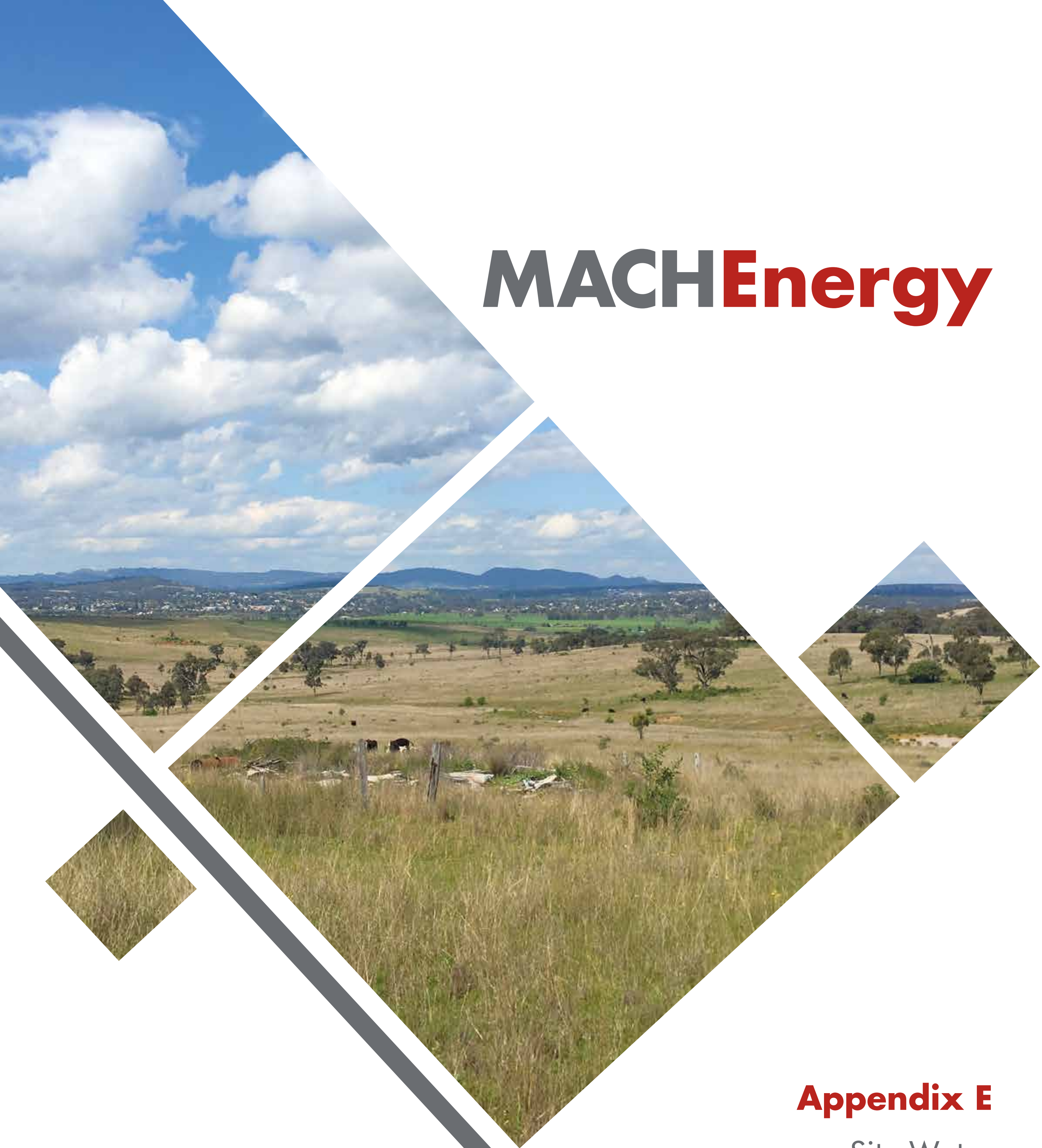

MACHEnergy

Appendix E

Site Water
Balance Review

REPORT

Mount Pleasant Operation
Mine Optimisation Modification
Site Water Balance Review

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Revision	Description	Author	Reviewer	Approved	Date
b	Draft	TSM	DNF	TSM	11/04/2017
c	Revised text following review	TSM	Resource Strategies	TSM	13/04/2017
d	Revised results – haul road update	TSM	Resource Strategies	TSM	24/04/2017
e	Revised text following review	TSM	Resource Strategies	TSM	24/04/2017
f	Revised text following review	TSM	Resource Strategies	TSM	25/05/2017

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1.0 INTRODUCTION

1.1 OVERVIEW OF THE MOUNT PLEASANT OPERATION

MACH Energy Australia Pty Ltd (MACH Energy) acquired the Mount Pleasant Operation from Coal and Allied Operations Pty Ltd (Coal & Allied) on 4 August 2016.

The approved Mount Pleasant Operation includes the construction and operation of an open cut coal mine and associated infrastructure located approximately three kilometres (km) north-west of Muswellbrook in the Upper Hunter Valley of New South Wales (NSW) (Figure 1). The mine is approved to produce up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.

The Mount Pleasant Operation will operate in accordance with Development Consent DA 92/97, granted by the (then) NSW Minister for Urban Affairs and Planning on 22 December 1999. When Development Consent DA 92/97 was granted in 1999, the mine was permitted to carry out mining operations for a period of 21 years (until 22 December 2020).

Development Consent DA 92/97 was subsequently modified by Coal & Allied in 2011, at which time various Consent Conditions were updated. However, the Consented time limit on mining operations (Condition 5, Schedule 2) was not updated to reflect the fact that mining had not commenced at that time.

A further very minor Modification to Development Consent DA 92/97 (i.e. to relocate the South Pit Haul Road only) was proposed by MACH Energy and subsequently approved in March 2017.

The Mount Pleasant Operation was also approved under the *Environment Protection and Biodiversity Conservation Act, 1999* in 2012 (EPBC 2011/5795).

MACH Energy recommenced the construction of the Mount Pleasant Operation in November 2016 and will commence overburden and ROM coal mining operations in 2017, in accordance with Development Consent DA 92/97 and EPBC 2011/5795.

1.2 OVERVIEW OF THE MODIFICATION

The Mine Optimisation Modification (the Modification) would primarily comprise:

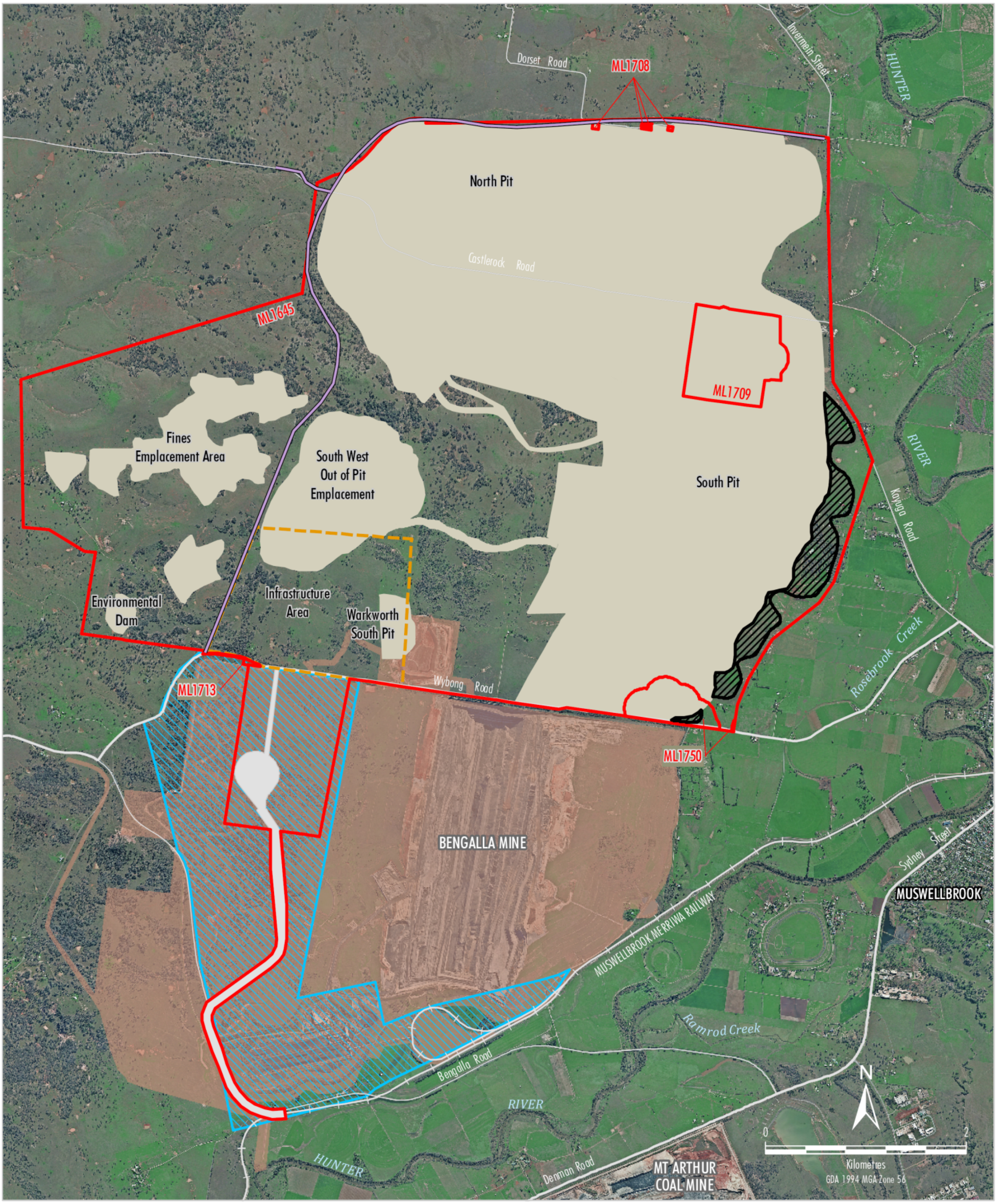
- An extension to the permitted period of mining operations at the Mount Pleasant Operation to provide for open cut mining to 22 December 2026.
- Extensions to the Eastern Out of Pit Emplacement to better align with the underlying topography and facilitate development of a final landform that is more consistent with the characteristics of the local topography and incorporates additional waste rock capacity (Figure 2).

The proposed extension to the Eastern Out of Pit Emplacement would enable MACH Energy to avoid the need to emplace waste rock material in the approved South West Out of Pit Emplacement and therefore the total development area of the Mount Pleasant Operation would be largely unchanged.

The Modification also involves some additional improvements to the final landform to be consistent with MACH Energy's intended truck and excavator mining methodology (as opposed to Coal & Allied's intended combination of truck, excavator and dragline operations) and associated minor adjustments to the development sequence of the mine.

The Modification would not increase the approved annual maximum ROM coal and waste rock production rates.

Figure 1 Regional Location



LEGEND
- Mining Lease Boundary
- Infrastructure Area Envelope
- Approximate Extent of Approved Surface Development (1997 EIS Year 20)
- Indicative Offsite Coal Transport Infrastructure
- Conveyor/Services Corridor Envelope
- Bengalla Mine (SSD-5170)
- Northern and Western Link Road
- Proposed Extension to Eastern Out of Pit Emplacement

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

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MOUNT PLEASANT OPERATION
Modification General Arrangement

Figure 2 Modification General Management

1.3 ASSESSMENT OF THE MODIFICATION

The Modification would not include any significant changes to the approved water management system at the site. Water management system modelling was previously undertaken for the Mount Pleasant Mine Environmental Impact Statement (ERM Mitchell McCotter, 1997) by PPK Environment & Infrastructure (1997). Notwithstanding, this report describes contemporary site water balance modelling and water management system design for the Mount Pleasant Operation (incorporating the Modification).

The water balance model has been developed using the GoldSim® software package, to simulate the future water balance for the Mount Pleasant Operation incorporating the Modification, using planned water management system details. Water management system details are generally consistent with those presented in the Mount Pleasant Mine Environmental Impact Statement. The model has been developed with the aim of assessing future site water balance behaviour such as water supply reliability, spill risk and pit water inventory using historical climatic data for the period of the simulation. Key model outputs were as follows:

- Predicted water supply security for make-up supply to the proposed coal handling and preparation plant (CHPP) and for haul road dust suppression use;
- Risk of (unlicensed) external spill occurring from site mine water storages; and
- Risk of accumulation of excess water in the Open Cut pit during the life of the Modification.

Water management system design includes sizing of sediment dams, diversion dams and relevant pumping systems. Sizing calculations were carried out using the GoldSim® water balance model and Landcom (2004) and Department of Environment and Climate Change (DECC, 2008) guidelines.

The total area of the extension to the Eastern Out of Pit Emplacement is approximately 65 hectares (ha). This is estimated to comprise approximately 2.9 percent (%) of the total existing catchment area of three small tributary streams (including Rosebrook Creek) that drain eastwards to the Hunter River. That is, the extension represents a maximum potential 2.9% increase in the reduction of the catchment area of the three small tributaries compared with the reduction in catchment area of these small tributaries that would result from the approved development. Once rehabilitated, the eastern face of the Eastern Out of Pit Emplacement would be free-draining.

The catchment excision associated with these incremental extensions to the Eastern Out of Pit Emplacement is not anticipated to result in an increase to the total maximum excised catchment associated with the Mount Pleasant Operation (at any one time), due to the delay to the commencement of the approved North Pit. Therefore any potential incremental impacts from the Modification on the Hunter River catchment would be negligible.

2.0 WATER MANAGEMENT SYSTEM DESCRIPTION

2.1 SURFACE LAYOUT

The water balance design period is from the start of mining, in 2017, to the end of 2026 (10 years). Open cut mining is planned with coal from the open cut operations to be washed in a CHPP. Fine rejects will be disposed in the approved Fines Emplacement Area. Figure 3 to Figure 5 show progressive mine stage plans, the planned surface water management features, and catchment and sub-catchment areas for the Mount Pleasant Operation incorporating the Modification. These include a revised haul road alignment (that was recently approved via a separate modification).

2.2 WATER MANAGEMENT SYSTEM

The Mount Pleasant Operation water management system will be comprised of a number of dams, the Open Cut pit and the Fines Emplacement Area, together with a system of pumped transfers and drains. Figure 6 shows a schematic representation of these storages and their inter-linkages. The GoldSim® water balance model has been developed based on Figure 6 (refer also Section 3.0).

The Mine Water Dam (MWD) will be 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 fine rejects bleed water[1] will be recovered via pumping to the MWD. Environmental Dam 2 (ED2) is to be located downstream of the Fines Emplacement Area and will serve as a sediment dam for Fines Emplacement Area construction. Any seepage from the Fines Emplacement Area is to be captured in a subsurface seepage collection system located at the toe of the Fines Emplacement Area embankment and will be pumped back to the fine rejects storage area.

Environmental Dam Mine Infrastructure Area (EDMIA), Environmental Dam 3 (ED3), Sediment Dam 1 (SD1), Sediment Dam 3 (SD3) and Sediment Dam 4 (SD4) will all have accumulated water pumped back to the water management system. Water collecting in SD4 will be pumped to SD3 which will be pumped to SD1. In turn, SD1 will transfer water to High Wall Dam 1 (HWD1) or, after HWD1 is mined through, direct to the MWD.

Water supply to haul road dust suppression will occur at a truckfill point at either HWD1 or High Wall Dam 2 (HWD2). Groundwater inflow occurring to the Open Cut pit will be dewatered, along with rainfall runoff, to either HWD1 or HWD2. Water from HWD1 and HWD2 will be pumped to the MWD to supplement site water demands.

The MWD will receive inflow from site treated effluent and will supply water for vehicle washdown and stockpile dust suppression, as well as the CHPP. The MWD will be able to receive water from the Hunter River via Water Allocation Licences (WALs) and (subject to a separate Environment Protection Licence [EPL] variation) discharge to the Hunter River via the Hunter River Salinity Trading Scheme (HRSTS). During periods of low water inventory, the MWD will be able to pump water to either HWD1 or HWD2 to maintain truckfill supply. During periods of high water inventory, the MWD will pump water to either HWD1 or HWD2 to control the risk of spill from MWD.

---

[1] Fine rejects bleed water is water liberated from fine rejects slurry as it settles within a Fines Emplacement Area. This water reports to the fine rejects surface, ponds and is available for reclaim pumping.

Two Clean Water Dams (CWD1 and CWD2) have been located upslope of the Open Cut pit 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 (refer Figure 6). Given site constraints, discharge off site from CWD1 and CWD2 would be via pumping to the north of the Mount Pleasant Operation.

A Rail Loop Dam (RLD) has been located adjacent to the rail loop to capture potentially mine affected runoff from this area.

The mine site access road would not require sediment control during operations as it would be sealed. During construction, best practice erosion and sediment control would be employed but no long term controls (i.e. sediment dams) would be required. Therefore, rainfall runoff from the mine site access road would not be captured in the water management system.

A number of drains are planned as part of and around the perimeter of the water management system for the Mount Pleasant Operation, as indicated on Figure 3 to Figure 5. 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;
- undisturbed area diversion drains around the perimeter of the Fines Emplacement Area and ED2; and
- drains around stockpile areas to the north of the Open Cut pit area early during the 10 year period (refer Figure 3) and to its south in the middle of the 10 year period (refer Figure 4).

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

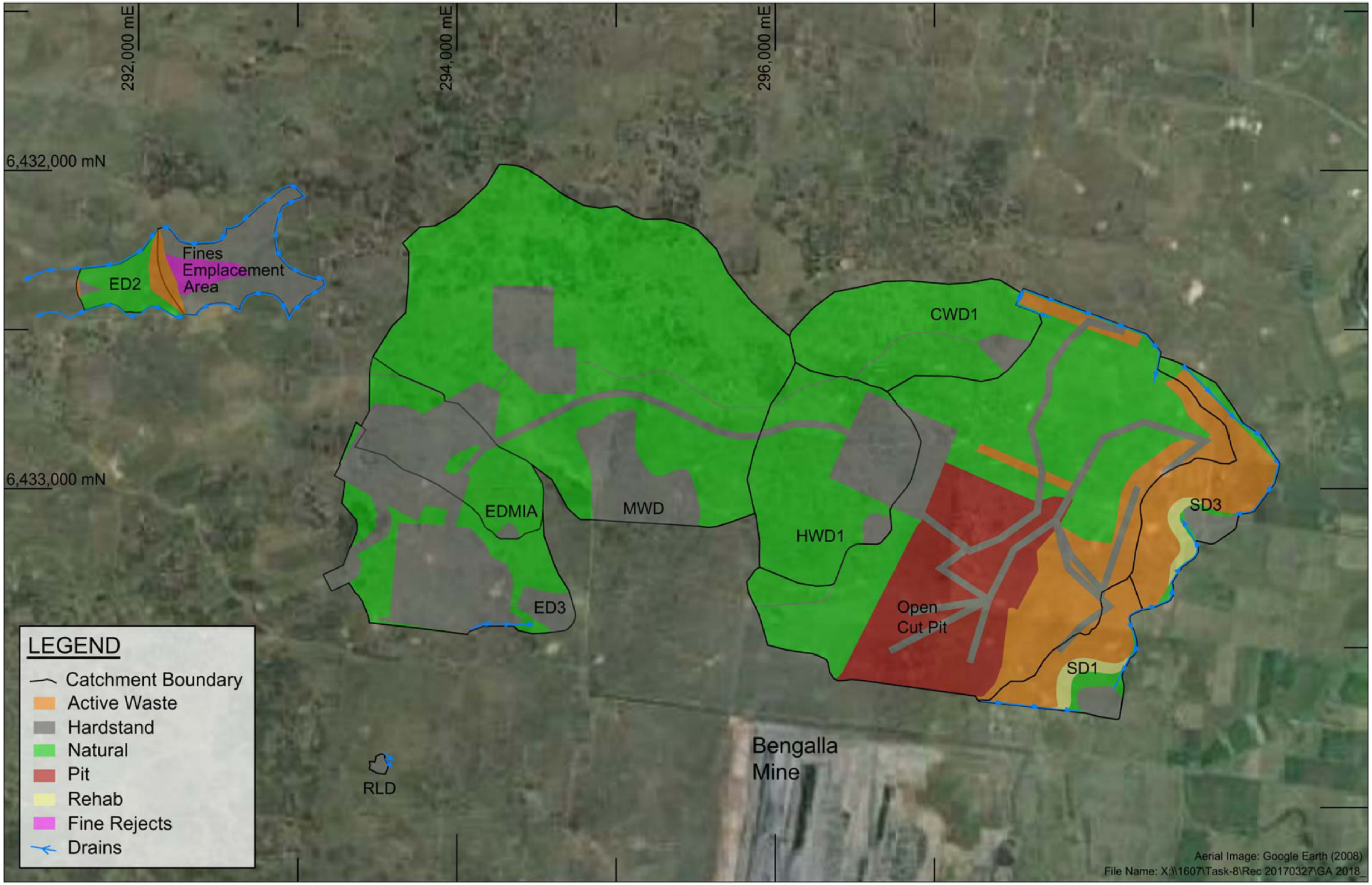

Figure 3 Site Catchment and Drainage Plan 30/9/2018

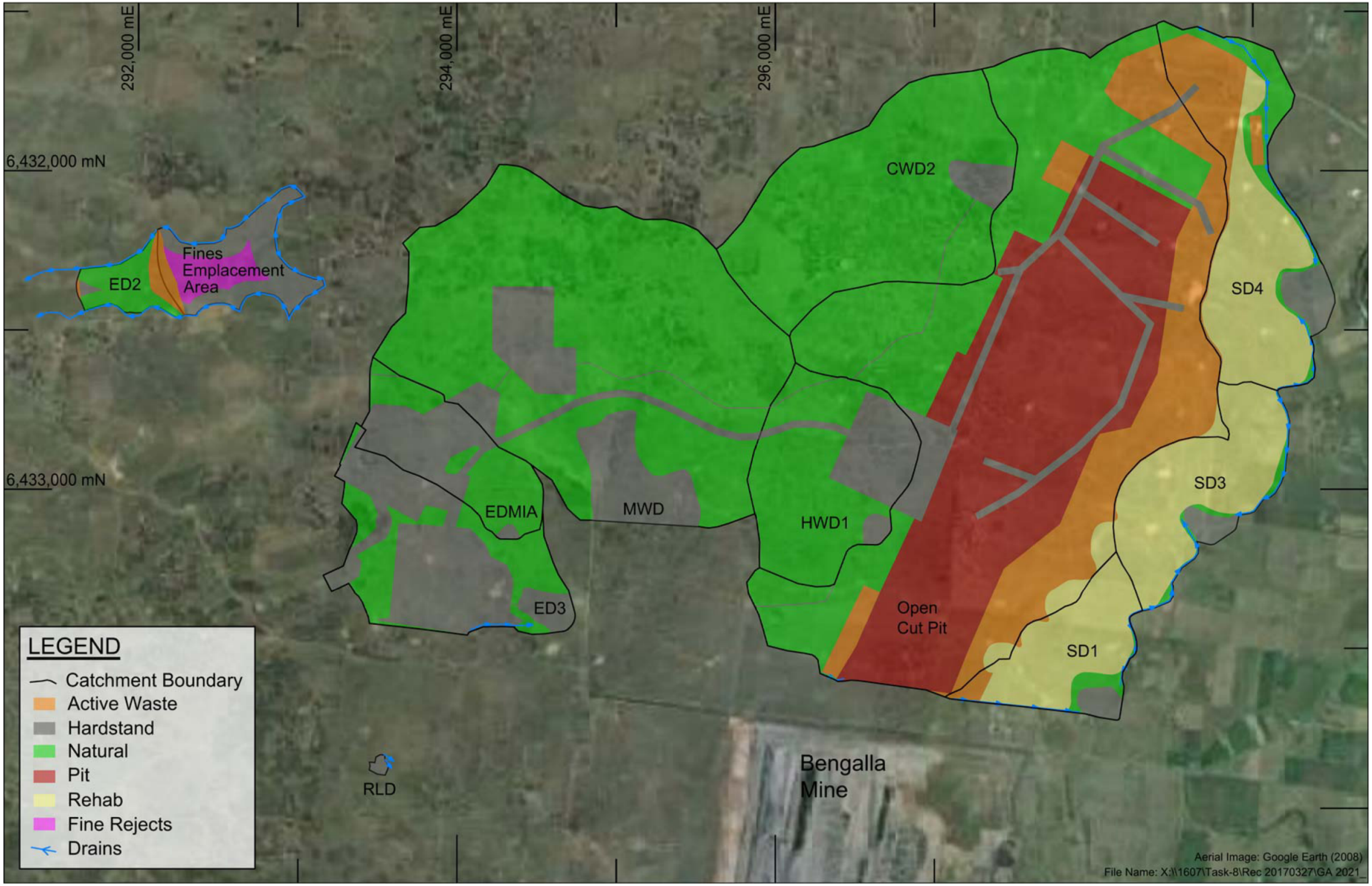

Figure 4 **Site Catchment and Drainage Plan 30/9/2021**

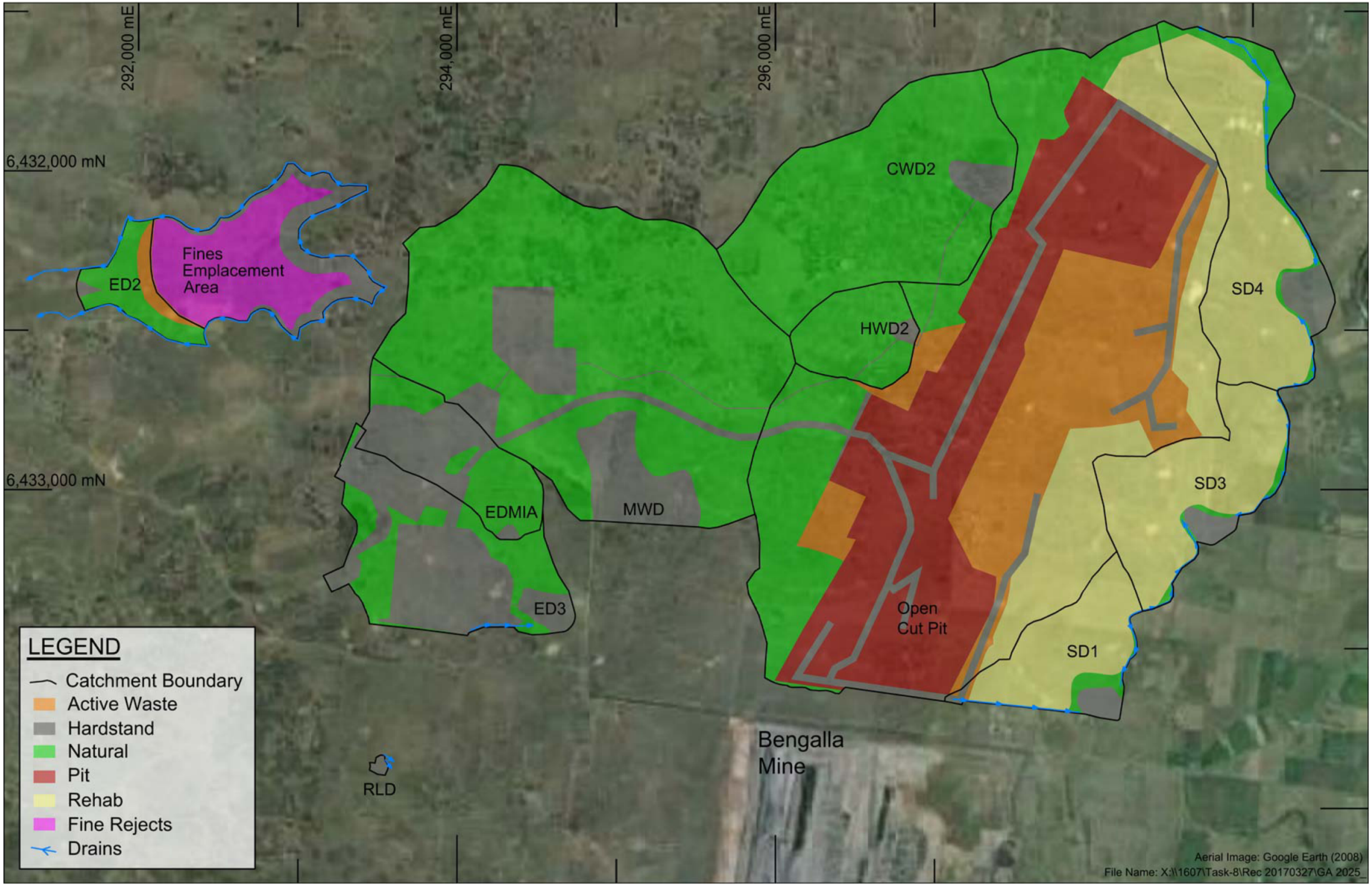

Figure 5 **Site Catchment and Drainage Plan 31/3/2025**

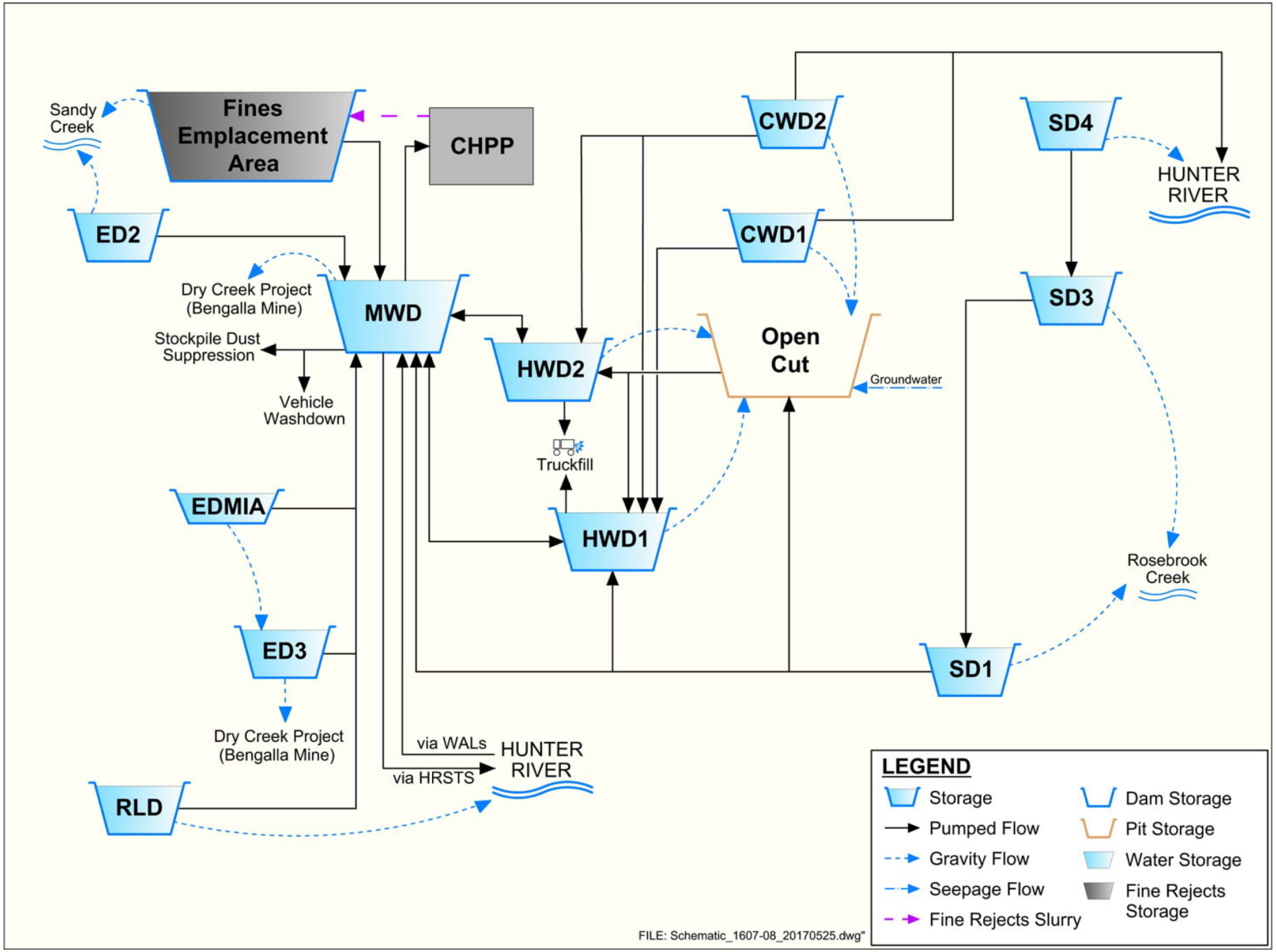

Figure 6 Water Management System Schematic

3.0 WATER BALANCE MODEL DEVELOPMENT

3.1 MODEL DESCRIPTION

The water balance model has been developed to simulate the storages and linkages shown in schematic form in Figure 6. The model has been developed using the GoldSim® simulation package. The model simulates the behaviour of water held in and pumped between all simulated water storages shown in Figure 6. For each storage, the model simulates:

Change in Storage = Inflow – Outflow

Where:

Inflow includes rainfall runoff, groundwater inflow (for the Open Cut pit), fine rejects bleed water (for the Fines Emplacement Area), water sourced from the Hunter River and all pumped inflows from other storages.

Outflow includes evaporation, spill, licensed discharge to the Hunter River via the HRSTS (subject to obtaining relevant secondary approvals) 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 nominally begin on 1/3/2017 and simulate the period to the end of 2026. The model simulates 121 "realizations" derived using the historical daily climatic record[2] from 1892 to 2012. Realization 1 uses climatic data from 1892 to 1902, realization 2 uses data from 1893 to 1903, realization 3 uses data from 1894 to 1904 and so on. The results from all realizations are used to generate estimates of supply reliability, spill and Open Cut pit water inventory. This method effectively includes all recorded historical climatic events in the water balance model, including high, low and median rainfall periods.

3.2 MODEL ASSUMPTIONS AND DATA

A summary of key model assumptions and underpinning data are provided in the sub-sections that follow.

3.2.1 Rainfall Runoff Simulation and Catchment Areas

Rainfall runoff in the water balance model is 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.

AWBM simulation of flow from six different sub-catchment types was undertaken, namely: undisturbed (natural) areas, hardstand (for example, roads and infrastructure areas), Open Cut pit, active waste rock emplacement, rehabilitated waste rock emplacement and fine rejects. AWBM simulation of flow from each of the sub-catchment types was undertaken using parameters adopted from previous work (by others) and are summarised in Table 1.

[2] Data was sourced from 'Data Drill' generated climatic data for the mine location. The Data Drill is a system which provides synthetic data sets for a specified point by interpolation between surrounding point records held by the Bureau of Meteorology (QLD Government, 2017). Both rainfall and pan evaporation data were obtained from this source.

Table 1 Adopted AWBM parameters

Parameter	Sub-catchment Type					
	Natural	Hardstand	Open Cut Pit	Active	Rehabilitated	Fine Rejects
C_1 (mm)	7.5	2	5	15	7.5	0
C_2 (mm)	76.2	10	70	50	76.2	5
C_3 (mm)	152.4	30	90	110	152.4	-
A_1	0.134	0.333	0.2	0.1	0.134	0.2
A_2	0.433	0.334	0.6	0.3	0.433	0.8
A_3	0.433	0.333	0.2	0.6	0.433	-
K_s (d^{-1})	0.2	0	0.1	0.5	0.3	0
BFI	0.22	0	0	0	0.22	0
K_b (d^{-1})	0.861	-	-	-	0.861	-

All AWBM parameters were adopted from those in the original OPSIM model supplied by Thiess Pty Ltd and are considered reasonable (it is understood this model was developed by Parsons Brinckerhoff) with the exception of the evaporation pan factors, which were set to 1 for fine rejects and hardstand areas and 0.85 for all other sub-catchment types on the basis of experience with similar projects. 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.

Each modelled storage catchment area was divided into sub-catchment areas corresponding with the above sub-catchment types. MACH Energy provided stage plans as at 2018, 2021 and 2025, comprising surface contours (1 metre [m] vertical interval) from which catchment areas were calculated. Assumed catchment boundaries and sub-catchment areas for these three plans are shown in Figure 3 to Figure 5.

Figure 7 summarises the total catchment area reporting to the water management system over the simulation period. The catchment area is calculated in the model by linearly interpolating in between the values derived from the above stage plans and assuming commission/decommission dates for storages as required. The total catchment area generally increases over time, reaching a maximum in 2020 of 2,016 ha.

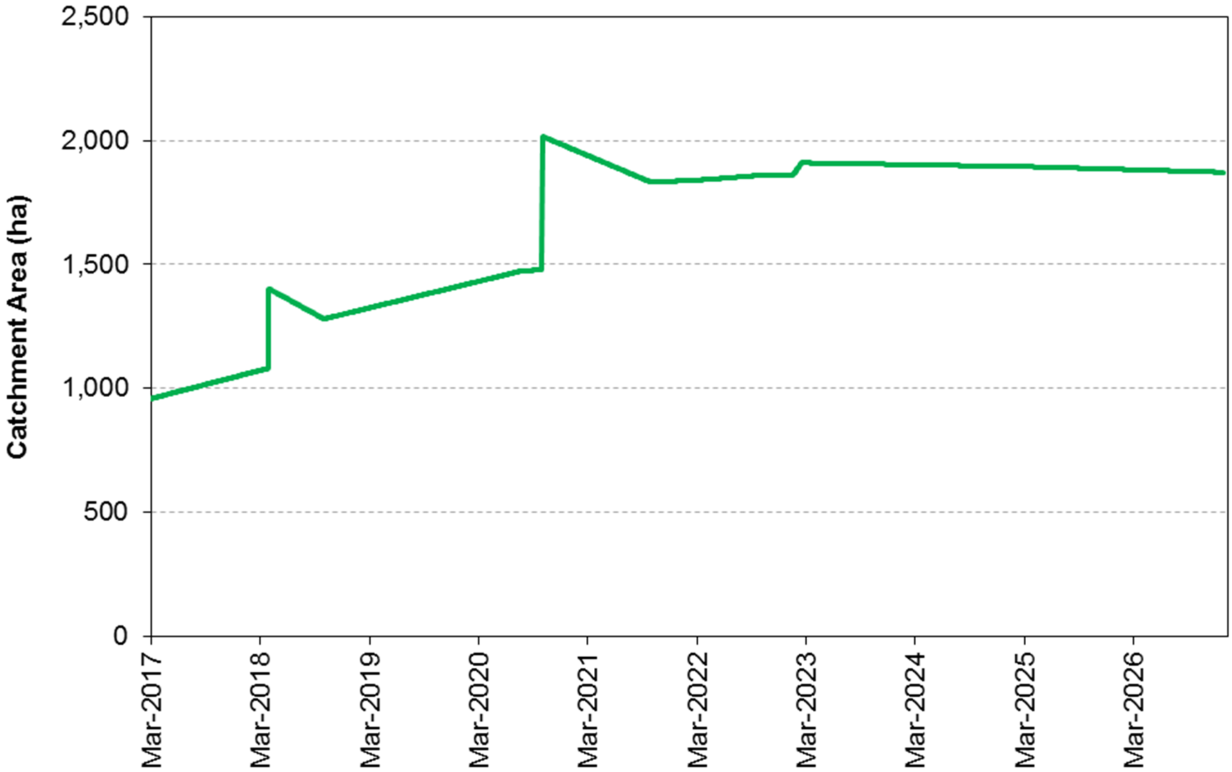

Figure 7 Modelled Total Catchment Area Versus Time

3.2.2 Evaporation from Storage Surfaces

Storage volumes simulated by the model are used to calculate storage surface area (i.e. water area) based on storage level-volume-area relationships for each water storage either based on data provided by MACH Energy or derived from available contour information.

The following pan factors were assumed in the estimation of evaporation from various water storage areas (as a multiplier on daily pan evaporation):

- Fines Emplacement Area = 1.1; due to the darker coal rejects surface;
- Open Cut pit = 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.

3.2.3 CHPP Demand and Fine Rejects Disposal

Table 2 summarises annual future ROM CHPP feed for the Modification life[3] and the associated CHPP demand rate based on an assumed make-up rate of 222 litres (L)/ROM tonne (as agreed with MACH Energy). Commencement of CHPP processing was nominally assumed to be 15 January 2018.

Table 2 ROM Tonnes and CHPP Demand

Calendar Year	Annual ROM tonnes	CHPP Demand (ML/d)
2018	4,499,151	2.73
2019	7,544,594	4.59
2020 to 2026	10,500,000	6.38

Note: ML/d = megalitres per day.

[3] As advised by MACH Energy.

Modelling assumed that fine rejects would be discharged to the Fines Emplacement Area for the duration of the simulation period. Dry fine reject tonnes were assumed to comprise 9.2% of ROM feed with a solids content of 30%[4]. The fine rejects bleed rate was assumed to comprise 56% of the water discharged with the fine rejects, with zero bleed in the first year[4]. Figure 8 shows the daily CHPP demand and the resulting fine rejects bleed rate.

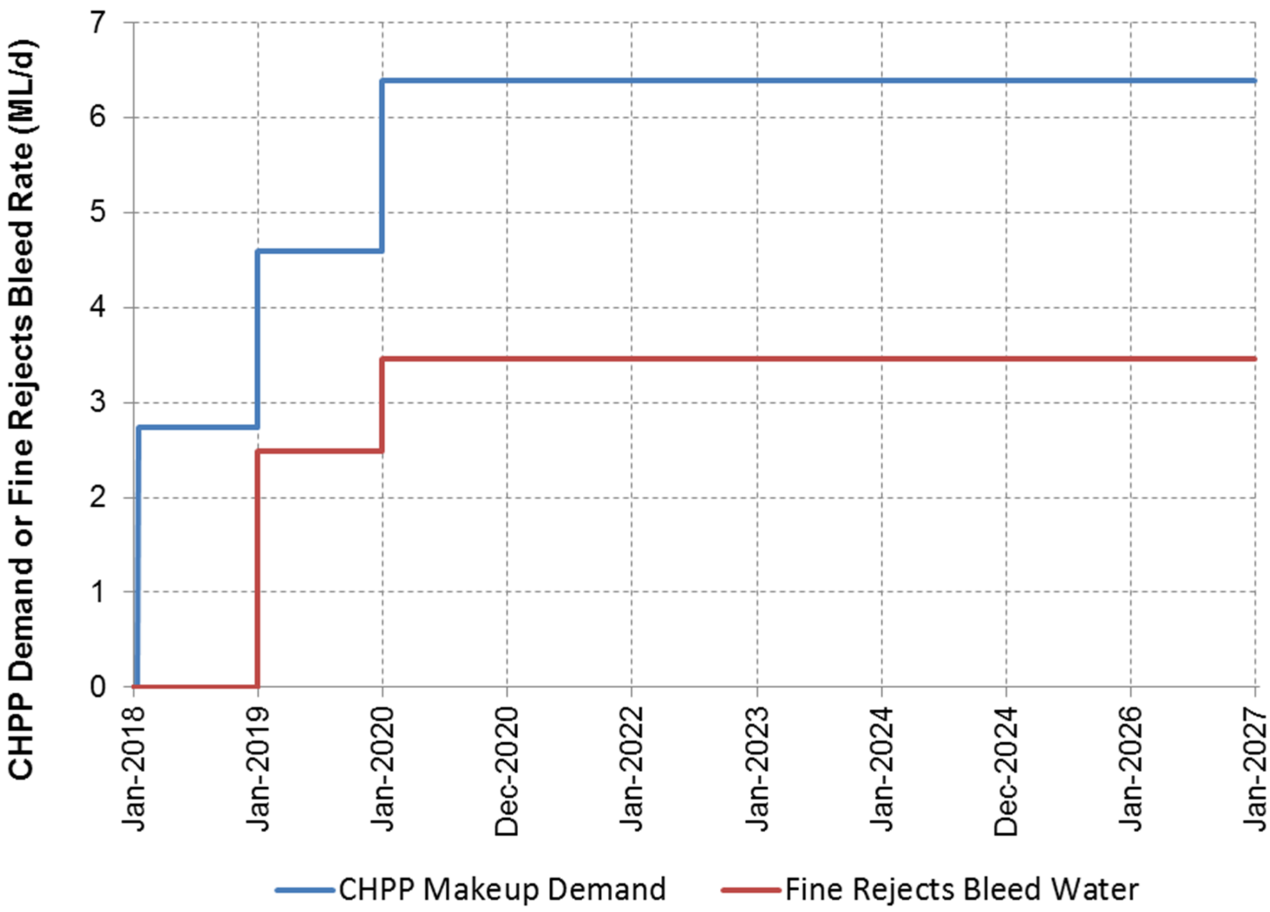

Figure 8 CHPP Demand and Fine Rejects Reclaim

3.2.4 Other Water Demands

Haul road dust suppression demand was calculated from haul road length multiplied by a 30 m width multiplied by the pan evaporation excess over rainfall each day multiplied by a pan factor of 1.1. Haul road lengths were calculated from stage plans varying from 9.7 km in 2018 to 18.7 km in 2021 and 17.1 km in 2025. Calculated average haul road dust suppression demand was approximately 1.9 ML/d, with a peak demand rate (averaged over all realizations) of approximately 4.1 ML/d in summer, mid-way during the 10 year planning period. This range of haul road dust suppression demand is consistent with experience at other sites.

Vehicle washdown demand was assumed to be[4] 36.5 megalitres per year (ML/year) while dust suppression of stockpiles was assumed to be[4] 115 ML/year for all modelled years.

[4] Advised by MACH Energy and consistent with experience at other sites.

3.2.5 Groundwater Inflow

Estimated groundwater inflow to the Open Cut pit over the 10 year simulation is shown in Table 3.

Table 3 Estimated Groundwater Inflows

Year	Calendar Year	Pit Inflow Rate (ML/year)*	Pit Inflow Rate (ML/day)
2	2018	40	0.11
5	2021	126	0.35
10	2026	253	0.69

* Source: HydroSimulations (2016).

These groundwater inflows were reduced to allow for evaporation from the exposed coal seam (recognising that the coal seam is the principal aquifer). Calculations allowed for coal seam thickness and strike length versus time[5] multiplied by a pan factor of 0.8. The calculated groundwater inflow rate net of evaporation is summarised in Figure 9.

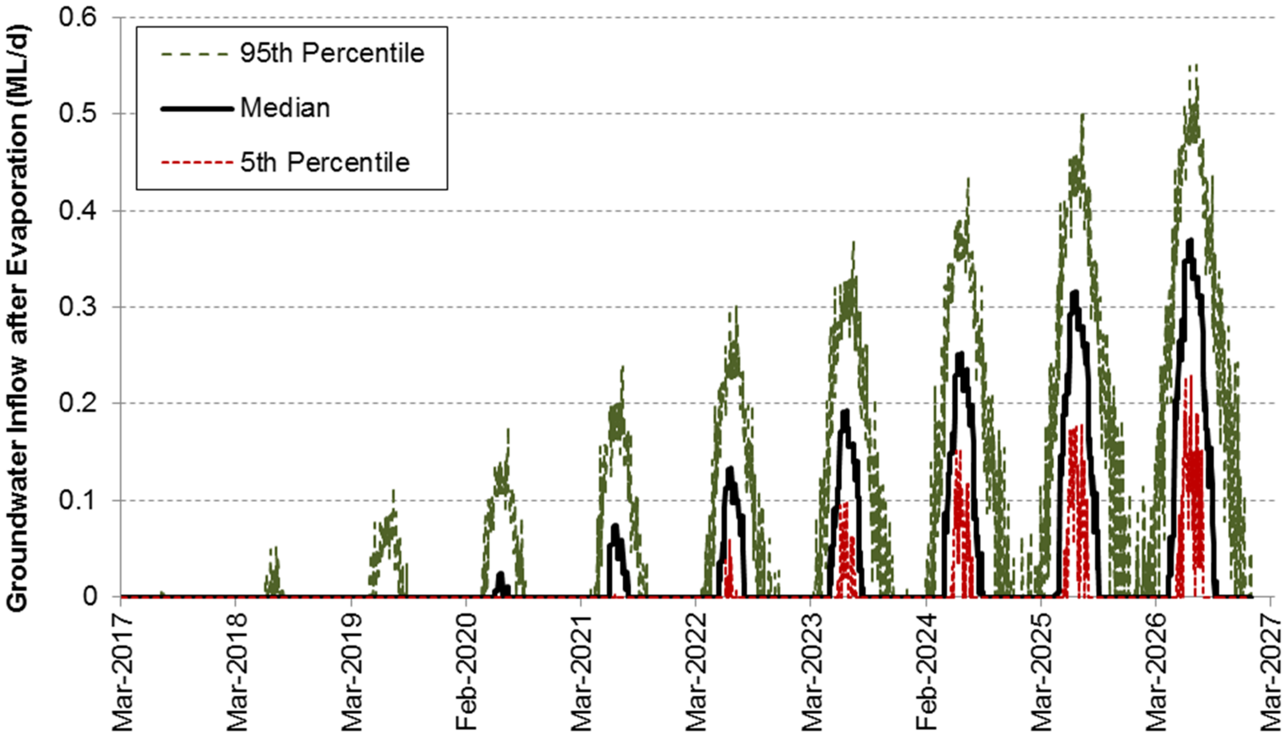

Figure 9 Groundwater Inflow After Evaporation

3.2.6 Hunter River Supply

The Integrated Quantity and Quality Model (IQQM) is the model used by the Department of Primary Industries Water (DPI 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 Entitlement (GSE) WALs available water determinations (AWDs), 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 AWD for High Security Entitlement (HSE) WALs.

A total of 829 ML/year Hunter River GSE WALs and 714 ML/year Hunter River HSE WALs are available for the Mount Pleasant Operation[5]. A peak pumping rate of 200 litres per second (L/s) was

[5] Advised by MACH Energy.

assumed to apply to extractions from the Hunter River. Sourcing of water from the Hunter River was only simulated when certain 'trigger' volumes in the MWD occurred (refer Section 3.2.9).

3.2.7 Licensed HRSTS Discharge

Simulated release from the MWD to the Hunter River via the HRSTS was assumed at a rate of 100 ML/d (1,157 L/s) and with 35 HRSTS credits[5]. The salinity (Total Dissolved Solids [TDS]) of water in the MWD was assumed to be 1,760 milligrams per litre (mg/L) (TDS), based on reported data[6] from the neighbouring Bengalla Mine. A review of site specific baseline data suggests that this value is likely to be conservative (i.e. high). This value of TDS was used to calculate the daily volume able to be discharged in accordance with HRSTS provisions. If the salinity of discharge water is higher than assumed, it is understood that MACH Energy would seek to obtain additional discharge credits under the HRSTS, subject to ongoing water balance reviews. Release was only simulated when certain 'trigger' volumes in the MWD occurred (refer Section 3.2.9).

Simulating periods available for licensed discharge involved firstly developing a relationship between Hunter River flow rate and river registers for declared "high" flow events. This was developed using historical river registers sourced from DPI Water records, correlated against recorded Hunter River daily flows. This correlation was 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 IQQM 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.

3.2.8 Storage Capacities and Design Criteria

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

- Type D sediment retention basin (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 mm (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 supplied stage plans – i.e. as at March 2025. The maximum catchment area reporting to ED2 was assumed to be from 2023 to 2028 as per supplied plans and Fines Emplacement Area embankment designs.

The capacities and storage operating levels of the remaining site 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 Annual Exceedance Probability (AEP) for each dam and iterative simulations were carried out to identify the required capacity for a given AEP.

A summary of the required capacity and the associated design criteria are shown in Table 4. All site storages were assumed empty at the start of the simulation.

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6 Six year reported average electrical conductivity (EC) for the Staged Discharge Dam of 2,751 microSiemens per centimetres (µS/cm), multiplied by 0.64 to convert to an equivalent TDS. Refer Bengalla Mining Company (2016).

Table 4 Modelled Storage Capacities and Design Criteria

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

MACH Energy notes the NSW Environment Protection Authority's (EPA) advice to the NSW 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 (NSW EPA letter dated 17 March 2017). In accordance with the NSW EPA's recommendations, MACH Energy would monitor the quality of water in sediment dams in order to regularly evaluate whether the salinity of controlled discharges/managed overflows from the sediment basins would comply with the provisions of the HRSTS. Recent (March 2017) water quality monitoring of storages on-site has indicated that EC ranged from 103 – 273 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 lower limit for 'saline water' of 400 µS/cm described in the HRSTS Regulation.

Notwithstanding, in the event that monitoring of the water quality in sediment dams indicates that water would exceed the HRSTS limit for non-regulated discharge, MACH Energy would identify and implement additional management measures in consultation with the NSW 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 Maximum Harvestable Right Dam Capacity (MHRDC) was calculated using the DPI Water website[7]. An assumed total property area of 5,503.6 ha resulted in a MHRDC of 385 ML. Proposed storages included in the MHRDC for the Modification are CWD1, CWD2 and EDMIA, for which the total capacity is 56.9 ML hence these storages are within the MHRDC.

The Open Cut pit was excluded from Table 4 because its capacity was not based on design criteria. For modelling purposes, the Open Cut pit storage was assumed to comprise a rectangular sump throughout the modelled period and the volume of water stored was tracked within the model and reported to assess risk of disruption to mining (refer Section 4.2).

[7] http://www.water.nsw.gov.au/water-licensing/basic-water-rights/harvesting-runoff/calculator

The Fines Emplacement Area was 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 as provided by MACH Energy for the period where fine rejects are present and estimated from existing topographic contours for the initial storage (at commissioning). A minimum capacity of approximately 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.

3.2.9 Pumping Rates and Triggers

Simulated pumped transfer rates between storages and the triggers which dictate whether pumping occurs are summarised in Table 5 and were set based on iterative simulations to achieve desired model results. Note that the column “Pump Rate” gives pump rates for individual pump units and that for HWD1, HWD2 and the Open Cut pit multiple pump units have been simulated.

Table 5 Modelled Pump Rates and Triggers

Source	Destination	Pump Rate	Trigger
ED2	MWD	11 L/s*	If >1 ML and MWD<1,175 ML, pump out
ED3	MWD	100 L/s	If >2 ML and MWD<1,299 ML, pump out
EDMIA	MWD	50 L/s	If >1 ML and MWD <782 ML, pump out
HWD1	MWD	100 L/s	If >15 ML and MWD <1,175 ML, pump out; if <8 ML, turn pump off
		200 L/s	If >25 ML and MWD <1,175 ML, pump out; if <15 ML, turn pump off
		100 L/s	If >35 ML and MWD <1,175 ML, pump out; if <25 ML, turn pump off
HWD2	MWD	100 L/s	If >10 ML and MWD <1,175 ML, pump out; if <8 ML, turn pump off
		200 L/s	If >12 ML and MWD <1,175 ML, pump out; if <10 ML, turn pump off
		100 L/s	If >14 ML and MWD <1,175 ML, pump out; if <12 ML, turn pump off
MWD	HWD1	50 L/s	If < 4 ML and MWD > 10 ML, pump out; if >8 ML, turn pump off OR if MWD > 1,299 ML, pump out
MWD	HWD2	50 L/s	If < 4 ML and MWD > 10 ML, pump out; if >8 ML, turn pump off OR if MWD > 1,299 ML, pump out
CWD1 and CWD2	HWD1 or HWD2 or Off-site	100 L/s	If >1 ML, pump out; if MWD < 782 ML pump to MWD else pump off site
Hunter River	MWD	200 L/s	If <504 ML, pump in; if >782 ML, turn pump off
MWD	Hunter River	100 ML/d	If >1,175 ML, pump out
Open Cut pit	HWD1	100 L/s	If >3 ML and HWD1<30 ML, pump out; if <1 ML, turn pump off
		200 L/s	If >40 ML and HWD1<30 ML, use 2nd pump; if<20 ML turn 2nd pump off
Open Cut pit	HWD2	100 L/s	If >3 ML and HWD2<15 ML, pump out; if <1 ML, turn pump off
		200 L/s	If >40 ML and HWD2<15 ML, use 2nd pump; if<20 ML turn 2nd pump off
RLD	MWD	100 L/s	If >0.1 ML and MWD<1,299 ML, pump out
SD1	HWD1	120 L/s*	If >2 ML and HWD1 not mined through, pump out
SD1	MWD or Open Cut pit†	120 L/s*	If >2 ML and MWD <1,175 ML, pump out to MWD else pump to Open Cut Pit
SD3	SD1	85 L/s*	If >1 ML, pump out
SD4	SD3	35 L/s*	If >1 ML, pump out
Fines Emplacement Area	MWD	110 L/s	If >'Dead' Storage volume** and MWD <1,299 ML, pump out

* In order to provide for full storage dewatering within five days, in accordance with Landcom (2004).
† Contingency pumping to Open Cut pit if HWD or MWD unavailable in order to dewater within five days.
** Varies from 1 ML to 58 ML during 10 year simulation period.

4.0 WATER BALANCE MODEL RESULTS

4.1 OVERALL SITE WATER BALANCE

Model predicted average inflows and outflows, averaged over all 121 realizations and the 10 year simulation period, are shown in Figure 10.

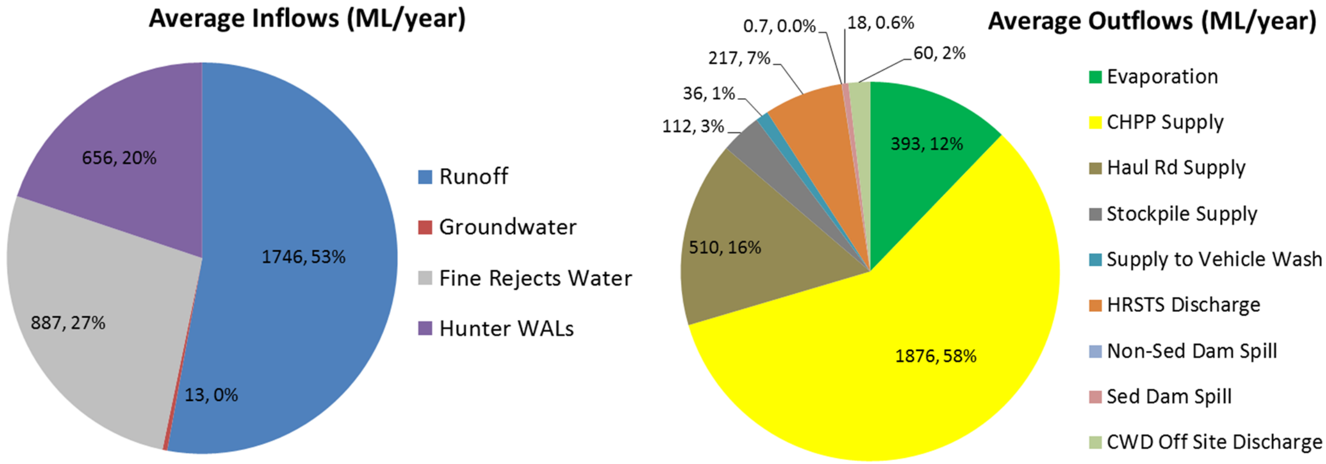

Figure 10 Average Modelled System Inflows and Outflows

Rainfall runoff provides the greatest average modelled system inflow, accounting for 53% of total inflows, followed by water liberated from settling fine rejects (27%). Licensed extraction (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%).

4.2 STORED WATER VOLUMES

Predicted total stored water inventory is shown in Figure 11 as probability plots over the simulation period. These probability plots show the range of likely total stored water volumes with the solid central plot representing the median (or the volumes that have an equal chance of being exceeded as not exceeded), the coloured upper and lower solid lines representing the $10^{th}/90^{th}$ percentile volumes and the broken upper and lower plots showing the $5^{th}/95^{th}$ percentile volume plots. There is a predicted 90% chance that the total water volume will fall in between the $5^{th}/95^{th}$ percentile volume plots. It is important to note that none of these plots represents a single climatic realization – these probability plots are compiled from all 121 realizations - e.g. the median volume plot does not represent model forecast volume for median climatic conditions.

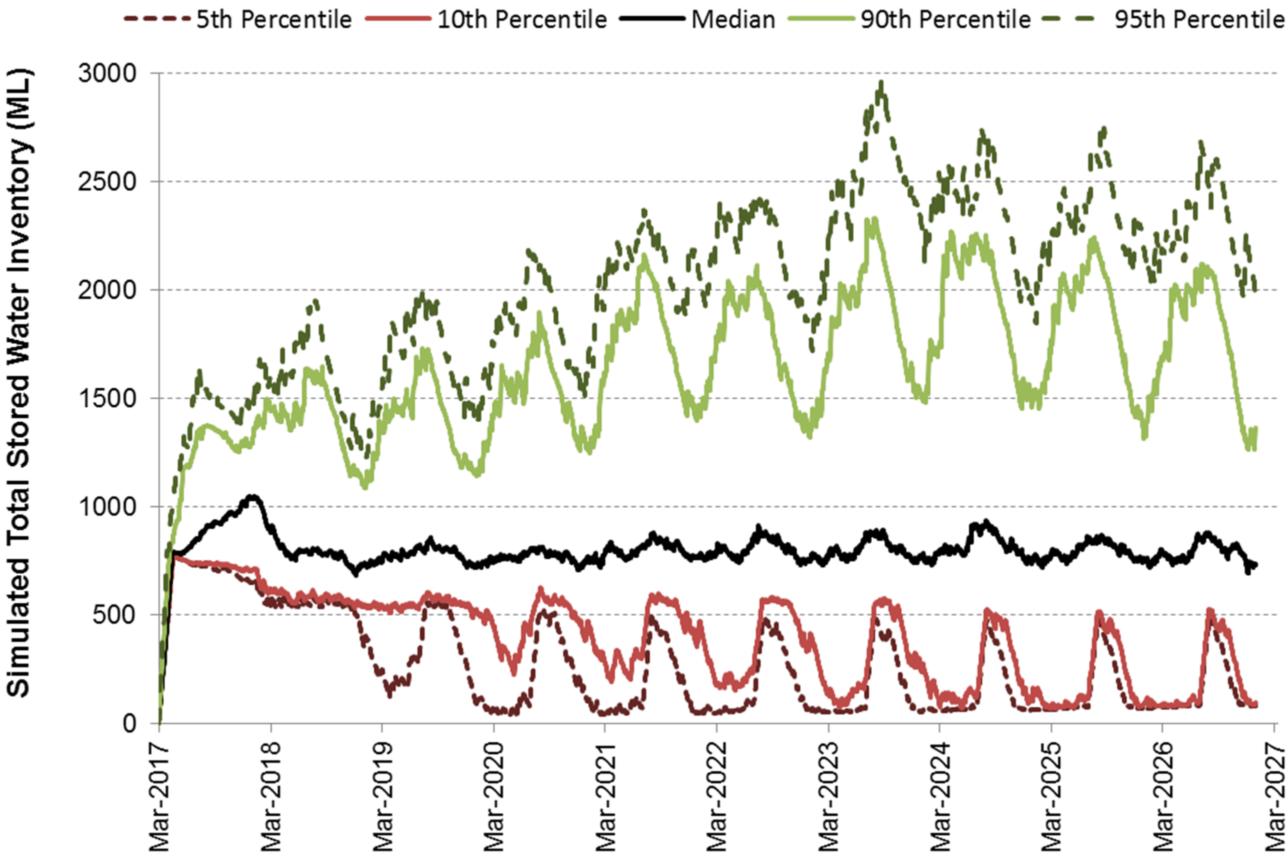

Figure 11 Simulated Total Stored Water Volume

The model results plotted in Figure 11 indicate that during the CHPP 'ramp up' period (refer Figure 8), the median total stored water volume on site is approximately 800 ML to 1,050 ML. Once the CHPP reaches full production, the predicted median volume fluctuates annually between a peak of approximately 900 ML in winter and 700 ML in summer.

The main water storage for the Mount Pleasant Operation is the MWD and Figure 12 provides a probability plot for the simulated volume in this storage.

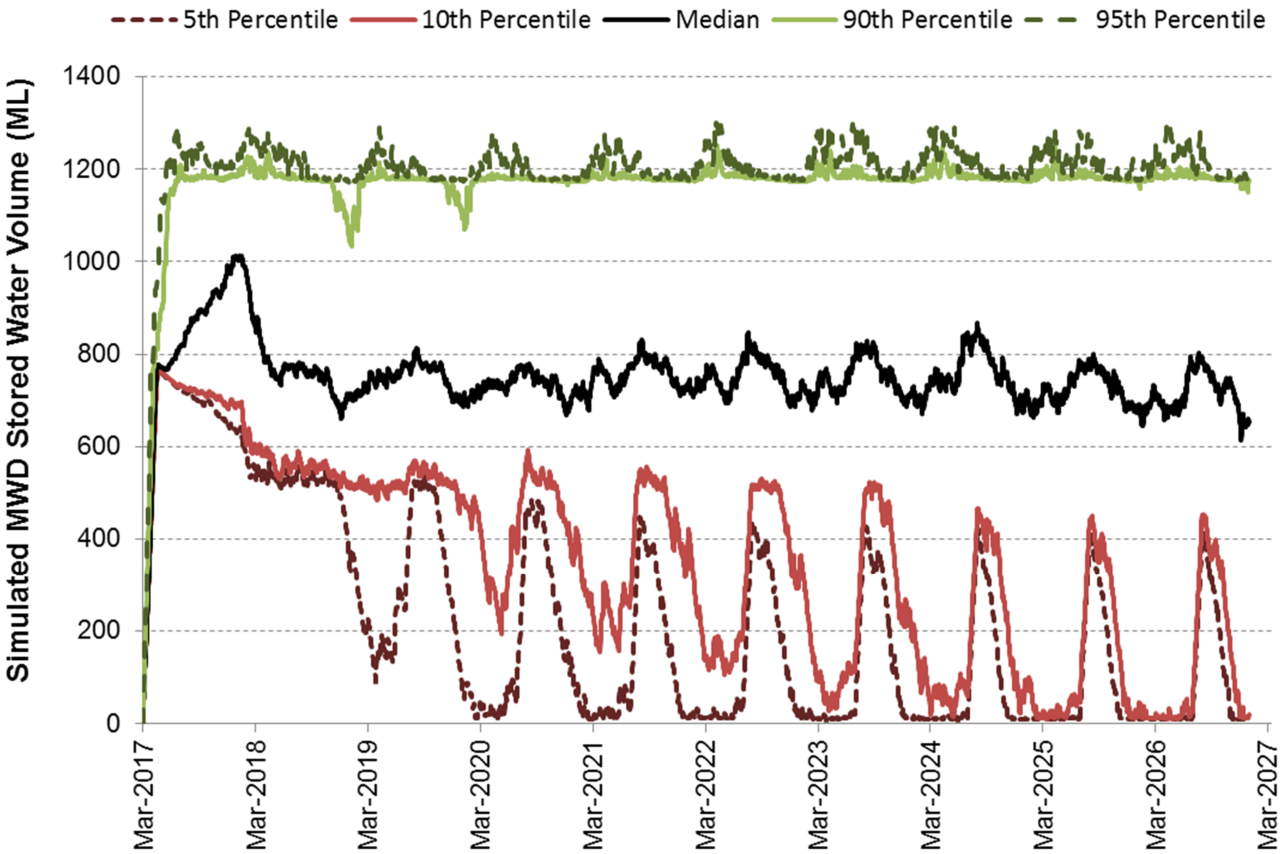

Figure 12 Simulated Stored Water Volume in the MWD

The model results plotted in Figure 12 are similar to those in Figure 11.

Excessive water stored in the Open Cut pit has the potential to disrupt mining hence it was a high priority during the design of the water infrastructure for the pit to be effectively dewatered. Figure 13 shows a ranked probability plot for the simulated volume in the Open Cut pit for four selected realizations: those with the highest, 90th percentile, median and lowest total catchment runoff for the simulation period.

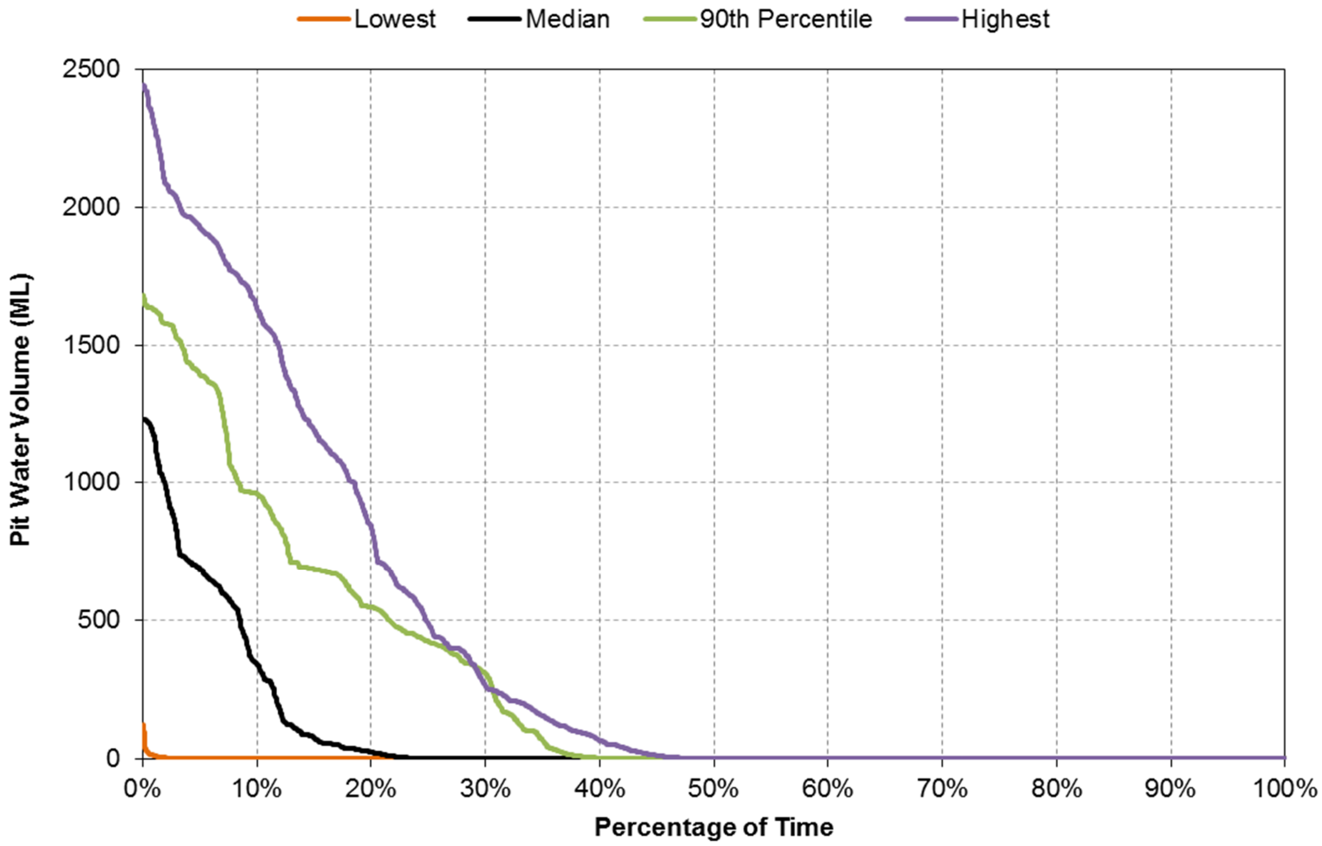

Figure 13 Frequency Plot - Simulated Stored Water Volume in the Open Cut Pit

The model results plotted in Figure 13 show, for example, that for the median runoff realization, the pit water volume is predicted to be below 340 ML for all but 10% of the time. However in the highest runoff realization, there is predicted to be at least 1,620 ML volume contained 10% of the time.

4.3 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, as well as the lowest single realization reliability (representing a simulated 'worst case' 10 year period), for CHPP supply, haul road dust suppression and stockpile dust suppression are summarised in Table 6.

Table 6 Summary of Modelled Water Supply Reliability

	CHPP Supply	Haul Road Dust Suppression	Stockpile Dust Suppression
Average	97.4%	97.0%	97.8%
Lowest	80.6%	72.9%	83.9%

An average 97.4% supply reliability is equivalent to 96 days lost operation over the 10 year simulation period, while 80.6% reliability equates to 707 days lost operation over that period.

The water balance modelling indicates that the lowest haul road dust suppression water supply reliability in any simulated climatic sequence 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.

4.4 HUNTER RIVER LICENSED EXTRACTION

A probability plot of predicted annual licensed extraction from the Hunter River via WALs for the simulation period is shown in Figure 14.

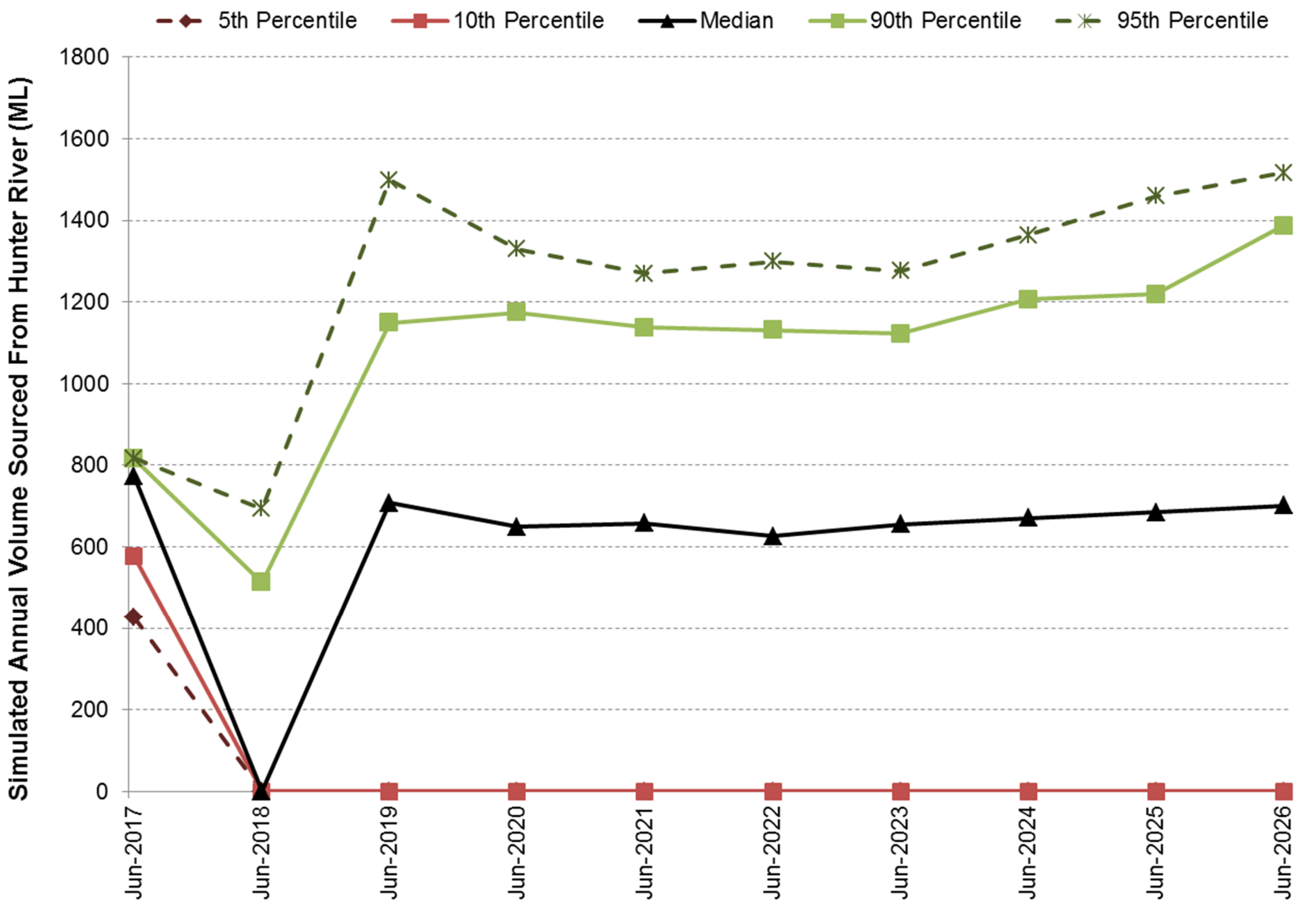

Figure 14 Predicted Annual WAL Extraction Volumes

The model results plotted in Figure 14 indicate that, following the CHPP ramp-up period, in the majority of years, at least approximately 700 ML would need to be sourced from the Hunter River.

4.5 LICENSED HRSTS RELEASE

A probability plot of predicted annual licensed release to the Hunter River via the HRSTS for the simulation period is shown in Figure 15.

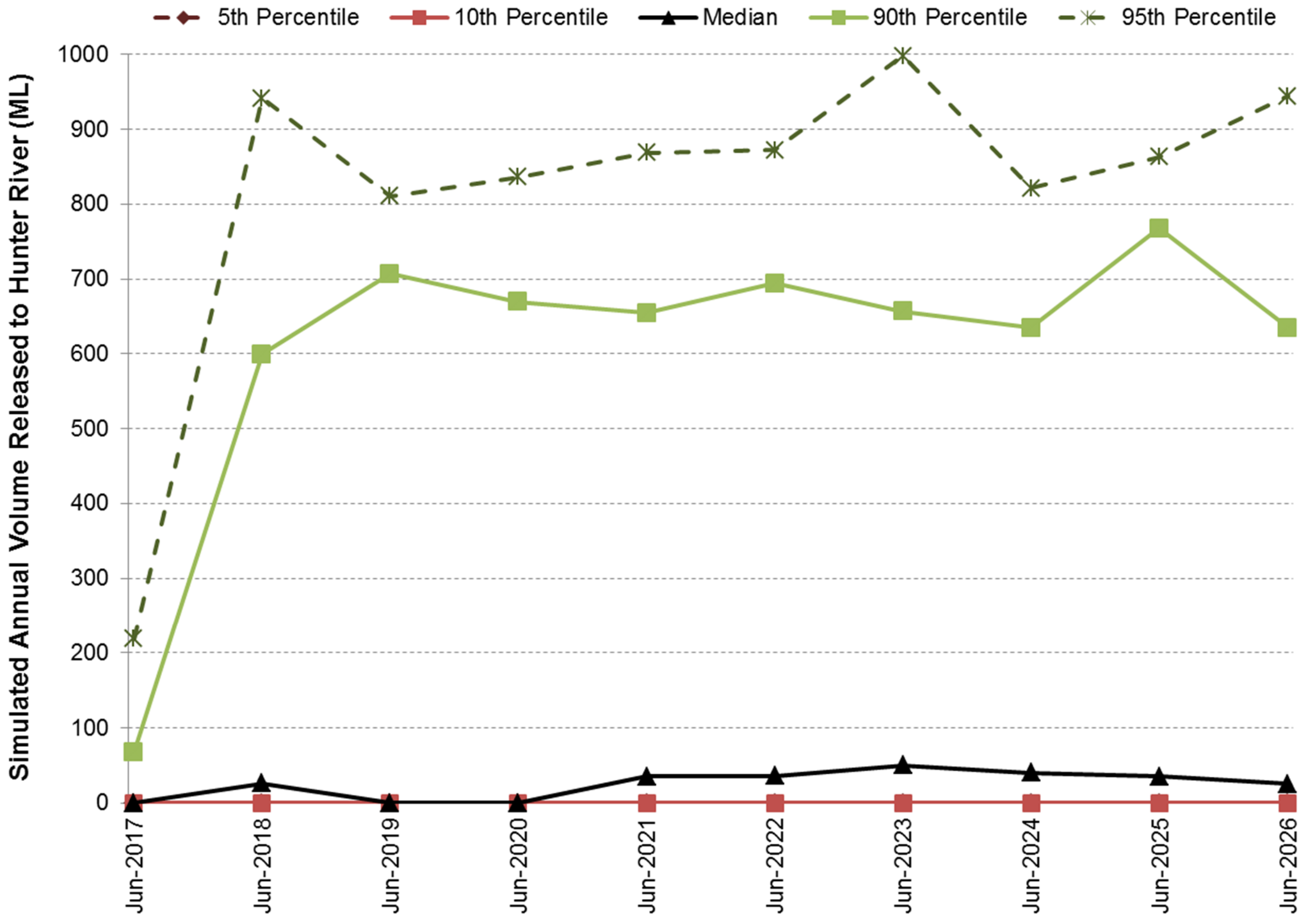

Figure 15 Predicted Annual HRSTS Discharge Volumes

The model results plotted in Figure 15 suggest that, in the majority of years little or no release would be required to the Hunter River. However, significant volumes may need to be released in some (higher runoff) years.

4.6 EXTERNAL SPILL

External spill results were used to nominate the required capacity of the storages on site based on the design criteria (refer Table 4). As such, simulated external spill from site storages was in line with these assumptions. No spills were simulated from the Fines Emplacement Area or the MWD.

4.7 SENSITIVITY ANALYSIS

A sensitivity analysis on predicted groundwater inflows was performed by varying the rates provided by HydroSimulations (2016) (refer Section 3.2.5) by +/- 20%. Given groundwater is a relatively small proportion of the total inflows to the system (contributing only 13 ML or less than 1% of inflows on average as shown in Figure 10), the sensitivity of model results to this value was negligible.

5.0 CONCLUSION

The Modification would not include any significant changes to the approved water management system at the site.

The incremental eastern extensions to the southern Eastern Out of Pit Emplacement would result in a small, temporary reduction (2.9%) of the total existing catchment area of three small tributary streams (including Rosebrook Creek) that drain eastwards to the Hunter River.

The catchment excision associated with these incremental extensions to the Eastern Out of Pit Emplacement is not anticipated to result in an increase to the total maximum excised catchment associated with the Mount Pleasant Operation (at any one time), due to the delay to the commencement of the approved North Pit. Therefore any potential incremental impacts from the Modification on the Hunter River catchment would be negligible.

Water management system modelling was undertaken for the Mount Pleasant Mine Environmental Impact Statement (ERM Mitchell McCotter, 1997) by PPK Environment & Infrastructure (1997). Notwithstanding, this report describes contemporary site water balance modelling and water management system design for the Mount Pleasant Operation (incorporating the Modification).

The site water balance modelling has predicted the:

- reliability of water supply;
- risk of (unlicensed) external spill occurring from site mine water storages; and
- risk of accumulation of excess water in the open cuts.

The outcomes of this modelling are not materially different to the approved outcomes of the water management system modelling presented in the Mount Pleasant Mine Environmental Impact Statement (ERM Mitchell McCotter, 1997), the only exception being less water is predicted to be drawn from the Hunter River for the Modification.

6.0 REFERENCES

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