Version: 3.0| **Released:** 29/03/2023 **Key Contact**: Environment Superintendent

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1 Preface

Hunter Valley Energy Coal Pty Ltd (HVEC) operates the Mt Arthur Coal Mine Complex (MAC), which consists of approved open cut and underground mining operations, a rail loop and associated rail loading facilities. The operations are located in the Upper Hunter Valley, NSW approximately five kilometres southwest of Muswellbrook.

Local hydrology comprises a number of ephemeral drainage lines and creeks flowing north and south-west towards the Hunter River. Quarry Creek, Whites Creek, and Ramrod Creek flow northwards while southwards flowing drainage lines report to Saddlers Creek which flows generally to the southwest and joins the Hunter River downstream of Denman. The Whites Creek Diversion directs runoff from undisturbed and rehabilitated mining areas around the north-eastern areas of the mine and discharges to a small tributary downstream of Denman Road and then to the Hunter River.

The water management system includes supplies drawn from clean water imported under licence to the mine from the Hunter River, mine water collected from runoff from the mine site, water recycling from the CHPP, treated effluent from Muswellbrook and fresh water from the potable water supply system (drawn from Muswellbrook town water) and water sourcing opportunities from the neighbouring Drayton Coal Mine under agreement. The network of on-site storages incorporates separation of undisturbed area runoff from mine water catchment areas. Runoff from areas disturbed by mining is diverted into on-site storages. These storages are used as priority sources of water for the CHPP and dust suppression.

The regional groundwater system consists broadly of three aquifer systems and includes:

- An extensive Quaternary alluvial aquifer system associated with the Hunter River and a smaller alluvial system associated with Saddlers Creek;
- A thin veneer of weathered bedrock (regolith) near ground surface; and
- The coal seams of the Permian Wittingham Coal Measures.

The groundwater quality of the alluvial aquifers is variable with the poorest quality water typically in the lower most extents of the basal gravel layer due to discharge from the underlying coal seam aquifers. The variation in quality in the alluvial aquifers reflects the dominant source of recharge, whether it be from the underlying coal measures resulting in very poor water quality, or recharge from rainfall or the Hunter River itself where fresher water results. Mining has resulted in localised changes to the groundwater gradient with discharge from the coal seams to the pit voids in the vicinity of open cut mining.

MAC is committed to minimising the impact of its operations on the local environment and community and has in place strict controls to monitor and manage these impacts.

A detailed description of the project can be found in the Environmental Assessment and supporting documents supplied in support of the modification to the Mt Arthur Coal Mine Open Cut Consolidation Project Approval 09_0062 MOD1 approved 26 September 2014.

2 Legislation, Standards and Regulations

2.1 Relevant Legislation and Regulations

Key legislation applicable to the management of water at MAC include but are not limited to:

- Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act);
- Protection of the Environment Operations Act 1997 (NSW) (PoEO Act);
- Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002;
- Water Act 1912;
- Water Management Act 2000; and
- Water Sharing Plans:
  - Water Sharing Plan for the Hunter Regulated River Water Source 2016;
  - Water Sharing Plan for the Hunter Unregulated and Alluvial Water Source 2009; and
  - Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016.

Key statutory approvals associated with water management are:

- Mt Arthur Coal Mine Open Cut Consolidation Project Modification 1 (PA 09_0062 MOD 1) (the Project Approval); and
- Environmental Protection Licence (EPL 11457).

2.2 Project Approval

The Project Approval was assessed under the EP&A Act and PA 09_0062) and granted on 26 September 2014. A list of the relevant conditions of the approval and where they are addressed in this Water Management Plan (WMP) is found in Appendix 8, Table 6.

2.3 Environment Protection Licence

Environment Protection Licence 11457 (EPL11457) was granted under the PoEO Act and prescribes the licensed discharges to water including locations of discharge points, concentration limits, volume limits and monitoring and recording limits. A list of the relevant conditions of the EPL and where they are addressed in this WMP is found in Appendix 8, Table 7.

2.4 Relevant Standards and Guidelines

MAC has well-established management systems that are aligned with the international environmental and safety management system standards ISO 14001 and ISO 45001. The management systems provide a framework to support the planning, implementation, monitoring and review of MAC's Water Management Systems, facilitating continual improvement in the performance of water management activities. The management systems include internal policies, subordinate plans and technical procedures that are referenced within this WMP.

2.5 Surface and Ground Water Licences

MAC also holds water access licences (WALs), water supply works and water use approvals under the Water Management Act 2000 for extraction of water from the Hunter River, under the Water Sharing Plan for the Hunter Regulated River Water Source 2016. All water licences held by MAC that are allocated for use in mining related activities are summarised in Table 1

Table 1: MAC Water Licences allocated for use in mining activities

WAL number	Work approval	Entitlement (Unit Shares)	Lot DP of Extraction Point Location	Water Sharing Plan, Source and Management Zone
WAL 917 (20AL201126)	20WA201128, 20WA203496	2197	3 DP387021	Water Sharing Plan for the Hunter Regulated River Water Source 2016, Hunter Regulated River Water Source (High Security), Zone 1A
WAL 918 (20AL201127)	20WA201128, 20WA203496	3564	3 DP387021	Water Sharing Plan for the Hunter Regulated River Water Source 2016, Hunter Regulated River Water Source (General Security), Zone 1A
WAL 1296	20WA201128, 20WA203496	301	3 DP387021	Water Sharing Plan for the Hunter Regulated River Water Source 2016, Hunter Regulated River Water Source (Supplementary Water), Zone 1A
WAL 18141	20CA207877	104	4 DP29451	Water Sharing Plan for the Hunter Unregulated and Alluvial Water Source 2009, Hunter Regulated River Alluvial Water Source, U/S Glennies Creek
WAL 18175	20CA208185	13	3 DP806149	Water Sharing Plan for the Hunter Unregulated and Alluvial Water Source 2009, Hunter Regulated River Alluvial Water Source, U/S Glennies Creek
WAL 18247	20CA 208013	247	5 DP29451	Water Sharing Plan for the Hunter Unregulated and Alluvial Water Source 2009, Hunter Regulated River Alluvial Water Source, U/S Glennies Creek
WAL41495	20MW065024	750	13 DP228159	Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016, Sydney Basin-North Coast Groundwater Source
WAL 41556	20MW065024	250	13 DP228159	Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016, Sydney Basin North Coast Groundwater Source
WAL 41557	20MW065024	10	13 DP228159	Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016, Sydney Basin-North Coast Groundwater Source

3 References

3.1 External Documents

- NSW EPA Environmental Protection Licence 11457
- Department of Planning, Minister of Planning's Project Approval document (dated 26 September 2014, Application Number 09-0062, Mt Arthur Coal Mine – Open Cut Consolidation Project.
- Hansen Bailey (2009), Mt Arthur Coal Consolidation Project Environmental Assessment. Prepared for Hunter Valley Energy Coal Pty Ltd.
- Australasian Groundwater and Environmental Consultants Pty Ltd (2009). "Mt Arthur Coal Consolidation Project Environmental Assessment – Appendix N Groundwater Impact Assessment". Report prepared for Hunter Valley Energy Coal Pty Ltd November.
- Australasian Groundwater and Environmental Consultants Pty Ltd, (2013). Groundwater Impact Assessment, Mt Arthur Coal Open Cut Modification. Report prepared for Mt Arthur Coal. Project No. G1602. January 2013
- Gilbert and Associates (2009). "Mt Arthur Coal Consolidation Project Environmental Assessment – Appendix M Surface Water Assessment". Report prepared for Hunter Valley Energy Coal Pty Ltd November.
- Minerals Council of Australia (1997), "Mine Site Water Management Handbook"
- Protection of Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002
- URS Australia Pty Limited (2000) The Mount Arthur North Coal Project, Environmental Impact Statement. Prepared for Coal Operations Australia Limited.
- Standards Australia (1998), "Water quality - Sampling - Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples", Australian/New Zealand Standard AS/NZS 5667.1:1998, Sydney.
- Resource Strategies (2013), Mt Arthur Coal Open Cut Modification – Prepared for Hunter Valley Energy Coal Pty Ltd.
- SLR Consulting Ltd (SLR), 2020. Mount Arthur Coal, Groundwater Modelling Report. Prepared for BHP, 660.20103-R01, V3. November 2020.
- HydroSimulations, (2019). Maxwell Project Groundwater Assessment. Prepared for Malabar Coal Limited. HS2018/44. July 2019.
- Barnett, B., Townley, L.R., Post, V., Evans, R.E., Hunt, R.J., Peeters, L., Richardson, S., Werner, A.D., Knapton, A. and Boronkay, A., (2012). Australian Groundwater Modelling Guidelines. Waterlines Report Series No. 82, June 2012.

3.2 Mt Arthur Coal Internal Documents

- MAC-STE-REG-013 Mt Arthur Environmental Compliance Register
- MAC-ENC-MTP-041 Environmental Management Strategy
- MAC-ENC-PRO-060 Erosion and Sediment Control Plan
- MAC-ENC-PRO-073 Hunter River Water Discharge Procedure
- MAC-ENC-PRO-080 Rehabilitation and Ecological Monitoring
- MAC-ENC-PRO-084 Water Monitoring Procedure
- MAC-STE-STD-181 Performance Standard – Inrush

4 Purpose

This Water Management Plan (WMP) has been prepared to satisfy the requirements of Schedule 3, Condition 29 of the Mt Arthur Coal Mine – Open Cut Consolidated Project Approval 09_0062, with the exclusion of the Erosions and Sediment Control Plan, which has been developed as a standalone plan as referenced in this document.

The WMP details relevant water quality impact assessment criteria, associated response procedures and compliance checking procedures for subsequent reporting in accordance with the relevant regulatory requirements for MAC.

The key purposes of this WMP are to:

- Ensure all relevant statutory requirements are met;

- Ensure applicable best practice water management tools are employed to mitigate the impact of mining operations on surrounding surface water and groundwater bodies;
- Maintain an effective response mechanism to deal with issues and complaints; and
- Set out a water management strategy that, as far as practicable, minimises the potential for surface water and groundwater quality to deviate outside of applicable criteria

5 Scope

This document applies to the management of both groundwater and surface water that has the potential to be impacted by activities undertaken at HVEC or companies contracted to undertake activities on its behalf.

Schedule 3, Condition 29 of the Mt Arthur Coal Mine – Open Cut Consolidated Project Approval 09_0062 MOD1 requires the WMP to include a:

- Site Water Balance;
- Erosion and Sediment Control Plan;
- Surface Water Monitoring Program;
- Groundwater Monitoring Program; and
- Surface and Ground Water Response Plan.

5.1 Included

- Site Water Balance;
- Surface Water Monitoring Program;
- Groundwater Monitoring Program; and
- Surface and Ground Water Response Plan.

5.2 Excluded

- The Erosion and Sediment Control Plan, is excluded from this WMP, it is addressed in a standalone plan, MAC-ENC-PRO-060 Erosion and Sediment Control Plan; and
- The proposed Mt Arthur Underground operation is not included in this plan. The management plan will be reviewed and updated prior to the commencement of underground operations.

6 Consultation and Communication

The original version of the WMP was prepared in 2011 in consultation with EPA and NSW Office of Water (NOW) and approved by the Department of Planning and Infrastructure in 2012. Subsequent versions are submitted to the Department of Planning and Environment for review and approval.

In addition to formal consultation previously undertaken relating to the WMP, Mt Arthur Coal has extensive consultation and communication processes, including:

- A comprehensive community engagement program which includes the establishment of a Community Consultative Committee (CCC);
- Consultation with Muswellbrook Shire Council (MSC);
- A community response line (1800 882 044) enables members of the community to contact Mt Arthur;
- Regular reporting on the environmental performance of the project on the BHP Mt Arthur Coal website; and
- Publicly available project approvals, environmental and other related documentation (annual reports, complaints register, CCC minutes etc.) via the BHP Mt Arthur Coal website.

7 Roles and Responsibilities

The maintenance and update of this WMP is the responsibility of the Environment Superintendent. Responsibilities with respect to implementation of operational controls are defined within this plan and referenced in operational control documentation.

8 Site Water Balance

8.1 Existing Water Environment

Environmental assessments were conducted by URS (2000), Hansen Bailey (2009) and Resource Strategies (2013) for the approved operations. These includes surface water and groundwater assessments.

A summary of the surface water and groundwater regime relevant to site is included below based on previous assessments and current information. A more comprehensive description of the local and regional surface water and groundwater resources is provided in Appendix B and Appendix C of the Modification Project Environmental Assessment.

In addition, reference / baseline data relevant to the program are provided in this document in Appendices 3, 5 and 6.

8.1.1 Surface Water Catchment Context

The surface topography at MAC varies between approximately 127 metres (m) Australian Height Datum (AHD) to the northwest of the site along Whites Creek and rises up to a maximum of approximately 465 mAHD on the top of Mt Arthur to the south of the site.

Surface drainage generally comprises ephemeral creeks with headwaters within the Project Area flowing north and south-westwards, ultimately draining into the Hunter River. Within MAC, the surface areas are drained by Saddlers Creek and its tributaries to the southeast, as well as Quarry Creek, Whites Creek and Ramrod Creek that all flow towards the Hunter River.

Saddlers Creek is an ephemeral creek that is around 5 to 10 m wide and consists of sand, silt and scattered woody debris (EcoLogical, 2019). Historically, high flow events occurred in response to rainfall events, with available data indicating the majority of stream flow occurred in the summer months, from January to March, with negligible flows from July to December.

Within the region, the Hunter River is around 20 to 50 m wide, and the river flows in a south to south-easterly direction. Flows within the Hunter River are monitored at gauging stations under the Hunter Integrated Telemetry System (HITS) operated by WaterNSW. The Hunter River has perennial flows, generally ranging between 100 ML/day and 1,000 ML/day.

8.1.2 Groundwater Context

The site occurs within the Sydney Basin, which comprises Permian aged Wittingham Coal Measures. The Wittingham Coal Measures include the Jerrys Plains Subgroup, Archerfield Sandstone and Vane Subgroup and Saltwater Creek Formation, which overlie the Maitland Group and Greta Coal Measures. At site the economic coal seams in the Wittingham Coal Measures are mined, from the Blakefield Seam to the Ramrod Creek Seam. The coal seams generally dip about 5 degrees toward the west-south-west. The structure of the coal measures and seam sub-crop are influenced by the Muswellbrook Anticline at the north-east end of site, where the Greta Coal Measures occur at surface in the historical Drayton Mine area. The Calool Syncline also trends in a north-south direction at the southern end of site and is associated with Triassic aged volcanic intrusions and sills (SLR, 2020).

Quaternary alluvium is present along the Hunter River and Saddlers Creek, and colluvium and regolith (weathered coal measures) is present in localised areas along drainage lines. The Hunter River alluvium generally comprises surficial clays underlain by sands and gravels. The alluvium can be variably saturated spatially and temporally, with unconfined groundwater conditions and fresh to brackish water quality. The alluvium is recharged from rainfall and streamflow. The water levels in the alluvium are generally 5 to 10 m below surface and approximately 2 m below the base of the Hunter River, indicating variable losing conditions depending on peak flood events. There is also potential for upward seepage from the underlying Permian coal measures where gradients enable this. Groundwater flow in the alluvium generally follows the Hunter River flow direction and topography (Umwelt, 2021a).

The Saddlers Creek alluvium is unconfined and recharged from occasional streamflow and rainfall, with potential recharge from water storage facilities in localised areas (SLR, 2020). The alluvium also potentially receives upward seepage from the underlying coal measures, with coal seams occurring at subcrop beneath the alluvium.

The water levels in the alluvium have been recorded around 3 to 10 m below surface, indicating losing conditions. However, gaining conditions can occur downstream near the confluence with the Hunter River. The water quality in the alluvium along Saddlers Creek has been characterised as moderately saline (SLR, 2020).

The Permian coal measures include the hydraulically ‘tight’ interburden sequences of siltstone and sandstone, and the coal seams that exhibit secondary porosity associated with the fractures and cleats in the coal. The coal measures occur at subcrop in the north and east of MAC where groundwater conditions are semi-confined, becoming confined with depth. The coal measures are recharged by rainfall and downward seepage from overlying alluvium, regolith and spoil. Groundwater flow in the coal measures is locally influenced by mining at MAC, Drayton and Bengalla, but is generally towards the south. The water quality is moderately saline (SLR, 2020).

8.2 Water Sources and Security

The water management system relies on water obtained from a number of different sources as follows:

- site runoff and groundwater seepage captured within the water management system;
- licensed extraction from the Hunter River;
- water recycling from the CHPP (including tailings water);
- treated effluent from Muswellbrook;
- fresh water from the potable water supply system (drawn from Muswellbrook town water); and
- third party supplied water where it can be beneficially used (e.g.: mine water from neighbouring mines).

Further detail on these sources is provided in Section 8.4.

8.3 Water Management Strategy

The objectives of the water management strategy are:

- To maintain a low risk of uncontrolled discharge occurring from the water management system.
- To minimise the need to discharge water to the Hunter River by maximising re-use on site.
- To minimise the need to extract water from the Hunter River by optimising the reuse and recycling of water on site and by maximising the use of Muswellbrook treated effluent.
- To minimise risks of disruption to mining operations by efficient mine dewatering.
- To ensure that effective control over emission of airborne particulates is uninterrupted by maintaining a reliable water supply.
- To ensure uninterrupted operation of the CHPP by maintaining a reliable water supply.

MAC will be guided in its decisions on sourcing or discharging water using the site water balance model (refer Section 8.8) which enables prediction of future water supply security and risks of excess open cut pit water.

MAC categorises water into three types to effectively manage water, and to mitigate any potential for environmental harm to occur. Each type of water requires different management measures to minimise the risk of contamination of downstream drainage systems. A description of the water quality and potential sources for the three categories of water are summarised in Table 2.

Table 2: Water Categories and Design Criteria

Water Category	Description	Target Design Criteria
Clean Water	Runoff from undisturbed or rehabilitated areas where vegetation is fully established and where the water quality is suitable for release/discharge.	Overland flow where practicable, to downstream environment.
Runoff Water	Runoff from disturbed areas that is unlikely to have the potential to generate elevated salinity and/or contain pollutants other than suspended solids.	Managed in accordance with the guidelines in Landcom (2004) (Managing Urban Stormwater: Soils and Construction Volume 1 and Volume 2E).
Mine Affected	Water runoff exposed to coal or used in coal processing. Mine water includes water associated with groundwater inflows into open cut pits. This water may be highly saline and/or contain pollutants such as hydrocarbons.	Contained within the mine water management system, for events up to and including the 1% Annual Exceedance Probability (AEP), 24 hour storm event (equivalent to the 100 year Average Recurrence Interval (ARI), 24 hour storm event). Contained water will be preferably reused, if necessary releases must be from the licensed discharge point documented within EPL 11457.

8.4 Water Management System

The MAC water management system includes:

- clean water from undisturbed and rehabilitated areas,
- sediment laden water treated through sediment control structures prior to flowing from site,
- mine water collected from runoff from the mine site,
- mine water collected from groundwater seepage in to the pit,
- water recycled from the Coal Handling and Processing Plant (CHPP),
- supplies drawn from water imported under licence to the mine from the Hunter River,
- treated effluent from the MAC main effluent treatment plant,
- treated effluent from Muswellbrook and potable water from Muswellbrook for the potable water supply system , and
- excess mine water from neighbouring mines where it can be reused beneficially.

Figure 1: Surface Water Catchment Areas shows surface water catchments and major storages, Figure 2 provides an illustration of the mine water management system in schematic form, with all major storages and inter-storage linkages.

Supply

Water supply for the CHPP and other non-potable uses on site is obtained from a network of on-site storages (dams and open cut pit voids), which provide containment for mine water. On-site storages are used as priority sources of water for the CHPP and dust suppression. Water is also sourced from Muswellbrook Shire Council's waste water treatment plant. The treated water is stored for beneficial reuse in the Dirty Water Dam.

Licensed extraction from the Hunter River occurs from a pumping station on the Hunter River to the Environmental Dam, with transfer to other on-site storages as required (refer Figure 1 and Figure 2). Mt Arthur Coal presently holds both General Security Entitlements (GSE), High Security Entitlements (HSE), and Supplementary Entitlements. The volume of water that can be extracted from the Hunter River by licence holders is limited by Available Water Determinations (AWDs) which are announced by the NSW Department of Planning and Environment (Water NSW) on the 1st July each year (the start of the water year) and then periodically thereafter. Refer to Section 2.5 for Hunter River extraction licence details.

Runoff from areas disturbed by mining and groundwater seepage to open cut pits report to the network of on-site storages (dams and open cut pit voids) – refer Figure 1. Refer to Section 2.5 for a summary of approvals for open cut interception of groundwater.

Storage

The network of on-site storages separates undisturbed area runoff from mine water catchment areas. Runoff from areas disturbed by mining is diverted into on-site storages or to active open cuts. The total target operational capacity of the existing on-site water storages totals 11,607 ML.

Treated effluent pumped from Muswellbrook into the Dirty Water Dam where it is stored for reuse. Treated effluent from the onsite Sewer Treatment Plant is directed to a wetland system for further treatment before being transferred to the mine water system for reuse.

Water from the Hunter River can be pumped directly to the Environmental dam where it can be stored. It can also be transferred and stored in the network of on-site storages.

Users

The CHPP, which is the dominant user of water on site, incorporates a tailings thickener and water recovery system to facilitate water recycling. The other significant water use is dust suppression on haul roads and coal stockpile areas. The main CHPP water supply storage is the Dirty Water Dam. Truck fill storages are positioned strategically to provide water for haul road dust suppression.

Runoff and Release of Water from site

Runoff from haul roads and open cut pre-strip areas is either directed to on-site storages or where they are not impacted by contaminants other than suspended solids to sediment dams. Potentially sediment impacted runoff water is managed in line with the Blue Book (Managing Urban Stormwater: Soils and Construction Volume 1 and Volume 2E), (refer ESCP). Runoff from upslope undisturbed areas is diverted where possible around mine operations. Runoff from fully rehabilitated areas is likewise, where possible, directed offsite, via sediment dams if needed.

Controlled releases of mine water from site to the Hunter River may only occur from the Environmental Dam under the Hunter River Salinity Trading Scheme (HRSTS), see Section 8.5.

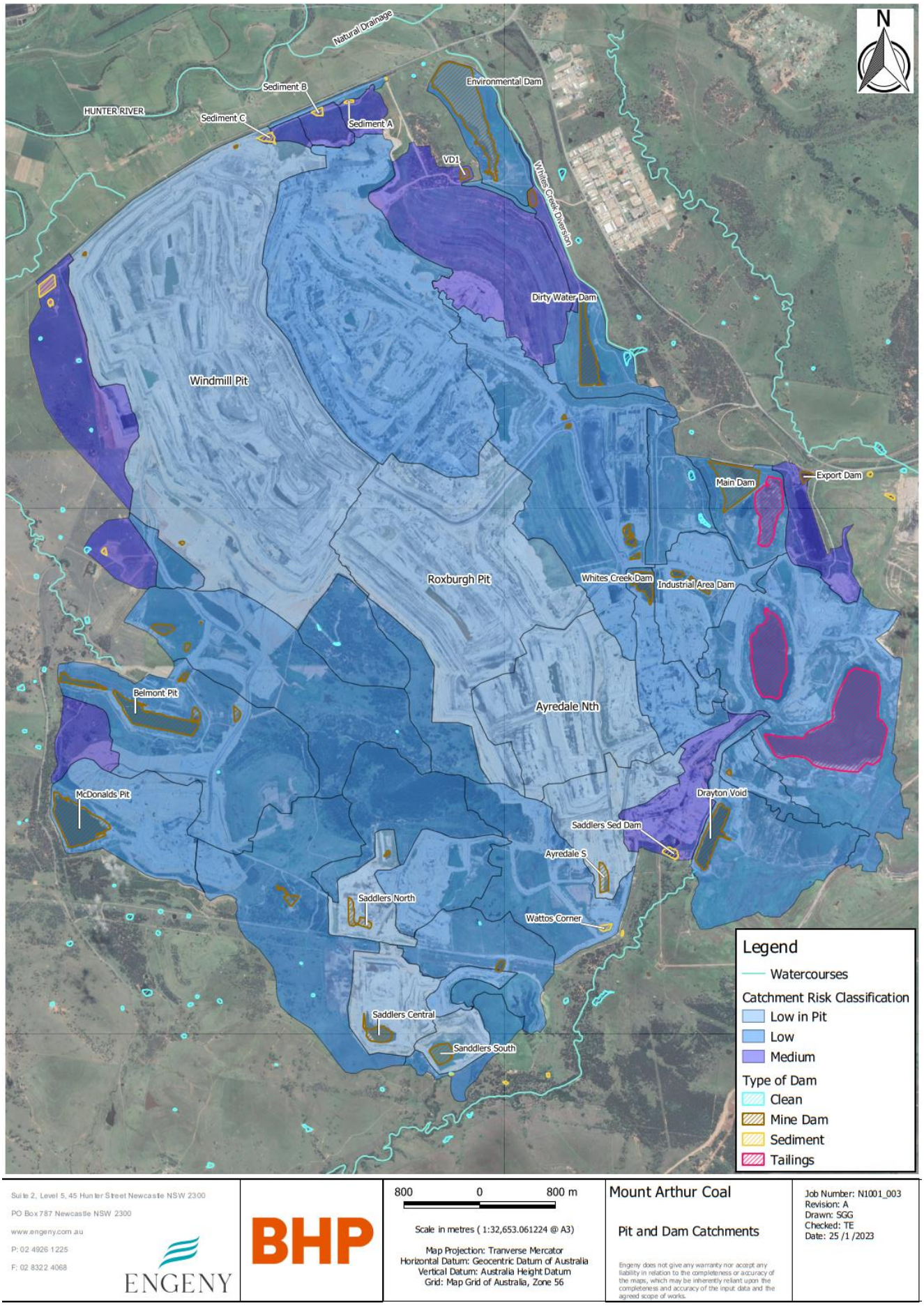


Figure 1: Surface Water Catchment Areas and Water Storages

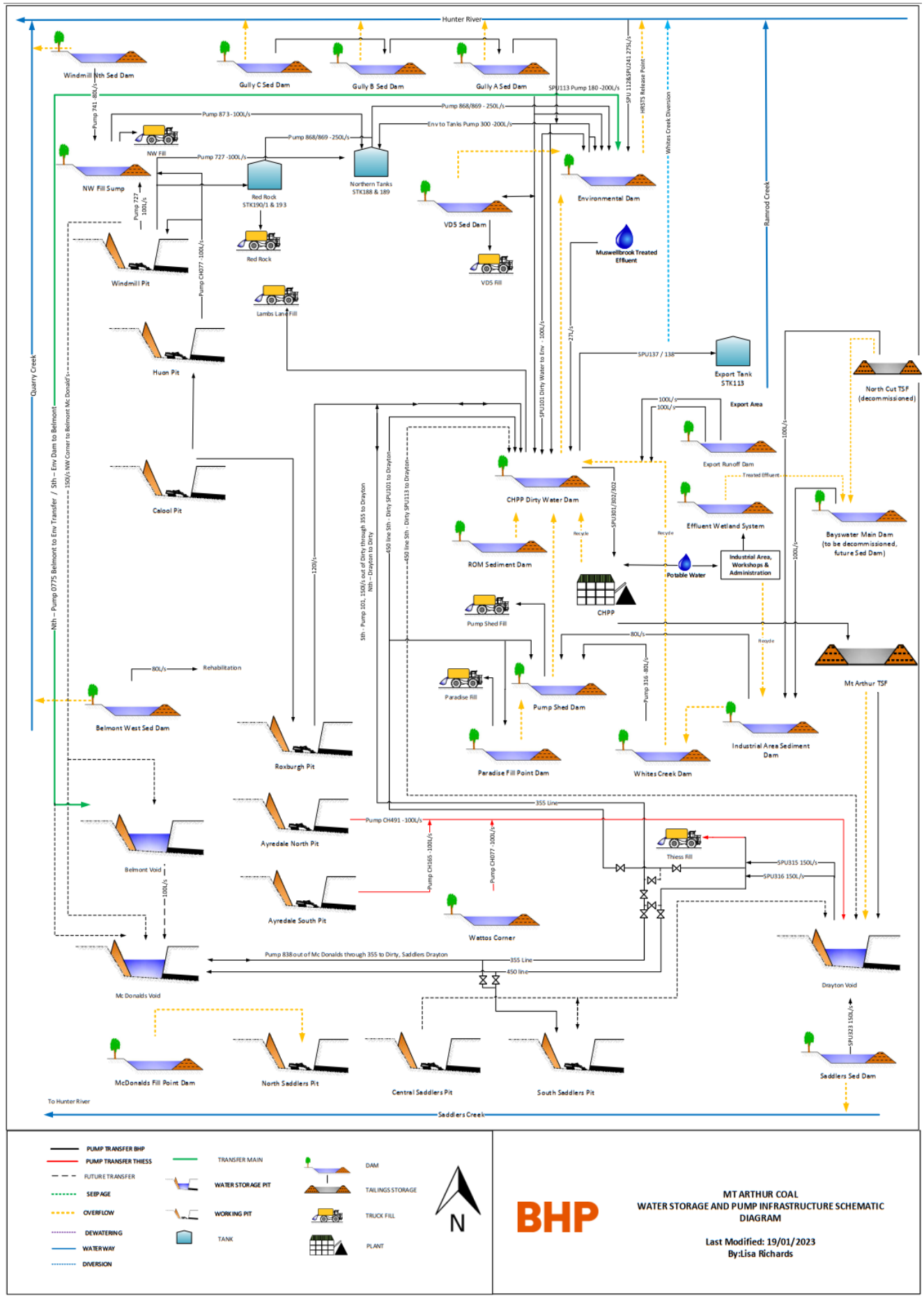


Figure 2: Water management schematic

8.5 Off-site Transfers

As indicated in Section 8, excess Mine Water from the site may be transferred off-site via controlled release from the Environmental Dam to the Hunter River with quality and volume limited in accordance with the HRSTS and EPL 11457.

The HRSTS was established to manage the discharge of saline waters to the Hunter River, such that salt concentrations would be maintained below irrigation and environmental standards. The scheme is managed by the EPA under the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002.

The scheme attempts to achieve these objectives by prohibiting releases of saline waters during periods of low flow and controlling releases of saline water during periods of high flow such that specific salinity targets at various points in the river are not exceeded. The operational parameters used to regulate the scheme are advised on a daily basis for each of the various sections of the Hunter River.

Participants in the scheme are issued with tradable discharge credits. Each credit entitles the holder to a 0.1% share of the available salt discharge capacity announced during high flow periods. The amount of saline water that may be discharged from a given discharge EPL holder is determined by reference to the salinity of the discharge waters, the river flow, the number of credits held and any overriding limit that may be applied as a condition of the EPL.

The specific operational process for discharging in accordance with the HRSTS requirement are detailed in MAC-ENC-PRO-073 Hunter River Water Discharge Procedure. The procedure is managed within the MAC document control system.

8.6 Measures to Minimise Water Use

A range of measures are applied to minimise water use on site, including:

- A number of trials have been conducted in order to examine possible ways in which use of water for dust suppression can be reduced. Chemical Dust suppressant additives are used across the site on main haul roads.
- Wherever possible direct recovery of tailings water is undertaken to maximise water reuse. Opportunities to improve water recovery from tailings are regularly explored.
- Pumping and reticulation infrastructure is planned and budgeted annually to ensure pumps and pipelines are in place for the efficient dewatering and transfer of water across site from non-active voids to key consumption points (i.e. CHPP and water cart fill points) and minimise the need, dependent on climatic conditions, to source water from the Hunter River.
- Exploring and maximising all possible water sharing opportunities between neighbouring mining operations, utilities and industries such as reuse of effluent water from the Muswellbrook Sewage Treatment plant, and the importation of mine affected water from other mine sites.

8.7 Measures to Mitigate Groundwater Leakage from Alluvial Aquifers

Groundwater leakage from alluvial aquifers must be minimised, prevented or offset, particularly for the Hunter River and Saddlers Creek alluvial.

Open cut mining operations within 150 metres of the Hunter River alluvials and Saddlers Creek alluvials that has not been granted approval under previous consents/approvals is not to be undertaken without the prior written approval of the Secretary.

Approval for mining within 150m of the Hunter River alluvial was granted by the secretary by the approval of the previous Surface and Groundwater Response Plan dated 28 April 2018, and approval from the National Recourse Access Regulator received on 21 June 2013 and for the extension of the barrier cut off wall on 7 November 2019.

To protect the Hunter River alluvial as approved by the secretary a combined groundwater cut-off wall and flood levee has been constructed parallel to Denman Road along the northern boundary of the site to prevent both surface and subsurface migration from the Hunter River to the active mining pit. The cut-off trench is composed of a soil-bentonite slurry mixture and is constructed from the crest of the embankment levee to the top of the weathered sandstone/siltstone to an average depth of approximately ten metres. The levee bank is constructed to provide protection from a 1 in 1000-year flood event.

There has been no mining within 150m of Saddlers Creek alluvial that was not approved under previous consents/approvals, and at this time there is none planned. Should this change an approval process will be undertaken prior to mining within 150m.

8.8 Water Balance Model

A predictive site water balance model has been developed using modelling software. The structure of the model is generally as per the schematic of the water management system in Figure 2.

The water balance model can be used to assess the capacity of the water management system to achieve its operational objectives. Modelling has involved simulating the dynamic water balance of the storage components in the water management system over a forward planning period under the variable climatic conditions that may be encountered. The water balance model developed for the project simulates all the inflows, outflows, transfers and changes in storage of water on site on a daily continuous basis to predict future water supply reliability.

The model is used as an operational and management planning tool to predict water source security and ensure effective water storage capacity is maintained. The model will be reviewed every two years to ensure accuracy, as a reliable water supply is crucial to the continued operation of the mine.

8.9 Groundwater Model Prediction Validation Process

Groundwater predictions (mine inflows and groundwater levels/drawdown) are calculated using a groundwater model developed to support the current approved mine. In order to validate the model performance, groundwater level predictions will be compared to observed data on an annual basis.

The groundwater model will be reviewed every five years and, if required, updated and recalibrated to reflect operational or water management changes.

The most recent model review was undertaken in 2020 by SLR (2020), the model review predictions were generally consistent with the predictions of AGE, 2013. The difference in predictions between the current model and the AGE (2013) are attributed to better stratigraphic vertical resolution and a better understanding of the extent of the alluvium, regolith and Permian depth. The cut-off wall constructed between the Windmill Open Cut and Hunter River alluvium was also included in the model.

As part of the review process an updated numerical groundwater model was developed by SLR (2020) based on the HydroSimulations (2019) model. The regional-scale model was developed in MODFLOW-USG code with 31 layers representing the alluvium, regolith and Permian coal measures. The model grid was developed with a Voronoi mesh with refinement along creeks, mine areas and the cut-off wall. General head boundary conditions were applied along the model edges and the model extent captures the Maxwell Project, historical Drayton Mine workings, Bengalla Mine and Mt Pleasant Mine. The model included a pre-mining steady state model, transient warmup model (pre-mining to 2001) and transient calibration model (January 2001 to March 2020). The model calibration provided an acceptable match with observed water levels and historical inflows in accordance with the Australian Groundwater Modelling Guidelines (Barnett et al., 2012). The updated model included a predictive period from 2020 to 2047 with quarterly stress periods representing the progression of approved mining at site, as well as capturing cumulative impacts associated with surrounding mining.

The model predictions were generally consistent with the predictions from AGE (2013) report. Further details of the up to date site groundwater model are included in the model report (SLR, 2020). The key conclusions from the SLR (2020) groundwater model update are summarised as follows:

- Negligible groundwater drawdown in the alluvium of Saddlers Creek consistent with previous predictions;
- Localised drawdown of up to 5 m within the alluvium along Hunter River. The extent of predicted drawdown in the alluvium are slightly less compared to the previous predictions for approved operations by AGE (2013);
- No change in landholder bores identified as potentially impacted by approved operations;
- No impacts predicted on landholder bores intersecting alluvium; predicted reduction in groundwater levels at three BHP owned bores that intersect the Permian coal measures;
- Negligible reductions in surface water flows/balance resulting from changes in groundwater baseflows to surface stream systems in Saddlers Creek;
- Reduction in potentiometric head depressurisation in the fractured and porous rock groundwater sources in the near vicinity of the Project;
- Up to 13.2 ML/year leakage (indirect take) from the Hunter River as a result of depressurisation with mining, which is lower than previously predicted;
- Reduction in upward leakage from the Permian coal measures to the overlying alluvium of the Hunter River by a maximum of 82 ML/year (0.22 ML/day) which is lower than previously predicted by AGE (2013) that predicted between 0.63 ML/day to 0.72 ML/day leakage from Hunter River; and

- Total groundwater inflows to the MAC open cut of approximately 657.5 ML/year on average (between 2020 to 2027) and ranging up to a peak in the order of 1,114 ML/year in 2026. The predicted inflow is largely consistent with the previously predicted average inflows by AGE (2013), which ranged between 711 ML/year to 912 ML/year from 2020 to 2026.

9 Water Monitoring Programs

9.1 Objectives

The key objective of the water monitoring programs is to provide accurate information to effectively:

- Assess performance against impact assessment criteria (Trigger Values);
- Manage depressurisation and associated impacts on the aquifer systems due to operations;
- Manage water quality impacts of mining on the aquifer systems;
- Validate the Water Balance Model and assess the effectiveness of groundwater management measures;
- Quantify changes to the surface water system that result from operations;
- Assess riparian and in-channel vegetation;
- Assess channel stability;
- Assess variations from modelled predictions detailed in the Environmental Assessment; and
- Provide evidence that effective water monitoring has taken place.

9.2 Surface Water Monitoring Program

9.2.1 Monitoring Methodology

Surface flow Monitoring

Flows are monitored at SW28 to ensure compliance with the discharge flow rates. Appendix 1 shows the location of the flow monitoring, Appendix 2 describes the location.

Stream Health

Riparian and in-stream vegetation and channel stability are used to assess potential impacts on stream health.

Vegetation Monitoring

Monitoring of riparian vegetation is undertaken annually and includes:

- Taking four photographs at each surface water monitoring site; looking upstream, downstream, at the left bank and at the right bank. Photographs are documented with their location, the direction and the date.
- An assessment of riparian condition will be undertaken annually, incorporating a riparian zone transect monitored for general vegetation condition and habitat quality and 20m x 20m survey plot monitored for species composition and community structure (dominance, age etc).

The methodology for the Vegetation Community Assessment is described in the Rehabilitation and Ecological Monitoring Procedure (MAC-ENC-PRO-080).

Channel Stability Monitoring

Channel stability monitoring is undertaken through an Annual Rapid Assessment. This includes:

- A desktop review of aerial photography and previous monitoring results to identify potential areas of stream erosion and deposition.
- Photographic logging and documenting dimensions of significant erosional and depositional features for quantitatively assessing changes over time. A GPS coordinate is noted for each photograph in addition to a photograph direction (compass bearing) to enable repeat monitoring.

The full methodology for the Annual Rapid Assessment is described in the Rehabilitation and Ecological Monitoring Procedure (MAC-ENC-PRO-080).

Surface Water Quality

Surface water quality monitoring and sample collection, storage and transportation will be undertaken in accordance with the procedures outlined in the relevant sections of the Australian Standard for Water Quality Sampling AS/NZS 5667.1:1998 . Laboratory analysis will be undertaken by a laboratory which has relevant accreditation by the National Association of Testing Authorities (NATA), Australia.

Electrical conductivity of the Hunter River varies significantly with climatic conditions and ranges from 36 (2004) to 2,147 (1993) microSiemens per centimetre (µS/cm) at the Muswellbrook Bridge gauging station, and from 66 (2000) to 1,292 (1993) µS/cm at the Denman gauging station. The average conductivity at the upstream and downstream stations is 471 and 560µS/cm, respectively, while the median conductivity at the upstream and downstream stations is 436 and 527µS/cm, respectively (based on data to 16 December 2019).

The Hunter River Salinity Trading Scheme (HRSTS) regulates salt loads discharged to the Hunter River. The amount of saline water that may be discharged from a given discharge EPL holder is determined by reference to the salinity of the discharge waters, the river flow, the number of credits held and any overriding limit that may be applied as a condition of the EPL. If required, controlled releases of excess water from the Mt Arthur Coal Mine to the Hunter River are undertaken in accordance with the HRSTS and EPL 11457.

9.2.2 Monitoring Locations

Water quality at MAC is currently monitored at five statutory monitoring sites, plus Mt Arthur Coal's licensed discharge point.

Surface water monitoring locations, and Stream Health vegetation and channel stability monitoring locations are shown in Appendix 1 and a description of location, including geographic coordinates, and the parameters monitored, and frequency are provided in Appendix 2.

9.2.3 Monitoring Frequency

Statutory monitoring of surface water is undertaken in accordance with the schedule in Appendix 2.

9.2.4 Impact Assessment Criteria

Impact assessment criteria are presented as trigger values which, if exceeded, lead to a response such as more intensive monitoring, investigation and if required, remedial action.

Stream Health

Riparian and impact assessment criteria has been established as:

(a) Significant degradation in species composition, community structure, vegetation condition or habitat quality recorded between consecutive monitoring periods.

(b) Significant change in erosional and/or depositional features recorded between consecutive monitoring periods.

No impact assessment criteria have been set for in-stream fauna as this has been assessed as limited due to the modified habitat prior to mining.

Surface Water Quality

Surface water quality impact assessment criteria for externally reportable monitoring locations downstream of the mining operation have been established as:

(a) pH: measured values outside the trigger level range of 6.5 – 9.0 for three consecutive readings.

(b) **Stage 1** electrical conductivity (EC) and Total Suspended Solids (TSS): measured values above the Stage 1 trigger values.

(c) **Stage 2** EC and TSS: measured values above the Stage 1 trigger values for three consecutive monitoring periods OR above Stage 2 trigger values for two consecutive monitoring periods.

Surface water quality impact assessment criteria trigger values are presented in Appendix 2.

A summary of baseline surface water quality results is presented in further detail in Appendix 3 and full baseline data is presented in Appendix M of the Environmental Assessment (Gilbert and Associates (2009)), including minimum, maximum, mean and median values for pH, EC, turbidity, TSS, total dissolved solids (TDS), filtered iron, nitrate and sulphate.

9.3 Groundwater Monitoring Program

9.3.1 Monitoring Methodology

Groundwater sampling is undertaken in accordance with AS 5667.1:-1998, Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples and AS5667.11-1998, Guidance on the Sampling of Groundwater's.

Representative monitoring bores in the alluvial aquifers and Permian strata have been fitted with data loggers for continuous depth to water measurement via either a pressure transducer (with barometric pressure correction) or vibrating wire piezometer (VWP) apparatus. The monitoring schedule allows groundwater levels to be assessed in terms of impacts on regional aquifers, alluvial aquifers (Hunter River and Saddlers Creek alluvial aquifers) and private users. The impacts of the operation on water users and surrounding aquifers will be monitored, assessed and responded to in accordance with Appendix 7 *Landholder Consultation and Investigation Process.*

9.3.2 Monitoring Locations

Bore monitoring locations are shown in Appendix 1 and a description of location, including geographic coordinates, is provided in Appendix 4.

9.3.3 Monitoring Frequency

Monitoring of groundwater levels and groundwater quality is undertaken at the bores/VWPs in accordance with the schedules in Appendix 4, and as further defined below:

- **Groundwater Level**
  - Manual groundwater elevation/depth to groundwater every 3 months,
  - Pressure transducers continuous every six hours,
  - VWP data logger download, and verification and validation of instrument drift and correction.
- **Groundwater Quality Analysis (Standard)** - Water temperature, pH, EC, TDS, TSS, iron, sulphate, chloride, calcium, magnesium, potassium, sodium, carbonate and bicarbonate. All metals and metalloids required as dissolved analytes.
- **Groundwater Quality Analysis (Comprehensive)** - Total phosphorus, aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc. All metals and metalloids required as dissolved analytes.

9.3.4 Impact Assessment Criteria

Groundwater Level

In 2020, SLR were engaged to develop a numerical groundwater model for MAC that included calibration of observed groundwater levels to June 2020. The water level predictions of the 2020 SLR model and available groundwater monitoring data (2008 to 2022) were used to establish the groundwater level triggers.

Based on the current SLR (2020) model results:

- Bores within the extent of predicted drawdown due to approved operations - the trigger level has been set at the maximum predicted drawdown (mAHD) for each bore/VWP sensor minus 2 m. The trigger elevation was determined based on the first recorded water level at the bore.
- Bores outside of the extent of predicted drawdown due to approved operations, the trigger level was established based on individual bore baseline data. The minimum recorded water level (mAHD) from the baseline dataset (2008 to 2022), minus 2 m, was used. Where the minimum recorded level is at the base of the bore screen, the trigger was set to the base of the bore screen.

A trigger level exceedance occurs where three consecutive readings are below the individual bore trigger level specified in Appendix 4, with response actions detailed in Section 10.

Groundwater Quality

Groundwater quality triggers have been developed for pH and electrical conductivity (EC) based on geological groups/units, as summarised in Table 3 below.

The trigger levels were developed for geological groups/units, based on combined data for all bores within the target unit and with outliers and erroneous data excluded. Where adverse trends and potential impacts have previously been identified, this impacted data was also excluded from the combined dataset.

The trigger levels include:

- pH - set at the 5th and 95th percentile of the final combined dataset for each geological group/unit
- EC - set at the 95th percentile and maximum of the final combined dataset for each geological group/unit

The trigger levels set for each geological group are summarised below, and individual bore trigger levels detailed in Appendix 4.

Table 3: Groundwater Quality Grouped Trigger Levels

Trigger Group	pH		EC (µS/cm)	
	5th Percentile	95th Percentile	95th Percentile (Stage 1)	Maximum (Stage 2)
Hunter River alluvium	6.9	7.7	5228	9090
Saddlers Creek alluvium	6.6	7.6	8783	11380
Saddlers Shallow Permian	6.7	7.1	14800	21480
Arrowfield Seam	6.7	8.9	7831	8210
Blakefield Seam	6.8	7.5	2973	3040
Bowfield Seam	6.9	7.7	7891	8300
Glen Munro Seam	6.7	8.3	11200	14710
Ramrod Creek Seam	6.6	7.4	6261	7720
Warkworth Seam	7.2	8.1	6170	9170
Woodlands Hill Seam	7.0	8.5	4802	5810

The trigger criteria for groundwater quality for each geological group/unit includes:

- pH
    - one reading recorded outside the 5th and 95th percentile trigger level range initiates an internal quality assurance check and review of the data to ensure it is representative.
    - three consecutive readings recorded outside the 5th and 95th percentile trigger level range indicates a trigger exceedance.
- EC
    - one reading recorded above the 95th percentile trigger level initiates an internal quality assurance check and review of the data to ensure it is representative.
    - three consecutive readings recorded above the 95th percentile trigger level indicates a trigger exceedance (stage 1).
    - two consecutive readings above the maximum value indicates a trigger exceedance (stage 2).

9.4 Groundwater Inflows to Mining Operations

Monitoring of hydrogeological conditions is undertaken to assess groundwater seepage into open cut pits, especially from adjacent alluvial aquifers. Groundwater level monitoring being the key data set used to simulate inflows to mine areas through modelling. A large proportion, if not all, of the seepage to the open pit is lost through evaporation at the coalface or exported as moisture in run of mine activities. Currently, there is no quantitative method to measure the volume of groundwater inflows to mining operations. The groundwater model for the current mine approval is the most appropriate method to calculate water take.

Predicted groundwater inflows to the MAC open cut were extracted from the calibration and prediction models by SLR (2020). Groundwater inflows to MAC are predicted to peak in 2026 at 1,114 ML/year (3.1 ML/day), with average inflows around 658.1 ML/year (1.81 ML/day) between 2020 and 2026. The timing of peak inflows is consistent with predictions by AGE (2013) that also showed a peak in inflows to the open cut in 2026. The predicted inflows are largely in line with the predicted average inflows by AGE (2013), which ranged between 712 ML/year to 912 ML/year and averaged 803 ML/year from 2020 to 2026. It should be noted that this total volume includes water removed in rock material with mining, as well as water evaporated from the pit surface. It is therefore an over-estimate of water that could report to the site water balance (SLR, 2020).

9.5 Groundwater Yield

The Environmental Assessment predicted negligible effects on groundwater use at surrounding private bores. Notwithstanding this, potential impacts of the operation on water users will be monitored via the groundwater level monitoring network, assessed and responded to in accordance with the Landholder Consultation and Investigation Process presented in Appendix 7. Monitoring to determine groundwater yield will be considered at privately owned bores upon landowner request.

Permeability testing is also undertaken during installation of new monitoring bores to determine local groundwater hydraulic parameters where additional data is required.

9.6 Groundwater Dependent Ecosystems and Riparian Vegetation

Monitoring of riparian vegetation is undertaken annually as part of the Stream Health Monitoring Program and serves equally as a monitor of groundwater dependent riparian vegetation. Four photographs are to be taken at each of the surface water vegetation monitoring sites; looking upstream, looking downstream, looking at the left bank and looking at the right bank . These photographs are labelled with the location, direction and date.

9.7 Cut-off wall and flood levee monitoring

The following safeguards associated with the ongoing management of this low permeability barrier wall will be implemented to minimise, prevent or offset groundwater leakage from the alluvial aquifer:

- inspections in accordance with MAC-STE-STD-181 Performance Standard – Inrush for structural and vegetation maintenance requirements;
- groundwater monitoring adjacent to the barrier wall to confirm the effectiveness of the wall and its' performance as a barrier in the long term; and

9.8 Monitoring Records

The following records are kept in respect of any samples collected as part of these monitoring programs:

- the date(s) on which the sample was taken;
- the time(s) at which the sample was collected;
- the point at which the sample was taken; and
- the name of the person who collected the sample.

10 Response Plan

10.1 Surface and Groundwater

In situations where water monitoring results are identified as being unacceptable, or the real-time monitoring results exceed the relevant impact assessment criteria, as outlined in Section 9.2.4 and Section 9.3.4, the response protocols in Table 4 shall apply:

Table 4 Surface Water and Groundwater Exceedance Protocol

Impact Assessment Criteria	Exceedance Criterion	Exceedance Response
pH surface water or groundwater quality	Measured values that are outside the trigger level shall trigger the exceedance response	Step 1: Quality assurance check of the sampling procedure and analytical data acquired, reported and entered. Step 2: For a single exceedance of the trigger value, no further action is required other than to record the exceedance. If the trigger value of the same parameter is exceeded at the same location for **three consecutive monitoring periods**, then the actions required for exceedance of the trigger values should be carried out. Step 3: Consult with the DPE to determine if a written report on the exceedance will be required and implement identified corrective/preventative actions.
pH surface water or groundwater quality	pH values recorded outside the trigger level range for **three consecutive monitoring periods** shall trigger the groundwater quality exceedance response	Step 1: Notify the DPE of an 'interim exceedance' as soon as practicable after becoming aware of the exceedance and relevant information required for the notification is confirmed (including preliminary quality assurance of information). Step 2: If quality assurance check of the sampling procedure and analytical data acquired, reported and entered, and the trigger level is still exceeded, then an investigation of the exceedance should be carried out and reasons for the exceedance identified. Step 3: Consult with the DPE to determine if a written report on the exceedance will be required, and implement identified corrective/preventative actions.
Electrical Conductivity (EC) Stage 1 surface water or groundwater quality	Measured values that are above the Stage 1 trigger level shall trigger the exceedance response	Step 1: Quality assurance check of the sampling procedure and analytical data acquired, reported and entered. Step 2: For a single exceedance of a 1st stage trigger value, no further action is required other than to record the exceedance. If the 1st stage trigger value of the same parameter is exceeded at the same location for **three consecutive monitoring periods**, then the actions required for exceedance of the 2nd stage trigger values should be carried out.
Electrical Conductivity (EC) Stage 2 surface water or groundwater quality	Measured values above Stage 1 trigger levels for **three consecutive monitoring periods** shall trigger the exceedance response Measured values above Stage 2 trigger levels for **two consecutive monitoring periods** shall trigger the exceedance response	Step 1: Notify the DPE of an 'interim exceedance' as soon as practicable after becoming aware of the exceedance and relevant information required for the notification is confirmed (including preliminary quality assurance of information). Step 2: If quality assurance check of the sampling procedure and analytical data acquired, reported and entered, and the trigger level is still exceeded, then an investigation of the exceedance should be carried out and reasons for the exceedance identified. Step 3: Consult with the DPE to determine if a written report on the exceedance will be required, and implement identified corrective/preventative actions.

Impact Assessment Criteria	Exceedance Criterion	Exceedance Response
Total Suspended Solids Stage 1 surface water	Measured values that are above the Stage 1 trigger level shall trigger the exceedance response	Step 1: Quality assurance check of the sampling procedure and analytical data acquired, reported and entered. Step 2: For a single exceedance of a 1st stage trigger value, no further action is required other than to record the exceedance. If the 1st stage trigger value of the same parameter is exceeded at the same location for three consecutive monitoring periods, then the actions required for exceedance of the 2nd stage trigger values should be carried out.
Total Suspended Solids Stage 2 surface water	Measured values above Stage 1 trigger levels for **three consecutive monitoring periods** shall trigger the exceedance response Measured values above Stage 2 trigger levels for **two consecutive monitoring periods** shall trigger the exceedance response	Step 1: Notify the DPE of an 'interim exceedance' as soon as practicable after becoming aware of the exceedance and relevant information required for the notification is confirmed (including preliminary quality assurance of information). Step 2: If quality assurance check of the sampling procedure and analytical data acquired, reported and entered, and the trigger level is still exceeded, then an investigation of the exceedance should be carried out and reasons for the exceedance identified. Step 3: Consult with the DPE to determine if a written report on the exceedance will be required and implement identified corrective/preventative actions.
Groundwater Level	Any monitoring bore groundwater level or vibrating wire piezometer groundwater head pressure recorded below the trigger level for **three consecutive monitoring periods** shall trigger the groundwater level exceedance response	Step 1: Notify the DPE of an 'interim exceedance' as soon as practicable after becoming aware of the exceedance and relevant information required for the notification is confirmed (including preliminary quality assurance information). Step 2: If quality assurance check of the sampling procedure and analytical data acquired, reported and entered, and the trigger level is still exceeded, then an investigation of the exceedance should be carried out and reasons for the exceedance identified. Step 3: Consult with the DPE to determine if a written report on the exceedance will be required, and implement identified corrective/preventative actions.

10.2 Stream Health

In the event of riparian and in-stream vegetation impact assessment criteria being exceeded, the following protocol will be followed:

1. The area will be inspected to confirm the condition of vegetation in the photograph and the condition of vegetation in other similar areas of the site.
2. The magnitude of the change in erosion/deposition will be verified within 24 hours of erosion or channel deposition change being identified.
3. If the inspection confirms a significant impact to vegetation specific to the area or additional erosion or deposition has occurred, DPE and any other relevant departments will be notified.
4. An investigation will then be undertaken in consultation with DPE and any other relevant department and will involve the consideration of the visual inspection documented above in conjunction with:
   a) site activities being undertaken at the time;
   b) baseline surface water and groundwater monitoring results;
   c) surface water and groundwater results in nearby locations;
   d) the prevailing and preceding meteorological conditions;
   e) hydrological conditions; and
   f) changes to the land use/activities being undertaken in the contributing catchment or hydrogeological regime.

   The investigation timeframe will be determined in consultation with DPE and other relevant departments. Consultation with DPE will be undertaken to determine if a written report on the exceedance will be required.
5. If the investigation shows that the stream health impact is linked to activities undertaken by MAC, causal factors will be addressed and rectified if possible. Corrective/preventative measures will be developed in consultation with DPE and any other relevant department and implemented in response to the outcomes of the investigation. Such measures could involve direct revegetation or vegetation offsets. The timeframe associated with development and implementation of corrective/preventative measures is to be determined in consultation with the DPE and relevant departments.
6. Additional monitoring would be implemented to measure the effectiveness of corrective/preventative measures if appropriate. The timeframe associated with additional monitoring is to be determined in consultation with DPE and relevant departments.

11 Review and Reporting

11.1 Review

This WMP will be reviewed and evaluated to assess its adequacy and effectiveness, to the satisfaction of the Secretary (in consultation with relevant government agencies) in accordance with Condition 4 of Schedule 5 of the Project Approval. This requires that this is undertaken within 3 months of:

- The submission of the Annual Review;
- The submission of an incident report;
- The submission of an audit; and
- Any modifications to the conditions of the Approval.

If necessary, this WMP will be revised to incorporate any recommended measures to improve the environmental performance of MAC resulting from audits, community complaints and incident investigation findings. In addition, the review process will include ongoing evaluation of operational modifications, alternative methodologies and new technologies that become available.

11.2 Reporting

Mt Arthur Coal will report on the effectiveness of the WMP annually in the MAC Annual Review which will include:

- Reporting of monitoring results, evaluating and comparing against impact assessment criteria;
- Results of the model validation assessment, which compares the model predictions against the monitoring program groundwater level information;
- Surface and/or groundwater related complaints and management/mitigation measures undertaken;
- Management/mitigation measures undertaken in the event of any confirmed exceedance of the impact assessment criteria; and
- Review of the effectiveness of management/mitigation measures and the monitoring program.

Mt Arthur Coal will also report results of any monitoring undertaken in accordance with the HRSTS on the BHP Mt Arthur Coal website (https://www.bhp.com/environment/regulatory-information) on a monthly basis in the event of a discharge.

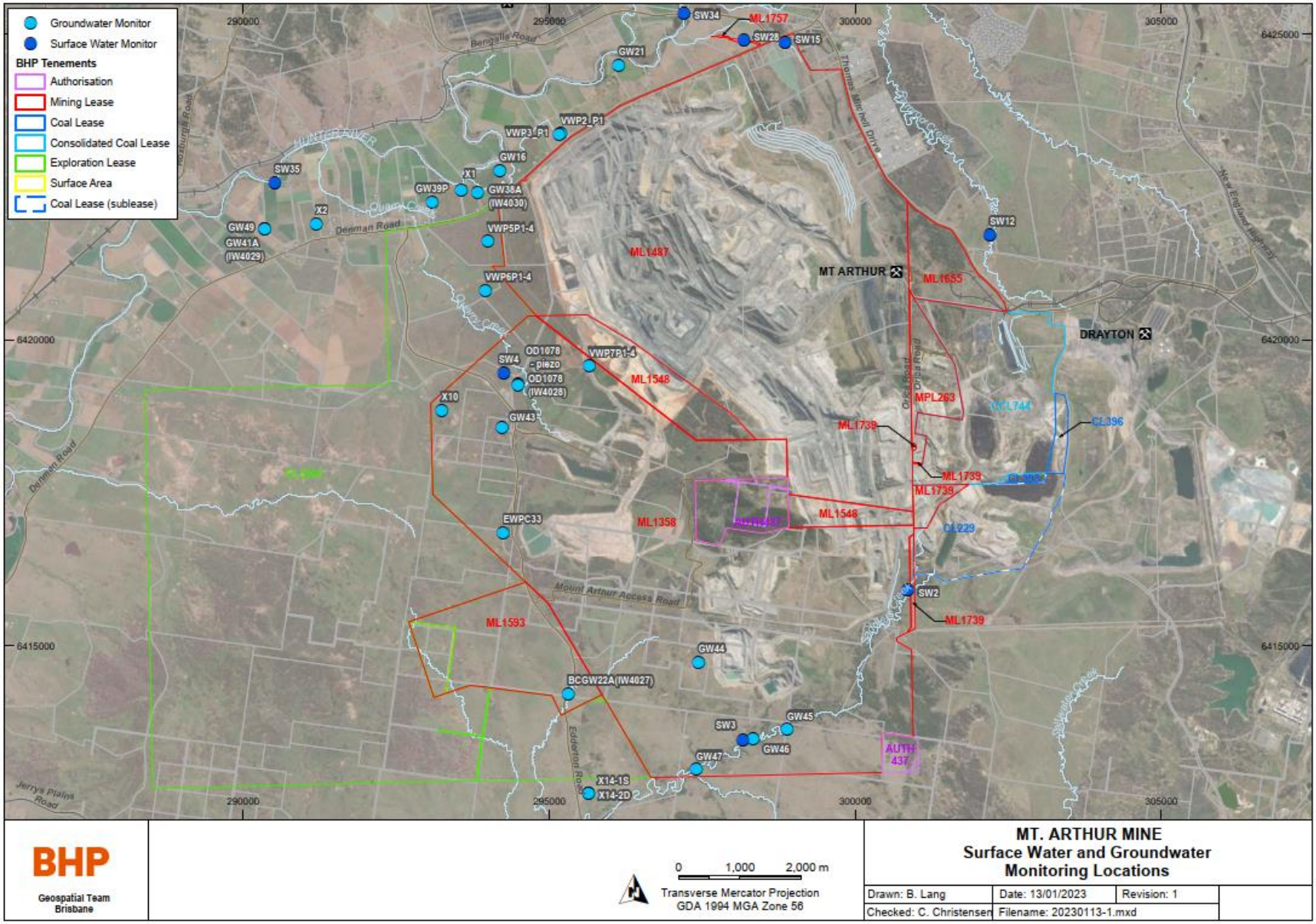
Version Management

Note:

- **Major** versions (1.0, 2.0 etc.) are for changes after a significant event / incident or for a periodic review of the document.
- **Minor** versions (1.1, 1.2 etc.) are for small changes to a page or pages within a document.

Date	Version Control		Page(s)	Details
	Major	***Minor***		
30/06/2011	1.0		All	Draft Submitted to DPI for comment
23/08/2012		1.1	All	Approved by the Department of Planning & Infrastructure on 23/08/2012
3/04/2020	2.0		All	Amended for DPIE Approval
06/10/2021		2.1	All	Updated to include all subordinate plans. New version approved by DPIE
29/03/2023	3.0		All	Approved by DPE

Appendix 1 – Monitoring Locations Plan



Appendix 2 – Surface Water Monitoring Locations and Schedule

Site	Location	Coordinates (GDA94 Zone 56)	Parameters	Trigger Levels		Frequency
SW02	Saddlers Creek	E. 300861 N. 6415905	pH	6.5 - 9.0		Monthly or following rainfall >25mm*
			EC (µS/cm)	Stage 1	12,365	
				Stage 2	13,900	
			TSS (mg/L)	Stage 1	219	
				Stage 2	277	
			Aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc.	NA		Annual
SW03	Saddlers Creek	E. 298165 N. 6413452	pH	6.5 - 9.0		Monthly
			EC (µS/cm)	Stage 1	10,133	
				Stage 2	11,402	
			TSS (mg/L)	Stage 1	37	
				Stage 2	46	
			Aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc.	NA		Annual
			Stream Health - Riparian and Stream Vegetation / Stream erosion	Significant degradation or change between consecutive monitoring periods		Annual
SW04	Quarry Creek	E. 294263 N. 6419453	pH	6.5 - 9.0		Monthly or following rainfall >25mm*
			EC (µS/cm)	Stage 1	13,959	
				Stage 2	15,509	
			TSS (mg/L)	Stage 1	82	
				Stage 2	104	
			Aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc.	NA		Annual
			Stream Health - Riparian and Stream Vegetation / Stream erosion	Significant degradation or change between consecutive monitoring periods		Annual
SW12	Ramrod Creek	E. 302205 N. 6421715	pH	6.5 - 9.0		Monthly or following rainfall >25mm*
			EC (µS/cm)	Stage 1	6,659	
				Stage 2	7,153	
			TSS (mg/L)	Stage 1	555	
				Stage 2	708	
			Aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc.	NA		Annual
			Stream Health - Riparian and Stream Vegetation / Stream erosion	Significant degradation or change between consecutive monitoring periods		Annual
SW15	White's Creek Diversion	E. 298854 N. 6424848	pH	6.5 - 9.0		Monthly or following rainfall >25mm*
			EC (µS/cm)	Stage 1	7,128	
				Stage 2	8,262	
			TSS (mg/L)	Stage 1	103	
				Stage 2	130	
			Aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc.	NA		Annual
			Stream Health - Riparian and Stream Vegetation / Stream erosion	Significant degradation or change between consecutive monitoring periods		Annual
SW28		E. 298190	pH	6.5 - 9.0		

Site	Location	Coordinates (GDA94 Zone 56)	Parameters	Trigger Levels		Frequency
	Hunter River Salinity Trading Scheme HRSTS) monitoring point EPL Point 6	N. 6424890	EC (µS/cm)	Stage 1	NA	Continuous when discharging
				Stage 2		
			TSS (mg/L)	Stage 1	120	
				Stage 2	120	
			Flow (ML/day)	Limit	450	
			Water temperature, pH, EC, TSS	NA		Daily during discharge
SW34	Hunter River Upstream	E. 297206 N. 6425319	pH	NA		Monthly or following rainfall >25mm*
			EC (µS/cm)	NA		
			TSS (mg/L)	NA		
			Aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc.	NA		Annual
SW35	Hunter River Downstream	E. 290519 N.6422566	pH	7.8 – 8.5		Monthly or following rainfall >25mm*
			EC (µS/cm)	323 - 893		
			TSS (mg/L)	54		
			Aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc.	NA		Annual

Note: All metals and metalloids will be measured as total (unfiltered) and dissolved (filtered).

** Grab samples collected when safe to do so and access permits, generally during daylight hours. Rainfall event sampling to be conducted when 25mm rain received within 24 hours, midnight to midnight, with a new rainfall event considered to have commenced if there has not been a rainfall event in the previous 48 hours.*

Appendix 3 - Baseline Surface Water Quality Data

	Site:	SW2	SW3	SW4	SW13	SW15
		Saddlers Upstream	Saddlers Downstream	Quarry Creek	Fairford Creek	White's Creek Diversion
Parameter	**Dates Sampled**	02/06/1995 - 23/01/2012	02/06/1995 - 23/01/2012	02/06/1995 - 23/01/2012	02/04/2001 - 23/01/2012	18/09/2002 - 23/01/2012
	min	6.9	6.6	6.9	6.1	7.2
	max	8.6	8.7	9.1	9.0	9.7
	median	7.7	8.0	8.3	7.4	8.3
	mean	7.7	8.0	8.3	7.4	8.4
EC (µS/cm)	**min**	1,360	760	490	120	232
	max	16,300	11,000	17,000	1,150	8,790
	median	8,010	6,220	9,010	325	3,260
	mean	7,501	6,007	9,122	418	3,215
Turbidity (NTU)	**min**	0.1	0.2	0.1	6.2	0.7
	max	765	56	36	587	1110
	median	3.9	2.0	2.2	28	5.0
	mean	23	4.7	4.7	102	32
TSS (mg/L)	**min**	0.0	0.0	0.0	0.0	0
	max	828	120	240	3,300	380
	median	10	4	6	167	14
	mean	31.3	8	15.4	453.7	22
TDS (mg/L)	**min**	850	550	310	150	305
	max	15,600	6,920	11,000	700	6,000
	median	6,400	3,900	5,500	280	2,350
	mean	5,876	3,751	5,573	288	2,222
Filtered Iron (mg/L)	**min**	0.01	0.00	0.01	0.15	0.01
	max	0.50	0.50	0.58	11.0	1.70
	median	0.05	0.05	0.05	1.73	0.05
	mean	0.10	0.05	0.05	2.42	0.07
Nitrate (mg/L)	**min**	0.01	0.01	0.01	0.01	0.01
	max	5.3	3.1	5.3	20.0	7.0
	median	0.4	0.2	0.4	1.1	0.1
	mean	0.6	0.5	0.8	2.7	0.4
Sulphate (mg/L)	**min**	44	0.4	14	1	25
	max	6,100	3,420	2,350	250	2,190
	median	2,440	380	250	10	799
	mean	2,419	426	333	20	753

Appendix 4 - Groundwater Monitoring Locations and Schedule

Table 5: Groundwater Monitoring Locations and Schedule

Site No.	Location	Coordinates (GDA94 Zone 56)		Target Formation	Monitoring Schedule			Level Triggers		Quality Triggers			
										pH		EC	
		Easting (m)	Northing (m)		GW Level[1] (Quarterly)	GW Quality Standard[2] (Quarterly)	GW Quality Comprehensive[3] (Annual)	Adopted Trigger Derivation method (1,2 or 3)[4]	Adopted Trigger Level (mAHD)	Lower (5th Percentile)	Upper (95th Percentile)	Stage 1 (95th Percentile)	Stage 2 (Maximum Value)
Hunter River Alluvium													
GW16	Off Denman Rd - west of Mt Arthur North	294197	6422759	Hunter River alluvium	Q	Q	A	2	119.0	6.9	7.7	5228	9090
GW21	Off Denman Rd - Edinglassie Homestead	296141	6424483	Hunter River alluvium	Q	Q	A	2	118.3	6.9	7.7	5228	9090
GW38A (IW4030)	Off Denman Rd - gate no. 968	293831	6422393	Hunter River alluvium	Q	Q	A	2	119.7	6.9	7.7	5228	9090
GW41A (IW4029)	Off Denman Rd - Well brook	290348	6421810	Hunter River Alluvium	Q	Q	A	2	116.7	6.9	7.7	5228	9090
X1MB	Off Denman Rd - gate no. 968	293566	6422429	Hunter River Alluvium	Q	Q	A	2	118.7	6.9	7.7	5228	9090
X2MB	Off Denman Rd	291196	6421899	Hunter River Alluvium	Q	Q	A	2	117.9	6.9	7.7	5228	9090
Saddlers Creek Alluvium													
GW45	On site - upper Saddlers Creek	298890	6413630	Saddlers Creek alluvium	Q	Q	A	2	137.7	6.6	7.6	8783	11380
GW47	On site - lower Saddlers Creek	297409	6412974	Saddlers Creek alluvium	Q	Q	A	2	126.9	6.6	7.6	8783	11380
Saddlers Creek Shallow Permian													
BCGW22A (IW4027)	On site - southwest of Bayswater No. 3	295314	6414210	Saddlers Creek shallow Permian	Q	Q	A	2	136.6	6.7	7.1	14800	21480
GW46	On site - central Saddlers Creek	298337	6413469	Saddlers Creek shallow Permian	Q	Q	A	2	132.5	6.7	7.1	14800	21480
X14MB-1S	On site – west of Saddlers Pit	295649	6412596	Saddlers Creek shallow Permian	Q	Q	A	2	114.5	6.7	7.1	14800	21480
Permian Coal Measures – Monitoring Bores													
EWPC33	Off Edderton Rd - west of Bayswater No. 3	294253	6416847	Blakefield Seam	Q	Q	A	2	190.4	6.8	7.5	2973	3040
GW2	On site - south of Saddlers Creek	299045	6413511	Woodlands Hill Seam	Q	Q	A	2	140.0	7.0	8.5	4802	5810
GW38P	Off Denman Rd - gate no. 968	293832	6422384	Warkworth Seam	Q	Q	A	1	117.3	7.2	8.1	6170	9170
GW39P-25mm	Off Denman Rd - Denman Rd West	293094	6422251	Warkworth Seam	Q	-	-	1	117.2	-	-	-	-
GW43	Off Edderton Rd - Roxburgh South	294233	6418560	Woodlands Hill Seam	Q	Q	A	1	166.8	7.0	8.5	4802	5810
GW44	On site - off McDonalds Lane	297445	6414733	Woodlands Hill Seam	Q	-	-	1	65.6	-	-	-	-
GW48	Off Denman Rd - 1212 Gia Gindi Holstiens	291830	6422111	Bowfield Seam	Q	Q	A	1	115.9	6.8	7.7	7891	8300
GW49	Off Denman Rd - Well brook	290346	6421798	Arrowfield Seam	Q	Q	A	1	115.8	6.7	8.9	7831	8210
OD1078P (IW4028)	On site - southwest of Mt Arthur North	294491	6419265	Arrowfield Seam	Q	-	-	2	132.9	-	-	-	-

Site No.	Location	Coordinates (GDA94 Zone 56)		Target Formation	Monitoring Schedule			Level Triggers		Quality Triggers			
										pH		EC	
		Easting (m)	Northing (m)		GW Level[1] (Quarterly)	GW Quality Standard[2] (Quarterly)	GW Quality Comprehensive[3] (Annual)	Adopted Trigger Derivation method (1,2 or 3)[4]	Adopted Trigger Level (mAHD)	Lower (5th Percentile)	Upper (95th Percentile)	Stage 1 (95th Percentile)	Stage 2 (Maximum Value)
X10MB	Off Edderton Rd - Roxburgh South	293247	6418841	Glen Munro Seam	Q	Q	A	1	179.6	6.7	8.3	11200	14710
X14MB-2D	On site – west of Saddlers Pit	295648	6412592	Glen Munro Seam	Q	Q	A	2	116.1	6.7	8.3	11200	14710
Permian Coal Measures – VWPs													
VWP2_P1	Off Denman Rd - west of Edinglassie Homestead	295195	6423364	F4 Fault	Q	-	-	1	-64.4	-	-	-	-
VWP3_P1	Off Denman Rd - west of Edinglassie Homestead	295166	6423349	Edinglassie Seam	Q	-	-	1	-46.5	-	-	-	-
VWP05_164	Off Edderton Rd - Opposite windmill south	293993	6421605	Vaux Seam	Q	-	-	1	-46.2	-	-	-	-
VWP05_192				Bayswater Seam	Q	-	-	1	-29.1	-	-	-	-
VWP05_227				Edderton Seam	Q	-	-	1	-74.1	-	-	-	-
VWP06_269	Off Edderton Rd - Opposite Huon	293960	6420850	Broonie Seam	Q	-	-	1	-15.3	-	-	-	-
VWP06_304				Edderton Seam	Q	-	-	1	-59.8	-	-	-	-
VWP06_366				Edinglassie Seam	Q	-	-	1	-4.5	-	-	-	-
VWP07_223	On site - southwest of Mt Arthur North	295656	6419565	Piercefield Seam	Q	-	-	1	64.7	-	-	-	-
VWP07_271				Vaux Seam	Q	-	-	1	57.3	-	-	-	-
VWP07_286				Bayswater Seam	Q	-	-	1	-17.1	-	-	-	-
VWP07_326				Edderton Seam	Q	-	-	1	-91.3	-	-	-	-
VWP07_418				Ramrod Creek Seam	Q	-	-	1	142.3	-	-	-	-
X1_S-1 (35)	Off Denman Rd - gate no. 968	293564	6422437	Alluvium	Q	-	-	1	97.6	-	-	-	-
X1_S-2 (59)				Mt Arthur Seam	Q	-	-	1	91.0	-	-	-	-
X1_S-3 (128.5)				Vaux Seam	Q	-	-	1	24.6	-	-	-	-
X1_S-4 (164)				Bayswater/Wynn Seam	Q	-	-	1	16.1	-	-	-	-
X1_S-5 (215)				Interburden above Bengalla Seam	Q	-	-	1	-31.7	-	-	-	-
X1_S-6 (255)				Edinglassie Seam	Q	-	-	1	-55.6	-	-	-	-
X1_S-7 (276.5)				Ramrod Creek Seam	Q	-	-	1	-64.6	-	-	-	-

Note:

*1- **Groundwater Level** - Manual groundwater elevation/depth to groundwater every 3 months, pressure transducers continuous every six hours, VWP data logger download, and verification and validation of instrument drift and correction.*

*2- **Groundwater Quality Analysis (Standard)** - Water temperature, pH, EC, TDS, TSS, iron, sulphate, chloride, calcium, magnesium, potassium, sodium, carbonate and bicarbonate. All metals and metalloids required as dissolved analytes.*

*3- **Groundwater Quality Analysis (Comprehensive)** - Total phosphorus, aluminium, antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, molybdenum, selenium and zinc. All metals and metalloids required as dissolved analytes.*

*4- **Groundwater Level Trigger Derivation**:*

1 = Model predicted drawdown (mAHD) minus 2 m

2 = Minimum recorded groundwater level (mAHD) minus 2 m

Appendix 5 – Baseline 2008 – 2022 Groundwater Level Data

Bore ID	Formation	Number of Records	Min (mAHD)	Median (mAHD)	Mean (mAHD)	Max (mAHD)
BCGW22A (IW4027)	Saddlers Creek Shallow Permian	38	138.62	140.08	139.92	141.14
EWPC33	Blakefield Seam	87	192.42	197.27	197.00	201.46
GW16	Hunter River alluvium	85	120.98	122.21	122.26	124.28
GW2	Woodlands Hill Seam	86	142.03	144.55	144.46	146.64
GW21	Hunter River alluvium	85	125.95	126.58	126.72	130.04
GW38A (IW4030)	Hunter River alluvium	38	121.68	122.00	122.13	123.38
GW38P	Warkworth Seam	86	121.23	121.59	121.67	122.76
GW39P	Warkworth Seam	87	119.12	121.45	121.20	122.22
GW41A (IW4029)	Hunter River alluvium	38	118.67	119.08	119.11	119.95
GW43	Woodlands Hill Seam	39	166.91	169.28	168.85	170.47
GW44	Woodlands Hill Seam	37	97.93	125.86	116.29	128.46
GW45	Saddlers Creek alluvium	39	139.66	141.79	141.70	144.54
GW46	Saddlers Creek Shallow Permian	39	134.46	136.57	136.16	137.44
GW47	Saddlers Creek alluvium	39	128.86	130.03	129.84	130.82
GW48	Bowfield Seam	39	115.87	118.86	118.99	120.81
GW49	Arrowfield Seam	39	118.58	118.75	118.80	119.63
OD1078P (IW4028)	Arrowfield Seam	34	134.86	140.56	142.11	150.57
X1MB	Hunter River alluvium	9	120.74	121.07	121.58	123.73
X10MB	Glen Munro Seam	9	182.58	183.02	183.34	185.49
X2MB	Hunter River alluvium	9	119.87	120.07	120.23	120.95
X14MB-1S	Saddlers Creek alluvium	10	116.49	118.74	119.51	124.28
X14MB-2D	Glen Munro Seam	9	118.11	123.13	121.72	124.04

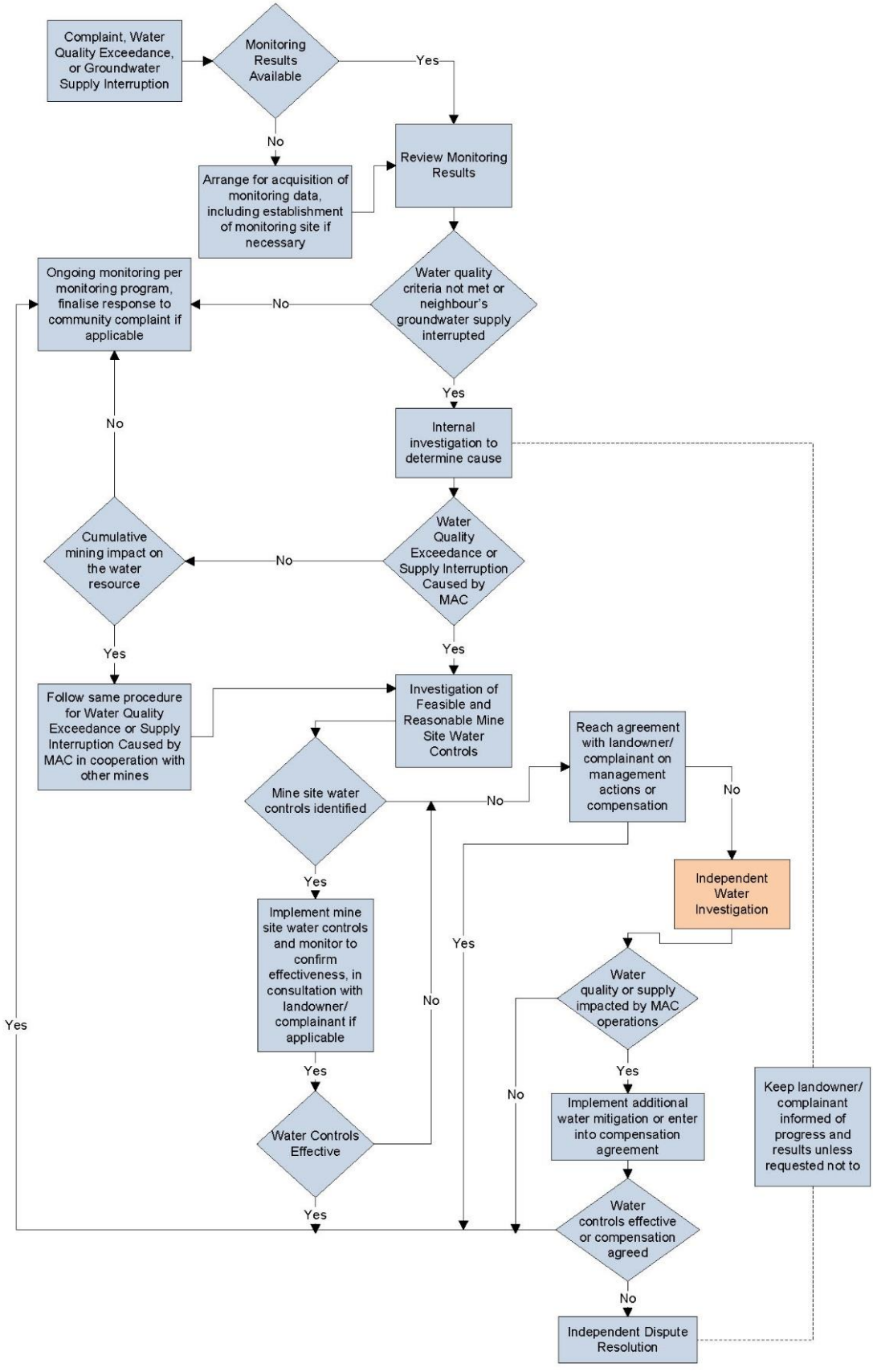
Appendix 6 – Baseline 2008 – 2022 Groundwater Quality Data

Bore ID	Formation	Field pH (pH Units)*							Field EC (µS/cm)*						
		No. of Records	Min	5th Percentile	Median	Mean	95th Percentile	Max	No. of Records	Min	5th Percentile	Median	Mean	95th Percentile	Max
BCGW05	Glen Munro Seam	31	6.7	6.7	7.8	7.5	7.4	7.9	32	6470	7154	14539	10425	10443	14710
BCGW10	Woodlands Hill Seam	32	7.0	7.2	8.7	8.2	8.1	8.8	33	2240	2380	3710	2760	2949	4510
BCGW11	Glen Munro Seam	41	6.8	7.0	8.3	7.7	7.6	8.8	42	70	581	5789	3430	3093	6240
BCGW15	Glen Munro Seam	24	6.1	6.5	7.5	7.1	7.1	7.7	25	1215	1278	8270	5750	5295	8510
BCGW18	Arrowfield Seam	62	5.5	7.1	9.1	8.2	8.1	9.3	62	3100	4215	7859	5220	5799	8210
BCGW19	Glen Munro Seam	38	6.7	7.0	8.6	8.0	7.9	8.6	38	1205	1253	5221	3185	3132	6370
BCGW22A (IW4027)	Saddlers Creek Shallow Permian	37	6.6	6.7	7.1	6.9	6.9	7.1	37	9200	9908	14800	11070	11562	15690
EWPC33	Blakefield Seam	79	6.5	6.8	7.5	7.1	7.1	8.0	80	290	821	2990	2331	2270	6280
GW16	Hunter River Alluvium	84	6.4	7.0	7.7	7.3	7.3	8.0	84	2139	2533	4219	3315	3354	4690
GW2	Woodlands Hill Seam	83	6.5	7.3	8.1	7.7	7.7	8.5	84	3030	3182	4890	3715	3855	5030
GW21	Hunter River Alluvium	84	6.4	6.9	7.8	7.2	7.2	8.0	84	636	743	1196	920	938	2000
GW22	Ramrod Creek Seam	119	5.9	6.7	12.3	7.0	7.9	12.5	119	3210	4514	15701	10500	9580	17350
GW23	Ramrod Creek Seam	47	6.3	6.8	7.4	7.0	7.0	7.4	47	3310	3660	5144	4510	4523	7720
GW3	Woodlands Hill Seam	42	7.1	7.5	8.6	8.0	8.0	8.8	43	3460	3598	4469	4160	4106	4930
GW38A (IW4030)	Hunter River alluvium	37	6.5	6.9	7.7	7.3	7.3	8.3	37	1762	2044	4812	4260	3955	5560
GW38P	Warkworth Seam	82	7.1	7.3	8.2	7.7	7.7	8.6	82	1290	1962	2886	2280	2323	3830
GW39P-25mm	Warkworth Seam	80	6.7	7.1	7.9	7.6	7.6	8.5	80	500	3058	6263	5445	5208	9170
GW41A (IW4029)	Hunter River alluvium	37	6.6	7.0	7.7	7.4	7.4	8.0	37	815	1820	9372	3840	4670	10600
GW43	Woodlands Hill Seam	26	6.7	6.8	7.3	7.1	7.1	7.4	26	3900	3953	4928	4260	4304	5210
GW44	Woodlands Hill Seam	2	11.6	11.6	12.4	12.0	12.0	12.4	2	5810	5999	9401	7700	7700	9590
GW45	Saddlers Creek alluvium	38	6.3	6.6	7.6	7.3	7.2	8.0	38	638	691	9870	1305	3262	11380
GW46	Saddlers Creek Shallow Permian	38	6.5	6.5	7.2	7.0	7.0	7.6	38	4840	5583	7549	6215	6445	8220
GW47	Saddlers Creek alluvium	38	6.8	6.8	7.3	7.1	7.1	7.5	38	3540	3735	5933	5150	4969	6100
GW48	Bowfield Seam	38	6.8	7.2	7.8	7.6	7.6	8.2	38	3090	3286	4372	3670	3753	4750
GW49	Arrowfield Seam	38	6.1	6.5	7.1	6.9	6.9	7.5	38	5020	5197	6773	5815	5919	7530

Bore ID	Formation	Field pH (pH Units)*							Field EC (µS/cm)*						
		No. of Records	Min	5th Percentile	Median	Mean	95th Percentile	Max	No. of Records	Min	5th Percentile	Median	Mean	95th Percentile	Max
GW6	Glen Munro Seam	64	6.3	6.5	7.5	7.1	7.1	8.0	64	2820	3902	4957	4610	4567	5090
GW7	Glen Munro Seam	63	6.4	6.8	7.4	7.1	7.1	7.6	64	3970	4123	5199	4820	4798	5590
OD1078-PIEZO	Bowfield Seam	37	6.4	6.8	7.5	7.2	7.2	7.7	38	1470	2157	8034	6955	6002	8300
OD1079-PIEZO	Glen Munro Seam	37	8.6	9.2	12.3	11.9	11.4	12.4	38	1250	1784	5238	4515	3951	5560
X1MB	Hunter River Alluvium	9	7.1	7.2	7.5	7.3	7.3	7.6	9	3600	3776	5218	4750	4567	5390
X2MB	Hunter River Alluvium	9	7.0	7.0	7.3	7.2	7.2	7.4	9	3280	3544	6900	4170	4783	7420
X10MB	Glen Munro	9	7.3	7.4	9.8	9.2	8.8	10.0	9	3740	3804	6514	5380	5266	6570
X14MB-1S	Saddlers Creek Alluvium	10	6.9	6.9	12.6	7.0	8.6	12.6	10	10450	10563	18474	11500	12928	21480
X14MB-2D	Glen Munro Seam	9	6.8	6.8	11.2	9.6	9.1	11.6	9	5610	5774	15430	7670	9458	16250

*Note: * Baseline data includes all data. Outliers were removed for the trigger derivation.*

Appendix 7 - Landholder Consultation and Investigation Process



Appendix 8 – Approval Conditions Compliance Tables

Table 6: Development Consent (09_0062) relevant conditions

Condition Number	Environmental Performance Condition	Addressed within
Development Consent (09_0062)		
Schedule 3 Condition 26	**Water Supply** The Proponent shall ensure that it has sufficient water for all stages of the project, and if necessary, adjust the scale of mining operations to match its available water supply, to the satisfaction of the Secretary. *Note: The Proponent is required to obtain all necessary water licences and approvals for the project under the Water Act 1912 and/or Water Management Act 2000.*	Section 2 Section 8
Schedule 3 Condition 27	**Water Pollution** Unless an EPL or the EPA authorises otherwise, the Proponent shall comply with Section 120 of the POEO Act and the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002.	This WMP Section 8
Schedule 3 Condition 28	**Hunter River and Saddlers Creek Alluvials** The Proponent shall not undertake any open cut mining operations within 150 metres of the Hunter River alluvials and Saddlers Creek alluvials that has not been granted approval under previous consents/approvals for Mt Arthur mine complex without the prior written approval of the Secretary. In seeking this approval the Proponent shall demonstrate, to the satisfaction of the Secretary in consultation with NOW, that adequate safeguards have been incorporated into the Surface and Ground Water Response Plan (see condition 34 below) to minimise, prevent or offset groundwater leakage from the alluvial aquifers. *Note: The alluvial aquifers and 150 metre buffers are shown conceptually in Appendix 6.*	Section 8.7 Section 9.4
Schedule 3 Condition 29	**Site Water Management Plan** The Proponent shall prepare and implement a Water Management Plan for the Mt Arthur mine complex to the satisfaction of the Secretary. This plan must: a) be prepared in consultation with NOW and the EPA; and b) include a: - Site Water Balance; - Erosion and Sediment Control Plan; - Surface Water Monitoring Program; - Groundwater Monitoring Program; and - Surface and Ground Water Response Plan.	This WMP Section 6 Section 8 Ref ESCP Section 9.2 Section 9.3 Section 10
Schedule 3 Condition 30	The Site Water Balance must: a) include details of: - sources and security of water supply; - water use on site; - water management on site; - any off-site water transfers; - reporting procedures; and b) investigate and implement all reasonable and feasible measures to minimise water use by the Mt Arthur mine complex.	Section 8
Schedule 3 Condition 31	The Erosion and Sediment Control Plan must: a) be consistent with the requirements of Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, 2004 (Landcom), or its latest version; b) identify activities that could cause soil erosion, generate sediment or affect flooding; c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters, and manage flood risk; d) describe the location, function, and capacity of erosion and sediment control structures and flood management structures; and e) describe what measures would be implemented to maintain the structures over time.	Separate Document referred to by this WMP
Schedule 3 Condition 32	The Surface Water Monitoring Program must include: a) detailed baseline data on surface water flows and quality in creeks and other waterbodies that could potentially be affected by the project; b) surface water and stream health impact assessment criteria; c) a program to monitor and assess: - surface water flows and quality; - impacts on water users;	Section 9 Section 9.2 Section 10.2 Appendix 2 Rehabilitation and Ecological

Condition Number	Environmental Performance Condition	Addressed within
Development Consent (09_0062)		
	- stream health; - channel stability,in Quarry Creek, Fairford Creek, Whites Creek (and the Whites Creek diversion), Saddlers Creek, Ramrod Creek and other unnamed creeks; and d) reporting procedures for the results of the monitoring program.	Monitoring Procedure (MAC-ENC-PRO-080).
Schedule 3 Condition 33	The Groundwater Monitoring Program must include: a) detailed baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores, that could be affected by the project; b) groundwater impact assessment criteria; c) a program to monitor: - groundwater inflows to the mining operations; - impacts on regional aquifers; - impacts on the groundwater supply of potentially affected landowners; - impacts on the Hunter River and Saddlers Creek alluvial aquifers; and - impacts on any groundwater dependent ecosystems and riparian vegetation; d) procedures for the verification of the groundwater model; and e) reporting procedures for the results of the monitoring program and model verification.	Section 9.3 Section 11
Schedule 3 Condition 34	The Surface and Ground Water Response Plan must describe the measures and/or procedures that would be implemented to: a) investigate, notify and mitigate any exceedances of the surface water, stream health and groundwater impact assessment criteria; b) compensate landowners of privately-owned land whose water supply is adversely affected by the project, including provision of an alternative supply of water to the affected landowner that is equivalent to the loss attributed to the project; c) minimise, prevent or offset potential groundwater leakage from the Hunter River and Saddlers Creek alluvial aquifers; and d) mitigate and/or offset any adverse impacts on groundwater dependent ecosystems or riparian vegetation.	Section 8 Section 9 Section 10 Appendix 7

Table 7: EPL 11457 relevant conditions

<table>
<tr><th>Condition Number</th><th>Environmental Performance Condition</th><th>Addressed within</th></tr>
<tr><td colspan="3">EPL 11457</td></tr>
<tr><td>P1.2</td><td>The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.</td><td>This WMP</td></tr>
<tr><td>P1.3</td><td>The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.
Water and land
<table><tr><th>EPA Identification no.</th><th>Type of Monitoring Point</th><th>Type of Discharge Point</th><th>Location Description</th></tr><tr><td>6</td><td>Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS)</td><td>Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS)</td><td>Discharge and monitoring at weir structure downstream of outlet pipe from storage dam at coordinates 298190, 6424890 (Easting, Northing), shown as SW28 on Figure 1.</td></tr><tr><td>15</td><td>Volumetric monitoring
Water quality monitoring
Discharge to utilisation area</td><td>Volumetric monitoring
Water quality monitoring
Discharge to utilisation area</td><td>Discharge and monitoring of STP discharge to effluent pond utilisation area at coordinates 301257, 6420449 (Easting, Northing), shown as LP15 on Figure 1.</td></tr><tr><td>26</td><td>Mine Water Storage</td><td></td><td>Mine water storage dam at coordinates 294158, 6442283 (Easting, Northing).</td></tr></table>
<table><tr><td>6</td><td>Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS)</td><td>Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS)</td><td>Discharge and monitoring at weir structure downstream of outlet pipe from storage dam at coordinates 298190, 6424890 (Easting, Northing), shown as SW28 on Figure 1.</td></tr><tr><td>15</td><td>Volumetric monitoring
Water quality monitoring
Discharge to utilisation area</td><td>Volumetric monitoring
Water quality monitoring
Discharge to utilisation area</td><td>Discharge and monitoring of STP discharge to effluent pond utilisation area at coordinates 301257, 6420449 (Easting, Northing), shown as LP15 on Figure 1.</td></tr><tr><td>26</td><td>Mine Water Storage</td><td></td><td>Mine water storage dam at coordinates 294158, 6442283 (Easting, Northing).</td></tr></table></td><td>Section 9.2</td></tr>
<tr><td>L1.1</td><td>L1 Pollution of Waters
Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.</td><td>This WMP</td></tr>
<tr><td>L2.1</td><td>L2 Concentration Limits
For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.</td><td>Section 9</td></tr>
<tr><td>L2.2</td><td>Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.</td><td>Section 9</td></tr>
<tr><td>L2.3</td><td>To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.</td><td>This WMP</td></tr>
<tr><td>L2.4</td><td>Water and/or Land Concentration Limits
POINT 6
<table><tr><th>Pollutant</th><th>Units of Measure</th><th>50 percentile concentration limit</th><th>90 percentile concentration limit</th><th>3DGM concentration limit</th><th>100 percentile concentration limit</th></tr><tr><td>pH</td><td>pH</td><td></td><td></td><td></td><td>6.5 - 9.0</td></tr><tr><td>Total suspended solids</td><td>milligrams per litre</td><td></td><td></td><td></td><td>120</td></tr></table></td><td>Section 9.2
Appendix 2</td></tr>
</table>

<table>
<tr><th>Condition Number</th><th>Environmental Performance Condition</th><th>Addressed within</th></tr>
<tr><td>L3.1</td><td>L3 Volume and Mass Limits
For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
a) liquids discharged to water; or;
b) solids or liquids applied to the area;
must not exceed the volume/mass limit specified for that discharge point or area.
<table><tr><th>Point</th><th>Unit of Measure</th><th>Volume/Mass Limit</th></tr><tr><td>6</td><td>megalitres per day</td><td>450</td></tr></table></td><td>Section 8
Section 9.2
Appendix 2</td></tr>
<tr><td>M2.3</td><td>Water and/ or Land Monitoring Requirements
POINT 6<table><tr><th>Pollutant</th><th>Units of measure</th><th>Frequency</th><th>Sampling Method</th></tr><tr><td>Conductivity</td><td>microsiemens per centimetre</td><td>Continuous during discharge</td><td>A probe designed to measure the range 0 to 10,000 uS/cm</td></tr><tr><td>pH</td><td>pH</td><td>Daily during any discharge</td><td>Representative sample</td></tr><tr><td>Total suspended solids</td><td>milligrams per litre</td><td>Daily during any discharge</td><td>Representative sample</td></tr></table>POINT 15<table><tr><th>Pollutant</th><th>Units of measure</th><th>Frequency</th><th>Sampling Method</th></tr><tr><td>Faecal Coliforms</td><td>colony forming units per 100 millilitres</td><td>Quarterly</td><td>Grab sample</td></tr></table>POINT 26<table><tr><th>Pollutant</th><th>Units of measure</th><th>Frequency</th><th>Sampling Method</th></tr><tr><td>Aluminium</td><td>micrograms per litre</td><td>Quarterly</td><td>Grab sample</td></tr><tr><td>Benzene</td><td>micrograms per litre</td><td>Quarterly</td><td>Grab sample</td></tr><tr><td>Cadmium</td><td>micrograms per litre</td><td>Quarterly</td><td>Grab sample</td></tr><tr><td>Iron</td><td>micrograms per litre</td><td>Quarterly</td><td>Grab sample</td></tr><tr><td>Lead</td><td>micrograms per litre</td><td>Quarterly</td><td>Grab sample</td></tr><tr><td>Manganese</td><td>micrograms per litre</td><td>Quarterly</td><td>Grab sample</td></tr><tr><td>Mercury</td><td>micrograms per litre</td><td>Quarterly</td><td>Grab sample</td></tr><tr><td>Zinc</td><td>micrograms per litre</td><td>Quarterly</td><td>Grab sample</td></tr></table></td><td>Section 8
Section 9.2
Appendix 2</td></tr>
<tr><td>M3.2</td><td>Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.</td><td>Section 8
Section 9.2
Appendix 2</td></tr>
<tr><td>M8</td><td>M8 Requirement to monitor volume or mass
M8.1 For each discharge point or utilisation area specified below, the licensee must monitor:
a) the volume of liquids discharged to water or applied to the area;
b) the mass of solids applied to the area;
c) the mass of pollutants emitted to the air;
at the frequency and using the method and units of measure, specified below.
POINT 6<table><tr><th>Frequency</th><th>Unit of Measure</th><th>Sampling Method</th></tr><tr><td>Continuous during discharge</td><td>megalitres per day</td><td>Weir structure and level sensor</td></tr></table>POINT 15<table><tr><th>Frequency</th><th>Unit of Measure</th><th>Sampling Method</th></tr><tr><td>Continuous during discharge</td><td>kilolitres per day</td><td>Flow meter and continuous logger</td></tr></table>M8.2 Condition M8.1 for monitoring point 15 comes into effect on 1 October 2017.</td><td>Section8
Section 9.2
Appendix 2</td></tr>
<tr><td>M10.1</td><td>M10 Other Monitoring and recording Conditions
HRSTS Conditions
The licensee must continuously operate and maintain communication equipment which makes the conductivity and flow measurements, taken at Point 6 available to the Department of Land and Water Conservation within one hour of those measurements being taken and makes them available in the format specified in the “Hunter River Salinity Trading</td><td>Section 8
Section 9.2
Appendix 2</td></tr>
</table>

Condition Number	Environmental Performance Condition	Addressed within
	Scheme Discharge Point Site Equipment" as published by the Department of Land and Water Conservation on 7 May 2002.	
M10.2	The licensee must ensure that all monitoring data is within a margin of error of 5% for conductivity measurements and 10% for discharge flow measurement.	Section 9
M10.3	The licensee must mark monitoring point(s) 5 & 6, with a sign, which clearly indicates the name of the licensee, whether the monitoring point is up or down stream of the discharge point(s) and that it is a monitoring point for the Hunter River Salinity Trading Scheme.	Section 8 Section 9.2 Appendix 1 Appendix 2
R4.1	**R4.1 HRSTS Reporting** The licensee must compile a written report of the activities under the Scheme for each scheme year. The scheme year shall run from 1 July to 30 June each year. The written report must be submitted to the EPA's regional office within 60 days after the end of each scheme year and be in a form and manner approved by the EPA. The information will be used by the EPA to compile an annual scheme report.	Section 8 Section 9.2 Appendix 2
E1.1	**8 Special Conditions** **E1 Hunter River Salinity Trading Scheme** This licence authorises the discharge of saline water into the Hunter River Catchment from an authorised discharge point (or points), in accordance with the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2009.	Section 8 Section 9.2 Appendix 2
E 1.2	For the purposes of Clauses 23 and 29 of the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002 the licensee must apply the conversion factor of 0.6.	Section 8 Section 9.2 Appendix 2
E 1.3	The licensee must not exceed the hourly volume discharge limit calculated using the following formula, at all discharge point(s) on this licence titled "Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS)": **H = V / RRT** Where: **H** is the hourly volume discharge limit (in megalitres per hour); **V** is the licence holder's volume discharge limit for the block (in megalitres) calculated in accordance with clause 23 of the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation (2002); and **RRT** is the difference between the discharge stop and start times shown on the river register for that block (in hours) Note 1: The intent of this condition is to prevent spikes of saline water in the Hunter River as a result of discharges of less than the duration permitted by the river register. Note 2: A river register is issued by the Service Co-ordinator and allows participants of the Hunter River Salinity Trading Scheme (HRSTS) to discharge saline to the Hunter River during a discharge period.	Section 8 Section 9.2 Appendix 2

Appendix 9 – Approval from Department of Planning and Environment

Department of Planning and Environment

NSW GOVERNMENT

Our ref: MP09_0062-PA-127

Choe Christensen
Environmental Specialist
Hunter Valley Energy Coal Pty Ltd
59 Thomas Mitchell Drive
Muswellbrook NSW 2333

29/03/2023

Subject: Approval of Mount Arthur Coal Mine Site Water Management Plan

Dear Ms Christensen

I refer to the Site Water Management Plan submitted in accordance with Condition 29, Schedule 3 of the development consent for the Mount Arthur Coal Mine (MP09_0062).

The Department has carefully reviewed the document and is satisfied that it meets the requirements of the relevant conditions of MP09_0062.

Accordingly, as nominee of the Planning Secretary, I approve the Site Water Management Plan (Version 3, dated January 2023).

You are reminded that if there are any inconsistencies between the Site Water Management Plan and the conditions of consent, the conditions prevail.

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact me on (02) 4908 6896.

Yours sincerely

Joe Fittell
Team Leader
Resource Assessments

As nominee of the Planning Secretary

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