). The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively (Figure 1). The proponent of the MPO is MACH Energy Australia Pty Ltd (MACH Energy), which purchased the MPO from Coal & Allied Operations Pty Ltd (Coal & Allied) in 2016.

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

The Mount Pleasant Project Modification (MOD 1) was submitted on 19 May 2010 with a supporting Environmental Assessment (EA) prepared by EMGA Mitchell McLennan (EMGA Mitchell McLennan, 2010). MOD 1 included the provision of an infrastructure envelope for siting the mine infrastructure, the provision of an optional conveyor/service corridor linking the MPO facilities with the Muswellbrook-Ulan Rail Line and modification of the existing Development Consent DA 92/97 boundaries to accommodate the optional conveyor/service corridor and minor administrative changes. MOD 1 was approved on 19 September 2011.

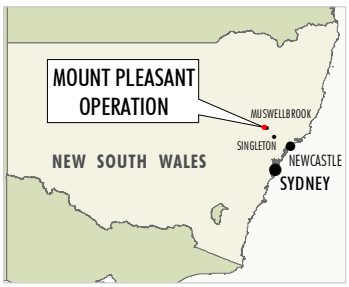
The MPO South Pit Haul Road Modification (MOD 2) was submitted on 30 January 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017a). MOD 2 proposed to realign an internal haul road to enable more efficient access to the South Pit open cut, with no other material changes to the approved MPO. MOD 2 was approved on 29 March 2017.

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

The MPO Rail Modification (MOD 4) was submitted on 18 December 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017c). MOD 4 proposed the following changes:

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

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



LEGEND

- Mining Operation
- Proposed Mining Operation
- Mining Lease Boundary (Mount Pleasant)
- Railway
- Local Government Boundary
- State Forest
- National Parks and Wildlife Estate

Source: © NSW Department of Finance, Services and Innovation (2018); Office of Environment and Heritage NSW (2018)

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MOUNT PLEASANT OPERATION

Project Location

Figure 1

MAC-16-01 MP2019_Figure1_RevA

1.1 PURPOSE AND SCOPE

This Water Management Plan (WMP) has been prepared by MACH Energy to satisfy the requirements under Development Consent DA 92/97 and specifically Condition 28, Schedule 3.

The WMP applies to all employees and contractors at the MPO and covers all areas within the MPO boundary. The WMP applies to the life of the MPO, including (but not limited to) the period of mining operations specified in Development Consent DA 92/97, which currently permits mining until 22 December 2026. As required by Condition 5, Schedule 2 of Development Consent DA 92/97, the WMP will continue to apply (excluding mining operations) beyond 22 December 2026, as required, until the rehabilitation and any additional undertakings (required by the Secretary of the Department of Planning, Industry and the Environment (DPIE), or the Division of Resources and Geoscience [DRG] within the DPIE) have been carried out satisfactorily.

This WMP has been prepared to manage surface water and groundwater related impacts associated with construction and operation of the MPO, including for example, initial establishment and development works, open cut mining, operation of the coal handling and preparation plant (CHPP), rail spur/loop, and Fines Emplacement Area, and the supply of water to the MPO.

1.1.1 Previous Versions

A previous version of the WMP was submitted by Coal & Allied Operations Pty Ltd as a Construction Water Management Plan (CWMP) and was approved on 23 July 2012. The CWMP was submitted as a staged plan limited to the management of water during the construction stage of the MPO, excluding the development of the box-cut and any extraction of coal.

An addendum to the CWMP was submitted by MACH Energy and approved on 8 February 2017. This addendum included a revised figure (Figure B.1A) replacing Figure B.1, which showed an updated alignment for the Hunter River water supply pipeline.

A new version of the WMP was prepared by MACH Energy to replace the CWMP described above. Consistent with Condition 28, Schedule 3 of Development Consent DA 92/97, this version of the WMP was prepared to allow for both construction and operation of the MPO and was approved on 3 August 2017.

The WMP was updated by MACH Energy in March 2018, to include description of the Surface Water Management Procedure (an internal procedure used to manage construction dams on-site) in the Surface Water Management Plan (SWMP). The updated WMP was approved on 16 March 2018.

The WMP was revised by MACH Energy in July 2018, to update a timing commitment within the Groundwater Management Plan (GWMP) relating to inclusion of information regarding the final void.

1.1.2 Current Version

The current version of the WMP was prepared to reflect the approval of MOD 3/MOD 4 and replace the previously approved version of the WMP described in Section 1.1.1.

1.2 STRUCTURE OF THE WMP

In accordance with Condition 28, Schedule 3 of Development Consent DA 92/97, the WMP includes the following five appendices:

- Site Water Balance (SWB) (Appendix 1);
- Erosion and Sediment Control Plan (ESCP) (Appendix 2);
- SWMP (Appendix 3);
- GWMP (Appendix 4); and
- Surface and Ground Water Response Plan (SGWRP) (Appendix 5).

A brief overview of the documentation referred to above is provided in Table 1.

Table 1
Overview of WMP Documentation

#	Appendix / Document	Description / Scope
1	Site Water Balance	Describes the MPO water management system (including modelling results) detailing water supply, use, management, transfers, and measures to minimise water use.
2	Erosion and Sediment Control Plan	Describes the management of potential erosion impacts (including details of erosion and sediment control structures and their maintenance), as well as implementation of measures to minimise soil erosion, generation of sediment and transport of sediment to downstream waters. The document also identifies activities that could affect flooding and describes how flood risk is managed.
3	Surface Water Management Plan	Describes the baseline surface water data, surface water impact assessment criteria (including trigger levels for investigation), surface water monitoring program and reporting procedures.
4	Groundwater Management Plan	Describes the baseline groundwater data, groundwater impact assessment criteria (including trigger levels for investigation), groundwater monitoring program and reporting procedures. The document also provides details of the design and management of the proposed final voids.
5	Surface and Ground Water Response Plan	Describes the response protocols (including trigger action response plans [TARPs]) for any exceedance of the surface water and groundwater impact assessment criteria, where relevant, including measures to prevent, minimise, mitigate, compensate and/or offset.

The remainder of the WMP is structured as follows:

- Section 2: Outlines the statutory obligations applicable to the WMP.
- Section 3: Provides an overview of the MPO water management system.
- Section 4: Provides details for the review and improvement of environmental performance.

- Section 5: Describes the management and reporting of incidents, complaints and non-compliances.
- Section 6: Provides a list of references cited in this report.
- Appendix 6: Lists comments received from the relevant consultees during the consultation period.

1.3 CONSULTATION

1.3.1 NSW Government Agencies

This WMP has been provided to DPIE Water (previously NSW Department of Primary Industries – Water) and the NSW Environment Protection Authority (EPA) for the purposes of consultation in accordance with Condition 28, Schedule 3 of Development Consent DA 92/97. DPIE Water provided comments on this WMP on 25 September 2019, regarding the MPO's groundwater licence entitlements, proposed additional monitoring bores, water level monitoring and reporting, flow in the Hunter Regulated River Alluvial Water Source and the privately-owned groundwater bores response protocol (refer to Appendix 6). DPIE Water's suggested reporting commitments were incorporated in the GWMP (Appendix 4) and relevant sections of the SGWRP (Appendix 5) were revised to incorporate the drawdown impact considerations. No material changes were made in relation to groundwater entitlements holdings and proposed additional monitoring bores.

During the consultation period, MACH Energy also contacted EPA on 1 August 2019 regarding comments on the WMP. To date EPA has not provided any comments on this WMP.

1.3.2 Community Consultation

MACH Energy's approach to community relations is focused on building enduring relationships based on mutual respect, active partnerships and a long-term commitment. MACH Energy is committed to:

- Having robust relationships with our communities of interest – this requires understanding the issues and needs of different stakeholders, as well as active engagement.
- Effectively contributing to communities – this means understanding the socio-economic environment and the community's vision for the future, and providing contributions that are sustainable and build long-term community capacity.

These objectives also form the primary goals for the MPO community relation activities and are reflected in our Community and Stakeholder Engagement Plan for the MPO and the Muswellbrook community. There are a variety of communication channels available for community members to become engaged with the MPO's progress (e.g. the MPO's Community Hotline [1800 886 889)]. MACH Energy is an active and accessible member of the community in which we live and operate. The hotline number will be published in a variety of MACH Energy's public communication tools.

The community is also invited to find out more about the MPO by accessing MACH Energy's website (https://machenergyaustralia.com.au/). Details on the site will allow interested parties to become informed about the MPO's progress and it provides a platform for publishing key monitoring results and public reports alongside information such as minutes from the MPO's Community Consultative Committee (CCC).

MACH Energy's approach to community engagement and consultation involves providing information regarding its activities in a timely, clear, open and transparent manner, and seeking feedback from communities to understand the potential impacts of its activities. MACH Energy will engage in regular consultation and on-going communication with our community members and stakeholders. Feedback from neighbours and local communities is used to inform MPO decisions.

2 STATUTORY OBLIGATIONS

MACH Energy's statutory obligations are contained in:

- the conditions of Development Consent DA 92/97 (as modified);
- the conditions of the Commonwealth Approvals EPBC 2011/5795;
- relevant licences (including EPL 20850) and permits and mining leases (MLs) (ML 1645, ML 1708, ML 1709, ML 1750 and ML 1713); and
- other relevant legislation.

Obligations relevant to this WMP are described below.

2.1 DEVELOPMENT CONSENT DA 92/97

2.1.1 WMP Requirements

Condition 28, Schedule 3 of Development Consent DA 92/97 requires the preparation of a WMP. Table 2 presents these requirements and indicates where they are addressed in this WMP.

Table 2
Water Management Plan Requirements in Development Consent DA 92/97

MPO Development Consent DA 92/97 Schedule 3	Section where addressed in this WMP document
28. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with DoI Water and EPA, and be submitted to the Secretary for approval by 30 June 2019, unless otherwise agreed by the Secretary. *The plan must include:*	This document (and Section 1.3.1)
(a) a Site Water Balance, …	Appendix 1
(b) an Erosion and Sediment Control Plan, …	Appendix 2
(c) a Surface Water Management Plan, …	Appendix 3
(d) a Groundwater Management Plan, …	Appendix 4
(e) a Surface and Ground Water Response Plan, …	Appendix 5

A comprehensive list of all conditions in Development Consent DA 92/97 relevant to water is provided in Attachment 2.

2.1.2 Management Plan (General) Requirements

Condition 2, Schedule 5 of Development Consent DA 92/97 outlines the general management plan requirements that are applicable to the preparation of the WMP.

Table 3 presents these requirements and indicates where each is addressed within this WMP.

Table 3
General Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 5	Section where addressed in this WMP document
2. The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Appendices 1–4
(b) a description of: • *the relevant statutory requirements (including any relevant consent, licence or lease conditions);*	Section 2
• *any relevant limits or performance measures/criteria;*	Appendices 1–4
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	Appendices 1–4
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Appendices 1–4
(d) a program to monitor and report on the: • *impacts and environmental performance of the development;* • *effectiveness of any management measures (see c above);*	Appendices 1–4
(e) a contingency plan to manage any unpredicted impacts and their consequences;	Appendix 5
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Appendices 1–5 and Section 4
(g) a protocol for managing and reporting any: • *incidents;* • *complaints;* • *non-compliances with statutory requirements; and* • *exceedances of the impact assessment criteria and/or performance criteria; and*	Section 5
(h) a protocol for periodic review of the plan. *Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*	Appendices 1–5 and Section 4

2.2 EPBC ACT CONTROLLED ACTION DECISION

Commonwealth approval for the MPO (EPBC 2011/5795) was granted on 29 February 2012. EPBC 2011/5795 does not include any specific water-related conditions.

2.3 LICENCES, PERMITS AND LEASES

Water management at the MPO is conducted in accordance with a number of licences, permits and leases. Key licences, permits and leases relating to water at the MPO include:

- Water Access Licences (WALs) issued under the *Water Management Act, 2000*.
- Discharge credits (20) held under the NSW *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation, 2002.*

- Environment Protection Licence (EPL) 20850 issued under Part 3 of the NSW *Protection of the Environment Operations Act, 1997* by the EPA.
- ML 1645, ML 1708, ML 1709, ML 1713 and ML 1750 issued under Part 5 of the NSW *Mining Act, 1992* and approved by the Minister for Mineral Resources.
- Mining Operations Plan approved by DRG.

2.3.1 Water Access Licences

Details of the WALs held by MACH Energy are summarised in Tables 4 and 5 below.

Table 4
Water Access Licences—Groundwater Sources

Water Access Licence	Water Source	Share (units)
18253	Hunter Regulated River Alluvial Water Source	74
18266	Hunter Regulated River Alluvial Water Source	68
18206	Hunter Regulated River Alluvial Water Source	24
18199	Hunter Regulated River Alluvial Water Source	5
18122	Hunter Regulated River Alluvial Water Source	33
18131	Hunter Regulated River Alluvial Water Source	60
21503	Hunter Regulated River Alluvial Water Source	21
18253	Hunter Regulated River Alluvial Water Source	74
18266	Hunter Regulated River Alluvial Water Source	68
23935	Muswellbrook Water Source	41
41437	Sydney Basin – North Coast Groundwater Source	40
40298	Sydney Basin – North Coast Groundwater Source	90
18336	Krui River Water Source	12

MACH Energy will obtain and hold volumetric licenses to account for maximum predicted groundwater inflows and surface water take associated with the development and operation of the MPO in accordance with the legislative requirements of the *Water Management Act, 2000*.

Relevant volumetric licences would remain to be held by MACH Energy (or retired to DoI Water) to account for predicted post-mining water take at the MPO.

Table 5
Water Access Licences – Surface Water Sources

Water Access Licence	Water Source	Share (units)
879	Hunter Regulated River Water Source	224
880	Hunter Regulated River Water Source	124
1113	Hunter Regulated River Water Source	366
973	Hunter Regulated River Water Source	3
974	Hunter Regulated River Water Source	210
975	Hunter Regulated River Water Source	8
988	Hunter Regulated River Water Source	156
989	Hunter Regulated River Water Source	8
1307	Hunter Regulated River Water Source	37.5
1229	Hunter Regulated River Water Source	480
1230	Hunter Regulated River Water Source	8
1259	Hunter Regulated River Water Source	33.2
1227	Hunter Regulated River Water Source	99
1258	Hunter Regulated River Water Source	5
992	Hunter Regulated River Water Source	75
7808	Hunter Regulated River Water Source	36
702	Hunter Regulated River Water Source	267
1260	Hunter Regulated River Water Source	4.8
993	Hunter Regulated River Water Source	265
1308	Hunter Regulated River Water Source	15.1
604	Hunter Regulated River Water Source	183
605	Hunter Regulated River Water Source	8
677	Hunter Regulated River Water Source	24
1338	Hunter Regulated River Water Source	17.5
662	Hunter Regulated River Water Source	9
663	Hunter Regulated River Water Source	16
638	Hunter Regulated River Water Source	3
639	Hunter Regulated River Water Source	134
41438	Hunter Regulated River Water Source	420
10775	Hunter Regulated River Water Source	243

2.4 OTHER LEGISLATION AND REQUIREMENTS

2.4.1 Water Management Act, 2000

The *Water Management Act, 2000* incorporates the provisions of various prior Acts relating to the management of surface and groundwater in NSW and provides a single statute for regulation of water access, use and works (e.g. pumps or bores) that affect the licensing of surface water and alluvial and non-alluvial (i.e. porous rock) groundwater in the vicinity of the MPO.

Under the *Water Management Act, 2000*, the MPO is regulated under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009* and the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources, 2016*.

A list of the water sources contained in these Water Sharing Plans, which are relevant to the MPO, is included in the GWMP (Appendix 4).

2.4.2 Water Act, 1912

As water sharing plans have been commenced under the *Water Management Act, 2000* for all groundwater and surface water systems that the MPO is predicted to extract water from, the *Water Act, 1912* is not relevant to licensing considerations for the MPO.

2.4.3 National Water Quality Management Strategy/ANZECC (2000) Guidelines

The National Water Quality Management Strategy is a joint national approach to improving water quality in Australian and New Zealand waterways. The Australian and New Zealand Environment and Conservation Council (ANZECC) *water quality guidelines* (ANZECC, 2000) have been considered where applicable in the SWMP (Appendix 3), GWMP (Appendix 4) and SGWRP (Appendix 5) for the MPO.

2.4.4 Aquifer Interference Policy

The *Aquifer Interference Policy* has been developed by the NSW Government as a component of the *NSW Government's Strategic Regional Land Use Policy*.

The Aquifer Interference Policy applies statewide and details water licence and impact assessment requirements. The *Aquifer Interference Policy* has been developed to ensure equitable water sharing between various water users and proper licensing of water taken by aquifer interference activities such that the take is accounted for in the water budget and water sharing arrangements. The *Aquifer Interference Policy* also enhances existing regulation, contributing to a comprehensive framework to protect the rights of all water users and the environment in NSW.

2.4.5 Hunter-Central Rivers Catchment Action Plan 2013–2023

The *Hunter-Central Rivers Catchment Action Plan 2013–2023* has been developed by the Hunter-Central Rivers Catchment Management Authority (2013) to set strategic goals, targets and outcomes maintaining and improving the health and productivity of the Hunter-Central Rivers Catchment.

The 2013–2023 plan is a further development on the goals and targets of the previous (and first) catchment action plan. The plan provides direction for actions at all levels of government, industry and community to maintain or improve the long-term viability of healthy and productive natural systems within the catchment region.

The goals, targets and outcomes of the *Hunter-Central Rivers Catchment Action Plan 2013–2023* have been considered where relevant in the preparation of this WMP.

3 WATER MANAGEMENT OVERVIEW

3.1 WATER MANAGEMENT SYSTEM AND SITE WATER BALANCE

Key water demands at the MPO include:

- water used in the CHPP, including water retained in coal products and rejects and water for dust suppression (including stockpiles);
- haul road dust suppression; and
- miscellaneous water usage, such as vehicle wash down and stockpile water usage.

These water demands are met through a combination of the following water sources:

- groundwater inflows to the open cut;
- runoff captured from the footprint of the mining disturbance area by the water management system;
- fine rejects bleed water captured from the Fines Emplacement Area; and
- water pumped from the Hunter River.

A detailed description of the MPO water management system and an overview of the supporting site water balance modelling is provided in the SWB (Appendix 1).

3.2 EROSION AND SEDIMENT CONTROL OVERVIEW

Key activities that have the potential to cause or increase soil erosion at the MPO are disturbance of land and soils in relation to clearing, stripping and stockpiling activities.

Erosion and sediment controls will be implemented at the MPO to mitigate the impacts of the proposed development on nearby watercourses and the surrounding environment.

Specific erosion and sediment controls to be implemented at the MPO include, but are not limited to, the following:

- clean water diversion drains and banks;
- silt fences (or equivalent control);
- vegetated buffer strips; and
- sediment dams/basins.

These erosion and sediment controls will be designed and operated in accordance with the requirements of *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Volume 2E - Mines and Quarries* (DECC, 2008).

Other *Blue Book* (Landcom, 2004) erosion and sediment control measures may be implemented at the MPO as required.

More detailed information regarding the erosion and sediment control scheme proposed at the site is provided in the ESCP (Appendix 2).

3.3 SURFACE WATER OVERVIEW

The MPO is located within the Hunter Catchment, which has an overall size of 21,500 square km, encapsulating the major towns of Newcastle, Singleton and Muswellbrook (DPI Water, 2016). The Hunter River is the main drainage feature within the catchment. It begins in the Mount Royal Range and flows adjacent to Muswellbrook and Singleton, before draining to the ocean at Newcastle. The Hunter River contains a number of significant tributaries, including the Goulburn, Pages and Isis Rivers, as well as the Middle, Dart, Stewart, Moonan and Ormadale Brooks. Alluvial floodplains ranging in width from 1.5–2 km border the river over the majority of its length. The eastern extent of the MPO ML boundary is located directly adjacent to these floodplains.

The drainage network in the vicinity of the MPO is generally characterised by steep gullies which drain from the surrounding hills into the flat alluvial plains adjacent the Hunter River.

The main drainage feature is the Hunter River which flows in a southerly direction approximately 1 km to the east of the MPO ML boundary. There are a number of ephemeral drainage lines which traverse the MPO area and drain into the Hunter River. The eastern portion of the MPO area drains via Rosebrook Creek, as well as other unnamed drainages. Areas in the south and west of the MPO boundary drain to Dry Creek and Sandy Creek, respectively, both of which are tributaries of the Hunter River. All other areas drain into unnamed drainage lines, which flow directly into the Hunter River.

A detailed description of the surface water management and monitoring at the MPO is provided in the SWMP (Appendix 3).

3.4 GROUNDWATER OVERVIEW

The MPO is located in the vicinity of two predominant groundwater schemes:

- the Alluvial groundwater system – associated with the alluvial plains of the Hunter River and its tributaries; and
- the Hard (fractured and porous) rock groundwater system – including the Permian aged Wittingham Coal measures.

The MPO 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. Coal seams amenable to open cut mining occur in eight correlated seams and include the Upper Piercefield (Warkworth) Seam to the lowermost Edderton Seam.

Alluvial sediments associated with the Hunter River are located to the east of the MPO. The alluvial sediments offer increased groundwater storage when compared to the hard (fractured and porous) rock groundwater system due to their higher porosity. Gravel zones within the alluvium are capable of providing the highest storage and permeability when compared to clay, sand and silt zones.

A detailed description of groundwater management and monitoring at the MPO is provided in the GWMP (Appendix 4).

3.5 SURFACE AND GROUND WATER RESPONSE OVERVIEW

The SGWRP (Appendix 5) includes response protocols for exceedances of the surface water and groundwater trigger levels established in the SWMP and GWMP. It also includes measures to:

- offset the loss of any baseflow to watercourses caused by the MPO;
- minimise groundwater leakage from alluvial aquifers as a result of the MPO;
- compensate landowners of privately-owned land whose water supply is adversely affected by the MPO; and
- mitigate any adverse impacts on groundwater dependent ecosystems or riparian vegetation.

3.6 ROLES AND RESPONSIBILITIES

The Environmental Superintendent is primarily responsible for implementing the suite of environmental management plans across the MPO, with assistance provided by the Managing Director and Department Managers/Supervisors.

4 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

4.1 ANNUAL REVIEW

In accordance with Condition 3, Schedule 5 of Development Consent DA 92/97, MACH Energy will review and evaluate the environmental performance of the MPO by the end of March each year (for the preceding calendar year) or other such timing as agreed by the Secretary of the DPIE.

In relation to water, the Annual Review will:

- include a review of the water monitoring results and complaints records relating to the MPO over the past year, which includes a comparison of these results to evaluate compliance against the:
  - relevant statutory requirements, limits or performance measures/criteria (refer Section 2.1.1);
  - monitoring results of the previous years; and
  - relevant predictions in the EIS and MOD 1, MOD 2, MOD 3 and MOD 4 EAs;
- identify any water-related non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the water monitoring data over the life of the MPO;
- identify any discrepancies between the predicted and actual water impacts of the MPO, and analyse the potential cause of any significant discrepancies; and
- describe what water-related measures will be implemented over the next year to improve the environmental performance of the MPO.

The Annual Review will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/) in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

4.2 WMP REVISION

In accordance with Condition 4, Schedule 5 of Development Consent DA 92/97, this WMP will be reviewed, and if necessary revised (to the satisfaction of the Secretary of the DPIE), within three months of the submission of:

- an Annual Review (Condition 3, Schedule 5);
- an incident report (Condition 7, Schedule 5);
- an Independent Environmental Audit (Condition 9, Schedule 5); and
- any modification to the conditions of Development Consent DA 92/97.

Within 4 weeks of conducting any such review, the Secretary of the DPIE will be advised of the outcomes of the review and any revised documents submitted to the Secretary for approval.

In accordance with Condition 4A, Schedule 5 of Development Consent DA 92/97, MACH Energy may submit a revised WMP for the approval of the Secretary at any time, and may also submit any revision to this WMP required under Development Consent DA 92/97 on a staged basis.

If agreed with the Secretary of the DPIE, a revision to this WMP required under Development Consent DA 92/97 may be prepared without undertaking consultation with all parties nominated under the relevant Condition of Development Consent DA 92/97.

This WMP will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/), in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

5 REPORTING SYSTEMS

In accordance with Condition 2, Schedule 5 of Development Consent DA 92/97, MACH Energy has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance criteria.

These protocols are described in detail in the MPO Environmental Management Strategy (MACH Energy, 2019).

In accordance with Condition 8, Schedule 5 of Development Consent DA 92/97, MACH Energy will provide regular reporting on the environmental performance of the MPO on the MACH Energy website (https://machenergyaustralia.com.au/).

Protocols for managing and reporting exceedances of the impact assessment criteria specific to water management are described in the SGWRP (Appendix 5).

Water monitoring and management will be reported as part of the Annual Review described in Section 4.1 and in accordance with the reporting requirements of EPL 20850.

6 REFERENCES

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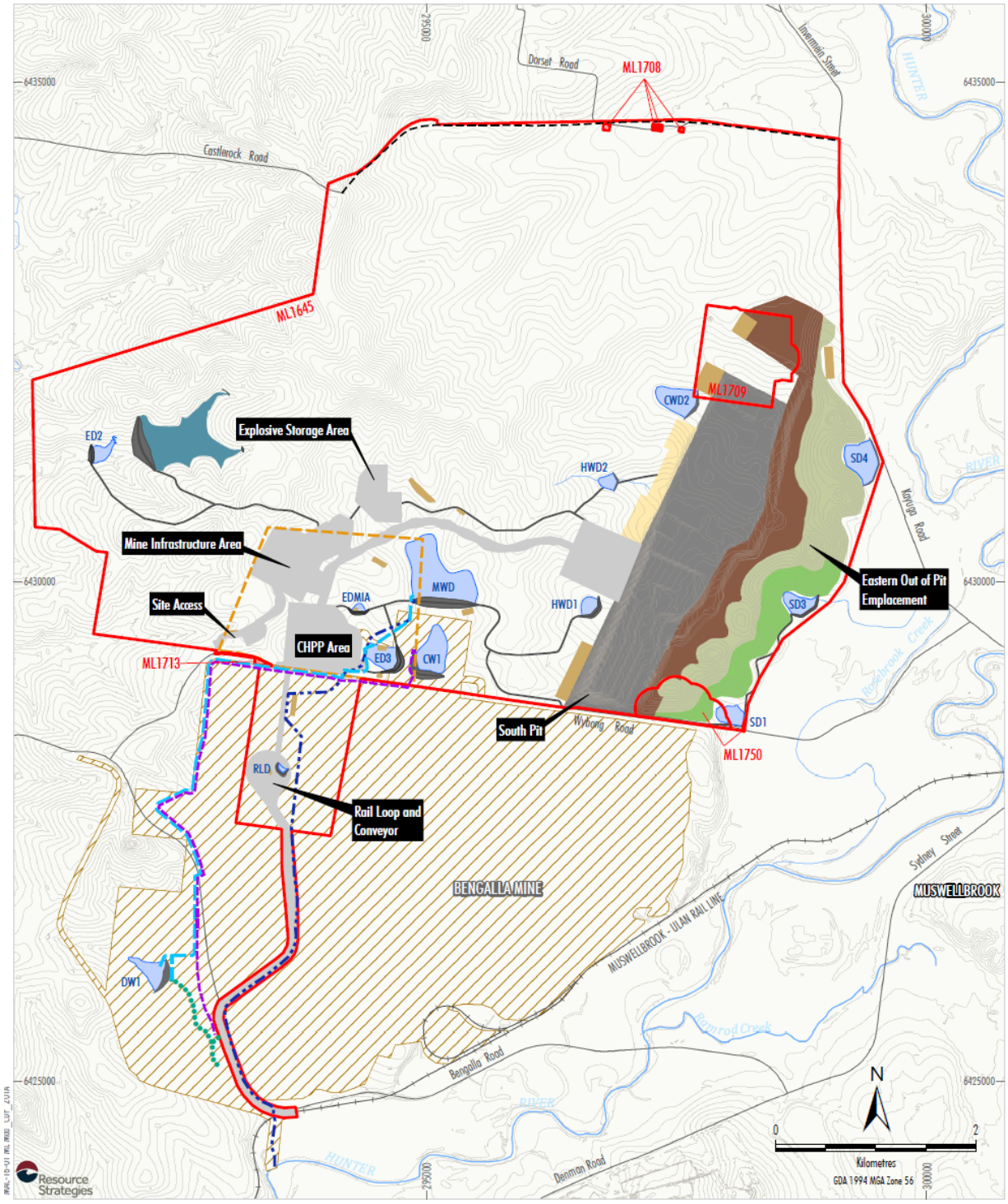
Accessed 9 December 2016.

ATTACHMENT 1

APPENDIX 2 OF DEVELOPMENT CONSENT DA 92/97

APPENDIX 2
FIGURE 1 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2021



LEGEND

- Mining Lease Boundary
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Infrastructure Area Envelope
- Active Stripping Area
- Active Mining Area
- Active Overburden Emplacement Area
- Topsoil Stockpile
- Initial Rehabilitation
- Established Rehabilitation
- Infrastructure and Borrow/Stockpile Area
- Access Road
- Northern Link Road

Indicative Water Pipeline Alignment

- MPO Hunter River Supply Pipeline
- MPO DW1 Pipeline (Bi-directional)
- Bengalla Mine CW1 Pipeline
- Approximate Extent of Scour Protection
- Water Dam
- Fines Emplacement Area

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017); MACH Energy (2017)

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FIGURE 2 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2025

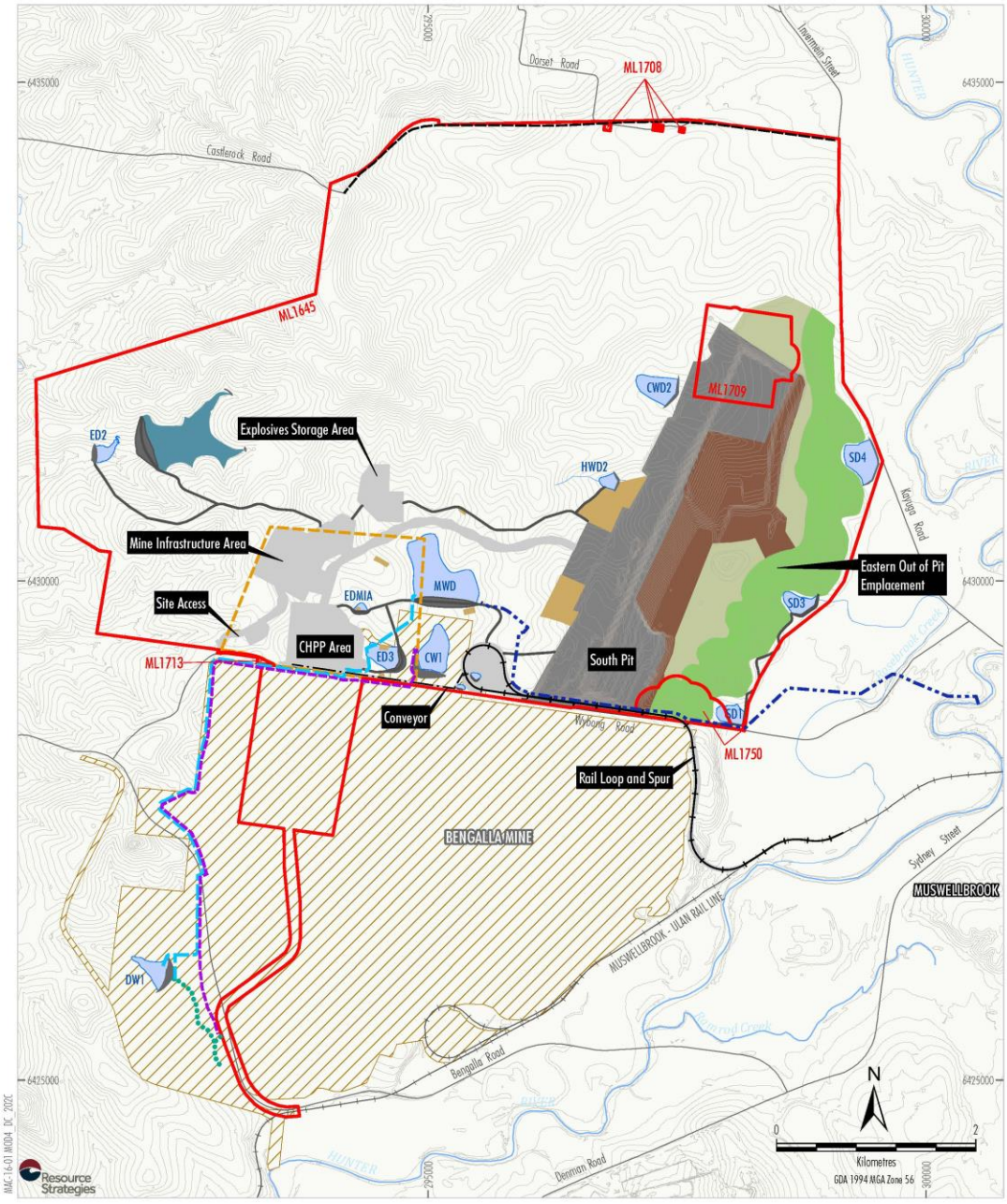
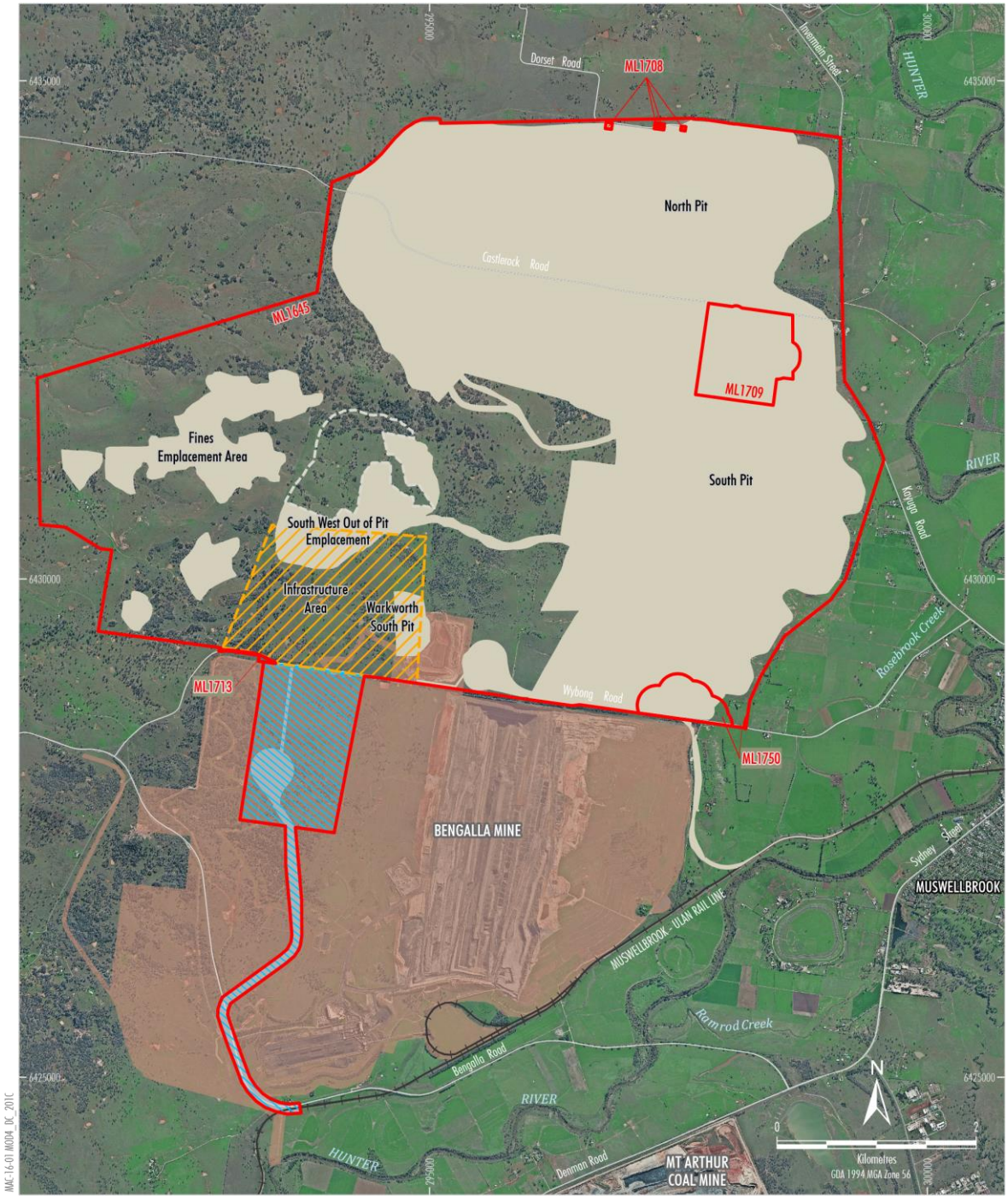


FIGURE 3 - APPROVED SURFACE DISTURBANCE PLAN



LEGEND

- Mining Lease Boundary
- Approximate Extent of Approved Surface Development [1]
- Area Relinquished for Overburden Emplacement and Major Infrastructure
- Infrastructure Area Envelope
- Infrastructure to be removed under the Terms of Condition 37, Schedule 3
- Indicative Existing Coal Transport Infrastructure
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)

NOTE

1. Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, offsite coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, signalling, other ancillary works and construction disturbance.

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2018); Department of Planning and Environment (2016); MACH Energy (2017)
Orthophoto: MACH Energy (Aug 2016)

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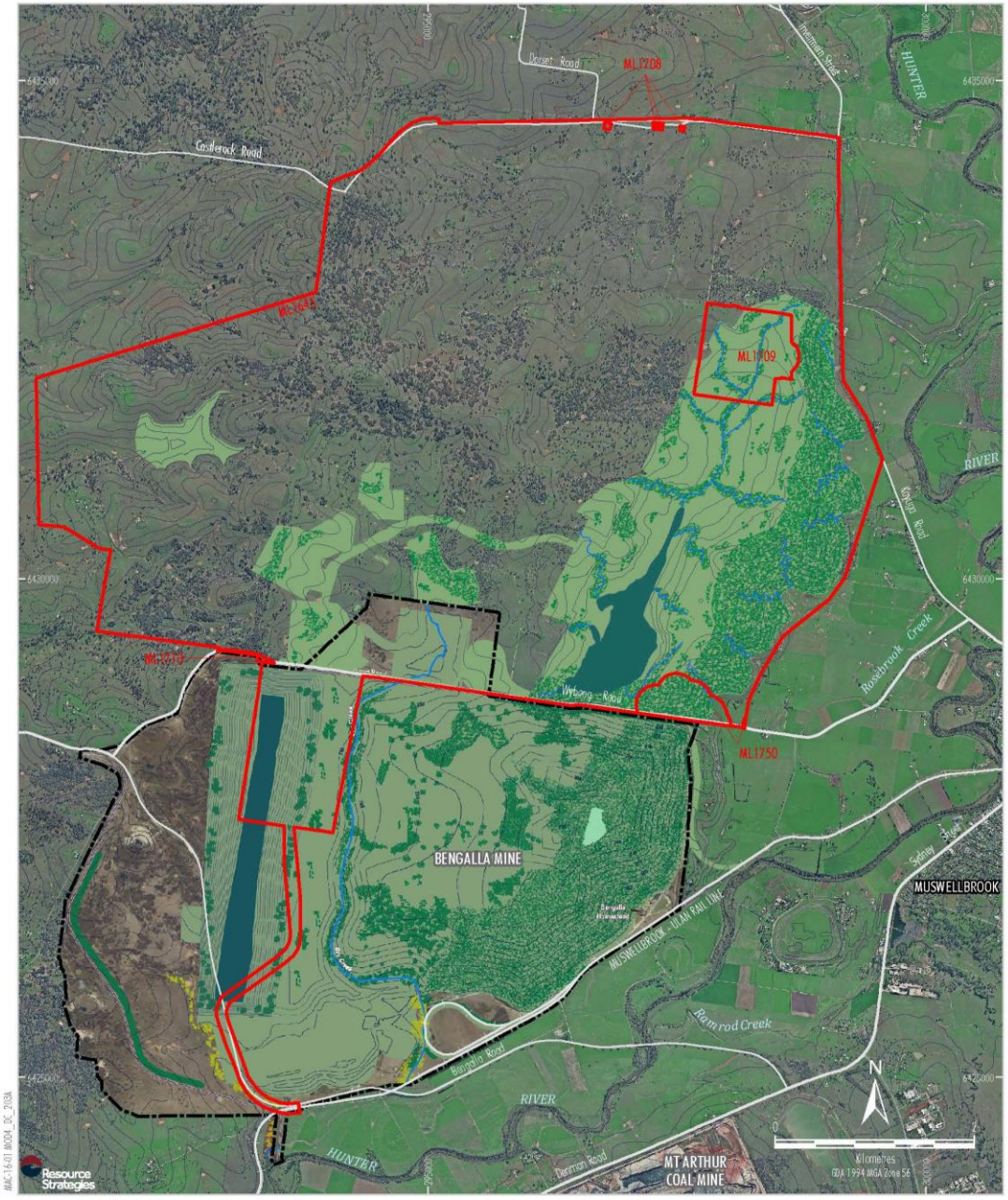
MOUNT PLEASANT OPERATION
Approved Surface Disturbance Plan

FIGURE 4 - CONCEPTUAL FINAL LANDFORM



ATTACHMENT 2

WATER-RELATED DEVELOPMENT CONSENT DA 92/97 CONDITIONS

Table 2-1
Water-Related Development Consent DA 92/97 Conditions

Development Consent DA 92/97	WMP Section
Schedule 3	
Water Management Plan 28. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with DoI Water and EPA, and be submitted to the Secretary for approval by 30 June 2019, unless otherwise agreed by the Secretary. The plan must include:	This document (and Section 1.3.1)

(a) a Site Water Balance, which must:
• include details of:
  ○ sources and security of water supply;
  ○ water use on site
  ○ water management on site;
  ○ any off-site water transfers; and
• investigate and implement all reasonable and feasible measures to minimise water use by the development;
	Appendix 1

(b) an Erosion and Sediment Control Plan, which must: • identify activities that could cause soil erosion, generate sediment or affect flooding; • describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters, and manage any flood risk; • describe the location, function, and capacity of erosion and sediment control structures; • describe what measures would be implemented to maintain the structures over time;	Appendix 2
(c) a Surface Water Management Plan, which must include: • detailed baseline data on surface water flows and quality in creeks and other waterbodies that could potentially be affected by the development; • surface water and stream health impact assessment criteria including trigger levels for investigating any potentially adverse surface water impacts; • a program to monitor and maintain the bridge openings and culverts associated with the MOD 4 rail infrastructure and ensure that they remain clear of blockages; • a program to monitor surface water flows and quality in the watercourses that could be affected by the project; and • reporting procedures for the results of the monitoring program;	Appendix 3

(d) a Groundwater Management Plan, which must include:
• detailed plans, including design objectives and performance criteria, for the design and management of the proposed final voids;
• detailed baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores, that could be affected by the development;
• groundwater impact assessment criteria including trigger levels for investigating any potentially adverse groundwater impacts;
• a program to monitor and assess:
  ○ groundwater inflows to the mining operations;
  ○ impacts on regional and local (including alluvial) aquifers;
  ○ impacts on the groundwater supply of potentially affected landowners;
  ○ impacts on groundwater dependent ecosystems and riparian vegetation;
	Appendix 4

Table 2-1
Water Related Development Consent DA 92/97 Conditions (Continued)

Development Consent DA 92/97	WMP Section
Schedule 3	
(e) a Surface and Ground Water Response Plan, which must include: • a response protocol for any exceedances of the surface water and groundwater assessment criteria; • measures to offset the loss of any baseflow to watercourses caused by the development; • measures to prevent, minimise or offset groundwater leakage from alluvial aquifers caused by the development; • measures to compensate landowners of privately-owned land whose water supply is adversely affected by the development; and • measures to mitigate and/or offset any adverse impacts on groundwater dependent ecosystems or riparian vegetation. The Applicant must implement the approved management plan as approved by the Secretary.	Appendix 5
SOIL & WATER Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain water licences for the development.	Section 2.3.1
Water Supply 25. The Applicant must ensure that it has sufficient water for all stages of development, and if necessary, adjust the scale of mining operations on site, to match its available water supply to the satisfaction of the Secretary.	Appendix 1
Water Discharges 26. The Applicant must ensure that any surface water discharges from the site comply with the: (a) discharge limits (both volume and quality) set for the development in any EPL; or (b) relevant provisions of the POEO Act or Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002.	Appendices 1, 2 and 3
Compensatory Water Supply 27. The Applicant must provide compensatory water supply to any landowner of privately-owned land whose water entitlements are adversely and directly impacted (other than an impact that is negligible) as a result of the development, in consultation with DoI Water, and to the satisfaction of the Secretary. The compensatory water supply measures must provide an alternative long-term supply of water that is equivalent, in quality and volume, to the loss attributed to the development. Equivalent water supply should be provided (at least on an interim basis) as soon as practicable after the loss is identified, unless otherwise agreed with the landowner. If the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution. If the Applicant is unable to provide an alternative long-term supply of water, then the Applicant must provide alternative compensation to the satisfaction of the Secretary.	Appendix 5

APPENDIX 1

SITE WATER BALANCE

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SITE WATER BALANCE

Document ID:	MP001-0000-ENV-PLN-0006		
Company:	MACH Energy Australia Pty Ltd		
Effective Date:	31 October 2019	**Status:**	Issued for Use
Approved By:	Andrew Reid	**Revision Number:**	01

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1 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton (Figure 1). The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively (Figure 1). The proponent of the MPO is MACH Energy Australia Pty Ltd (MACH Energy), which purchased the MPO from Coal & Allied Operations Pty Ltd (Coal & Allied) in 2016.

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

The Mount Pleasant Project Modification (MOD 1) was submitted on 19 May 2010 with a supporting Environmental Assessment (EA) prepared by EMGA Mitchell McLennan (EMGA Mitchell McLennan, 2010). MOD 1 included the provision of an infrastructure envelope for siting the mine infrastructure, the provision of an optional conveyor/service corridor linking the MPO facilities with the Muswellbrook-Ulan Rail Line and modification of the existing Development Consent DA 92/97 boundaries to accommodate the optional conveyor/service corridor and minor administrative changes. MOD 1 was approved on 19 September 2011.

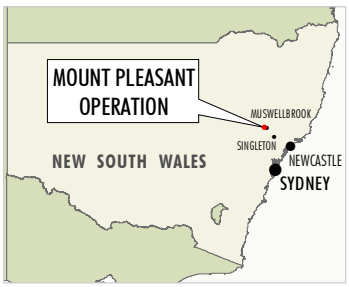
The MPO South Pit Haul Road Modification (MOD 2) was submitted on 30 January 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017a). MOD 2 proposed to realign an internal haul road to enable more efficient access to the South Pit open cut, with no other material changes to the approved MPO. MOD 2 was approved on 29 March 2017.

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

The MPO Rail Modification (MOD 4) was submitted on 18 December 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017c). MOD 4 proposed the following changes:

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

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



LEGEND

- Mining Operation
- Proposed Mining Operation
- Mining Lease Boundary (Mount Pleasant)
- Railway
- Local Government Boundary
- State Forest
- National Parks and Wildlife Estate

Source: © NSW Department of Finance, Services and Innovation (2018); Office of Environment and Heritage NSW (2018)

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MOUNT PLEASANT OPERATION

Project Location

Figure 1

MAC-16-01 MP2019_ Figure 1_ Rev A

1.1 PURPOSE AND SCOPE

This Site Water Balance (SWB) has been prepared by MACH Energy to satisfy the requirements under Development Consent DA 92/97 (as modified) and specifically Condition 28(a), Schedule 3.

This SWB has been prepared to predict the water demand/supply associated with construction and operation of the MPO, including for example, initial establishment and development works, open cut mining, operation of the coal handling and preparation plant (CHPP), rail spur/loop and Fines Emplacement Area, and the supply of water to the MPO.

The SWB applies to all employees and contractors at the MPO and covers all areas within the MPO boundary. The SWB applies to the life of the MPO, including (but not limited to) the period of mining operations specified in Development Consent DA 92/97, which currently permits mining until 22 December 2026. As required by Condition 5, Schedule 2 of Development Consent DA 92/97, the SWB will continue to apply (excluding mining operations) beyond 22 December 2026, as required, until the rehabilitation and any additional undertakings (required by the Secretary of the Department of Planning, Industry and the Environment [DPIE], or the Division of Resources and Geoscience [DRG] within the DPIE) have been carried out satisfactorily.

1.2 STRUCTURE OF THE SWB

Consistent with the requirements of Condition 28(a), Schedule 3 of Development Consent DA 92/97, the remainder of the SWB is structured as follows:

- Section 2: Outlines the statutory obligations relevant to this SWB.
- Section 3: Outlines the available data used in the modelling of the SWB.
- Section 4: Describes the water management system implemented at the MPO.
- Section 5: Outlines the predicted water demands present at the site.
- Section 6: Describes the controlled water releases proposed.
- Section 7: Outlines the site water sources.
- Section 8: Describes the water balance modelling undertaken as part of this SWB.
- Section 9: Outlines the review process for MPO documentation and in particular for this SWB.
- Section 10: Describes the reporting procedures relevant for this SWB.
- Section 11: Lists the references cited in this report.

2 STATUTORY OBLIGATIONS

MACH Energy's statutory obligations are contained in:

- the conditions of Development Consent DA 92/97 (as modified);
- the condition of the Commonwealth Approval EPBC 2011/5795;
- relevant licences (including Environment Protection Licence [EPL] 20850), permits and mining leases (mining leases 1645, 1708, 1709, 1713 and 1750); and
- other relevant legislation.

Obligations relevant to this SWB are described below.

2.1 DEVELOPMENT CONSENT DA 92/97

The conditions of Development Consent DA 92/97 relevant to the content and structure of this SWB are described below. A comprehensive list of all conditions in Development Consent DA 92/97 relevant to water is provided in the Water Management Plan (WMP).

2.1.1 SWB Requirements

Condition 28(a), Schedule 3 of Development Consent DA 92/97 requires the preparation of a SWB, as part of the WMP for the MPO (refer Table 1).

Table 1
SWB Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 3	Section where addressed in this SWB document
28. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with DoI Water and EPA, and be submitted to the Secretary for approval by 30 June 2019, unless otherwise agreed by the Secretary. *The plan must include:* *(a) a Site Water Balance, which must:* • *include details of:*	
– *sources and security of water supply;*	Section 7
– *water use on site;*	Section 5
– *water management on site;*	Section 4
– *any off-site water transfers; and*	Section 6
• *investigate and implement all reasonable and feasible measures to minimise water use by the development;*	Section 4.3

2.1.2 Management Plan (General) Requirements

Condition 2, Schedule 5 of Development Consent DA 92/97 outlines the general management plan requirements that are applicable to the preparation of this SWB.

Table 2 presents these requirements and indicates where each is addressed within this SWB, or within the overarching WMP for the MPO.

Table 2
General Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 5	Section where addressed in this SWB document
2. The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 3
(b) a description of: • *the relevant statutory requirements (including any relevant consent, licence or lease conditions);*	Section 2
• *any relevant limits or performance measures/criteria;*	Surface Water Management Plan (SWMP) and Groundwater Management Plan (GWMP)
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	SWMP and GWMP
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	SWMP and GWMP
(d) a program to monitor and report on the: • *impacts and environmental performance of the development;* • *effectiveness of any management measures (see c above);*	Section 9
(e) a contingency plan to manage any unpredicted impacts and their consequences;	Refer to Surface and Groundwater Response Plan (SGWRP)
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 9 and Section 10
(g) a protocol for managing and reporting any: • *incidents;* • *complaints;* • *non-compliances with statutory requirements; and* • *exceedances of the impact assessment criteria and/or performance criteria; and*	Section 10
(h) a protocol for periodic review of the plan. *Note: The Secretary may waive some of these requirements if they are unnecessary for particular management plans.*	Section 9

2.2 LICENCES, PERMITS AND LEASES

Water management at the MPO is conducted in accordance with a number of licences, permits and leases. Key licences, permits and leases relating to water at the MPO include:

- Water Access Licences (WAL 879, 880, 1113 and 41438) issued under the *Water Management Act, 2000* (Table 3).
- Discharge credits (20) held under the NSW *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation, 2002* (HRSTS).
- Mining leases 1645, 1708, 1709, 1713 and 1750 issued under Part 5 of the NSW *Mining Act, 1992* and approved by the Minister for Mineral Resources.
- EPL 20850 issued under Part 3 of the NSW *Protection of the Environment Operations Act, 1997* by the NSW Environment Protection Authority (EPA).
- The Mining Operations Plan, as required by mining lease conditions issued under the *Mining Act 1992* and approved by the DRG.

2.3 OTHER LEGISLATION

A description of other legislation relevant to water resources at the MPO is provided in the WMP, SWMP and GWMP.

Table 3
Surface Water Access Licences Held for the Mount Pleasant Operation

Water Access Licence	Water Source	Type	Share (units)
879	Hunter Regulated River Water Source	Regulated River (High Security)	224
880	Hunter Regulated River Water Source	Regulated River (High Security)	124
1113	Hunter Regulated River Water Source	Regulated River (High Security)	366
973	Hunter Regulated River Water Source	Regulated River (High Security)	3
638	Hunter Regulated River Water Source	Regulated River (High Security)	3
		High Security Subtotal	720
639	Hunter Regulated River Water Source	Regulated River (General Security)	134
974	Hunter Regulated River Water Source	Regulated River (General Security)	210
988	Hunter Regulated River Water Source	Regulated River (General Security)	156
1229	Hunter Regulated River Water Source	Regulated River (General Security)	480
1227	Hunter Regulated River Water Source	Regulated River (General Security)	99
992	Hunter Regulated River Water Source	Regulated River (General Security)	75
7808	Hunter Regulated River Water Source	Regulated River (General Security)	36
702	Hunter Regulated River Water Source	Regulated River (General Security)	267
993	Hunter Regulated River Water Source	Regulated River (General Security)	265
604	Hunter Regulated River Water Source	Regulated River (General Security)	183
662	Hunter Regulated River Water Source	Regulated River (General Security)	9
10775	Hunter Regulated River Water Source	Regulated River (General Security)	243
41438	Hunter Regulated River Water Source	Regulated River (General Security)	420
		General Security Subtotal	**2577**
975	Hunter Regulated River Water Source	Domestic And Stock	8
989	Hunter Regulated River Water Source	Domestic And Stock	8
1230	Hunter Regulated River Water Source	Domestic And Stock	8
605	Hunter Regulated River Water Source	Domestic And Stock	8
677	Hunter Regulated River Water Source	Domestic And Stock	24
663	Hunter Regulated River Water Source	Domestic And Stock	16
1259	Hunter Regulated River Water Source	Supplementary Water	33.2
1258	Hunter Regulated River Water Source	Supplementary Water	5
1307	Hunter Regulated River Water Source	Supplementary Water	37.5
1260	Hunter Regulated River Water Source	Supplementary Water	4.8
1308	Hunter Regulated River Water Source	Supplementary Water	15.1
1338	Hunter Regulated River Water Source	Supplementary Water	17.5
		Other Subtotal	**185.1**

3 AVAILABLE DATA

The SWB model has been developed using historical climate data representative of the MPO area, as described below.

3.1 CLIMATE DATA

Climate data for the SWB model was sourced from the Queensland Government's Data Drill service (Queensland Government, 2017). This service provides synthetic data sets for a specified point by interpolation between surrounding point records held by the Bureau of Meteorology. Daily evaporation and rainfall data from 1892 to 2012 was obtained for the mine site and used in the SWB model (See Section 8).

3.2 HUNTER RIVER FLOW DATA

To calculate periods where licensed discharge could be simulated for the SWB, a relationship between the Hunter River flow rate and river registers for declared 'high' flow events was developed. This relationship was formulated using historical river registers sourced from Department of Industry - Water records, correlated against recorded Hunter River daily flows. This correlation extended to 'flood' flow events in the Hunter River (during which no daily discharge restriction applies). Hunter River flow rates at Muswellbrook were simulated by the Integrated Quantity and Quality Model for the same period of historical climate data as used in the water balance model and these flows used with the above correlation relationship to simulate river registers.

4 WATER MANAGEMENT SYSTEM

The MPO water management system is comprised of a number of dams, the open cut and the Fines Emplacement Area, together with a system of pumped transfers and drains. The Water Management System is shown in Schematic form in Figure 2 and described in detail below.

Conceptual Project Layout Plans for the MPO, showing the proposed location of key water management system infrastructure, are shown in Attachment 1.

4.1 WATER MANAGEMENT SCHEME

4.1.1 Storage Dams

The Mine Water Dam (MWD) is the main water storage on-site and will supply makeup water to the CHPP. Fine rejects slurry produced by the CHPP will be pumped to the Fines Emplacement Area and water recovered from the Fines Emplacement Area is pumped back to the MWD. Any seepage from the Fines Emplacement Area is captured in a subsurface seepage collection system located at the toe of the Fines Emplacement Area embankment and pumped back to the storage area.

Environmental Dam 2 (ED2) is located downstream of the Fines Emplacement Area and will serve as a sediment dam for the construction of the Fines Emplacement Area.

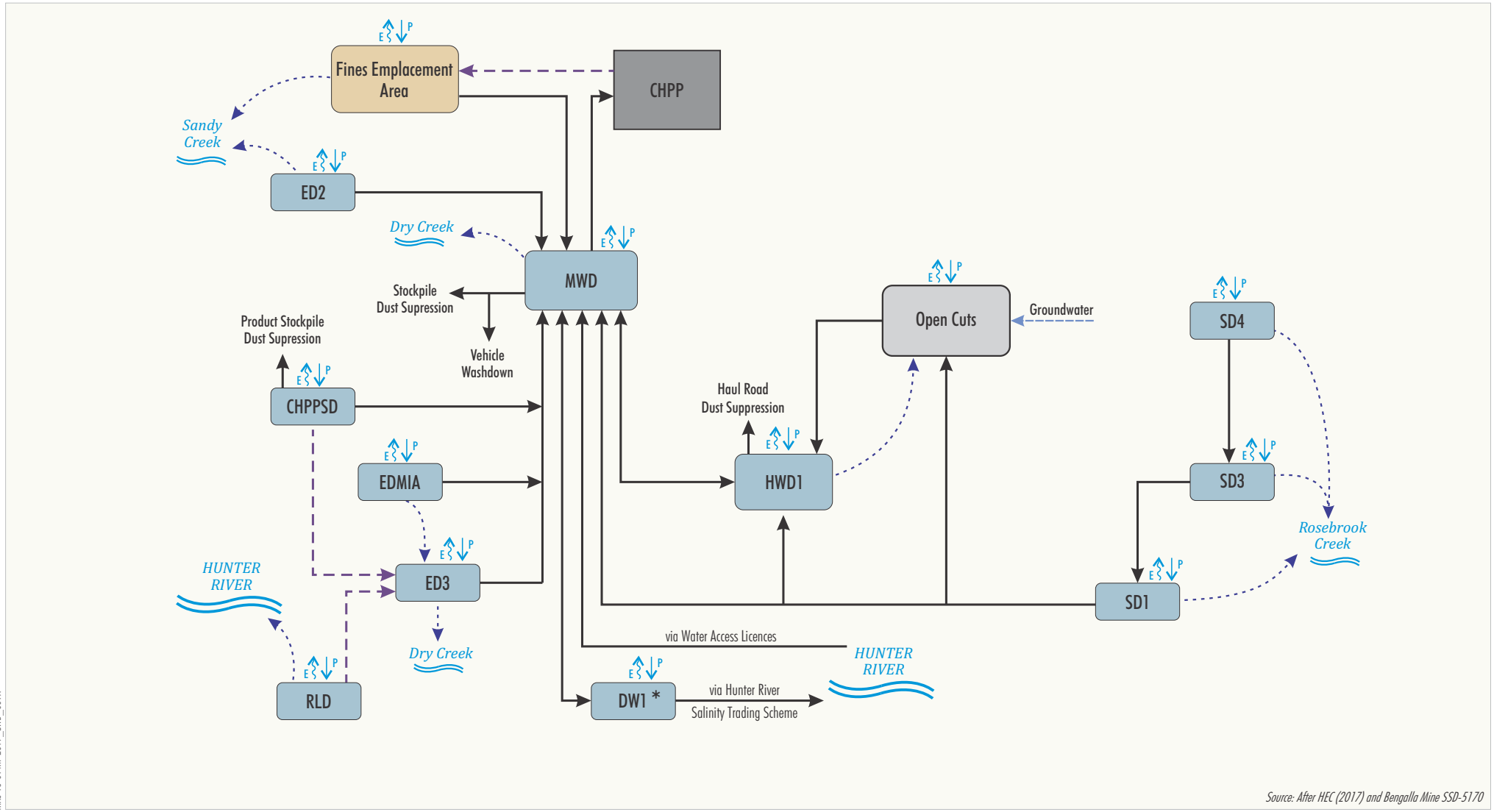
Other site water storages include:

- Environment Dam Mine Infrastructure Area (EDMIA);
- Environmental Dam 3 (ED3);
- Sediment Dam 1 (SD1);
- Sediment Dam 3 (SD3);
- Sediment Dam 4 (SD4);
- High Wall Dam 1 (HWD1);
- High Wall Dam 2 (HWD2); and
- Rail Loop Dam (RLD).

Each of these storages are pumped back to the water management system.

The MWD is able to receive water from the Hunter River via WALs. A discharge dam (DW1) and associated pipeline will also be constructed in the south-southwest of the MPO to receive excess water from the MWD (Attachment 1). DW1 and its associated pipeline were originally approved for construction under the development consent for the Bengalla Continuation Project (SSD-5170) with the intention that the MPO would seek any necessary secondary approvals required to facilitate its use. MACH Energy will seek approval for a licensed discharge point at the outflow from DW1 to the Hunter River, in accordance with the HRSTS as a variation of EPL 20850.

Two Clean Water Dams (CWD1 and CWD2) will be located in order to direct rainfall runoff from upslope undisturbed areas either off-site or, if required, to either HWD1 or HWD2 to supplement site water supply during periods of low water inventory (subject to harvestable right entitlements or appropriate WALs). Groundwater inflow to the open cut is dewatered to HWD1.



MAC-16-01 MP 2019_SWB_001A

LEGEND

- Water Storage
- Fine Rejects Storage
- Pumped Flow
- Overflow Due to Rainfall in Excess of Design Criteria
- Seepage Flow
- Fine Reject Slurry Flow
- Precipitation
- Evaporation

NOTE

* Mount Pleasant Discharge Dam authorised under Bengalla Mine SSD-5170.

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MOUNT PLEASANT OPERATION

Water Management System Schematic

Figure 2

4.1.2 Drains

A number of drains have been developed and/or are planned as part of the water management system, these include:

- a series of downslope (toe) drains at the perimeter of the Eastern Out of Pit Emplacement, directing runoff to SD1, SD3 and SD4;
- a drain downslope of the CHPP area directing runoff to ED3;
- a short clean water diversion drain upslope of the RLD;
- clean water diversion drains around the perimeter of the Fines Emplacement Area and ED2; and
- drains around the out of pit emplacement areas to the north and west of the open cut areas.

While not specifically incorporated in this SWB, MACH Energy is also progressively implementing additional clean water diversion drains upslope of the MWD.

4.2 DAM AND DRAIN DESIGN

The storage dams and their associated design capacities are outlined in Table 4 below.

Table 4
Water Storage and Sediment Dam Design Capacities

Name of Dam	Type of Dam	Design Criterion	Design Capacity (ML)
ED2	Sediment Dam	Landcom (2004) & DECC (2008)	7.6
ED3	Sediment Dam	1% AEP spill risk*	304.4
RLD	Sediment Dam	1% AEP spill risk	1.3
EDMIA	Sediment Dam	Nominal size - spills allowed internally to ED3	15
HWD1	Mine Water Dam	Spills (to open cut) once every two years on average	106.5
HWD2	Mine Water Dam	Spills (to open cut) once every two years on average	30.9
CWD1	Clean Water Dam	Spills (to open cut) once every five years on average	6.7
CWD2	Clean Water Dam	Spills (to open cut) once every five years on average	35.2
MWD	Mine Water Dam	Allow for buffer to supply site demands	2018.2
SD1	Sediment Dam	Landcom (2004) & DECC (2008)	18.3
SD3	Sediment Dam	Landcom (2004) & DECC (2008)	27.2
SD4	Sediment Dam	Landcom (2004) & DECC (2008)	39.7
DW1	Discharge/Storage Dam	1% AEP spill risk	300

Note: ML = Megalitres, AEP = Annual Exceedance Probability and DECC = NSW Department of Environment and Climate Change.

* MACH Energy has installed a pump and pipeline system at ED3 to dewater the storage to MWD to reduce the potential for overtopping. This would provide additional capacity above the design criterion listed above and further reduce spill risks.

Actual water storage and sediment dam design capacities may vary from those described in Table 4 based on progressive water balance modelling reviews.

The open cut was excluded from Table 4 because its capacity was not based on design criteria. For modelling purposes, the open cut storage was assumed to comprise a rectangular sump throughout the MPO life and the volume of water stored was tracked within the model and reported to assess potential risk of disruption to mining.

The Fines Emplacement Area was also excluded from Table 4 because its capacity varies with time. The storage was assumed to comprise a sloping fine rejects beach and the water storage level-volume-area relationships were derived for the period where fine rejects are present and estimated from existing topographic contours for the initial storage (at commissioning). A minimum capacity of 400 ML was simulated in early 2023 (just before a planned dam wall raise). The Fines Emplacement Area reclaim pumping rate was set so that no spills were simulated.

The capacities of sediment dams SD1, SD3, SD4 and ED2 were calculated using Landcom (2004) and DECC (2008) guidelines, assuming:

- classification as Type D sediment retention basins (10% or more of the soils are dispersible);
- dams to be in place for more than three years;
- a standard receiving environment and therefore capacity to be designed to capture a 90th percentile, 5 day duration rainfall event, which was calculated as 39.3 millimetres (average of values for Cessnock and Scone in Table 6.3a of Landcom [2004]);
- a volumetric runoff coefficient of 0.51 assuming soil hydrologic group C (Table F2 of Landcom [2004]); and
- allowance for sediment storage zone capacity equal to 50% of the above calculated settling zone capacity.

The catchment area of sediment dams SD1, SD3 and SD4 was assumed to be the maximum from the Conceptual Project Layout Plans (i.e. as at 2025 [Attachment 1]). The maximum catchment area reporting to ED2 was assumed to be from 2023 onwards from stage plans and Fines Emplacement Area embankment designs.

MACH Energy notes the EPA's advice to the Department of Planning and Environment on the Hunter Valley Operations South MOD 5 proposal, which provided guidance regarding sediment dam design in the context of the HRSTS (EPA letter dated 17 March 2017). In accordance with the EPA's recommendations, MACH Energy is monitoring the quality of water in sediment dams in order to regularly evaluate whether the salinity of controlled discharges/managed overflows from the sediment basins complied with the provisions of the HRSTS.

2017 water quality monitoring of storages on-site indicated that Electrical Conductivity (EC) ranged from 103 – 273 microsiemens per centimetre (µS/cm). Longer term (2004 to 2016) monitoring results indicate an average EC at all site monitoring points (within the mining lease area) of 272 µS/cm. These values are less than the limit for 'saline water' of 400 µS/cm described in the HRSTS Regulation.

Recent (2018) data for SD1 has indicated EC values greater than 400 µS/cm, however this data has been collected during a dry period at the MPO and a correspondingly low water level in SD1 (i.e. due to evapoconcentration of salts). MACH Energy therefore considers that these results would not be indicative of a managed overflow event at SD1 (e.g. in the event of rainfall in excess of design criteria).

MACH Energy will continue to monitor the MPO sediment dams to ensure any controlled discharges are in accordance with the HRSTS.

Notwithstanding, in the event that monitoring of the water quality in sediment dams after a significant rainfall event indicates that water would not meet the HRSTS maximum for non-regulated discharge, MACH Energy would identify and implement additional management measures in consultation with EPA. These may include:

- Licensing of sediment dams in an EPL and acquisition of additional salinity credits under the HRSTS.
- Increasing the capacity of relevant sediment dams.
- Implementing additional pumping arrangements to return water from the sediment dams to the mine water management system.

The capacities and storage operating levels of the remaining MPO storages were developed based on iterative simulations to achieve specific design criteria (as summarised in Table 4). For the MWD, ED3 and the RLD, which spill externally, a spill risk assessment identified an AEP for each dam and iterative simulations were carried out to identify the required capacity for a given AEP. As noted in Table 4, MACH Energy has installed a pump and pipeline system at ED3 to dewater the storage to MWD. This would provide additional capacity above the design criterion and further reduce spill risks.

Drains are sized in accordance with Landcom (2004) and NSW DECC (2008) guidelines and would either be grassed or rip-rap lined or similar to control erosion.

4.3 MINIMISATION OF WATER USE

MACH Energy's water management strategy includes preferential use of on-site derived mine water, thereby reducing the need to import raw water from external sources for operational purposes. As described in Section 4.1.1, the water management system has been designed to recycle runoff, fine rejects bleed water and groundwater inflow wherever practicable. This water is reused for haul road and stockpile dust suppression, vehicle wash down, and in the CHPP.

Notwithstanding, general water management measures undertaken include, but are not limited to:

- finalising construction of proposed water storages as early as possible to increase site yield;
- limiting the extent of disturbance to reduce dust suppression requirements;
- pumping water from the Hunter River only when a low trigger volume for the mine water storage has been reached. All surface and groundwater will be taken in accordance with WALs; and
- regularly reviewing water use to identify areas for reduction and identify best practice technologies. This will be reviewed every year as part of the Annual Review process (Section 9.1).

During construction activities, water may be sourced externally, e.g. taken from commercial water fill points in the light industrial area.

MACH Energy would also seek opportunities to source excess mine water from the adjoining mines (i.e. Dartbrook and Bengalla Mines) should it be available, to minimise extraction from the Hunter River. The frequency, quality and quantity of water to be sourced from the Dartbrook or Bengalla Mines would depend on:

- Availability of surplus water on the other mine sites coinciding with a water deficit at the MPO.
- Suitability of Dartbrook/Bengalla water quality for the intended use at the MPO.
- MACH Energy and the other mining operator obtaining all necessary secondary approvals (e.g. EPL variations).

MACH Energy would also consider the feasibility of other potential alternative water supply sources over the life of the mine in consultation with DPIE and EPA.

4.4 POTABLE WATER

Treated potable water for all facilities is trucked to site and stored in on-site storage tanks with sufficient capacity to store a 7 day supply. All potable water supplied on-site will meet the requirements of the *Australian Drinking Water Guidelines* (National Health and Medical Research Council, 2011).

5 WATER DEMANDS

5.1 OVERVIEW

Key water demands on-site include the following:

- water used in the CHPP, including water retained in coal products and rejects;
- haul road dust suppression; and
- miscellaneous water usage such as vehicle wash down and stockpile water usage.

A description of these water demands and the assumptions adopted in development of the SWB model is provided in the sections below.

5.2 CHPP

The CHPP accounts for the largest use of water at the MPO. Water lost from the coal handling and preparation process is either entrained within product coal or reject materials. CHPP demand in the water model was been based upon an assumed make-up rate of 222 litres (L)/ROM tonne.

The CHPP water demand was assumed to increase over time, corresponding with the increase of ROM coal production over the mine life. CHPP demand is initially predicted to be at its lowest at the start of production at 2.73 ML/day (ML/d). At maximum production, the MPO is licensed to mine up to 10.5 million tonnes per annum, which yields an assumed water requirement of 6.38 ML/d.

5.3 DUST SUPPRESSION

MPO haul road dust suppression demand was calculated based on water cart use during 2018 and 2019. Calculated haul road dust suppression demand averaged approximately 1.8 ML/d.

5.4 MISCELLANEOUS (VEHICLE WASHDOWN AND STOCKPILE USAGE)

Vehicle wash down demand was assumed to be 37 ML/year (ML/yr) while dust suppression of stockpiles was assumed to be 115 ML/yr for all modelled years.

5.5 OTHER LOSSES

For the purposes of calculating evaporation losses, storage volume surface areas were derived using storage level-volume-area relationships. Where storage specific information was unavailable, contour data was used to derive storage information.

Evaporation losses were calculated using the following pan factors over the various water storages at the site:

- the Fines Emplacement Area = 1.1 - due to the darker fine rejects surface;
- the open cut = 0.8 - due to shading effects and lower wind speed at depth; and
- all other storages - monthly values varying from 0.84 to 0.95 on the basis of values in McMahon et al. (2013) for Scone.

6 CONTROLLED WATER RELEASE

6.1 TREATED EFFLUENT DISPOSAL

Wastewater from offices, workshop and bath houses is collected and treated in an on-site effluent treatment system located within the Mine Infrastructure Area. Effluent is treated to meet the *Australian Guidelines for Water Recycling* (Environment Protection and Heritage Council, 2006), as well as NSW Health Department and local council requirements. Any additional effluent sites installed for expanded operations will be appropriately licensed. Effluent is removed from site by a suitably qualified contractor. Additionally, on-site treated effluent may be pumped to the MWD to supplement CHPP usage, vehicle wash down and stockpile dust suppression.

Any treated effluent released from the MWD to the Hunter River via the HRSTS will comply with the discharge conditions specified in EPL 20850.

6.2 LICENSED DISCHARGE

Licensed discharge will occur between MWD and the Hunter River via DW1 when appropriate secondary approvals are obtained. At the appropriate time, MACH Energy will seek these approvals in accordance with the HRSTS as a variation of EPL 20850 (Section 4.1.1).

The HRSTS regulates the amount and salinity of water which can be discharged into the Hunter River.

7 WATER SOURCES

Sources of water supply to the MPO are summarised below:

- groundwater inflows to the open cut;
- runoff captured from the footprint of the mining disturbance area by the water management system;
- fine rejects bleed water captured from the Fines Emplacement Area; and
- water pumped from the Hunter River and/or groundwater supply bores.

Operational water supply is reviewed regularly, collating all groundwater extractions, in-pit rainfall accumulation and runoff, as well as imported water to inform on-site water management.

MACH Energy will manage the available water sources and, if necessary, adjust the scale of operations to match the available water supply (in accordance with Condition 25, Schedule 3 of Development Consent DA 92/97).

MACH Energy would also seek opportunities to source excess mine water from the adjoining mines (i.e. Dartbrook and Bengalla Mines) should it be available (Section 4.3). However, potential access to excess water from other mining operations has not been assumed for this SWB model.

7.1 GROUNDWATER INFLOWS

Groundwater inflows were assumed to progressively increase over time, corresponding to the size of the open cut increasing over the mine life. The assumed pit inflow rate was lowest in 2018 at 0.11 ML/d, and peaking in 2026 at 0.69 ML/d. These inflow rates were reduced before use in the SWB model, to allow for evaporation from the exposed coal seams. Evaporation rates were calculated based upon coal seam thickness and strike length, using a pan factor of 0.8.

The median net inflow rate (incorporating evaporation) increased progressively, peaking yearly in the winter months. The inflow rate increased from a negligible daily rate, to approximately 0.38 ML/d for the final year of the simulation (during winter 2026).

7.2 CATCHMENT RUNOFF

As far as practical, clean water runoff from up catchment areas is diverted around active mining and other disturbance areas. Diversion design will consider catchment extent, required disturbance and safety. Water that accumulates within mining pits is pumped to surface storages for reuse in the mining operations and CHPP, as described in Section 4.1.

Catchment areas were derived using mine stage plans and converting mine areas into different sub-catchment types based upon their function and expected runoff behaviour. This is described in detail in Section 8.2.

7.3 FINE REJECTS BLEED WATER

As described in Section 4.1.1, fine rejects slurry will be pumped from the CHPP to the Fines Emplacement Area. Fine rejects bleed water is water liberated from fine rejects slurry as it settles. This water ponds at the fine rejects surface and is available for reclamation. Fine rejects bleed water recovered from the Fines Emplacement Area is pumped to the MWD.

The fine rejects bleed rate was assumed to increase progressively over the mine life due to the increased rate of ROM coal being handled in the CHPP (See Section 5.2). The bleed rate was assumed to be negligible in the first year of operations, approximately 2.5 ML/d during 2019 and approximately 3.5 ML/d for the rest of the simulation (2020 to end 2026).

7.4 PUMPING FROM THE HUNTER RIVER/GROUNDWATER SUPPLY BORES

If the volume of the MWD is less than 504 ML, water is pumped into the MWD from the Hunter River, and when the volume of the dam rises above 782 ML, pumping will cease. A peak pumping rate of 200 L/s has been assumed for this extraction.

714 ML/yr of Hunter River High Security Entitlment WALs and 829 ML/yr of MACH Energy's Hunter River General Security WALs are assumed to be available for the MPO.

The Integrated Quantity and Quality Model (IQQM) is the model used by the Department of Industry - Water to set licence allocation levels in the Hunter Valley, in accordance and in conjunction with the *Water Sharing Plan for the Hunter Regulated River Water Source 2016*.

IQQM simulations have previously been undertaken using climatic data from 1892 to 2012 (the same period of data as used in the water balance model) to generate predictions of General Security WALs available water determinations, periods of off-allocation flow and volume of water stored in Glenbawn Dam and Glennies Creek Dam (the two Hunter River major regulating storages), used to estimate available water determinations for WALs.

MACH Energy may also obtain make-up water from groundwater supply bores. Any water taken from groundwater bores would be in accordance with WALs issued under the relevant water sharing plan (i.e. depending on the relevant groundwater source).

8 WATER BALANCE MODELLING

8.1 OVERVIEW

The water balance model has been developed for the MPO, using the GoldSim simulation package. The model simulates the behaviour of water held in and pumped between all simulated water storages shown in Figure 2. For each storage, the model simulates:

Change in Storage = Inflow – Outflow

Where:

- *Inflow* includes rainfall runoff, groundwater inflow (to the open cut), fine rejects bleed water, water pumped from the Hunter River and all pumped inflows from other storages.
- *Outflow* includes evaporation, spill, licensed discharge to the Hunter River via the HRSTS and all pumped outflows to other storages or to a demand sink (e.g. the CHPP).

The model operates on an 8-hourly time step. Model simulations were undertaken for a ten year period, beginning on 1/3/2017 and simulating until the end of 2026. The model simulates 121 'realisations', derived using ten year time steps of the historical daily climatic record from 1892 to 2012 (i.e. realisation 1 uses climate data from 1892 to 1902; realisation 2 uses data from 1893 to 1903 etc.). The results from all realisations were used to generate estimates of supply reliability, spill and open cut water inventory. This method effectively includes all recorded historical climatic events in the water balance model, including high, low and median rainfall periods.

8.2 SIMULATION OF CATCHMENT RUNOFF

Rainfall runoff in the water balance model was simulated using the Australian Water Balance Model (AWBM) (Boughton, 2004). The AWBM is a nationally-recognised catchment-scale water balance model that estimates catchment yield (flow) from rainfall and evaporation.

The MPO site was split into six different sub-catchment types for AWBM simulation, these were:

- undisturbed (natural) areas;
- hardstand (for example, roads and infrastructure areas);
- open cut pit;
- active waste rock emplacements;
- rehabilitated waste rock emplacements; and
- fine rejects.

AWBM simulation of flow from each of the sub-catchment types was undertaken. Evaporation pan factors were set to 1 for fine rejects and hardstand areas and 0.85 for all other sub-catchment types. The fine rejects sub-catchment was split into two classifications: wet beach (20% of the area), and dry beach (80% of the area), to allow for the different runoff properties expected.

For water surface areas, rainfall was assumed to add directly to the storage volume with no losses.

Catchment areas for the above sub-catchment types changed progressively over the life of the mine, due to changes in surface topography and water storage size. Catchment sizes were calculated for years 2018, 2021 and 2025. These areas were derived using mine stage plans, which showed the variance of surface contours and mining areas over the ten year simulation period. Catchment areas for in-between years were calculated by linearly interpolating between the catchment values for these three years.

The total catchment area for the mine increased from approximately 1,000 hectares (ha) in 2017 to 2,016 ha in 2020, before reaching a plateau of approximately 1800 ha from 2023 to the end of the simulation.

8.3 OVERALL WATER BALANCE

Water balance results, averaged over all 121 model realisations during the 10 year simulation period are presented in Table 5 below. The results for this single realisation show inflows and outflows for a representative climate sequence.

It should be recognised that the following items are subject to climatic variability:

- rainfall runoff;
- evaporation; and
- licensed site releases (including licensed sediment dam spills).

The results presented in Table 5 are an average of all realisations, and will include wet and dry periods distributed throughout the mine life. Rainfall yield for each phase is affected by the variation in climatic conditions within the adopted climate sequence.

Table 5
Average Annual Water Balance

Water Inflows		
Inflow	**Volume (ML/Yr)**	**Approximate Percentage of Total Inflow (%)**
Runoff	1746	53
Groundwater	13	0
Fine Rejects Bleed Water	887	27
Hunter River Pumping (via WALs)	656	20
Water Outflows		
Outflow	**Volume (ML/Yr)**	**Approximate Percentage of Total Outflow (%)**
Evaporation	393	12
CHPP Demand	1876	58
Haul Road Demand	510	16
Stockpile Demand	112	3
Vehicle Wash Demand	36	1
Discharge to Hunter River (via HRSTS)	217	7
Non Sediment Dam Spillage	0.7	0

Table 5 (Continued)
Average Annual Water Balance

Water Outflows		
Outflow	**Volume (ML/Yr)**	**Approximate Percentage of Total Outflow (%)**
Sediment Dam Spillage	18	0.6
Off-site Clean Water Discharge	60	2

Rainfall runoff provides the greatest average modelled system inflow, accounting for 53% of total inflows, followed by water liberated from fine rejects bleed water (27%). Licensed extraction via WALs accounts for approximately 20% of inflows on average. Average outflows are dominated by supply to the CHPP (58%), followed by supply for haul road dust suppression (16%) and evaporation (12%).

8.4 SIMULATED HUNTER RIVER INTERACTION

As part of the water balance output, graphs of modelled outputs for the simulated extraction and release of water to/from the Hunter River were produced. These graphs showed the 5th, 10th, 90th and 95th percentile, as well as the median extraction/discharge values over the ten year simulation period, and are presented in the sections below.

8.4.1 Hunter River Extraction

Figure 3 below presents the predicted extraction from the Hunter River simulated over the ten year period.

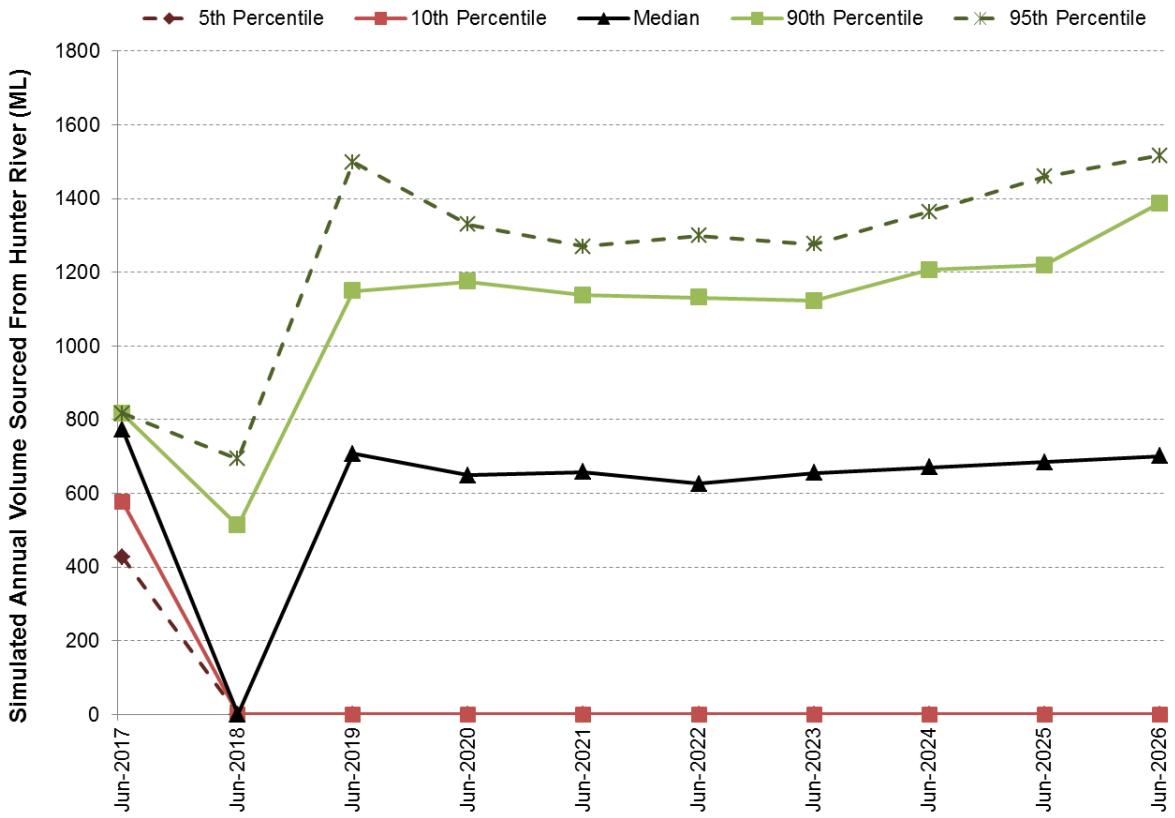

Figure 3: Simulated Hunter River Extraction

8.4.2 Hunter River Discharge

Figure 4 below presents the predicted discharge to the Hunter River simulated over the ten year period.

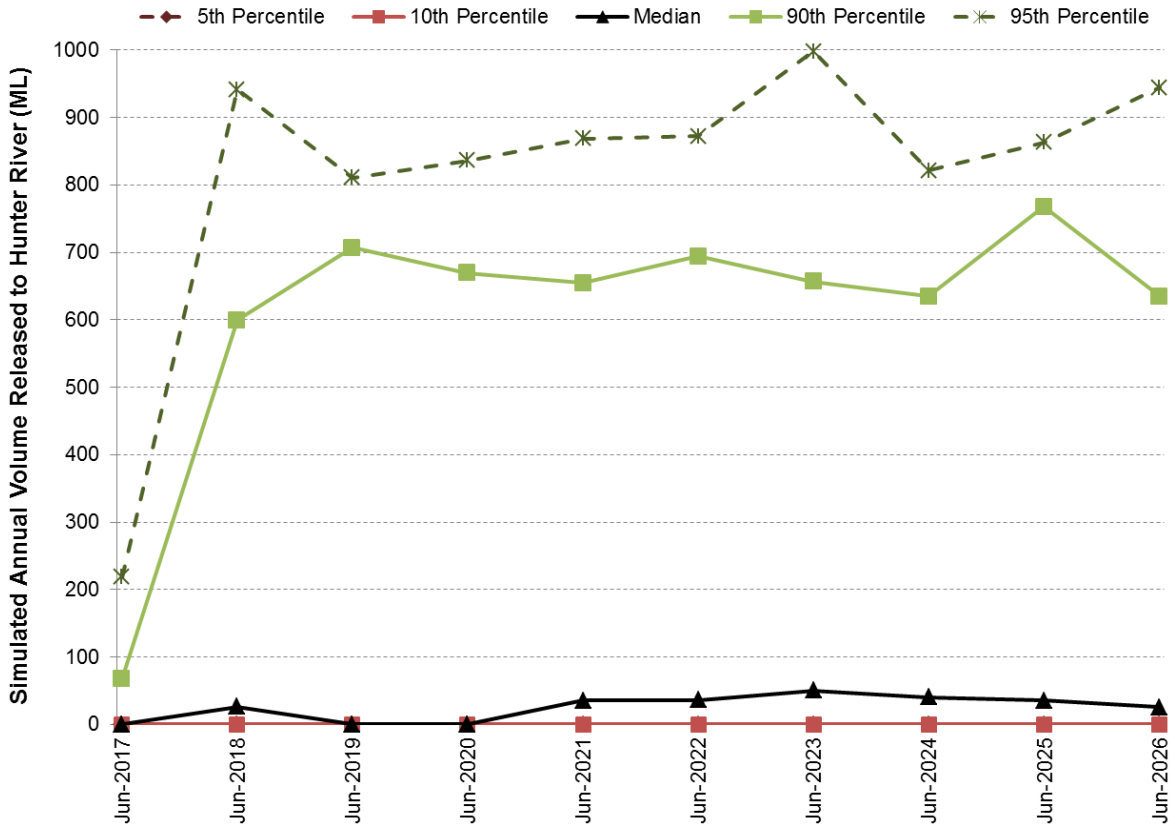

Figure 4: Simulated Hunter River Release

8.5 EXTERNAL OVERFLOWS

Sediment dams were designed to operate in accordance with the criteria listed in Table 4. The sediment dams overflowed when rainfall exceeded the design rainfall event. No overflows occurred from the MWD or Fines Emplacement Area.

8.6 WATER SUPPLY RELIABILITY

Predicted average supply reliability is expressed as total water supplied divided by total demand (i.e. a volumetric reliability) over the simulation period. Average supply reliability over all climatic realizations for CHPP supply, haul road dust suppression and stockpile dust suppression are summarised in Table 6.

Table 6
Summary of Average Modelled Water Supply Reliability

CHPP Supply	Haul Road Dust Suppression	Stockpile Dust Suppression
97.4%	97.0%	97.8%

An average 97.4% supply reliability is equivalent to 96 days lost operation over the 10 year simulation period.

The water balance modelling indicates that the average haul road dust suppression water supply reliability across the simulated climatic sequences would be 72.9%. During operations, MACH Energy would undertake periodic updates to the site water balance modelling. This would allow MACH Energy to maintain the continuity of water supply for dust suppression by identifying and implementing additional management measures as required.

These may include:

- acquiring additional WALs;
- adding or relocating pumps to provide additional supply to truckfill points and/or installing additional truckfill points on the MWD or other available water storages;
- increasing the available water storage capacity on-site (e.g. providing additional in pit storage capacity) to provide additional buffer capacity; and/or
- adjusting coal washing rates in the CHPP (and potentially producing additional bypass coal) as necessary in particularly dry periods to maintain continuity of dust suppression activities.

As discussed in Section 4.3, MACH Energy may also pursue opportunities to source water from adjoining mine operations (e.g. Dartbrook and Bengalla mines), should it be mutually advantageous and subject to obtaining any necessary secondary approvals.

9 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

9.1 ANNUAL REVIEW

In accordance with Condition 3, Schedule 5 of Development Consent DA 92/97 MACH Energy will review and evaluate the environmental performance of the MPO by the end of March each year (for the preceding calendar year) (or other such timing as agreed by the Secretary).

In relation to water, the Annual Review will:

- include a review of the SWB relating to the MPO over the past year, which includes a comparison of these results to evaluate compliance against the:
  - relevant statutory requirements, limits or performance measures/criteria (refer Section 2.1);
  - monitoring results of the previous years; and
  - relevant predictions in the EIS and MOD 1, MOD 2, MOD 3 and MOD 4 EAs;
- identify any water-related non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the water monitoring data over the life of the MPO;
- identify any discrepancies between the predicted and actual water impacts of the MPO, and analyse the potential cause of any significant discrepancies; and
- describe what water-related measures will be implemented over the next year to improve the environmental performance of the MPO.

The Annual Review will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/) in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

9.2 SWB REVISION

In accordance with Condition 4, Schedule 5 of Development Consent DA 92/97, this SWB will be reviewed, and if necessary revised to the satisfaction of the Secretary of the DPE, within three months of the submission of:

- an Annual Review (Condition 3, Schedule 5);
- an incident report (Condition 7, Schedule 5);
- an Independent Environmental Audit (Condition 9, Schedule 5); and
- any modification to the conditions of Development Consent DA 92/97[1].

Within 4 weeks of conducting any such review, the Secretary of the DPE will be advised of the outcomes of the review and any revised documents submitted to the Secretary for approval.

In accordance with Condition 4A, Schedule 5 of Development Consent DA 92/97, MACH Energy may submit a revised SWB for the approval of the Secretary at any time, and may also submit any revision to this SWB required under Development Consent DA 92/97 on a staged basis.

[1] Note that in the event of an inconsistency between Condition 4(d), Schedule 5 of Development Consent DA 92/97 and any Condition in Schedule 3 of Development Consent DA 92/97, the latter prevails.

If agreed with the Secretary of the DPE, a revision to this SWB required under Development Consent DA 92/97 may be prepared without undertaking consultation with all parties nominated under the relevant Condition of Development Consent DA 92/97.

This SWB will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/), in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

10 REPORTING PROCEDURES

In accordance with Condition 2, Schedule 5 of Development Consent DA 92/97, MACH Energy has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance criteria.

These protocols are described in Section 5 of the WMP.

In accordance with Condition 8, Schedule 5 of Development Consent DA 92/97, MACH Energy will provide regular reporting on the environmental performance of the MPO on the MACH Energy website (https://machenergyaustralia.com.au/).

11 REFERENCES

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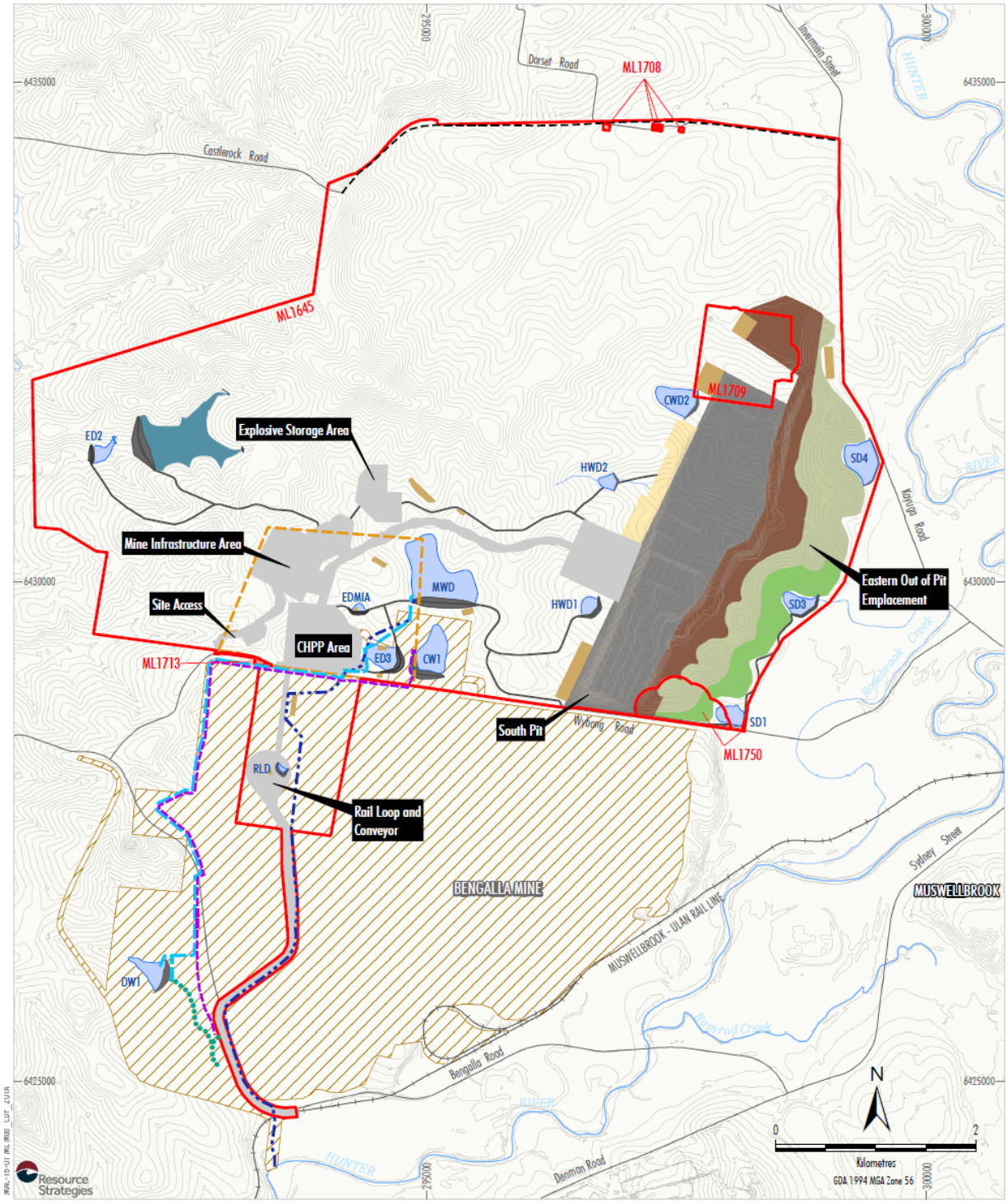
ATTACHMENT 1

APPENDIX 2 OF DEVELOPMENT CONSENT DA 92/97

APPENDIX 2
FIGURE 1 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2021



LEGEND

- Mining Lease Boundary
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Infrastructure Area Envelope
- Active Stripping Area
- Active Mining Area
- Active Overburden Emplacement Area
- Topsoil Stockpile
- Initial Rehabilitation
- Established Rehabilitation
- Infrastructure and Borrow/Stockpile Area
- Access Road
- Northern Link Road

Indicative Water Pipeline Alignment

- MPO Hunter River Supply Pipeline
- MPO DW1 Pipeline (Bi-directional)
- Bengalla Mine CW1 Pipeline
- Approximate Extent of Scour Protection
- Water Dam
- Fines Emplacement Area

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017); MACH Energy (2017)

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MOUNT PLEASANT OPERATION

FIGURE 2 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2025

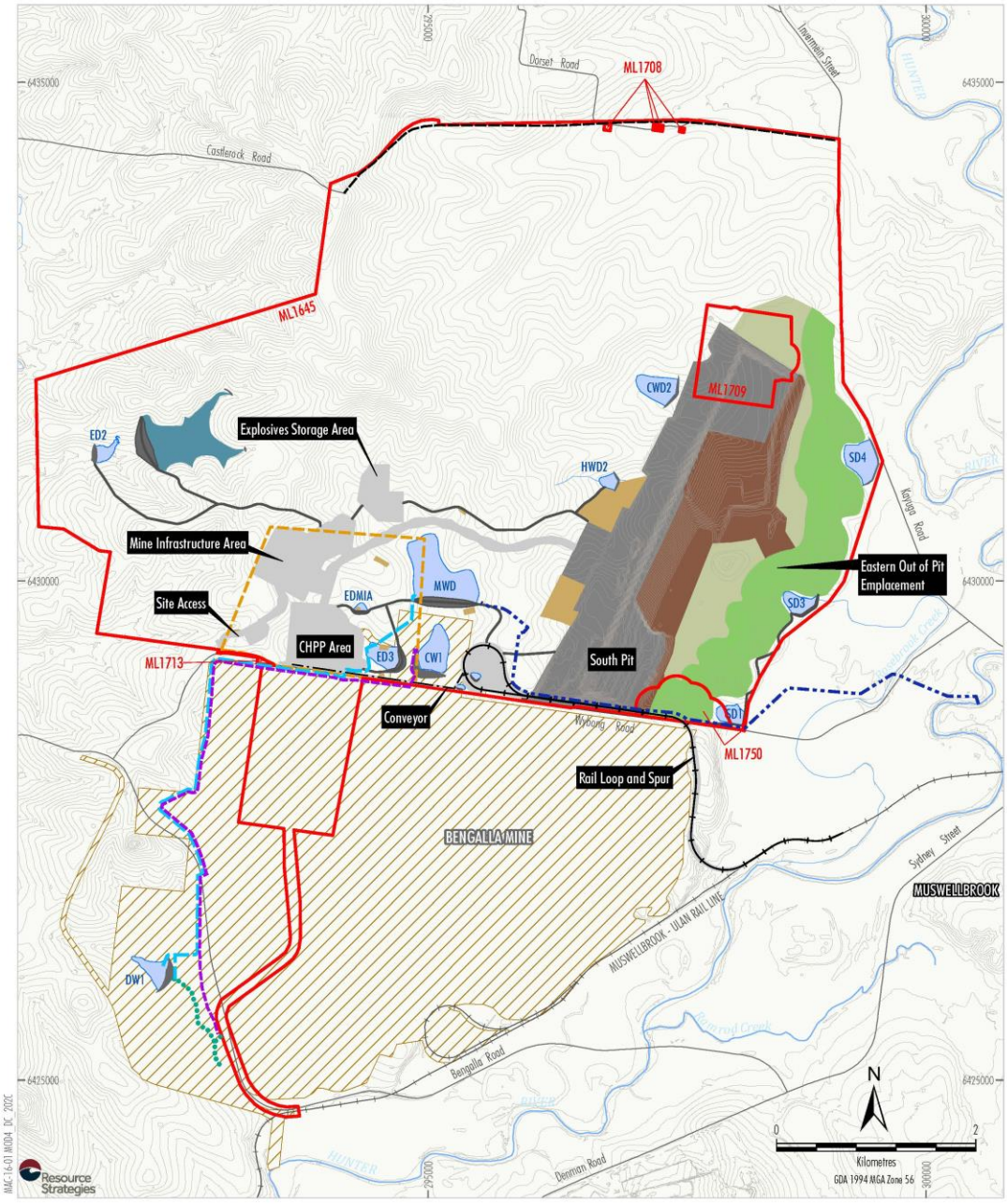
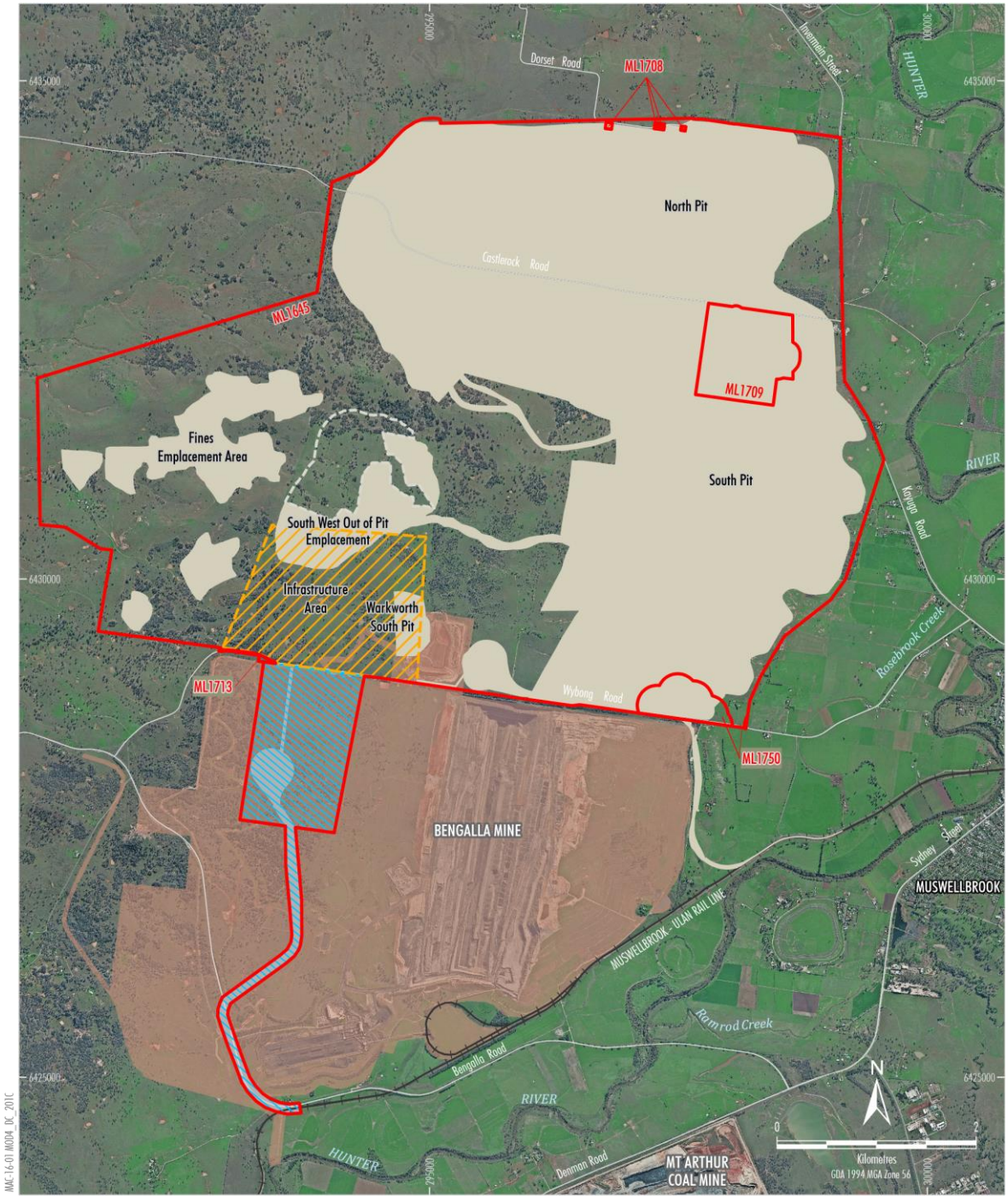


FIGURE 3 - APPROVED SURFACE DISTURBANCE PLAN



LEGEND

- Mining Lease Boundary
- Approximate Extent of Approved Surface Development [1]
- Area Relinquished for Overburden Emplacement and Major Infrastructure
- Infrastructure Area Envelope
- Infrastructure to be removed under the Terms of Condition 37, Schedule 3
- Indicative Existing Coal Transport Infrastructure
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)

NOTE

1. Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, offsite coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, signalling, other ancillary works and construction disturbance.

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2018); Department of Planning and Environment (2016); MACH Energy (2017)
Orthophoto: MACH Energy (Aug 2016)

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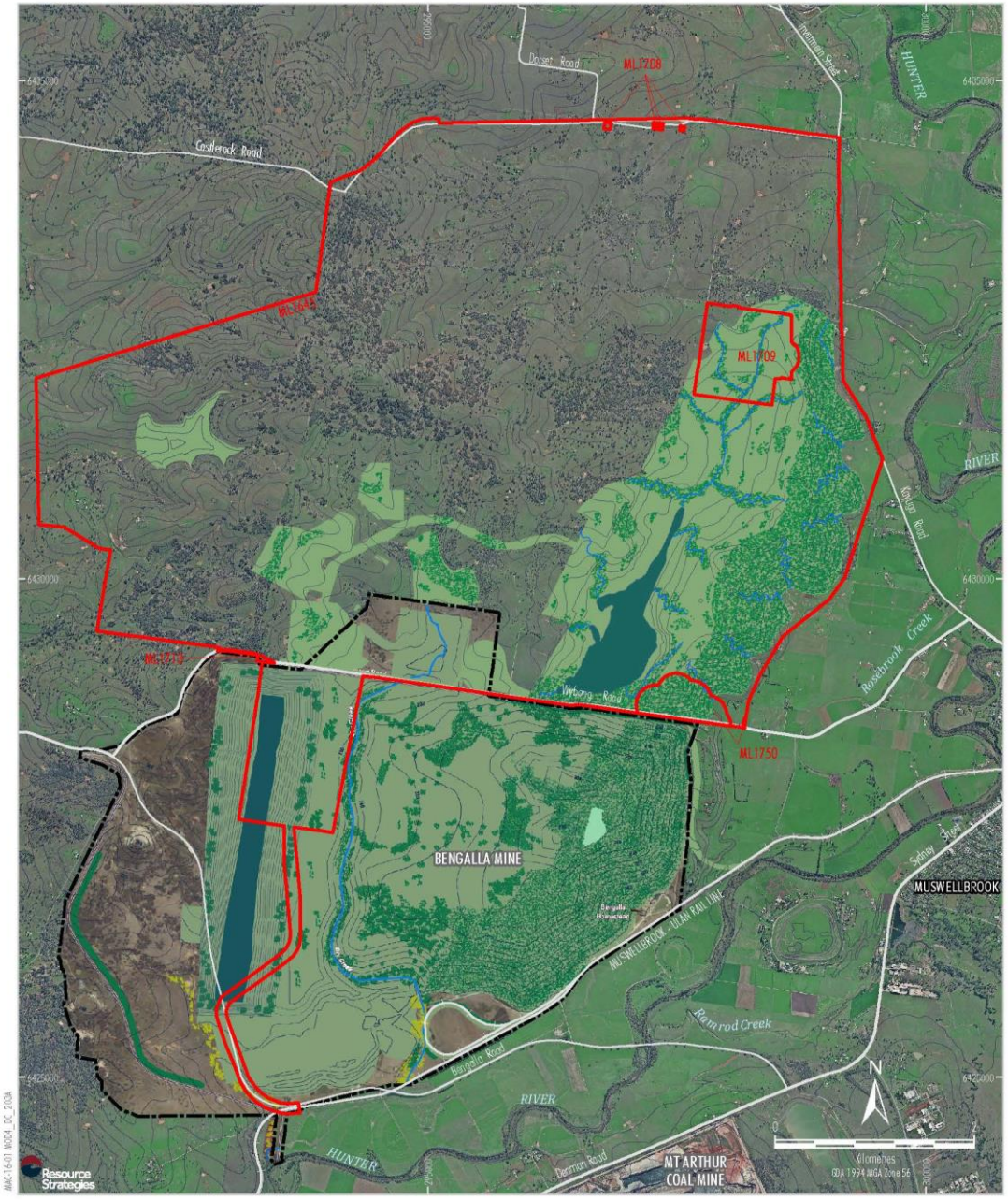
MOUNT PLEASANT OPERATION
Approved Surface Disturbance Plan

FIGURE 4 - CONCEPTUAL FINAL LANDFORM



APPENDIX 2

EROSION AND SEDIMENT CONTROL PLAN

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MOUNT PLEASANT OPERATION

EROSION AND SEDIMENT CONTROL PLAN

Document ID:	MP001-0000-ENV-PLN-0006		
Company:	MACH Energy Australia Pty Ltd		
Effective Date:	31 October 2019	**Status:**	Issued for Use
Approved By:	Andrew Reid	**Revision Number:**	02

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LIST OF ATTACHMENTS

1 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton (Figure 1). The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively (Figure 1). The proponent of the MPO is MACH Energy Australia Pty Ltd (MACH Energy), which purchased the MPO from Coal & Allied Operations Pty Ltd (Coal & Allied) in 2016.

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

The Mount Pleasant Project Modification (MOD 1) was submitted on 19 May 2010 with a supporting Environmental Assessment (EA) prepared by EMGA Mitchell McLennan (EMGA Mitchell McLennan, 2010). MOD 1 included the provision of an infrastructure envelope for siting the mine infrastructure, the provision of an optional conveyor/service corridor linking the MPO facilities with the Muswellbrook-Ulan Rail Line and modification of the existing Development Consent DA 92/97 boundaries to accommodate the optional conveyor/service corridor and minor administrative changes. MOD 1 was approved on 19 September 2011.

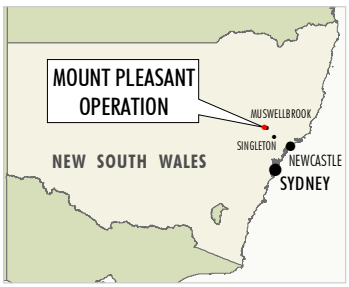
The MPO South Pit Haul Road Modification (MOD 2) was submitted on 30 January 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017a). MOD 2 proposed to realign an internal haul road to enable more efficient access to the South Pit open cut, with no other material changes to the approved MPO. MOD 2 was approved on 29 March 2017.

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

The MPO Rail Modification (MOD 4) was submitted on 18 December 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017c). MOD 4 proposed the following changes:

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

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



LEGEND

- Mining Operation
- Proposed Mining Operation
- Mining Lease Boundary (Mount Pleasant)
- Railway
- Local Government Boundary
- State Forest
- National Parks and Wildlife Estate

Source: © NSW Department of Finance, Services and Innovation (2018); Office of Environment and Heritage NSW (2018)

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MOUNT PLEASANT OPERATION

Project Location

Figure 1

MAC-16-01 MP2019_ Figure 1_ Rev A

1.1 PURPOSE AND SCOPE

This Erosion and Sediment Control Plan (ESCP) has been prepared by MACH Energy to satisfy the requirements under Development Consent DA 92/97 (as modified) and specifically Condition 28(b), Schedule 3.

This ESCP describes the management measures proposed to control potential erosion impacts associated with construction and operation of the MPO, including for example, initial establishment and development works, open cut mining, operation of the coal handling and preparation plant, rail spur/loop and Fines Emplacement Area, and the supply of water to the MPO.

The ESCP applies to all employees and contractors at the MPO and covers all areas within the MPO boundary. The ESCP applies to the life of the MPO, including (but not limited to) the period of mining operations specified in Development Consent DA 92/97, which currently permits mining until 22 December 2026. As required by Condition 5, Schedule 2 of Development Consent DA 92/97, the ESCP will continue to apply (excluding mining operations) beyond 22 December 2026, as required, until the rehabilitation and any additional undertakings (required by the Secretary of the NSW Department of Planning, Industry and Environment [DPIE], or the Division of Resources and Geoscience [DRG] within the DPIE) have been carried out satisfactorily.

This ESCP has been developed in-line with best practice erosion and sediment control measures listed in *Managing Urban Stormwater Soils and Construction Volume 1* (Landcom, 2004), *Managing Urban Stormwater Soils and Construction Volume 2E – Mines and quarries* (NSW Department of Environment and Climate Change [DECC], 2008), and the International Erosion Control Association (IECA) Australasian document, *Best Practice Erosion and Sediment Control* (IECA, 2008).

1.2 STRUCTURE OF THE ESCP

This ESCP is a component of the Water Management Plan (WMP) for the MPO.

The remainder of the ESCP is structured as follows:

- Section 2: Outlines the statutory obligations relevant to this ESCP.
- Section 3: Provides a description of the baseline data available for the MPO which relates to this ESCP.
- Section 4: Outlines the potential causes of soil erosion, sedimentation and flooding, relevant to the MPO.
- Section 5: Describes the MPO erosion and sediment control strategy.
- Section 6: Outlines the review process for MPO documentation, including in particular for this ESCP.
- Section 7: Outlines the reporting procedures proposed for the MPO.
- Section 8: Provides a list of references cited in this report.

2 STATUTORY OBLIGATIONS

The statutory obligations relevant to the MPO are contained in:

- the conditions of Development Consent DA 92/97 (as modified);
- the condition of the Commonwealth Approval EPBC 2011/5795;
- relevant licences (including Environment Protection Licence [EPL] 20850), permits and mining leases (MLs) (ML 1645, ML 1708, ML 1709, ML 1713 and ML 1750); and
- other relevant legislation.

Obligations relevant to this ESCP are described below.

2.1 DEVELOPMENT CONSENT DA 92/97

The conditions of Development Consent DA 92/97 relevant to the content and structure of this ESCP are described below. A comprehensive list of all conditions in Development Consent DA 92/97 relevant to water is provided in the WMP.

2.1.1 ESCP Requirements

Condition 28(b), Schedule 3 of Development Consent DA 92/97 requires the preparation of an ESCP as part of the WMP for the MPO (refer Table 1).

Table 1
ESCP Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 3	Section where addressed in this ESCP document
28. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary...The plan must include: *... (b) an Erosion and Sediment Control Plan, which must:*	
• *identify activities that could cause soil erosion, generate sediment or affect flooding;*	Section 4
• *describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters, and manage any flood risk;*	Section 5
• *describe the location, function, and capacity of erosion and sediment control structures;*	Section 5
• *describe what measures would be implemented to maintain the structures over time;*	Section 5

2.1.2 Management Plan (General) Requirements

Condition 2, Schedule 5 of Development Consent DA 92/97 outlines the general management plan requirements that are applicable to the preparation of the ESCP.

Table 2 presents these requirements and indicates where each is addressed within this ESCP.

Table 2
General Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 5	Section where addressed in this ESCP Document
2. The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 3
(b) a description of: • *the relevant statutory requirements (including any relevant consent, licence or lease conditions);*	Section 2
• *any relevant limits or performance measures/criteria;*	Surface Water Management Plan (SWMP) and Groundwater Management Plan (GWMP)
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	SWMP and GWMP
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 5
(d) a program to monitor and report on the: • *impacts and environmental performance of the development;* • *effectiveness of any management measures (see c above);*	Section 6
(e) a contingency plan to manage any unpredicted impacts and their consequences;	Surface and Ground Water Response Plan
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 6
(g) a protocol for managing and reporting any: • *incidents;* • *complaints;* • *non-compliances with statutory requirements; and* • *exceedances of the impact assessment criteria and/or performance criteria; and*	Section 7
(h) a protocol for periodic review of the plan. *Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*	Section 6

2.2 LICENCES, PERMITS AND LEASES

Water management at the MPO is conducted in accordance with a number of licences, permits and leases. Key licences, permits and leases relating to water at the MPO include:

- Water Access Licences (WAL 879, 880, 1113 and 41438) issued under the *Water Management Act, 2000*.
- Discharge credits (20) held under the NSW *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation, 2002.*
- ML 1645, ML 1708, ML 1709, ML 1713 and ML 1750 issued under Part 5 of the NSW *Mining Act, 1992* and approved by the Minister for Mineral Resources.

- Environment Protection Licence 20850 issued under Part 3 of the NSW *Protection of the Environment Operations Act, 1997* by the NSW Environment Protection Authority (EPA).
- The Mining Operations Plan, as required by ML conditions issued under the *Mining Act 1992* and approved by the DRG.

2.3 OTHER LEGISLATION

A description of other legislation relevant to MPO water management is provided in the WMP, SWMP and GWMP.

3 BASELINE DATA

3.1 SOIL TYPES

Soil type data derived across the MPO area from the 1997 EIS is summarised in Table 3 below.

Table 3
Summary of Soil Types

Soil Types	Characteristics
Alluvial – Floodplain Soils	Uniform medium or fine textured clay profile, consisting of clay loams, silty clay loam or light clay topsoils. Slightly to highly dispersive.
Drainage Flat / Drainage Line Soils	Brown solonised soils and brown and yellow solidic soils. Slightly dispersible topsoils and highly dispersible subsoils.
Hillslope Soils	Dominate the study area. Topsoils are stable though occasionally highly dispersible. Subsoils are highly dispersible.
Sandy Hillslope Soils	Sandy parent material. Topsoil in two layers: • Light sandy clay loam, loam fine sandy or fine sandy clay loam. • Clayey sand, sandy loam or light – fine sandy clay loam. Subsoil is sandy – light medium clay – slightly – highly dispersible.
Volcanic Hillslope Soils	Uniform structured clay soils. Topsoil is fine sandy clay loam or light clay. Subsoils consist of silty – light medium clays. Slight – moderate dispersibility.

Source: ERM Mitchell McCotter (1997).

More recently, Golder Associates (2016) compiled a Geotechnical Investigation Report on the MPO area. This investigation described the typical soil conditions found at the site as follows:

1. Vegetation cover throughout the site varies with grass cover in lower areas including gullies and flood plains.
2. Topsoil depth ranges from 0.2 metres (m) to 0.4 m depth. Topsoils generally comprise of sandy and/or silty clays.
3. Alluvial soils underlying the topsoil generally comprise cohesive soils and granular soils.
    I. Alluvial soils are predominately cohesive, comprising clay with varying quantities of silt and sand.
    II. Granular soils were only encountered on the lower slopes, towards the south-eastern portion of the site. Granular soils comprise a mixture of sand and gravel with up to 30% silts and clays.
4. Residual soils generally comprise clays derived from the weathering of the underlying sandstone and siltstone materials. Residual soils are generally less than 1 m in depth.
5. Bedrock encountered in the shallow excavations generally comprised sandstone or siltstone.

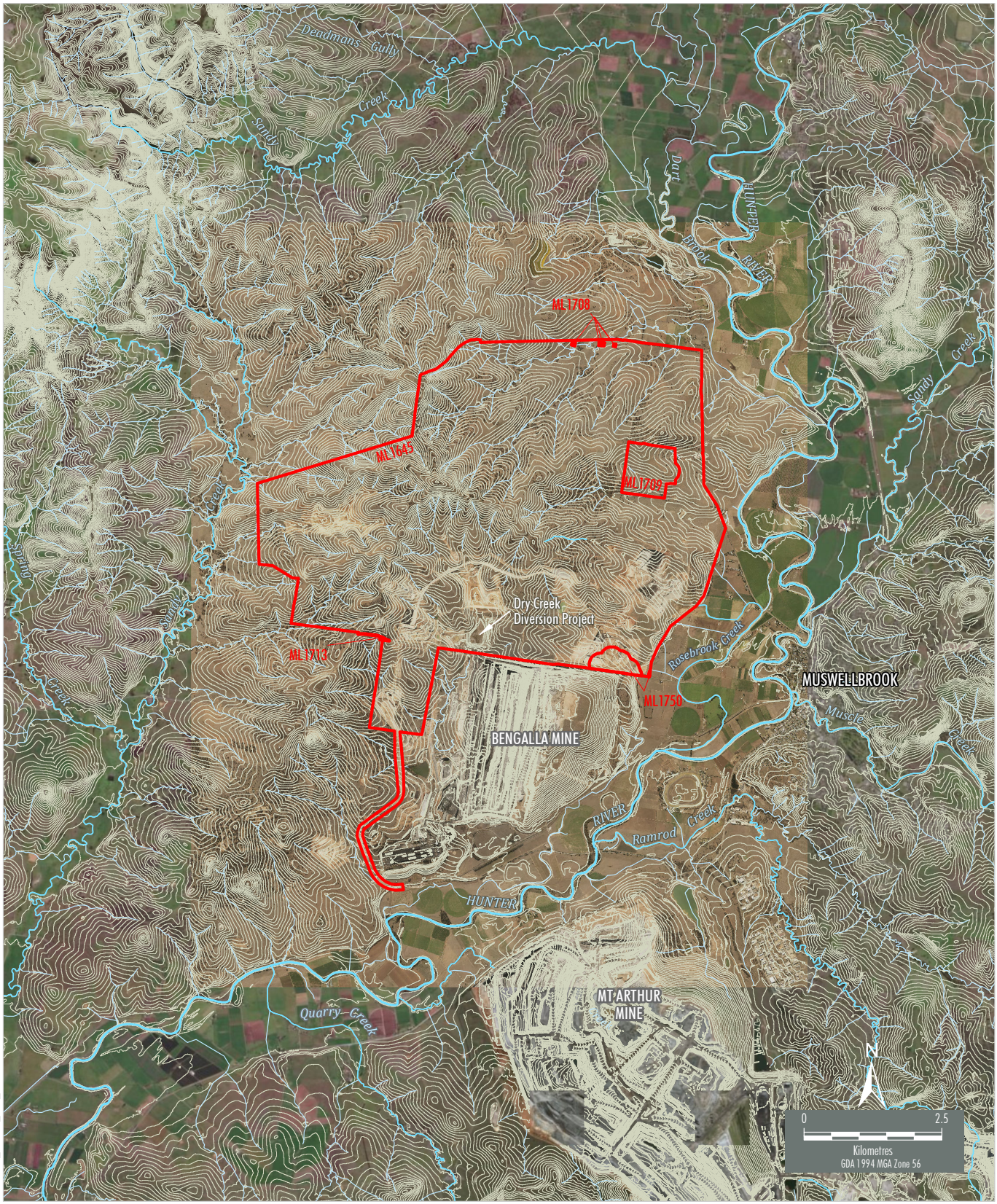
In the southern portion of the MPO area, deep alluvial soil deposits associated with the Hunter River system exist.

3.2 FLOOD EVENTS

The main drainage feature within the vicinity of the MPO is the Hunter River which flows in a southerly direction approximately 1 km to the east of the MPO ML boundary. There are a number of ephemeral drainage lines which traverse the MPO area and drain into the Hunter River. The eastern portion of the MPO area drains via Rosebrook Creek, as well as other unnamed drainages. Areas in the south and west of the MPO area drain via an unnamed drainage line (sometimes referred to as Dry Creek) and Sandy Creek respectively, both of which are tributaries of the Hunter River. All other areas drain into unnamed drainage lines, which flow directly into the Hunter River. Figure 2 shows the pre-mining drainage network and topography in the vicinity of the MPO.

In 2018, Royal HaskoningDHV completed a Muswellbrook Floodplain Risk Management Study on behalf of the Muswellbrook Shire Council (Royal HaskoningDHV, 2018). Royal HaskoningDHV (2018) determined the 1% Annual Exceedance Probability (AEP) flood extent for the Hunter River.

The 1% AEP flood extent, in conjunction with the Approximate Eastern Extent of Approved Surface Development of the MPO, and the proposed MOD 4 rail spur, are shown on Figure 3.



MAC-16-01_MP2019_ESCP_202A

LEGEND

Mining Lease Boundary

Contour (5 m Intervals)

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017)
Orthophoto: MACH Energy (Jul 2018); Esri, DigitalGlobe (2018)

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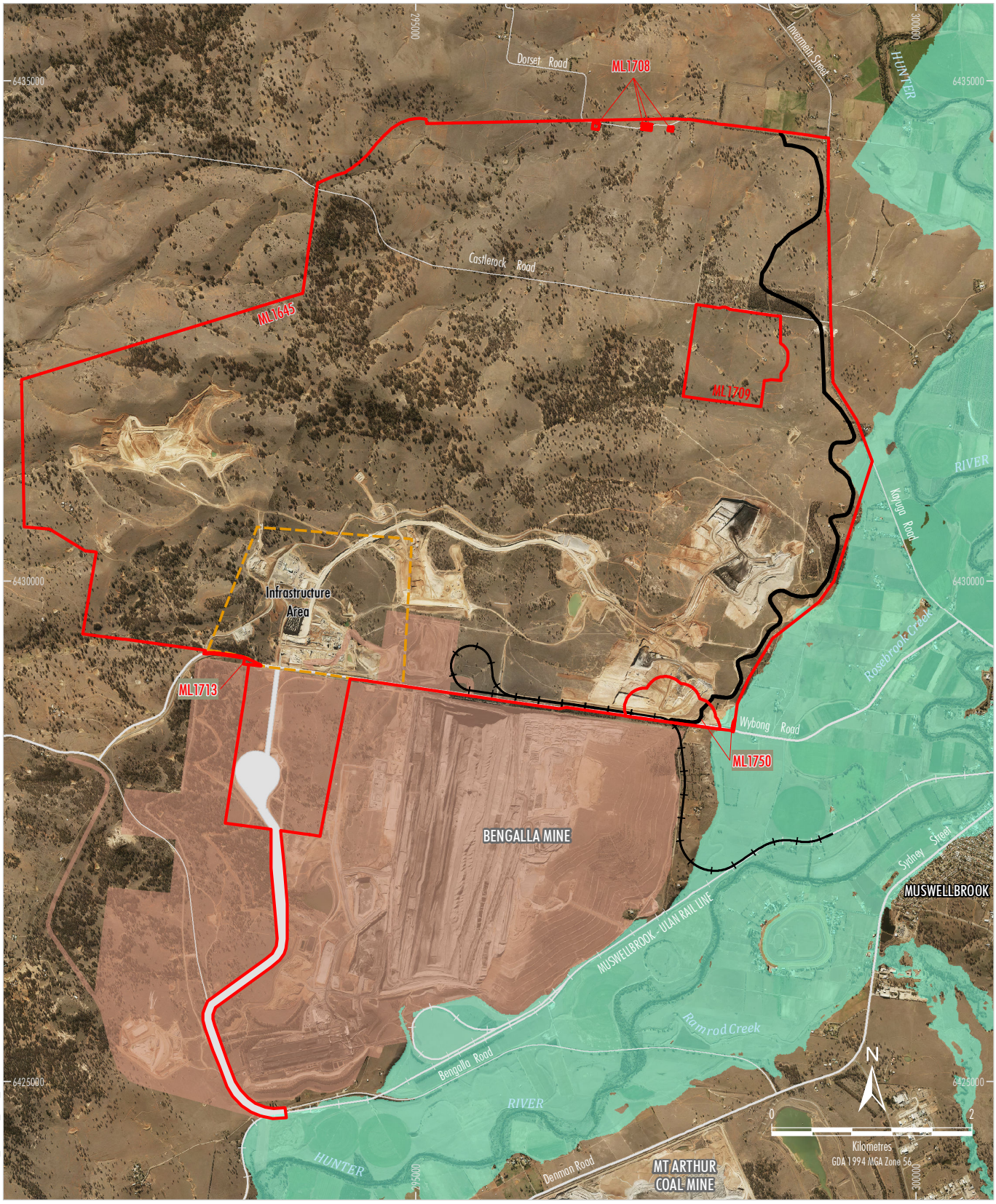
MOUNT PLEASANT OPERATION

Local Drainage Network and Topography

Figure 2



MAC-16-01_MP2019_ESCP_201A

LEGEND

- Mining Lease Boundary
- Infrastructure Area Envelope
- Eastern Extent of Approved Surface Development (1997 EIS Year 20, as modified)*
- MOD4 Approved Rail Spur Alignment
- Indicative Existing Coal Transport Infrastructure
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- 1% AEP Flood Extent #

Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, power supply, other ancillary works and construction disturbance.

The 1% AEP Flood Extent has been digitised from Royal Haskoning DHV (2018).

Source: NSW Land & Property Information (2017); NSW Division Resources & Energy (2017); Department of Planning and Environment (2016); Royal Haskoning DHV (2018) Orthophoto: MACH Energy (Jul 2018)

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MOUNT PLEASANT OPERATION

Hunter River - 1% AEP Flood Extent

Figure 3

4 POTENTIAL CAUSES OF SOIL EROSION, SEDIMENTATION AND FLOODING EFFECTS

Key activities that have the potential to cause or increase soil erosion and sedimentation at the MPO are disturbance of land and soils in relation to mining activities involving clearing, stripping and stockpiling activities. Specifically, these include:

- clearing and stripping of land prior to mining, or for other mining related activities;
- clearing of land for some Aboriginal archaeological surveys (i.e. scrapes);
- open cut mining activities including the placement of overburden and topsoil stockpiling;
- exploration activities;
- installation of services and infrastructure, including mine water dams, sumps and drains;
- changes to drainage lines and/or catchments, including upslope diversions;
- excavation of borrow areas and quarries for obtaining material for construction;
- management and rehabilitation of the Fines Emplacement Area;
- use of coal stockpiles and coal handling equipment including mobile equipment, coal crushing equipment, train loading infrastructure and conveyors;
- runoff from haul roads and access roads;
- vehicle and equipment movements; and
- earthworks associated with mine site rehabilitation.

4.1 FLOODING EFFECTS

As shown on Figure 3, the Eastern Extent of Approved Surface Development (incorporating the MPO major landforms) are located outside the 1% AEP flood extent for the Hunter River. Accordingly, the potential for the MPO major landforms to result in changes to flood depth, extent or velocity in the vicinity of the MPO is considered to be negligible.

Notwithstanding, the approved, but yet to be developed, MPO MOD 4 rail spur would cross the Hunter River floodplain, as defined by the 1% AEP flood extent (Figure 3). MACH Energy's proposed management of flood risks associated with the MOD 4 rail infrastructure (including the rail spur) is outlined in Section 5.5.

5 EROSION AND SEDIMENT CONTROL STRATEGY

Erosion and sediment controls are implemented at the MPO to mitigate the impacts of the proposed development on nearby watercourses and the surrounding environment. Standard erosion and sediment control techniques are designed and operated in accordance with the requirements of *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Volume 2E - Mines and Quarries* (DECC, 2008).

A summary of the general erosion and sediment control principles employed by MACH Energy to limit erosion on site are outlined in Section 5.1. In addition, site specific erosion and sediment control strategies are described in Section 5.2, and design criteria associated with the ESCP are described in Section 5.3.

5.1 GENERAL PRINCIPLES

The following general principles underpin MACH Energy's approach to erosion and sediment control at the site:

- Minimising surface disturbance and restricting access to undisturbed areas.
- Progressive rehabilitation/stabilisation of mining and infrastructure areas.
- Separation of runoff from disturbed and undisturbed areas, where practicable.
- Management of runoff from mining and infrastructure areas through the mine water management system.
- Construction of suitable erosion and sediment controls such as drains and sediment dams to control, contain and manage sediment laden surface runoff.

Development activities will generally occur in the following order:

1. Installation of a stabilised site access route.
2. Selective stripping and stockpiling of available topsoil.
3. Construction of diversion drains (typically upslope of disturbance areas) – these are only constructed where they significantly reduce the catchment reporting to disturbance areas.
4. Construction of appropriately sized sediment dams/sumps where required to provide for temporary retention of runoff from disturbance areas. Where practicable, existing farm dams, mine water dams and open cut pits will be preferentially utilised for this purpose.
5. Construction of collection drains (downslope of or within disturbance areas) where required, to convey runoff to sediment dams or other mine water storages.
6. Construction of sediment controls (e.g. sediment fences) downslope of disturbance and stockpile areas, where required.

Construction/development works and mining activities will only take place once appropriate erosion and sediment control measures are in place.

5.2 EROSION AND SEDIMENT CONTROL MEASURES

Typical erosion and sedimentation control strategies that will be implemented for construction, operation and rehabilitation activities at the MPO are described in the sections below. Specific erosion and sediment controls will be designed in conjunction with the design of water management systems.

The function and capacity of key erosion and sediment control structures (e.g. environmental and sediment dams) are described in Sections 4.1 and 4.2 of the Site Water Balance. The location of these features are shown on the Conceptual Project Layout Plans in Attachment 1.

5.2.1 Erosion and Sediment Control

The following erosion and sediment control measures will be implemented in all areas of the site where disturbance from construction/development and mining activities occurs:

- relevant internal approvals and permits will be obtained before commencement of surface disturbance in the construction stage and mining phase (e.g. Ground Disturbance Permits [GDPs]);
- the extent of disturbance (including trafficable areas) will be minimised and identified using appropriate pegging, barriers or signage;
- appropriate erosion and sediment controls will be approved and established prior to land disturbance and will remain in place until exposed areas are stabilised;
- runoff from undisturbed catchments will be diverted around the disturbance areas via diversion drains and banks to discharge into natural watercourses, where practical;
- runoff from disturbed areas will be diverted into sediment dams;
- drains, diversion banks and channels will be stabilised and scour protection will be provided as necessary;
- temporary erosion and sediment control measures will be used on-site and may include silt fences, hay bales, stacked timber with geotextile, jute mesh, check dams, cross banks, contour banks, armouring and straw mulching; and
- topsoil will be stockpiled for reuse and all stockpiles will be managed as described in Section 5.2.2.

Drainage considerations will be incorporated into the landform design plan to slow and direct water flow and minimise erosion. Diversion drains will be constructed as per MACH Energy design plans.

5.2.2 Soil Management

Topsoil management strategies are described in the approved MOP for the MPO and summarised below.

Topsoil Stripping

Topsoil stripping activities will be undertaken in a manner that minimises impacts to air quality, flora and fauna, and water quality due to erosion. Measures to reduce potential impacts of topsoil stripping on air quality, flora and fauna are described in the Air Quality and Greenhouse Gas Management Plan and Biodiversity Management Plan.

Examples of these measures include:

- Minimising the re-handling of topsoil material.
- Avoiding or postponing stripping activities if excessive dust lift off occurs.

- Spraying material having low moisture content with water prior to and/or during handling if necessary and practicable to control visible dust.
- Limiting vegetation clearance where practical.

Erosion and sediment controls that would be implemented to minimise potential impacts to downstream water quality are described in Section 5.2.1.

Topsoil will be stripped and salvaged to maximise its value for re-use in rehabilitation and will be guided by soil mapping and the suitable soil stripping depths. Prior to disturbance, the area will be stripped of topsoil.

Topsoil Management

Where possible, topsoil will be transported directly to rehabilitation areas. Where this is not possible, topsoil stockpiles will be established separate to the subsoil and away from active transport corridors. The stockpiles will be managed to maintain seed reserves and microbial soil associations. Level or gently sloping areas where available will be selected as stockpile sites to minimise erosion and potential soil loss.

Topsoil stockpiles will be established with sediment control measures such as those listed in Section 5.2.1, including installation of silt fences around stockpiles to control potential loss of stockpiled soil through erosion prior to vegetative stabilisation and construction of stockpiles with a “rough” surface condition to reduce erosion hazard.

5.2.3 Specific ESCPs

Specific erosion and sediment control plans (Specific ESCPs) may be required to be developed to accompany a GDP. A GDP is required for all proposed land disturbance works at the MPO. The GDP application process requires the person/s seeking the disturbance ‘the applicant’, provide a plan which adequately illustrates the location and type of all proposed erosion and sediment controls.

The preparation of specific ESCPs must be developed in accordance with this ESCP and in consultation with the MPO Environmental Superintendent.

5.3 DESIGN CRITERIA

Specific erosion and sediment controls to be implemented at the MPO include, but are not limited to:

- clean water diversion drains and banks;
- silt fences (or equivalent control);
- vegetated buffer strips; and
- sediment dams/basins.

Other *Blue Book* (Landcom, 2004) erosion and sediment control measures may be implemented at the MPO as required.

5.3.1 Clean Water Diversion Drains and Banks

Clean water runoff from undisturbed areas will be preferentially diverted around disturbed areas. Appropriate protection will be established at the down slope end of diversion drains, including level spreaders and other energy dissipation devices.

Additional planting of grass, small shrubs and riparian species will be implemented as necessary to maintain channel stability.

5.3.2 Silt Fences

Where necessary, silt fences will be constructed immediately down slope of areas to be disturbed to minimise the potential for sediment transport into receiving catchments and waterways. Silt fences will be constructed along site contours where practicable. The catchment areas of silt fences are to be limited by constructing the fences with small returns at 20 m intervals to create smaller contributing sub catchments (refer Figure SD 6-8 [Landcom, 2004] [Attachment 2]), unless otherwise approved in the GDP.

The requirement and location for silt fences will be assessed by the applicant of the GDP, in consultation with the MACH Environment Superintendent as part of the GDP process.

Silt fences are considered a temporary control measure and would only be utilised until they are no longer required or a more permanent control measure is installed.

5.3.3 Vegetated Buffer Strips

A vegetated buffer strip is a vegetated area (generally grass covered), provided around the perimeter of an earthworks footprint. The primary purpose of a vegetated buffer strip is to reduce sediment transportation by acting as a ‘sediment trap’.

A vegetated buffer strip shall generally be located adjacent to the earthworks clearance footprint. A visible structure, such as a fence, markers, or road, will generally be constructed around the buffer zone to clearly identify the area and prevent vehicle disturbance.

The vegetation within a vegetated buffer strip shall be maintained such that it remains effective in controlling bed load sediment runoff.

The requirement and utilisation of any proposed vegetative buffer strip will be assessed by the applicant of the GDP, in consultation with the MACH Environment Superintendent as part of the GDP process.

5.3.4 Sediment Dams

Sediment dams would be installed as required in order to capture and treat sediment laden runoff from disturbed areas prior to release off-site. The use of flocculants or other ameliorants to reduce suspended sediment content will be considered on a case-by-case basis.

Sediment dams will be designed with consideration given to soil and overburden characteristics and the contributing area of disturbance. The sediment dams will be sized in accordance with current recommended design standards in the following guidelines:

- *Managing Urban Stormwater, Soils and Construction Volume 1* (Landcom, 2004); and
- *Managing Urban Stormwater, Soils and Construction*, *Volume 2E – Mines and Quarries* (DECC, 2008).

The sediment dam volumes will be designed to comply with Table 6.1 of *Managing Urban Stormwater, Soils and Construction, Volume 2E – Mines and Quarries* (DECC, 2008) based on the following design standards and methodology:

- "Type D and F" sediment basins consistent with SD 6-4 from Landcom (2004) (Attachment 3).
- Embankment and spillway design standard will vary based on the duration of the disturbance of the sediment dam catchment, however, it is anticipated that most sediment dam catchments will be disturbed for greater than three years (including time for rehabilitation to adequately establish). Therefore, assuming a 'standard' receiving environment, the dam capacity must be designed to capture a 90th percentile 5-day duration rainfall event (39.35 mm for the MPO), with a spillway that is structurally sound for a 1 in 50 AEP rainfall event.
- Total sediment basin volume = settling zone volume + sediment storage volume. The sediment storage volume is the portion of the basin storage volume that progressively fills with sediment until the basin is de-silted. The settling zone is the minimum required free storage capacity that must be restored within 5 days after a runoff event.
- Sediment storage volume = 50% of settling zone volume.

The adopted design standard does not provide 100% containment for runoff from disturbed areas. Hence, it is possible and expected that overflows will occur from sediment dams if rainfall exceeds the design standard. The final design, type, location, function and capacity of all proposed sediment dams will be assessed by the applicant of the GDP, in consultation with the MACH Environment Superintendent, as part of the GDP process.

Sediment dams will be constructed prior to any land disturbance activities occurring, in accordance with the GDP and will be maintained during the duration of catchment disturbance. Sediment dams will be maintained in a drawn down state as far as practicable by transferring water to the mine water dams, with water to be used for dust suppression or other mine related purposes.

Level markers will be installed in sediment dams that are in place for longer durations (i.e. three years or more) to identify the required storage volumes. Dams will be dewatered as required, and in some cases, capacities may be increased to provide additional storage capacity if catchment areas or catchment disturbance changes.

Runoff from rehabilitated areas will be diverted to sediment dams for treatment until the water quality of surface runoff is suitable for release from the site, at which time the sediment dams may be decommissioned or active management (by dewatering and periodic de-silting) ceased. In the latter case, the sediment dams would remain in place in the longer term and become an asset for future land use.

5.4 MANAGEMENT OF EROSION AND SEDIMENT CONTROLS

MACH Energy will implement the following management measures in relation to environmental and sediment dams:

- Within 5 days following a rainfall event, sediment dams will be dewatered to the mine water system or to well-grassed areas where sufficient grassed buffer exists to prevent the migration of sediments to watercourses.
- Environmental and sediment dams will be maintained in between rainfall events to ensure sufficient capacity is available to manage the required rainfall intensity.
- Environmental and sediment dam batters will be appropriately stabilised to assist with minimising the potential for erosion of dam batters.

- Environmental and sediment dams that have the potential to spill to the environment will be inspected monthly and immediately after rainfall events with more than 20 mm in 24 hours. Dams will be inspected for capacity, structural integrity and effectiveness. Where inspections indicate substantial accumulation of sediment in a sediment dam, clean-out will be undertaken as soon as practicable so as to reinstate the minimum required volumes.

Each inspection will be documented with a summary of the identified maintenance requirements for each inspected dam.

5.5 MANAGEMENT OF FLOOD RISK

As described in Section 4.1, the MPO major landforms are not located within the Hunter River 1% AEP flood extent and are therefore predicted to have a negligible impact on flood depth, extent and velocity in the vicinity of the MPO.

Notwithstanding, the proposed, but yet to be developed, MPO MOD 4 rail spur would cross the Hunter River floodplain. MACH Energy has not yet completed the final design for the MOD 4 rail infrastructure, however, a conceptual mitigation design for the MOD 4 rail spur was modelled by WRM as part of the MOD 4 EA (WRM, 2017). WRM (2017) concluded that:

> *The model results show that the proposed rail spur has no adverse flood level and velocity impacts on private dwellings or commercial spaces for the 5% AEP and 1% AEP flood events.*

In accordance with Condition 44C, Schedule 3 of Development Consent DA 92/97, MACH Energy will design and construct the final MOD 4 rail infrastructure to meet the following performance criteria during a 1% AEP flood event:

a) no more than 0.1 m increase in flood levels on any privately-owned land;

b) no more than 0.01 m increase in flood levels at any privately-owned residence or commercial spaces;

c) no more than 0.01 m increase in flood levels at any public roads servicing privately-owned properties; and

d) no more than 0.1 m per second increase in flood velocities at privately-owned residences or commercial spaces.

In addition, MACH Energy will commission an independent review of the MOD 4 rail infrastructure, including any associated hydraulic structures. In accordance with Condition 44D, Schedule 3 of Development Consent DA 92/97, this review will:

a) be undertaken by suitably qualified and experienced persons;

b) be undertaken in consultation with OEH;

c) demonstrate that the final design meets the performance criteria in Condition 44C, Schedule 3 of Development Consent DA 92/97; and

d) be conducted and reported to the satisfaction of the Secretary of DPIE.

MACH Energy will submit a final report detailing the outcomes of the independent review to the Secretary of the DPIE. MACH Energy will not commence MOD 4 construction works until the final report has been approved.

5.6 MANAGEMENT OF EXISTING RAIL LOOP AND INFRASTRUCTURE CORRIDOR

In accordance with Condition 37, Schedule 3 of Development Consent DA 92/97, MACH Energy will remove all infrastructure associated with the development within ML 1645 south of Wybong Road, including infrastructure associated with the existing rail spur and loop (shown as 'Indicative Existing Coal Transport Infrastructure' in Figure 3). This is with the exception of infrastructure which the operator of the Bengalla Mine agrees, in writing, can remain in situ.

MACH Energy will stabilise redundant rail infrastructure areas within the footprint of the Bengalla Mine such that they do not pose an ongoing material source of dust emissions (i.e. seeding to establish a cover crop and/or application of a dust suppressant) prior to management of these areas being transferred to the Bengalla Mine.

Existing MPO rail spur erosion and sediment control water management structures (e.g. sediment fences) within the footprint of the Bengalla Mine will also be left in place, subject to agreement of the Bengalla Mine.

6 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

6.1 ANNUAL REVIEW

In accordance with Condition 3, Schedule 5 of Development Consent DA 92/97 MACH Energy will review and evaluate the environmental performance of the MPO by the end of March each year (for the preceding calendar year) (or other such timing as agreed by the Secretary of the DPIE).

In relation to water, the Annual Review will:

- include a review of the performance of erosion and sediment controls relating to the MPO over the past year, which includes a comparison of these results to evaluate compliance against the:
  - relevant statutory requirements, limits or performance measures/criteria (refer Section 2);
  - monitoring results of the previous years; and
  - relevant predictions in the EIS and MOD1, MOD2, MOD3 and MOD4 EAs;
- identify any water-related non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the water monitoring data over the life of the MPO;
- identify any discrepancies between the predicted and actual water impacts of the MPO, and analyse the potential cause of any significant discrepancies; and
- describe what water-related measures will be implemented over the next year to improve the environmental performance of the MPO.

The Annual Review will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/) in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

6.2 ESCP REVISION

In accordance with Condition 4, Schedule 5 of Development Consent DA 92/97, this ESCP will be reviewed, and if necessary revised (to the satisfaction of the Secretary of the DPIE), within three months of the submission of:

- an Annual Review (Condition 3, Schedule 5);
- an incident report (Condition 7, Schedule 5);
- an Independent Environmental Audit (Condition 9, Schedule 5); and
- any modification to the conditions of Development Consent DA 92/97[1].

Within 4 weeks of conducting a review of this ESCP, MACH Energy will advise the Secretary of the DPIE of the outcomes of the review, and submit any revised documents for the approval of the Secretary.

In accordance with Condition 4A, Schedule 5 of Development Consent DA 92/97, MACH Energy may submit a revised ESCP for the approval of the Secretary at any time, and may also submit any revision to this ESCP required under Development Consent DA 92/97 on a staged basis.

[1] Note that in the event of an inconsistency between Condition 4(d), Schedule 5 of Development Consent DA 92/97 and any Condition in Schedule 3, the latter prevails.

If agreed with the Secretary of the DPIE, a revision to this ESCP required under Development Consent DA 92/97 may be prepared without undertaking consultation with all parties nominated under the relevant Condition of Development Consent DA 92/97.

This ESCP will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/), in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

7 REPORTING PROCEDURES

In accordance with Condition 2, Schedule 5 of Development Consent DA 92/97, MACH Energy has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance criteria.

These protocols are described in Section 5 of the WMP.

In accordance with Condition 8, Schedule 5 of Development Consent DA 92/97, MACH Energy will provide regular reporting on the environmental performance of the MPO on the MACH Energy website (https://machenergyaustralia.com.au/).

8 REFERENCES

EMGA Mitchell McLennan (2010) *Mount Pleasant Project Modification, Environmental Assessment.*

Environmental Resources Management (ERM) Mitchell McCotter (1997) *Mount Pleasant Operation Environmental Impact Statement.*

Golder Associates (2016) *Mount Pleasant Mine – Geotechnical Investigation Report.*

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Landcom (2004) *Managing Urban Stormwater Soils and Construction Volume 1 Fourth Edition*. March 2004, NSW Government.

MACH Energy Australia Pty Ltd (2017a) *Mount Pleasant Operation (DA 92/97) – South Pit Haul Road Modification*.

MACH Energy Australia Pty Ltd (2017b) *Mount Pleasant Operation – Mine Optimisation Modification Environmental Assessment.*

MACH Energy (2017c) *Mount Pleasant Operation – Rail Modification Environmental Assessment.*

NSW Department of Environment and Climate Change (DECC) (2008) *Managing Urban Stormwater – Soils and Construction – Volume 2E Mines and Quarries*. June 2008.

Royal HaskoningDHV (2018) *Muswellbrook Floodplain Risk Management Study and Plan.*

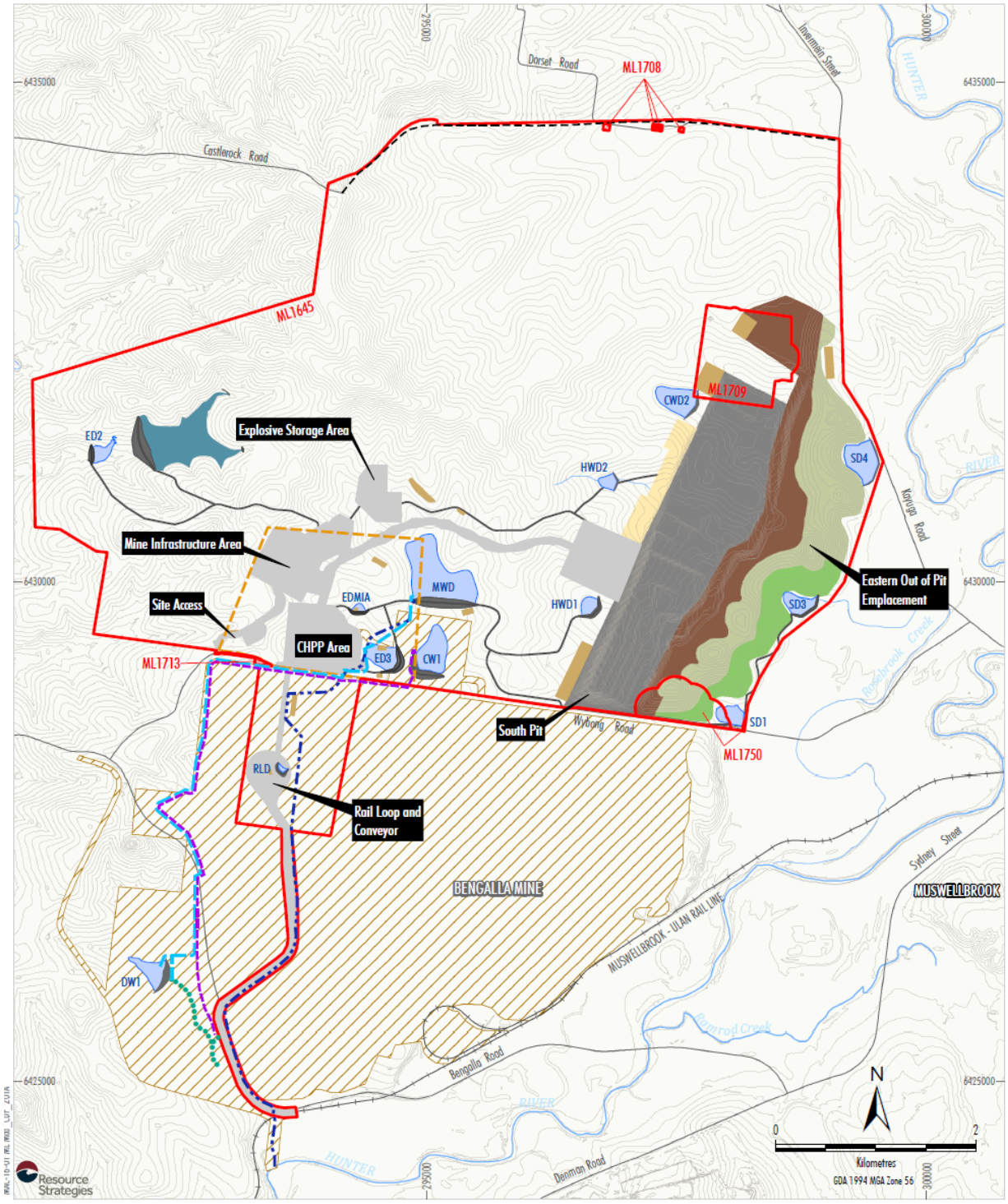
WorleyParsons Services Pty Ltd (2014) *Hunter River Flood Study (Muswellbrook to Denman)*. Prepared for the Muswellbrook Shire Council.

WRM (2018) *Mount Pleasant Operation Rail Modification Flood Assessment.*

ATTACHMENT 1

APPENDIX 2 OF DEVELOPMENT CONSENT DA 92/97

APPENDIX 2
FIGURE 1 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2021



LEGEND

- Mining Lease Boundary
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Infrastructure Area Envelope
- Active Stripping Area
- Active Mining Area
- Active Overburden Emplacement Area
- Topsoil Stockpile
- Initial Rehabilitation
- Established Rehabilitation
- Infrastructure and Borrow/Stockpile Area
- Access Road
- Northern Link Road

Indicative Water Pipeline Alignment

- MPO Hunter River Supply Pipeline
- MPO DW1 Pipeline (Bi-directional)
- Bengalla Mine CW1 Pipeline
- Approximate Extent of Scour Protection
- Water Dam
- Fines Emplacement Area

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017); MACH Energy (2017)

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MOUNT PLEASANT OPERATION

FIGURE 2 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2025

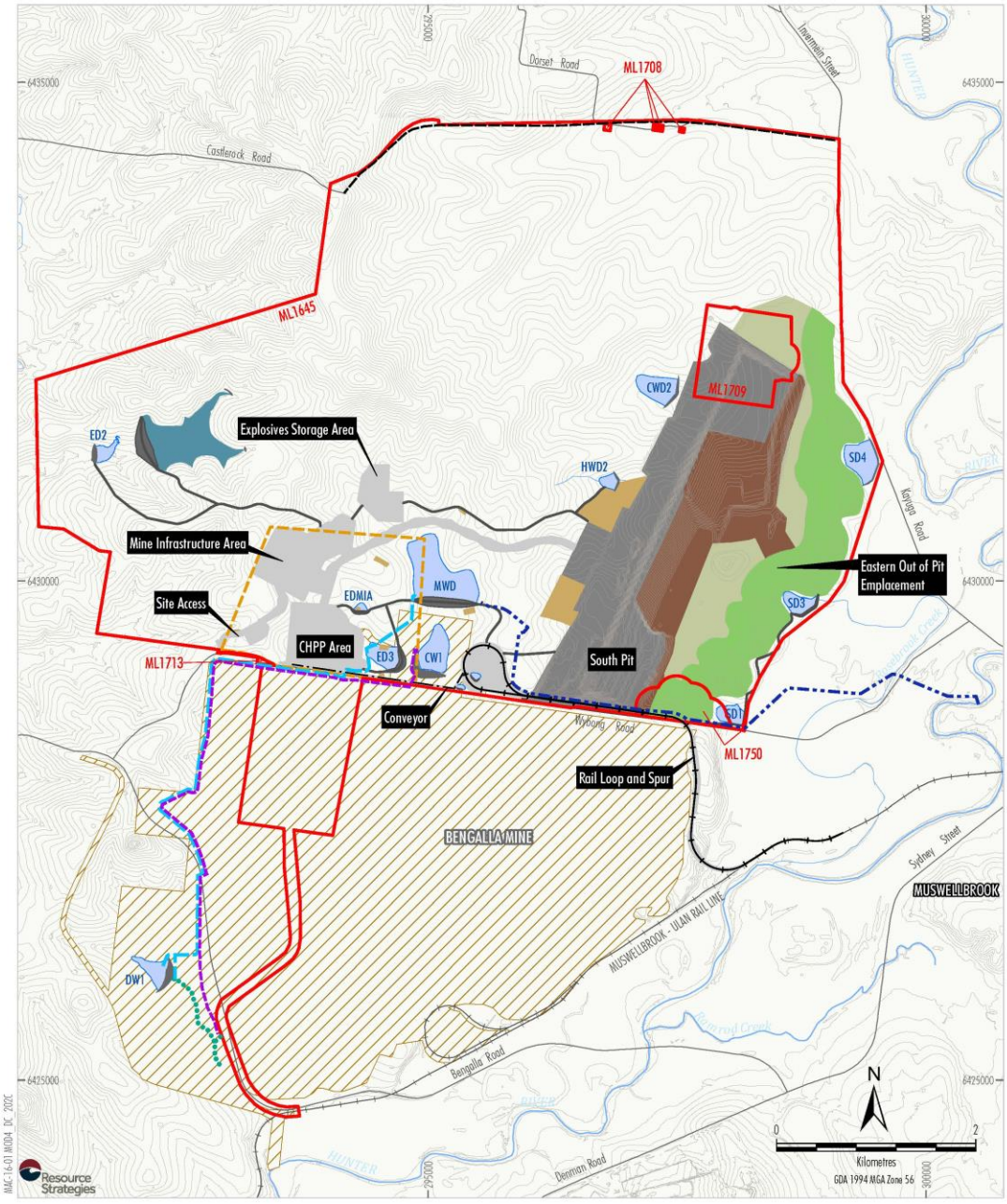
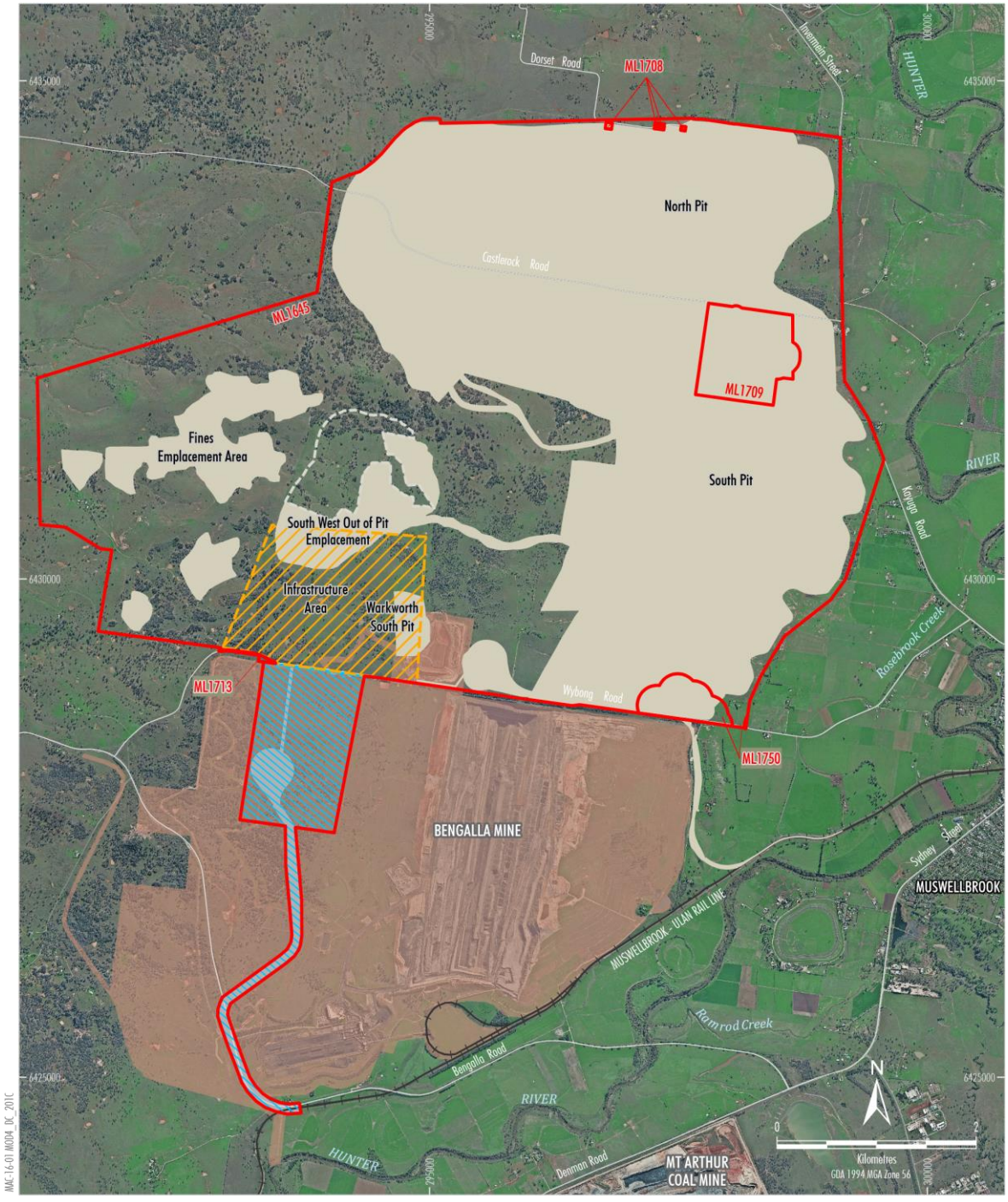


FIGURE 3 - APPROVED SURFACE DISTURBANCE PLAN



LEGEND

- Mining Lease Boundary
- Approximate Extent of Approved Surface Development [1]
- Area Relinquished for Overburden Emplacement and Major Infrastructure
- Infrastructure Area Envelope
- Infrastructure to be removed under the Terms of Condition 37, Schedule 3
- Indicative Existing Coal Transport Infrastructure
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)

NOTE

1. Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, offsite coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, signalling, other ancillary works and construction disturbance.

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2018); Department of Planning and Environment (2016); MACH Energy (2017)
Orthophoto: MACH Energy (Aug 2016)

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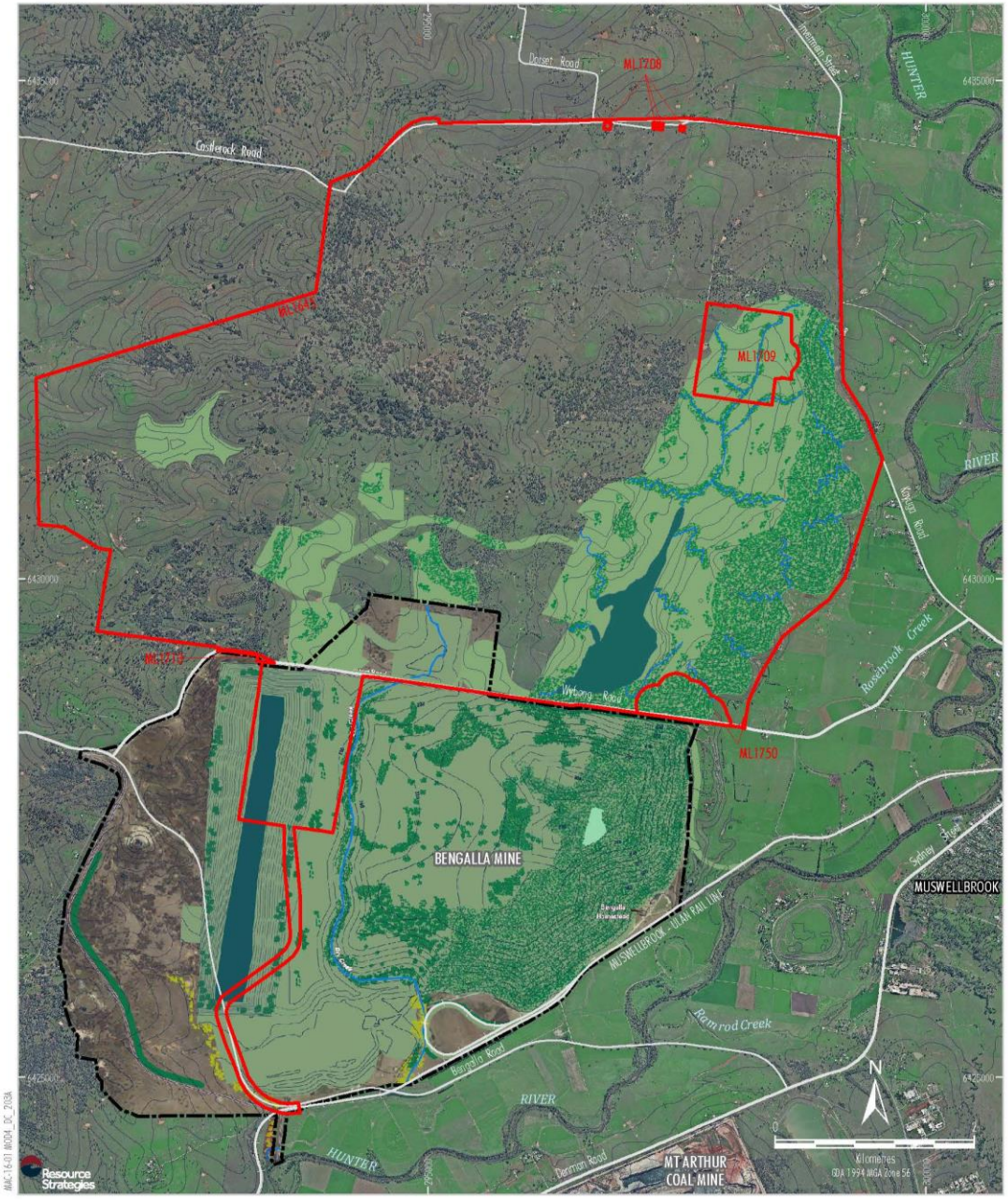
MOUNT PLEASANT OPERATION
Approved Surface Disturbance Plan

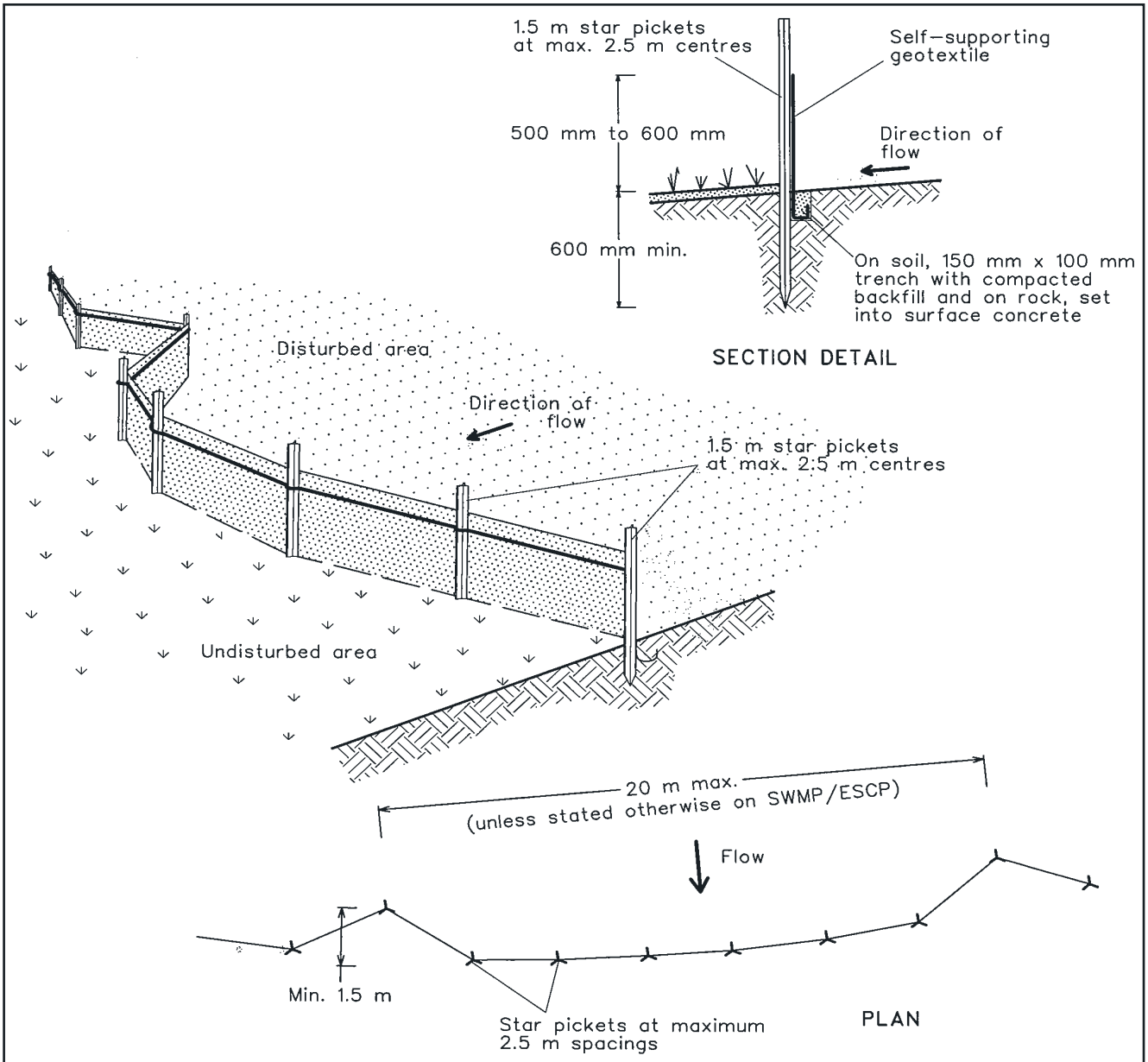
FIGURE 4 - CONCEPTUAL FINAL LANDFORM



ATTACHMENT 2

LANDCOM BLUE BOOK FIGURE SD6-8

(LANDCOM, 2004)



Construction Notes

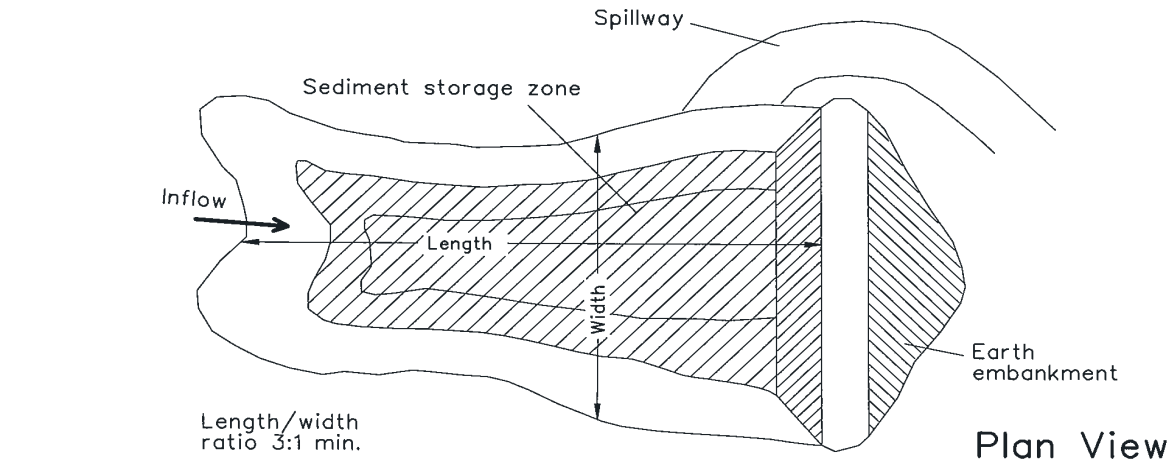
1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

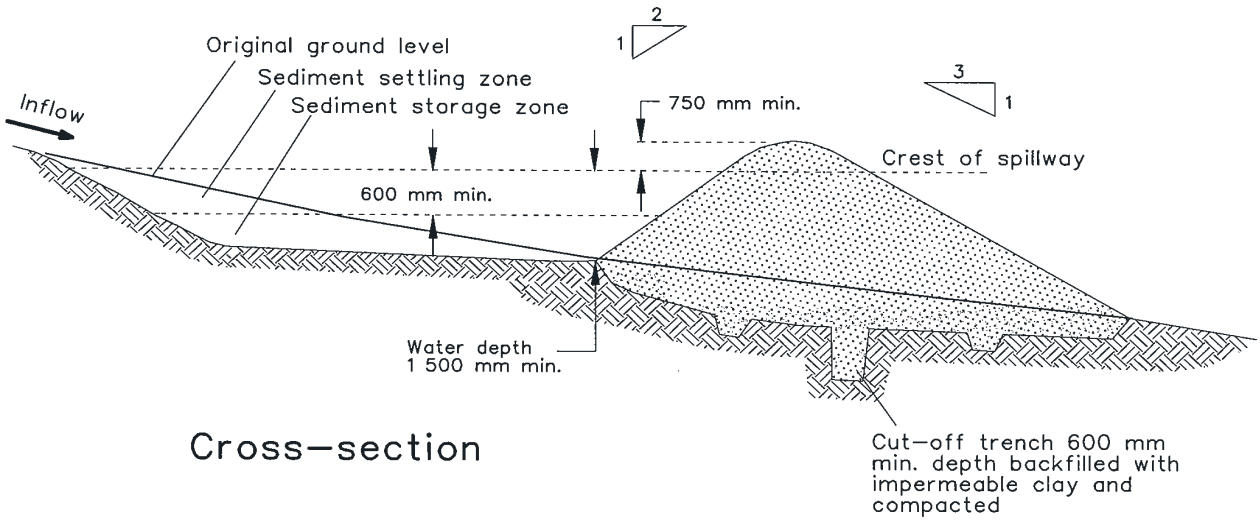
SEDIMENT FENCE — SD 6-8

ATTACHMENT 3

LANDCOM BLUE BOOK FIGURE SD6-4

(LANDCOM, 2004)





Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

SD 6-4

1.1 PURPOSE AND SCOPE

This Visual Impact Management Plan (VIMP) has been prepared by MACH Energy to satisfy the requirements under Development Consent DA 92/97 and specifically Condition 47, Schedule 3.

The VIMP applies to all employees and contractors at the MPO and covers all areas within the MPO boundary. The VIMP applies to the life of the MPO, including (but not limited to) the period of mining operations specified in Development Consent DA 92/97 (as modified), which currently permits mining until 22 December 2026. As required by Condition 5, Schedule 2 of Development Consent DA 92/97, the VIMP will continue to apply (excluding mining operations) beyond 22 December 2026, as required, until the rehabilitation and any additional undertakings (required by the Secretary of the NSW Department of Planning, Industry and the Environment (DPIE), or the Division of Resources and Geoscience [DRG] within the DPIE) have been carried out satisfactorily.

This VIMP has been prepared to manage visual impacts associated with construction and operation of the MPO, including for example, initial establishment and development, open cut mining, operation of the coal handling and preparation plant (CHPP), construction and operation of the rail spur/loop, construction and operation of the Fines Emplacement Area and rehabilitation.

The provisional general arrangement of the MPO at 2021 and 2025 (as per the Development Consent DA 92/97 [Attachment 1]), showing the key mine components relevant to this VIMP, are shown on Figures 2 and 3 respectively. These plans have been used to guide the management measures in this VIMP.

1.1.1 Previous Versions

A previous version of the Landscape Management Plan (LMP) (Version 6) was prepared by Coal & Allied and was approved on 23 July 2012.

The previously approved version of the LMP was prepared by MACH Energy to provide a contemporary outline of MACH Energy's proposed visual treatment of the MPO, following the approval of MOD 3.

1.1.2 Current Version

This VIMP has been prepared to replace the previously approved version of the LMP described in Section 1.1.1 following the approval of MOD 4. This VIMP describes additional visual impact management measures proposed for the MOD 4 rail infrastructure.

As required by Condition 47, Schedule 3 of Development Consent DA 92/97, a draft version of this VIMP was submitted to the Muswellbrook Shire Council (MSC) for the purpose of consultation. MSC provided comments on the draft VIMP on 12 July 2019, regarding visual screen monitoring, in-text references of the relevant sections/figures as well as the addition of indicative location of the train light screens in Figure 5. MSC's suggested text and figure edits were made. No material changes were made in relation to visual screen monitoring as the monitoring proposed is consistent with contemporary examples for other visual screens across the Hunter Valley.

As described in Section 8.2, this VIMP will be updated to include additional details regarding visual impact management measures relevant to MOD 4 rail infrastructure following completion of detailed design and approval of the Construction Environmental Management Plan.

APPENDIX 3

SURFACE WATER MANAGEMENT PLAN

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SURFACE WATER MANAGEMENT PLAN

Document ID:	MP001-0000-ENV-PLN-0006		
Company:	MACH Energy Australia Pty Ltd		
Effective Date:	31 October 2019	**Status:**	Issued for Use
Approved By:	Andrew Reid	**Revision Number:**	02

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1 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton (Figure 1). The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively (Figure 1). The proponent of the MPO is MACH Energy Australia Pty Ltd (MACH Energy), which purchased the MPO from Coal & Allied Operations Pty Ltd (Coal & Allied) in 2016.

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

The Mount Pleasant Project Modification (MOD 1) was submitted on 19 May 2010 with a supporting Environmental Assessment (EA) prepared by EMGA Mitchell McLennan (EMGA Mitchell McLennan, 2010). MOD 1 included the provision of an infrastructure envelope for siting the mine infrastructure, the provision of an optional conveyor/service corridor linking the MPO facilities with the Muswellbrook-Ulan Rail Line and modification of the existing Development Consent DA 92/97 boundaries to accommodate the optional conveyor/service corridor and minor administrative changes. MOD 1 was approved on 19 September 2011.

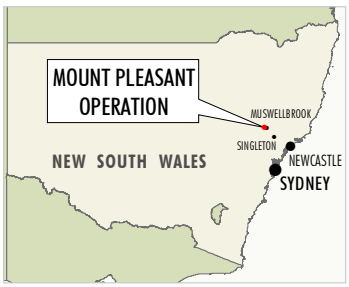
The MPO South Pit Haul Road Modification (MOD 2) was submitted on 30 January 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017a). MOD 2 proposed to realign an internal haul road to enable more efficient access to the South Pit open cut, with no other material changes to the approved MPO. MOD 2 was approved on 29 March 2017.

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

The MPO Rail Modification (MOD 4) was submitted on 18 December 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017c). MOD 4 proposed the following changes:

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

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



LEGEND

- Mining Operation
- Proposed Mining Operation
- Mining Lease Boundary (Mount Pleasant)
- Railway
- Local Government Boundary
- State Forest
- National Parks and Wildlife Estate

Source: © NSW Department of Finance, Services and Innovation (2018); Office of Environment and Heritage NSW (2018)

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MOUNT PLEASANT OPERATION

Project Location

Figure 1

MAC-16-01 MP2019_ Figure 1_ Rev A

1.1 PURPOSE AND SCOPE

This Surface Water Management Plan (SWMP) has been prepared by MACH Energy to satisfy the requirements under Development Consent DA 92/97 (as modified) and specifically Condition 28(c), Schedule 3.

The SWMP applies to all employees and contractors at the MPO and covers all areas within the MPO boundary. The SMP applies to the life of the MPO, including (but not limited to) the period of mining operations specified in Development Consent DA 92/97, which currently permits mining until 22 December 2026. As required by Condition 5, Schedule 2 of Development Consent DA 92/97, the SWMP will continue to apply (excluding mining operations) beyond 22 December 2026, as required, until the rehabilitation and any additional undertakings (required by the Secretary of the Department of Planning, Industry and the Environment [DPIE], or the Division of Resources and Geoscience [DRG] within the DPIE) have been carried out satisfactorily.

This SWMP has been prepared to manage surface water related impacts associated with construction and operation of the MPO, including for example, initial establishment and development works, open cut mining, operation of the coal handling and preparation plant (CHPP), rail spur/loop, and Fines Emplacement Area, and the supply of water to the MPO.

1.2 STRUCTURE OF THE SWMP

This SWMP is a component of the Water Management Plan (WMP) for the MPO.

The remainder of the SWMP is structured as follows:

- Section 2: Outlines the statutory obligations relevant to this SWMP.
- Section 3: Describes the existing environment including regional and local drainage network.
- Section 4: Provides a description of the baseline data available for the MPO which relates to this SWMP.
- Section 5: Describes the surface water management measures implemented at the MPO.
- Section 6: Outlines the surface water impact trigger levels proposed for the MPO.
- Section 7: Describes the surface water monitoring program proposed for the MPO.
- Section 8: Describes the review process for MPO documentation, including in particular for this SWMP.
- Section 9: Outlines the reporting procedures proposed for the MPO.
- Section 10: Provides a list of the references cited in this report.

2 STATUTORY OBLIGATIONS

MACH Energy's statutory obligations are contained in:

- the conditions of Development Consent DA 92/97 (as modified);
- the condition of the Commonwealth Approval EPBC 2011/5795;
- relevant licences (including Environment Protection Licence [EPL] 20850), permits and mining leases (mining leases 1645, 1708, 1709, 1713 and 1750); and
- other relevant legislation.

Obligations relevant to this SWMP are described below.

2.1 DEVELOPMENT CONSENT DA 92/97

The conditions of Development Consent DA 92/97 relevant to the content and structure of this SWMP are described below. A comprehensive list of all conditions in Development Consent DA 92/97 relevant to the water is provided in the WMP.

2.1.1 SWMP Requirements

Condition 28(c), Schedule 3 of Development Consent DA 92/97 requires the preparation of a SWMP as part of the WMP for the Project (refer Table 1).

Table 1
SWMP Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 3	Section where addressed in this SWMP Document
28. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with DoI Water and EPA, and be submitted to the Secretary for approval by 30 June 2019, unless otherwise agreed by the Secretary. *The plan must include:* *...* *(c) a Surface Water Management Plan, which must include:*	
• *detailed baseline data on surface water flows and quality in creeks and other waterbodies that could potentially be affected by the development;*	Section 4
• *surface water and stream health impact assessment criteria including trigger levels for investigating any potentially adverse surface water impacts;*	Section 6
• *a program to monitor and maintain the bridge openings and culverts associated with the MOD 4 rail infrastructure and ensure that they remain clear of blockages;*	Section 7.6
• *a program to monitor surface water flows and quality in the watercourses that could be affected by the project; and*	Section 7
• *reporting procedures for the results of the monitoring program;*	Sections 8 and 9

2.1.2 Management Plan (General) Requirements

Condition 2, Schedule 5 of Development Consent DA 92/97 outlines the general management plan requirements that are applicable to the preparation of the SWMP.

Table 2 presents these requirements and indicates where each is addressed within this SWMP.

Table 2
General Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 5	Section where addressed in this SWMP Document
2. The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 4
(b) a description of: • *the relevant statutory requirements (including any relevant consent, licence or lease conditions);*	Section 2
• *any relevant limits or performance measures/criteria;*	Section 6
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	Section 6
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 5
(d) a program to monitor and report on the: • *impacts and environmental performance of the development;* • *effectiveness of any management measures (see c above);*	Sections 7 and 8
(e) a contingency plan to manage any unpredicted impacts and their consequences;	Surface and Ground Water Response Plan (SGWRP)
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 8
(g) a protocol for managing and reporting any: • *incidents;* • *complaints;* • *non-compliances with statutory requirements; and* • *exceedances of the impact assessment criteria and/or performance criteria; and*	Section 9
(h) a protocol for periodic review of the plan. *Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*	Section 8

2.2 LICENCES, PERMITS AND LEASES

Water management at the MPO is conducted in accordance with a number of licences, permits and leases. Key licences, permits and leases relating to water at the MPO include:

- Water Access Licences (WAL 879, 880, 1113 and 41438) issued under the *Water Management Act, 2000*.
- Discharge credits (20) held under the NSW *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation, 2002* (HRSTS).
- Mining leases 1645, 1708, 1709, 1713 and 1750 issued under Part 5 of the NSW *Mining Act, 1992* and approved by the Minister for Mineral Resources.
- Environment Protection Licence (EPL) 20850 issued under Part 3 of the NSW *Protection of the Environment Operations Act, 1997* by the NSW Environment Protection Authority (EPA).
- The Mining Operations Plan, as required by mining lease conditions issued under the *Mining Act, 1992* and approved by the DRG.

2.3 OTHER LEGISLATION / GUIDELINES / POLICY / PLANS

Other NSW Acts, Regulations and policies that may be applicable to the SWMP for the MPO are summarised in the following sub-sections.

2.3.1 Water Management Act, 2000

The *Water Management Act, 2000* aims to provide sustainable and integrated management of the water sources of NSW for the benefit of both present and future generations.

The MPO is located in the Hunter Catchment, and is regulated under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* and the *Water Sharing Plan for the Hunter Regulated River Water Source 2016*.

The water sharing plans contain various rules applying to surface water sources in the MPO, such as access licence dealing rules, water supply works approval rules, water allocation account rules and access rules for rivers and creeks.

2.3.2 ANZECC/ARMCANZ (2000) Guidelines

The Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000) provide a national benchmark for assessing water quality in systems throughout Australia and New Zealand. The ANZECC & ARMCANZ (2000) guidelines provide guidance for developing local guidelines or strategies such as catchment water quality and river flow objectives (see Section 2.3.3).

2.3.3 NSW Water Quality and River Flow Objectives

The NSW Water Quality and River Flow Objectives (NSW Office of Environment and Heritage [OEH], 2006) have been developed to guide plans and actions to achieve healthy waterways in NSW. Each objective is based on providing the right water quality for the environment and the different beneficial uses of the water. They are based on measurable environmental values, which are those values or uses of water that the community believes are important for a healthy ecosystem for public benefit, welfare, safety or health. The target concentrations for each water quality objective are based on ANZECC & ARMCANZ (2000).

2.3.4 Hunter River Salinity Trading Scheme

The HRSTS was originally established by the then Department of Land and Water Conservation and Hunter River Trust in 1995 as a pilot trial to manage salinity discharges to the Hunter River, such that salt concentrations would be held below irrigation and environmental standards.

The scheme is now managed by the NSW EPA under a statutory regulation attached to the *Protection of Environmental Operations Act, 1997*. The regulation came into effect on 1 December 2002. The stated objectives of the HRSTS are:

a) *to minimise the impact of discharges of saline water on irrigation, other water uses and on aquatic ecosystems in the Hunter River catchment:*
    i. *at the lowest overall cost to the community, and*
    ii. *in a way that provides ongoing financial incentives to reduce pollution, and*
b) *to facilitate sustainable water management by industry in the Hunter River catchment.*

The HRSTS achieves these objectives by prohibiting the release of saline water during periods of low flow in the Hunter River and controlling releases of saline water during periods of high flow in the Hunter River such that specific salinity targets at various points in the river are not exceeded.

Participants in the HRSTS are issued with tradeable discharge credits. Each credit entitles the holder to a share of the available salt discharge capacity announced by WaterNSW during high flow periods.

Discharges at the MPO would be undertaken in accordance with the HRSTS and EPL 20850. MACH Energy currently holds 20 discharge credits.

2.3.5 Local Policy and Plans

Local land service plans and policies for the Hunter region have been considered in the development of this SWMP. The key plan is the *Hunter-Central Rivers Catchment Action Plan 2013 – 2023* (Hunter Central Rivers Catchment Management Authority, 2013). This plan provides a direction for all government, industry and community actions in the region to maintain the health of natural systems in the region. The goals, targets and outcomes of the *Hunter-Central Rivers Catchment Action Plan 2013 – 2023* have been considered where relevant in the preparation of this SWMP.

3 EXISTING ENVIRONMENT

3.1 REGIONAL DRAINAGE NETWORK

The MPO is located within the Hunter Catchment. The Hunter Catchment has an overall size of 21,500 square kilometres (km^2), and includes the city of Newcastle and the major towns of Singleton and Muswellbrook. The Hunter River 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.

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. Alluvial floodplains ranging in width from 1.5 to 2 km border the river over the majority of its length. The eastern extent of the MPO mining lease boundary is located directly adjacent to these floodplains.

The Hunter River is regulated by two major storages, the Glenbawn and the Glennies Creek Dams. The Glenbawn Dam is located approximately 16 km north-east of the MPO mining lease boundary. 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 megalitres (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 MPO mining lease boundary and has a capacity of 283,000 ML (WaterNSW, 2018b).

3.2 LOCAL DRAINAGE NETWORK

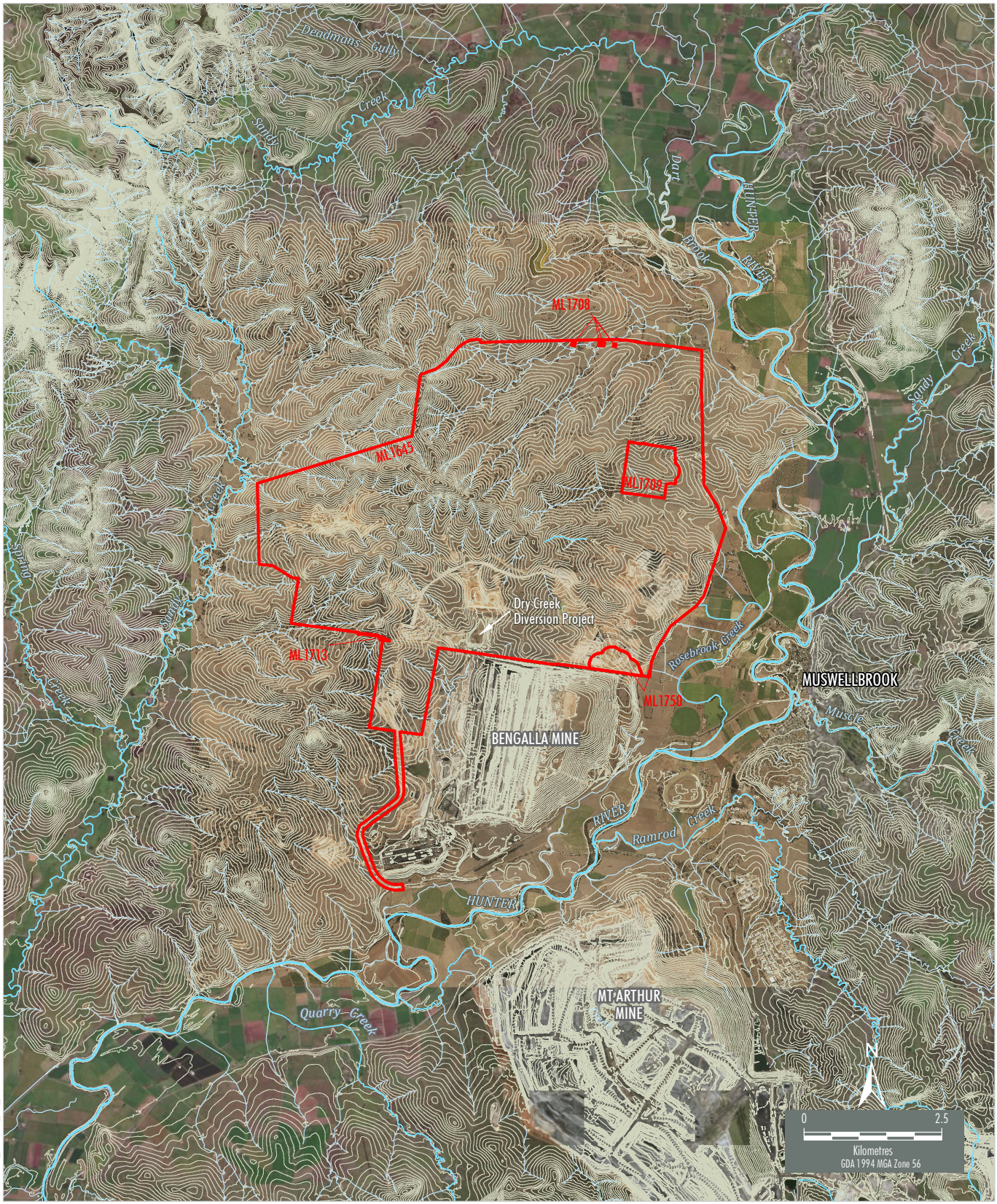
The pre-mining local drainage network in the vicinity of the MPO is shown on Figure 2.

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

The main drainage feature within the vicinity of the MPO is the Hunter River which flows in a southerly direction approximately 1 km to the east of the MPO mining lease boundary. There are a number of ephemeral drainage lines which traverse the MPO area and drain into the Hunter River. The eastern portion of the MPO area drains via Rosebrook Creek, as well as other unnamed drainages. Areas in the south and west of the MPO area drain via an unnamed drainage line (sometimes referred to as Dry Creek) and Sandy Creek respectively, both of which are tributaries of the Hunter River. All other areas drain into unnamed drainage lines, which also flow to the Hunter River.

The Bengalla Mine's Dry Creek Project diverts the unnamed drainage line that drains the south of the MPO area (Figure 2). The Dry Creek 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. The Bengalla Mining Company (BMC) monitors a number of unnamed drainage lines and the Hunter River, downstream of the MPO. Relevant monitoring information from the Bengalla Mine has been considered in this SWMP.

Part of Mangoola Coal is located within the Sandy Creek catchment. Accordingly, Mangoola Coal Operations Pty Limited (MCO) undertake surface water and stream health monitoring in Sandy Creek. Relevant monitoring information has been considered in this SWMP.



MAC-16-01_MP2019_SW_202A

LEGEND

Mining Lease Boundary

Contour (5 m Intervals)

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017)
Orthophoto: MACH Energy (Jul 2018); Esri, DigitalGlobe (2018)

MACHEnergy

MOUNT PLEASANT OPERATION

Local Drainage Network and Topography

Figure 2

4 BASELINE DATA

Surface water monitoring was undertaken from January 1993 to December 1995 to inform the EIS Water Management Study. The results of this monitoring are presented in PPK Environment & Infrastructure (1997) and included creeks and other waterbodies in the vicinity of the MPO.

The collection of surface water monitoring data at the MPO resumed in 2000 at ten monitoring locations. For the purposes of this plan, baseline monitoring is taken as the period up to and including July 2016. Construction at the MPO commenced in November 2016. Sampling locations used to establish baseline data in the MPO surface water monitoring network are summarised in Table 3 and shown on Figure 3.

Table 3
Baseline Surface Water Monitoring Locations

Site	Watercourse	Baseline Period of Record
W1	Hunter River	July 2000 – October 2011
W2	Hunter River	July 2000 – July 2016
W3	Hunter River	July 2000 – July 2016*
W4	Muscle Creek	July 2000 – July 2016
W5	Unnamed Drainage Line	July 2000 – July 2016
W6#	Hunter River	July 2000 – April 2015
W7	Unnamed Drainage Line	July 2000 – July 2016
W8^	Unnamed Drainage Line	July 2000 – July 2016
W9	Unnamed Drainage Line	July 2000 – July 2016
W10^	Unnamed Drainage Line (Dry Creek)	July 2000 – July 2016

* Located adjacent to Department of Primary Industry – Water (DPI – Water) gauging station. Only monitored intermittently for laboratory analysis.

^ Note these monitoring locations have since been disturbed by mining activities and are therefore no longer monitored (Figure 3).

Note this monitoring site has been replaced by Site W6A, as outlined in Section 7.3.

Other baseline monitoring data and assessments undertaken for creeks and other waterbodies by surrounding mining operations have also been utilised where available including (Figure 3):

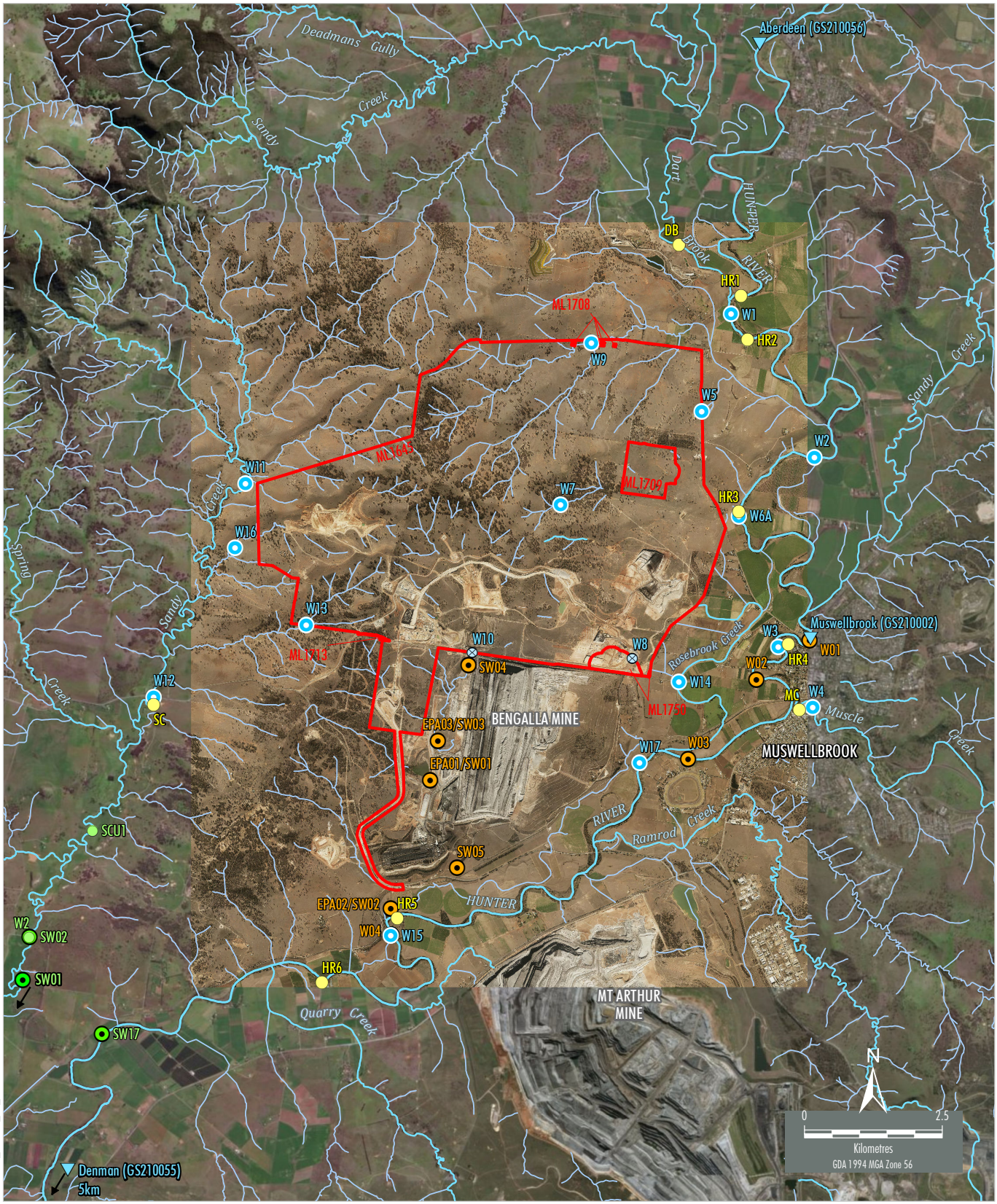
- downstream water quality monitoring undertaken by the BMC;
- water quality monitoring on Sandy Creek undertaken by MCO; and
- stream health monitoring on Sandy Creek undertaken by MCO.

In addition to the above, DPI – Water streamflow and electrical conductivity (EC) gauging stations are located on the Hunter River at Aberdeen (GS210056), Muswellbrook (GS210002) and Denman (GS210055) (Figure 3).

4.1 STREAMFLOW

4.1.1 Hunter River

DPI-Water monitor flow in the Hunter River at three gauging stations in the vicinity of the MPO (Figure 3). Data from these gauging stations is summarised in Table 4. All three gauging stations monitor flow continuously.



MAC-16-01_MP2019_SW_201B

LEGEND

- Mining Lease Boundary
- DPI Water Gauging Station

Mt Pleasant Monitoring

- Surface Water Monitoring Site
- Historical Surface Water Monitoring Site
- Stream Health Monitoring Site

Mangoola Monitoring

- Surface Water Monitoring Site
- Stream Health Monitoring Site

Bengalla Monitoring

- Surface Water Monitoring Site

Source: NSW Land & Property Information (2019); NSW Division of Resources & Energy (2019); NSW Department of Primary Industries - Water (2016); Bengalla Mining Company (2015); Mangool Coal Operations Pty Ltd (2014)
Orthophoto: MACH (Jul 2018); Esri, DigitalGlobe (2018)

MACHEnergy

MOUNT PLEASANT OPERATION

Surface Water and Stream Health Monitoring Sites

Figure 3

Table 4
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	65.3%	3,090	13.7	372	91,556
Muswellbrook (GS210002)	1906	67.6%	4,220	0.0	348.5	167,292
Denman (GS210055)	1908	80.9%	4,530	0.0	346.1	108,560

Note: ML/day Megalitres per day.
* Data Source: http://realtimedata.water.nsw.gov.au/water.stm?ppbm=SURFACE_WATER&rs&3&rskm_url; accessed 15 Dec 2016

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 14 ML/day (Table 4). Flow duration curves since 1988 for each gauge are shown on Figure 4. These flow duration curves indicate that flow in the Hunter River is fairly consistent immediately upstream and downstream of the MPO, with some variation primarily due to missing data.

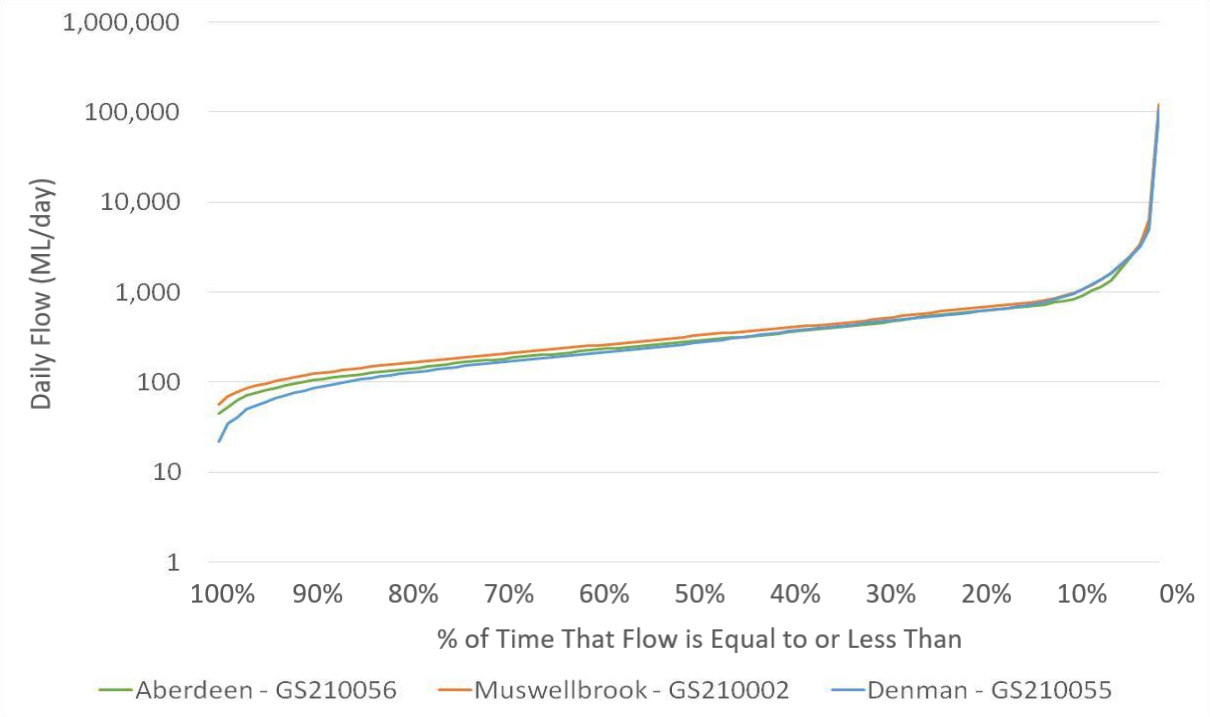


Figure 4: Flow Duration Curves

4.1.2 Sandy Creek

MCO monitor Sandy Creek at SW01 (downstream of Mangoola Coal) and SW02 (upstream of Mangoola Coal). Both monitoring sites are located downstream of the MPO, where Sandy Creek has a larger catchment than adjacent to the MPO.

The Mangoola Coal Water Management Plan (MCO, 2014) includes monitoring data for SW01 and SW02 from 2002 to 2014 (reproduced in Attachment 3). During this period, both monitoring sites were frequently dry with SW01 reporting dry/no flow approximately 50% of the time and SW02 reporting dry/no flow approximately 42% of the time.

4.1.3 Other Local Drainages

A summary of samples collected from local drainages in the MPO area is provided in Table 5. This indicates that the drainages are highly ephemeral, with dry samples representing more than 85% of the total samples obtained at each site.

Table 5
Flow Frequency of Local Drainages

Site	Number of Samples	Number of Dry Samples	Flow Frequency
W5	186	183	1.6%
W7	188	186	1.1%
W8	188	161	14.4%
W9	188	178	5.3%
W10	187	186	0.5%

BMC has historically monitored the unnamed drainage line that drains the south of the MPO area (referred to as Dry Creek in the Bengalla Mine Water Management Plan). From 2008 to 2013, there were only 14 occasions that the unnamed drainage line had sufficient flow (not including controlled discharges from Bengalla Mine's Staged Discharge Dam in accordance with the HRSTS) for water quality sampling to be undertaken (BMC, 2015). As described in Section 3.2, Bengalla Mine's Dry Creek Project involves the diversion of flow in this unnamed drainage line.

4.2 SURFACE WATER QUALITY

Baseline surface water quality data is presented in Attachment 2 and a summary is provided in Tables 6 and 7 below.

Table 6
Surface Water Quality Summary – pH and Electrical Conductivity

Site	Number of Samples with Flow	Median pH	Median Electrical Conductivity (µS/cm)
W1	131	8.00	400
W2	184	8.10	410
W3*	-	-	-
W4	186	7.60	2030
W5	3	6.30	120
W6	123	8.10	400
W7	2	7.30	228
W8	27	7.30	238
W9	10	7.05	255
W10	1	6.20	30

Note: µS/cm = micro Siemens per centimetre,

* Located adjacent to DPI - Water gauging station. Only monitored intermittently for laboratory analysis.

Median pH values at creek sites show that surface water in the vicinity of the site is relatively neutral. Sites located along the Hunter River (i.e. W1, W2 and W6), have a median pH value and overall pH range which is slightly alkaline.

Median electrical conductivity (EC) values for the surface water sites were generally below 400 µS/cm. Given the frequency in which the unnamed drainage lines were dry, the monitoring results for these drainage lines likely reflect flows occurring during or immediately after rainfall events, which is why the local median EC is lower than the Hunter River. This is with the exception of site W4 located at Muscle Creek, which had a median EC value of 2,030 µS/cm.

Table 7
Surface Water Quality Summary – Total Suspended Solids and Total Dissolved Solids

Site	Number of TSS Samples	Median TSS (mg/L)	Number of TDS Samples	Median TDS (mg/L)
W1	129	8	1	<5
W2	182	8	5	251.00
W3*	-	-	-	-
W4	185	6	4	1620
W5	3	15	0	-
W6	119	8	0	-
W7	2	46	0	-
W8	26	292	1	1560
W9	10	159	0	-
W10	1	139	0	-

Note: TSS = Total Suspended Solids, TDS = Total Dissolved Solids.

* Located adjacent to DPI Water gauging station. Only monitored intermittently for laboratory analysis.

4.3 STREAM HEALTH

Stream health surveying at a number of surface water sites in the Hunter Catchment was undertaken from 1994 – 1999 and included as part of the EPA's *River Health in the New South Wales Lower North Coast, Hunter and Central Coast Catchments* report (Hose and Turak, 2004). This report identified a number of parameters using the Australian River Assessment System (AusRivAS), averaged over two monitoring periods (Autumn and Spring) during a single year. AusRivAS is a rapid river health assessment system which uses the presence or absence of macro invertebrate taxa to assess the biological health of Australian rivers. Observed (O) numbers of macro invertebrates at the site are compared with the Expected (E) number of macro invertebrates which could be found at the site, if the site was in a natural state (i.e. had not been disturbed). This informs an overall 'band of impairment' score ranging from X (more biologically diverse than expected) to D (extremely impaired).

The measured average parameters and the resulting 'band of impairment' score for four sites in the vicinity of the MPO are outlined in Table 8 below.

Table 8
Historical Stream Health in the Vicinity of the MPO

Historical Site ID	Updated Site ID	Site Location	Edge			Riffle		
			O/E Taxa	Band	O/E Signal	O/E Taxa	Band	O/E Signal
Hunt 585	DB	Dart Brook at MacIntyre Bridge	0.79	B	0.88	0.75	B	0.93
Hunt 506	MC	Muscle Creek at Muswellbrook	0.77	B	0.83	-	-	-
Hunt 571	HR4	Hunter River at Muswellbrook	0.56	B	0.88	0.73	B	1.06
Hunt 854	HR3	Hunter River downstream of Aberdeen	1.02	A	1	-	-	-

Source: Hose and Turak, 2004.

As shown, three of the four monitoring sites fell within band 'B'. This indicates that ecological condition of macro invertebrates at the sites has been 'significantly impaired', meaning that a potential impact on water quality and/or habitat quality has resulted in a loss of taxa. The monitoring location on the Hunter River downstream of Aberdeen however, fell within band 'A'. This indicates that impacts on water and habitat condition at the site have not resulted in a loss of macro invertebrate diversity.

Stream health monitoring has been undertaken at three points along Sandy Creek by Glencore for Mangoola Coal. This monitoring has involved assessing macro invertebrate community structures, water quality, and overall riparian health using AusRivAS, SIGNAL2 sampling, HABSCORE assessments, and physicochemical water quality testing. Stream health results published as part of the 2015 *Mangoola Annual Review* indicates that Sandy Creek has remained in a poor but stable condition since monitoring began in 2009 (SLR Consulting Australia Pty Ltd, 2015).

Extensive historical surveying of river health in the Hunter River has been undertaken due to its regional ecological and agricultural significance. This surveying has indicated that the river has been historically degraded due to agricultural and industrial use, however surveys in recent years suggest river health has improved.

The 2002 Healthy Rivers Commission investigation of the Hunter River determined that the river was not ecologically sustainable in its current capacity (Healthy Rivers Commission, 2002). The commission found that the overall water quality of the river was variable, and that nearly two thirds of streams were considered to be in a degraded condition. Approximately 30% of native fish species were estimated to have been lost from the River, and between 40 and 70% of sampled macro invertebrate sites were found to be in poor condition.

A suite of more contemporary surveys undertaken between 2004 – 2006 have shown the overall health of the Hunter River has been improving (Cumberland Ecology, 2013). These surveys showed suitable habitat for a variety of macro invertebrates and amphibians, with the presence of a diverse variety of macro invertebrate species.

A 2010 *State of the Catchment Report* (NSW Government) determined that although the health of the overall Hunter Catchment was poor, the health of the Hunter River was considered 'moderate'.

Macro invertebrate condition (a measure of the remaining proportion of macro invertebrate assemblages which have been retained in the river system) of the Hunter River and surface water drainages in the vicinity of the MPO, was found to be 'moderate'. This means that less than half, but more than a quarter, of macro invertebrate were estimated to have been lost in the river system.

Although overall fish condition for the Hunter Catchment was determined to be very poor, fish condition along the Hunter River in the vicinity of the MPO was rated as 'moderate'. Fish condition scores are based upon both the proportion of fish species which are native to the region, as well as the proportion of fish species that have been retained relative to pre-disturbance conditions (NSW Government, 2010).

Historical surveys of the Hunter River have not indicated the presence of any threatened species and the overall habitat of the Hunter River Catchment has been considered unsuitable for threatened species and communities listed under both the *Fisheries Management Act, 1994* and the *Environmental Protection and Biodiversity Conservation Act, 1999* (Cumberland Ecology, 2013).

5 SURFACE WATER MANAGEMENT MEASURES

5.1 MINIMISATION OF WATER USE

MACH Energy's water management strategy includes preferential use of on-site derived mine-affected water (i.e. water that has come into contact with mining or processing operations), thereby reducing the need to import raw water from external sources for operational purposes. As described in the Site Water Balance (SWB), the water management system involves recycling site runoff, fine rejects reclaim water and groundwater inflow wherever practicable, for reuse in the CHPP and/or for dust suppression.

General water management measures proposed at the site include, but are not limited to:

- Finalising construction of proposed water storages as early as possible to increase site yield.
- Limiting the extent of disturbance to reduce dust suppression requirements.
- Pumping water from the Hunter River only when a low trigger volume for the Mine Water Dam has been reached. All surface and groundwater will be taken in accordance with WALs.
- Regularly reviewing water use to identify areas for reduction and identify best practice technologies. This will be reviewed every year as part of the Annual Review process (Section 8.1).

During construction and/or prior to commissioning of the Hunter River water supply pipeline, water may be sourced externally (e.g. taken from commercial water fill points in the light industrial area).

In addition, in order to reduce make-up water demand from the Hunter River over the life of the MPO, MACH Energy may also source excess mine water from the adjoining mines (i.e. Dartbrook and Bengalla Mines) for use on-site. Should this water sharing be undertaken, it would be subject to MACH Energy and the other mining operator obtaining all necessary secondary approvals.

5.2 INFRASTRUCTURE DESIGN

Sediment dams will be designed with consideration given to topsoil and overburden characteristics and the contributing area of disturbance. The sediment dams will be sized in accordance with current recommended design standards in the following guidelines:

- *Managing Urban Stormwater, Volume 1 - Soils and Construction* (Landcom, 2004).
- *Managing Urban Stormwater, Soils and Construction, Volume 2E - Mines and Quarries* (DECC, 2008).

Discussion on the design of specific sediment and mine water dams is provided in the SWB.

5.3 MANAGEMENT OF POTENTIALLY ACID FORMING MATERIALS

Geochemical testing of overburden material undertaken at the site has revealed that the only acid forming leachate occurs in the Wynn Seam (Mountford and Wall, 1995). Material balance calculations undertaken for the 1997 EIS indicated that dilution and neutralisation will negate any acid forming potential that may occur in this leachate.

Due to the predicted small proportion of potentially acid forming material, it is expected that operational blending during ROM dumping will produce a non-acid forming material within the overburden emplacement and back-filled open cut. The management strategy for the MPO will provide that no zones of poorly blended, potentially acid forming material are exposed in the final surface of the overburden emplacement and back-filled open cut. This will be achieved by excluding the material identified as potentially being acid forming (i.e. non-economic coal and identified coal seam roof and floor rock from the Wynn Seam) from the final face of the overburden emplacement.

Using this strategy, it is anticipated that no surface water will come into contact with potentially acid forming materials at the site.

5.4 CHEMICAL AND HYDROCARBON STORAGE

Chemicals and hydrocarbons will be managed through the MPO procedures for site contamination prevention and control. These procedures will minimise the potential for land and water contamination from the handling, storage and disposal of these substances.

Chemicals and hydrocarbons will be transported and stored on-site in accordance with the NSW *Work Health and Safety Act 2011* and *Work Health and Safety (Mines and Petroleum Sites) Act 2013*. Additionally, MACH Energy will register all chemicals used on site within a central database. The central database will contain all information in the Safety Data Sheets (SDS) and an inventory of chemicals held on-site. The information will be accessible at any computer terminal within the MPO and provide guidance on storage, use and disposal.

On-site controls will include storage within properly sealed containers and controlled areas, bunded for medium to long-term storage requirements. These storage and waste receival areas will be isolated from clean water catchments to minimise the risk of land or water pollution should an unplanned spill occur.

The response to any accidental spills or ground contamination will be assessed on a case-by-case basis and remediated using biodegradable spill absorbent. Emergency response procedures will also be enacted as required in accordance with the relevant environmental procedures. Hydrocarbon or chemical spills will be reported in the mine site incident reporting and management system with corrective and preventative measures undertaken as appropriate.

6 SURFACE WATER IMPACT TRIGGER LEVELS

6.1 SURFACE WATER QUALITY

Surface water quality triggers have been developed using the ANZECC & ARMCANZ (2000) guidelines in conjunction with baseline data collected at the site.

The ANZECC & ARMCANZ (2000) guidelines recommend that wherever possible, site-specific data is used to define trigger values for physical and chemical factors which can adversely impact the environment. Trigger values are not regarded as assessment criteria; rather they are used as an indicator of potential impacts and to initiate investigations into the surface water quality as reported by the monitoring program.

The approach recommended by ANZECC & ARMCANZ (2000) for developing site-specific trigger values for slightly to moderately disturbed ecosystems, is to formulate trigger values based on the 20th and 80th percentile of the site-specific monitoring data. These values should be calculated from a minimum of 2 years of monthly data (i.e. 24 data points). The objective of this approach is to develop conservative, site-specific trigger values for use as a means to improve water quality in highly disturbed ecosystems.

Trigger levels have not been established for sites upstream of the MPO (i.e. W1, W2 and W4) because these cannot be affected by the MPO. Site W6 contains sufficient data to develop trigger levels although there was insufficient data to develop TDS trigger levels for this site. The remaining sites (i.e. W5, W7 and W9) are located on ephemeral drainage lines which are frequently dry and do not have sufficient data to develop site-specific trigger levels. ANZECC & ARMCANZ (2000) default trigger levels for these sites have been adopted, until such time as sufficient data is available to develop site-specific triggers.

Trigger levels for the new surface water monitoring sites (sites W11-W16 [Figure 3]) have not been established but will be incorporated once sufficient monitoring data has been collected at these sites. This is with the exception of site W17 which has been assigned preliminary trigger values from the *Bengalla Water Management Plan* (BMC, 2017). MACH Energy has established preliminary triggers at this site as it is the only site downstream of MPO's footprint on the Hunter River which is not also downstream of the Bengalla Mine footprint. MACH Energy therefore considers this site particularly important for assessing surface water impacts prior to site specific triggers becoming available to establish.

MCO has established triggers on Sandy Creek, downstream of the MPO. A description of these triggers and how they were derived is contained in the *Mangoola Coal Surface Water Monitoring Plan* (MCO, 2018).

Proposed water quality trigger levels for the surface water sites and the corresponding ANZECC & ARMCANZ guidelines are presented in Table 9 below. Where the 80th percentile value for EC is lower than the ANZECC & ARMCANZ (2000) guidelines, the guidelines have been adopted as the trigger value for that specific parameter.

An investigation is triggered when:

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

Table 9
Surface Water Quality Trigger Levels

Site	pH	EC (µS/cm)	TSS (mg/L)
	20th – 80th Percentile Trigger Values	80th Percentile Trigger Value	80th Percentile Trigger Value
Site Specific Trigger Levels			
W2	7.8 – 8.3	539	18
W6*	7.8 – 8.4	496	19
Default Trigger Levels^			
W5	6.5 – 7.5	350	-
W7	6. 5 – 7.5	350	-
W9	6. 5 – 7.5	350	-
Bengalla Mine Trigger Levels#			
W17	6.5 – 8.1	650	40

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

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

Preliminary trigger values have been sourced from the *Bengalla Water Management Plan* (BMC, 2017), which have been established from baseline data for monitoring sites adjacent to W17 (e.g. Bengalla sites W01, W02 and W03 [Figure 3]), as well as the ANZECC & ARMCANZ (2000) guideline.

6.2 STREAM HEALTH

Baseline data for the stream health of surface water in the vicinity of the MPO has been collected using the AusRivAS system, which is described in Section 4.3. Using the AusRivAS system, observed (O) numbers of macro invertebrate taxa were compared with the expected (E) numbers of macro invertebrate taxa found at each site. Using this information, an O/E proportion was calculated, and this informed an overall 'band of impairment' score for each site.

Band of impairment scores are based upon where the O/E values fall within a specified range, as shown in Table 10 below.

Table 10
Stream Health Band of Impairment Scores

Band Label	O/E Taxa Range	Band Name	Band Description
Band X	>1.12	More biologically diverse than reference sites.	More taxa found than expected. Potential biodiversity hot-spot. Possible mild organic enrichment.
Band A	0.85 – 1.15	Reference condition.	Most/all of the expected families found. Water quality and/or habitat condition roughly equivalent to reference sites. Impact on water quality and habitat condition does not result in a loss of macro invertebrate diversity.
Band B	0.55 – 0.84	Significantly impaired.	Fewer families than expected. Potential impact either on water quality or habitat quality or both resulting in loss of taxa.
Band C	0.25 – 0.54	Severely impaired.	Many fewer families than expected. Loss of macro invertebrate biodiversity due to substantial impacts on water and/or habitat quality.
Band D	0 – 0.24	Extremely impaired.	Few of the expected families remain. Extremely poor water and/or habitat quality. Highly degraded.

Source: Gray B. (2004); Hose, G. and Turak, E. (2004).

Baseline band of impairment scores have been determined using the above scoring scheme, by combining edge and riffle habitat scores at each of the stream health monitoring sites listed in Table 8. These band of impairment scores have been assigned using the most conservative score from the edge and riffle values, where both habitats were measured (i.e. the score furthest from Band X).

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

The stream health triggers for each downstream site are presented in Table 11.

Table 11
Stream Health Trigger Values

Historical Site ID	Updated Site ID	Baseline Band of Impairment Score	Trigger Value (O/E Taxa)
Hunt 571	HR4	B	0.54
Hunt 854	HR3	A	0.84

MACH Energy commenced stream health monitoring at three additional downstream sites in Spring 2017, including one on Sandy Creek and two on the Hunter River. Stream health trigger values will be developed for these sites following the Spring 2019 monitoring round (assuming suitable conditions for sampling), when two years of baseline data will be available. In the interim, MCO has established stream health trigger levels for monitoring sites on Sandy Creek (Figure 3). In the event a deterioration in stream health is observed at these locations, MACH Energy would consult with MCO during the implementation of their response mechanisms.

6.3 LICENSED DISCHARGE

Licensed discharges from the MPO will be undertaken in accordance with the HRSTS and criteria described in EPL 20850.

7 SURFACE WATER MONITORING PROGRAM

7.1 STANDARDS

Surface water monitoring at the MPO will be undertaken in accordance with relevant Australian Standards, legislation and NSW Guidelines, including (but not limited to):

- *Approved Methods for the Sampling and Analysis of Water pollutants in NSW* (DEC, 2004);
- *AS/NZS 5667.1:1998 Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples*; and
- *AS/NZS 5667.10:1998 Water Quality – Sampling – Guidance on Sampling of Waste Waters.*

7.2 STREAMFLOW

MACH Energy would continue to review data from DPI-Water's gauging stations in the vicinity of the MPO (e.g. to inform groundwater modelling reviews). All three of these gauges continuously monitor:

- level (m);
- discharge/flow (ML/day);
- EC (μS/cm); and
- water temperature (degrees Celsius).

A qualitative measure of flow would also be recorded at all surface water quality sites at the time of sampling (e.g. dry, stagnant pool, low flow or high flow).

7.3 SURFACE WATER QUALITY

Monthly water sampling is undertaken at the relevant monitoring locations listed in Table 3. The surface water monitoring program is summarised in Table 12 below.

Since 2011, monitoring data has not been collected at the Hunter River site W6 due to the river bank being too steep at this location to allow safe access. As such, water monitoring at site W6 has been discontinued and monitoring is undertaken at the new monitoring site W6A. This site is located at the same point as stream health monitoring site HR3, approximately 500 m downstream of the historical W6 site (Figure 3). Given its close proximity to the original site, as well as the overall scale of the Hunter River, trigger values developed at site W6 (Table 9) are used for monitoring at site W6A.

Monitoring at site W8 has been discontinued due to being disturbed by mining activities. Monitoring at site W10 has been discontinued as the site is located on Dry Creek directly downstream of the Bengalla Mine Dry Creek Diversion Project.

Table 12
Surface Water Monitoring Program

Feature	Locations/Sites	Parameters	Frequency[1]
Hunter River[#]	Upstream (Aberdeen [GS210056])	Streamflow, EC	Continuous (DPI-Water)
	Upstream (W1)	Water Quality (Suite 1)	Monthly & Event Based
	Upstream (W1)	Water Quality (Suite 2)	Special Frequency
	*Upstream / Downstream (Muswellbrook [210002])	Stream Flow	Continuous (DPI-Water)
	*Upstream / Downstream (W2, W3 & W6A)	Water Quality (Suite 1)	Monthly (*Baseline*)
			Monthly & Event Based (*When development within sub-catchment*)
	*Upstream / Downstream (W2, W3 & W6A)	Water Quality (Suite 2)	Special Frequency
	*Upstream / Downstream (HR3 & HR4)	Stream Health[%]	Bi-Annual (Spring and Autumn)
	Downstream (W15 & W17)	Water Quality (Suite 1)	Monthly & Event Based
	Downstream (W15 & W17)	Water Quality (Suite 2)	Special Frequency
	Downstream (Denman [210055])	Stream Flow	Continuous (DPI-Water)
Dart Brook	Upstream (DB)	Stream Health[%]	Bi-Annual (Spring and Autumn)
Muscle Creek	Upstream (W4)	Stream Quality	Event Based
	Upstream (MC)	Stream Health[%]	Bi-Annual (Spring and Autumn)
Unnamed Tributaries – Draining mining lease 1645 (Northeast to Hunter River)	Downstream (W5 & W9)	Water Quality (Suite 1)	Event Based (*Baseline*)
			Monthly & Event Based (*When development within sub-catchment*)
	Downstream (W5 & W9)	Water Quality (Suite 2)	Special Frequency
Rosebrook Creek	Downstream (W14)	Water Quality (Suite 1)	Monthly & Event Based
	Downstream (W14)	Water Quality (Suite 2)	Special Frequency
Unnamed Tributaries – Draining mining lease 1645 (East to Rosebrook Creek)	Downstream (W7)	Water Quality (Suite 1)	Event Based (*Baseline*)
			Monthly & Event Based (*When development within sub-catchment*)
	Downstream (W7)	Water Quality (Suite 2)	Special Frequency
Sandy Creek^	Upstream (W11)	Water Quality (Suite 1)	Monthly & Event Based
	Upstream (W11)	Water Quality (Suite 2)	Special Frequency
	Downstream (W12)	Water Quality (Suite 1)	Event Based (*Baseline*)
			Monthly & Event Based (*When development within sub-catchment*)
	Downstream (W12)	Water Quality (Suite 2)	Special Frequency
	Downstream (SC)	Stream Health[%]	Bi-Annual (Spring & Autumn)

Table 12 (continued)
Surface Water Monitoring Program

Feature	Locations/Sites	Parameters	Frequency[1]
Unnamed Tributaries – Draining mining lease 1645 (West to Sandy Creek)	Downstream (W13 & W16)	Water Quality (Suite 1)	Event Based (*Baseline*)
			Monthly & Event Based (*When development within sub-catchment*)
	Downstream (W13 & W16)	Water Quality (Suite 2)	Special Frequency

[1] Event based frequency would be no greater than once per month.

[#] Available water monitoring results from the Mangoola Coal water monitoring program at nearby sites on Hunter River (SW14, SW15 & SW17) would also be used for comparative purposes.

[*] Upstream / Downstream – reflects monitoring locations that would not be potentially affected by the development until later in the Project life.

[^] Available water monitoring results from the Mangoola Coal water monitoring program at nearby sites on Sandy Creek (SW1 & SW2) would also be used for comparative purposes.

[%] Stream health monitoring parameters are described in Section 7.4.

Suite 1 = pH, EC, TSS and TDS sampling.

Suite 2 = pH, EC, TSS, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Sr, Turbidity, Dissolved Oxygen, Total P and Total N.

Special Frequency = Quarterly until the end of 2018 and annually thereafter.

Note: During the construction phase of the MOD 4 rail loop and associated infrastructure, a Construction Environmental Management Plan (CEMP) will be implemented. The CEMP will include project-specific surface water quality monitoring, in addition to that prescribed in Table 12, to monitor potential impacts to water quality from the construction activities.

7.4 STREAM HEALTH

The stream health monitoring program is based on the AusRivAS aquatic invertebrate monitoring protocol, as used for the baseline stream health study.

AusRivAS is a rapid biological assessment protocol with twice yearly (spring and autumn) aquatic macro invertebrate sampling. Monitoring would continue to be undertaken at the four sites shown on Figure 3. Stream health monitoring is also undertaken by MCO on Sandy Creek, to the south of site SC, and to the south-west of the MPO (Figure 3) and published in the Mangoola Coal Annual Reviews.

In addition to the aquatic macro invertebrate sampling, monitoring at the MPO stream health sites will also include:

- fish observations;
- site water quality;
- stream condition; and
- aquatic and riparian edge plants.

Due to the highly ephemeral nature of drainage lines within the MPO boundary, it is unlikely that these drainage lines support significant ecosystems. Therefore, all stream health monitoring locations are located on significant watercourses outside the MPO boundary.

The outcomes of the annual stream health monitoring (i.e. two rounds of monitoring) will be described in the Annual Review.

7.5 ON-SITE (MINE) WATER MANAGEMENT

A description of the on-site water management system is provided in the SWB.

Regular on-site water management monitoring will be undertaken to minimise potential environmental harm, ensure relevant statutory requirements are being met and to improve the water management system implemented at the site.

Regular monitoring of water levels in all mine water management storage dams will be undertaken. The integrity of clean water diversion and runoff collection structures will be monitored after rainfall events causing flow and on scheduled inspections. Visual and olfactory checks will occur following any contamination incidents, to monitor for any remnant contamination (this may involve laboratory assessment). All mine water storages (including open cut pits and sediment dams) will be sampled for Suite 1 water quality parameters monthly. An automated system for water diversion is used on-site to reduce human error.

The Secretary of the DPIE and the Chief Executive Officer of the EPA will be notified as soon as practicable after monitoring has identified a discharge incident causing material environmental harm. A detailed report on the incident will be made available within seven calendar days after the incident was identified.

To further reduce the risk of a discharge incident causing material harm, MACH Energy has developed a Surface Water Management Procedure which provides a set of recommended work practices for use by MPO employees and contractors to manage construction dams within the Operation. The Surface Water Management Procedure is an internal MACH Energy document, which expands on the procedures outlined in this SWMP[1].

MACH Energy will also prepare the CEMP required by Condition 44I, Schedule 3 of Development Consent DA 92/97, which will provide measures to minimise potential environmental impacts from MOD 4 construction works, including surface water management.

7.6 BRIDGE OPENINGS AND CULVERTS

Condition 28(c), Schedule 3 of Development Consent DA 92/97 requires MACH Energy to implement a program to monitor and maintain the bridge openings and culverts associated with the MOD 4 rail infrastructure and ensure that they remain clear of blockages.

The MOD 4 Flood Impact Assessment (WRM Water and Environment, 2017) included conceptual mitigation measures in the modelled design to confirm that the proposed rail spur can be designed to meet the required flooding criteria. The modelled mitigation measures included extension of two existing railway culvert crossings and two bridge openings in the rail embankment. The two bridge openings were assumed to be 105 m and 90 m in length, made up of rail bridges with 15 m span length. The rail, viaduct and culverts are still subject to detail design development and therefore the hydraulic structures may differ from the geometry considered by WRM Water and Environment (2018), however they will be developed to:

- meet the required flooding criteria;
- minimise potential for scouring of the floodplain or abutments as a result of the infrastructure; and
- present a low potential for blockage.

[1] Note that the Surface Water Management Procedure has not been reviewed or endorsed by the DPIE. MACH Energy takes responsibility for ensuring the procedures in the Surface Water Management Procedure are in accordance with provisions in this SWMP and provisions in Development Consent DA 92/97.

An assessment of the potential for blockages to occur in the conceptual bridge openings and culverts was undertaken by WRM Water and Environment (2018) in response to feedback on MOD 4 from the OEH. Assessment of the design blockage for the conceptual rail spur bridge openings was undertaken in accordance with Australian Rainfall and Runoff 2016, which included consideration of key design criteria including debris availability, mobility and transportability. The blockage assessment for the conceptual rail spur bridge openings indicated a very low blockage potential and resulted in a 0% blockage for the most likely inlet blockage level. The conceptual extension of two existing culvert crossings was found to have the same design blockage risk as the existing culvert crossings. Any potential blockage of the existing culvert crossings and the culvert crossing extension will not change the flood impacts (WRM Water and Environment, 2018).

Condition 44C and 44D, Schedule 3 of Development Consent DA 92/97 require MACH Energy to design and construct the MOD 4 rail infrastructure to meet specific flooding criteria and commission an independent review of the final design of the MOD 4 rail infrastructure by a suitably qualified and experienced person, in consultation with the OEH and to the satisfaction of the Secretary of DPIE.

Notwithstanding the limited potential for blockages to occur, MACH Energy would undertake visual inspections annually and following flooding events[2] of the existing culvert crossings, culvert crossing extension and rail bridges to identify any blockages or potential blockage risks. Any blockages that are identified would be removed by MACH Energy personnel and disposed of in accordance with the Waste Management Plan.

[2] Defined as a flood event equal to or exceeding the 'minor flooding' classification in the Muswellbrook Shire Local Flood Plan (NSW State Emergency Service, 2013).

8 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

8.1 ANNUAL REVIEW

In accordance with Condition 3, Schedule 5 of Development Consent DA 92/97 MACH Energy will review and evaluate the environmental performance of the MPO by the end of March each year (for the preceding calendar year) or other such timing as agreed by the Secretary of the DPIE.

In relation to water, the Annual Review will:

- include a review of the surface water monitoring data and site water balance relating to the MPO over the past year, which includes a comparison of these results to evaluate compliance against the:
  - relevant statutory requirements, limits or performance measures/criteria (refer Section 2.1.1);
  - monitoring results of the previous years; and
  - relevant predictions in the EIS and MOD 1, MOD 2, MOD 3 and MOD 4 EAs;
- identify any surface water-related non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the surface water monitoring data over the life of the MPO;
- identify any discrepancies between the predicted and actual surface water impacts of the MPO, and analyse the potential cause of any significant discrepancies; and
- describe what surface water-related measures will be implemented over the next year to improve the environmental performance of the MPO.

The Annual Review will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/) in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

8.2 SWMP REVISION

In accordance with Condition 4, Schedule 5 of Development Consent DA 92/97, this SWMP will be reviewed, and if necessary revised (to the satisfaction of the Secretary of the DPIE), within three months of the submission of:

- an Annual Review (Condition 3, Schedule 5);
- an incident report (Condition 7, Schedule 5);
- an Independent Environmental Audit (Condition 9, Schedule 5); and
- any modification to the conditions of Development Consent DA 92/97.

Within 4 weeks of conducting a review of this SWMP, MACH Energy will advise the Secretary of the DPIE of the outcomes of the review, and submit any revised documents for the approval of the Secretary.

In accordance with Condition 4A, Schedule 5 of Development Consent DA 92/97, MACH Energy may submit a revised SWMP for the approval of the Secretary at any time, and may also submit any revision to this SWMP required under Development Consent DA 92/97 on a staged basis.

If agreed with the Secretary of the DPIE, a revision to this SWMP required under Development Consent DA 92/97 may be prepared without undertaking consultation with all parties nominated under the relevant Condition of Development Consent DA 92/97.

The approved SWMP will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/), in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

9 REPORTING PROCEDURES

In accordance with Condition 2, Schedule 5 of Development Consent DA 92/97, MACH Energy has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance criteria.

These protocols are described in Section 5 of the WMP.

In accordance with Condition 8, Schedule 5 of Development Consent DA 92/97, MACH Energy will provide regular reporting on the environmental performance of the MPO on the MACH Energy website (https://machenergyaustralia.com.au/).

10 REFERENCES

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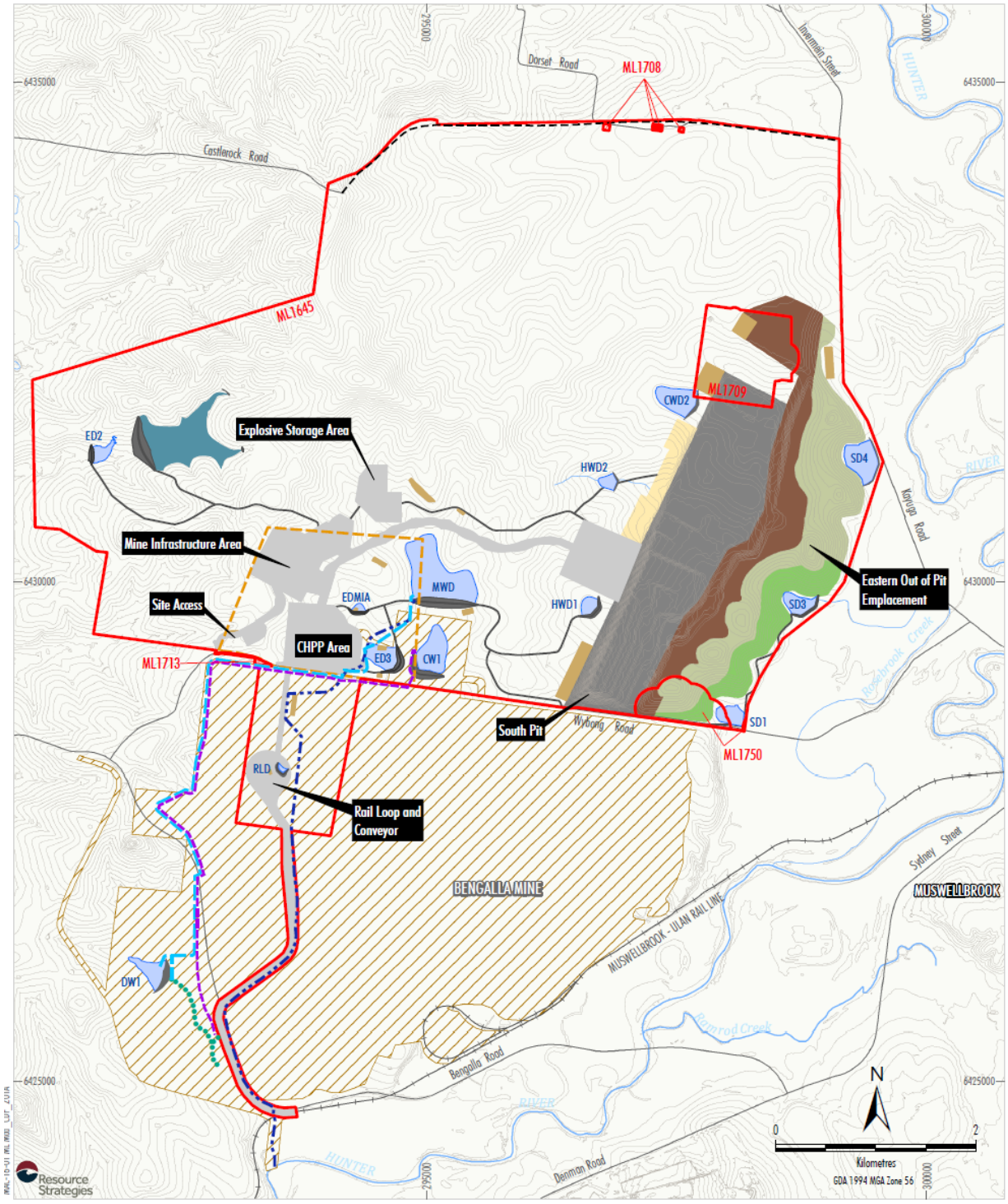
ATTACHMENT 1

APPENDIX 2 OF DEVELOPMENT CONSENT DA 92/97

APPENDIX 2
FIGURE 1 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2021



LEGEND

- Mining Lease Boundary
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Infrastructure Area Envelope
- Active Stripping Area
- Active Mining Area
- Active Overburden Emplacement Area
- Topsoil Stockpile
- Initial Rehabilitation
- Established Rehabilitation
- Infrastructure and Borrow/Stockpile Area
- Access Road
- Northern Link Road

Indicative Water Pipeline Alignment

- MPO Hunter River Supply Pipeline
- MPO DW1 Pipeline (Bi-directional)
- Bengalla Mine CW1 Pipeline
- Approximate Extent of Scour Protection
- Water Dam
- Fines Emplacement Area

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017); MACH Energy (2017)

MACHEnergy
MOUNT PLEASANT OPERATION

FIGURE 2 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2025

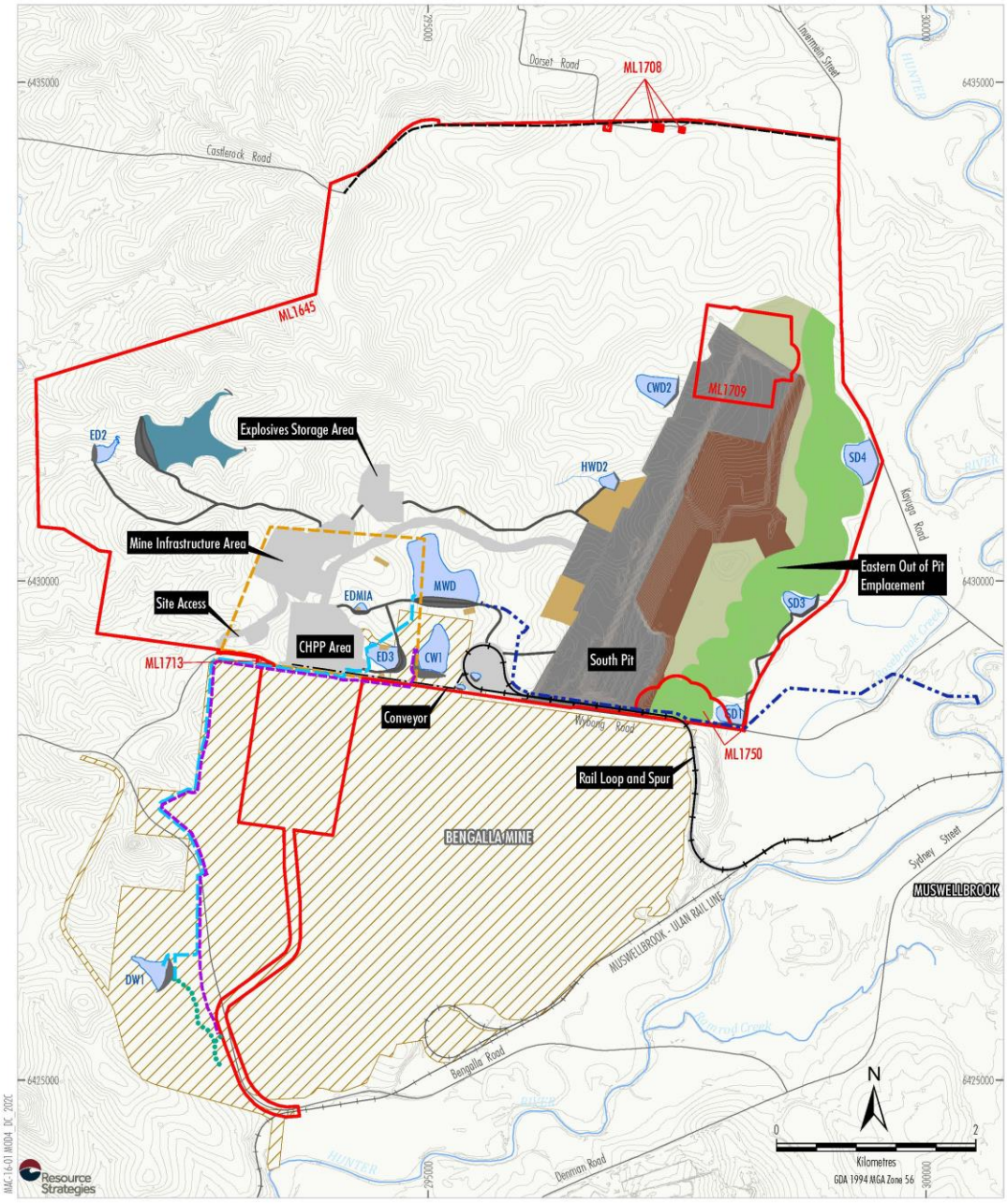
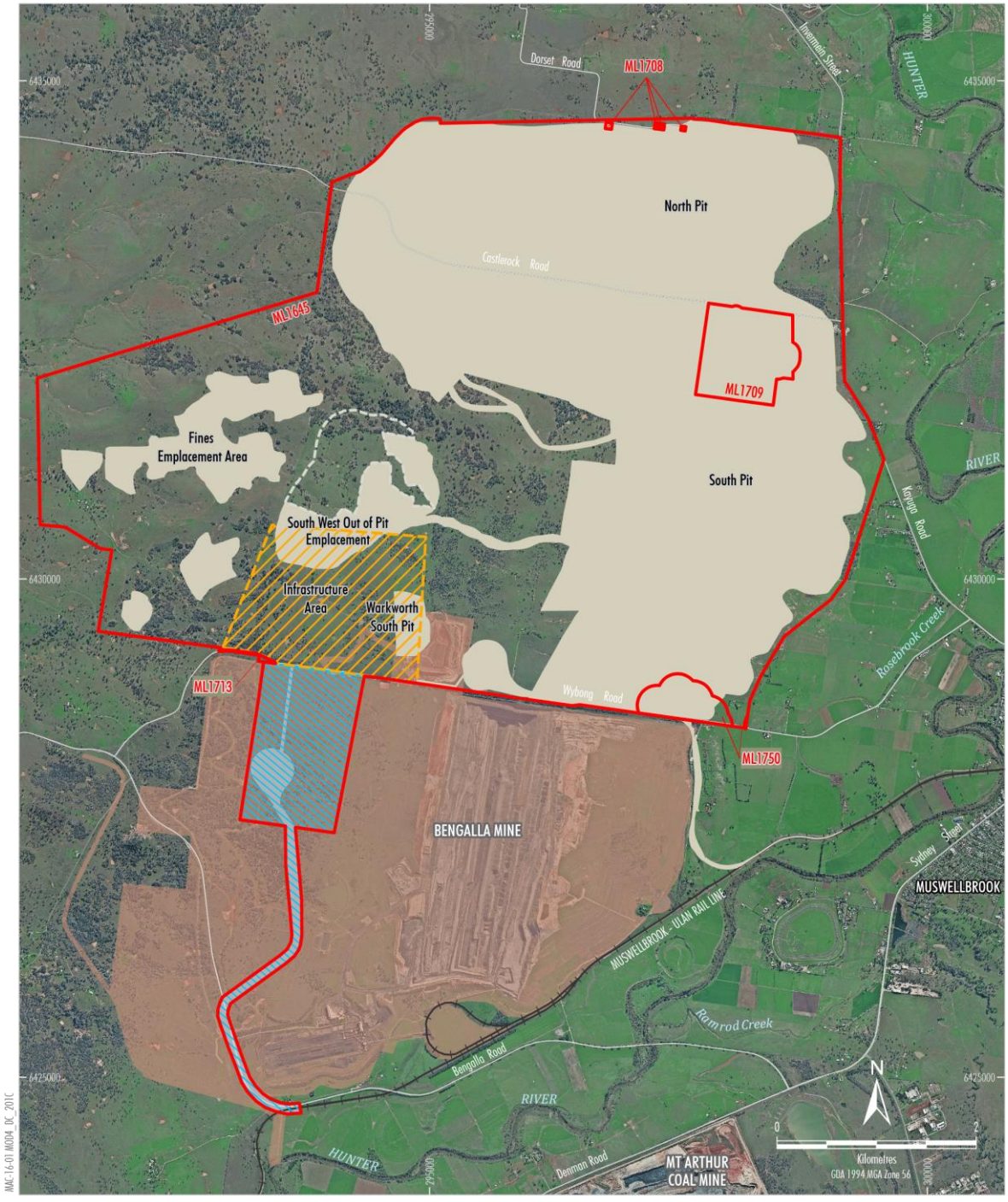


FIGURE 3 - APPROVED SURFACE DISTURBANCE PLAN



LEGEND

- Mining Lease Boundary
- Approximate Extent of Approved Surface Development [1]
- Area Relinquished for Overburden Emplacement and Major Infrastructure
- Infrastructure Area Envelope
- Infrastructure to be removed under the Terms of Condition 37, Schedule 3
- Indicative Existing Coal Transport Infrastructure
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)

NOTE

1. Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, offsite coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, signalling, other ancillary works and construction disturbance.

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2018); Department of Planning and Environment (2016); MACH Energy (2017)
Orthophoto: MACH Energy (Aug 2016)

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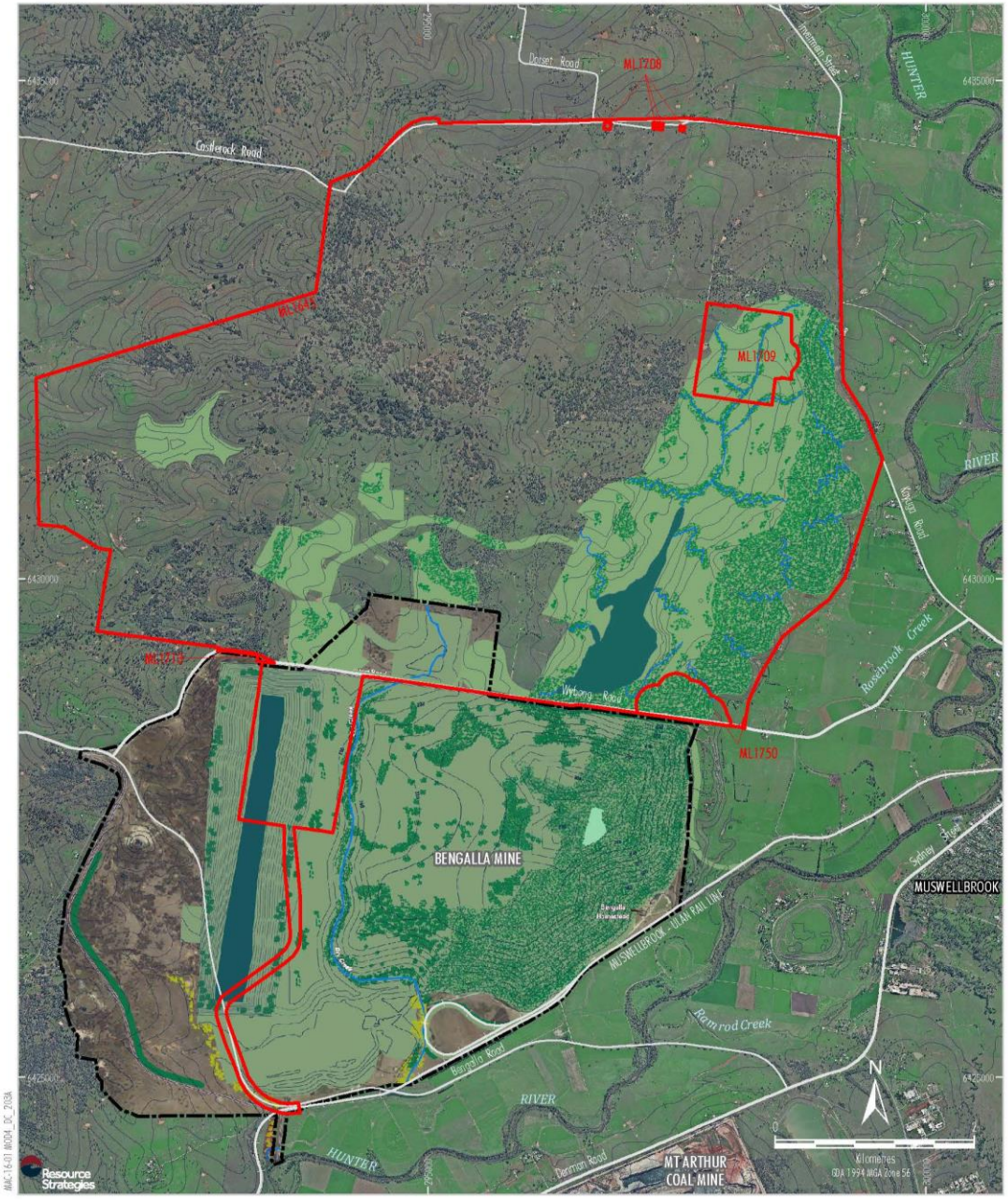
MOUNT PLEASANT OPERATION
Approved Surface Disturbance Plan

FIGURE 4 - CONCEPTUAL FINAL LANDFORM



ATTACHMENT 2

MPO BASELINE SURFACE WATER QUALITY DATA

Table A2-1
MPO Baseline Surface Water pH and EC Water Quality Data Summary

Site	Number of Samples	Number of Dry Samples	First Record	Final Record	pH					EC				
					Min	20th %ile	Median	80th %ile	Max	Min	20th %ile	Median	80th %ile	Max
W1	131	0	20/07/2000	17/10/2011	6.14	7.60	8.00	8.20	8.60	231	355	400	529	880
W2	184	0	20/07/2000	12/07/2016	6.47	7.80	8.10	8.30	8.80	229	351	410	539	790
W3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
W4	186	0	20/07/2000	12/07/2016	6.50	7.36	7.60	7.80	8.30	383	1,468	2,030	2,480	5,580
W5	186	183	20/07/2000	12/07/2016	6.10	6.18	6.30	6.72	7.00	80	96	120	983	1,558
W6	123	0	20/07/2000	17/04/2015	6.89	7.8	8.10	8.40	8.70	280	358	400	496	860
W7	188	186	20/07/2000	12/07/2016	6.80	7.00	7.30	7.60	7.80	145	178	228	277	310
W8	188	161	21/07/2000	12/07/2016	6.10	6.90	7.30	7.60	8.50	60	114	238	318	930
W9	188	178	21/07/2000	12/07/2016	6.40	6.68	7.05	7.30	7.40	50	128	255	365	537
W10	187	186	21/07/2000	12/07/2016	6.20	6.20	6.20	6.20	6.20	30	30	30	30	30

Table A2-2
MPO Baseline Surface Water TSS and TDS Water Quality Data Summary

Site	Number of Samples	Number of Dry Samples	First Record	Final Record	TSS (mg/L)					TDS (mg/L)				
					Min	20th %ile	Median	80th %ile	Max	Min	20th %ile	Median	80th %ile	Max
W1	131	0	20/07/2000	17/10/2011	1	3	8	20	194	-	-	-	-	-
W2	184	0	20/07/2000	12/07/2016	1	4	8	18	211	8	178	251	262	268
W3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
W4	186	0	20/07/2000	12/07/2016	1	3	6	12	232	1530	1566	1620	1758	1850
W5	186	183	20/07/2000	12/07/2016	8	11	15	18	20	-	-	-	-	-
W6	123	0	20/07/2000	17/04/2015	1	4	8	19	219	-	-	-	-	-
W7	188	186	20/07/2000	12/07/2016	20	30	46	61	71	-	-	-	-	-
W8	188	161	21/07/2000	12/07/2016	7	100	292	672	2060	1560	1560	1560	1560	1560
W9	188	178	21/07/2000	12/07/2016	28	36	159	678	784	-	-	-	-	-
W10	187	186	21/07/2000	12/07/2016	139	139	139	139	139	-	-	-	-	-

ATTACHMENT 3

MANGOOLA COAL BASELINE SURFACE WATER DATA – SANDY CREEK

	old site name	W1					W2				
	new site name	SW01					SW02				
	Eastings (MGA, z 56)	284041					286917				
	Northings (MGA, z 56)	6419087					6423773				
month	date sampled	Flow Condition	pH	EC (uS/cm)	TSS (mg/L)	TDS (mg/L)	Flow Condition	pH	EC (uS/cm)	TSS (mg/L)	TDS (mg/L)
Feb-02	19/02/2002		6.81	304	29	328		7.48	839	119	704
Mar-02	19/03/2002		7.60	605	11	410		7.50	4060	21	2330
Apr-02	17/04/2002		8.25	568	10	360		7.86	5910	8	3650
May-02	14/05/2002		8.27	696	10	355		8.02	6840	0	3700
Jun-02	18/06/2002		8.40	548	38	330		8.10	4920	25	2810
Jul-02	24/07/2002		8.40	830	0	434		8.20	4940	25	3070
Aug-02	21/08/2002		8.26	1090	14	645		8.12	5640	6	3140
Sep-02	20/09/2002		8.00	1100	60	665		8.00	5850	2	3150
Oct-02	18/10/2002	Dry						7.93	6890	4	3920
Nov-02	19/11/2002	Dry					Dry				
Dec-02	11/12/2002		7.50	279	69	195		7.60	3390	21	1960
Jan-03	16/01/2003		8.26	520	9	398		7.39	4620	20	2670
Feb-03	19/02/2003		8.06	779	14	569		7.23	5430	116	2800
Mar-03	12/03/2003		8.29	518	27	363		7.26	5560	103	2960
Apr-03	15/04/2003		8.29	633	31	430		7.28	5310	58	3040
May-03	21/05/2003		8.60	735	18	577		7.33	5670	54	3310
Jun-03	18/06/2003		8.44	1010	444	706		7.28	5520	48	2970
Jul-03	17/07/2003		8.31	538	26	360		8.07	6990	3	3940
Aug-03	18/08/2003		7.98	419	6	264		7.86	4190	6	2260
Sep-03	15/09/2003		7.95	247	10	295		7.75	2950	10	1540
Oct-03	14/10/2003		7.90	304	9	243		7.95	5820	7	3230
Nov-03	17/11/2003		8.30	459	26	336	Dry				
Dec-03	24/11/2003		7.37	216	29	242		7.34	968	22	517
Jan-04	15/12/2003		7.63	233	21	261		7.52	1780	6	961
Feb-04	13/01/2004		8.23	440	26	344	Dry				
Mar-04	11/02/2004		7.77	283	30	243	Dry				
Apr-04	10/03/2004		8.62	286	18	202	Dry				
May-04	14/04/2004		8	347	31	233	Dry				
Jun-04	12/05/2004		8.24	505	44	316	Dry				
Jul-04	15/06/2004		8.5	423	41	270	Dry				
Aug-04	15/07/2004		8.3	527	48	342	Dry				
Sep-04	16/08/2004		8.3	599	123	384	Dry				
Oct-04	14/09/2004		7.9	372	843	262	Dry				
Nov-04	1/10/2004		7.74	373	141	270	Dry				
Dec-04	5/11/2004		8.31	314	130	350	Dry				
Jan-05	14/12/2004		8	620	5	380	Dry				
Feb-05	4/01/2005		8.2	470	103	300	Dry				
Mar-05	10/02/2005		7.3	240	97	230	Dry				
Apr-05	1/03/2005		7.9	370	68	250	Dry				
May-05	6/04/2005		7.5	503	58	518	Dry				
Jun-05	3/05/2005		7.4	634	25	414	Dry				
Jul-05	9/06/2005	Dry					Dry				
Aug-05	4/07/2005		7.22	116	65	245	Dry				
Sep-05	31/08/2005		7.3	331	80	256	Dry				
Oct-05	12/09/2005		7.2	360	129	282	Dry				
Nov-05	11/10/2005		7.6	479	63	320	Dry				
Dec-05	15/11/2005		8.2	437	99	216	Dry				
Jan-06	19/01/2006		7.1	561	49	466	Dry				
Feb-06	17/02/2006		7.3	831	101	564	Dry				
Mar-06	6/03/2006	Dry					Dry				
Apr-06	6/04/2006	Dry					Dry				
May-06	9/05/2006	Dry					Dry				
Jun-06	8/06/2006	Dry					Dry				
Jul-06	10/07/2006	Dry					Dry				
Aug-06	10/08/2006	Dry					Dry				
Sep-06	8/09/2006	Dry					Dry				
Oct-06	18/10/2006	Dry					Dry				
Nov-06	23/11/2006	Dry					Dry				
Dec-06	28/12/2006	Dry					Dry				
Jan-07	25/01/2007	Dry					Dry				
Feb-07	22/02/2007	Dry					Dry				
Mar-07	21/03/2007	Dry					Dry				
Apr-07	26/04/2007	Dry					Dry				
May-07	24/05/2007	Dry					Dry				
Jun-07	8/06/2007		5.63	62	456	420		5.77	16	120	20
Jul-07	20/07/2007		8.1	528	11	356		7.5	7050	22	3944
Aug-07	21/08/2007		7.1	567	68	343		7.6	3335	92	2334
Sep-07	12/09/2007		7.6	701	254	370		7.4	4930	13	2690
Oct-07	17/10/2007		8	1695	99	1061		7.2	5720	200	3795
Nov-07	19/11/2007		7.9	1382	44	870		6.9	7765	34	4420
Dec-07	14/12/2007		8.1	964	13	436		7.9	1915	7	1072
Jan-08	15/01/2008		7.9	950	31	542		8.3	3700	10	1890
Feb-08	14/02/2008		6.4	825	34	500		7.3	1792	12	1034
Mar-08	14/03/2008		7.8	840	54	556		8.3	5385	0	2760
Apr-08	16/04/2008		7.6	1899	57	1031		8.3	6440	11	10675
May-08	13/05/2008		9.8	1310	47	854		9.2	5920	14	3635
Jun-08	12/06/2008		7.6	1331	63	676		7.8	5220	8	3100
Jul-08	10/07/2008		8.4	1500	38	770		8.1	5620	3	3080
Aug-08	12/08/2008		8.3	1288	26	662		7.9	6120	6	2960
Sep-08	15/08/2008		8.6	730	86	376		8	3250	3	1570
Oct-08	10/10/2008		7.8	680	142	482		8	1940	21	1126
Nov-08	12/11/2008		8.3	952	139	590		8.4	4620	6	3215
Dec-08	8/12/2008		8.3	1160	185	700		8	4480	8	3110
Jan-09	20/01/2009	Dry					Dry				
Feb-09	12/02/2009	Dry						7.2	4800	20	3000
Mar-09	19/03/2009		7.9	790	30	530		8.2	5300	20	3300
Apr-09	16/04/2009		7.6	630	26	420		8	5220	4	3020
May-09	13/05/2009	Dry						8.3	5200	2	3400
Jun-09	11/06/2009	Dry						8	5000	3	2740
Jul-09	15/07/2009	Dry						8.2	4940	2	2805
Aug-09	10/08/2009	Dry						8.3	5065	1	2978
Sep-09	11/09/2009	Dry						8.1	4900	1	2600
Oct-09	15/10/2009	Dry						9	5600	4	3600
Nov-09	12/11/2009	Dry						8.1	4800	5	2800
Dec-09	29/12/2009	Dry						7.5	5600	8	3200
Jan-10	15/01/2009		7.6	510	7	350		7.8	3100	7	2500
Feb-10	12/02/2010		8.5	650	100	440	Dry				
Mar-10	17/03/2010	Dry					Dry				
Apr-10	12/04/2010		7.3	400	15	340	Dry				
May-10	12/05/2010	Dry					Dry				
Jun-10	11/06/2010	Dry						8	4310	27	1960

	old site name	W1					W2				
	new site name	SW01					SW02				
	Eastings (MGA, z 56)	284041					286917				
	Northings (MGA, z 56)	6419087					6423773				
month	date sampled	Fluw Conditions	pH	EC (uS/cm)	TSS (mg/L)	TDS (mg/L)	Fluw Conditions	pH	EC (uS/cm)	TSS (mg/L)	TDS (mg/L)
Jul-10	9/07/2010	Dry					Flow	8.4	5495	6	2805
Aug-10	20/08/2010	No Flow	8.6	287	3	182	Flow	8.2	5330	11	2865
Sep-10	16/09/2010	No Flow	8.0	336	8	178	Flow	7.8	5465	14	2915
Oct-10	19/10/2010	Dry					No Flow	8.1	5630	232	3050
Nov-10	10/11/2010	No Flow	7.8	318	8	242	No Flow	7.7	4020	4	2570
Dec-10	2/12/2010	No Flow	7.7	334	15	282	No Flow	7.7	4310	26	2440
Jan-11	10/01/2011	No Flow	8.2	297	35	380	No Flow	8.2	5440	19	3080
Feb-11	14/02/2011	No Flow	7.5	859	249	580	No Flow	7.7	6470	23	4070
Mar-11	10/03/2011	No Flow	7.5	999	394	694	Dry				
Apr-11	14/04/2011	No Flow	7.4	678	725	514	Dry				
May-11	11/05/2011	Dry					Dry				
Jun-11	9/06/2011	No Flow	8.8	383	48	228	No Flow	8.0	3890	5	2220
Jul-11	25/07/2011	No Flow	7.6	487	17	282	Flow	8.0	5250	21	2870
Aug-11	18/08/2011	No Flow	8.0	529	11	327	Flow	8.0	5230	2	2960
Sep-11	29/09/2011	Flow	9.0	485	15	310	Flow	7.8	5220	<1	2900
Oct-11	20/10/2011	No Flow	7.3	269	5	358	Flow	8.0	3410	1	1880
Nov-11	17/11/2011	No Flow	7.4	283	43	209	Flow	7.8	5380	16	2920
Dec-11	28/12/2011	No Flow	9.0	1253	4	714	Flow	7.7	2730	1	1500
Jan-12	26/01/2012	No Flow	7.9	1461	23	924	Flow	7.6	4580	4	2660
Feb-12	24/02/2012	No Flow	8.8	825	5	475	Flow	7.7	2560	4	1380
Mar-12	3/03/2012	Flow	6.7	126	25	223	Flow	7.9	1993	293	1230
Apr-12	20/04/2012	No Flow	8.5	1736	4	976	Flow	8.0	3260	3	1970
May-12	22/05/2012	No Flow	8.4	1739	11	991	Flow	8.1	3850	2	2060
Jun-12	28/06/2012	No Flow	8.4	1660	10	892	Flow	8.1	3690	5	2060
Jul-12	26/07/2012	Flow	7.9	1463	8	773	Flow	8.2	3070	3	1650
Aug-12	27/08/2012	No Flow	8.3	1983	6	1090	Flow	8.2	3790	<1	2120
Sep-12	24/09/2012	No Flow	8.8	2820	24	1500	Flow	8.1	3940	2	2150
Oct-12	16/10/2012	No Flow	9.0	3080	13	1750	Flow	8.0	4080	1	2330
Nov-12	13/11/2012	No Flow	7.7	4460	215	2450	No Flow	7.9	4950	11	2760
Dec-12	21/12/2012	No Flow					Dry				
Jan-13	16/01/2013	Dry					No Flow	7.6	6200	11	3460
Feb-13	14/02/2013	No Flow	7.4	541	12	391	Flow	7.9	4040	69	2460
Mar-13	14/03/2013	Flow	7.5	1739	1	974	Flow	7.8	2030	3	1160
Apr-13	17/04/2013	No Flow	8.3	2270	2	1340	Flow	7.9	3550	<1	1920
May-13	16/05/2013	No Flow	8.4	2970	10	1560	Flow	8.1	3930	1	2190
Jun-13	6/06/2013	No Flow	8.3	2940	15	1460	Flow	8.2	4180	<5	2150
Jul-13	10/07/2013	No Flow	8.6	1615	7	934	Flow	8.2	3740	3	2150
Aug-13	19/08/2013	No Flow	9.2	3190	9	1740	Flow	8.6	3800	<1	2140
Sep-13	12/09/2013	No Flow	8.4	3820	29	2170	Flow	8.0	3850	<1	2240
Oct-13	10/10/2013	No Flow	8.3	4640	32	5310	Flow	8.0	4220	3	2400
Nov-13	20/11/2013	No Flow	7.8	1329	82	774	Flow	7.8	1984	19	1090
Dec-13	18/12/2013	No Flow	8.3	2020	25	1130	Flow	7.7	3800	4	2090
Jan-14	20/01/2014	No Flow	8.9	4150	51	2400	No Flow				
Feb-14	13/02/2014	No Flow					No Flow				
Mar-14	20/03/2014	No Flow	7.5	554	17	408	No Flow	7.6	5510	6	3260
Apr-14	9/04/2014	No Flow	7.4	371	24	327	Flow	7.7	3900	1	2220
May-14	7/05/2014	No Flow	7.7	485	95	926	Flow	7.9	3980	1	2310
Jun-14	19/06/2014	No Flow	8.2	672	10	388	Flow	8.1	4540	<5	2320
Jul-14	9/07/2014	No Flow	7.8	768	39	458	Flow	8.0	4340	<1	2430
All data	95th Percentile		8.8	3014	251	1632		8.3	6544	118	3924
July 2010 to July 2014 - Flow	95th Percentile		8.8	1698	24	944		8.3	5410	57	2917
July 2010 to July 2014 - No Flow	95th Percentile		9.0	4181	264	2405		8.2	6362	150	3826
All data	Maximum		9.8	4640	843	5310		9.2	7765	293	10675
All data	Minimum		5.6	62	0	178		5.8	16	0	20

APPENDIX 4

GROUNDWATER MANAGEMENT PLAN

MACHEnergy

MOUNT PLEASANT OPERATION

GROUNDWATER MANAGEMENT PLAN

Document ID:	MP001-0000-ENV-PLN-0006		
Company:	MACH Energy Australia Pty Ltd		
Effective Date:	31 October 2019	**Status:**	Issued for Use
Approved By:	Andrew Reid	**Revision Number:**	02

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1 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton (Figure 1). The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively (Figure 1). The proponent of the MPO is MACH Energy Australia Pty Ltd (MACH Energy), which purchased the MPO from Coal & Allied Operations Pty Ltd (Coal & Allied) in 2016.

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

The Mount Pleasant Project Modification (MOD 1) was submitted on 19 May 2010 with a supporting Environmental Assessment (EA) prepared by EMGA Mitchell McLennan (EMGA Mitchell McLennan, 2010). MOD 1 included the provision of an infrastructure envelope for siting the mine infrastructure, the provision of an optional conveyor/service corridor linking the MPO facilities with the Muswellbrook-Ulan Rail Line and modification of the existing Development Consent DA 92/97 boundaries to accommodate the optional conveyor/service corridor and minor administrative changes. MOD 1 was approved on 19 September 2011.

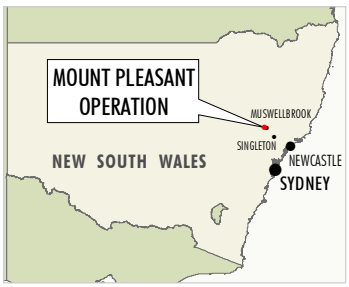
The MPO South Pit Haul Road Modification (MOD 2) was submitted on 30 January 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017a). MOD 2 proposed to realign an internal haul road to enable more efficient access to the South Pit open cut, with no other material changes to the approved MPO. MOD 2 was approved on 29 March 2017.

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

The MPO Rail Modification (MOD 4) was submitted on 18 December 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017c). MOD 4 proposed the following changes:

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

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



LEGEND

- Mining Operation
- Proposed Mining Operation
- Mining Lease Boundary (Mount Pleasant)
- Railway
- Local Government Boundary
- State Forest
- National Parks and Wildlife Estate

Source: © NSW Department of Finance, Services and Innovation (2018); Office of Environment and Heritage NSW (2018)

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MOUNT PLEASANT OPERATION

Project Location

Figure 1

MAC-16-01 MP2019_ Figure 1_ Rev A

1.1 STRUCTURE OF THE GROUND WATER MANAGEMENT PLAN

Consistent with the requirements of Condition 28(d), Schedule 3 of Development Consent DA 92/97, the remainder of the Ground Water Management Plan (GWMP) is structured as follows:

- Section 2: Outlines the statutory obligations relevant to this GWMP.
- Section 3: Describes the existing groundwater environment present at the MPO.
- Section 4: Provides a description of the baseline data available for the GWMP.
- Section 5: Describes the management strategy proposed for the final voids (including development of detailed plans).
- Section 6: Describes the groundwater model predictions and validation (including contemporary groundwater modelling).
- Section 7: Outlines the groundwater impact trigger levels.
- Section 8: Describes the groundwater monitoring program proposed for the MPO.
- Section 9: Describes the review process for MPO documentation, including in particular for this GWMP.
- Section 10: Outlines the reporting procedures for MPO documentation.
- Section 11: Provides a list of the references cited in this report.

2 STATUTORY OBLIGATIONS

MACH Energy's statutory obligations are contained in:

- the conditions of Development Consent DA 92/97 (as modified);
- the conditions of the Commonwealth Approval EPBC 2011/5795;
- relevant licences (including Environment Protection Licence [EPL] 20850), permits and mining leases (MLs) (ML 1645, ML 1708, ML 1709, ML 1713 and ML 1750); and
- other relevant legislation.

Obligations relevant to this GWMP are described below.

2.1 PURPOSE AND SCOPE

This GWMP has been prepared by MACH Energy to satisfy the requirements under Development Consent DA 92/97 and specifically Condition 28(d), Schedule 3.

The GWMP applies to all employees and contractors at the MPO and covers all areas within the MPO boundary. The GWMP applies to the life of the MPO, including (but not limited to) the period of mining operations specified in Development Consent DA 92/97, which currently permits mining until 22 December 2026. As required by Condition 5, Schedule 2 of Development Consent DA 92/97, the GWMP will continue to apply (excluding mining operations) beyond 22 December 2026, as required, until the rehabilitation and any additional undertakings (required by the Secretary of the NSW Department of Planning, Industry and the Environment [DPIE], or the Division of Resources and Geoscience [DRG] within the DPIE) have been carried out satisfactorily.

This GWMP has been prepared to monitor and manage potential groundwater related impacts (through groundwater model validation and the development of trigger levels) associated with the MPO, including open cut mining.

Response protocols in the event of an exceedance of trigger levels from this GWMP and appropriate measures to prevent, minimise, mitigate, compensate and/or offset such adverse impacts are described separately in the Surface and Ground Water Response Plan.

2.2 DEVELOPMENT CONSENT DA 92/97

The conditions of Development Consent DA 92/97 relevant to the content and structure of this GWMP are described below. A comprehensive list of all conditions in Development Consent DA 92/97 relevant to water resources (in general) is provided in the Water Management Plan (WMP).

2.2.1 GWMP Requirements

Condition 28(d), Schedule 3 of Development Consent DA 92/97 requires the preparation of a GWMP (refer Table 1).

Table 1
Groundwater Management Plan Development Consent DA 92/97 Condition

MPO Development Consent DA 92/97 Schedule 3	Section where addressed in this GWMP Document
28. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with DoI Water and EPA, and be submitted to the Secretary for approval by 30 June 2019, unless otherwise agreed by the Secretary. *The plan must include:* *…* *(d) a Groundwater Management Plan, which must include:*	
• *detailed plans, including design objectives and performance criteria, for the design and management of the proposed final voids;*	Section 5
• *detailed baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores, that could be affected by the development;*	Section 4
• *groundwater impact assessment criteria including trigger levels for investigating any potentially adverse groundwater impacts;*	Section 7
• *a program to monitor and assess:* – *groundwater inflows to the mining operations;* – *impacts on regional and local (including alluvial) aquifers;* – *impacts on the groundwater supply of potentially affected landowners;* – *impacts on groundwater dependent ecosystems and riparian vegetation;*	Section 8

2.2.2 Management Plan (General) Requirements

Condition 2, Schedule 5 of Development Consent DA 92/97 outlines the general management plan requirements that are applicable to the preparation of the GWMP.

Table 2 presents these requirements and indicates where each is addressed within this GWMP.

Table 2
General Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 5	Section where addressed in this GWMP Document
2. The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 4
(b) a description of: • *the relevant statutory requirements (including any relevant consent, licence or lease conditions);*	Section 2
• *any relevant limits or performance measures/criteria;*	Section 7
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	Section 7
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 5
(d) a program to monitor and report on the: • *impacts and environmental performance of the development;* • *effectiveness of any management measures (see c above);*	Sections 7 and 8
(e) a contingency plan to manage any unpredicted impacts and their consequences;	Surface and Ground Water Response Plan
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 9
(g) a protocol for managing and reporting any: • *incidents;* • *complaints;* • *non-compliances with statutory requirements; and* • *exceedances of the impact assessment criteria and/or performance criteria; and*	Section 10
(h) a protocol for periodic review of the plan. *Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*	Section 9

2.3 LICENCES, PERMITS AND LEASES

Water management at the MPO is conducted in accordance with a number of licences, permits and leases. Key licences, permits and leases relating to water at the MPO include:

- Water Access Licences (WAL 879, 880, 1113 and 41438) issued under the NSW *Water Management Act, 2000*.
- Discharge credits (20) held under the NSW *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation, 2002.*
- ML 1645, ML 1708, ML 1709, ML 1713 and ML 1750 issued under Part 5 of the NSW *Mining Act, 1992* and approved by the Minister for Mineral Resources in December 2010.
- EPL 20850 issued under Part 3 of the NSW *Protection of the Environment Operations Act, 1997* by the NSW Environment Protection Authority (EPA).
- Mining Operations Plan/Rehabilitation Management Plan (MOP/RMP)approved by the DRG.

2.4 OTHER LEGISLATION / POLICY / PLANS

Other NSW Acts and Regulations that may be applicable to the GWMP for the MPO are discussed in the following sub-sections.

2.4.1 Water Management Act, 2000

The NSW *Water Management Act, 2000* aims to provide sustainable and integrated management of the water sources of NSW for the benefit of both present and future generations.

Under the NSW *Water Management Act, 2000*, the MPO is regulated under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009* and the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources, 2016*.

The following groundwater sources are relevant to the MPO (Figure 2):

- *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources, 2016:*
  - Sydney Basin – North Coast;
  - New England Fold Belt Coast; and
  - Liverpool Ranges Basalt Coast.
- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009*:
  - Hunter Regulated River Alluvial Water Source;
  - Unnamed alluvium within the Muswellbrook Water Source; and
  - Unnamed alluvium within the Dart Brook Water Source.

A summary of licences held by MACH Energy is provided in Tables 3 and 4.

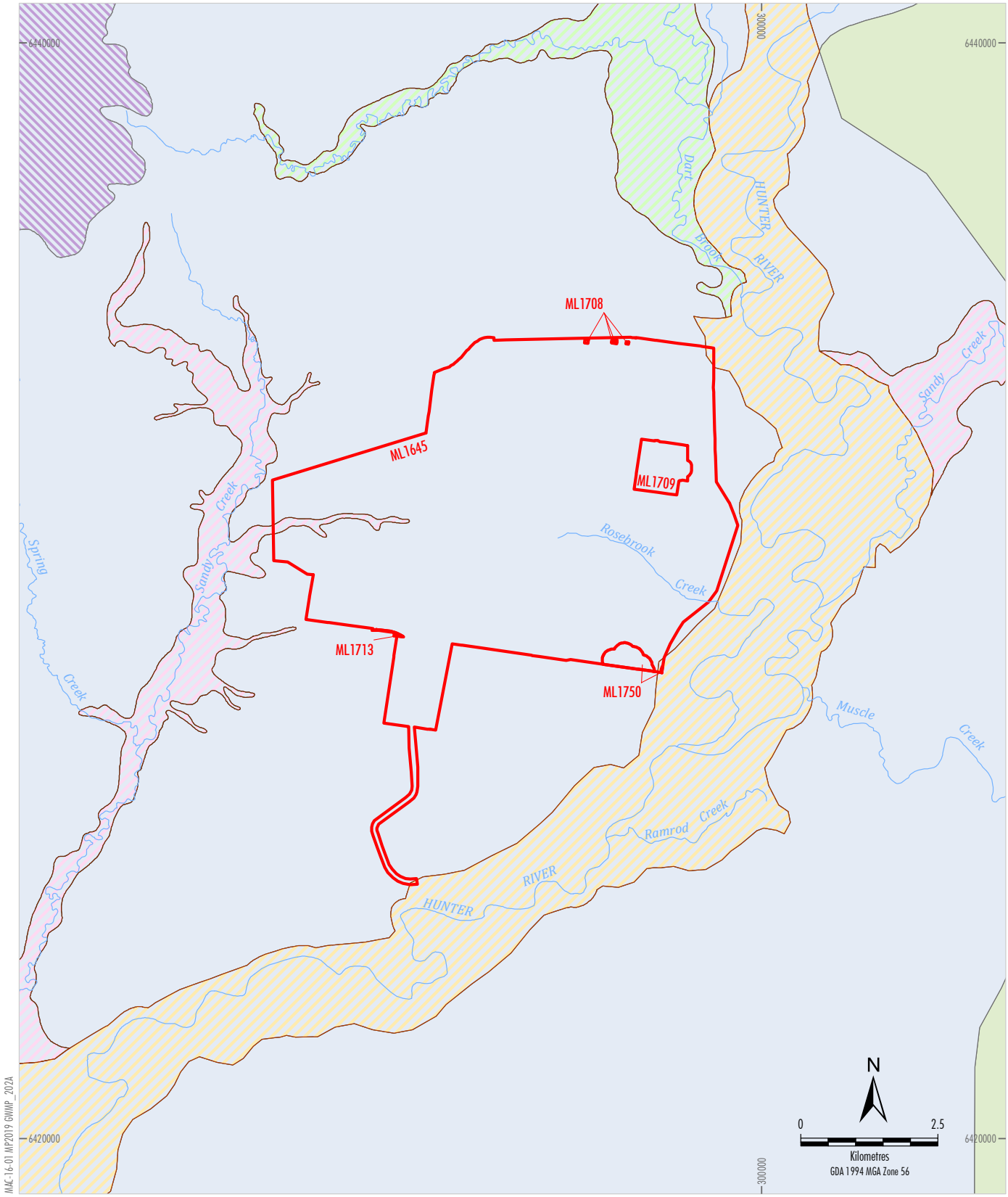
Table 3
Water Access Licences – Groundwater Sources

Water Access Licence	Water Source	Shares (units)
18253	Alluvial Water Source	74
18266	Hunter Regulated River Alluvial Water Source	68
18206	Hunter Regulated River Alluvial Water Source	24
18199	Hunter Regulated River Alluvial Water Source	5
18122	Hunter Regulated River Alluvial Water Source	33
18131	Hunter Regulated River Alluvial Water Source	60
21503	Hunter Regulated River Alluvial Water Source	21
18177	Hunter Regulated River Alluvial Water Source	5
23935	Muswellbrook Water Source	41
41437	Sydney Basin - North Coast Groundwater Source	40
40298	Sydney Basin - North Coast Groundwater Source	90
18336	Krui River Water Source	12
	Aquifer Subtotal	473

Table 4
Water Access Licences – Surface Water Sources

Water Access Licence	Water Source	Type	Shares (units)
879	Hunter Regulated River Water Source	Regulated River (High Security)	224
880	Hunter Regulated River Water Source	Regulated River (High Security)	124
1113	Hunter Regulated River Water Source	Regulated River (High Security)	366
973	Hunter Regulated River Water Source	Regulated River (High Security)	3
638	Hunter Regulated River Water Source	Regulated River (High Security)	3
		High Security Subtotal	**720**
639	Hunter Regulated River Water Source	Regulated River (General Security)	134
974	Hunter Regulated River Water Source	Regulated River (General Security)	210
988	Hunter Regulated River Water Source	Regulated River (General Security)	156
1229	Hunter Regulated River Water Source	Regulated River (General Security)	480
1227	Hunter Regulated River Water Source	Regulated River (General Security)	99
992	Hunter Regulated River Water Source	Regulated River (General Security)	75
7808	Hunter Regulated River Water Source	Regulated River (General Security)	36
702	Hunter Regulated River Water Source	Regulated River (General Security)	267
993	Hunter Regulated River Water Source	Regulated River (General Security)	265
604	Hunter Regulated River Water Source	Regulated River (General Security)	183
662	Hunter Regulated River Water Source	Regulated River (General Security)	9
10775	Hunter Regulated River Water Source	Regulated River (General Security)	243
41438	Hunter Regulated River Water Source	Regulated River (General Security)	420
		General Security Subtotal	**2,577**
975	Hunter Regulated River Water Source	Domestic And Stock	8
989	Hunter Regulated River Water Source	Domestic And Stock	8
1230	Hunter Regulated River Water Source	Domestic And Stock	8
605	Hunter Regulated River Water Source	Domestic And Stock	8
677	Hunter Regulated River Water Source	Domestic And Stock	24
663	Hunter Regulated River Water Source	Domestic And Stock	16
1259	Hunter Regulated River Water Source	Supplementary Water	33
1258	Hunter Regulated River Water Source	Supplementary Water	5
1307	Hunter Regulated River Water Source	Supplementary Water	38
1260	Hunter Regulated River Water Source	Supplementary Water	5
1308	Hunter Regulated River Water Source	Supplementary Water	15
1338	Hunter Regulated River Water Source	Supplementary Water	18
		Other Subtotal	**185**

In addition to licensing requirements, the NSW *Water Management Act, 2000* includes the concept of ensuring “no more than minimal harm”. Minimal impact considerations have been developed in the *NSW Aquifer Interference Policy* (Department of Primary Industries [DPI], 2012) (Section 2.4.3).



MAC-16-01 MP2019 GWMP_202A

LEGEND

Mining Lease Boundary

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

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017)

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MOUNT PLEASANT OPERATION

Relevant Groundwater Sources

Figure 2

2.4.2 Water Act, 1912

As water sharing plans have been commenced under the NSW *Water Management Act, 2000* for all groundwater and surface water systems that the MPO is predicted to take water from, the *Water Act, 1912* is not relevant to licensing considerations for the MPO.

2.4.3 NSW Aquifer Interference Policy

The *NSW Aquifer Interference Policy* has been developed by the NSW Government as a component of the *NSW Government's Strategic Regional Land Use Policy*.

The *NSW Aquifer Interference Policy* applies State-wide and details water licence and impact assessment requirements. The *NSW Aquifer Interference Policy* has been developed to ensure equitable water sharing between various water users and proper licensing of water taken by aquifer interference activities such that the take is accounted for in the water budget and water sharing arrangements. The *NSW Aquifer Interference Policy* also enhances existing regulation, contributing to a comprehensive framework to protect the rights of all water users and the environment in NSW.

The *NSW Aquifer Interference Policy* includes minimal impact considerations relating to water table and groundwater pressure drawdown and changes in groundwater and surface water quality. Where relevant, these minimal impact considerations have informed the groundwater impact trigger levels (i.e. more than 2 metres [m] drawdown) (Section 7). The *NSW Aquifer Interference Policy* establishes minimal impact considerations for groundwater categories of both 'highly productive' and 'less productive' groundwater. 'Highly productive groundwater' is defined by the *NSW Aquifer Interference Policy* as groundwater which (NSW Government, 2012):

> *...is defined in this Policy as a groundwater source that is declared in the Regulations and will be based on the following criteria:*
>
> *a) has total dissolved solids of less than 1,500 mg/L, and*
>
> *b) contains water supply works that can yield water at a rate greater than 5 L/sec.*

The NSW Government's classification of the productivity of the various Groundwater Sources in this area is discussed in Section 3.

3 EXISTING GROUNDWATER ENVIRONMENT

A Water Management Study, including a regional groundwater investigation, was undertaken for the Mount Pleasant EIS by PPK Environment & Infrastructure (1997). A number of subsequent studies have been undertaken as part of mining planning and feasibility studies for the MPO as well as development applications for neighbouring mines (e.g. Bengalla Mine). A summary of the existing groundwater environment described by PPK Environment & Infrastructure (1997) is provided below.

Consistent with the relevant water sharing plans under the NSW *Water Management Act, 2000* (Section 2.4.1), the two key groundwater systems identified are the:

- **Alluvial groundwater system** – associated with the alluvial plains of the Hunter River and its tributaries.
- **Hard (fractured and porous) rock groundwater system** – including the Permian aged Wittingham Coal measures.

The regional geology of the MPO area is shown on Figure 3.

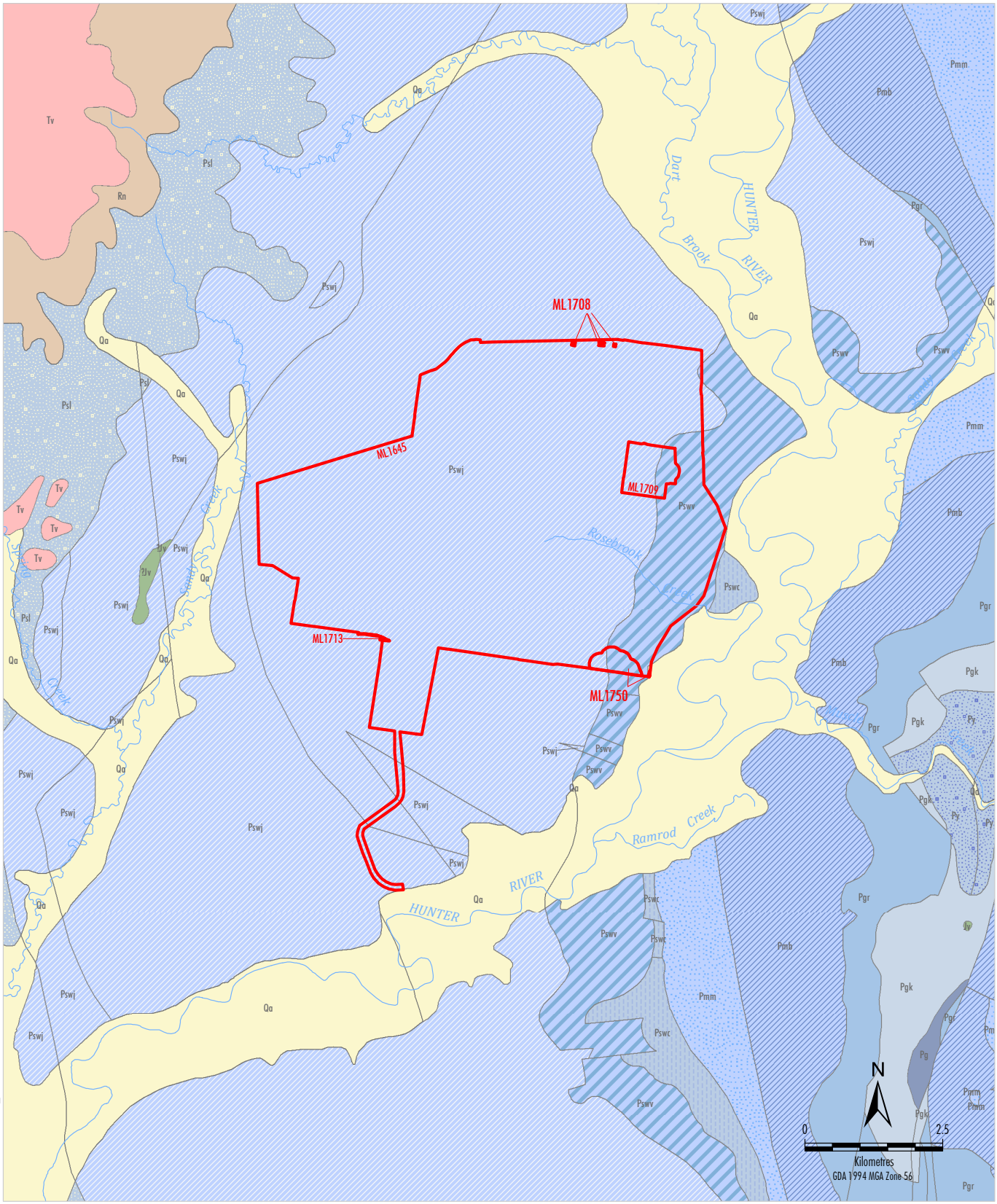
3.1 HARD (FRACTURED AND POROUS) ROCK GROUNDWATER SYSTEM

The MPO 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. Coal seams amenable to open cut mining occur in eight correlated seams and include the Upper Piercefield (Warkworth) Seam to the lowermost Edderton Seam.

The sequence of stratigraphic units, focussing on the seams targeted at the MPO, is as follows:

Table 5
MPO Stratigraphic Units

Coal Measure	Subgroup	Coal Seam
Wittingham Coal Measures	Jerrys Plains Subgroup	Warkworth seam
		Interburden #1
		Mount Arthur seam
		Interburden #2
		Piercefield seam
		Interburden #3
		Vaux seam
		Interburden #4
		Broonie seam
		Interburden #5
		Bayswater seam
	Archerfield Sandstone	
	Vane Subgroup	Interburden #6
		Wynn seam
		Interburden #7
		Edderton seam
	Saltwater Creek Formation	
Maitland Group	Mulbring Sandstone / Branxton Formation	



MAC-16-01 MP2019 GWMP_203A

LEGEND

Mining Lease Boundary

Quaternary
- Qa: Silt, Sand, Gravel

Tertiary
- Tv: Basalt

Jurassic
- Jv: Basalt

Triassic
- Rn: Hawkesbury Sandstone and Narrabeen Group

Permian
- Pswj: Denman Formation and Jerry Plains Subgroup
- Pswv: Archerfield Sandstone and Vane Subgroup
- Pswc: Saltwater Creek Formation
- Pmm: Mulbring Siltstone
- Pmb: Branxton Formation
- Pg: Greta Coal
- Pgr: Greta Coal Measures (coal seams, siltstone and sandstone)
- Pgk: Greta Coal Measures (pellet claystone, siltstone and chert)
- Psl: Wollombi Coal Measures
- Py: Gyarran Volcanics

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017)

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MOUNT PLEASANT OPERATION

Regional Geology

Figure 3

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.

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.

The hard (fractured and porous) rock groundwater system is considered ‘less productive’ under the *NSW Aquifer Interference Policy* (Section 2.4.3). The exception to this is the 'highly productive' Liverpool Ranges Basalt, which is about 8 km from the MPO.

3.2 ALLUVIAL GROUNDWATER SYSTEM

Alluvial sediments associated with the Hunter River are located to the east of the MPO. Alluvial sediments associated with Sandy Creek are located to the west of the MPO (Figures 2 and 3).

The Hunter River alluvium comprises silt underlain by sands and gravels, reaching a thickness of up to 30 m. The Hunter River alluvium is classified as a highly productive groundwater source. These alluvial sediments offer increased groundwater storage when compared to the hard (fractured and porous) rock groundwater system due to their higher porosity. Gravel zones within the alluvium are capable of providing the highest storage and permeability when compared to sand, silt and clay zones.

Recharge to the Hunter Alluvium is also significantly controlled by surface water flows in the Hunter River. The Hunter River is perennial due to releases from Glenbawn Dam. Groundwater levels within the alluvium have remained relatively stable over time, despite periods of below average rainfall, indicating recharge from surface water flows. Groundwater flow within the Hunter River alluvium generally follows the direction of surface water flow, in a south to south-easterly direction (HydroSimulations, 2019).

Groundwater take from the Hunter Regulated River Alluvial Water Source will be reported as part of the Annual Review, where relevant.

4 BASELINE DATA

Groundwater monitoring was undertaken from 1994 to 1995 to inform the Mount Pleasant EIS Water Management Study. The results of this monitoring are presented in PPK Environment & Infrastructure (1997). The collection of baseline groundwater monitoring data at the MPO resumed in 2003. The baseline period of record has been taken up until August 2018. Mining activities have been undertaken prior to August 2018, however, these activities have been minor in nature and are not anticipated to have caused propagation at monitoring sites.

Bores in the MPO groundwater monitoring network are shown on Figure 4 and summarised in Table 6.

Table 6
Groundwater Monitoring Network

Bore	Bore Group	Bore Depth/Screened Interval (mBG)	Aquifer/Unit Monitored	Baseline Period of Record
MPBH1	Eastern	Screen 12.6 – 18.6	Hunter Alluvium	Jan 2003 – Aug 2018
MPBH2	Eastern	Screen 11.5 – 17.5	Hunter Alluvium	Jan 2003 – Aug 2018
MPBH3	Eastern	Depth 14.0	Hunter Alluvium	Historical (Jan 2003 – Dec 2010)
MPBH3b	Eastern	Depth 14.0	Hunter Alluvium	Jan 2011 – Aug 2018
MPBH4 (formerly A1)	Eastern	Screen 6.0 – 12.0	Hunter Alluvium	Drilled Feb 2018, no data yet.
MPBH5 (formerly B1)	Eastern	Screen 5.8 – 8.8	Hunter Alluvium	Drilled Feb 2018, no data yet.
Melody Bore	Central	Depth 43.8	Unknown	Mar 2017
3500B500S	Central	Depth 21.43	Interburden #1	Oct 2011 – Aug 2018
3500B500L	Central	Depth 175.36	Bayswater Seam	Jan 2003 – Aug 2017
3500C500S	Central	Depth 28.48	Interburden #1	Jan 2003 – Aug 2018
3500C500L	Central	Depth 86.77	Mount Arthur Seam	Oct 2011 – Aug 2018
3500E000U	Central	Screen 50 - 55	Warkworth Seam	Historical (Aug 2012 – May 2016)
3500E000M	Central	Screen 120 - 125	Piercefield Seam and Interburden #3	Historical (Aug 2012 – May 2016)
3500E000L	Central	Screen 180 - 186	Vaux Seam	Historical (Aug 2012 – May 2016)
4500F000	Central	Depth 121.24	Vaux Seam	Jan 2003 – Aug 2018
5000A500	Central	Screen 56 - 65	Vaux Seam	Historical (Pre-EIS Only)
5000D000	Central	Depth 171.35	Wynn and Edderton Seams	Jan 2003 – Aug 2018
5500D000	Central	Screen 130 - 136	Interburden #7 and Wynn Seam	Jan 2003 – Aug 2018
6000C000S*	Central	Depth 51.27	Wynn Seam	Historical (Oct 2011 – Dec 2017)
6000C000L*	Central	Depth 20.69	Interburden #2	Historical (Jan 2003 – Dec 2017)
6500F500U	Central	Depth 35.10	Interburden #4/Broonie Seam	Jan 2003 – Aug 2018
6500F500M	Central	Depth 77.30	Interburden #6/Wynn Seam	Jan 2003 – Aug 2018
6500F500L	Central	Depth 115.20	Maitland Group	Jan 2003 – Aug 2018
6500F625	Central	Depth 36.30	Permian	Jan 2003 – Mar 2017
7000D000U	Central	Depth 12.89	Interburden #7/Edderton Seam	Jan 2003 – Aug 2018
7000D000L	Central	Depth 98.73	Maitland Group	Nov 2014 – Aug 2018
7500F000	Central	Depth 182.80	Edderton Seam	Jan 2003 – Aug 2018

Table 6 (Continued)
Groundwater Monitoring Network

Bore	Bore Group	Bore Depth/Screened Interval (mBG)	Aquifer/Unit Monitored	Baseline Period of Record
WRA1U	Western	Depth 6.50	Alluvium/Regolith	Jan 2007 – Aug 2018
WRA1L	Western	Depth 19.40	Warkworth/Permian	Jan 2003 – Aug 2018
WRA2U	Western	Depth 5.50	Alluvium/Regolith	Jan 2007 – Aug 2018
WRA2L	Western	Depth 18.95	Warkworth/Permian	Jan 2003 – Aug 2018
WRA3U	Western	Depth 6.75	Alluvium/Regolith	Jan 2003 – Aug 2018
WRA3L	Western	Depth 22.19	Warkworth/Permian	Jan 2003 – Aug 2018
WRA5U*	Western	Screen 1.64 – 7.64	Alluvium/Regolith	Historical (Jan 2003 – Feb 2018)
WRA5L*	Western	Screen 13.40 – 19.30	Warkworth/Permian	Historical (Jan 2003 – Feb 2018)
WRA6U	Western	Depth 18.98	Alluvium/Regolith	Jan 2003 – Aug 2018
WRA6L	Western	Depth 9.27	Warkworth/Permian	Jan 2003 – Aug 2018

Note:

mBG = metres below grade.

* Bore destroyed.

Sites with U, M and L suffixes refer to 'upper', 'middle' and 'lower' (depths), but sites with S and L suffixes usually refers to piezometer diameter (small and large), which may be unrelated to the depth.

4.1 GROUNDWATER LEVELS

Baseline groundwater levels are presented as hydrographs in Attachment 2. Depending on the bore location, the baseline period may include groundwater level effects from neighbouring Bengalla and Dartbrook mines.

4.1.1 Eastern Domain

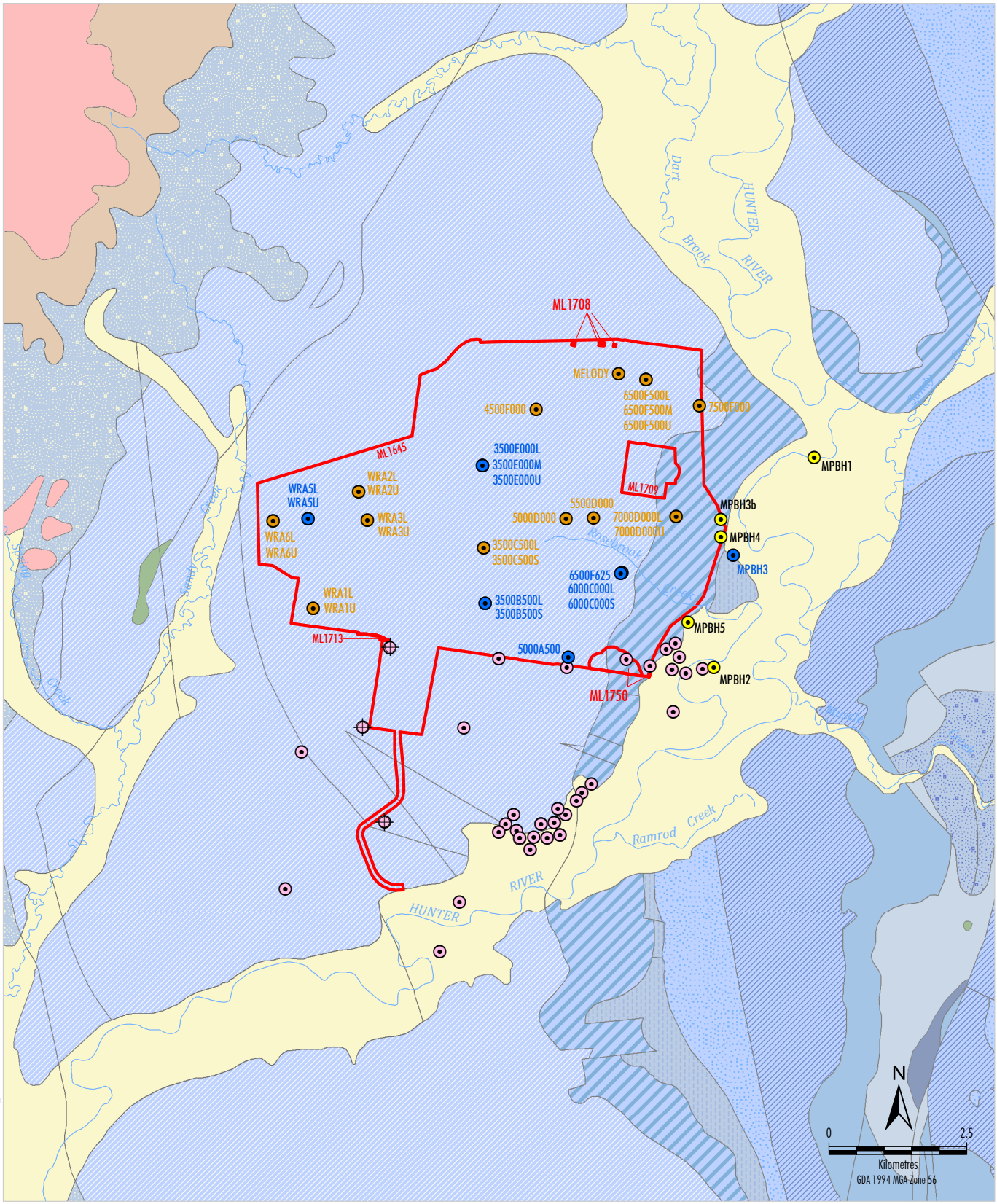
The alluvium bores MPBH1, 2, 3 and 3b show fairly static groundwater levels, varying by only 1-2 m, supporting the concept that these are controlled by nearby Hunter River stage elevation. MPBH1-2 both show a period of greater variation in 2009-10, which could have been caused by local bore pumping.

4.1.2 Central Domain

Some of the bores monitoring the hard rock units, e.g. 3500B500L and 3500B500S show a response to historical mining at Bengalla Mine. 3500B500L and 3500B500S are about 1.5 km north of Bengalla Mine and the deeper bore 3500B500L shows about 35 m of drawdown from 2002 to 2013-16, while about 25-30 m drawdown was observed at 3500C500L, which is a further 1 km north. The shallow (S) piezometers at these locations do not exhibit the same response to Bengalla Mine, indicating that there is only a weak connection (due to low permeability) between the deep and shallow units.

4.1.3 Western Domain

Bores in the west (e.g. WRA1U, WRA3U, WRA5U and WRA6U) show a higher degree of correlation to rainfall trends, and even some of the deeper piezometers exhibit the same (e.g. WRA3L, WRA5L and WRA6L). Generally, these bores also show consistent head separation between upper/shallow and lower piezometers, with the exception of WRA5U and WRA6U. The reason for the lack of head separation at these two bores is not yet known, but will be assessed further as part of on-going Contemporary Groundwater Modelling for the Project.



MAC-16-01 MP2019 GWMP_204C

LEGEND

- Mining Lease Boundary

Mount Pleasant Monitoring

- Standpipe
- Standpipe - Alluvium
- Standpipe - Historical

Bengalla Monitoring

- Standpipe
- Vibrating Wire Piezometer

Source: NSW Land & Property Information (2019); NSW Division of Resources & Energy (2019); MACH Energy (2019)

Note: Refer Figure 3 for geology legend

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MOUNT PLEASANT OPERATION

Groundwater Monitoring Network

Figure 4

4.2 GROUNDWATER QUALITY

Baseline groundwater quality data is provided in Attachment 3 and a summary is provided in Table 7.

Table 7
Groundwater Quality Summary

Bore Group	Groundwater System Monitored	Median pH	Median Electrical Conductivity (EC) (µS/cm)
Eastern Groundwater Site (MPBH1 and MPBH2)	Alluvium	6.9	790
Eastern Groundwater Site (MPBH3)	Alluvium	6.8	1,005
Eastern Groundwater Site (MPBH3b)	Alluvium / Permian regolith	7.6	3,860
Central Groundwater Site	Hard (Porous and Fractured) Rock	6.9	5,210
Western Groundwater Site	Hard (Porous and Fractured) Rock	7.2	5,690

Note: µS/cm = microsiemens per centimetre.

Median pH in both the alluvial and hard (porous and fractured) rock aquifer systems are neutral. The range of data shown in Attachment 3 indicate the pH is quite stable across both groundwater systems.

Groundwater within the alluvium is generally fresh to slightly brackish (median of 540 – 1,005 µS/cm), as recorded at MPBH1, MPBH2 and MPBH3. Bore MPBH3b intersects the basal alluvium and weathered Permian coal measures, resulting in more brackish water quality. Groundwater within the Permian coal measures (Central and Western groundwater sites) is generally brackish to moderately saline.

4.3 AQUIFER PARAMETERS/GROUNDWATER YIELD

A number of investigations into aquifer parameters have been undertaken at the MPO and neighbouring Bengalla and Mt Arthur mines.

A summary of these investigations is provided in the sub-sections below.

4.3.1 MPO Investigations

As part of the Water Management Study undertaken for the Mount Pleasant EIS (PPK Environment & Infrastructure, 1997), a suite of groundwater testing, including injection, pump out and packer tests, were undertaken at the site.

Groundwater testing of the hard rock aquifers involved injection, slug and packer testing, and indicated very low rates of flow. A range of <0.0001 metres per day (m/day) to 0.84 m/day was determined for the hydraulic conductivity of the aquifer, with a global median value (omitting extreme values) of 0.015 m/day across all testing types.

In contrast to the hard rock coal measures, the alluvial aquifer regime was found to be highly transmissive, with an average hydraulic conductivity of 20.3 m/day, and an overall range of 8.8 m/day to 33.2 m/day.

Data obtained from the groundwater testing undertaken for the Mount Pleasant EIS (PPK Environment & Infrastructure, 1997) is provided in Attachment 4.

4.3.2 Investigations at Neighbouring Mines

Various groundwater tests have been undertaken in the vicinity of the MPO area, including at the Bengalla Mine directly to the south of the MPO, and the Mt Arthur Coal Mine to the south-east.

Pumping tests were undertaken as part of the Bengalla Mine EIS (Mackie Martin and Associates, 1993) on the alluvial aquifer bordering the Hunter River, to the south-east of the MPO. These tests found a transmissivity ranging from 100 square metres per day (m^2/day) to 700 m^2/day. Assuming a saturated thickness of 10 m (which is typical, based on nearby bore logs), this equates to a hydraulic conductivity ranging from 10 m/day to 70 m/day (AGEC, 2013).

Pumping tests were also undertaken on five bores bordering the Hunter River to the south of the MPO boundary, as part of the *Mt Arthur North Groundwater Management Studies* (Mackie Environmental Research, 2000). These tests indicated that basal gravel in the aquifer had a moderate to high hydraulic conductivity, which ranged from 5 m/day to 40 m/day, with a median value of 8.2 m/day.

Overall, available data in the area to the south of the MPO indicates a generally high but spatially variable hydraulic conductivity in the alluvial aquifer regime bordering the Hunter River (Australasian Groundwater and Environmental Consultants, 2013).

In the Wittingham Coal Measures to the south of the MPO, various tests were undertaken as part of the Bengalla Mine EIS (HLA-Envirosciences, 1993) which found a transmissivity range of 0.2 m^2/day to 10 m^2/day.

Australian Groundwater Consultants (AGC) (1979) and Laurie, Montgomerie and Petit Pty Ltd (LM&P) (1982) undertook groundwater testing in the Wittingham Coal Measures at the Mt Arthur Coal Mine to the south of the MPO boundary. The outcomes of these tests are summarised in Attachment 4, which indicate a large variation in the hydraulic conductivities of coal seams in the area (AGEC, 2013).

4.4 PRIVATELY-OWNED GROUNDWATER BORES

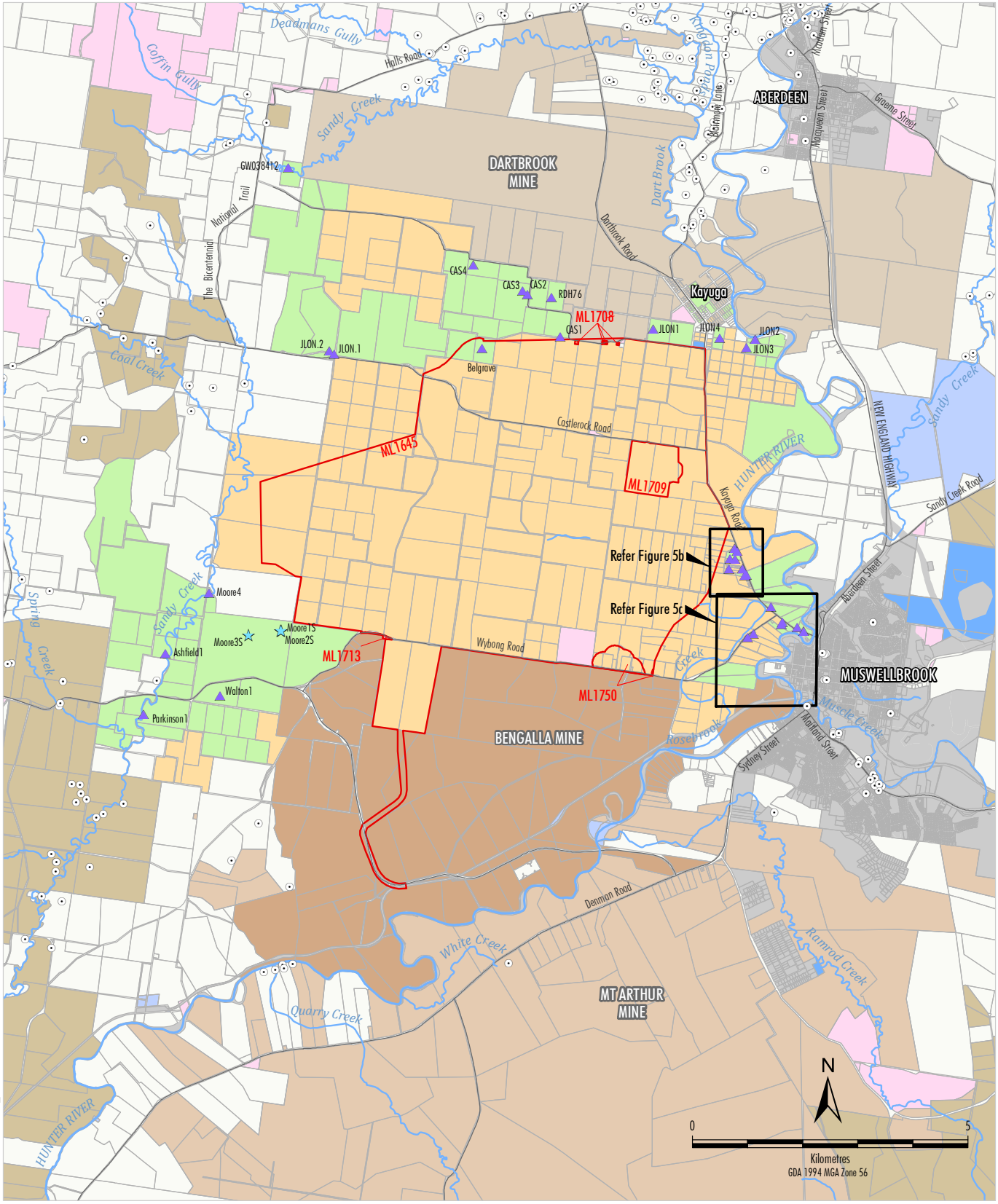
MACH Energy has conducted a census of privately-owned groundwater bores in the vicinity of the MPO (MACH Energy, 2017d).

The census involved:

- Characterisation of existing groundwater bores through collation and review of the NSW Department of Planning, Industry and Environment – Water (DPIE-Water) (former Department of Industry – Water);
- DPIE-Water 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 Figures 5a, 5b and 5c. A number of bores were also visited on mine-owned land during the census (e.g. monitoring bores). PINNEENA records are shown for properties that were not visited (e.g. due to distance from the MPO mining areas).

A summary of the results of the bore census is provided in Attachment 5.



MAC-16-01 MP2019 GWMP_205B

LEGEND

- Mining Lease Boundary
- Bores/Wells on Privately-Owned Land
- Springs on Privately-owned Land
- PINNEENA Record

- Muswellbrook and Upper Hunter LEPs Zones B2, B5, IN1,SP2, R2, R5, RE1, RE2 and W1
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Mount Pleasant Controlled
- Bengalla Controlled
- Dartbrook Controlled
- Mt Arthur Controlled
- Other Mining/Resource Company Controlled
- Relevant Privately-owned Land

Source: NSW Land & Property Information (2019); NSW Division of Resources & Energy (2019); MACH Energy (2019)

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MOUNT PLEASANT OPERATION

Groundwater Bores, Wells and Springs Identified During the Bore Census

Figure 5a

MAC-16-01 MP2019 GWMP_205B

LEGEND

- Mining Lease Boundary
- Bores/Wells on Privately-Owned Land
- PINNEENA Record
- Muswellbrook and Upper Hunter LEPs Zones B2, B5, IN1,SP2, R2, R5, RE1, RE2 and W1
- Mount Pleasant Controlled
- Relevant Privately-owned Land

Source: NSW Land & Property Information (2019); NSW Division of Resources & Energy (2019); MACH Energy (2019)

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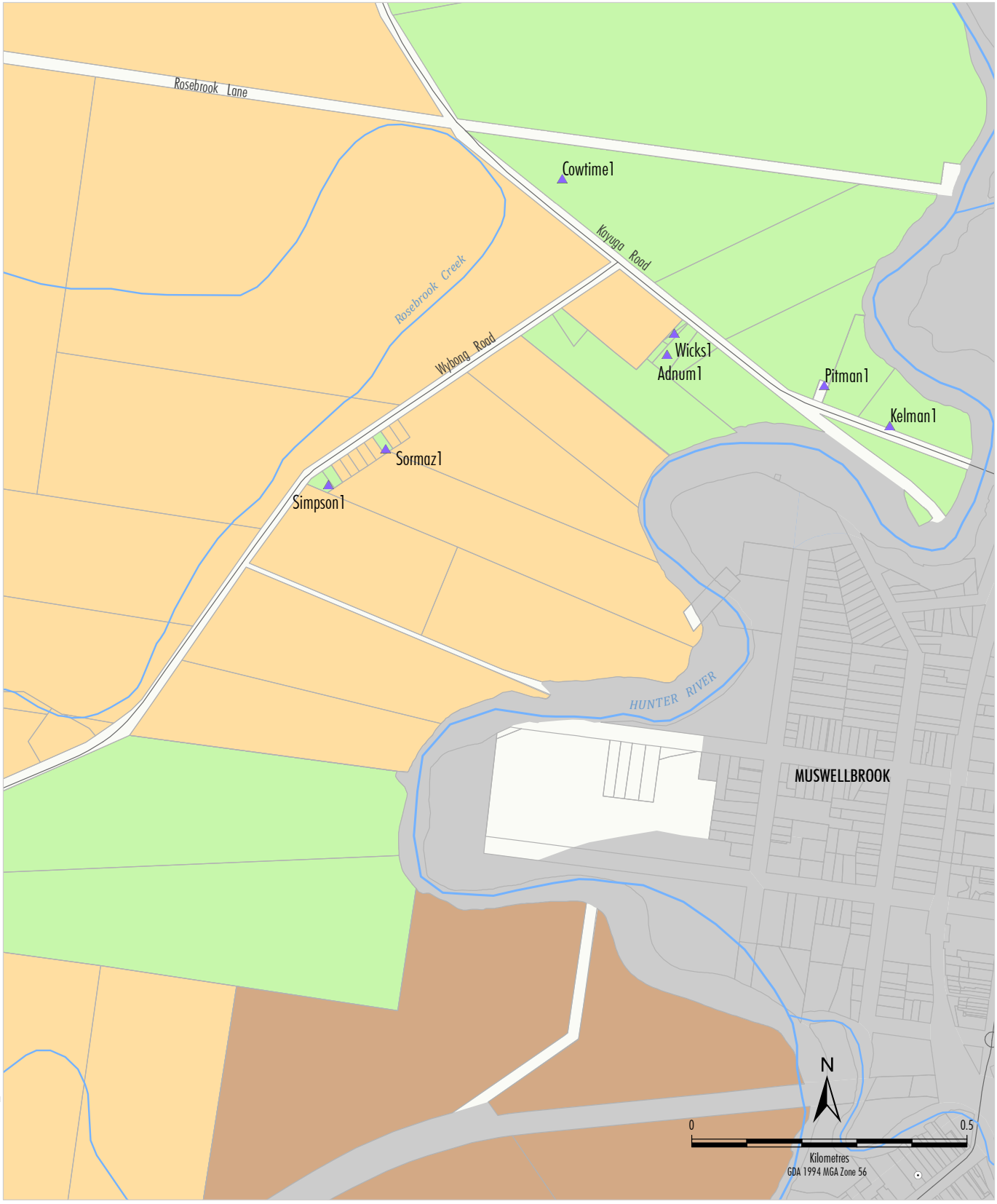
MOUNT PLEASANT OPERATION

Groundwater Bores and Wells –
Inset 1 [Collins Lane/Kayuga Road]
Identified During the Bore Census

Figure 5b



MAC-16-01 MP2019 GWMP_205B

LEGEND

- Mining Lease Boundary
- Bores/Wells on Privately-Owned Land
- PINNEENA Record
- Muswellbrook and Upper Hunter LEPs Zones B2, B5, IN1,SP2, R2, R5, RE1, RE2 and W1
- Muswellbrook Shire Council
- Mount Pleasant Controlled
- Bengalla Controlled
- Relevant Privately-owned Land

Source: NSW Land & Property Information (2019); NSW Division of Resources & Energy (2019); MACH Energy (2019)

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MOUNT PLEASANT OPERATION

Groundwater Bores and Wells – Inset 2 [Wybong Road/Kayuga Road] Identified During the Bore Census

Figure 5c

4.5 METEOROLOGICAL DATA

Meteorological data is collected from a number of Bureau of Meteorology (BoM) stations in the vicinity of the MPO. Average monthly rainfall for each of these stations is summarised in Table 8.

Data from the Aberdeen (Main Road) (1900 – 1960) and Muswellbrook (Lindisfarne) (1961 – 2018) has been aggregated to develop a rainfall residual mass curve shown on Figure 6 and has been used on the groundwater hydrographs in Attachment 2. This curve is used as it allows easy identification of short or long periods of below average rainfall (downward gradient) or above average rainfall (upward gradient), as well as periods of roughly average rainfall (flat). Comparison of this curve with groundwater level hydrographs indicates whether groundwater levels are responding to dry or wet conditions, or potentially to some other mechanism (e.g. groundwater pumping, mining).

Table 8
Average Monthly Rainfall in the Vicinity of the MPO

Parameter	Muswellbrook (St Heliers)	Aberdeen (Main Road)	Muswellbrook (Lindisfarne)	Muswellbrook (Spring Creek, Castle Vale)
Station Information				
Station Number	061374	61000	61168	61192
Period of Record	1992 – 2018	1894 – 2007 and 2013	1960 – 2018	1960 – 2016
Average Monthly Rainfall (mm)				
January	60.0	73.5	77.9	90.5
February	62.2	62.2	61.0	68.5
March	59.3	51.6	58.7	68.7
April	37.1	40.2	37.1	46.5
May	42.5	41.5	41.1	48.1
June	51.9	44.5	38.3	42.9
July	37.2	40.6	30.6	33.3
August	40.5	36.5	30.2	36.8
September	45.7	39.1	39.4	36.8
October	44.9	49.3	49.7	53.9
November	75.0	50.9	57.7	66.9
December	63.8	66.1	63.9	76.5
Annual Average Rainfall (mm)	***620.1***	***601.4***	***596.2***	***663.1***

Note: Data current as of 18 October 2018.

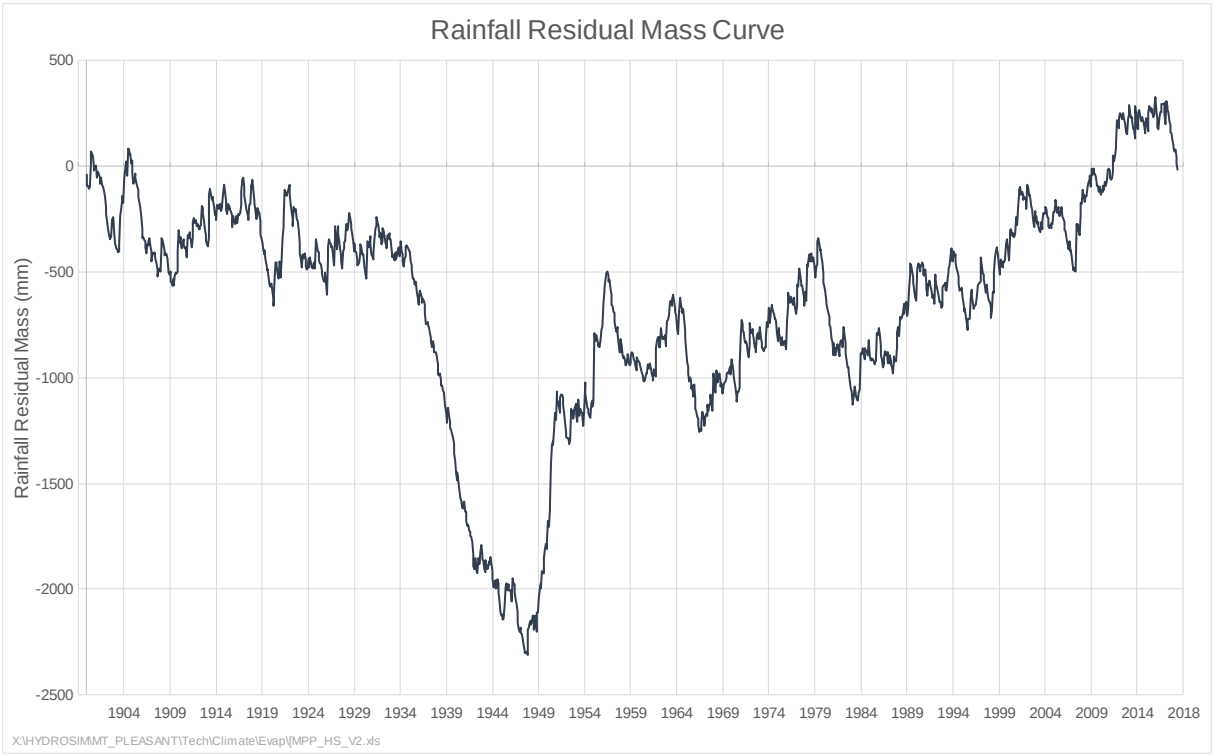


Figure 6: Rainfall Residual Mass Curve – Aberdeen and Muswellbrook

4.6 FLOW MONITORING DATA

Baseline flow monitoring data in the vicinity of the MPO is described in the Surface Water Management Plan (SWMP).

4.7 GEOCHEMISTRY DATA

Metal concentrations in overburden and coal reject materials was assessed by RGS Environmental Pty Ltd (2013) in the *Continuation of Bengalla Mine Geochemical Impact Assessment*. This data is considered to be representative of the overburden and coal reject materials at the MPO, which is located in the same geology as the Bengalla Mine (Figure 3). RGS Environmental Pty Ltd (2013) conclude:

- the concentration of trace metals and sulfate in run-off and seepage from overburden will be low;
- the concentration of trace metals and sulfate from most coal rejects will be low; and
- coal reject materials from the Wynn seam have the potential to generate elevated concentrations of some metals (Al, Cd, Co, Cu, As, Ni, Se and Zn) if exposed to oxidising conditions.

On this basis, the potential for elevated metals to be present in groundwater seepage is considered low.

5 FINAL VOID WATER MANAGEMENT

As part of the MOD 3 EA, MACH Energy developed revisions to the final landform to reflect a less engineered profile that is more consistent with the surrounding natural environment. Construction of the final landform would involve a range of earthworks to push down areas of the final highwalls and low walls, the outcome being a single void remaining in the south with a relatively natural looking shape (Figure 7).

Once mining operations cease, groundwater inflows to the final void would no longer be collected and pumped out. As a result, the final void would gradually fill with water. Inflows into the final void would comprise incident rainfall, runoff within the final void catchment area and groundwater.

The final void catchment would incorporate batter slope and drainage principles as described in the MOD 3 EA (MACH Energy, 2017b). The design of the final void would be refined as required to ensure that the final void would not spill to the environment and would provide a groundwater sink.

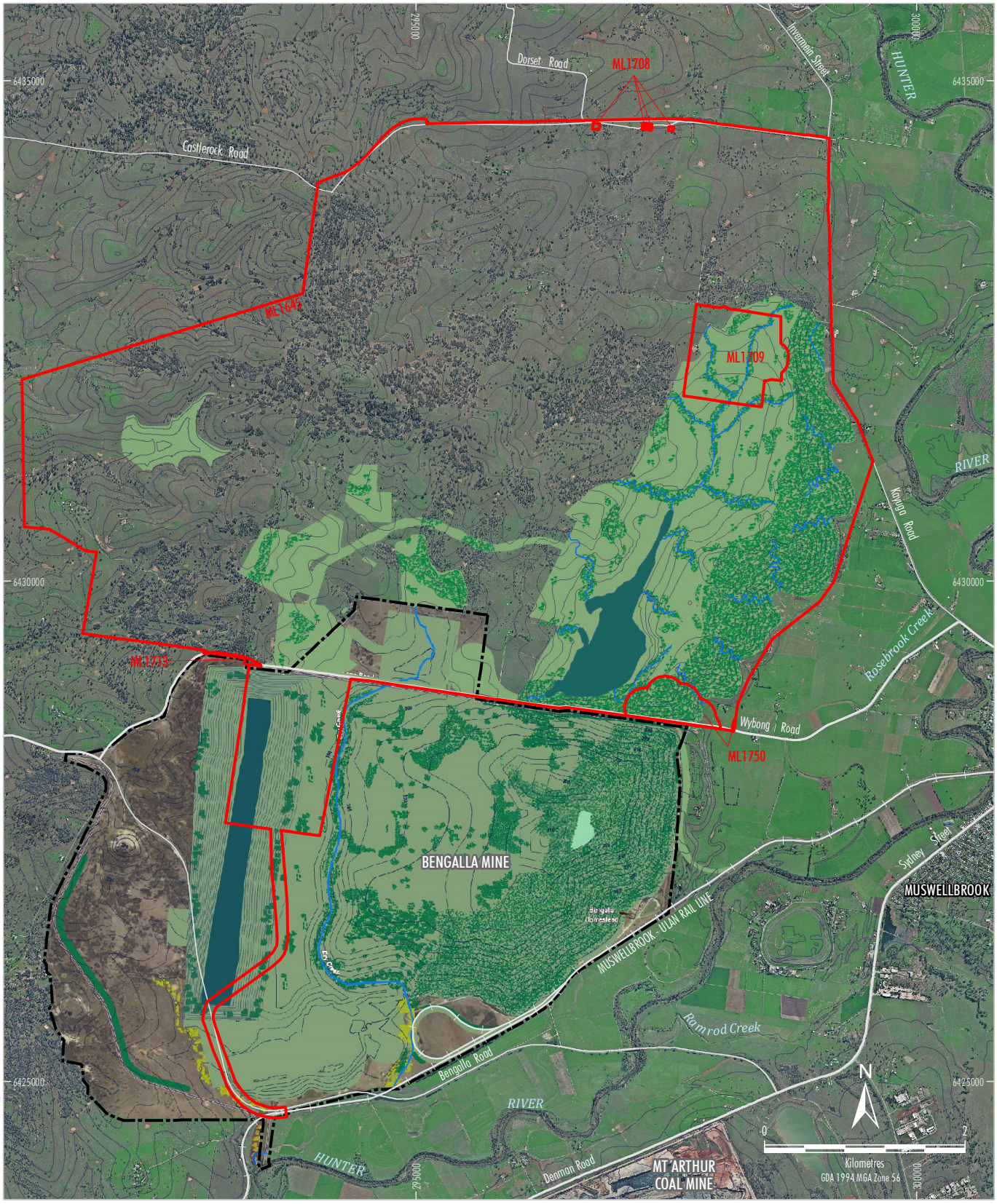
In consultation with DRG and the Muswellbrook Shire Council, MACH Energy has developed the following Provisional Post-Mining design objectives for the final void:

- The residual final void will form a waterbody.
- The final void (and associated drainage network) will be shaped to reflect a less engineered profile that is more consistent with the surrounding natural environment.
- The final void will typically act as a groundwater sink.
- The final void could provide long-term use for recreational or industrial activities.

The final void landform will be rehabilitated with vegetation species appropriate for the complex landform. The highwall will be rehabilitated using the best reasonable and feasible rehabilitation technologies available and revegetated with species that are appropriate for its steepness and aspect. Design alternatives for the final void will be continually evaluated and prepared as part of the closure planning process at the MPO and will be subject to ongoing regulatory consultation.

Relevant geotechnical studies will be undertaken to assess the stability and provide guidance on measures to minimise instability. Appropriate measures will be used to limit access to steep areas around the final void to restrict cattle, pedestrian and vehicle access. These measures may include large rock placement, landform shaping, or fencing, as agreed with relevant government authorities prior to closure.

MACH Energy will refine the design objectives of the final void over the life of the MPO in the relevant MOP/RMP. In addition, MACH Energy will develop performance criteria relevant to the design and management of the final void in the next MOP/RMP.



MAC-16-01 MP2018 GWMP_208A

LEGEND

- Mt Pleasant Mining Lease Boundary
- Final Void
- Final Rehabilitation

Bengalla Mine Conceptual Final Landform *

- Project Boundary (Appendix 2 of Development Consent SSD-5170) (Dated 23 December 2016)
- Dry Creek
- Final Void Lake
- Rehabilitation
- Rehabilitation Class III
- Indicative Tree Screens (or equivalent)
- Treed Rehabilitation
- Indicative Restorative Area

** Digitised from Appendix 9 of Development Consent (SSD-5170) and amended in the Mount Pleasant Operation CHPP area.*

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017); Department of Planning and Environment (2016); MACH Energy (2017)
Orthophoto: MACH Energy (Jul 2018)

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MOUNT PLEASANT OPERATION

Conceptual Final Landform (2026)

Figure 7

6 GROUNDWATER PREDICTIONS AND VALIDATION

6.1 PREDICTED GROUNDWATER IMPACTS

Groundwater modelling was undertaken for the Mount Pleasant EIS by PPK Environment & Infrastructure (1997).

A number of subsequent groundwater modelling exercises have been undertaken as part of mine planning and feasibility studies for the MPO as well as development applications for neighbouring mines (e.g. Bengalla Mine).

6.1.1 Groundwater Inflows

HydroSimulations (2016) has undertaken a desktop review of these studies in order to conservatively estimate the MPO groundwater pit inflows and associated licensing requirements. As described in Section 6.2, HydroSimulations is conducting contemporary groundwater modelling for the MPO to validate that the groundwater inflow estimates are conservative.

The maximum predicted inflow rate for the MPO was derived by averaging the maximum predicted inflow rates in each of the studies that were reviewed. This results in a maximum inflow rate of 400 megalitres per annum (ML/a) (HydroSimulations, 2016).

The maximum inflow rate of 400 ML/a was then pro-rated according to pit inflows for the various mine development stages described in the Mount Pleasant Water Management Studies (PPK Environment & Infrastructure, 1997). The pro-rated progressive pit inflow rates are shown in Table 9.

Table 9
Predicted Pit Inflows

Mine Development Stage	Pit Inflow Rate (ML/a)
Year 2	40
Year 5	125
Year 10	250
Year 15	320
Year 20	380
Year 21	400

Source: HydroSimulations (2016).

6.1.2 Groundwater Quality

Depressurisation of the coal seams is expected to have little impact on groundwater quality. In some cases, a slight improvement in water quality may occur due to increased rainfall infiltration (PPK Environment & Infrastructure, 1997).

On cessation of mining, groundwater seepage to the final void is expected to result in a recovery of groundwater levels. Ultimately, if void water levels recover to levels above the elevation of groundwater levels in the alluvium, the pre-mining upward leakage of water from the hard rock groundwater system to the alluvial groundwater system will resume. While the quality of water in the backfilled material may be poorer than the pre-mining quality of the hard rock groundwater system, the reduced rate of leakage relative to pre-mining is expected to result in negligible changes to the rate of salt migration to the alluvium (PPK Environment & Infrastructure, 1997).

6.1.3 Licensing Requirements

The full groundwater take from the hard rock is anticipated to derive from the Sydney Basin – North Coast Groundwater Source, within *the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources, 2016*. The take from the other two hard rock groundwater sources in the region (i.e. the New England Fold Belt Coast and the Liverpool Ranges Basalt Coast Groundwater Sources) was assumed to be negligible given the large distance between these sources and the open cut (HydroSimulations, 2016).

The estimate of maximum alluvial groundwater take was derived following a similar approach for the maximum groundwater inflows, but conservatively applied to obtain a higher estimate of alluvial take. This resulted in a maximum alluvial groundwater take of 60 ML/a (HydroSimulations, 2016).

The estimated alluvial groundwater take was assigned to the sources described in Section 2.4.1 based on their distance from the active open cut. It was conservatively assumed that the maximum alluvial licensing requirement and maximum hard rock licensing requirement would occur at separate times and as a result there would be no offsetting effect of the take from the hard rock and alluvial water sources (HydroSimulations, 2016).

The estimated groundwater licensing requirements for the MPO are summarised in Table 10.

Table 10
Recommended Groundwater Licensing Requirements

Water Sharing Plan	Water Source	Distance from Open Cut	Year 1 - 2 Extraction from Water Source (ML/a)	Maximum Predicted Extraction Year 1 – 5 (ML/a)	Maximum Extraction from Water Source (ML/a)
Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources, 2016	Sydney Basin - North Coast Groundwater Source	Within MPO tenements / open cut	40	125	400
	New England Fold Belt Coast Groundwater Source	5.4 km north-east	Negligible	Negligible	<5
	Liverpool Ranges Basalt Coast Groundwater Source	8.5 km north-west	Negligible	Negligible	Negligible
Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009	Hunter Regulated River Alluvial Water Source	400 m east	6	25	40
	Unnamed Alluvium in the Dart Brook Water Source	1 km north	Negligible	5	15
	Unnamed Alluvium in the Muswellbrook Water Source	5 km west to main channel at Sandy Creek and 1.5 km west to finger of alluvium associated with tributary	Negligible	Negligible	5

Source: HydroSimulations (2016).

MACH Energy has commenced the process of acquiring licences in the Sydney Basin – North Coast Groundwater Source. The Year 1 - 2 licensing requirement for the MPO (40 shares) represents a very small portion of the total shares available in the source:

- As of December 2018, there are 182 WALs with a total entitlement of approximately 64,674 shares (NSW Water Register[1]).

6.2 CONTEMPORARY GROUNDWATER MODELLING

MACH Energy has engaged specialist hydrogeologists to undertake contemporary groundwater modelling for the MPO.

The contemporary groundwater model will be consistent with the Australian Groundwater Modelling Guidelines prepared by the National Water Commission in June 2012 (Barnett et. al., 2012).

MODFLOW-USG will be used for groundwater simulation with GIS, AlgoMesh and Groundwater Vistas as the interface software. MODFLOW-USG is a recent version of the popular MODFLOW code developed by the United States Geological Survey. MODFLOW-USG is able to simulate variably saturated flow and can handle desaturation and re-saturation of multiple aquifers without the “dry cell” problems of standard-MODFLOW, and has the advantage of using ‘unstructured’ meshes, which allows more focus on the areas where detail is warranted and coarsening of the mesh in areas where detail is not required.

The GWMP will be updated to include the outcomes of the contemporary groundwater modelling, once complete.

6.3 GROUNDWATER MODEL VALIDATION

The contemporary groundwater model described in Section 6.2 would be used as a management tool for the periodic review and calibration of predicted groundwater impacts through the life of the MPO.

This review would be undertaken at least every five years over the life of the MPO.

The results of the groundwater monitoring program would inform progressive refinement of the groundwater model as each of the open cut mining areas are developed. Revised outputs from the groundwater model would be reported in the Annual Review, as relevant over the life of the MPO and used to inform regular site water balance reviews.

[1] NSW Water Register: https://waterregister.waternsw.com.au/water-register-frame

7 GROUNDWATER IMPACT TRIGGER LEVELS

Groundwater trigger levels have been developed for the MPO based on the *NSW Aquifer Interference Policy* and *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).

7.1 GROUNDWATER LEVELS

MACH Energy will evaluate the environmental performance of the MPO against the predictions of impacts made by the contemporary groundwater modelling, once complete (Section 6.2).

In the interim, and in accordance with the *NSW Aquifer Interference Policy*, groundwater trigger levels will focus on potential effects of mining on:

- the groundwater supply of potentially affected landowners;
- High Priority groundwater dependent ecosystems (GDEs); and
- High Priority culturally significant sites.

There are no High Priority GDEs or High Priority culturally significant sites in the vicinity of the MPO described in the relevant water sharing plans.

A review of the DPIE-Water registered bore database and other regional information indicates the majority of private groundwater users are accessing the alluvial groundwater system to the east of the MPO and registered bores within the MPO tenements are sparse. This lower groundwater use reflects the relatively poorer quality and lower expected bore yield of the hard rock groundwater systems in the vicinity of the MPO (Section 4.2).

Based on the above, groundwater level triggers have been established to monitor for potential impacts on the alluvial groundwater system to the east associated with the Hunter River. Water level triggers have been developed for the alluvial monitoring bores listed in Table 11 in order to identify trends that could potentially lead to a private bore being impacted (i.e. experiencing greater than 2 m drawdown). These water level triggers have been set at 2 m below the 80th percentile water level reported during the baseline monitoring period to date.

Table 11
Groundwater Triggers – Water Level

Bore	Screened Interval (mbgl)	Observed Groundwater Level (mbgl)		Trigger Level (mbgl)
		Minimum	80th percentile	
MPBH1	12.6 – 18.6	8.8	9.7	11.7
MPBH2	11.5 – 17.5	11.6	12.2	14.2
MPBH3b	Well to 14 m	11.6	12.0	Dry (or 14.0 m)

7.2 GROUNDWATER QUALITY

The Australian and New Zealand *Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000) apply to the quality of both surface waters and groundwaters since they have been developed to protect environmental values relating to above-ground uses such as irrigation and stock use.

ANZECC & ARMCANZ (2000) recommends that wherever possible site-specific data be used to define trigger values for physical and chemical factors which can adversely impact the environment, rather than using default trigger values. For pH triggers however, a single trigger range of 6 - 8.5 was applied to all bores. This decision was made as the proposed 20th to 80th percentile trigger ranges proved to be too narrow to allow inaccuracy in pH measurement. The adopted range of 6 - 8.5 pH units is consistent with the pH recommended by ANZECC & ARMCANZ (2000) to prevent corrosion of infrastructure associated with the groundwater, as well as the recommend range for drinking water as outlined in the *Australian Drinking Water Quality Guidelines* (National Health and Medical Research Council [NHMRC] & National Resource Management Ministerial Council [NRMMC], 2011).

Baseline groundwater monitoring results indicate that baseline values of EC in the vicinity of the MPO vary across a wide range and can be outside of the ANZECC & ARMCANZ (2000) guideline values for ecosystem protection. Therefore, site-specific trigger levels based on the baseline data have been developed for monitoring the effect of the MPO.

The *NSW Aquifer Interference Policy* sets out the minimal impact considerations for aquifer interference activities for groundwater sources, including:

> *Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity;*

The water sharing plans that regulate groundwater use in the vicinity of the MPO do not describe beneficial use categories for the groundwater sources. However, the *National Land and Water Resources Audit* (Murray Darling Basin Commission, 2005) specified groundwater quality ranges for beneficial use categories based on salinity (Table 12).

Table 12
Groundwater Quality Categories – EC

Beneficial Use	Quality Range	Description
Potable	Up to 800 µS/cm (500 mg/L TDS)*	Suitable for all drinking water and uses.
Marginal Potable	800-2,350 µS/cm (500-1,500 mg/L TDS)*	At the upper level this water is at the limit of potable water, but is suitable for watering of livestock, irrigation and other general uses.
Irrigation	2,350-7,800 µS/cm (1,500-5,000 mg/L TDS)*	At the upper level, this water requires shandying for use as irrigation water or to be suitable for selective irrigation and watering of livestock.
Saline	7,800-22,000 µS/cm (5,000-14,000 mg/L TDS)*	Generally unsuitable for most uses. It may be suitable for a diminishing range of salt-tolerant livestock up to about 6,500mg/L [~10,150 µS/cm] and some industrial uses.
Highly Saline	> 22,000 µS/cm (14,000 mg/L TDS)*	Suitable for coarse industrial processes up to about 20,000 mg/L [~31,000 µS/cm].

Source: *National Land and Water Resources Audit* (Murray Darling Basin Commission, 2005).

Notes:

mg/L = milligrams per litre; and

TDS = Total Dissolved Solids.

* Approximate EC ranges derived from TDS ranges, with conversion Factor of 1.5625 applied.

Beneficial use categories have been assigned to each monitoring bore based on its 80th percentile baseline EC and the EC ranges specified in the table above, with the exception of bores 5500D000, 6500F500L and 4500F000. These bores have been experiencing sustained increases in salinity since approximately 2012, leading to data collected since 2016-2017 being greater than the beneficial use category that would be otherwise designated by their respective 80th percentile EC value. Salinity in bores 5500D000, and 4500F000 stabilised around 2017, however, data indicates that bore 6500F500L is still becoming progressively more saline. It is believed that the salinity recorded at these bores indicates a new equilibrium and EC is not expected to return to values recorded pre-2012. Therefore, the beneficial use category allocated to these three bores has been assigned to complement the more saline measurements recorded in the previous two years and do not necessarily reflect the 80th percentile baseline EC value.

Should a measured EC value exceed the upper limit of the beneficial use quality range for EC at a particular bore for three successive monitoring rounds, the groundwater investigation protocol, as detailed in the Surface and Ground Water Response Plan, would be initiated.

The water quality triggers for each bore are presented in Table 13.

Table 13
Groundwater Triggers – Water Quality

Site	pH		pH Trigger Range	EC		
	20th %ile	80th %ile		80th %ile (µS/cm)	Beneficial Use Category	Trigger (µS/cm)
3500B500U	7.2	9.6*	6 – 8.5	3,530	Irrigation	7,800
3500B500L	7.1	7.4		5,826	Irrigation	7,800
3500C500U	7.1	7.4		5,664	Irrigation	7,800
3500C500L	7.2	7.4		5,590	Irrigation	7,800
4500F000	6.5	6.9		6,904	Saline	22,000
5000D000	6.7	7.0		703	Potable	800
5500D000	6.4	6.9		1,570	Irrigation	7,800
6000C000U	6.4	7.1		4,984	Irrigation	7,800
6000C000L	7.0	7.2		5,474	Irrigation	7,800
6500F500U	6.8	7.0		5,778	Irrigation	7,800
6500F500M	6.9	7.2		2,804	Irrigation	7,800
6500F500L	6.5	7.0		1,526	Irrigation	7,800
6500F625	6.7	7.0		4,086	Irrigation	7,800
7000D000U	6.6	7.6		6,730	Irrigation	7,800
7000D000L	6.6	6.8		1,370	Marginal Potable	2,350
7500F000	6.7	7.6		5,918	Irrigation	7,800
WRA1U	-	-		-	-	-
WRA1L	7.2	7.7		4,496	Irrigation	7,800
WRA2U	6.7	7.0		4,108	Irrigation	7,800
WRA2L	7.0	7.3		6,086	Irrigation	7,800
WRA3U	7.1	7.5		9,020	Saline	22,000
WRA3L	6.6	6.9		16,734	Saline	22,000

Table 13 (Continued)
Groundwater Triggers – Water Quality

Site	pH		pH Trigger Range	EC		
	20th %ile	80th %ile		80th %ile (µS/cm)	Beneficial Use Category	Trigger (µS/cm)
WRA5U	7.1	7.4	6 – 8.5	4,772	Irrigation	7,800
WRA5L	7.1	7.8		7,034	Irrigation	7,800
WRA6U	6.8	7.0		11,240	Saline	22,000
WRA6L	7.2	7.7		5,970	Irrigation	7,800
MPBH1	6.8	7.1		590	Potable	800
MPBH2	6.8	7.1		930	Marginal Potable	930**
MPBH3	6.6	6.9		1,083	Marginal Potable	1,083**
MPBH3b	7.4	7.7		4,420	Irrigation	7,800
MPBH4 (formerly A1)^	-	-		-	-	-
MPBH5 (formerly B1)^	-	-		-	-	-
Melody Bore^	-	-		-	-	-

Notes:

* pH values for bore 3500B500S exceed the pH trigger range of 6 – 8.5 however, this bore was mined through in August 2018.

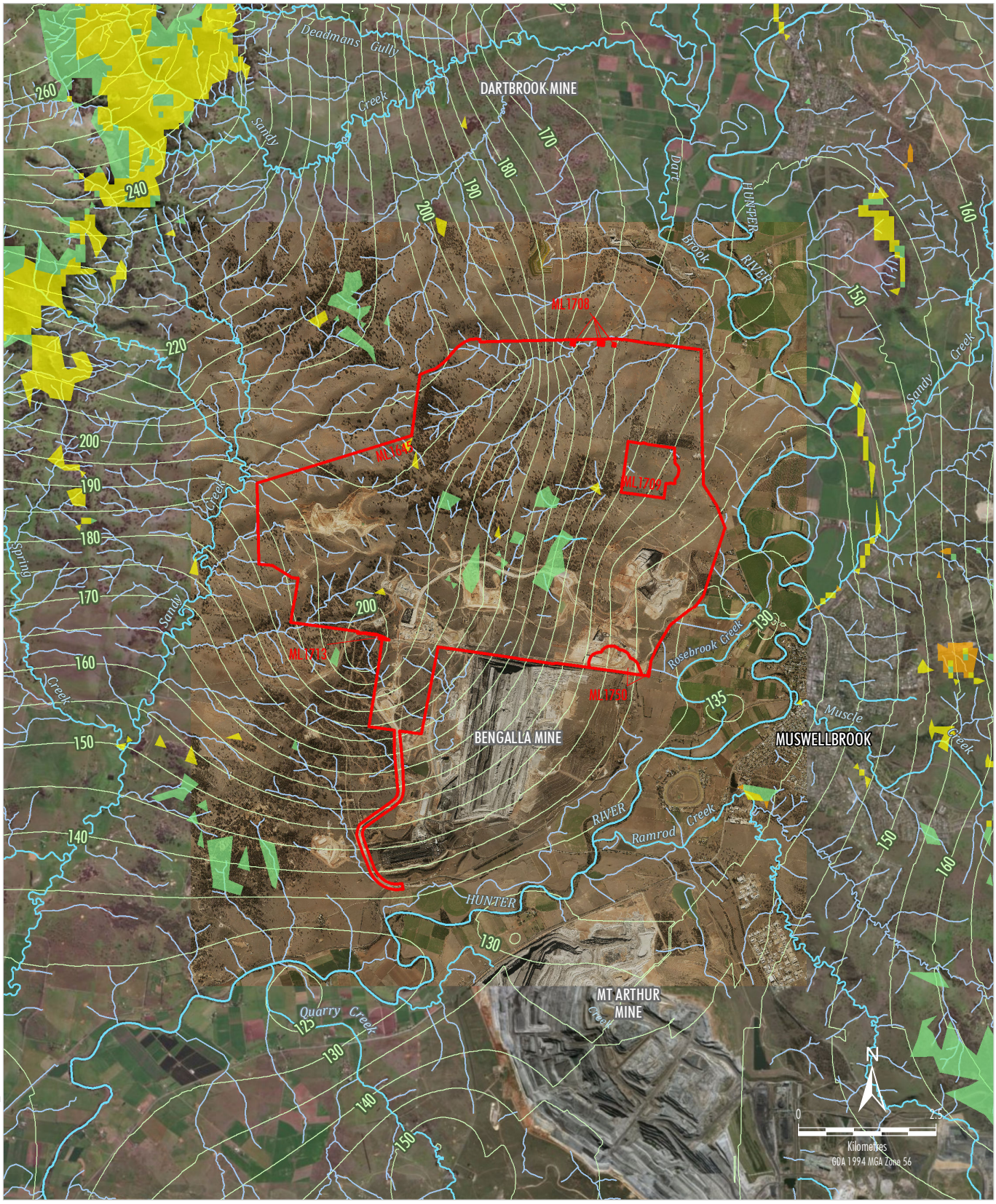
** Existing 80th percentile values have been adopted for these bores given the baseline water quality is close to potable and these sites are representative of the Hunter River alluvium.

^ Sufficient data is not yet available to develop baseline trigger ranges for new alluvial bores MPBH4 and MPBH5, or Melody Bore. This table will be revised with the appropriate values once the data becomes available. For more information on these bores refer to Section 8.6.

7.3 GROUNDWATER DEPENDENT ECOSYSTEMS

Potential GDEs mapped in the *National Atlas of Groundwater Dependent Ecosystems* (BoM, 2016) are presented on Figure 8, along with the interpreted depth of the water table based on baseline water level monitoring (Section 4.1).

Figure 8 indicates that none of the potential GDEs are likely to be groundwater dependent, due to the significant depth to groundwater in these areas. The trees that are located in the gullies running north/south through the MPO are thought to rely on ephemeral surface water flows down the gullies rather than on groundwater. On this basis, GDEs are likely restricted to the trees on the bank of the Hunter River, with the historic GDE vegetation on the main floodplain out from the river banks having been cleared for farming. Accordingly, the triggers established for alluvial groundwater levels (Section 7.1) are considered to be sufficient for monitoring potential effects on GDEs.



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LEGEND

Mining Lease Boundary

Groundwater Level Contour (5 m Intervals)

Potential Groundwater Dependent Ecosystems (BoM, 2016)

High Potential for Groundwater Interaction

Moderate Potential for Groundwater Interaction

Low Potential for Groundwater Interaction

Source: NSW Land & Property Information (2019); NSW Department Resources & Energy (2019)
Orthophoto: MACH (Jul 2018); Esri, DigitalGlobe (2018)

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Potential Groundwater Dependent Ecosystems

Figure 8

8 GROUNDWATER MONITORING PROGRAM

Groundwater monitoring bores within the MPO monitoring network cover all major hydrogeological units and are broadly distributed across the project area (Figure 4).

The groundwater monitoring network is listed in Table 6.

8.1 WATER LEVEL

All non-historical bores listed in Table 6 will be monitored manually on a quarterly basis. Monitoring at bore locations within mine disturbance areas will be discontinued when mined by the advancing open cut. The elevation at each bore will be surveyed by a registered surveyor with water levels reported in Australian Height Datum and depth in the Annual Review. Electronic data of these monitoring results will be made available to DPIE upon request.

Data from the MPO monitoring program will be supplemented with data available from the Bengalla Mine monitoring bores in the region, as required for comparison.

Privately-owned bores (shown in Figure 5) will be monitored on a regular basis to ensure that mining related drawdown of greater than 2 m has not occurred (as described in Section 8.4).

8.2 WATER QUALITY

All non-historical bores listed in Table 6 will be sampled quarterly for pH and EC. MACH Energy will consider additional water quality bores once final landform, including voids and waste emplacements, is determined.

The potential for elevated metals to be present in groundwater seepage is considered low (Section 4.7). Notwithstanding, samples will be sent for laboratory analysis annually for the suite of parameters listed in Table 14.

Table 14
Parameters for Laboratory Analysis

Parameters			
EC	TDS	Total Hardness as $CaCO_3$	Carbonate alkalinity as $CaCO_3$
Total alkalinity as $CaCO_3$	pH	Calcium	Magnesium
Sodium	Potassium	Chloride	Sulfate as SO_4
Aluminium	Arsenic	Boron	Nitrite as N
Cadmium	Copper	Ionic Balance	Lead
Zinc	Mercury	Nickel	Selenium
Total Cations	Ammonia as N	Beryllium	Reactive Silica
Antimony	Hydroxide Alkalinity as $CaCO_3$	Nitrate as N	Total Phosphorous as P
Nitrate & Nitrite as N	Total Anions	Bicarbonate Alkalinity as CaCO3	Acidity as $CaCO_3$

8.3 GROUNDWATER INFLOWS (PIT DEWATERING / EXTRACTION)

Groundwater extraction for mining activities from all pumping bores will be monitored by means of a flow meter attached to the bore headworks or installed in the discharge pipeline as required under the conditions of the relevant water licences. The MPO Environmental Superintendent (or delegate) will be responsible for monitoring and recording of volumes extracted.

Volumes of water pumped directly from the open cut pits will be monitored by means of flow meters fitted to pipelines or recording of pumping times and rates. Water reporting to the open cut pits may include both groundwater seepage inflows and incident rainfall and runoff.

Where appropriate for comparison, estimates of seepage inflows to the open cut will be determined using the contemporary groundwater model (once complete). The rainfall runoff component estimates will also be determined where appropriate for comparison using the rainfall records and the existing site water balance model.

Operational water balance reviews will be conducted regularly as described in the Site Water Balance.

8.4 GROUNDWATER SUPPLY OF POTENTIALLY AFFECTED LANDOWNERS

MACH Energy conducted a census of privately-owned bores in the vicinity of the MPO (MACH Energy, 2017d) (Section 4.4).

Trigger levels have been established at three alluvial bores (Table 11) to monitor the potential effects of the MPO on the groundwater resource in the Hunter Alluvium. In the event that a trigger is exceeded, the groundwater investigation protocol, as detailed in the Surface and Ground Water Response Plan, will be initiated.

The bore census (MACH Energy, 2017d) concluded that there were a number of privately-owned bores to the east, north and west of the MPO mining tenements. Bores to the east lie generally within 1-1.5 km of the proposed area of initial mining. Bores to the north and west are nominally 5-6 km from early mining, however they are also situated close to mining at the Bengalla Mine (western bores) and the Dartbrook Mine (northern bores).

In order to satisfy the requirements of the *NSW Aquifer Interference Policy,* groundwater monitoring at bores located between the MPO and bores owned by potentially affected landowners will occur on a regular basis to ensure that mining related drawdown of greater than 2 m has not occurred, including:

- for the monitoring bores to the east of the MPO, monitoring of the groundwater levels will occur at a higher frequency (quarterly) to ensure that a suitable baseline record is obtained and to detect whether initial mining is affecting water levels at these bores; and
- for the monitoring bores to the north and west of the mining tenements a lower frequency of monitoring will occur (6-monthly) to obtain a suitable baseline dataset, until mining at MPO progresses closer to those areas.

In order to satisfy the requirements of the *NSW Aquifer Interference Policy*, monitoring of groundwater levels around potentially affected landowners is necessary to ensure that drawdown greater than 2 m has not occurred. The existing network of monitoring bores along with five additional bores to be drilled in 2019 will be utilised to assess drawdown extents. Monitoring of water levels at these bores is intended to occur quarterly. This frequency is considered appropriate to identify any mining related drawdown which may affect groundwater supply at landowner bores.

8.5 GROUNDWATER DEPENDENT ECOSYSTEMS AND RIPARIAN VEGETATION

As described in Section 7.3, GDEs are likely restricted to the trees on the bank of the Hunter River, with the historic GDE vegetation on the main floodplain out from the river banks having been cleared for farming.

Accordingly, the water level and quality monitoring programme for the alluvium (described in Sections 7.1 and 7.2) are considered to be adequate for monitoring potential effects on GDEs.

Specific monitoring of riparian vegetation is described in the SWMP.

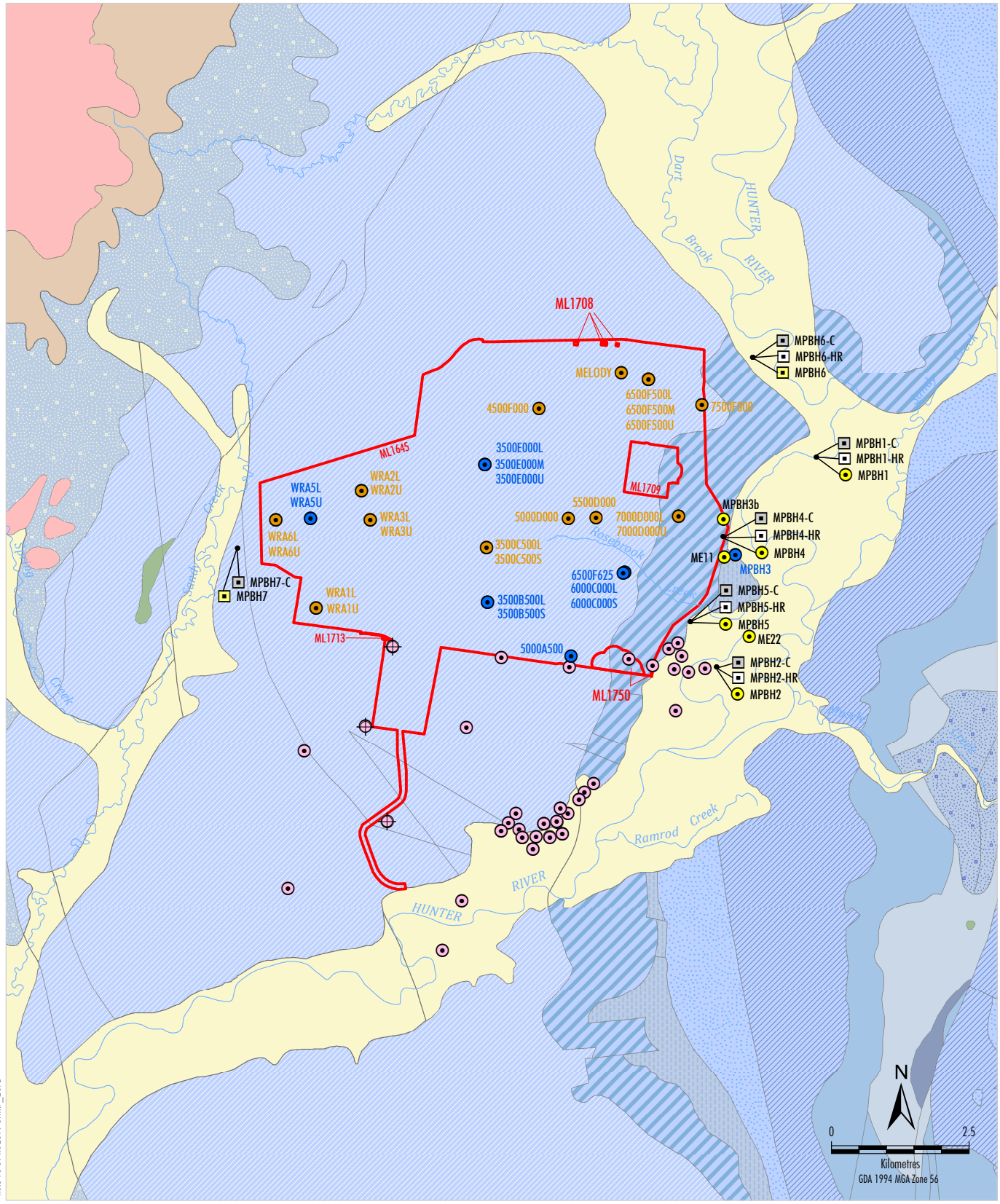
8.6 AUGMENTATIONS TO THE GROUNDWATER MONITORING PROGRAM

MACH Energy are currently undertaking a review of the groundwater monitoring programme at the MPO as a component of the contemporary groundwater modelling (Section 6.2). As a component of this review, MACH Energy will establish the following additional groundwater monitoring bores (Figure 9):

- A new nested site to the north-east of the MPO that includes an alluvial and hard rock monitoring bore (i.e. MPBH6).
- Two additional sites to the east of the MPO as part of an alluvial investigation programme. These bores, MPBH4 and MPBH5 (see Figure 4), were drilled by ENRS in February 2018 (ENRS, 2018). Details regarding these bores are included in Table 6.
- New hard rock monitoring bores at two of the existing alluvial sites to the east of the MPO (i.e. MPBH1 and MPBH2).
- A new site to the west of the MPO (i.e. MPBH7).
- Two additional sites to the east of the MPO identified during the bore census (i.e. ME11 and ME22).

MACH Energy will progressively implement these bores subject to receiving approvals from DPIE – Water.

Trigger levels will be established for these new monitoring bores when sufficient monitoring data is available.



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LEGEND

- Mining Lease Boundary

Mount Pleasant Monitoring

- Standpipe
- Standpipe - Alluvium
- Standpipe - Historical

Planned Mount Pleasant Monitoring

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

Bengalla Monitoring

- Standpipe
- Vibrating Wire Piezometer

Source: NSW Land & Property Information (2019); NSW Division of Resources & Energy (2019); MACH Energy (2019)

Note: Refer Figure 3 for geology legend

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Augmentations to the Groundwater Monitoring Network

Figure 9

9 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

9.1 ANNUAL REVIEW

In accordance with Condition 3, Schedule 5 of Development Consent DA 92/97 MACH Energy will review and evaluate the environmental performance of the MPO by the end of March each year (for the preceding calendar year) or other such timing as agreed by the Secretary of the DPIE.

In relation to water, the Annual Review will:

- include a comprehensive review of the groundwater monitoring results at the MPO over the past year, which includes a comparison of the results to evaluate compliance against:
  - relevant statutory requirements, limits or performance measures/criteria (refer Sections 2 and 7);
  - monitoring results of the previous years; and
  - relevant predictions in the EIS and MOD 1, MOD 2, MOD 3 and MOD 4 EAs;
- identify any groundwater-related non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the groundwater monitoring data over the life of the MPO;
- identify any discrepancies between the predicted and actual groundwater impacts of the MPO, and analyse the potential cause of any significant discrepancies; and
- describe what groundwater-related measures will be implemented over the next year to improve the environmental performance of the MPO.

The Annual Review will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/) in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

The Annual Review will also include reporting on elevation at each bore with water levels being presented in Australian Height Datum and depth.

9.2 GROUND WATER MAGEMENT PLAN REVISION

In accordance with Condition 4, Schedule 5 of Development Consent DA 92/97, this GWMP will be reviewed, and if necessary revised to the satisfaction of the Secretary of the DPIE, within three months of the submission of:

- an Annual Review (Condition 3, Schedule 5);
- an incident report (Condition 7, Schedule 5);
- an Independent Environmental Audit (Condition 9, Schedule 5); and
- any modification to the conditions of Development Consent DA 92/97.

Within 4 weeks of conducting any such review, the Secretary of the DPIE will be advised of the outcomes of the review and any revised documents submitted to the Secretary for approval.

In accordance with Condition 4A, Schedule 5 of Development Consent DA 92/97, MACH Energy may submit a revised GWMP for the approval of the Secretary at any time, and may also submit any revision to this GWMP required under Development Consent DA 92/97 on a staged basis.

If agreed with the Secretary of the DPIE, a revision to this GWMP required under Development Consent DA 92/97 may be prepared without undertaking consultation with all parties nominated under the relevant Condition of Development Consent DA 92/97.

This GWMP will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/), in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

9.3 INDEPENDENT ENVIRONMENTAL AUDIT

In accordance with Condition 9, Schedule 5 of Development Consent DA 92/97, an independent environmental audit of the MPO will be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary of the DPIE.

The independent environmental audit will assess the environmental performance of the MPO and review the adequacy of this GWMP. If necessary, appropriate measures or actions to improve the environmental performance of the MPO or this GWMP will be recommended.

10 REPORTING PROCEDURES

In accordance with Condition 2, Schedule 5 of Development Consent DA 92/97, MACH Energy has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance criteria.

These protocols are described in Section 5 of the WMP.

In accordance with Condition 8, Schedule 5 of Development Consent DA 92/97, MACH Energy will provide regular reporting on the environmental performance of the MPO on the MACH Energy website (https://machenergyaustralia.com.au/).

11 REFERENCES

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

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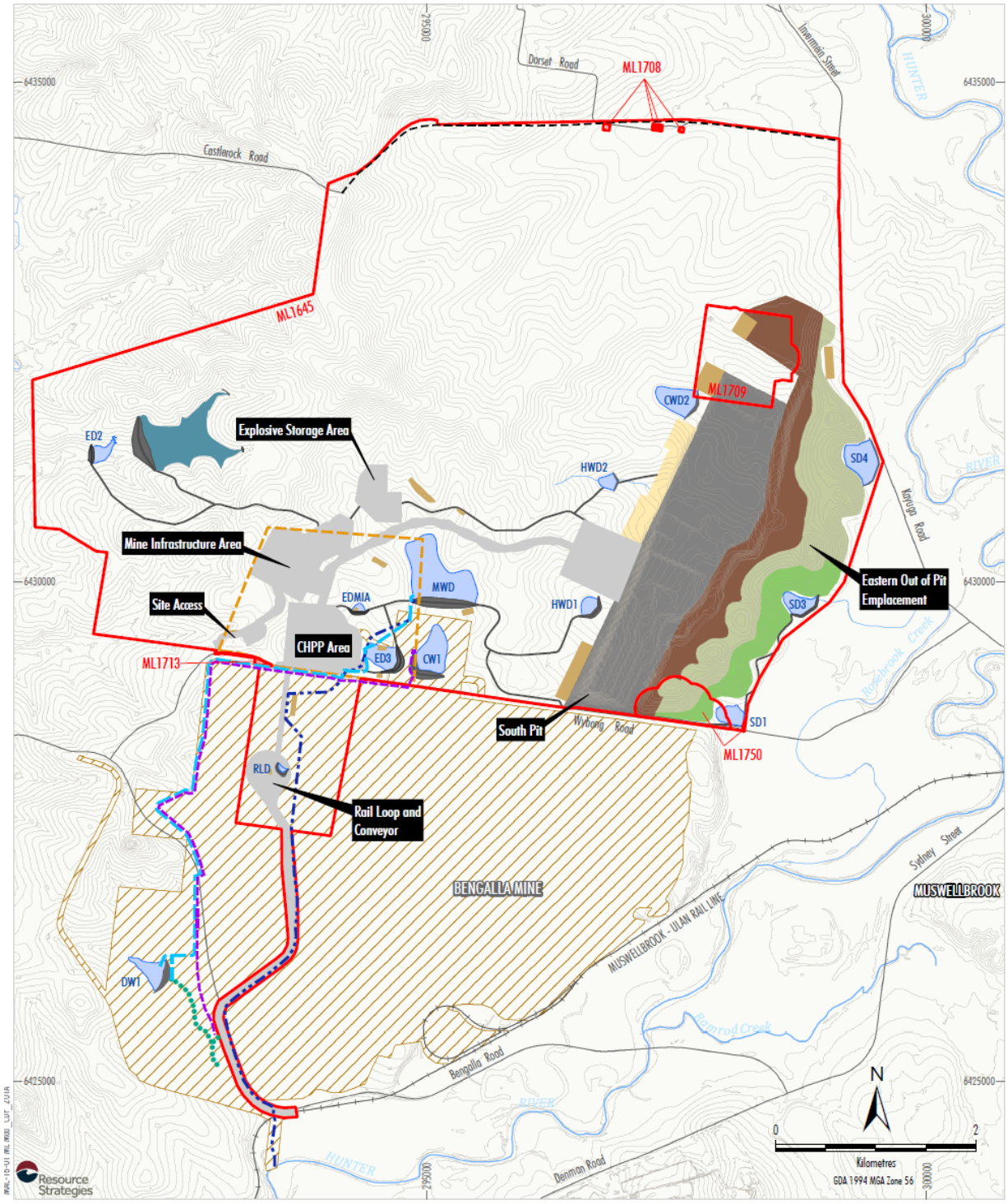
ATTACHMENT 1

APPENDIX 2 OF DEVELOPMENT CONSENT DA 92/97

APPENDIX 2
FIGURE 1 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2021



LEGEND

- Mining Lease Boundary
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Infrastructure Area Envelope
- Active Stripping Area
- Active Mining Area
- Active Overburden Emplacement Area
- Topsoil Stockpile
- Initial Rehabilitation
- Established Rehabilitation
- Infrastructure and Borrow/Stockpile Area
- Access Road
- Northern Link Road

Indicative Water Pipeline Alignment

- MPO Hunter River Supply Pipeline
- MPO DW1 Pipeline (Bi-directional)
- Bengalla Mine CW1 Pipeline
- Approximate Extent of Scour Protection
- Water Dam
- Fines Emplacement Area

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017); MACH Energy (2017)

MACHEnergy
MOUNT PLEASANT OPERATION

FIGURE 2 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2025

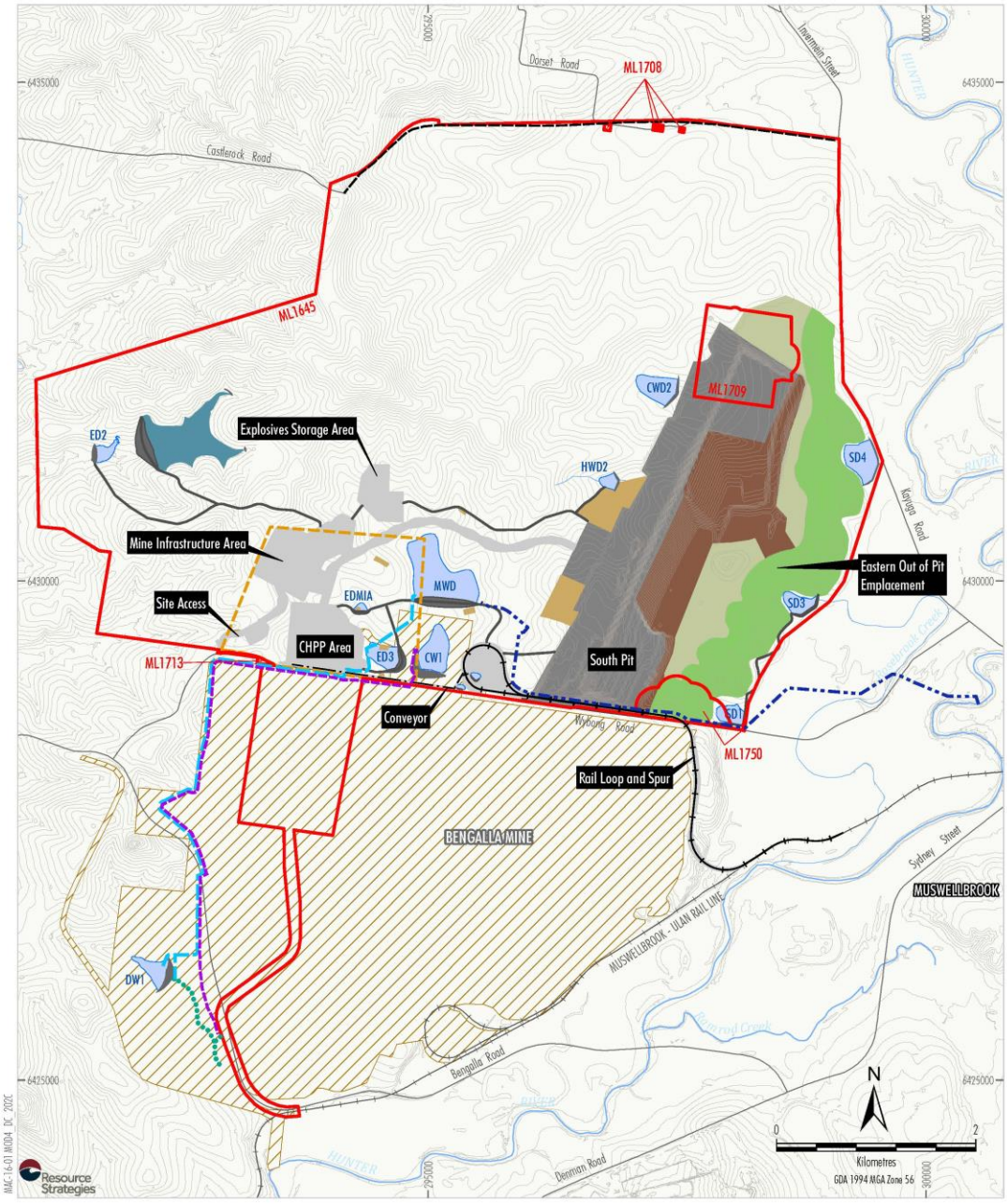
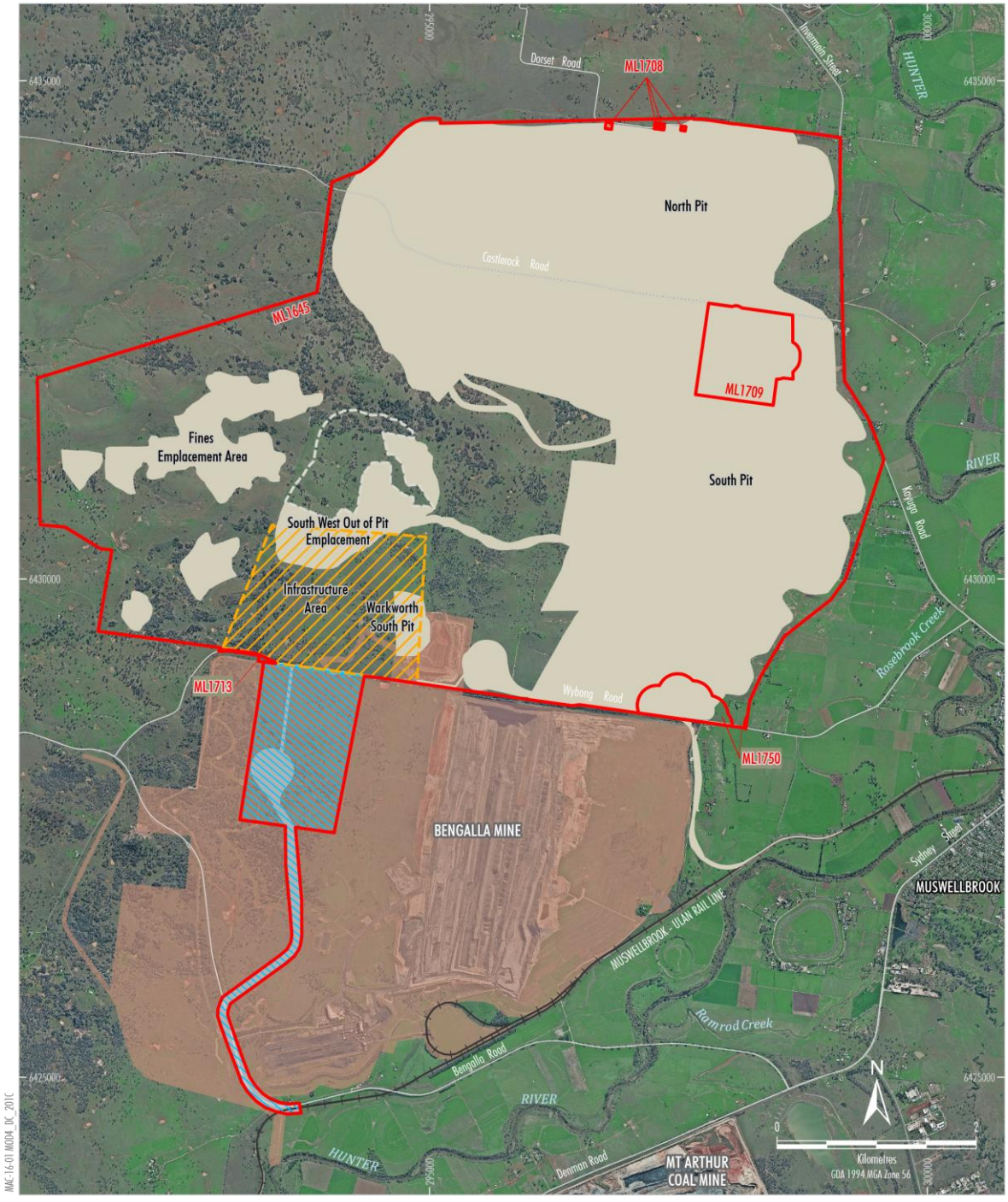


FIGURE 3 - APPROVED SURFACE DISTURBANCE PLAN



LEGEND

- Mining Lease Boundary
- Approximate Extent of Approved Surface Development [1]
- Area Relinquished for Overburden Emplacement and Major Infrastructure
- Infrastructure Area Envelope
- Infrastructure to be removed under the Terms of Condition 37, Schedule 3
- Indicative Existing Coal Transport Infrastructure
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)

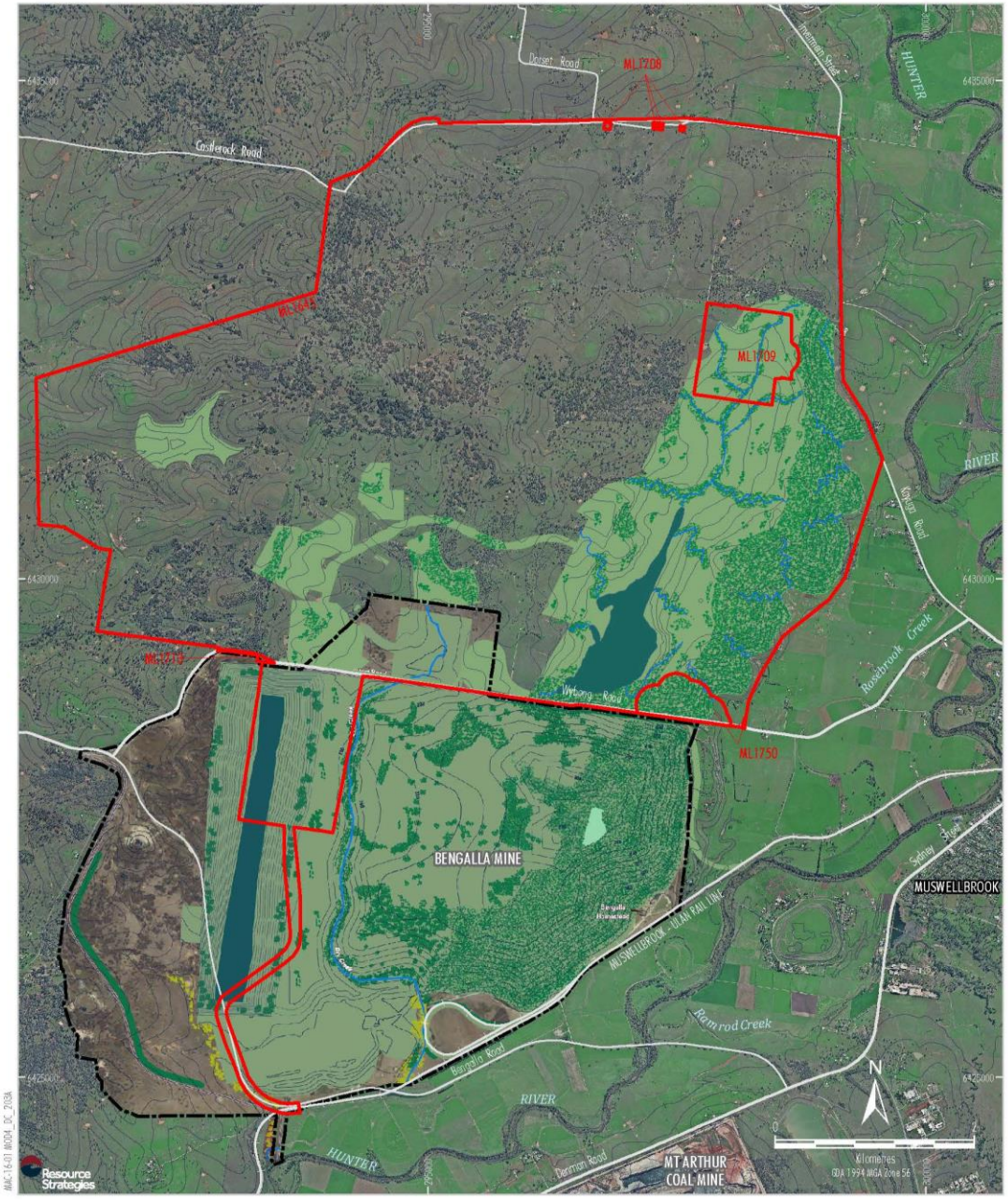
NOTE

1. Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, offsite coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, signalling, other ancillary works and construction disturbance.

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2018); Department of Planning and Environment (2016); MACH Energy (2017)
Orthophoto: MACH Energy (Aug 2016)

MACHEnergy
MOUNT PLEASANT OPERATION
Approved Surface Disturbance Plan

FIGURE 4 - CONCEPTUAL FINAL LANDFORM

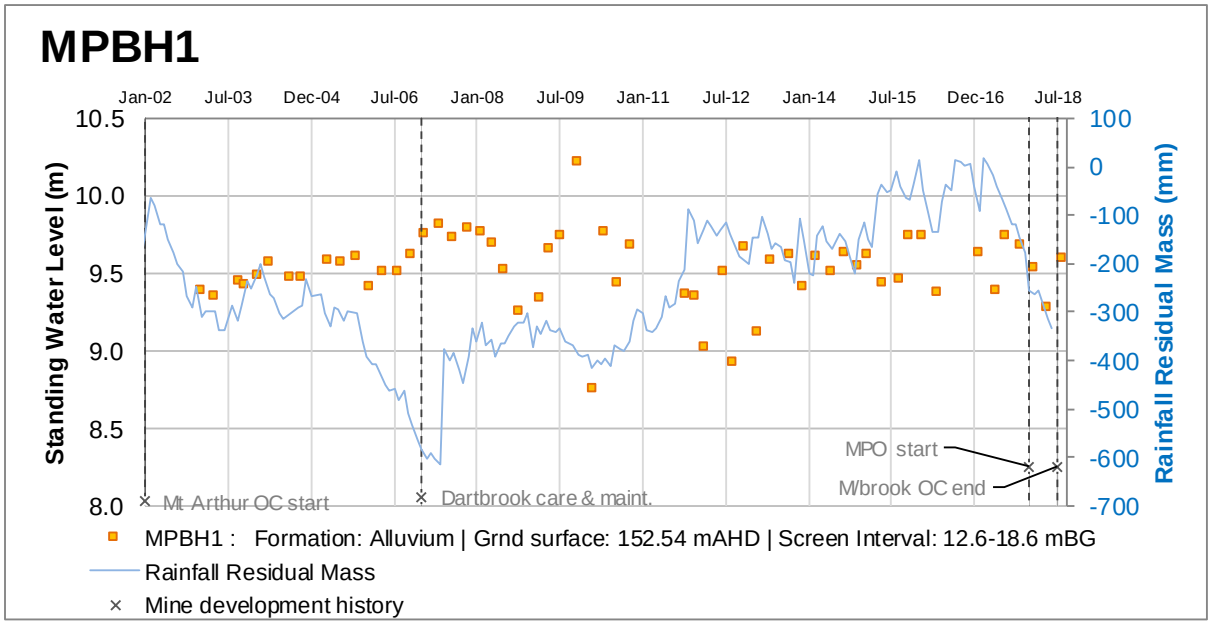


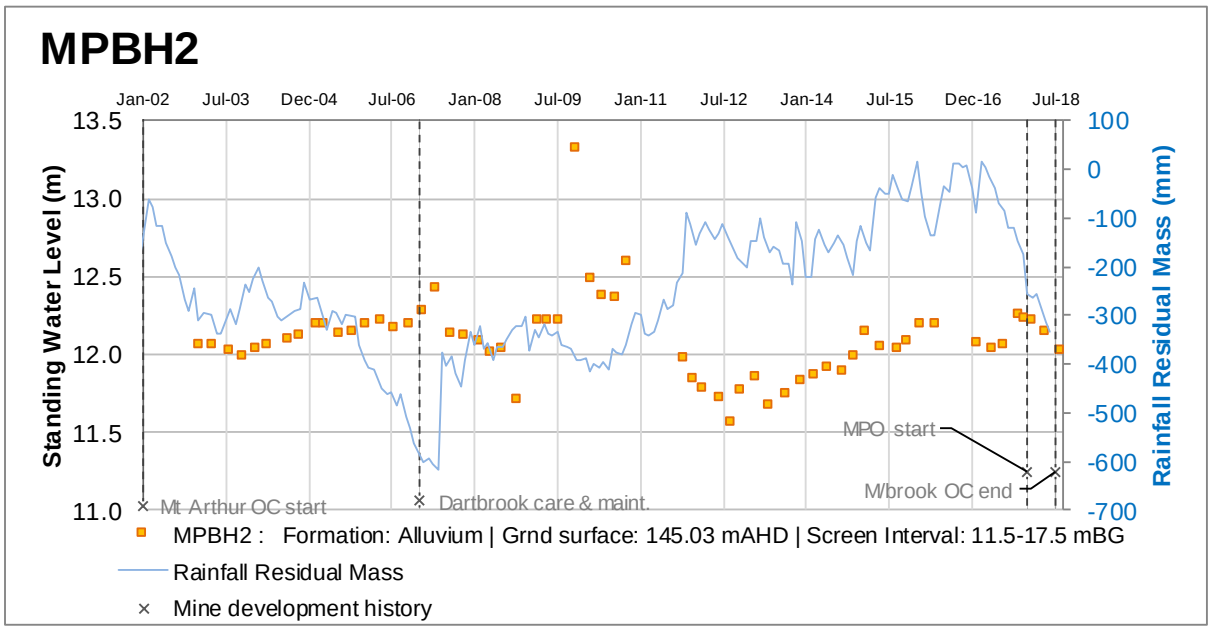
ATTACHMENT 2

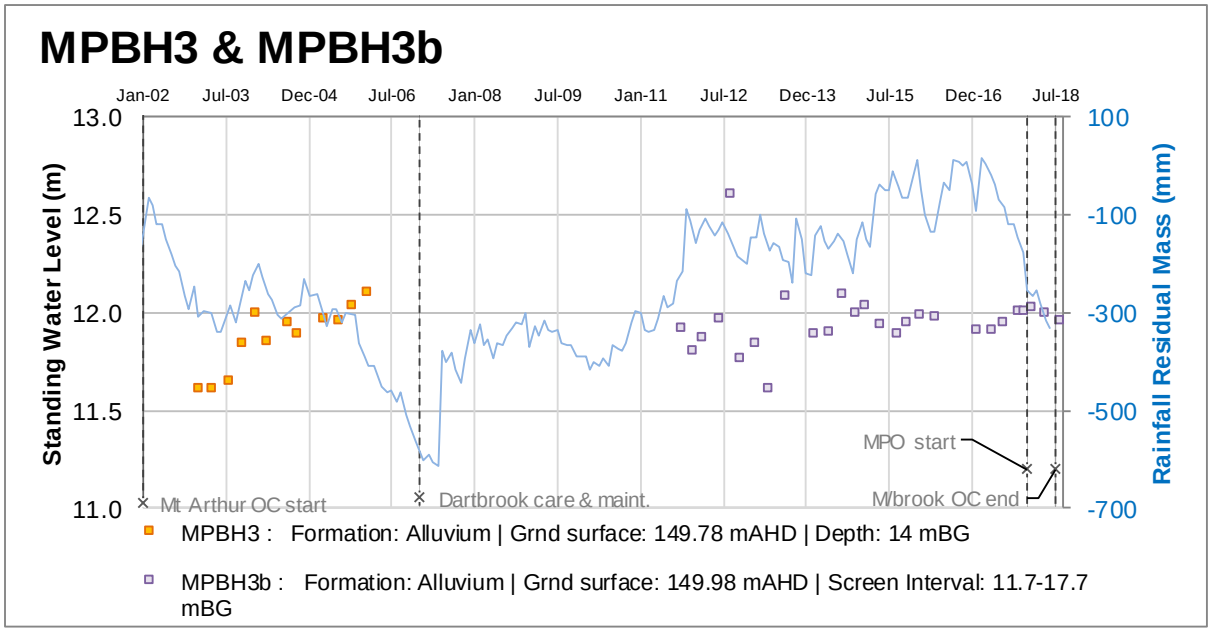
GROUNDWATER HYDROGRAPHS

BELOW GROUND WATER LEVEL AND RAINFALL RESIDUAL MASS

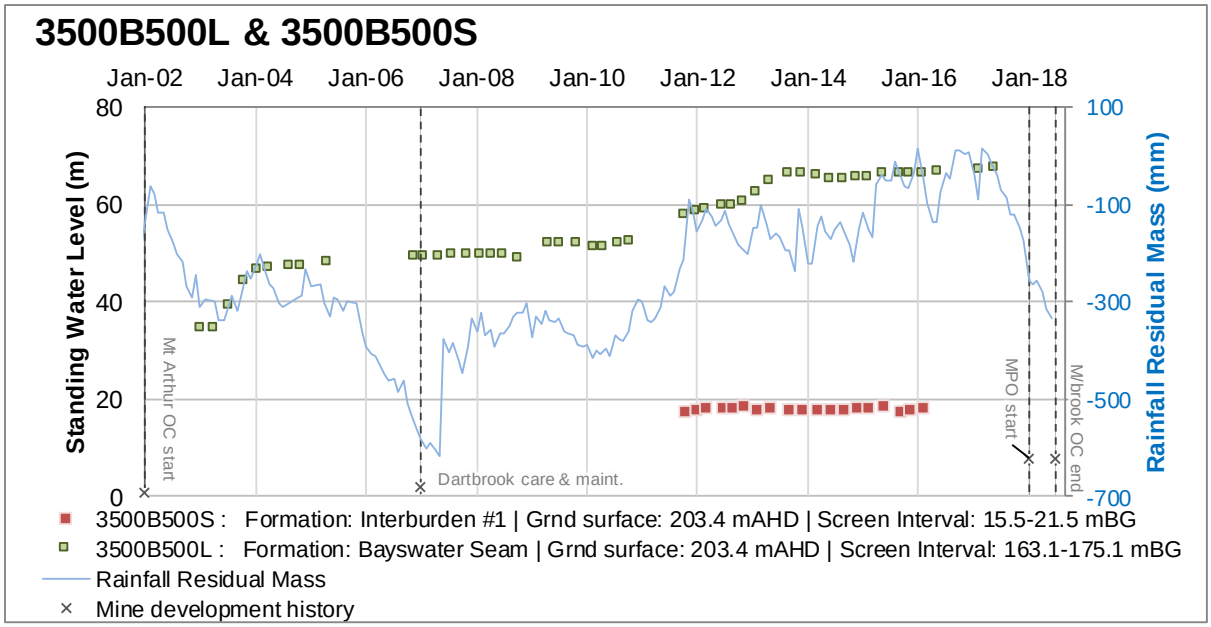
Eastern Bores

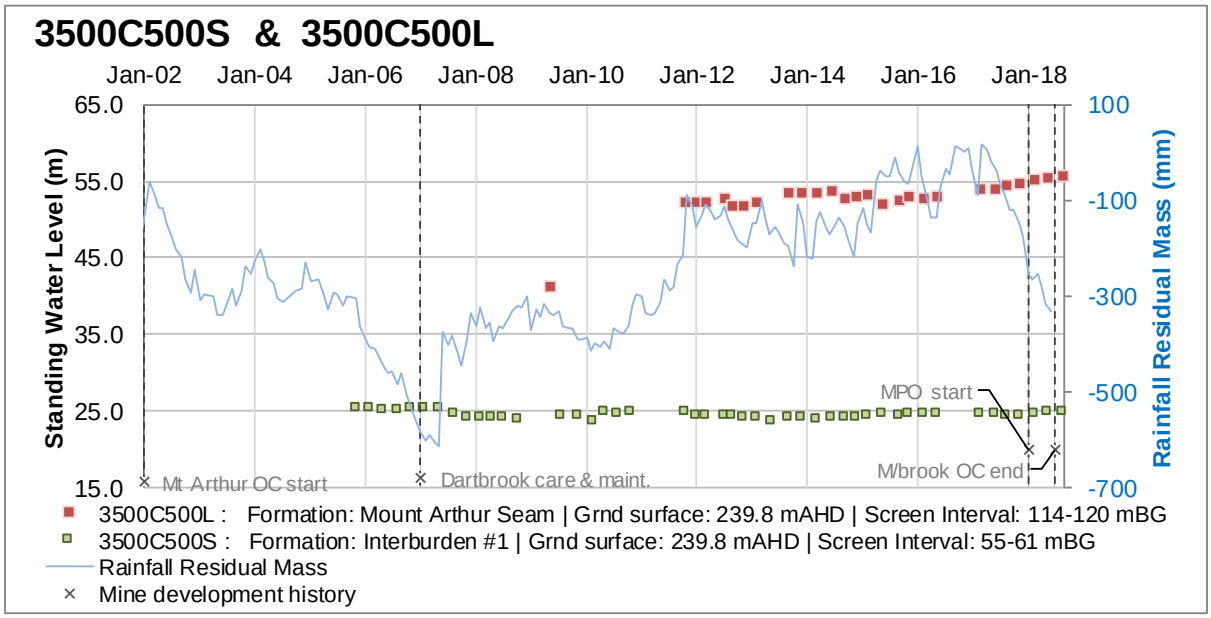


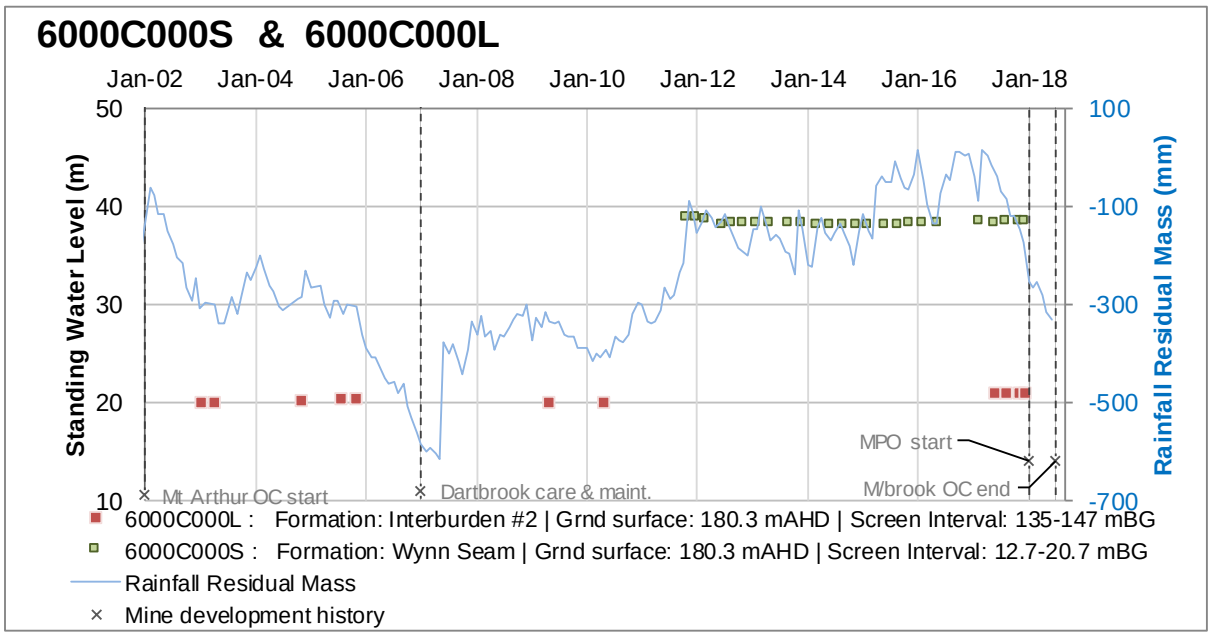


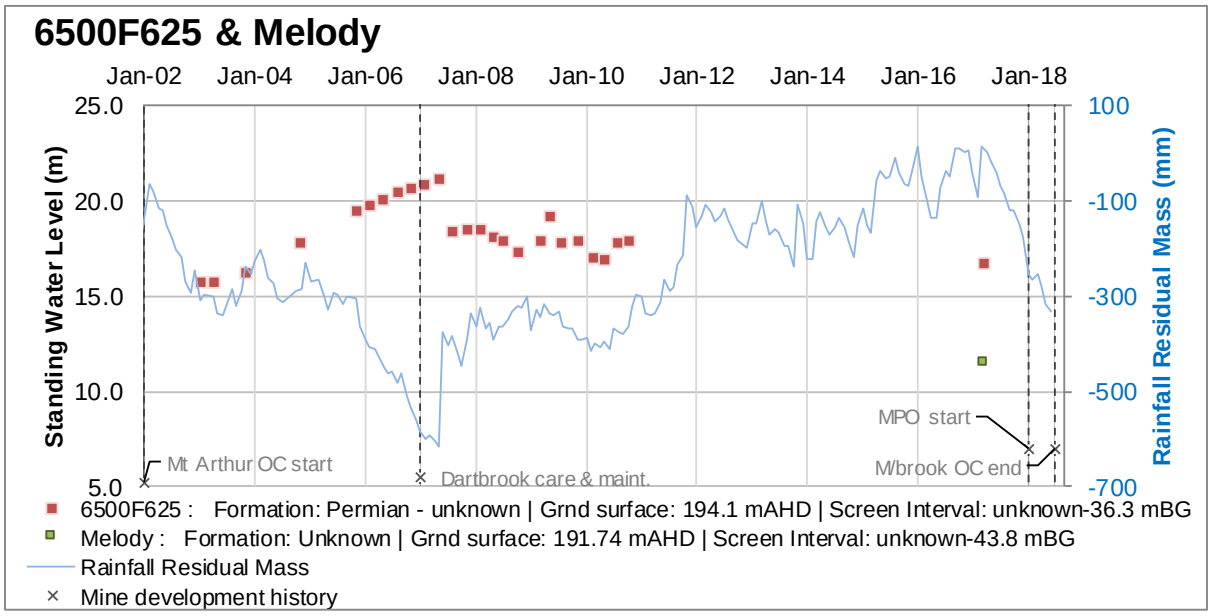

MPBH3 & MPBH3b
Jan-02
Jul-03
Dec-04
Jul-06
Jan-08
Jul-09
Jan-11
Jul-12
Dec-13
Jul-15
Dec-16
Jul-18
13.0
12.5
12.0
11.5
11.0
Standing Water Level (m)
100
-100
-300
-500
-700
Rainfall Residual Mass (mm)
Mt Arthur OC start
Dartbrook care & maint.
MPO start
M'brook OC end
MPBH3 : Formation: Alluvium | Grnd surface: 149.78 mAHD | Depth: 14 mBG
MPBH3b : Formation: Alluvium | Grnd surface: 149.98 mAHD | Screen Interval: 11.7-17.7 mBG

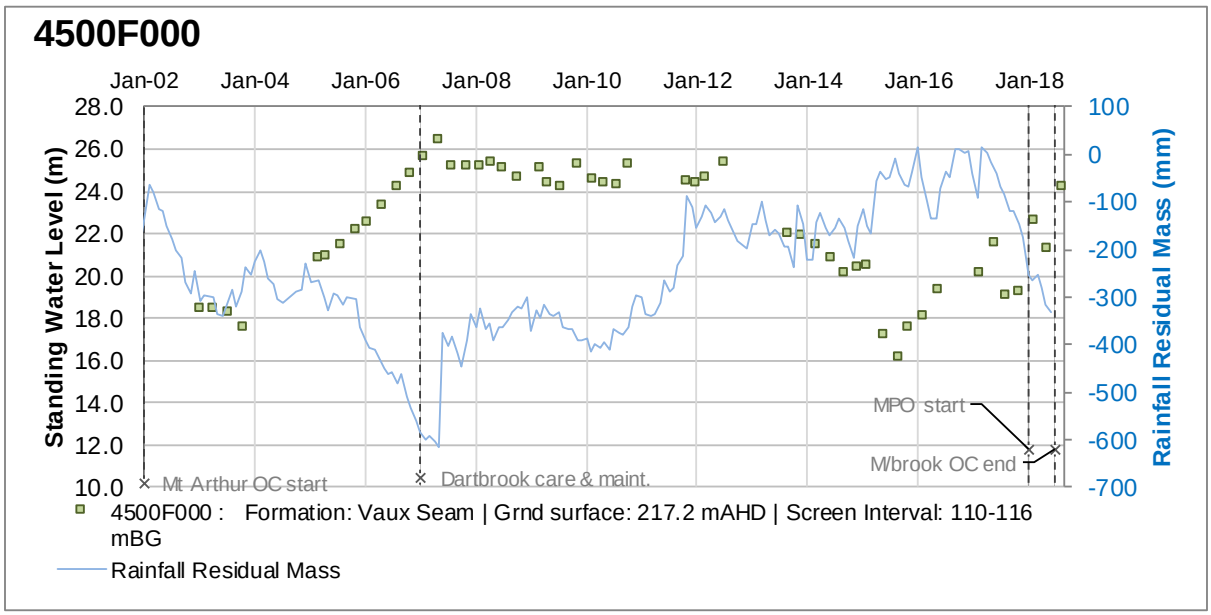
Central Bores

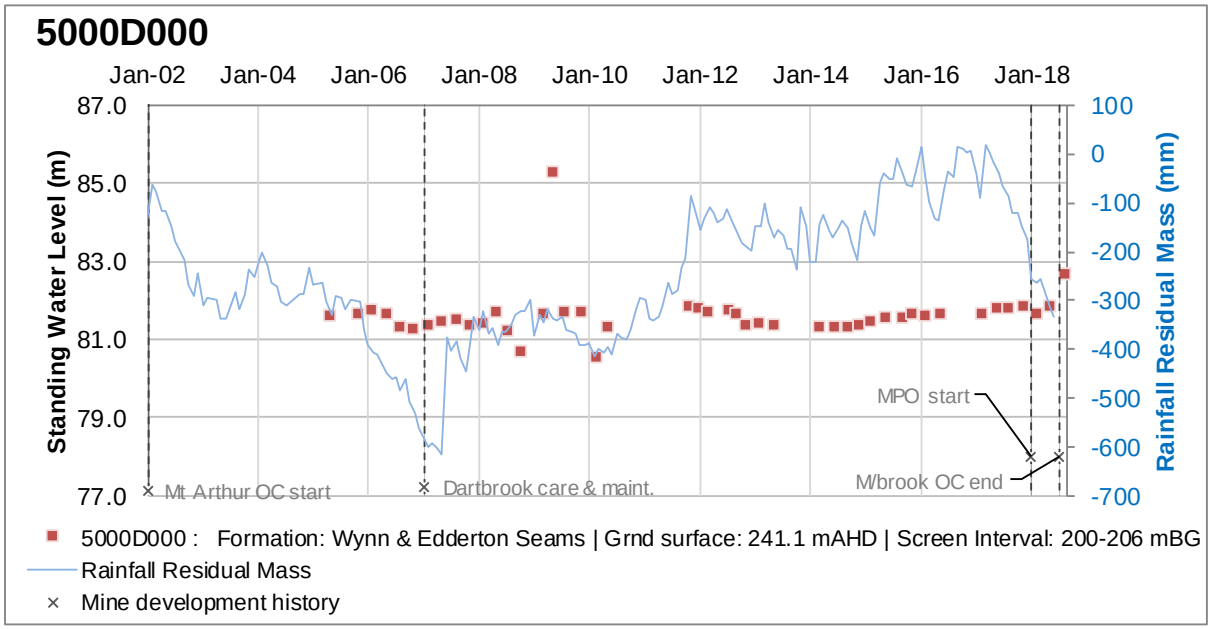


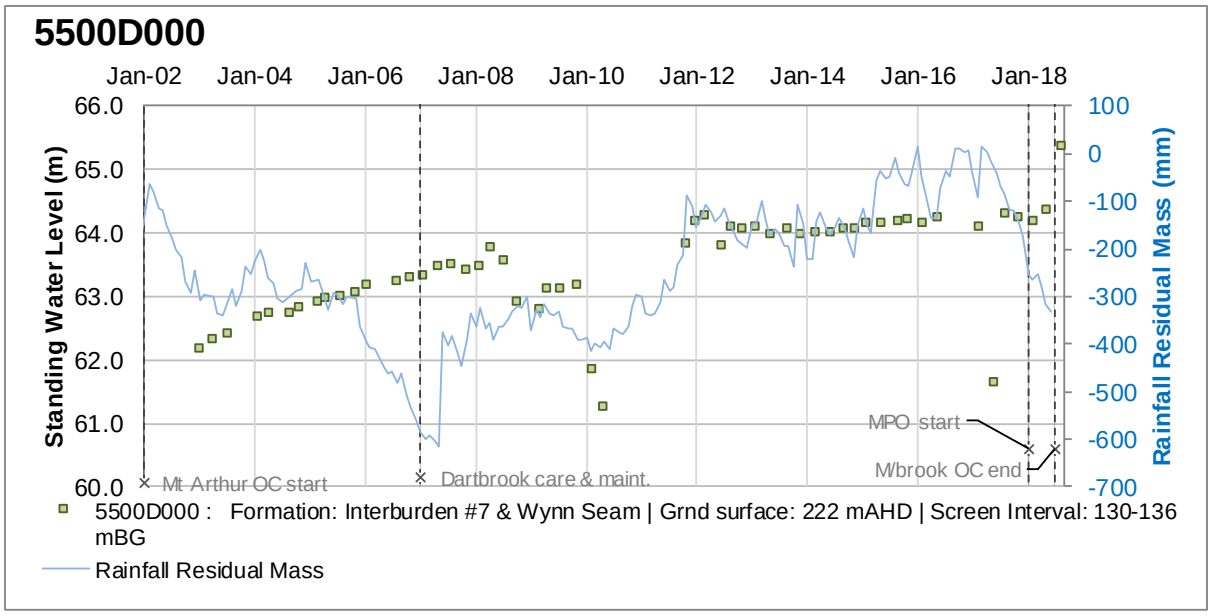


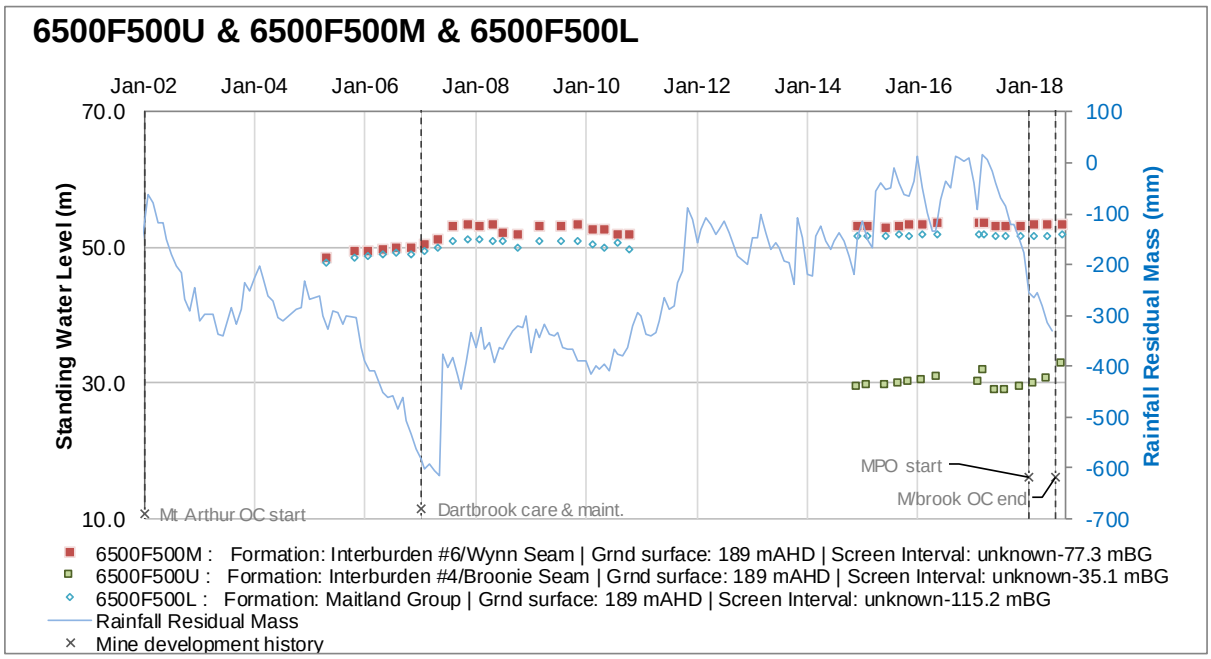

6000C000S & 6000C000L
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Standing Water Level (m)
50
40
30
20
10
Rainfall Residual Mass (mm)
100
-100
-300
-500
-700
MPO start
M/brook OC end
Mt Arthur OC start
Dartbrook care & maint.
6000C000L : Formation: Interburden #2 | Grnd surface: 180.3 mAHD | Screen Interval: 135-147 mBG
6000C000S : Formation: Wynn Seam | Grnd surface: 180.3 mAHD | Screen Interval: 12.7-20.7 mBG
Rainfall Residual Mass
Mine development history

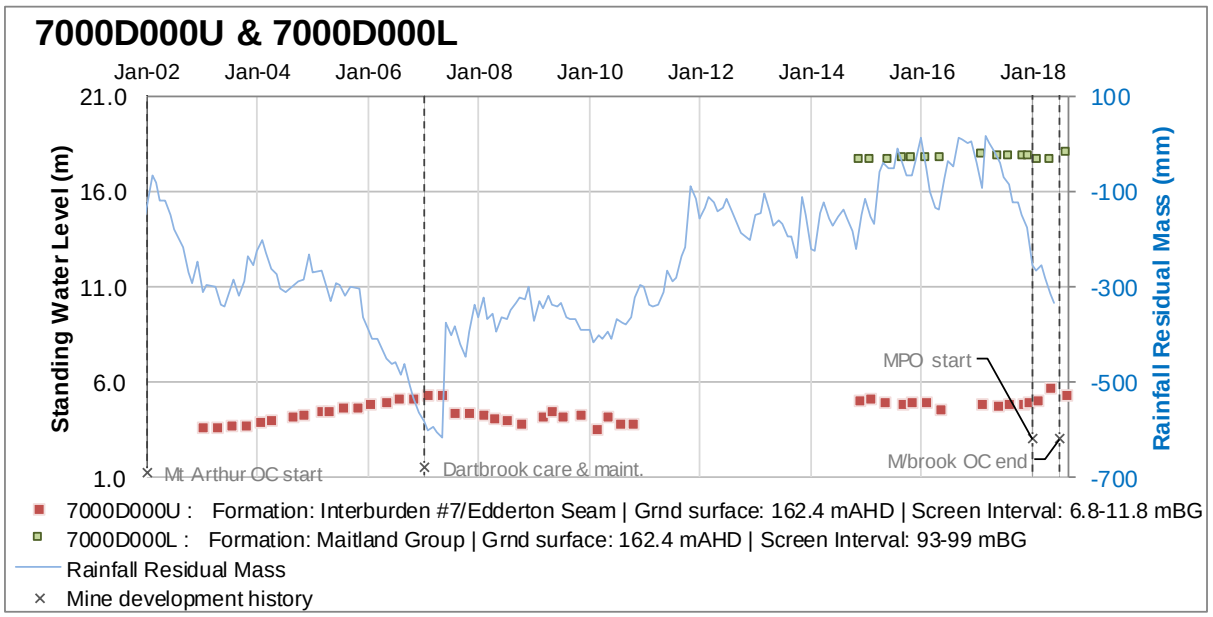

6500F625 & Melody
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Standing Water Level (m)
25.0
20.0
15.0
10.0
5.0
Rainfall Residual Mass (mm)
100
-100
-300
-500
-700
MPO start
M/brook OC end
Mt Arthur OC start
Dartbrook care & maint.
6500F625 : Formation: Permian - unknown | Grnd surface: 194.1 mAHD | Screen Interval: unknown-36.3 mBG
Melody : Formation: Unknown | Grnd surface: 191.74 mAHD | Screen Interval: unknown-43.8 mBG
Rainfall Residual Mass
Mine development history

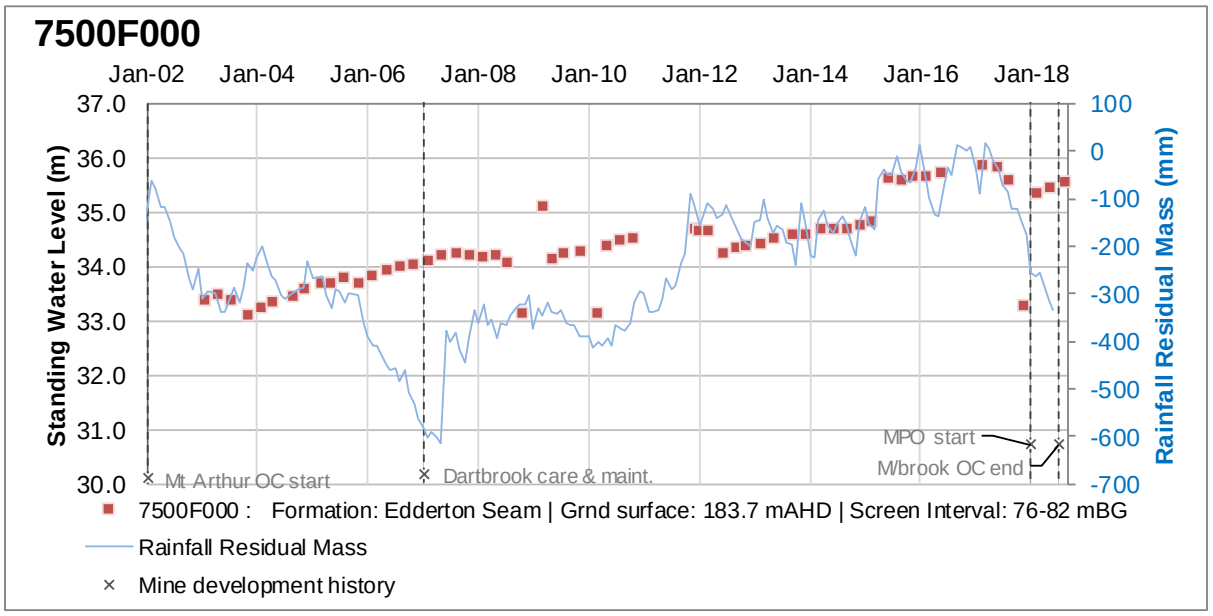

4500F000
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
28.0
26.0
24.0
22.0
20.0
18.0
16.0
14.0
12.0
10.0
Standing Water Level (m)
100
0
-100
-200
-300
-400
-500
-600
-700
Rainfall Residual Mass (mm)
MPO start
M'brook OC end
Mt Arthur OC start
Dartbrook care & maint.
4500F000 : Formation: Vaux Seam | Grnd surface: 217.2 mAHD | Screen Interval: 110-116 mBG
Rainfall Residual Mass


5000D000
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
87.0
85.0
83.0
81.0
79.0
77.0
Standing Water Level (m)
100
0
-100
-200
-300
-400
-500
-600
-700
Rainfall Residual Mass (mm)
MPO start
M/brook OC end
Mt Arthur OC start
Dartbrook care & maint.
5000D000 : Formation: Wynn & Edderton Seams | Grnd surface: 241.1 mAHD | Screen Interval: 200-206 mBG
Rainfall Residual Mass
Mine development history

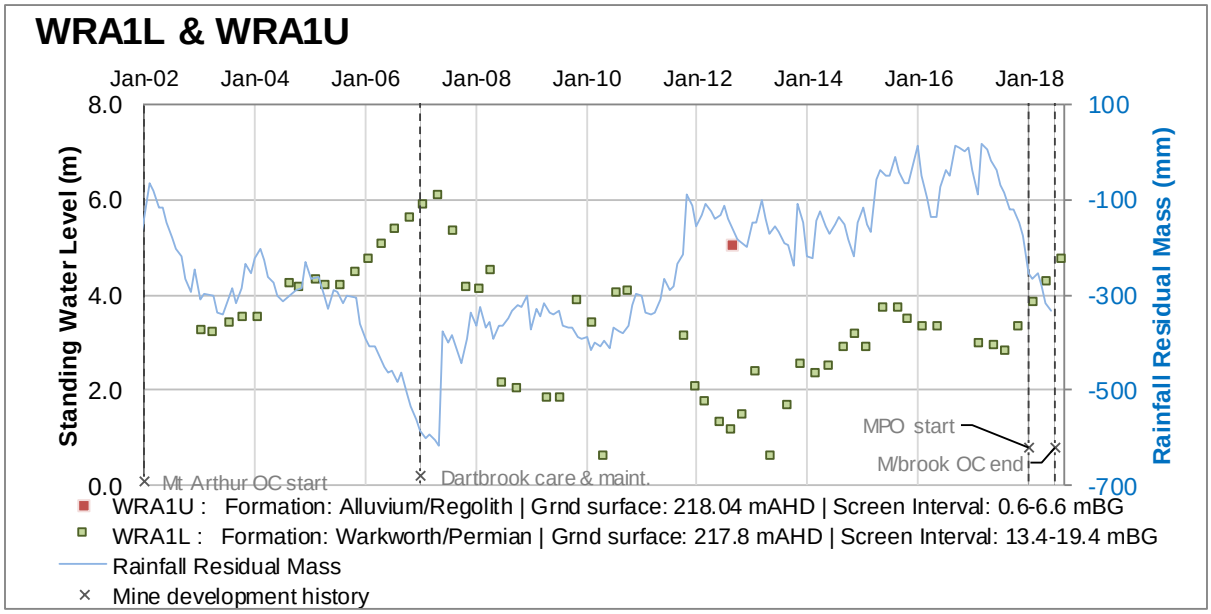

5500D000
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
66.0
65.0
64.0
63.0
62.0
61.0
60.0
Standing Water Level (m)
100
0
-100
-200
-300
-400
-500
-600
-700
Rainfall Residual Mass (mm)
MPO start
M/brook OC end
Mt Arthur OC start
Dartbrook care & maint.
5500D000 : Formation: Interburden #7 & Wynn Seam | Grnd surface: 222 mAHD | Screen Interval: 130-136 mBG
Rainfall Residual Mass

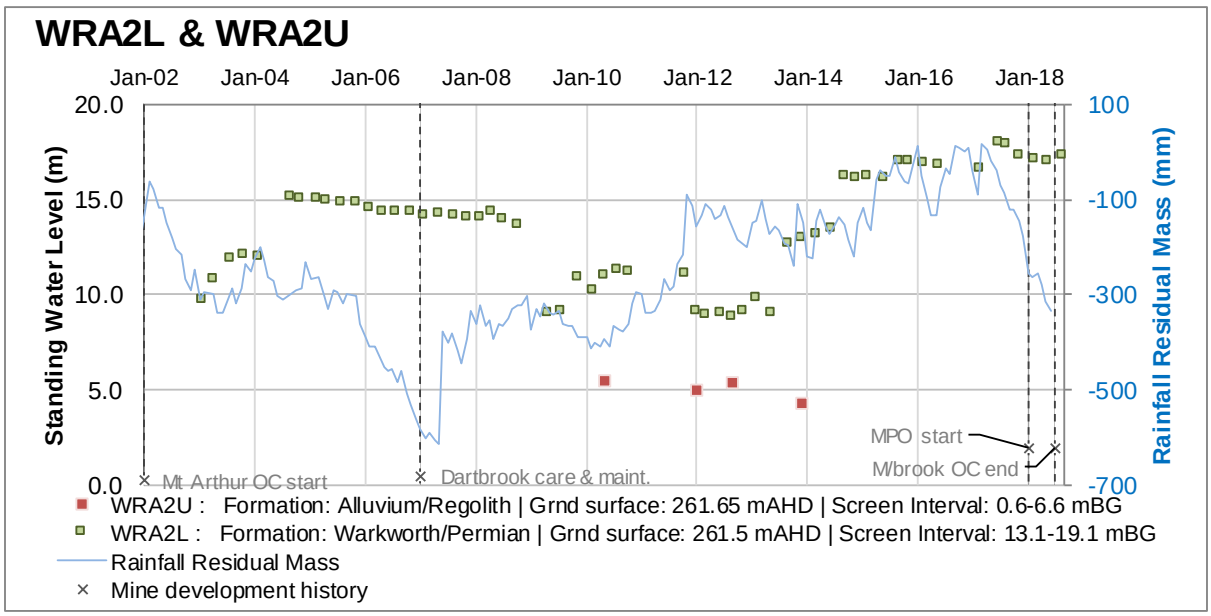

6500F500U & 6500F500M & 6500F500L
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
70.0
50.0
30.0
10.0
Standing Water Level (m)
100
0
-100
-200
-300
-400
-500
-600
-700
Rainfall Residual Mass (mm)
MPO start
M'brook OC end
Mt Arthur OC start
Dartbrook care & maint.
6500F500M : Formation: Interburden #6/Wynn Seam | Grnd surface: 189 mAHD | Screen Interval: unknown-77.3 mBG
6500F500U : Formation: Interburden #4/Broonie Seam | Grnd surface: 189 mAHD | Screen Interval: unknown-35.1 mBG
6500F500L : Formation: Maitland Group | Grnd surface: 189 mAHD | Screen Interval: unknown-115.2 mBG
Rainfall Residual Mass
Mine development history

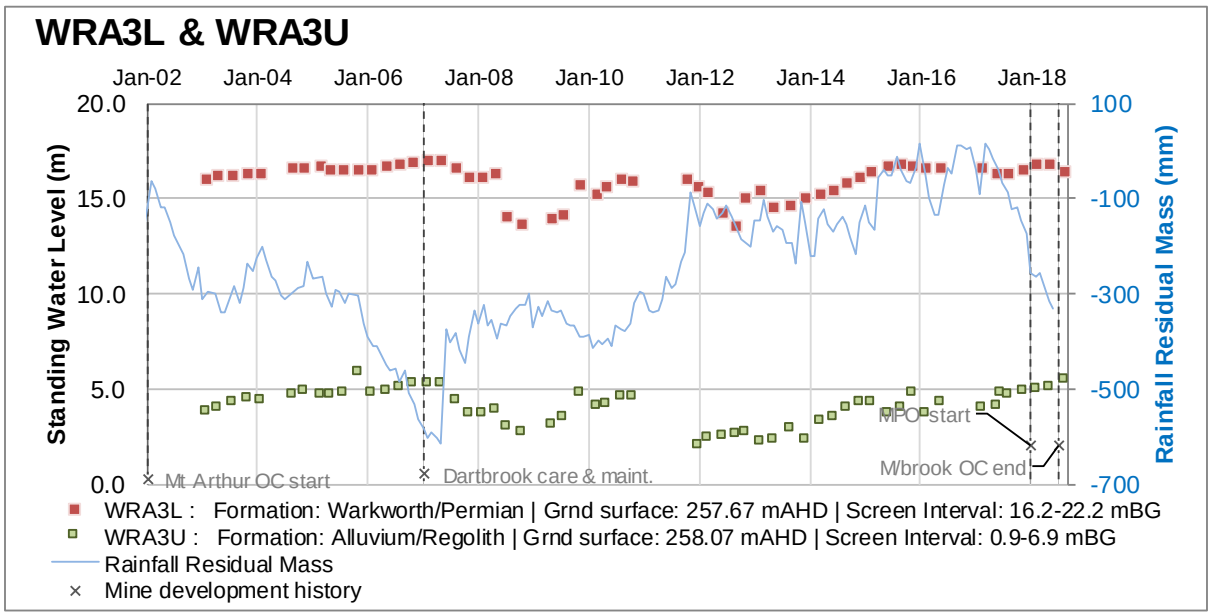

7000D000U & 7000D000L
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Standing Water Level (m)
21.0
16.0
11.0
6.0
1.0
Rainfall Residual Mass (mm)
100
-100
-300
-500
-700
MPO start
M/brook OC end
Mt Arthur OC start
Dartbrook care & maint.
7000D000U : Formation: Interburden #7/Edderton Seam | Grnd surface: 162.4 mAHD | Screen Interval: 6.8-11.8 mBG
7000D000L : Formation: Maitland Group | Grnd surface: 162.4 mAHD | Screen Interval: 93-99 mBG
Rainfall Residual Mass
Mine development history

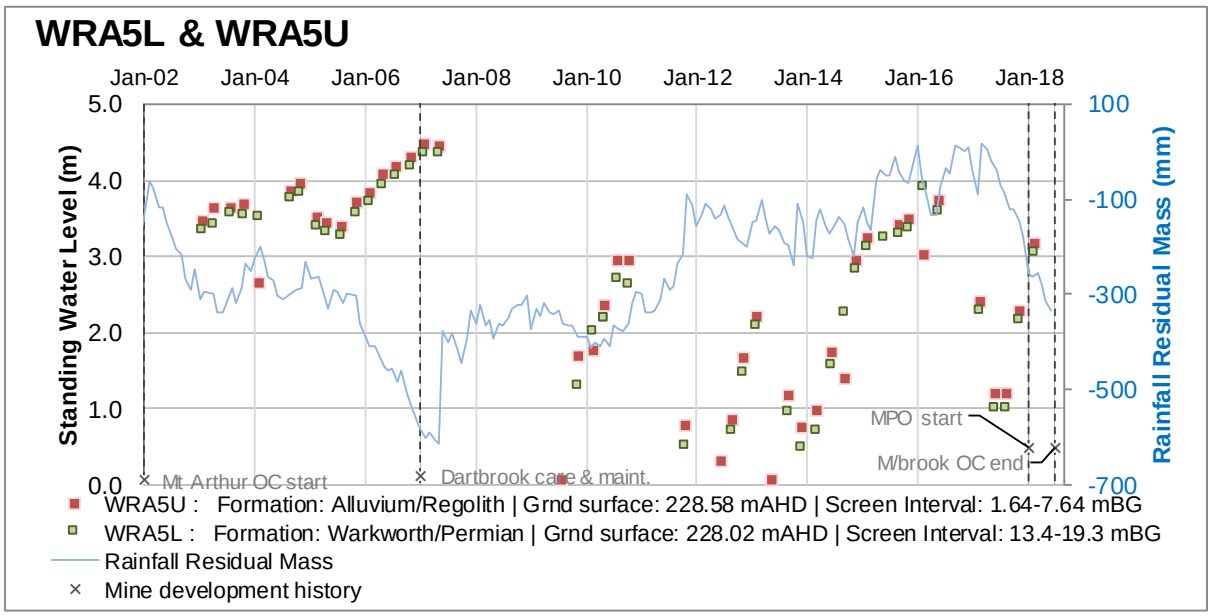

7500F000
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
Standing Water Level (m)
37.0
36.0
35.0
34.0
33.0
32.0
31.0
30.0
Rainfall Residual Mass (mm)
100
0
-100
-200
-300
-400
-500
-600
-700
MPO start
M/brook OC end
Mt Arthur OC start
Dartbrook care & maint.
7500F000 : Formation: Edderton Seam | Grnd surface: 183.7 mAHD | Screen Interval: 76-82 mBG
Rainfall Residual Mass
Mine development history

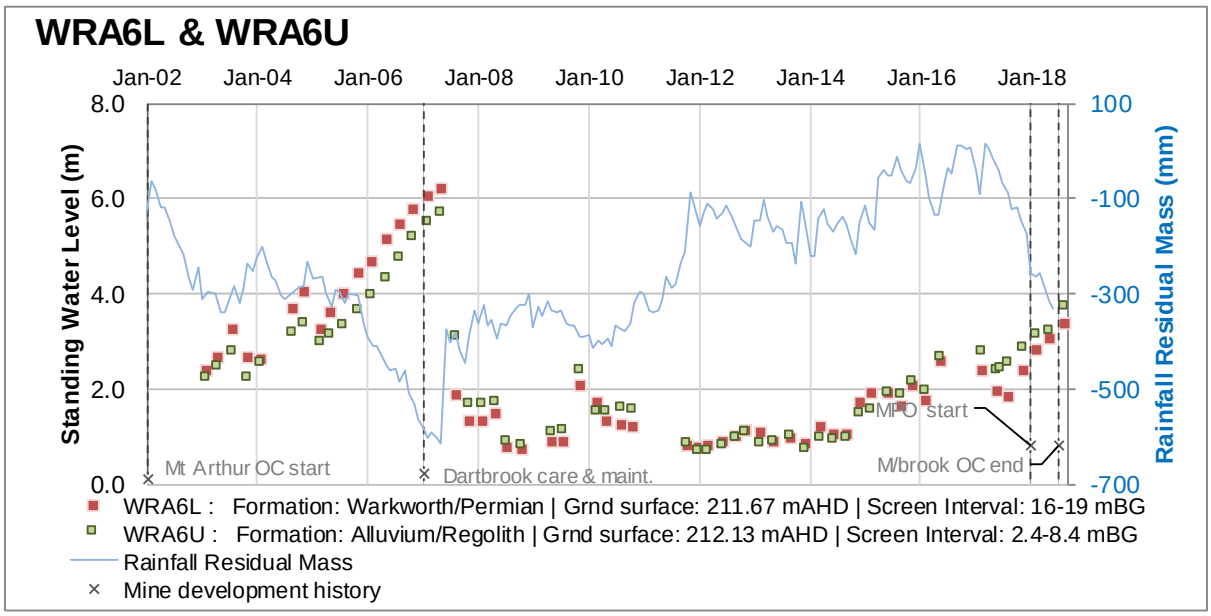
Western Bores






WRA3L & WRA3U
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
20.0
15.0
10.0
5.0
0.0
100
-100
-300
-500
-700
Standing Water Level (m)
Rainfall Residual Mass (mm)
Mt Arthur OC start
Dartbrook care & maint.
MPO start
M/brook OC end
WRA3L : Formation: Warkworth/Permian | Grnd surface: 257.67 mAHD | Screen Interval: 16.2-22.2 mBG
WRA3U : Formation: Alluvium/Regolith | Grnd surface: 258.07 mAHD | Screen Interval: 0.9-6.9 mBG
Rainfall Residual Mass
Mine development history


WRA5L & WRA5U
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
5.0
4.0
3.0
2.0
1.0
0.0
100
-100
-300
-500
-700
Standing Water Level (m)
Rainfall Residual Mass (mm)
Mt Arthur OC start
Dartbrook care & maint.
MPO start
M/brook OC end
WRA5U : Formation: Alluvium/Regolith | Grnd surface: 228.58 mAHD | Screen Interval: 1.64-7.64 mBG
WRA5L : Formation: Warkworth/Permian | Grnd surface: 228.02 mAHD | Screen Interval: 13.4-19.3 mBG
Rainfall Residual Mass
Mine development history


WRA6L & WRA6U
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
Jan-18
8.0
6.0
4.0
2.0
0.0
100
-100
-300
-500
-700
Standing Water Level (m)
Rainfall Residual Mass (mm)
Mt Arthur OC start
Dartbrook care & maint.
MPO start
M/brook OC end
WRA6L : Formation: Warkworth/Permian | Grnd surface: 211.67 mAHD | Screen Interval: 16-19 mBG
WRA6U : Formation: Alluvium/Regolith | Grnd surface: 212.13 mAHD | Screen Interval: 2.4-8.4 mBG
Rainfall Residual Mass
Mine development history

ATTACHMENT 3

BASELINE GROUNDWATER QUALITY DATA

Table A3-1
Baseline Groundwater Quality Data – Fractured and Porous Rock Groundwater Sources

Site	Number of Samples*	Number of Dry Samples	pH					EC (µS/cm)				
			Min	20th %ile	Median	80th %ile	Max	Min	20th %ile	Median	80th %ile	Max
Central Groundwater Site												
3500B500S	30	0	7.0	7.2	9.2	9.6	9.9	1,820	2,060	2,410	3,530	4,990
3500B500L	56	0	6.8	7.1	7.3	7.4	7.7	4,350	5,454	5,600	5,826	6,930
3500C500S	40	0	6.8	7.1	7.2	7.4	7.7	726	2,708	5,130	5,664	9,320
3500C500L	39	0	6.9	7.2	7.3	7.4	7.6	3,290	4,140	4,140	5,590	7,260
4500F000	59	0	6.3	6.5	6.7	6.9	7.2	1,300	1,616	1,830	6,904	9,550
5000D000	59	2	6.2	6.7	6.8	7.0	7.3	460	522	618	703	840
5500D000	59	2	6.0	6.4	6.6	6.9	7.1	730	900	990	1,570	3,910
6000C000S	28	0	6.3	6.4	6.9	7.1	7.2	800	930	4,555	4,984	5,090
6000C000L	60	51	6.4	7.0	7.0	7.2	7.5	3,860	5,016	5,305	5,474	6,000
6500F500U	55	22	6.6	6.8	6.9	7.0	7.0	5,150	5,366	5,570	5,778	5,880
6500F500M	48	0	6.0	6.9	7.1	7.2	7.4	1,126	1,820	1,900	2,804	3,040
6500F500L	55	22	6.1	6.5	6.8	7.0	7.3	1,170	1,290	1,360	1,526	3,410
6500F625	49	0	6.4	6.7	6.9	7.0	7.4	3,490	3,890	4,026	4,086	5,200
7000D000U	53	0	6.4	6.6	6.7	7.6	12.4	830	970	6,415	6,730	7,480
7000D000L	15	0	6.6	6.6	6.8	6.8	6.9	1,045	1,115	1,243	1,370	1,480
7500F000	59	0	6.2	6.7	7.0	7.6	8.0	955	1,416	1,650	5,918	6,390
Western Groundwater Site												
WRA1U	41	40	-	-	-	-	-	-	-	-	-	-
WRA1L	57	0	7.0	7.2	7.4	7.7	8.0	2,690	3,120	3,520	4,496	4,770
WRA2U	38	34	6.7	6.7	6.8	7.0	7.2	360	850	1,586	4,108	5,790
WRA2L	58	3	6.7	7.0	7.1	7.3	8.0	4,140	5,508	5,840	6,086	7,550
WRA3U	57	1	6.8	7.1	7.3	7.5	8.0	488	3,010	5,935	9,020	11,590
WRA3L	57	0	6.3	6.6	6.8	6.9	7.0	9,740	14,802	15,830	16,734	22,690
WRA5U	61	0	5.7	7.1	7.3	7.4	7.8	2,030	2,496	2,905	4,772	5,470
WRA5L	58	0	6.9	7.1	7.5	7.8	8.2	2,250	2,854	4,160	7,034	7,530
WRA6U	58	0	6.5	6.8	6.9	7	7.1	7,260	10,110	10,735	11,240	13,290
WRA6L	57	0	6.9	7.2	7.3	7.7	7.9	4,510	5,434	5,740	5,970	6,910

Table A3-2
Baseline Groundwater Quality Data – Alluvial Groundwater Sources

Site	Number of Samples*	Number of Dry Samples	pH					EC (µS/cm)				
			Min	20th %ile	Median	80th %ile	Max	Min	20th %ile	Median	80th %ile	Max
Eastern Groundwater Site												
MPBH1	59	0	6.4	6.8	6.9	7.1	7.8	467	500	540	590	970
MPBH2	60	0	6.3	6.8	6.9	7.1	7.6	758	822	870	930	1080
MPBH3	30	17	6.2	6.6	6.8	6.9	6.9	850	970	1005	1083	1130
MPBH3b	27	0	7.1	7.4	7.6	7.7	8.1	2650	3190	3860	4420	4740

ATTACHMENT 4

BASELINE AQUIFER TESTING DATA

Table A4-1
Groundwater Testing undertaken as part of the Mount Pleasant EIS (1997)

Bore/Piezometer	Test Undertaken	Test Interval (m)	Lithology	Transmissivity (kL/day/m)	Hydraulic Conductivity (kL/day/m^2)	Hydraulic Conductivity (m/day)
3500B500L	Slug	-	-	-	0.017	-
3500B500U	Slug	-	-	-	0.0064	-
3500C500L	Injection	-	-	0.44	0.09	-
3500C500U	Injection	-	-	0.51	0.085	-
3500E000U	Slug	-	-	-	0.022	-
3500E000M	Slug	-	-	-	0.0040	-
3500E000L	Injection	-	-	0.69	0.18	-
4500F000	Injection	-	-	0.084	0.014	-
5000A500	Injection	-	-	1.35	0.15	-
5000D000	Injection	-	-	0.077	0.013	-
5500D000	Injection	-	-	0.28	0.14	-
6000C000L	Slug	-	-	-	0.0046	-
6500F500U	Injection	-	-	0.14	0.046	-
6500F500M	Injection	-	-	0.1	0.03	-
6500F500L	Slug	-	-	-	0.042	-
7000D000L	Slug	-	-	-	0.84	-
7000D000U	Slug	-	-	-	0.05	-
7500F000	Injection	-	-	0.43	0.078	-
4250F250	Packer	150.0 – 153.0	Coal – VAU	-	-	0.1479
4750C000	Packer	70.5 – 73.5	Coal - PFD	-	-	0.1415
5750D750	Packer	91.0 – 94.0	Coal - BAY			0.1132
5750D750	Packer	106.0 – 109.0	Coal - WYN	-	-	0.1029
4250F250	Packer	191.5 – 194.5	Coal - BAY	-	-	0.0958
5750D750	Packer	133.0 – 136.0	Coal – WYN	-	-	0.0801
5750D750	Packer	141.0 – 144.0	Coal – EDD	-	-	0.063
5750D750	Packer	56.0 – 59.0	Coal – BRN	-	-	0.037
4750C000	Packer	135.0 – 138.0	Coal – BRN	-	-	0.0336
4250F250	Packer	86.0 – 89.0	Coal – PFD	-	-	0.0145
5750D750	Packer	124.0 – 127.0	Interburden	-	-	0.0064
5750D750	Packer	72.0 – 75.0	Interburden	-	-	0.0062
5750D750	Packer	83.0 – 86.0	Coal and Interburden	-	-	0.0053
4750C000	Packer	153.5 – 156.5	Interburden	-	-	0.0033
5750D750	Packer	113.0 – 116.0	Interburden	-	-	0.0032
4750C000	Packer	111.0 – 114.0	Interburden	-	-	0.003
4250F250	Packer	173.5 – 176.5	Interburden and coal	-	-	0.003
4250F250	Packer	127.0 – 130.0	Interburden	-	-	0.0026
4250F250	Packer	211.0 – 214.0	Interburden	-	-	0.0024
4750C000	Packer	164.5 – 167.5	Interburden	-	-	0.0017
4750C000	Packer	52.0 – 55.0	Interburden	-	-	0.0011
4750C000	Packer	97.5 – 100.5	Interburden	-	-	0.0011

Table A4-1 (continued)
Groundwater Testing undertaken as part of the Mount Pleasant EIS (1997)

Bore/Piezometer	Test Undertaken	Test Interval (m)	Lithology	Transmissivity (kL/day/m)	Hydraulic Conductivity (kL/day/m^2)	Hydraulic Conductivity (m/day)
4750C000	Packer	77.0 – 80.0	Interburden	-	-	0.0008
5750D750	Packer	87.0 – 90.0	Interburden	-	-	<0.0001

Notes: kL/day/m = kilolitre per day per metre, kL/day/m^2 = kilolitre per day per square metre.
Source: ERM Mitchell McCotter (1997).

Table A4-2
Groundwater Testing undertaken on Coal Seams at the Mt Arthur Coal Mine

ss	Test Method	Seam	Depth (m)	Transmissivity (m^2/day)	Hydraulic Conductivity (m/day)
WT1	Packer	Vaux	25 - 35	1	0.12
		Bayswater	50 – 60	1	0.11
		Wynn	65 – 75	0.1	0.04
		Clanricard	85 – 95	0.01	0.01
		Bengalla	98 - 108	0.05	0.02
		Edinglassie	130 – 140	0.5	0.05
		U. Ramrod Creek	156 – 166	0.6	0.12
		L. Ramrod Creek	168 – 178	0.3	0.15
		Interburden	Various	<0.01	<0.01
T13 (BH403)	Packer	Piercefield	-	-	0.69
		Vaux	-	-	0.52
		Bayswater	-	-	0.35
		Wynn	-	-	0.35
		Clanricard	-	-	0.26
		Bengalla	-	-	0.15
		Edinglassie	-	-	0.16
		Ramrod Creek	-	-	0.06
T16 (BH401)	Packer	Piercefield	-	-	0.6
		Vaux	-	-	0.52
		Bayswater	-	-	0.26
		Wynn	-	-	0.17
		Clanricard	-	-	0.35
		Bengalla	-	-	0.60
		Edinglassie	-	-	0.26
		Ramrod Creek	-	-	0.1
		Interburden	-	-	5.2×10^{-3} to 8.6×10^{-5}

Source: AGC (1979) and LM&P (1982).

ATTACHMENT 5

SUMMARY OF BORE CENSUS RESULTS

Bore ID (ME No.)	PS WGS84)	Northing	Year Drilled (Census Letter)	Property	Bore ID (property & Bore No.) - Field Sheet	GW No.	Survey Sheet	Use (Y/N)	Observed Purpose	Equipment Type	Casing ID & Type
4500F000	296128	6433360	1994 & 2003	MACH	THORNDALE 1	V078628 (1994) & GW080733 (2003	20161214P1	Y	Monitoring	Piezometer (PVC)	50mm (NB)
5000D000	296664	6431370	2003	MACH	BOXFIELD	N/A	20161214P3	Y	Monitoring	Piezometer (PVC)	40mm (NB)
5500D000	297166	6431378	2003	5500D000	MACH	GW078629	20170314P4	Y	Monitoring	Steel Casing	160mm
6000F625	297642	6433994	2003	6000F625 (1)	MACH	GW080732	20170314P3	N	Monitoring	PVC Casing	PVC 96mm
6500F500	298120	6433898	2003	6500F500	GLENMORE / 6500 F500	GW080729 / 080730 / 080731	20161213P4 & 20170314P3	Y	Monitoring	Piezo (L M U nested)	40mm PVC
7000D000	298661	6431400	2003	MACH	COUNTRY VIEW	NA	20161214P3	Y	Monitoring	Piezometer (PVC)	1x40mm (D) 1x50mm (S)
7500F000	299088	6433428	2003	MACH	GLENMORE No1	GW078630 / GW080728	20161214P1	Y	Monitoring	Piezometer (PVC)	50mm (NB)
ADNUM1	300521	6429434	N/A	KAYUGA RD 51	ADNUM1	GW040531	20170316P1	Y	Domestic	Equipped	Concrete Cylinder
ASHFIELD1	289344	6428899	<50-60 YRS	ASHFIELD (JLON)	WYBONG RD 1510	GW047863	20170316P7	Y	Stock & Domestic	Concrete Cylinder	Concrete Cylinder Well [1120mm] – Pump Equipped
BARRY1	299564	6430431	N/A	BARRY	PRIVATE BARRY 1	N/A	20170315P2	Y	Stock & Domestic	Concrete Cylinder	Concrete cylinder (1200mm ID)
BE1	293476	6429036	2011	MACH	McLEAN	GW201518 & GW201519	20161215P1	Y	Monitoring	50mm PVC	50mm (PVC)
BELGRAVE	295085	6434438	N/A	LONERGAN	LONERGAN 6 (FAR WEST)	N/A	20161215P3	Y	Stock	Timber Frame	Timber Frame Well
CAS1	296503	6434654	1964	CASEY GM	CAS1	GW078985	20170313P2	N	N/A	N/A	Steel Casing 155mm
CAS2	295914	6435419	<1950s	CASEY GM	CAS2	GW078986	20170313P1	N	Monitoring - Not Equipped	Steel Casing	Steel Casing 155mm
CAS3	295821	6435484	1957	CASEY GM	CAS3	GW078987	20170313P1	N	Windmill	Steel Casing	Windmill / Steel Casing 130mm
CAS4	294928	6435957	N/A	CASEY GM	CAS4	GW078988	20170313P2	N	Monitoring	N/A	Steel Casing 155mm
COWTIME1	300330	6429753	N/A	KAYUGA RD 72	COWTIME1	N/A	20170316P1	Y	Stock	Equipped (Housing)	Steel Casing (6 inch)
GRAY1	299882	6430334	N/A	KAYUGA RD 161	GRAY1	N/A	20170316P3	Y	Domestic	Steel Casing	Steel Casing (6 inch)
GRAY2	299856	6430316	N/A	KAYUGA RD 161	GRAY2	N/A	20170316P3	Y	Stock & Domestic	Steel Casing	Steel Casing (6 inch)
GW015881	299428	6428129	1957	MACH	OVERDEEN 2	GW015881	20161214P4	N	Backfilled/Collapsed	Timber? Not located	N/A
GW028510	298649	6429099	1965	MACH	WYBONG (1)	GW028510	20161215P5	N	Monitoring, Stock & Irrigation	Concrete Cylinder	1219mm
GW037774	298661	6429086	1974	MACH	WYBONG (2)	GW037774	20161215P5	N	Monitoring, Stock & Irrigation	Concrete Cylinder	1219mm
GW038412	291568	6437714	<1950s	TONY LONERGAN	NWEST (892 DORSET RD)	GW038412	20170315P1	Y	Stock & Domestic	Pump Equipped	Timber Frame (Square 1180mm)
GW038752	294050	6436664	N/A	MACH	NW Properties (Woodburn2)	GW038752	20161212P1	N	N/A	N/A	N/A
GW042701	298568	6428634	1976 (GW Record)	MACH	SCRIVENS (1)	GW047277	20161215P4	Y	Monitoring & Stock	Concrete Cylinder	900mm
GW053007	298718	6428859	1965	MACH	SCRIVENS (2)	GW053007	20161215P4	Y	Monitoring & Stock	Concrete Cylinder	1200mm
HAYES1	299582	6430624	1930s	HAYES1	HAYES1	GW053534	20170314P1	Y	Irrigation (Lucerne) Stock & Domest	8 FT Concrete	Concrete Well (~8 ft)
HAYES2	299681	6430616	1950s-60s	HAYES2	HAYES2	N/A	20170314P2	Y	Stock & Domestic (Taps)	Concrete Cylinder	Concrete Cylinder (1200mm)
JLON.1	292407	6434333	1 Feb 1971#	JOHN LONERGAN	MARYLANDS1_GW33725	GW033725	20170315P1	Y	Stock (NB: Mill not bringing water to	Windmill / Tanks	Steel Casing [152mm OD]#
JLON.2	292320	6434393	1 Sep 1965*	JOHN LONERGAN	MARYLANDS2_GW23652	GW023652	20170315P1	N	N/A	Steel Casing	Steel Casing [127mm OD]*
JLON1	298194	6434785	1 Feb 1979# (Converted to Bore)	LONERGAN	LONERGAN 5 (MARYLANDS WESTERN PADDOCK)	GW078926 & GW049015	20161215P3	Y	Monitoring & Stock (NB: Well was D	Concrete Cylinder + Bore	Concrete Cylinder Well [1200mm] with internal Bore [Steel Casing 162 mm]#
JLON2	300044	6434608	~1965-80s	LONERGAN	LONERGAN 1 (WEST OF HOUSE)	GW053282	20161215P2	N	Never Used	Steel Casing (hole)	Steel Casing 200mm
JLON3	299887	6434455	<1961	LONERGAN	LONERGAN 2 (FRONT OF HOUSE)	N/A	20161215P2	Y	Domestic	Concrete Cylinder. Well (pump equiped)	Concrete Cylinder Well [1200mm] – Pump Equipped
JLON4	299404	6434623	1932 (GW Record)	LONERGAN	LONERGAN 3 (PADDOCK)	GW037479	20161215P2	Y	Stock	Concrete Cylinder	Concrete Cylinder Well [1200mm]
JLON5	299629	6434796	1 August 1954^	LONERGAN	LONERGAN 4 (MARYLANDS BACK PADDOCK)	rrigation) and GW026137 (test bore	20161215P3	N	Irrigation (not in use)	Concrete Cylinder	Concrete Cylinder [1000mm]
KELMAN1	300925	6429305	N/A	KAYUGA RD 20	KELMAN1	GW037964	20170316P1	Y	Domestic	Equipped	Concrete Cylinder (1,828mm) *
MATHER1	299814	6430440	> 40 years old	MATHER	KAYUGA RD 175	N/A	20170316P2	Y	Domestic	Concrete Cylinder	Concrete Cylinder (750mm)
ME1 [1 Collins Ln]	299805	6430470	1970	MACH	COLLINS LANE	GW032709	20161213P2	Y	Domestic	GW Records	152mm
ME10 [Road Reserve Collins Ln]	299484	6430555	N/A	OVERGRONN SHED	MACH	N/A	20170315P3	N	N/A	N/A	N/A
ME11 [Road Reserve Collins Ln]	299495	6430656	N/A	DAMAGED	SHED	N/A	20170315P3	N	N/A	N/A	N/A
ME12 [57 Kayuga Rd]	300474	6429471	N/A	MACH	KAYUGA RD 57	GW034015	20161212P2	Y	Stock & Domestic	Surface Pump	TIMBER
ME13 [135 Kayuga Rd]	299959	6430143	N/A	KAYUGA RD 135	MACH	N/A	20170314P2	Y	Equipped	Concrete Cylinder	1200mm
ME14 [137 Kayuga Rd]	299946	6430151	N/A	KAYUGA RD 137	MACH	N/A	20170314P2	Y	Equipped	Steel Casing	5 Inch (Casing)
ME15 [141 Kayuga Rd]	299952	6430191	N/A	KAYUGA RD 141	KAYUGA RD 141	N/A	20170313P4	Y	Front Garden	Equiped (Tap)	6 Inch
ME16 [153 Kayuga Rd]	299875	6430285	N/A	KAYUGA RD 153	MACH	N/A	20170316P6	Y	Domestic	Equipped Concrete Cylinder	1000mm
ME17 [163-165 Kayuga Rd]	299874	6430370	N/A	MACH	KAYUGA RD 163-165	GW037832	20170316P3	Y	Domestic	Concrete Cylinder	4 FT
ME18 [167 Kayuga Rd]	299827	6430402	N/A	KAYUGA RD 167	KAYUGA RD 167	N/A	20170316P4	Y	Domestic	Concrete Cylinder	1200mm
ME19 [353 Wybong Rd]	299996	6429261	N/A	WYBONG RD 353	MACH	N/A	20170315P4	Y	Domestic	Equipped	5 Inch (Steel)
ME2 [1 Collins Ln]	299811	6430465	N/A	COLLINS LANE 1	T. POWELL	N/A	20170313P2	N	N/A	Equipment / Not Used	6 Inch / 5 Inch
ME20 [357 Wybong Rd]	299956	6429231	N/A	WYBONG 357	MACH	N/A	20170316P4	Y	Domestic	PVC Casing Equipped	6 Inch
ME21 [359 Wybong Rd]	299960	6429225	N/A	WYBONG 359	MACH	N/A	20170316P4	N	N/A	Steel Casing	6 Inch
ME22 [361 Wybong Rd]	299946	6429214	1953 (GW Record)	MACH	WYBONG RD 361	GW078902	20170316P5	Y	Domestic	Steel Casing	N/A
ME23 [Bimbadeen]	299456	6430443	N/A	MACH	BIMBADEEN	GW048754	20161213P2	Y	Equiped	Concrete Cylinder	1067mm (OD)
ME24 [Broomfield]	292374	6433010	N/A	MACH	BROOMFIELD (1)	N/A	20161215P4	N	N/A	Concrete Cylinder	1200mm
ME25 [Country View]	298695	6431537	N/A	MACH	COUNTRY VIEW 2	N/A	20161214P3	N	Stock	Timber	1200mm
ME26 [Glenmore]	298441	6434044	1985	MACH	GLENMORE	GW061302	20161213P3	N	N/A	Welded Steel	165mm (OD)
ME27 [Glenmore 'C']	299563	6434555	1984	MACH	GLENMORE 'C'	GW058686	20161213P3	Y	Stock	Concrete Cylinder	1219mm (1350 OD)
ME28 [Jandell]	300056	6428793	1983	MACH	JANDELL	GW060024	20161214P4	Y	Stock & Irrigation	Concrete Cylinder	1600mm
ME29 [Jandell]	299621	6428790	N/A	MACH	(NEAR 6006E)	N/A	20170317P2	Y	Stock	Equipped - Pump	Steel Casing (6Inch)
ME3 [3 Collins Ln]	299803	6430447	N/A	COLLINS LANE 3	COLLINS LANE 3	N/A	20170313P3	N	Not Used	Equiped / Pump	1000mm
ME30 [Karrabah]	299843	6434195	1981	MACH	KARRABAH	GW053783	20161213P3	Y	Irrigation (Lapsed)	Concrete Cylinder	1219mm
ME31 [Kropp]	292302	6436824	21/04/1994	MACH	NW Properties (KROPP)	N/A	20161212P1	Y	Stock	Solar Submersible	Concrete Cylinder [1m]
ME32 [Melody Farm]	297625	6434009	N/A	6500F625 (2)	MACH	N/A	20170314P4	N	Monitoring	Steel surface Casing (W PVC)	60mm (PVC)
ME33 [Overdeen]	299100	6427748	1946	MACH	OVERDEEN 1	GW015696	20161214P4	Y	Irrigation	Concrete Cylinder	1829mm (OD)
ME34 [Rosebrook 1]	299259	6429884	N/A	MACH	ROSEBROOK 1	GW034303	20161213P1	Y	Stock	Concrete Cylinder	1219mm
ME35 [Rosebrook 2]	300330	6429634	N/A	MACH	ROSEBROOK 2	GW034302	20161213P1	N	Collapsed	N/A	N/A
ME36 [Rosehill]	299550	6430090	1971 (GW Record)	MACH	ROSEHILL	GW033610	20161213P1	Y	Surface Pump	Concrete Cylinder	1800mm
ME37 [Roselyn 1]	299495	6428767	1962	MACH	ROSELYN 1	GW020305	20161215P1	Y	Stock & Irrigation	Concrete Cylinder	1219mm (OD)
ME38 [Roselyn 2]	299457	6429125	1964	MACH	ROSELYN 2	GW022223	20161215P1	Y	Stock & Domestic	Open Hole / Steel Casing	150mm (Steel)
ME39 [Scrivens]	298768	6428561	1976 (GW Record)	MACH	SCRIVENS (3)	GW071295	20161215P5	N	Stock	Concrete Cylinder	1219mm
ME4 [4 Collins Ln]	299769	6430448	N/A	COLLINS LANE 4	COLLINS LANE 4	N/A	20170313P3	Y	Domestic	Equiped / Pump	6 Inch
ME40 [Thorndale 1]	296326	6433371	2002 (GW Record)	MACH	THORNDALE 2	GW080205	20161214P1	N	Stock	Well	(1200mm) Timber
ME41 [Thorndale 2]	295772	6433898	N/A	MACH	THORNDALE	GW080206	20161214P2	N	Collapsed	Windmill / Timber Frame	N/A
ME42 [Thorndale South]	295117	6432422	2002 (GW Record)	MACH	THORNDALE SOUTH	GW080203	20161214P2	N	Collapsed	Windmill / Timber Frame	1200mm
ME43 [Warrawee]	296672	6434348	1999 (GW Record)	MACH	WARRAWEE	GW080134	20161214P2	N	Collapsed	Windmill / Timber Frame	N/A
ME5 [5 Collins Ln]	299756	6430451	N/A	COLLINS LANE 5	COLLINS LANE 5	N/A	20170313P3	Y	Domestic	Equiped / Pump	1000mm (Well)
ME6 [9 Collins Ln]	299734	6430455	N/A	COLLINS LANE 9	COLLINS LANE 9	N/A	20170313P4	N	Vacant	Equiped (Hose)	1000mm (Well)
ME7 [17 Collins Ln]	299680	6430461	N/A	COLLINS LANE 17	MACH	N/A	20170316P6	Y	Pump Raised	Concrete Cylinder	1200mm
ME8 [33 Collins Ln]	299474	6430442	N/A	COLLINS LANE 33	COLLINS LANE 33	N/A	20170315P3	Y	Domestic	Concrete Cylinder	1219mm
ME9 [Lot 3 Collins Ln]	299600	6430535	N/A	COLLINS LANE LOT 3	LOT 3	N/A	20170315P2	Y	Domestic	Steel Casing	6 Inch
MITCHELL1	299860	6430413	N/A	MITCHELL	KAYUGA RD 173	N/A	20170316P2	Y	Domestic	Steel Casing	Steel Casing (6 inch)
MOORE1	299668	6430812	1 January 1958#	KAYUGA RD 211 (MOORE)	MOORE 1	GW045435	20170314P1	Y	Domestic (Front Yard)	Concrete Cylinder	Concrete Cylinder
MOORE1S	291441	6429318	N/A	GILGAI	MOORE (S1)	N/A	20170317P1	Y	Stock (Grazing)	Spring	Spring (Pond immediately up-catchment of Moore2S)
MOORE2	299720	6430762	27 Feb 2003*	KAYUGA RD 207 (MOORE)	MOORE 2 [PREVIOUS MP-BH3]	GW080726	20170314P1	N	Previously Monitoring	PVC In Steel Mount	PVC [100mm] in Steel Monument
MOORE2S	291427	6429323	N/A	GILGAI	MOORE (S2)	N/A	20170317P1	Y	Stock (Grazing)	Spring	Spring (Pond immediately down-catchment of Moore 1S)
MOORE3S	290851	6429236	N/A	GILGAI	MOORE (S3)	N/A	20170317P1	Y	Stock (Grazing)	Spring	Spring (Pond further down-catchment of Moore 1S & Moore 2S)
MOORE4	290139	6430000	< 60 Years (1800 GW Record)	GILGAI	JB MOORE	GW019979	20170317P2	Y	Stock	Equipped - Pump	Timber Frame Well (1200mm)
MP-BH1	301149	6432563	2003	YORE / DAPKOS	MP-BH1	GW080727	20170314P3	Y	Monitoring	Steel Casing	Steel casing with PVC (4 inch) in monument
MP-BH2	299407	6428712	N/A	MP - BH2	MACH	N/A	20170313P4	Y	N/A	None	6 Inch
MP-BH3	299481	6431354	N/A	MACH	MPBH3 (BORE2)	N/A	20161213P2	Y	Monitoring	Concrete Cylinder	1200mm
PARKINSON1	288944	6427796	N/A	WYBONG RD (LEFT)	PARKINSON1	N/A	20170316P6	Y	Stock	Windmill	Well (1m diameter)
PITMAN1	300806	6429378	30 Apr 1991*	KAYUGA RD 36	PITMAN1	GW200004	20170316P7	Y	Domestic	Steel Casing	Steel Casing 190mm OD* (~7 inch)
RDH76	296343	6435365	1982	CASEY GM	RDH76	GW078941	20170313P1	N	Monitoring^	PVC Casing	PVC Casing 130mm
SIMPSON1	299906	6429198	> 50 years (Hand Dug)	WYBONG RD 365	SIMPSON1	N/A	20170316P5	Y	Stock & Domestic	Concrete Cylinder	Concrete Cylinder (900mm)
SORMAZ1	300010	6429263	1992 (GW Record)	WYBONG RD 351	SORMAZ1	GW078261 (Cancelled)	20170316P7	N	Would require reconditioning to use	Steel Casing	Steel Casing (6 inch)
TLON1	294061	6436687	7/10/1999 (Form A)	MACH	NW Properties (Woodburn1)	GW078952	20161212P1	Y	Monitoring	Windmill	100mm (ID) (5 inches)
WALTON1	290331	6428144	N/A	WYBONG RD 1431	WALTON1	N/A	20170316P5	Y	Stock	Steel Casing	Steel Casing (6 inch)
WICKS1	300534	6429472	N/A	KAYUGA RD 53	WICKS1	N/A	20170316P2	Y	Domestic	Concrete Cylinder	Concrete Cylinder (900mm)

Bore ID (ME No.)	PS WGS84)	Northing	Year Drilled (Census Letter)	Property	Bore ID (property & Bore No.) - Field Sheet	Casing Stick Up (SU)	Depth To Water (mbtoc)	Bore Depth (mbtoc)	SWL (mbgl)	SWL (mbgl)	EC (µs/Cm)	pH	Sample Source
4500F000	296128	6433360	1994 & 2003	MACH	THORNDALE 1	1.0	19.88	-	18.88	18.88	7,300	6.62	BAILER
5000D000	296664	6431370	2003	MACH	BOXFIELD	1.0	82.45	-	81.45	81.45	-	-	-
5500D000	297166	6431378	2003	5500D000	MACH	1.0	64.7	121.7	63.7	63.7	-	-	(DNF)
6000F625	297642	6433994	2003	6000F625 (1)	MACH	0.0	16.73	34.5	16.73	16.73	3,620	6.66	BAILER
6500F500	298120	6433898	2003	6500F500	GLENMORE / 6500 F500	1.0	measured from top of steel U[32.8]M[54.53]L[52.9]	114.60(L) / 76.70(M) / 35.40(U)	U[31.8] M[53.53] L[51.9]	U[31.8] M[53.53] L[51.9]	-	-	-
7000D000	298661	6431400	2003	MACH	COUNTRY VIEW	1.0	[50]=6.0[40]=18.93	-	[50]=5.0 [40]=17.93	[50]=5.0 [40]=17.93	4,650 [50mm]	6.57 [50mm]	BAILER
7500F000	299088	6433428	2003	MACH	GLENMORE No1	1.0	36.07	not measured 168-170 Check GW?	35.07	35.07	6,170	7.67	BAILER
ADNUM1	300521	6429434	N/A	KAYUGA RD 51	ADNUM1	0.9	11.52	13	10.62	10.62	918	6.66	TAP
ASHFIELD1	289344	6428899	<50-60 YRS	ASHFIELD (JLON)	WYBONG RD 1510	0.15	3.1	5.75	2.95	2.95	5,320	7.10	BAILER
BARRY1	299564	6430431	N/A	BARRY	PRIVATE BARRY 1	0.7	12.36	13.56	11.66	11.66	842	6.01	BAILER
BE1	293476	6429036	2011	MACH	McLEAN	-	-	-	-	-	-	-	-
BELGRAVE	295085	6434438	N/A	LONERGAN	LONERGAN 6 (FAR WEST)	0.2	7.25	23.85 (75ft)	7.05	7.05	6,820	7.42	BAILER
CAS1	296503	6434654	1964	CASEY GM	CAS1	0.3	11.65	28.23	11.35	11.35	8040	7.74	BAILER
CAS2	295914	6435419	<1950s	CASEY GM	CAS2	0.55	40.01	65	39.46	39.46	10,010	6.79	BAILER
CAS3	295821	6435484	1957	CASEY GM	CAS3	0.2	Dry	76.7	Dry	Dry	Dry	Dry	-
CAS4	294928	6435957	N/A	CASEY GM	CAS4	0.45	27.96	34.8	27.51	27.51	8170	6.78	BAILER
COWTIME1	300330	6429753	N/A	KAYUGA RD 72	COWTIME1	1.2	-	-	-	-	890	6.89	TAP
GRAY1	299882	6430334	N/A	KAYUGA RD 161	GRAY1	-	-	-	-	-	712	6.49	TAP
GRAY2	299856	6430316	N/A	KAYUGA RD 161	GRAY2	-	-	-	-	-	693	6.49	TAP
GW015881	299428	6428129	1957	MACH	OVERDEEN 2	-	-	-	-	-	-	-	-
GW028510	298649	6429099	1965	MACH	WYBONG (1)	1.25	12.16	14.69	10.91	10.91	1,880	6.74	BAILER
GW037774	298661	6429086	1974	MACH	WYBONG (2)	1.5	12.05	15.25	10.55	10.55	870	6.90	BAILER
GW038412	291568	6437714	<1950s	TONY LONERGAN	NWEST (892 DORSET RD)	0.5	5	7.7	4.5	4.5	1,103	6.44	TAP
GW038752	294050	6436664	N/A	MACH	NW Properties (Woodburn2)	-	-	-	-	-	-	-	-
GW042701	298568	6428634	1976 (GW Record)	MACH	SCRIVENS (1)	1.5	11.99	13.7	10.49	10.49	941	6.76	BAILER
GW053007	298718	6428859	1965	MACH	SCRIVENS (2)	0.15	11.1	12.65	10.95	10.95	881	6.67	BAILER
HAYES1	299582	6430624	1930s	HAYES1	HAYES1	0.0	11.9	15.2	11.9	11.9	-	-	-
HAYES2	299681	6430616	1950s-60s	HAYES2	HAYES2	1.2	12.7	15.5	11.5	11.5	680	6.60	TAP
JLON.1	292407	6434333	1 Feb 1971#	JOHN LONERGAN	MARYLANDS1_GW33725	0.5	-	57.9	-	-	-	-	TANK
JLON.2	292320	6434393	1 Sep 1965*	JOHN LONERGAN	MARYLANDS2_GW23652	0.5	31.04	37.4	30.54	30.54	6,650	6.13	BAILER
JLON1	298194	6434785	1 Feb 1979# (Converted to Bore)	LONERGAN	LONERGAN 5 (MARYLANDS WESTERN PADDOCK)	1.0	Dry	6 (Well) 51.8 (Bore from GW Record)	Dry	Dry	-	-	-
JLON2	300044	6434608	~1965-80s	LONERGAN	LONERGAN 1 (WEST OF HOUSE)	0.4	14.39	82	13.99	13.99	650	7.33	BAILER
JLON3	299887	6434455	<1961	LONERGAN	LONERGAN 2 (FRONT OF HOUSE)	0.2	10.4	12.83	10.2	10.2	1,730	6.99	TAP
JLON4	299404	6434623	1932 (GW Record)	LONERGAN	LONERGAN 3 (PADDOCK)	1.8	11.35	12.5	9.55	9.55	1,980	6.99	BAILER
JLON5	299629	6434796	1 August 1954^	LONERGAN	LONERGAN 4 (MARYLANDS BACK PADDOCK)	0.0	10.2	11.7	10.2	10.2	800	6.60	BAILER
KELMAN1	300925	6429305	N/A	KAYUGA RD 20	KELMAN1	0.0	-	12.4	-	-	652	6.60	TAP
MATHER1	299814	6430440	> 40 years old	MATHER	KAYUGA RD 175	0.95	11.46	13.08	10.51	10.51	742	6.44	TAP
ME1 [1 Collins Ln]	299805	6430470	1970	MACH	COLLINS LANE	-	-	12	-	-	-	-	-
ME10 [Road Reserve Collins Ln]	299484	6430555	N/A	OVERGRONN SHED	MACH	-	-	-	-	-	-	-	-
ME11 [Road Reserve Collins Ln]	299495	6430656	N/A	DAMAGED	SHED	-	-	-	-	-	-	-	-
ME12 [57 Kayuga Rd]	300474	6429471	N/A	MACH	KAYUGA RD 57	0.35	11.17	14.0 (from GW Record)	10.82	10.82	1176	6.98	BAILER
ME13 [135 Kayuga Rd]	299959	6430143	N/A	KAYUGA RD 135	MACH	1.0	12.45	14.1	11.45	11.45	945	6.50	TAP
ME14 [137 Kayuga Rd]	299946	6430151	N/A	KAYUGA RD 137	MACH	-	-	-	-	-	470	6.80	TAP
ME15 [141 Kayuga Rd]	299952	6430191	N/A	KAYUGA RD 141	KAYUGA RD 141	N/A	-	-	-	-	1,000	6.65	TAP
ME16 [153 Kayuga Rd]	299875	6430285	N/A	KAYUGA RD 153	MACH	1.0	12.12	13.42	11.12	11.12	930	6.60	TAP
ME17 [163-165 Kayuga Rd]	299874	6430370	N/A	MACH	KAYUGA RD 163-165	0.3	12.6	14.85	12.3	12.3	656	6.59	TAP
ME18 [167 Kayuga Rd]	299827	6430402	N/A	KAYUGA RD 167	KAYUGA RD 167	0.6	11.5	13.45	10.9	10.9	752	6.46	TAP
ME19 [353 Wybong Rd]	299996	6429261	N/A	WYBONG RD 353	MACH	-	-	-	-	-	1003	6.51	TAP
ME2 [1 Collins Ln]	299811	6430465	N/A	COLLINS LANE 1	T. POWELL	N/A / 0	N/A / 10.80	N/A / 11.24	10.8	10.8	N/A / 905	N/A / 6.68	N/A / BAILER
ME20 [357 Wybong Rd]	299956	6429231	N/A	WYBONG 357	MACH	-	-	-	-	-	1,027	6.78	TAP
ME21 [359 Wybong Rd]	299960	6429225	N/A	WYBONG 359	MACH	-	-	-	-	-	N/A	N/A	-
ME22 [361 Wybong Rd]	299946	6429214	1953 (GW Record)	MACH	WYBONG RD 361	-	(Equipped)	12.12m based on GW Record (Equipped)	-	-	1,025	6.72	TAP
ME23 [Bimbadeen]	299456	6430443	N/A	MACH	BIMBADEEN	0.0	11.87	14.57	11.87	11.87	1,863	6.88	BAILER
ME24 [Broomfield]	292374	6433010	N/A	MACH	BROOMFIELD (1)	0.45	3.15	4.65	2.7	2.7	4,500	8.10	BAILER
ME25 [Country View]	298695	6431537	N/A	MACH	COUNTRY VIEW 2	0.0	4.16	-	4.16	4.16	6,770	7.14	BAILER
ME26 [Glenmore]	298441	6434044	1985	MACH	GLENMORE	0.3	50.05	38.15	49.75	49.75	3,010	7.37	BAILER
ME27 [Glenmore 'C']	299563	6434555	1984	MACH	GLENMORE 'C'	0.8	10.12	11.33	9.32	9.32	1,060	6.83	BAILER
ME28 [Jandell]	300056	6428793	1983	MACH	JANDELL	1.1	11.58	11.67	10.48	10.48	-	-	DRY (MOISTURE)
ME29 [Jandell]	299621	6428790	N/A	MACH	(NEAR 6006E)	-	-	-	-	-	-	-	-
ME3 [3 Collins Ln]	299803	6430447	N/A	COLLINS LANE 3	COLLINS LANE 3	0.5	11.8	12.1	11.3	11.3	840	6.63	BAILER
ME30 [Karrabah]	299843	6434195	1981	MACH	KARRABAH	0.5	9.96	12.95	9.46	9.46	1,050	7.02	BAILER
ME31 [Kropp]	292302	6436824	21/04/1994	MACH	NW Properties (KROPP)	-	-	-	-	-	3,600	7.73	TAP
ME32 [Melody Farm]	297625	6434009	N/A	6500F625 (2)	MACH	0.4	11.98	40.46	11.58	11.58	890	6.70	BAILER
ME33 [Overdeen]	299100	6427748	1946	MACH	OVERDEEN 1	0.0	11.03	14.04	11.03	11.03	1,350	6.84	BAILER
ME34 [Rosebrook 1]	299259	6429884	N/A	MACH	ROSEBROOK 1	0.3	12.13	14.1	11.83	11.83	1016	6.88	BAILER
ME35 [Rosebrook 2]	300330	6429634	N/A	MACH	ROSEBROOK 2	-	-	12.0 (from GW Record)	-	-	-	-	-
ME36 [Rosehill]	299550	6430090	1971 (GW Record)	MACH	ROSEHILL	0.1	12.13	14.25	12.03	12.03	720	6.93	BAILER
ME37 [Roselyn 1]	299495	6428767	1962	MACH	ROSELYN 1	-	-	13.4 (GW Record)	-	-	-	-	-
ME38 [Roselyn 2]	299457	6429125	1964	MACH	ROSELYN 2	0.5	11.78	11.88	11.28	11.28	-	-	-
ME39 [Scrivens]	298768	6428561	1976 (GW Record)	MACH	SCRIVENS (3)	1.0	12.35	14.6	11.35	11.35	1,100	6.84	BAILER
ME4 [4 Collins Ln]	299769	6430448	N/A	COLLINS LANE 4	COLLINS LANE 4	N/A	N/A	-	-	-	725	7.18	BAILER
ME40 [Thorndale 1]	296326	6433371	2002 (GW Record)	MACH	THORNDALE 2	0.0	4.5	8.5	4.5	4.5	7,900	7.03	BAILER
ME41 [Thorndale 2]	295772	6433898	N/A	MACH	THORNDALE	-	-	-	-	-	-	-	-
ME42 [Thorndale South]	295117	6432422	2002 (GW Record)	MACH	THORNDALE SOUTH	0.0	5.95	19.25	5.95	5.95	3,150	7.90	BAILER
ME43 [Warrawee]	296672	6434348	1999 (GW Record)	MACH	WARRAWEE	-	-	-	-	-	-	-	-
ME5 [5 Collins Ln]	299756	6430451	N/A	COLLINS LANE 5	COLLINS LANE 5	0.6	12.37	12.85	11.77	11.77	745	6.80	BAILER
ME6 [9 Collins Ln]	299734	6430455	N/A	COLLINS LANE 9	COLLINS LANE 9	1.1	12.7	13.6	11.6	11.6	796	6.82	BAILER
ME7 [17 Collins Ln]	299680	6430461	N/A	COLLINS LANE 17	MACH	0.76	12.31	12.9	11.55	11.55	912	6.65	BAILER
ME8 [33 Collins Ln]	299474	6430442	N/A	COLLINS LANE 33	COLLINS LANE 33	0.3	12.45	14.9	12.15	12.15	1,315	6.54	BAILER
ME9 [Lot 3 Collins Ln]	299600	6430535	N/A	COLLINS LANE LOT 3	LOT 3	-	-	-	-	-	830	6.25	TAP
MITCHELL1	299860	6430413	N/A	MITCHELL	KAYUGA RD 173	0.5	-	-	-	-	664	6.64	TAP @ HOUSE
MOORE1	299668	6430812	1 January 1958#	KAYUGA RD 211 (MOORE)	MOORE 1	0.75	12.55	52-56FT (13)	11.8	11.8	740	6.60	BAILER
MOORE1S	291441	6429318	N/A	GILGAI	MOORE (S1)	-	AT SURFACE	-	0	0	12,000	8.68	GRAB SAMPLE
MOORE2	299720	6430762	27 Feb 2003*	KAYUGA RD 207 (MOORE)	MOORE 2 [PREVIOUS MP-BH3]	0.47	N/A (blocked)	-	-	-	-	-	-
MOORE2S	291427	6429323	N/A	GILGAI	MOORE (S2)	-	AT SURFACE	-	0	0	8,200	8.28	GRAB SAMPLE
MOORE3S	290851	6429236	N/A	GILGAI	MOORE (S3)	-	AT SURFACE	-	0	0	7,900	8.80	GRAB SAMPLE
MOORE4	290139	6430000	< 60 Years (1800 GW Record)	GILGAI	JB MOORE	0.25	3.1	4.5	2.85	2.85	3,670	7.40	BAILER
MP-BH1	301149	6432563	2003	YORE / DAPKOS	MP-BH1	0.35	9.99	18	9.64	9.64	510	6.60	BAILER
MP-BH2	299407	6428712	N/A	MP - BH2	MACH	0.45	12.46	17.4	12.01	12.01	856	6.56	BAILER
MP-BH3	299481	6431354	N/A	MACH	MPBH3 (BORE2)	0.3	12.22	14	11.92	11.92	2,005	7.38	BAILER
PARKINSON1	288944	6427796	N/A	WYBONG RD (LEFT)	PARKINSON1	0.7	3.75	4.7	3.05	3.05	5,160	7.35	BAILER
PITMAN1	300806	6429378	30 Apr 1991*	KAYUGA RD 36	PITMAN1	1.5	-	-	-	-	715	6.83	TAP
RDH76	296343	6435365	1982	CASEY GM	RDH76	0.0	17.36	49.4	17.36	17.36	4800	6.84	BAILER
SIMPSON1	299906	6429198	> 50 years (Hand Dug)	WYBONG RD 365	SIMPSON1	0.0	10.9	11.6	10.9	10.9	990	7.40	TAP
SORMAZ1	300010	6429263	1992 (GW Record)	WYBONG RD 351	SORMAZ1	0.6	11.55	11.61	10.95	10.95	-	-	-
TLON1	294061	6436687	7/10/1999 (Form A)	MACH	NW Properties (Woodburn1)	0.2	11.43	-	11.23	11.23	-	-	-
WALTON1	290331	6428144	N/A	WYBONG RD 1431	WALTON1	0.3	NA (Equipped)	90m Deep / 87m to Pump (From Owner)	-	-	8,290	7.10	TAP
WICKS1	300534	6429472	N/A	KAYUGA RD 53	WICKS1	0.9	11.8	12.5	10.9	10.9	1,340	6.80	BAILER

Bore ID (ME No.)	PS WGS84)	Northing	Year Drilled (Census Letter)	Property	Bore ID (property & Bore No.) - Field Sheet	Allocation (ML/Yr)	Pump Regime (Rate/Frequency)	Storage (Dam/Tank/Troughs/Vol)	Log (Y/N)	Water Sample (Y/N)	Photo (Y/N)	Date Inspected
4500F000	296128	6433360	1994 & 2003	MACH	THORNDALE 1	-	-	-	N	Y	Y	14/12/2016
5000D000	296664	6431370	2003	MACH	BOXFIELD	-	-	-	N	N	Y	14/12/2016
5500D000	297166	6431378	2003	5500D000	MACH	-	-	-	N	N	Y	14/03/2017
6000F625	297642	6433994	2003	6000F625 (1)	MACH	-	-	-	N	Y	Y	14/03/2017
6500F500	298120	6433898	2003	6500F500	GLENMORE / 6500 F500	-	-	-	N	N	Y	13/12/2016 & 14/03/2017
7000D000	298661	6431400	2003	MACH	COUNTRY VIEW	-	-	-	N	Y	Y	14/12/2016
7500F000	299088	6433428	2003	MACH	GLENMORE No1	-	-	-	N	Y	Y	14/12/2016
ADNUM1	300521	6429434	N/A	KAYUGA RD 51	ADNUM1	-	AS REQUIRED	-	N	Y	Y	16/03/2017
ASHFIELD1	289344	6428899	<50-60 YRS	ASHFIELD (JLON)	WYBONG RD 1510	-	-	Tank	N	Y	Y	16/03/2017
BARRY1	299564	6430431	N/A	BARRY	PRIVATE BARRY 1	-	-	-	N	Y	Y	15/03/2017
BE1	293476	6429036	2011	MACH	McLEAN	-	-	-	N	N (refer to BENGALLA records)	Y	15/12/2016
BELGRAVE	295085	6434438	N/A	LONERGAN	LONERGAN 6 (FAR WEST)	-	-	-	N	Y	Y	15/12/2016
CAS1	296503	6434654	1964	CASEY GM	CAS1	-	-	-	N	Y	Y	13/03/2017
CAS2	295914	6435419	<1950s	CASEY GM	CAS2	-	-	-	N	Y	Y	13/03/2017
CAS3	295821	6435484	1957	CASEY GM	CAS3	-	-	-	N	N	Y	13/03/2017
CAS4	294928	6435957	N/A	CASEY GM	CAS4	-	-	-	N	Y	Y	13/03/2017
COWTIME1	300330	6429753	N/A	KAYUGA RD 72	COWTIME1	-	AS REQUIRED	-	N	Y	Y	16/03/2017
GRAY1	299882	6430334	N/A	KAYUGA RD 161	GRAY1	-	-	-	N	Y	Y	16/03/2017
GRAY2	299856	6430316	N/A	KAYUGA RD 161	GRAY2	-	-	-	N	Y	Y	16/03/2017
GW015881	299428	6428129	1957	MACH	OVERDEEN 2	-	-	-	N	N	N	14/12/2016
GW028510	298649	6429099	1965	MACH	WYBONG (1)	-	-	-	N	Y	Y	15/12/2016
GW037774	298661	6429086	1974	MACH	WYBONG (2)	-	-	-	N	Y	Y	15/12/2016
GW038412	291568	6437714	<1950s	TONY LONERGAN	NWEST (892 DORSET RD)	-	AS REQUIRED	-	N	Y	Y	15/03/2017
GW038752	294050	6436664	N/A	MACH	NW Properties (Woodburn2)	-	-	-	N	N	Y	12/12/2016
GW042701	298568	6428634	1976 (GW Record)	MACH	SCRIVENS (1)	-	-	-	N	Y	Y	15/12/2016
GW053007	298718	6428859	1965	MACH	SCRIVENS (2)	-	-	-	N	Y	Y	15/12/2016
HAYES1	299582	6430624	1930s	HAYES1	HAYES1	22 units	EVERYDAY/SUMMER	-	N	N	Y	14/03/2017
HAYES2	299681	6430616	1950s-60s	HAYES2	HAYES2	-	-	-	N	Y	Y	14/03/2017
JLON.1	292407	6434333	1 Feb 1971#	JOHN LONERGAN	MARYLANDS1_GW33725	-	Windmill	YES	N	N	Y	15/03/2017
JLON.2	292320	6434393	1 Sep 1965*	JOHN LONERGAN	MARYLANDS2_GW23652	-	-	-	N	Y	Y	15/03/2017
JLON1	298194	6434785	1 Feb 1979# (Converted to Bore)	LONERGAN	LONERGAN 5 (MARYLANDS WESTERN PADDOCK)	-	-	-	N	N	Y	15/12/2016
JLON2	300044	6434608	~1965-80s	LONERGAN	LONERGAN 1 (WEST OF HOUSE)	-	-	-	N	Y	Y	15/12/2016
JLON3	299887	6434455	<1961	LONERGAN	LONERGAN 2 (FRONT OF HOUSE)	-	PUMPING (TIMED)	-	N	Y	Y	15/12/2016
JLON4	299404	6434623	1932 (GW Record)	LONERGAN	LONERGAN 3 (PADDOCK)	-	-	-	N	Y	Y	15/12/2016
JLON5	299629	6434796	1 August 1954^	LONERGAN	LONERGAN 4 (MARYLANDS BACK PADDOCK)	-	-	-	N	Y	Y	15/12/2016
KELMAN1	300925	6429305	N/A	KAYUGA RD 20	KELMAN1	-	AS REQUIRED	-	N	Y	Y	16/03/2017
MATHER1	299814	6430440	> 40 years old	MATHER	KAYUGA RD 175	-	AS REQUIRED	-	N	Y	Y	16/03/2017
ME1 [1 Collins Ln]	299805	6430470	1970	MACH	COLLINS LANE	-	-	-	N	N	Y	13/12/2016
ME10 [Road Reserve Collins Ln]	299484	6430555	N/A	OVERGRONN SHED	MACH	-	-	-	N	N	Y	15/03/2017
ME11 [Road Reserve Collins Ln]	299495	6430656	N/A	DAMAGED	SHED	-	-	-	N	N	Y	15/03/2017
ME12 [57 Kayuga Rd]	300474	6429471	N/A	MACH	KAYUGA RD 57	-	-	TAP	N	Y	Y	12/12/2016
ME13 [135 Kayuga Rd]	299959	6430143	N/A	KAYUGA RD 135	MACH	-	-	-	N	Y	Y	14/03/2017
ME14 [137 Kayuga Rd]	299946	6430151	N/A	KAYUGA RD 137	MACH	-	-	-	N	Y	Y	14/03/2017
ME15 [141 Kayuga Rd]	299952	6430191	N/A	KAYUGA RD 141	KAYUGA RD 141	-	-	-	N	Y	Y	13/03/2017
ME16 [153 Kayuga Rd]	299875	6430285	N/A	KAYUGA RD 153	MACH	-	AS REQUIRED	-	N	Y	Y	16/03/2017
ME17 [163-165 Kayuga Rd]	299874	6430370	N/A	MACH	KAYUGA RD 163-165	60 Units in Hunter Regulat	-	-	N	Y	Y	16/03/2017
ME18 [167 Kayuga Rd]	299827	6430402	N/A	KAYUGA RD 167	KAYUGA RD 167	-	AS REQUIRED	-	N	Y	Y	16/03/2017
ME19 [353 Wybong Rd]	299996	6429261	N/A	WYBONG RD 353	MACH	-	-	-	N	Y	Y	15/03/2017
ME2 [1 Collins Ln]	299811	6430465	N/A	COLLINS LANE 1	T. POWELL	-	-	-	N	N / Y	Y (x2)	13/03/2017
ME20 [357 Wybong Rd]	299956	6429231	N/A	WYBONG 357	MACH	-	AS REQUIRED	-	N	Y	Y	16/03/2017
ME21 [359 Wybong Rd]	299960	6429225	N/A	WYBONG 359	MACH	-	-	-	N	N	Y	16/03/2017
ME22 [361 Wybong Rd]	299946	6429214	1953 (GW Record)	MACH	WYBONG RD 361	-	-	-	N	Y	Y	16/03/2017
ME23 [Bimbadeen]	299456	6430443	N/A	MACH	BIMBADEEN	-	-	-	N	Y	Y	13/12/2016
ME24 [Broomfield]	292374	6433010	N/A	MACH	BROOMFIELD (1)	-	-	-	N	Y	Y	15/12/2016
ME25 [Country View]	298695	6431537	N/A	MACH	COUNTRY VIEW 2	-	-	-	N	Y	Y	14/12/2016
ME26 [Glenmore]	298441	6434044	1985	MACH	GLENMORE	-	-	-	N	Y	Y	13/12/2016
ME27 [Glenmore 'C']	299563	6434555	1984	MACH	GLENMORE 'C'	-	-	TANK (Concrete)	N	Y	Y	13/12/2016
ME28 [Jandell]	300056	6428793	1983	MACH	JANDELL	-	-	-	N	N	Y	14/12/2016
ME29 [Jandell]	299621	6428790	N/A	MACH	(NEAR 6006E)	-	-	-	N	N	Y	17/03/2017
ME3 [3 Collins Ln]	299803	6430447	N/A	COLLINS LANE 3	COLLINS LANE 3	-	-	-	N	Y	Y	13/03/2017
ME30 [Karrabah]	299843	6434195	1981	MACH	KARRABAH	-	-	-	N	Y	Y	13/12/2016
ME31 [Kropp]	292302	6436824	21/04/1994	MACH	NW Properties (KROPP)	-	-	-	N	Y	Y	12/12/2016
ME32 [Melody Farm]	297625	6434009	N/A	6500F625 (2)	MACH	-	-	-	N	Y	Y	14/03/2017
ME33 [Overdeen]	299100	6427748	1946	MACH	OVERDEEN 1	-	-	-	Y	Y	Y	14/12/2016
ME34 [Rosebrook 1]	299259	6429884	N/A	MACH	ROSEBROOK 1	-	On demand	TANK	N	Y	Y	13/12/2016
ME35 [Rosebrook 2]	300330	6429634	N/A	MACH	ROSEBROOK 2	-	-	-	N	N	Y	13/12/2016
ME36 [Rosehill]	299550	6430090	1971 (GW Record)	MACH	ROSEHILL	-	Timer	TROUGHS	N	Y	Y	13/12/2016
ME37 [Roselyn 1]	299495	6428767	1962	MACH	ROSELYN 1	-	-	-	N	N	Y	15/12/2016
ME38 [Roselyn 2]	299457	6429125	1964	MACH	ROSELYN 2	-	-	Plastic Tank	N	N	Y	15/12/2016
ME39 [Scrivens]	298768	6428561	1976 (GW Record)	MACH	SCRIVENS (3)	-	-	-	N	Y	Y	15/12/2016
ME4 [4 Collins Ln]	299769	6430448	N/A	COLLINS LANE 4	COLLINS LANE 4	-	AS REQUIRED	-	N	Y - At House	Y	13/03/2017
ME40 [Thorndale 1]	296326	6433371	2002 (GW Record)	MACH	THORNDALE 2	-	-	-	N	Y	Y	14/12/2016
ME41 [Thorndale 2]	295772	6433898	N/A	MACH	THORNDALE	-	-	-	N	N	Y	14/12/2016
ME42 [Thorndale South]	295117	6432422	2002 (GW Record)	MACH	THORNDALE SOUTH	-	-	-	N	Y	Y	14/12/2016
ME43 [Warrawee]	296672	6434348	1999 (GW Record)	MACH	WARRAWEE	-	-	-	N	N	Y	14/12/2016
ME5 [5 Collins Ln]	299756	6430451	N/A	COLLINS LANE 5	COLLINS LANE 5	-	AS REQUIRED	-	N	Y	Y	13/03/2017
ME6 [9 Collins Ln]	299734	6430455	N/A	COLLINS LANE 9	COLLINS LANE 9	-	-	-	N	Y	Y	13/03/2017
ME7 [17 Collins Ln]	299680	6430461	N/A	COLLINS LANE 17	MACH	-	-	-	N	Y	Y	16/03/2017
ME8 [33 Collins Ln]	299474	6430442	N/A	COLLINS LANE 33	COLLINS LANE 33	-	-	-	N	Y	Y	15/03/2017
ME9 [Lot 3 Collins Ln]	299600	6430535	N/A	COLLINS LANE LOT 3	LOT 3	-	-	-	N	Y	Y	15/03/2017
MITCHELL1	299860	6430413	N/A	MITCHELL	KAYUGA RD 173	-	AS REQUIRED	-	N	Y	Y	16/03/2017
MOORE1	299668	6430812	1 January 1958#	KAYUGA RD 211 (MOORE)	MOORE 1	-	-	-	N	Y	Y	14/03/2017
MOORE1S	291441	6429318	N/A	GILGAI	MOORE (S1)	-	-	-	Y	Y	Y	17/03/2017
MOORE2	299720	6430762	27 Feb 2003*	KAYUGA RD 207 (MOORE)	MOORE 2 [PREVIOUS MP-BH3]	-	-	-	N	N	Y	14/03/2017
MOORE2S	291427	6429323	N/A	GILGAI	MOORE (S2)	-	-	-	Y	Y	Y	17/03/2017
MOORE3S	290851	6429236	N/A	GILGAI	MOORE (S3)	-	-	-	Y	Y	Y	17/03/2017
MOORE4	290139	6430000	< 60 Years (1800 GW Record)	GILGAI	JB MOORE	-	-	-	N	Y	Y	17/03/2017
MP-BH1	301149	6432563	2003	YORE / DAPKOS	MP-BH1	-	-	-	N	Y	Y	14/03/2017
MP-BH2	299407	6428712	N/A	MP - BH2	MACH	-	-	-	N	Y	Y	13/03/2017
MP-BH3	299481	6431354	N/A	MACH	MPBH3 (BORE2)	-	-	TROUGHS	N	Y	Y	13/12/2016
PARKINSON1	288944	6427796	N/A	WYBONG RD (LEFT)	PARKINSON1	-	-	-	N	Y	Y	16/03/2017
PITMAN1	300806	6429378	30 Apr 1991*	KAYUGA RD 36	PITMAN1	-	-	-	N	Y	Y	16/03/2017
RDH76	296343	6435365	1982	CASEY GM	RDH76	-	-	-	N	Y	Y	13/03/2017
SIMPSON1	299906	6429198	> 50 years (Hand Dug)	WYBONG RD 365	SIMPSON1	-	-	-	N	Y	Y	16/03/2017
SORMAZ1	300010	6429263	1992 (GW Record)	WYBONG RD 351	SORMAZ1	-	-	-	N	N	Y	16/03/2017
TLON1	294061	6436687	7/10/1999 (Form A)	MACH	NW Properties (Woodburn1)	-	-	-	N	N	Y	12/12/2016
WALTON1	290331	6428144	N/A	WYBONG RD 1431	WALTON1	-	-	-	N	Y	Y	16/03/2017
WICKS1	300534	6429472	N/A	KAYUGA RD 53	WICKS1	-	-	-	N	Y	Y	16/03/2017

Bore ID (ME No.)	PS WGS84)	Northing	Year Drilled (Census Letter)	Property	Bore ID (property & Bore No.) - Field Sheet	Comments
4500F000	296128	6433360	1994 & 2003	MACH	THORNDALE 1	4500F000
5000D000	296664	6431370	2003	MACH	BOXFIELD	5000D000
5500D000	297166	6431378	2003	5500D000	MACH	MONITORING BORE 5500D000 (2003). [UNABLE TO LOCATE 500E000]
6000F625	297642	6433994	2003	6000F625 (1)	MACH	6500F625 "MELODY FARM". ABOVE DAM. STAR PICKET
6500F500	298120	6433898	2003	6500F500	GLENMORE / 6500 F500	UPPER=32.8MID=54.53LOWER=52.9TRIPLE NESTED PIEZOMETERS
7000D000	298661	6431400	2003	MACH	COUNTRY VIEW	TOP OF STEEL7000D0002X PIEZOS. DEEP(40MM) SHALLOW (50MM)BESIDE DAM. PVC DISCONNECTED IN THE MONUMENT [CABLE TIES]
7500F000	299088	6433428	2003	MACH	GLENMORE No1	7500 F000NB: LOCATION ALIGNED WITH GW078629 + GW078630
ADNUM1	300521	6429434	N/A	KAYUGA RD 51	ADNUM1	SERVICES BTH. HOUSES ON ADNVM (4-51)
ASHFIELD1	289344	6428899	<50-60 YRS	ASHFIELD (JLON)	WYBONG RD 1510	SANDY CREEK WINDMILL. LOCATION ALIGNS WITH GW047863 HOWEVER DEPTH & YR CORRESPONDS WITH GW014135
BARRY1	299564	6430431	N/A	BARRY	PRIVATE BARRY 1	BACK OF PROPERTY.
BE1	293476	6429036	2011	MACH	McLEAN	VWP (WITH LOGGER) + OPEN HOLE. BE1
BELGRAVE	295085	6434438	N/A	LONERGAN	LONERGAN 6 (FAR WEST)	75FT DEPTH. "BELGRAVE". ANGLO AMERICAN. MONITORING SITE
CAS1	296503	6434654	1964	CASEY GM	CAS1	CAS1. OFF DIRECT RD (CRN OF PROPERTY)
CAS2	295914	6435419	<1950s	CASEY GM	CAS2	ADJACENT TO DWELLING [S-E] DARTBROOK MONITORING SITE DATA
CAS3	295821	6435484	1957	CASEY GM	CAS3	WINDMILL - WEST OF DWELLING [IN 1975 USED @ 2 GALLONS/MIN]
CAS4	294928	6435957	N/A	CASEY GM	CAS4	DARTBROOK MONITORING SITE [CAS4]
COWTIME1	300330	6429753	N/A	KAYUGA RD 72	COWTIME1	GREEN HOUSING AT BACK OF HOUSE. OPERATING AT TIME - FOR CATTLE TROUGH
GRAY1	299882	6430334	N/A	KAYUGA RD 161	GRAY1	FRONT OF HOUSE. EQUIPPED. GREEN SHADE CLOTH.
GRAY2	299856	6430316	N/A	KAYUGA RD 161	GRAY2	FEEDS HORSE TROUGH. NEW SLAB LAID
GW015881	299428	6428129	1957	MACH	OVERDEEN 2	BACKFILLED NOT LOCATED
GW028510	298649	6429099	1965	MACH	WYBONG (1)	(BENGALLA). 28510. NEAREST HOUSE TO WEST.
GW037774	298661	6429086	1974	MACH	WYBONG (2)	(BENGALLA). 37774. MIDDLE OF PADDOCK
GW038412	291568	6437714	<1950s	TONY LONERGAN	NWEST (892 DORSET RD)	ANGLOAMERICAN GW038412. SOLAR PANELS. OLD WINDMILL
GW038752	294050	6436664	N/A	MACH	NW Properties (Woodburn2)	NO CASING VISIBLE
GW042701	298568	6428634	1976 (GW Record)	MACH	SCRIVENS (1)	42701 (BENGALLA). MONITOR.
GW053007	298718	6428859	1965	MACH	SCRIVENS (2)	53007 (BENGALLA). MONITOR.
HAYES1	299582	6430624	1930s	HAYES1	HAYES1	9 HORSE POWER METER (WEIDEMAN'S DIARY). FIRBRE GLASS MESH. GW RECORD ASSIGNED BASED ON PROXIMITY
HAYES2	299681	6430616	1950s-60s	HAYES2	HAYES2	FRONT YARD (TAPS)
JLON.1	292407	6434333	1 Feb 1971#	JOHN LONERGAN	MARYLANDS1_GW33725	EQUIPPED & OPERATING (NO MEASUREMENTS OBTAINED). OLD WINDMILL
JLON.2	292320	6434393	1 Sep 1965*	JOHN LONERGAN	MARYLANDS2_GW23652	JLON.2
JLON1	298194	6434785	1 Feb 1979# (Converted to Bore)	LONERGAN	LONERGAN 5 (MARYLANDS WESTERN PADDOCK)	WINDMILL. ANGLO AMERICAN. JLON1. BORE+WELL. DARTBROOK MONITORING SITE
JLON2	300044	6434608	~1965-80s	LONERGAN	LONERGAN 1 (WEST OF HOUSE)	NORTH EAST OF HOUSE. GW ASSIGNED BASED ON SIMILAR DEPTH. DEEPENED 1981
JLON3	299887	6434455	<1961	LONERGAN	LONERGAN 2 (FRONT OF HOUSE)	FRONT OF HOUSE
JLON4	299404	6434623	1932 (GW Record)	LONERGAN	LONERGAN 3 (PADDOCK)	PADDOCK. CONCRETE CYLINDERS REPLACED TIMBER CIRCA 1976
JLON5	299629	6434796	1 August 1954^	LONERGAN	LONERGAN 4 (MARYLANDS BACK PADDOCK)	NO LONGER USED
KELMAN1	300925	6429305	N/A	KAYUGA RD 20	KELMAN1	GREEN SHED AT RD FRONT NEAR WORKSHOP. METAL GRILL IN WELL (PREVENTED ACCESS FOR DIPPING)
MATHER1	299814	6430440	> 40 years old	MATHER	KAYUGA RD 175	BACK OF HOUSE. PUMP AT 1955 FLOOD LEVEL (1.6MAGL)
ME1 [1 Collins Ln]	299805	6430470	1970	MACH	COLLINS LANE	CORNER HOUSE. COLLINS LANE
ME10 [Road Reserve Collins Ln]	299484	6430555	N/A	OVERGRONN SHED	MACH	SHED - OVERGROWN OVER BACK OF LOT 3.
ME11 [Road Reserve Collins Ln]	299495	6430656	N/A	DAMAGED	SHED	SHED COLLAPSED. FLOOD PROTECTION.
ME12 [57 Kayuga Rd]	300474	6429471	N/A	MACH	KAYUGA RD 57	TENANTED
ME13 [135 Kayuga Rd]	299959	6430143	N/A	KAYUGA RD 135	MACH	FRONT OF HOUSE (NE). TAP SAMPLE
ME14 [137 Kayuga Rd]	299946	6430151	N/A	KAYUGA RD 137	MACH	FRONT OF HOUSE. TAP SAMPLE. RAINWATER TANK (INFLUENCE)
ME15 [141 Kayuga Rd]	299952	6430191	N/A	KAYUGA RD 141	KAYUGA RD 141	-
ME16 [153 Kayuga Rd]	299875	6430285	N/A	KAYUGA RD 153	MACH	BACK OF HOUSE. DOGS LOCKED UP.
ME17 [163-165 Kayuga Rd]	299874	6430370	N/A	MACH	KAYUGA RD 163-165	SERVICES BOTH 163-165 DWELLINGS. GW RECORD ASSIGNED BASED ON LOCATION AND CONSTRUCTION
ME18 [167 Kayuga Rd]	299827	6430402	N/A	KAYUGA RD 167	KAYUGA RD 167	BACK OF HOUSE .
ME19 [353 Wybong Rd]	299996	6429261	N/A	WYBONG RD 353	MACH	-
ME2 [1 Collins Ln]	299811	6430465	N/A	COLLINS LANE 1	T. POWELL	GW LEVEL (UNABLE TO USE) *ALSO INSPECTED ROUND 1 DEC2016. TWO BORES LOCATED 10M APART
ME20 [357 Wybong Rd]	299956	6429231	N/A	WYBONG 357	MACH	BACK OF SHED.
ME21 [359 Wybong Rd]	299960	6429225	N/A	WYBONG 359	MACH	NOT USED. OVERGROWN.
ME22 [361 Wybong Rd]	299946	6429214	1953 (GW Record)	MACH	WYBONG RD 361	BACK OF HOUSE. COVERED BLACK SEMI-CIRCLE. GW RECORD ASSIGNED BASED ON LOCATION.
ME23 [Bimbadeen]	299456	6430443	N/A	MACH	BIMBADEEN	BIMBADEEN. CASED HOLE ADJACENT
ME24 [Broomfield]	292374	6433010	N/A	MACH	BROOMFIELD (1)	WINDMILL. CREEK NEAR CONFLUENCE
ME25 [Country View]	298695	6431537	N/A	MACH	COUNTRY VIEW 2	DISUSED WINDMILL AT BASE OF DAM
ME26 [Glenmore]	298441	6434044	1985	MACH	GLENMORE	WINDMILL DISMANTLED. DOWNSLOPE OF DAM
ME27 [Glenmore 'C']	299563	6434555	1984	MACH	GLENMORE 'C'	WINDMILL
ME28 [Jandell]	300056	6428793	1983	MACH	JANDELL	GW060025 WAS BACKFILLED NEARBY
ME29 [Jandell]	299621	6428790	N/A	MACH	(NEAR 6006E)	BACK OF YARDS (JANDELL). [6006E NO BORES. HORNE NO BORES]
ME3 [3 Collins Ln]	299803	6430447	N/A	COLLINS LANE 3	COLLINS LANE 3	-
ME30 [Karrabah]	299843	6434195	1981	MACH	KARRABAH	IRRIGATION INFRASTRUCTURE
ME31 [Kropp]	292302	6436824	21/04/1994	MACH	NW Properties (KROPP)	KUMINANDI 21/4/19994R. KROPP
ME32 [Melody Farm]	297625	6434009	N/A	6500F625 (2)	MACH	"MELODY FARM" BESIDE 6500F625 (1). (BUCKET ON TOP).
ME33 [Overdeen]	299100	6427748	1946	MACH	OVERDEEN 1	IRRIGATION. PUMPING AT TIME OF MEASUREMENT
ME34 [Rosebrook 1]	299259	6429884	N/A	MACH	ROSEBROOK 1	HORSES.BORE PUMPING WHEN MEASURED.MAIN SUPPLY SOURCE
ME35 [Rosebrook 2]	300330	6429634	N/A	MACH	ROSEBROOK 2	FRONT PADDOCK. COLLAPSED
ME36 [Rosehill]	299550	6430090	1971 (GW Record)	MACH	ROSEHILL	BACK OF HOUSE AT SHED
ME37 [Roselyn 1]	299495	6428767	1962	MACH	ROSELYN 1	ROSEBROOK CREEK CHANNEL. PADLOCKED
ME38 [Roselyn 2]	299457	6429125	1964	MACH	ROSELYN 2	BACK OF HOUSE. INSUFFICIENT WATER TO SAMPLE.
ME39 [Scrivens]	298768	6428561	1976 (GW Record)	MACH	SCRIVENS (3)	OVERGROWN. CORNER NEAR ROSEBROOK CREEK. GW RECORD ASSIGNED BASED ON PROXIMITY & SIMILAR DEPTH
ME4 [4 Collins Ln]	299769	6430448	N/A	COLLINS LANE 4	COLLINS LANE 4	-
ME40 [Thorndale 1]	296326	6433371	2002 (GW Record)	MACH	THORNDALE 2	WINDMILL TIMBER FRAME
ME41 [Thorndale 2]	295772	6433898	N/A	MACH	THORNDALE	FENCED OFF AREA. TREE GROWING IN WELL. NO MEASUREMENT
ME42 [Thorndale South]	295117	6432422	2002 (GW Record)	MACH	THORNDALE SOUTH	COLLAPSED. ONE SAMPLE MEASURED. WINDMILL DERELICT
ME43 [Warrawee]	296672	6434348	1999 (GW Record)	MACH	WARRAWEE	COLLAPSED. NO MEASUREMENT. WINDMILL DERELICT
ME5 [5 Collins Ln]	299756	6430451	N/A	COLLINS LANE 5	COLLINS LANE 5	-
ME6 [9 Collins Ln]	299734	6430455	N/A	COLLINS LANE 9	COLLINS LANE 9	VACANT MACH PROPERTY
ME7 [17 Collins Ln]	299680	6430461	N/A	COLLINS LANE 17	MACH	NOT USED AT MOMENT. PUMP TOO HIGH.
ME8 [33 Collins Ln]	299474	6430442	N/A	COLLINS LANE 33	COLLINS LANE 33	-
ME9 [Lot 3 Collins Ln]	299600	6430535	N/A	COLLINS LANE LOT 3	LOT 3	EQUIPPED. DOMESTIC
MITCHELL1	299860	6430413	N/A	MITCHELL	KAYUGA RD 173	MATHER ACCESS (KEY). MITCHELL VACANT
MOORE1	299668	6430812	1 January 1958#	KAYUGA RD 211 (MOORE)	MOORE 1	FRONT OF HOUSE. GW RECORD ASSIGNED BASED ON PROXIMITY AND SIMILAR DEPTH.
MOORE1S	291441	6429318	N/A	GILGAI	MOORE (S1)	TWO SPRINGS ADJACENT. UPSTREAM POND
MOORE2	299720	6430762	27 Feb 2003*	KAYUGA RD 207 (MOORE)	MOORE 2 [PREVIOUS MP-BH3]	OLD C&A (SITE) BLOCKED LIKELY WITH TREE ROOTS
MOORE2S	291427	6429323	N/A	GILGAI	MOORE (S2)	DOWNSTREAM POND
MOORE3S	290851	6429236	N/A	GILGAI	MOORE (S3)	TWO DAMS / PONDS
MOORE4	290139	6430000	< 60 Years (1800 GW Record)	GILGAI	JB MOORE	WELL WITH OLD/DERELICT WINDMILL. CORRUGATED IRON OVER COVER. GW RECORD ASSINGED BASED ON PROXIMITY AND SIMILAR CONSTRUCTION
MP-BH1	301149	6432563	2003	YORE / DAPKOS	MP-BH1	MP-BH1 (NEAR POWER BOX TOP OF BANK). KEITH YORE/DAPKOS. SPOKE TO PROPERTY MANAGER
MP-BH2	299407	6428712	N/A	MP - BH2	MACH	MACH
MP-BH3	299481	6431354	N/A	MACH	MPBH3 (BORE2)	ENV. MONITORING SITE. MPBH3.
PARKINSON1	288944	6427796	N/A	WYBONG RD (LEFT)	PARKINSON1	BEHIND PROPERTY. ELECTRIC FENCE. WINDMILL.
PITMAN1	300806	6429378	30 Apr 1991*	KAYUGA RD 36	PITMAN1	HOUSING ABOVE FLOOD LEVEL. IN CORNER OF PROPERTY.
RDH76	296343	6435365	1982	CASEY GM	RDH76	DARTBROOK MONITORING SITE [RDH76] - PHOTO TAKEN OF NEARBY VENTURI HOLE AS WELL
SIMPSON1	299906	6429198	> 50 years (Hand Dug)	WYBONG RD 365	SIMPSON1	BACK OF HOUSE. HAND DUG
SORMAZ1	300010	6429263	1992 (GW Record)	WYBONG RD 351	SORMAZ1	BACK OF PROPERTY. SHED. LAID CONCRETE UP NEXT DOOR. GW RECORD ASSINGED BASED ON LOCATION.
TLON1	294061	6436687	7/10/1999 (Form A)	MACH	NW Properties (Woodburn1)	TLON1. CHECK FOR DARTBROOK /ANGLO AMERICAN RECORDS
WALTON1	290331	6428144	N/A	WYBONG RD 1431	WALTON1	BACK OF SHED - FRONT PROPERTY. STAR PICKETS. SALTY/CORROSION. GW080272 LOCATED 300M WEST UPHILL
WICKS1	300534	6429472	N/A	KAYUGA RD 53	WICKS1	WELL IN THE HOUSE. 53 KAYUGA

APPENDIX 5

SURFACE AND GROUND WATER RESPONSE PLAN

MACHEnergy

MOUNT PLEASANT OPERATION

SURFACE AND GROUND WATER RESPONSE PLAN

Document ID:	MP001-0000-ENV-PLN-0006		
Company:	MACH Energy Australia Pty Ltd		
Effective Date:	31 October 2019	**Status:**	Issued for Use
Approved By:	Andrew Reid	**Revision Number:**	02

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1 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton (Figure 1). The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively (Figure 1). The proponent of the MPO is MACH Energy Australia Pty Ltd (MACH Energy), which purchased the MPO from Coal & Allied Operations Pty Ltd (Coal & Allied) in 2016.

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

The Mount Pleasant Project Modification (MOD 1) was submitted on 19 May 2010 with a supporting Environmental Assessment (EA) prepared by EMGA Mitchell McLennan (EMGA Mitchell McLennan, 2010). MOD 1 included the provision of an infrastructure envelope for siting the mine infrastructure, the provision of an optional conveyor/service corridor linking the MPO facilities with the Muswellbrook-Ulan Rail Line and modification of the existing Development Consent DA 92/97 boundaries to accommodate the optional conveyor/service corridor and minor administrative changes. MOD 1 was approved on 19 September 2011.

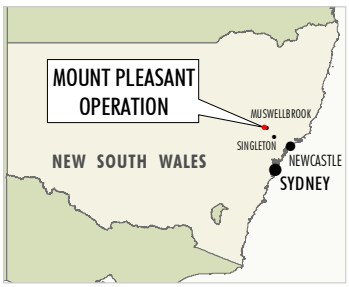
The MPO South Pit Haul Road Modification (MOD 2) was submitted on 30 January 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017a). MOD 2 proposed to realign an internal haul road to enable more efficient access to the South Pit open cut, with no other material changes to the approved MPO. MOD 2 was approved on 29 March 2017.

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

The MPO Rail Modification (MOD 4) was submitted on 18 December 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017c). MOD 4 proposed the following changes:

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

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



LEGEND

- Mining Operation
- Proposed Mining Operation
- Mining Lease Boundary (Mount Pleasant)
- Railway
- Local Government Boundary
- State Forest
- National Parks and Wildlife Estate

Source: © NSW Department of Finance, Services and Innovation (2018); Office of Environment and Heritage NSW (2018)

MACHEnergy

MOUNT PLEASANT OPERATION

Project Location

Figure 1

MAC-16-01 MP2019_ Figure 1_ Rev A

1.1 PURPOSE AND SCOPE

This Surface and Ground Water Response Plan (SGWRP) has been prepared by MACH Energy to satisfy the requirements under Development Consent DA 92/97 (as modified) and specifically Condition 28(e), Schedule 3.

The SGWRP applies to all employees and contractors at the MPO and covers all areas within the MPO boundary. The SGWRP applies to the life of the MPO, including (but not limited to) the period of mining operations specified in Development Consent DA 92/97, which currently permits mining until 22 December 2026. As required by Condition 5, Schedule 2 of Development Consent DA 92/97, the SGWRP will continue to apply (excluding mining operations) beyond 22 December 2026, as required, until the rehabilitation and any additional undertakings (required by the Secretary of the Department of Planning, Industry and the Environment [DPIE], or the Division of Resources and Geoscience [DRG] within the DPIE) have been carried out satisfactorily.

This SGWRP has been prepared to manage surface water and groundwater related impacts associated with construction and operation of the MPO, including for example, initial establishment and development works, open cut mining, operation of the coal handling and preparation plant, rail spur/loop and Fines Emplacement Area, and the supply of water to the MPO.

1.2 STRUCTURE OF THE SGWRP

This SGWRP is a component of the Water Management Plan (WMP) for the MPO.

The remainder of the SGWRP is structured as follows:

- Section 2: Outlines the statutory requirements relevant to this SGWRP.
- Section 3: Describes the response protocols for trigger events which may occur at the MPO.
- Section 4: Provides potential contingency measures for the MPO.
- Section 5: Describes the review process for MPO documentation, including in particular for this SGWRP.
- Section 6: Outlines the reporting procedures proposed for the MPO.
- Section 7: Provides a list of references cited in this report.

2 STATUTORY OBLIGATIONS

MACH Energy's statutory obligations are contained in:

- the conditions of Development Consent DA 92/97 (as modified);
- the condition of the Commonwealth Approval EPBC 2011/5795;
- relevant licences (including Environment Protection Licence [EPL] 20850), permits and mining leases (MLs) (ML 1645, ML 1708, ML 1709, ML 1713 and ML 1750); and
- other relevant legislation.

Obligations relevant to this SGWRP are described below.

2.1 DEVELOPMENT CONSENT DA 92/97

The conditions of Development Consent DA 92/97 relevant to the content and structure of this SGWRP are described below. A comprehensive list of all conditions in Development Consent DA 92/97 relevant to water is provided in the WMP.

2.1.1 SGWRP Requirements

Condition 28(e), Schedule 3 of Development Consent DA 92/97 requires the preparation of a SGWRP (refer Table 1).

Table 1
Surface and Groundwater Response Plan Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 3	Section where addressed in this SGWRP Document
28. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with DoI Water and EPA, and be submitted to the Secretary for approval by 30 June 2019, unless otherwise agreed by the Secretary. *The plan must include:* *…* *(e) a Surface and Ground Water Response Plan, which must include:*	
• *a response protocol for any exceedances of the surface water and groundwater assessment criteria;*	Section 3
• *measures to offset the loss of any baseflow to watercourses caused by the development;*	Section 4.1
• *measures to prevent, minimise or offset groundwater leakage from alluvial aquifers caused by the development;*	Section 4.2
• *measures to compensate landowners of privately-owned land whose water supply is adversely affected by the development; and*	Section 4.3
• *measures to mitigate and/or offset any adverse impacts on groundwater dependent ecosystems or riparian vegetation.*	Section 4.4

2.1.2 Management Plan (General) Requirements

Condition 2, Schedule 5 of Development Consent DA 92/97 outlines the general management plan requirements that are applicable to the preparation of the SGWRP.

Table 2 presents these requirements and indicates where each is addressed within this SGWRP.

Table 2
General Development Consent DA 92/97 Conditions

MPO Development Consent DA 92/97 Schedule 5	Section where addressed in this SGWRP Document
2. The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Refer to the Surface Water Management Plan (SWMP) and Groundwater Management Plan (GWMP)
(b) a description of: • *the relevant statutory requirements (including any relevant consent, licence or lease conditions);*	Section 2
• *any relevant limits or performance measures/criteria;*	Refer to the SWMP and GWMP
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	Section 3
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Sections 3 and 4 and refer to the SWMP and GWMP
(d) a program to monitor and report on the: • *impacts and environmental performance of the development;* • *effectiveness of any management measures (see c above);*	Refer to the SWMP and GWMP
(e) a contingency plan to manage any unpredicted impacts and their consequences;	Section 4
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 5
(g) a protocol for managing and reporting any: • *incidents;* • *complaints;* • *non-compliances with statutory requirements; and* • *exceedances of the impact assessment criteria and/or performance criteria; and*	Section 6
(h) a protocol for periodic review of the plan. *Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*	Section 5

2.2 LICENCES, PERMITS AND LEASES

A description of licences, permits and leases relevant to the MPO is provided in the WMP, SWMP and GWMP.

2.3 OTHER LEGISLATION

A description of other legislation relevant to the MPO is provided in the WMP, SWMP and GWMP.

3 RESPONSE PROTOCOLS

Trigger response protocols have been developed by MACH Energy to address potential impacts to surface water and/or groundwater that may arise from mining activities. These include surface water impact and stream health assessment criteria defined in the SWMP and groundwater impact assessment criteria defined in the GWMP.

Each response protocol outlines the trigger conditions for potential impacts and the investigation and response protocols that will be implemented if an incident or trigger exceedance has occurred or a complaint is reported. If at any time during the investigation protocol the trigger exceedance/complaint is deemed not to have occurred as a result of activities at the MPO, the response protocol can be ceased without completing the remaining steps.

3.1 SURFACE WATER INVESTIGATIONS

MACH Energy has developed a surface water response protocol to ensure all trigger exceedances and complaints related to surface water are appropriately investigated and addressed. Details are included in the individual response protocols below.

3.1.1 Surface Water Quality Response Protocol

Site specific triggers for surface water quality criteria have been set for electrical conductivity (EC), pH and total suspended solids (TSS) levels at three monitoring locations downstream of the MPO on the Hunter River.

Consistent with the Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) Guidelines (2000), these criteria have been defined in terms of persistent statistical variation from baseline data and comparison with upstream monitored values. Default trigger levels developed using the ANZECC & ARMCANZ Guidelines have been established for other sites in the MPO area which did not have sufficient data to generate site specific trigger values. Details are provided in Section 6.1 of the SWMP.

In the event that one of the water quality impact assessment criteria is triggered at the monitoring locations above, the response protocol in Table 3 will be implemented.

Table 3
Surface Water Quality Response Protocol

Response Protocol	
Trigger	• a water quality indicator at a downstream water monitoring location is above (or outside the range) of trigger levels (refer to Table 9 of the SWMP) for three consecutive sampling events; and • a water quality indicator at a downstream water monitoring location is above (or below in event of a trigger of the lower pH limit) the corresponding upstream monitoring location (where such a monitoring location exists) sampled on the same day.

Table 3 (Continued)
Surface Water Quality Response Protocol

Response Protocol	
Investigation	1. Notify the MACH Energy Environmental Superintendent within 24 hours of becoming aware of the trigger event. 2. Check and validate the data which indicates an exceedance of the trigger conditions. 3. Collect and analyse supplementary samples of the exceedance parameter (as well as any other relevant parameters) upstream (where possible) and downstream of the MPO, to assess whether the exceedance is ongoing. 4. Assess any changes to MACH Energy activities and inspect all relevant water management structures and infrastructure, and erosion and sediment controls in the area of the trigger event. 5. Assess conditions (climatic, hydrological, hydrogeological and changes in land use activities in the catchment – including other mining activities and riparian revegetation works), both preceding and during the event and assess their impact. 6. For the Hunter River monitoring locations, investigate changes in continuously recorded salinity values over time and compare with Department of Planning, Industry and Environment– Water (DPIE Water) stream gauging stations located on the river, to assess if any trends are evident. 7. For the Hunter River, assess whether releases were occurring from Glenbawn Dam or other mines. 8. Identify plausible and possible causes of the exceedance. 9. Decide if the exceedance was directly caused by or predominantly as a result of activities being undertaken by or directly related to the MPO. 10. If required, engage a suitably qualified aquatic ecologist or similar to determine if any material harm to the surface water ecosystems have occurred. 11. Provide a preliminary investigation report to the DPIE, Environment Protection Authority (EPA) and DPIE Water within seven days of identifying the trigger exceedance.
Response	• Develop/design contingency and remedial measures based on the results of the above investigations. Contingency and remedial measures considered practical for implementation 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 water management infrastructure; and – developing and implementing a training package specifically related to the cause of the incident/non-compliance. • Communicate results of investigation, contingency and remedial measures to government agencies as required and summarise in the Annual Review. • Review and update the WMP and resubmit to the DPIE (if required).

3.1.2 Stream Health Response Protocol

Stream health assessment triggers have been developed based upon the O/E[1] taxa scores found at two sites located along the Hunter River. Upstream baseline data from two additional sites (e.g. Dart Brook and Muscle Creek) will also be used to assist an investigation into any exceedance of the trigger. Using baseline data, baseline stream health band of impairment scores were allocated to each downstream site based upon where their O/E taxa values fell within a standardised range. Trigger levels were developed in the event that the measured band of impairment score falls below the baseline level. Details are provided in Section 6.2 of the SWMP.

In the event that the stream health assessment criteria is triggered at a downstream monitoring site, the response protocol in Table 4 will be implemented.

[1] O/E taxa scores are obtained by comparing the Observed (O) numbers of macro invertebrates at the site with the Expected (E) number of macro invertebrates which could be found at the site, if the site was in a natural state (i.e. had not been disturbed).

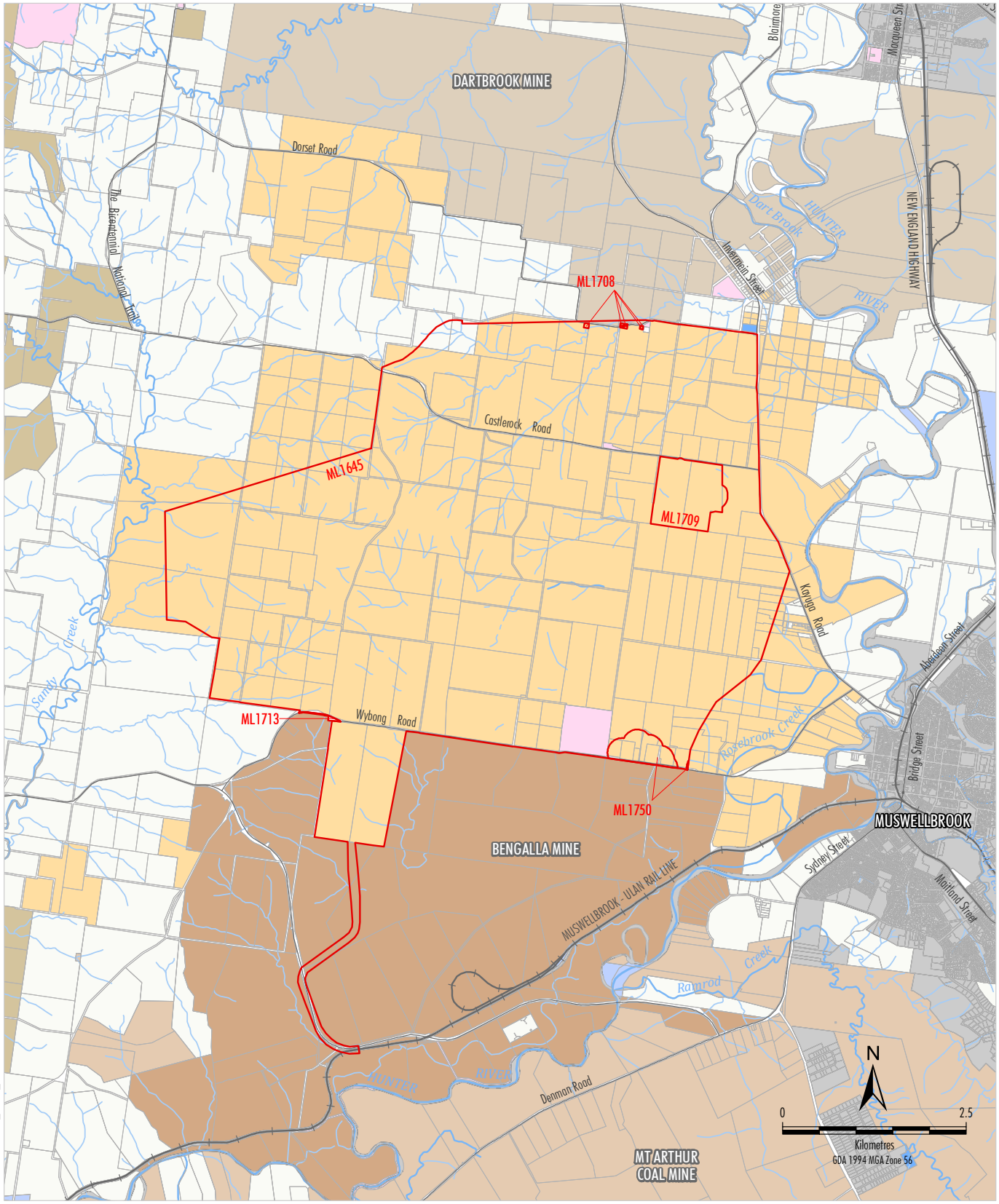
Table 4
Stream Health Response Protocol

Response Protocol	
Trigger	A stream health indicator at a relevant monitoring location falls below the specified trigger levels (refer to Table 11 of the SWMP) for two consecutive monitoring rounds.
Investigation	1. Notify the MACH Energy Environmental Superintendent within 24 hours of becoming aware of the trigger event. 2. Check and validate the data which indicates an exceedance of the trigger conditions. 3. Compare data with other stream health data available in the vicinity (e.g. Muscle Creek and Dart Brook). 4. Undertake supplementary stream health investigations upstream (where possible) and downstream of the MPO. 5. Assess any changes to MACH Energy activities and inspect all relevant water management structures and infrastructure, and erosion and sediment controls in the area of the trigger event. 6. Assess conditions (climatic, hydrological, hydrogeological and changes in land use activities in the catchment – including other mining/pastoral activities and riparian revegetation works), both preceding and during the event and assess their impact. 7. Check water quality data to see if any trend is evident. 8. Identify plausible and possible causative mechanisms and assess/quantify these against all relevant data and information to identify most likely causes. 9. Decide if the exceedance was directly caused by or predominantly as a result of activities being undertaken by or directly related to the MPO. If required, engage a suitably qualified aquatic ecologist or similar to determine the cause of the stream health deterioration. 10. Provide a preliminary investigation report to the DPIE, EPA and DPIE Water when stream health monitoring and investigation is complete.
Response	• Develop/design contingency and remedial measures based on the results of the above investigations. Contingency and remedial measures considered practical for implementation may include: – undertaking stream bank remedial works including desilting and revegetation works; – reviewing and refining the stream health and surface water monitoring programs; – 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 – restricting stock access to affected areas of the stream. • Communicate results of investigation, contingency and remedial measures to government agencies as required and summarise in the Annual Review. • Review and update the WMP and resubmit to the DPIE (if required).

MACH Energy commenced stream health monitoring at three additional sites in Spring 2017, including one on Sandy Creek and one on the Hunter River. Stream health trigger values will be developed for these sites following the Spring 2019 monitoring round (assuming suitable conditions for sampling), when two years of baseline data will be available. In the interim, Mangoola Coal Operations has established stream health trigger levels for monitoring sites on Sandy Creek (refer to Figure 3 of the SWMP). In the event a deterioration in stream health is observed at these locations, MACH Energy would consult with Mangoola Coal Operations during the implementation of their response mechanisms.

3.1.3 Surface Water Supply on Privately-Owned Land Response Protocol

A number of privately-owned properties reside along unnamed drainage lines which flow out of the MPO to the east and west of the MPO boundary (Figure 2). MACH Energy has designed the surface water management system to ensure that all discharges from the site are controlled and meet acceptable water quality standards, and to avoid unlicensed discharges of contaminated water (refer Site Water Balance). Notwithstanding, in the event that a surface water-related complaint is received from a local landholder in relation to a potential MPO-related impact on their surface water supply, the response protocol in Table 5 will be initiated.



MAC-16-01 MP20198_SGWRP_201A

LEGEND

- Mining Lease Boundary
- Muswellbrook and Upper Hunter LEPs Zones B2, B5, IN1, SP2, R2, R5, RE1, RE2 and W1
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Mount Pleasant Controlled
- Bengalla Controlled
- Dartbrook Controlled
- Mt Arthur Controlled
- Other Mining/Resource Company Controlled
- Privately Owned Land

Source: NSW Land & Property Information (2019); NSW Division of Resources & Energy (2019)

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MOUNT PLEASANT OPERATION

Land Ownership (June 2019)

Figure 2

Table 5
Surface Water Supply Response Protocol

Response Protocol	
Trigger	Complaint by local landholder regarding surface water supply.
Investigation	1. Notify the MACH Energy Environmental Superintendent within 24 hours of receiving the complaint. 2. Check and validate the information provided with the complaint. 3. Undertake a review of monitoring data. 4. Collect and analyse supplementary samples of the exceedance parameter (as well as any other relevant parameters) upstream (where possible) and downstream of the MPO, to assess whether the exceedance is ongoing. 5. Assess any changes to MACH Energy activities and inspect all relevant water management structures and infrastructure, and erosion and sediment controls in the area of the complaint. 6. Assess conditions (climatic, hydrological, hydrogeological and changes in land use activities in the catchment – including other mining/pastoral activities and riparian revegetation works), both prevailing and preceding the complaint and assess the potential impact. 7. Identify plausible and possible causative mechanisms and assess/quantify these against all relevant data and information to identify most likely causes. 8. Decide if the impact (i.e. impact on surface water supply) is solely attributable to activities being undertaken by or directly related to the MPO. 9. Notify owner of the outcome of the investigation. 10. Provide a preliminary investigation report to the DPIE, EPA and DPIE Water within seven days of identifying the trigger exceedance.
Response	• Develop/design contingency and remedial measures based on the results of the above investigations. Contingency and remedial measures considered practical for implementation 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 SWMP; – 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. • Communicate results of investigation, contingency and remedial measures to government agencies as required and summarise in the Annual Review. • Review and update the WMP and resubmit to the DPIE (if required).

All complaints will be managed in accordance with the complaints procedure outlined in Section 5 of the WMP.

3.2 GROUNDWATER INVESTIGATIONS

MACH Energy has developed a groundwater response protocol to ensure all exceedances of groundwater triggers and complaints related to groundwater are appropriately investigated and addressed. These have been incorporated in the individual response protocols provided below.

3.2.1 Groundwater Levels Response Protocol

As described in Section 7.1 of the GWMP, final groundwater level trigger values will be based upon the results of contemporary groundwater modelling yet to be completed. In the interim, groundwater level trigger values have been established to monitor for potential impacts on the alluvial groundwater system to the east of the MPO, associated with the Hunter River (this is anticipated to be where the majority of private groundwater users are accessing groundwater in the vicinity of the MPO). Trigger values have been developed in accordance with the *NSW Aquifer Interference Policy*, at three monitoring bores situated in this alluvial groundwater system. In the event that groundwater levels at these bores fall below these trigger values, the response protocol in Table 6 will be initiated.

Table 6
Groundwater Level Response Protocol

Response Protocol	
Trigger	A groundwater level measurement at a relevant alluvial monitoring bore falls below the trigger value specified within Table 10 of the GWMP.
Investigation	1. Notify the MACH Energy Environmental Superintendent within 24 hours of becoming aware of the trigger event. 2. Check and validate the data which indicates an exceedance of the trigger conditions. 3. Undertake supplementary water level measurements to check if the exceedance is ongoing. 4. Conduct a preliminary investigation, including a review of site activities being undertaken at the time, baseline groundwater monitoring results, groundwater results at nearby locations, the prevailing and preceding meteorological and streamflow conditions and changes to the landuse/activities being undertaken in the area, including mining/pastoral activities. If necessary, engage a suitably qualified hydrogeologist to assist with the preliminary investigation (e.g. interpretation of monitoring results). 5. Identify plausible and possible causative mechanisms and assess/quantify these against all relevant data and information to identify most likely causes. 6. Determine if private groundwater supply bores in the vicinity of the monitoring bore have experienced cumulative drawdowns in excess of 2 metres (m) and an associated reduction in groundwater yield (The minimal impact consideration for privately owned groundwater bores under the *NSW Aquifer Interference Policy* is drawdowns greater than 2 m). 7. Determine if there has been an effect on potential GDEs located along the Hunter River. 8. Provide a preliminary investigation report to the DPIE, EPA and DPIE Water within seven days of identifying the trigger exceedance.
Response	• Implement appropriate contingency and remedial measures (including the privately-owned groundwater bores response protocol, if required). • Communicate results of investigation, contingency and remedial measures to government agencies as required and summarise in the Annual Review. • Review and update the WMP and resubmit to the DPIE (if required).

3.2.2 Groundwater Quality Response Protocol

Water quality triggers for groundwater have been developed in accordance with the Australian and New Zealand *Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000). These triggers are based upon exceedance of the assigned beneficial use categories for EC values, and the exceedance/deterioration of pH values outside the 20th and 80th percentile range of baseline pH data. Details regarding the trigger values are provided in Section 7.2 of the GWMP. In the event that one of the groundwater quality assessment criteria is triggered, the response protocol in Table 7 will be implemented.

Table 7
Groundwater Quality Response Protocol

Response Protocol	
Trigger	A monitoring bore records an EC or pH value above (or outside the range of) the trigger values specified in Table 12 of the GWMP at three successive monitoring rounds.
Investigation	1. Notify the MACH Energy Environmental Superintendent within 24 hours of becoming aware of the trigger event. 2. Check and validate the data which indicates an exceedance of the trigger conditions. 3. In the event of an apparently anomalous groundwater monitoring result, conduct a resample/retest. 4. Conduct a preliminary investigation, including a review of site activities being undertaken at the time, baseline groundwater monitoring results, groundwater results at nearby locations, the prevailing and preceding meteorological and streamflow conditions and changes to the landuse/activities being undertaken in the area, including mining/pastoral activities. If necessary, engage a suitably qualified hydrogeologist to assist with the preliminary investigation (e.g. interpretation of monitoring results). 5. Provide a preliminary investigation report to the DPIE, EPA and DPIE Water within seven days of identifying the trigger exceedance.
Response	• Subject to the outcomes of the investigation, develop/design contingency and remedial measures. Contingency and remedial measures considered practical for implementation may include: – notification to local groundwater users; – providing an alternative water source for the duration of the water quality impact; – reviewing and refining the Ground Water Monitoring Program including undertaking additional specific monitoring of private landholder bores; – reviewing mine plan impacts on the alluvial groundwater source; and – repairing, replacing, or constructing new water management infrastructure. • Communicate results of investigation, contingency and remedial measures to government agencies as required and summarise in the Annual Review. • Review and update the WMP and resubmit to the DPIE (if required).

3.2.3 Privately-Owned Groundwater Bores Response Protocol

In the event that a groundwater-related complaint is received from a local landholder in relation to a potential mine-related effect on their groundwater supply, or an investigation undertaken in accordance with the response protocol in Table 6 indicates a drawdown of greater than 2 m at a privately owned bore, the response protocol in Table 8 will be initiated.

In addition, all complaints will be managed in accordance with the complaint protocols outlined in Section 5 of the WMP.

Table 8
Privately-Owned Groundwater Bores Response Protocol

Response Protocol	
Trigger	Complaint by local landholder regarding water supply from groundwater bore.
Investigation	1. Notify the MACH Energy Environmental Superintendent within 24 hours of receiving the complaint. 2. Check and validate the information provided with the complaint. 3. Conduct a preliminary investigation, including a review of site activities being undertaken at the time, baseline groundwater monitoring results, groundwater results at nearby locations, the prevailing and preceding meteorological and streamflow conditions and changes to the landuse/activities being undertaken in the area, including mining/pastoral activities. If necessary, engage a suitably qualified hydrogeologist to assist with the preliminary investigation (e.g. interpretation of monitoring results). 4. Where a preliminary investigation indicates a potential mining effect at the complainant's bore, conduct a detailed investigation to determine whether the MPO has contributed to a greater than 2 m cumulative drawdown or a detrimental water quality effect.
Response	• In the event that a detailed investigation conclusively attributes greater than 2 m drawdown, or a detrimental water quality effect, for an existing groundwater supply user to the MPO, investigate appropriate contingency and remedial measures which may include: – deepening the affected groundwater supply bore; – construction of a new groundwater supply bore; or – provision of an alternative water supply. • Determine the exact nature of contingency/remedial measures in consultation with the affected landholder (and relevant regulatory agencies as required). • Communicate results of investigation, contingency and remedial measures to government agencies as required and summarise in the Annual Review. • Review and update the WMP and resubmit to the DPIE (if required).

4 POTENTIAL CONTINGENCY MEASURES

4.1 LOSS OF BASEFLOW

Potential impacts to Hunter River baseflow were considered as part of the Mt Pleasant Water Management Studies (PPK Infrastructure and Environment, 1997).

PPK Infrastructure and Environment (1997) concluded that a minor reversal in flow, resulting in downward leakage from the alluvium to the hard rock, would be offset by natural groundwater recharge. Accordingly, the water table within the alluvial sediments was predicted to remain largely unaffected by depressurisation and the impacts on Hunter River water supply were therefore predicted to be negligible.

Notwithstanding, HydroSimulations has been engaged by MACH Energy to undertake contemporary groundwater modelling for the MPO. This contemporary groundwater modelling will include updated predictions of Hunter River baseflow loss due to the approved MPO.

Any incidental water take from the Hunter River would be licensed in accordance with requirements of the *Water Management Act, 2000*. Unnamed drainage lines in the MPO vicinity are unlikely to receive any significant baseflow given their ephemeral nature. On this basis, further measures to offset the loss of any baseflow to watercourses is not considered to be warranted.

4.2 GROUNDWATER LEAKAGE FROM ALLUVIAL AQUIFERS

HydroSimulations (2016) has undertaken a desktop review of a number of groundwater studies in order to conservatively estimate the MPO groundwater pit inflows and associated alluvial groundwater licensing requirements (refer to Section 6.1.1 of the GWMP).

Groundwater leakage from alluvial aquifers will be licensed in accordance with requirements of the *Water Management Act, 2000*. On this basis, further measures to prevent, minimise or offset groundwater leakage from alluvial aquifers due to the MPO are not considered warranted.

4.3 ADVERSELY AFFECTED WATER SUPPLY ON PRIVATELY-OWNED LAND

Response protocols have been developed for potential impacts on privately-owned surface water and groundwater users (Sections 3.1.3 and 3.2.3).

The *NSW Aquifer Interference Policy* includes minimal impact considerations relating to water table and groundwater pressure drawdown. The minimal impact consideration for privately owned groundwater bores is cumulative drawdowns greater than 2 m. In the event the MPO contributed to a drawdown greater than 2 m at a private bore was attributed to the MPO, and this has negative impacts on the landholder's water supply, the following potential make-good provisions may be implemented:

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

If an unapproved, adverse impact occurs on a downstream surface water user due to the MPO, MACH Energy would implement the following contingency measures:

- providing an alternative water source during the duration of the impact; and
- reviewing and refining the surface water and groundwater monitoring programs.

These contingency measures would be assessed on a case by case basis and implemented in consultation with the affected landholder.

4.4 ADVERSELY AFFECTED GROUNDWATER DEPENDENT ECOSYSTEMS AND RIPARIAN VEGETATION

Review of the relevant water sharing plans has indicated that there are no high priority groundwater dependent ecosystems (GDEs) in the vicinity of the MPO.

GDEs are likely restricted to the trees on the bank of the Hunter River, with the historic GDE vegetation on the main floodplain out from the river banks having been cleared for farming. Accordingly, the triggers established for alluvial groundwater levels are considered to be sufficient for monitoring potential effects on GDEs (refer to Section 7.3 of the GWMP).

As described in Section 4.3 of the SWMP, the Hunter River and its tributaries have been historically degraded due to agricultural and industrial use. Riparian condition at all four stream health monitoring locations was described as poor, with the majority of native flora species at the sites being replaced by exotic species (Hose and Turak, 2004).

Notwithstanding the above, a stream health monitoring program has been developed to detect any changes in macro invertebrate ecology in the vicinity of the MPO. This monitoring program will include macro invertebrate sampling at two downstream monitoring locations on the Hunter River, in the vicinity of the MPO.

In addition to aquatic macro invertebrate sampling, monitoring will also include:

- fish observations;
- site water quality;
- stream condition; and
- aquatic and riparian edge plants.

In the event that deterioration is identified in GDEs or in riparian vegetation condition during stream health monitoring, the response protocol outlined in Table 9 will be initiated.

Table 9
Groundwater Dependent Ecosystems and Riparian Vegetation Condition Response Protocol

Response Protocol	
Trigger	Detection of deterioration in GDEs or riparian vegetation along watercourses in the vicinity of the MPO.
Investigation	1. Notify the MACH Energy Environmental Superintendent within 24 hours of becoming aware of the deterioration. 2. Check and validate the data/information which indicates an impact. 3. In the event of an apparently anomalous monitoring result, conduct a resample/retest where possible. 4. Review the impact, including consideration of: – any relevant monitoring data; and – current mine activities and land management practices in the relevant catchment, including other mining/pastoral activities. 5. Commission an investigation by an appropriate specialist into the impact, if considered appropriate by the Environmental Superintendent. 6. Provide a preliminary investigation report to the DPIE, EPA and DPIE Water within seven days of identifying the trigger exceedance.
Response	• Develop appropriate contingency/remedial measures based on the results of the above investigations, in consultation with the relevant authorities if or as required.

5 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

5.1 ANNUAL REVIEW

In accordance with Condition 3, Schedule 5 of Development Consent DA 92/97 MACH Energy will review and evaluate the environmental performance of the MPO by the end of March each year (for the preceding calendar year) or other such timing as agreed by the Secretary of the DPIE.

In relation to water, the Annual Review will:

- include a review of the surface and groundwater monitoring results at the MPO over the past year, which includes a comparison of the results to evaluate compliance against the:
  - relevant statutory requirements, limits or performance measures/criteria (refer Section 2.1.1);
  - monitoring results of the previous years; and
  - relevant predictions in the EIS and MOD 1, MOD 2, MOD 3 and MOD 4 EAs;
- identify any water-related non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the water monitoring data over the life of the MPO;
- identify any discrepancies between the predicted and actual water impacts of the MPO, and analyse the potential cause of any significant discrepancies; and
- describe what water-related measures will be implemented over the next year to improve the environmental performance of the MPO.

The Annual Review will be made publicly available on the MACH Energy website (http://www.machenergyaustralia.com.au) in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

5.2 SGWRP REVISION

In accordance with Condition 4, Schedule 5 of Development Consent DA 92/97, this SGWRP will be reviewed, and if necessary revised to the satisfaction of the Secretary of the DPIE, within three months of the submission of:

- an Annual Review (Condition 3, Schedule 5);
- an incident report (Condition 7, Schedule 5);
- an Independent Environmental Audit (Condition 9, Schedule 5); and
- any modification to the conditions of Development Consent DA 92/97.

Within 4 weeks of conducting any such review, the Secretary of the DPIE will be advised of the outcomes of the review and any revised documents submitted to the Secretary for approval.

In accordance with Condition 4A, Schedule 5 of Development Consent DA 92/97, MACH Energy may submit a revised SGWRP for the approval of the Secretary at any time, and may also submit any revision to this SGWRP required under Development Consent DA 92/97 on a staged basis.

If agreed with the Secretary of the DPIE, a revision to this SGWRP required under Development Consent DA 92/97 may be prepared without undertaking consultation with all parties nominated under the relevant Condition of Development Consent DA 92/97.

The approved SGWRP will be made publicly available on the MACH Energy website (http://www.machenergyaustralia.com.au), in accordance with Condition 11, Schedule 5 of Development Consent DA 92/97.

6 REPORTING PROCEDURES

In accordance with Condition 2, Schedule 5 of Development Consent DA 92/97, MACH Energy has developed protocols for managing and reporting the following:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and/or performance criteria.

These protocols are described in Section 5 of the WMP.

In accordance with Condition 8, Schedule 5 of Development Consent DA 92/97, MACH Energy will provide regular reporting on the environmental performance of the MPO on the MACH Energy website (http://www.machenergyaustralia.com.au).

7 REFERENCES

Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.*

EMGA Mitchell Mclennan (2010) *Mount Pleasant Project Modification Environmental Assessment Report.* Prepared for Coal and Allied Operations Pty Limited.

Environmental Resources Management (ERM) Mitchell McCotter (1997) *Mount Pleasant Operation Environmental Impact Statement.*

Hose, G. and Turak, E. (2004) *River Health in the New South Wales Lower North Coast, Hunter and Central Coast Catchments.* Report prepared for the NSW Environmental Protection Authority.

HydroSimulations (2016) *Mt Pleasant Project – Groundwater Inflow and Licensing Estimates*.

MACH Energy (2017a) *Mount Pleasant Operation (DA 92/97) – South Pit Haul Road Modification*.

MACH Energy (2017b) *Mount Pleasant Operation – Mine Optimisation Modification Environmental Assessment.*

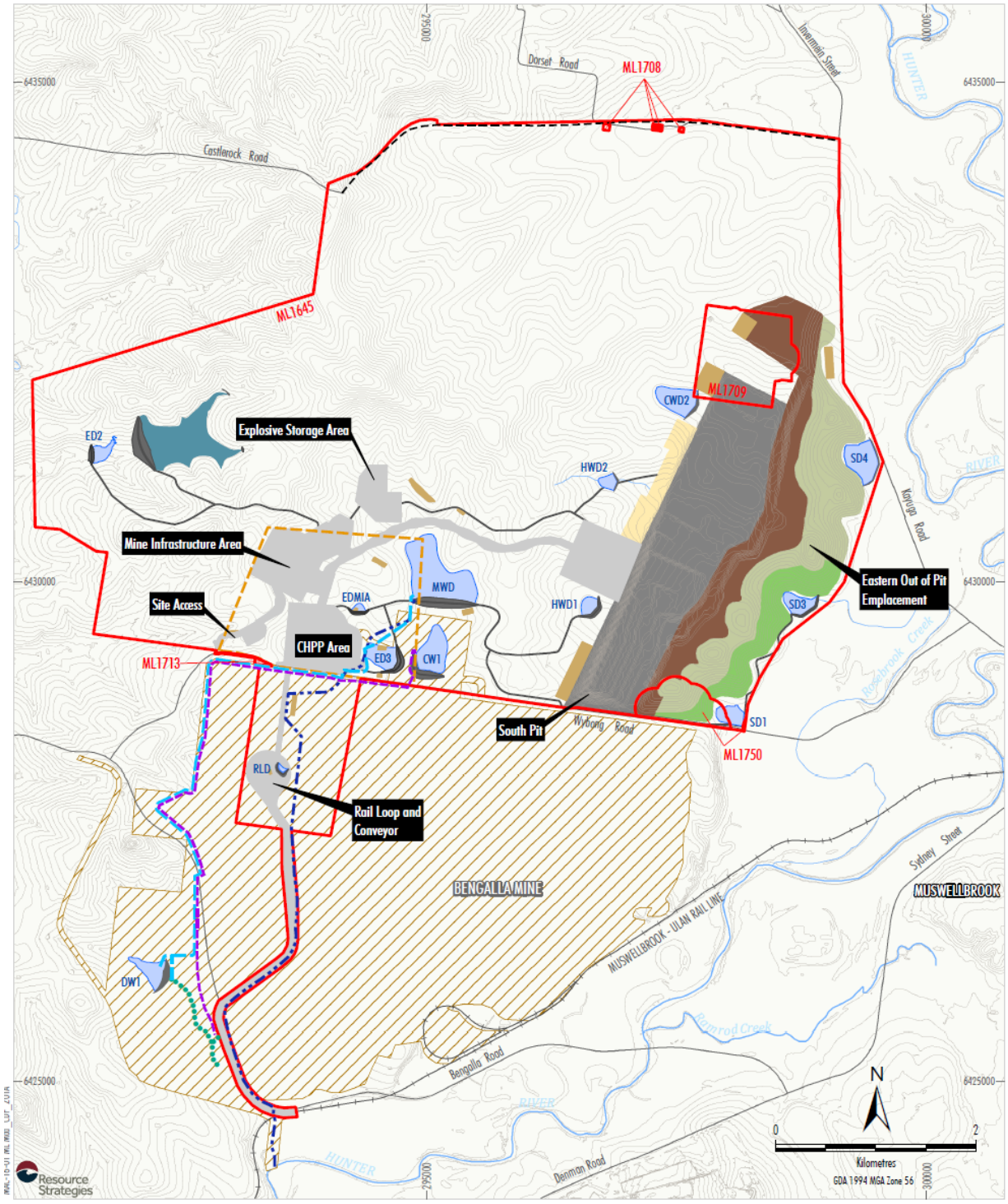
MACH Energy (2017c) *Mount Pleasant Operation – Rail Modification Environmental Assessment.*

PPK Environment & Infrastructure (1997) Water Management Studies. Supplementary Report 3 *in Mt Pleasant Mine Environmental Impact Statement.*

ATTACHMENT 1

APPENDIX 2 OF DEVELOPMENT CONSENT DA 92/97

APPENDIX 2
FIGURE 1 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2021



LEGEND

- Mining Lease Boundary
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Infrastructure Area Envelope
- Active Stripping Area
- Active Mining Area
- Active Overburden Emplacement Area
- Topsoil Stockpile
- Initial Rehabilitation
- Established Rehabilitation
- Infrastructure and Borrow/Stockpile Area
- Access Road
- Northern Link Road

Indicative Water Pipeline Alignment

- MPO Hunter River Supply Pipeline
- MPO DW1 Pipeline (Bi-directional)
- Bengalla Mine CW1 Pipeline
- Approximate Extent of Scour Protection
- Water Dam
- Fines Emplacement Area

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017); MACH Energy (2017)

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MOUNT PLEASANT OPERATION

FIGURE 2 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2025

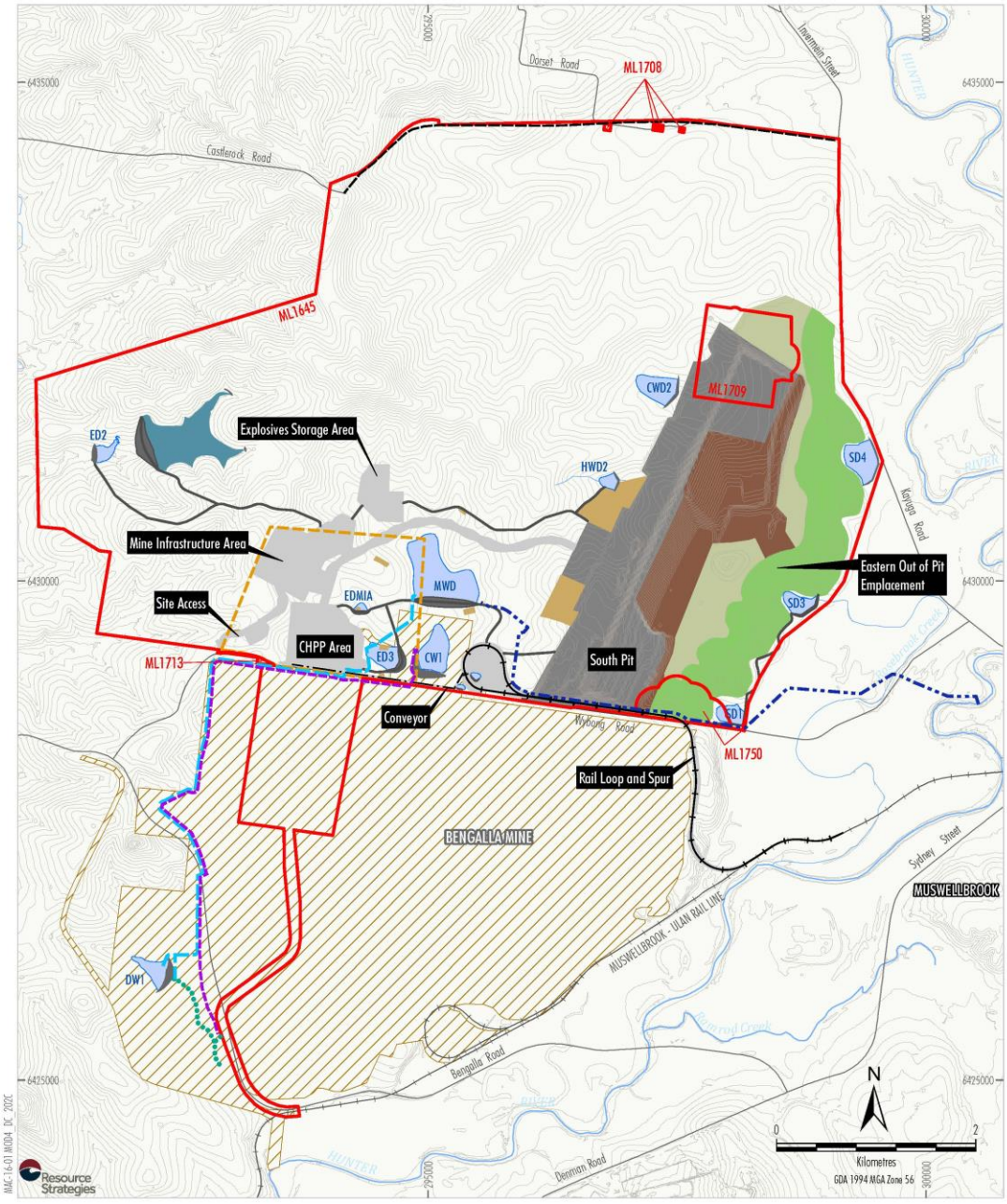
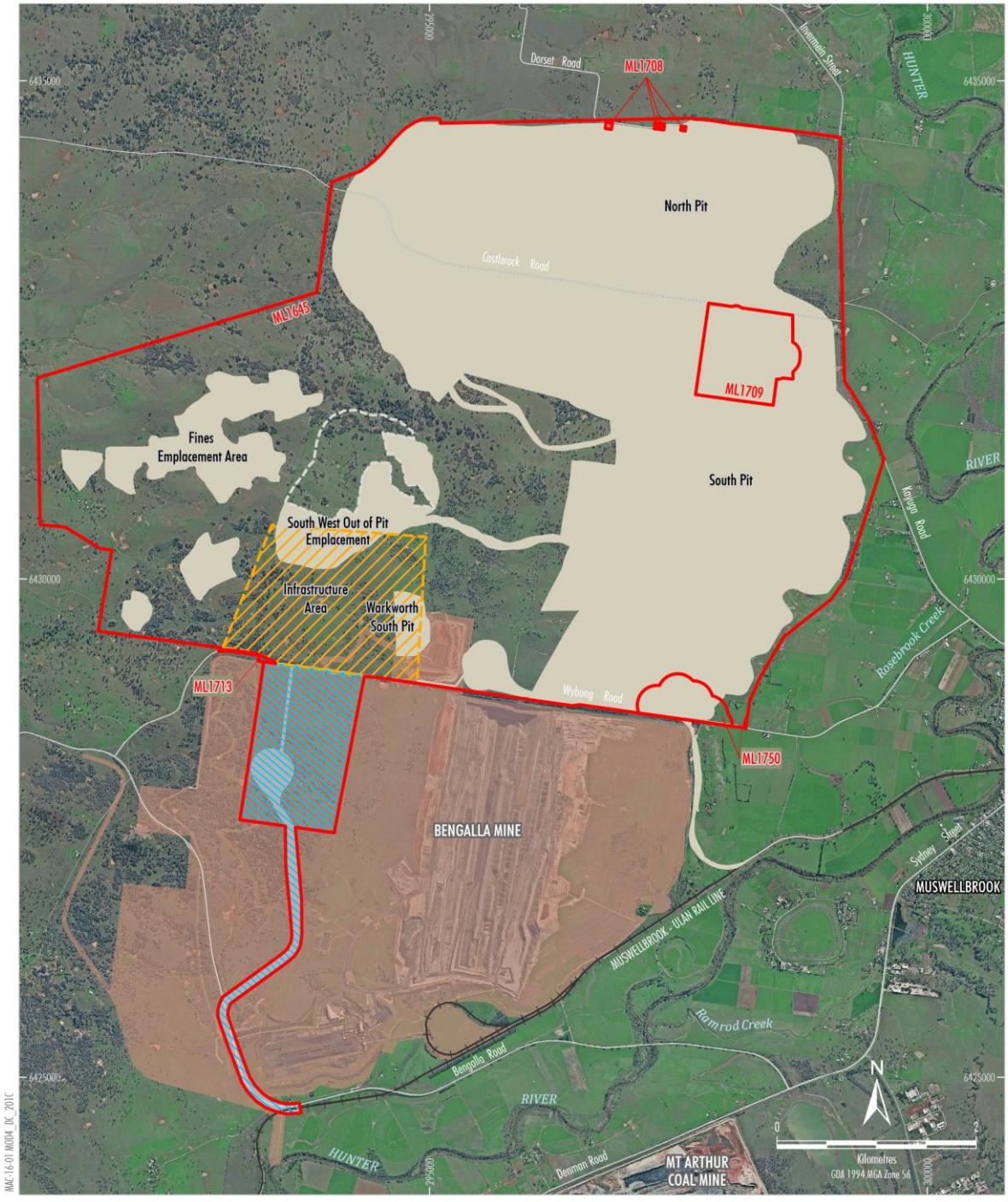


FIGURE 3 - APPROVED SURFACE DISTURBANCE PLAN



LEGEND

- Mining Lease Boundary
- Approximate Extent of Approved Surface Development [1]
- Area Relinquished for Overburden Emplacement and Major Infrastructure
- Infrastructure Area Envelope
- Infrastructure to be removed under the Terms of Condition 37, Schedule 3
- Indicative Existing Coal Transport Infrastructure
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)

NOTE

1. Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, offsite coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, signalling, other ancillary works and construction disturbance.

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2018); Department of Planning and Environment (2016); MACH Energy (2017)
Orthophoto: MACH Energy (Aug 2016)

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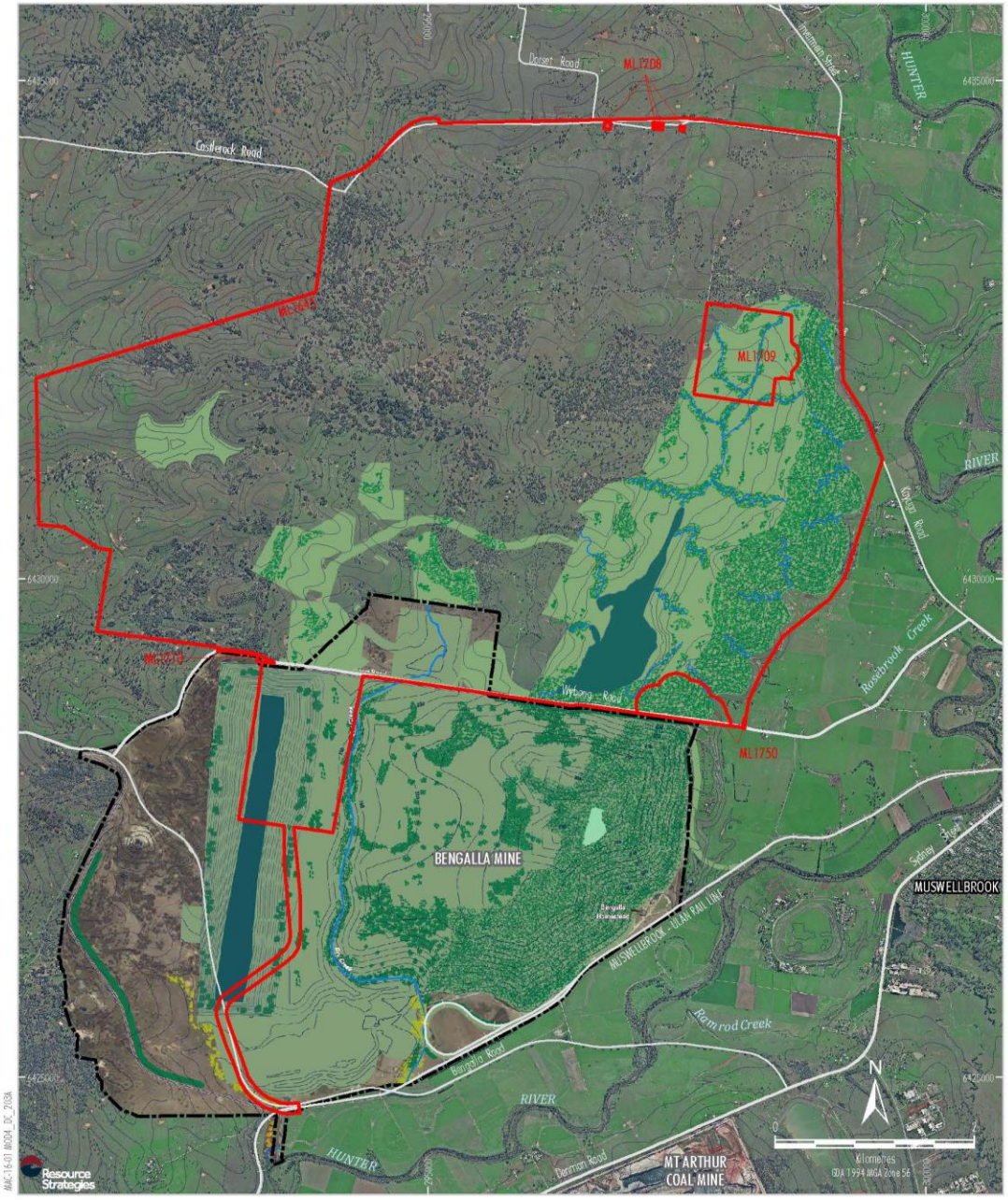
MOUNT PLEASANT OPERATION
Approved Surface Disturbance Plan

FIGURE 4 - CONCEPTUAL FINAL LANDFORM



APPENDIX 6

CONSULTEE FEEDBACK – KEY CORRESPONDENCE

(AVAILABLE ON REQUEST)