WHITEHAVEN COAL

GUNNEDAH CHPP WATER MANAGEMENT PLAN

Edition	Rev.	Comments	Author	Authorised	Date
1	0	2012 CHPP Ponds Upgrade	URS	D Young	July 2012
2	0	Modification 3 review	T Dwyer	J Johnson	July 2016
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Approval	Name	Position	Signed	Date
Document Owner:	Harry Mills	Environmental Advisor	H.Mills	28/12/23
Authorised by:	Megan Martin	Environmental Superintendent	M.Martin	28/12/23

Contents

1 INTRODUCTION

1.1 BACKGROUND

The Gunnedah CHPP (**the CHPP**), incorporating the Rail Load-Out Facility (**RLF**), is owned and operated by Whitehaven Coal Limited (**WHC**) and was originally approved by Gunnedah Shire Council on 7th September 2002 under Project Approval 0079.2002. Figure 1 shows the locality of the CHPP which is approximately 6 km northwest of Gunnedah between Quia Road and the Kamilaroi Highway.

Surface operations are located adjacent to and accessed by the Kamilaroi Highway across:

- DP705086
  - Lot 678
- DP755503
  - Lot 111
  - 112,
  - 120,
  - 471-475 and
  - 498
- DP723509
  - Lot 1
- DP810271
  - Lot 1
- DP239575
  - Lot 1
- DP542047.
  - Lot 12

1.2 PURPOSE AND SCOPE

This document presents the Water Management Plan (**WMP**) for the CHPP. The WMP includes surface water management system, surface and ground water management measures, design objectives and performance criteria and details of the surface water monitoring program. In accordance with condition 14A, WHC will implement the approved Water Management Plan.

1.3 STRUCTURE OF WATER MANAGEMENT PLAN

The following sections of the WMP describe:

- Statutory obligations under the project approval (Section 2)
- Water Management System on site (Section 3)
- Surface water Management on site (Section 4)
- Ground Water Management on site (Section 5)
- Reporting and Review (Section 6)

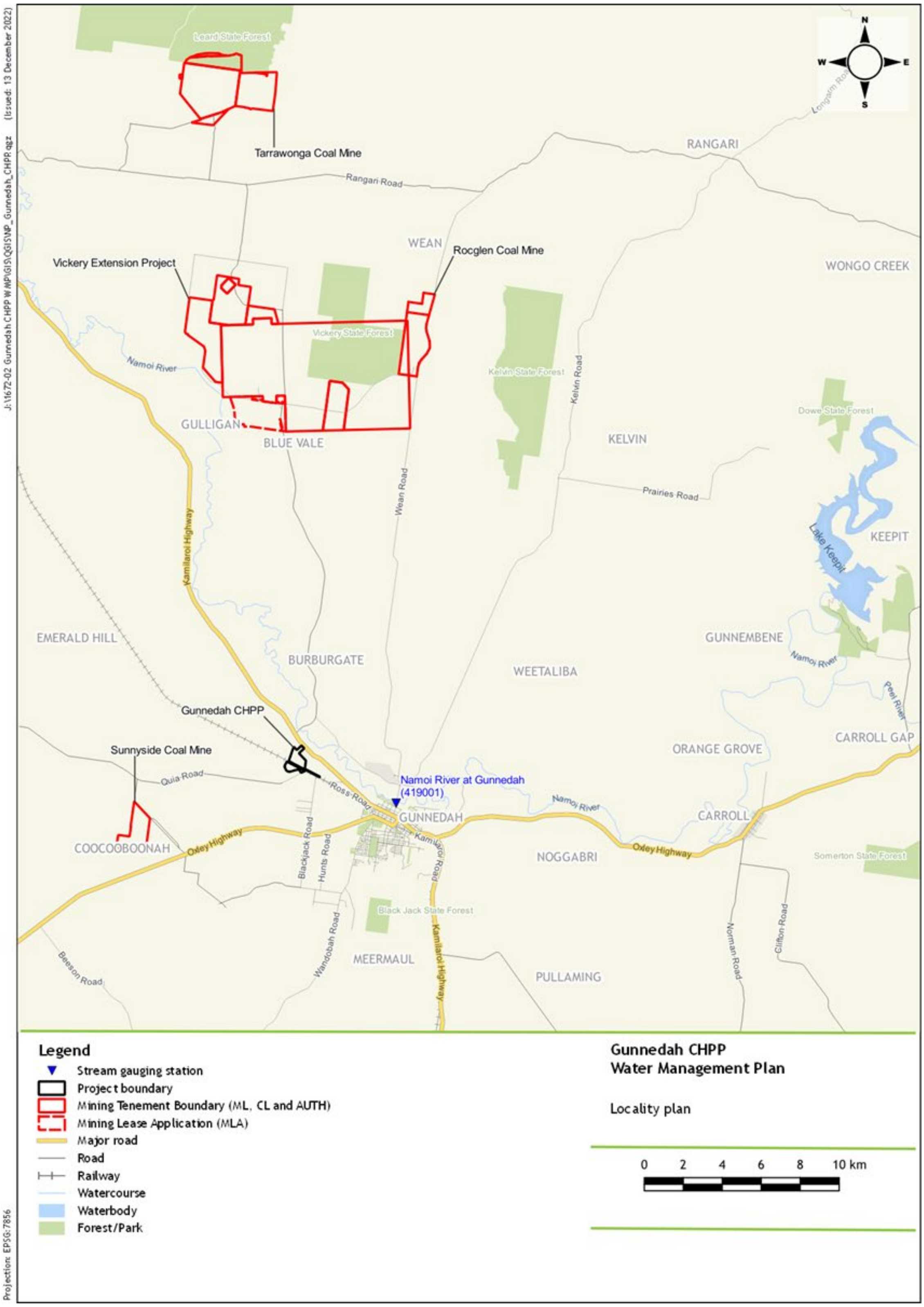

Figure 1 Locality Plan

2 STATUTORY OBLIGATIONS

On 23 December 2011, a proposal to construct additional reject ponds at the CHPP was approved by the then Department of Planning and Infrastructure (DoPI), now Department of Planning and Environment (DP&E), which provided for the construction of 3 additional reject ponds and 2 settlement ponds to the immediate east of the existing pond footprint. On 24 August 2015 an administrative modification to DA 0079.2002 was approved.

The WMP was prepared in accordance with Schedule 3, Condition 3 and 14 of Project Approval 0079.2002 to support the construction of the additional ponds and outline water management requirements for the site. Following a modification in 2015, the WMP was revised in 2016 in accordance with Schedule 3 Condition 19 of DA 0079.2002. The WMP was revised in 2023 for the inclusion of a new raw water dam (RWD) and augmentation of settling ponds, as per Modification 4. The requirements for the WMP from DA 0079.2002 are provided in Table 1, which also shows the section of the WMP where each of these requirements is addressed.

Table 1 - Water Management Obligations Register

Water Management Obligations Register	Condition	Section of WMP
The Applicant shall ensure that any surface water discharges from the site comply with the discharge limits (both volume and quality) set for the development in any EPL.	Schedule3 Condition 3	Section 4.7
The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must be prepared in consultation with DPE Water and the EPA and be submitted to the Secretary for approval prior to construction of the additional reject and settlement ponds. The plan must include:	Schedule3 Condition 14	This Document
an Erosion and Sediment Control Plan, prepared in accordance with Managing Urban Stormwater: Soils and Construction (the Blue Book), 4th Edition or its latest version;	Schedule3 Condition 14, A	Section 3.6
a Surface Water Management Plan, including:	Schedule3 Condition 14, B	Section 4
• a program to monitor surface water flows and quality in the watercourses that could be affected by the project, including trigger levels for investigating adverse impacts; and		Section 4.1
• a site water balance that includes details of: i. predicted annual inflows and outflows from the site; ii. sources and security of water supply for the life of the development (including authorised entitlements and licences); iii. water storage capacity; iv. water use and management on the site, including measures to manage freeboard and minimise offsite discharges; v. licenced discharge points and limits; and vi. reporting procedures.		Section 4.8
a Groundwater Management and Response Plan, which must include:	Schedule3 Condition 14, C	Section 5
• baseline data of groundwater levels, yield and quality in the project area; • groundwater impact assessment criteria, including trigger levels for investigating any adverse groundwater impacts;		Section 5.2
• a program to monitor groundwater in the area of the additional reject and settlement ponds; • a response protocol for any exceedances of assessment criteria; and		Section 5.3
• measures to mitigate and/or offset any adverse impacts on groundwater.		Section 5.3.2

3 WATER MANAGEMENT SYSTEM

3.1 WATER MANAGEMENT STRATEGY OBJECTIVES

The proposed water management strategy for the CHPP is based on targeted management of water from different sources based on anticipated water quality. Water on the site is categorised as either:

- Clean water – water from areas relatively undisturbed by CHPP activities;
- Mine water – surface runoff that is likely to come into contact with coal or other contaminants. Runoff from these catchments is to be contained, as far as practicable, to avoid discharge of potentially contaminated water into the natural water courses; or
- Dirty water – disturbed runoff from infrastructure or disturbed areas, which will potentially have high sediment concentrations.
- Raw Water – Water imported to site from licensed extraction points or from the town water supply with approval from council.

The objectives of the water management system are to ensure:

- clean water runoff from undisturbed catchment areas is diverted away from the coal handling and processing areas, where possible and practical to do so;
- dirty water and mine water runoff from operational areas is contained and reused on-site;
- discharge of water off-site if water quality meets Environmental Protection Licence (EPL) requirements (treatment may be required); and
- on-site water demands are satisfied whilst minimising raw water requirements.

3.2 WATER MANAGEMENT SYSTEM CONFIGURATION

Figure 2 shows a schematic of the site water management system, indicating the key storages on the site and the interconnections between storages. Further details of the site water management system are provided in the following sections.

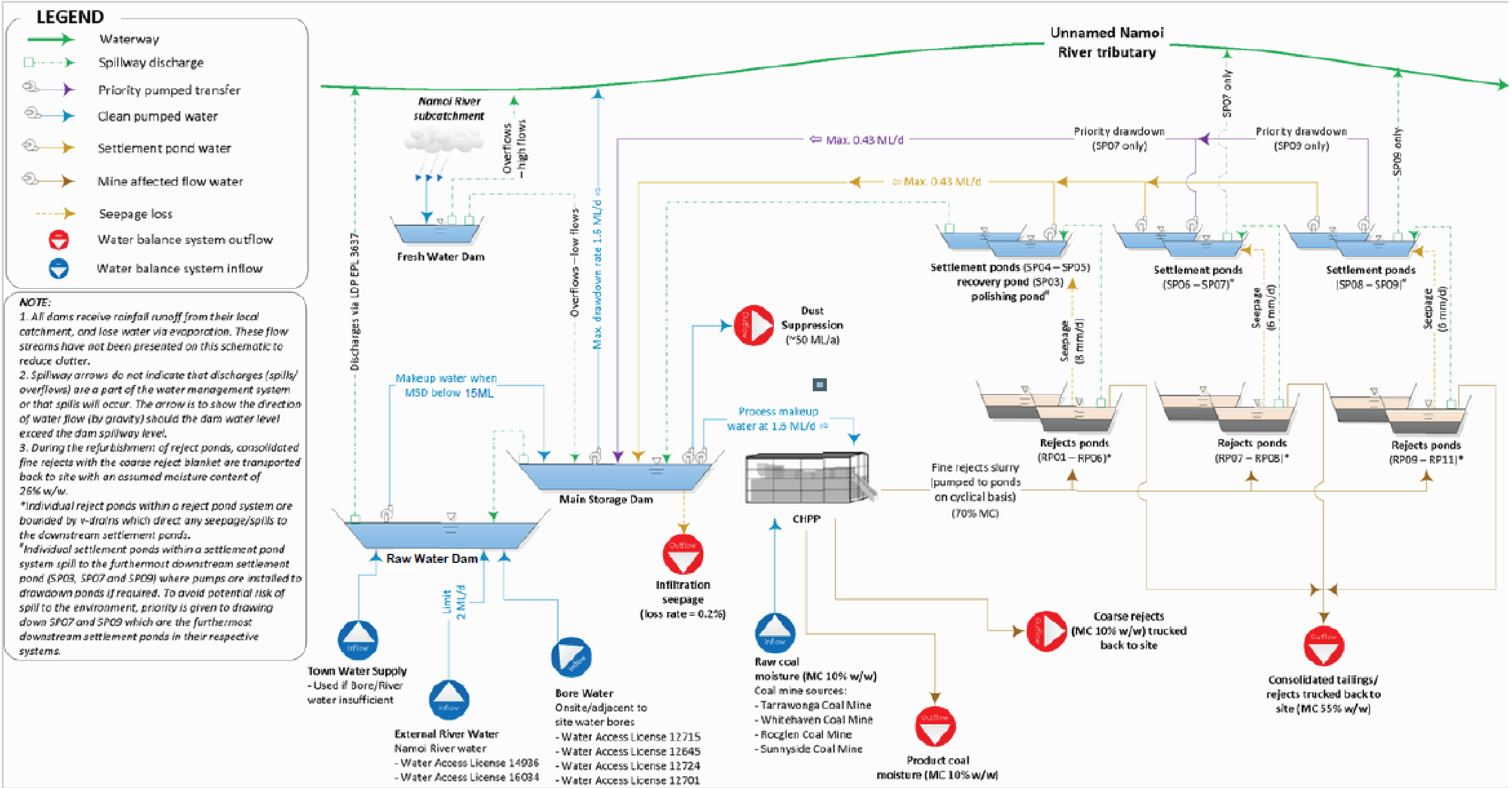

Figure 2 Water Management System Schematic

3.3 CLEAN WATER MANAGEMENT SYSTEM

3.3.1 OVERVIEW

The clean water management system for the CHPP includes the following key components (Refer to Figure 3 for layout):

- Fresh Water Dam;
- Clean water diversion infrastructure; and
- Raw Fresh water infrastructure

Further details of the clean water management strategy are provided in the following sub-sections.

3.3.2 FRESH WATER DAM

Runoff from the central drainage line flows into the Fresh Water Dam (**FWD**). Dam overflows are diverted beneath the railway line via a box culvert to either the MSD or diverted around site to the eastern drainage line. The FWD has a total capacity of 7 ML and complies with the site's harvestable rights allocation. This FWD can be seen in Figure 3.

3.3.3 CLEAN WATER DIVERSION DRAIN

Clean water runoff from the surrounding areas is diverted around the site, as much as practicable, towards the Namoi River. This is achieved using diversion embankments and drainage channels to ensure separation from dirty water and mine water. The diversion of clean water includes:

- The western drainage line is located outside of the project boundary, an embankment along the western boundary prevents clean water entering site.
- The central diversion line passes through the CHPP operational area via the FWD and a diversion drain. Low flows enter into the MSD and high flows are diverted via a weir north of where it connects with the eastern drainage line
- The eastern drainage line is located outside of the project boundary. An embankment and drain prevents clean water entering site. The eastern diversion drain flows north, then northwest past the mine access road before connecting with the western drainage line.

The CHPP is looking to improve the management of clean water by modifying an existing drain to divert clean water from the FWD overflow into the eastern drainage line during high flow conditions, as shown in Figure 3. The modified diversion drain shall be designed and constructed in accordance with the "Blue Book" (Landcom, 2004). The modified diversion drain will improve separation of clean water from the CHPP Water Management System (**WMS**).

Figure 3 CHPP Water Management System

3.3.4 RAW WATER SOURCES

The CHPP has access to three sources of raw water. The licensed extraction points are shown in Table 2 including:

- **Groundwater:** Water is sourced from the "River Bore" and "Olive View Bore". The two bores share three WALs (12645,12715 and 12724) with a combined annual allocation of 155 ML and a maximum combined extraction of 310 ML with carry over or temporary transfers. An inactive bore is not used by the CHPP, however the water from WAL 12701 is transferred to the other WALs as required.
- **River water:** Water is sourced from the Namoi River via a river pump. The works approval has a high security and general security license. Since the construction of the new River Water Dam, the CHPP Has been able to source more water from the river, reducing bore water use
- **Town Water Supply:** During extreme droughts, the CHPP may connect to the town water supply to source water. This connection requires approval from the Gunnedah Shire Council.

Licensed extraction from groundwater and river water is metered with telemetry through WaterNSW-Data Acquisition Services (DAS) and all water take is accounted for in WaterNSW-Internet Accounting System (iWAS).

Table 2 CHPP Licence Extraction Points and WALS

Extraction Site	Works Approval	WAL	Water Source	Annual Allocation (ML)	Max take with carryover/Temporary transfer (ML)
River Bore	90WA807004	12645	Upper Namoi Zone 4, Namoi Valley (Keepit Dam To Gin'S Leap) Groundwater Source	35	70
Olive View Bore	90CA806981	12715		75	150
		12724		45	90
Inactive Bore	90CA806971	12701		20	Bore is inactive – No Take
			Total Groundwater	**155**	**310**
River Pump	90WA801821	16034	Lower Namoi Regulated River Water Source (High Security)	50	50
		14936	Lower Namoi Regulated River Water Source (General Security)	1056	1584
			Total River Water	**1106**	**1634**

3.4 MINE WATER MANAGEMENT SYSTEM

The CHPP workshop has been constructed with concrete flooring which in conjunction with bunding, oil/water separation infrastructure, and spill kits minimises the likelihood of contamination.

Routine sampling of the MSD allows identification of any hydrocarbon contamination issues that may arise and management of the dam with sufficient freeboard minimises the likelihood of wet weather discharges. All samples of Oil and Grease from the MSD have been below 10 mg/L as shown in Table 3.

All chemical and hydrocarbon storages will be constructed and maintained in accordance with Australian Standard 1940 The Storage and Handling of Flammable and Combustible Liquids.

3.4.1 REJECT PONDS

The reject ponds are set up in three distinct systems, spread across the CHPP site. Rejects ponds are used to temporarily store and dry rejects prior to transport to Tarrawonga and Vickery Coal Mine in accordance with the relevant project approvals. Each system consists of a number of reject ponds, all of which are connected to a smaller number of settlement ponds. Reject material is directed to the reject ponds on a cyclical basis depending upon available storage. The reject ponds have been constructed with compacted clay bases, and coarse reject walls to enable the water to filter through the walls and into the settlement ponds. The combined volumes and surface areas of the three reject ponds systems are shown in Table 3-Table 5.

Table 3 Reject Ponds System 1 (RP1-RP6) Volumes and Surface Area

Pond	Operating Volume (m^3)	Freeboard Volume (m^3)	Total Volume to Crest (m^3)	Top Surface Area (m^2)
RP-1	15,038	7,262	22,300	12,103
RP-2	15,612	7,018	22,630	11,697
RP-3	15,133	7,327	22,460	12,212
RP-4	2,379	2,411	4,790	4,019
RP-5	2,728	2,552	5,280	4,254
RP-6	4,689	2,471	7,160	4,119
Sum	**55,578**	**29,042**	**84,620**	**48,404**

Table 4 Reject Ponds System 2 (RP7-RP8) Volumes and Surface Area

Pond	Operating Volume (m^3)	Freeboard Volume (m^3)	Total Volume to Crest (m^3) *	Top Surface Area (m^2)
RP-7	20,050	6,035	26,085	10,650
RP-8	17,160	5,648	22,808	9,345
Sum	**37,210**	**11,683**	**48,893**	**19,995**

* Allowance has been made for reduction of volume due to the Coarse Reject Blanket.

Table 5 Reject Ponds System 3 (RP9-RP11) Volumes and Surface Area

Pond	Operating Volume (m3)	Freeboard Volume (m³)	Operating Volume (m³)	Freeboard Volume (m³)	Total Volume to Crest (m³) *	Top Surface Area (m²)
	Including Coarse Reject Blanket Volume					
RP-9	36,703	46,592	32,410	9,890	42,300	16,731
RP-10	37,143	46,884	32,933	9,741	42,674	16,480
RP-11	44,233	53,533	40,390	9,300	49,690	15,740
Sum	**104,079**	**147,009**	**105,733**	**289,301**	**134,664**	**48,950**

Figure 4 Reject Pond Site Map

3.5 DIRTY WATER MANAGEMENT SYTSTEM

3.5.1 DIRTY WATER DRAINAGE SYSTEM

The dirty water management system is based around a series of dirty water drains that convey surface flows (see Figure 4). The system also contains a series of settlement ponds that make up the individual reject pond systems.

The dirty water diversion channels constructed around the site convey dirty water in a controlled way to the respective dirty water dams prior to re-use and/or subsequent discharge. Diversion bunds are used to direct surface flows to the diversion channels.

All water collected and contained within the reject pond system at the CHPP will be either retained in settlement ponds, pumped to the MSD for storage, or pumped directly to the CHPP for use in the coal washing process.

3.5.2 MAIN STORAGE DAM

The MSD at the CHPP was constructed by the previous occupiers of the site (Rio Tinto) as a containment structure associated with the operation of the RLF for the Vickery Coal Project. The stored water is utilised to fulfil the water requirements of the CHPP. As the MSD also provides direct feed to the CHPP, the storage volume is constantly changing based on plant feed requirements and subsequent inflows to maintain supply.

In terms of ongoing management, the MSD will continue to be subject to consistent drawdown as a consequence of water being recirculated through the CHPP for coal washing purposes. This will reduce the potential for discharge from the MSD to occur.

Table 6 shows details of the MSD design, operational volumes and pumping rates.

The MSD is managed as follows:

- a maximum operating volume (MOV) of 15 ML
- a free board of 25 ML for a 10% AEP 24-hour design storm;
- An outlet valve is located to allow for discharges; and
- a full storage volume (FSV) of 40 ML
- Construction of the new RWD will reduce the FSV to 30 ML. This will be compensated for by providing 20 ML of freeboard in the RWD

Any stormwater detained above the MOV will be released in accordance with the EPL or used for processing operations.

Table 6 Main Storage Dam Volumes, Surface Area and Pumping Rates

Parameter	Value	Comment
Full Storage Volume (ML) =	40 (30)	Up to spillway level
Maximum operating volume (ML) =	15	
Draw Down Volume (Storage) (ML) =	12	Valve outlet
Pumping Stops Volume (ML) =	2.25	
Maximum Surface Area (ha) =	2.8	Used for evaporation loss
Infiltration Seepage Rate =	0.2%	Ground water loss

3.5.3 RAW WATER DAM

Table 7 shows details of the RWD design, operational volumes and pumping rates. The proposed RWD to be constructed in 2023 (shown in Figure 4) will provide 50 ML of additional storage capacity. The following design rules will be used for the construction of the RWD:

- Detailed design by a suitably qualified engineer.
- Dam walls will be compacted to low permeability to reduce seepage (1x10-9).
- The dam excavation will be designed so as not to interact with groundwater (the groundwater table is approximately 8-9 m below natural ground surface).
- The spillway will be designed for a 1% AEP design storm.

The RWD will receive potential overflow from the MSD. The RWD will be operated at a MOV of 30 ML, with 20 ML freeboard storage volume to account for spills from the MSD, for to FSV of 50 ML.

Table 7 Raw Water Dam Volumes, Surface Area and Pumping Rates

Parameter	Value	Comment
Full Storage Volume (ML) =	50	Up to spillway level
MOV (ML) =	30	
Import Volume (Storage) (ML) =	4	Import from raw sources when RWD is below 4 ML
Import Rate (ML/day) =	2	
Maximum Surface Area (ha) =	3	Used for evaporation loss
Infiltration Seepage Rate =	0%	Ground water loss

The RWD is primarily designed to increase site's ability to draw water from the Namoi River during block releases, reducing the use of groundwater. Raw water will be piped in to the RWD when MSD volumes are low and insufficient to meet site demands.

The RWD will also provide site with reduced spill risk from the MSD, by providing an additional 20 ML of freeboard. The RWD will spill offsite via a Licensed Discharge Point (**LDP**) in accordance with the EPL. The additional freeboard, and mixing of water from the MSD and RWD will help improve water quality prior to any discharges offsite.

3.5.4 SETTLEMENT PONDS

Settlement pond are utilised to polish water captured from the reject ponds to allow for the clarified water to be reused by the CHPP circuit either through direct pumping through the plant or via storage in the MSD. No new settling ponds have been constructed at the CHPP since 2013, and no new Settling ponds are planned to be constructed. In the event any new settling ponds were constructed, the following design principles would be adopted:

- Design by a suitably qualified engineer;
- Settling ponds will be compacted (0.3 m) to low permeability to reduce seepage (1x10-9);
- The excavation will be no deeper than 4m below natural (the groundwater table is approximately 8-9 m below natural); and
- The spillway will be designed for a 1% AEP design storm.

Table 8 provides details for the settlement ponds which are operated in the following manner:

- Gauge boards are installed to ensure the dam's freeboard of 0.6 m is maintained.
- In the event of rainfall elevating the water levels of these ponds above the freeboard level, water will be pumped back to the MSD. The adopted pumping rate to the MSD is 12 L/s pumping 10 hours per day.
- Water within the settlement ponds is pumped into the ring main for use in the CHPP or for dust suppression.
- Pumping ceases when the basin reaches 1 m from invert to avoid agitation of the settled sediments.

Ponds SP-7 and SP-9 have the potential to overflow directly to the unnamed tributary and eventually the Namoi River. To manage the risk of unlicensed discharge, priority is given to drawing down these ponds first, pumping the water to the MSD. This process provides sufficient freeboard in the settlement ponds to avoid overflow except in extreme rainfall events. The SPs are not predicted to spill under the modelled climate conditions. This is possible due to the relatively small catchments within each reject pond system (max of 5.5 ha) that reports to these settlement ponds. Settlement ponds SP-1 and SP-2 have been excluded as separate water storages because of their small size and are assumed to contribute directly to the MSD catchment.

Table 8 Settlement Ponds Volumes, Surface Area and Pumping Rates

Parameter	SP-4 and SP-5 Recovery (SP-3) and Polishing	SP-6 and SP-7	SP-8 to SP-9
Max Volume (m^3) =	3,046	5,117	8,842
Pumping Start Volume (m^3) =	1,620	3,400	6,320
Pumping Stops Volume (m^3) =	620	1,400	2,320
Surface Area (m^2) =	3,019	3,632	5,615
Infiltration Seepage Rate =	0%	0%	0%
Pumping Rate to Storage (12L/s x 10 hours per day (m^3/day) =	432	432	432

3.5.4.1 Settlement Pond Upgrades

As per Modification 4, the CHPP is approved to augment the settling ponds SP06, SP05, SP07 and SP08 by removing internal walls. Removing internal walls allows the ponds to be more easily managed and dewatered. Figure 5 shows the location of the walls that are to be removed. The removal of the internal walls will have a negligible impact on the size of the settlement ponds. No changes will be made to the external walls or the base lining of the settling ponds.

Figure 5 Settling Pond Augmentation

3.6 EROSION AND SEDIMENT CONTROL

3.6.1 GENERAL PRINCIPLES

Effective erosion and sediment control (**ESC**) is based on three key activities:

- Erosion control – prevention or minimisation of erosion caused by runoff on disturbed surfaces.
- Drainage control – a secondary erosion control, prevention or minimisation of soil erosion caused by concentrated flows. Appropriate management and separation of different water types through/around the area of concern.
- Sediment control – trapping or retention of sediment generated from either overland flow or concentrated flow.

3.6.2 SOURCES OF EROSION AND SEDIMENTATION

There are a number of activities which are undertaken at the CHPP which have the potential to cause soil erosion and generate sediment unless adequate control measures and practices are implemented. Erosion or sedimentation may potentially result from any of the following:

- Surface runoff from areas disturbed as a result of vegetation or topsoil removal;
- Surface runoff from topsoil or subsoil stockpiles prior to establishment of an adequate vegetative cover;
- Surface runoff from rehabilitation areas prior to the establishment of a suitable ground cover;
- Runoff from hardstand areas including roads and the main office area;
- Excessive surface water runoff velocity within drainage lines and on disturbed surfaces; and
- Surface runoff from coal stockpile areas.

Potential impacts from these activities include:

- increased surface erosion from disturbed and rehabilitated areas through the removal of vegetation and stripping of topsoil;
- increased sediment and pollutant load entering the natural water system; and
- siltation or erosion of watercourses and water bodies.

3.6.3 ON-GOING EROSION AND SEDIMENT MANAGEMENT PRACTICES

The sediment laden runoff produced from these activities must be managed to ensure that downstream water quality is within the adopted water quality compliance criteria. Sediment and erosion control measures for the CHPP are designed to ensure effective management of clean surface water and sediment laden runoff from CHPP operational areas. The following practices will be implemented at the CHPP to minimise potential for erosion and sedimentation:

- Installation of all erosion and sediment controls and water management structures prior to any ground disturbance taking place; Temporary erosion and sediment control measures will be implemented for the construction of the proposed water management structures.
- Land disturbance will be minimised by clearing the smallest practical area of land ahead of disturbance activities;
- Disturbance areas which will not be actively utilised will be revegetated as soon as practical following completion of works in that area;
- Where practical, disturbance areas will be shaped such as to provide a free draining surface to direct dirty water runoff into the dirty water drains for collection in the MSD;
- Where localised flooding or ponding occurs, access will be restricted where practicable until such time as the ground is no longer waterlogged in order to reduce the potential for additional sediment mobilisation;
- If erosion is identified on a rehabilitating landform or in the operational area, it will be remediated as quickly as practical to reduce the potential for significant erosion to develop. Areas previously rehabilitated will be inspected regularly to ensure rehabilitation works are effective; and

- Where necessary, temporary erosion and sediment control measures will be utilised to prevent and/or reduce the potential for adverse erosion developing, and may include sediment fences, check dams, surface protection and advanced revegetation methods such as hydro-mulching.

The design of erosion and sediment control measures at the CHPP will be based on the principle of ensuring that runoff from disturbed areas is separated from clean area runoff and collected in settlement ponds for reuse on site. Sediment control structures will be designed in accordance with current recommended design standards including:

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

3.7 DAM LICENSING

Water captured by all storages at the CHPP will be appropriately licensed under the Water Management Act 2000 (WM Act 2000) based on the location and purpose of each storage. The various licence categories for storages located within the project boundary are shown in Table 9 and 10

Table 9 Licence Categories for Site Water Use and Storage

Licence Category	Reference	Conditions
Water Access License (WAL)	Section 56 *WM Act 2000*	Approval for water supply works and/or water use from *WaterNSW*
Harvestable right	Section 53 *WM Act 2000*	Dam located on a minor stream[1]. Total of all harvestable rights dams not to exceed 10% of the average regional run-off calculated from landholding area multiplier.
Mixed Rights	New South Wales (NSW) Government Gazette No. 40, Schedule 3, p1630	A dam from which water is taken as a harvestable right, as well as for other water rights. Runoff captured calculated on the average regional run-off calculation assuming 100% capture.
Excluded work	Water Management (General) Regulation 2018 – Schedule 1	Dam for control of erosion, flood detention or capture of drainage consistent with best management practice to prevent the contamination of a water source. Located on a minor stream[1].
Exempt	NSW Farm Dams Policy	Pre-1999, less than 7 ML

[1] A minor stream is a first or second order stream

3.7.1 CLEAN WATER COMPLIANCE

The licence category of each dam on the site is provided in Table 10. The CHPP compliance of clean water take is summarised as:

- The sum of the project boundary area is 88 ha, with a specific multiplier value of 0.065, which equates to a Maximum Harvestable Rights Dam Capacity (MHRDC) of 5.7 ML.
- The total volume of Harvestable Rights Dams is currently 7 ML.
- An additional 20.4 ha of contiguous landholdings shown in Figure 6 provides the CHPP with MHRDC of 7 ML.

Table 10 Dam Licence Categories

Dam	Dam Volume (ML)	Catchment Area (ha)	Licence Category
FWD	7.0	53.77	Harvestable rights
MSD	40.0	43.26	Excluded works
RWD*	50.0	2.22	N/A
RP1-RP6	84.6	4.72	Excluded works
RP7-RP8	48.9	2.00	Excluded works
RP9-RP11	134.7	5.45	Excluded works
SP3-SP5 and Polishing-pond	10.5	4.36	Excluded works
SP6-SP7	4.0	2.50	Excluded works
SP8-SP9	8.7	3.35	Excluded works
SP1	0.6	0.06	Excluded works
SP2	0.6	0.06	Excluded works

*The proposed RWD has no clean water catchment

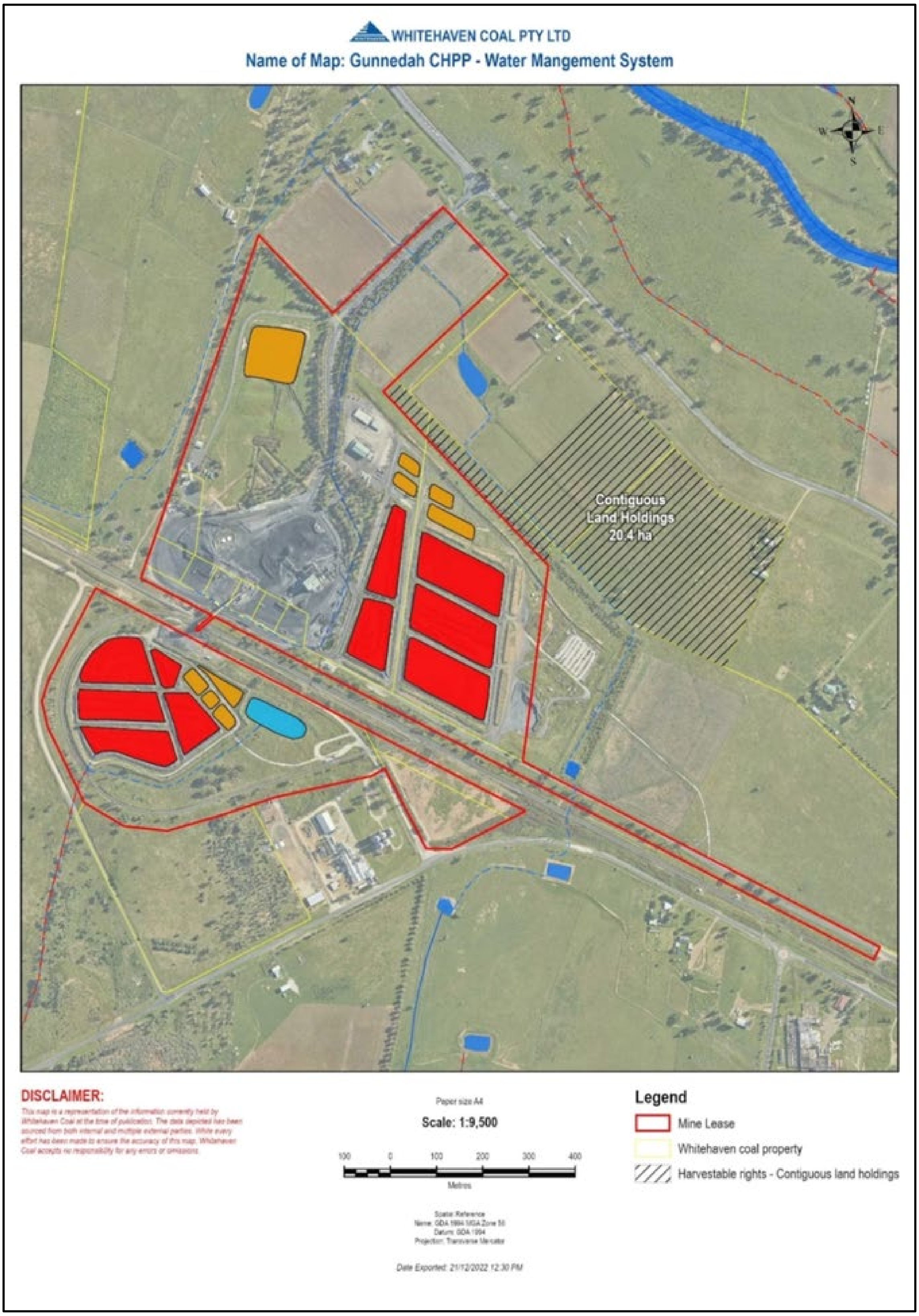

Figure 6 Harvestable Rights Contiguous Landholdings

4 SURFACE WATER MANAGEMENT PLAN

4.1 SURFACE WATER MONITORING PROGRAM

The CHPP is subject to a water monitoring program to verify the quality of water in key storages and in the receiving environment. Monitoring of water quality and quantity will assist in demonstrating that the site water management system is effective in meeting its objective of no adverse impact on receiving water quality and will allow for early detection of any impacts and appropriate corrective action.

Figure 7 shows the locations of surface water sampling undertaken by the CHPP. The surface water monitoring program will:

- ensure compliance with the Gunnedah CHPP environment protection licences;
- provide valuable information on the performance of the water management system and for the validation of the site water balance model; and
- facilitate adaptive management of water resources on the site.

To improve monitoring of water quality in the upstream and receiving environment, Whitehaven is proposing 5 additional monitoring locations shown in Figure 7, including

- Namoi River upstream and downstream
- Western Drainage Line upstream and downstream
- Central Drainage Line upstream

These monitoring locations will improve understanding of the baseline conditions in the receiving environment.

4.2 UPSTREAM AND RECEIVING ENVIRONMENT WATER QUALITY MONITORING

In addition to monitoring water quality in the discharges from LDPs, water quality in the upstream and receiving environmental shall also be monitored. The proposed monitoring locations are shown in Figure 7 and include;

- Upstream and downstream of the Western Drainage Line;
- Upstream and Downstream of the Namoi River; and
- Upstream of the Central Drainage Line.

4.3 INSPECTION AND MAINTENANCE

Regular inspections will be undertaken for all water management and erosion and sediment control structures throughout the operational life of the CHPP. Inspections are undertaken monthly or following a significant rainfall event (greater than 25 mm of rainfall in 24 hours).
Where water management structures or erosion and sediment control structures have lost capacity due to excessive sediment build up or scouring is identified, rectification works will be undertaken, when possible, to ensure the structures have sufficient capacity to handle any subsequent rainfall events.

Figure 7 Surface Water Monitoring locations

4.4 SURFACE WATER SAMPLING STANDARDS

Surface water monitoring will be undertaken in accordance with relevant Australian Standards, legislation and NSW Guidelines, including:

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

4.5 MONITORING LOCATIONS, PARAMETERS AND FREQUENCY

Figure 7 shows the locations of surface water sampling undertaken by the CHPP. Table 11 summarises sampling frequency for the water storages onsite. The current water quality monitoring program includes discharge and quarterly samples for the MSD to determine whether site runoff meets the adopted water quality compliance criteria.

On-site quarterly sampling from the MSD allows for any potential problem areas with respect to pollutant generation on-site to be identified early, ensuring appropriate remedial action can be taken. The event-based sampling should enable quantification of any pollutant loads from the site.

Table 11 Surface Water Monitoring

Monitoring Locations	Parameters	Frequency
MSD, RWD	Oil and Grease (O&G), pH, TSS, TOC, EC Temperature (°C), pH – Field, Field Electrical conductivity(µS/cm), Lead[a] (mg/L), Calcium (mg/L), Magnesium (mg/L), Sodium (mg/L), Potassium (mg/L), Total Cations (mq/L), Chloride (mg/L), Sulphate (mg/L), Hydroxide Alkalinity (mg/L), Carbonate Alkalinity (mg/L), Bi-Carbonate Alkalinity (mg/L), Total Alkalinity (mg/L), Total Anions (mq/L), Ionic Balance (%), Nitrite, Nitrate (mg/L), Ammonia	Quarterly
LDPs	O&G, pH, TSS, TOC, EC	Within 12 hours of a discharge
Receiving Environment	O&G, pH, TSS, TOC, EC	Within 12 hours after a discharge

a All metals will be analysed for total and dissolved concentration

4.6 SURFACE WATER BASELINE DATA

4.6.1 REGIONAL DRAINAGE NETWORK

The Namoi River catchment is part of the Murray-Darling Basin. The Namoi River is a tributary of the Barwon River that ultimately flows to the Murray-Darling River System.

The Namoi River catchment is bounded by the Great Dividing Range in the east, the Liverpool Ranges and Warrumbungle Ranges in the south, and the Nandewar Ranges and Mount Kaputar to the north. Major tributaries of the Namoi River include the Mooki, Peel, Cockburn, Manilla and Macdonald Rivers, all of which join the Namoi River upstream of Gunnedah. Flow in the river has been regulated by releases from Keepit Dam, located about 56 kilometres (km) west of Tamworth, since the dam's completion in 1960. Keepit Dam has a storage capacity of 425,510 ML. Water is released from this major water storage for irrigation, industrial and domestic/urban requirements and as environmental flow in the Namoi River catchment.

Figure 1 shows the closest gauging station to the CHPP which is located at Gunnedah (419001) upstream of the Cohens Bridge crossing of the Namoi River. The catchment area of the Namoi River to Gunnedah is approximately 17,100 km2 (Water NSW, 2022). Streamflow in the Namoi River at Gunnedah is characterised by strong flow persistence with flows exceeding 1.6 ML/day on 90% of days. Zero flow is recorded on 7.7% of days. Over the full period of available data, streamflow in the Namoi River at Gunnedah has a median of 484 ML/day and an average of 1,678 ML/day.

4.6.2 LOCAL DRAINAGE NETWORK

The CHPP is located within a sub catchment of the Namoi River basin, with elevations in the region ranging from 761 mAHD at King Jack Mountain (approximately 12 km south-southwest from the site) to 886 mAHD in the Kelvin Range (approximately 25 km north from the site). To the immediate north of the site, along the Namoi River, ground elevations are approximately 260 mAHD.

The local drainage within the vicinity of the CHPP includes the modified drainage network to divert water around and through site as shown in Figure 3, which including the following drainage features:

- The Western catchment flows past the western boundary of the CHPP via the western drainage line. The western drainage line enters the Namoi River to the North of the CHPP. The western catchment is highly modified, including several dams, a waste treatment facility, irrigation areas associated with the Gunnedah Leather Processes and agricultural land (grazing and cropping).
- The Central catchment flows through the CHPP via the central drainage line which enters the Fresh Water Dam before draining through a clean water diversion, which connects to the eastern drainage line. The central catchment is highly modified, including several dams, the Gunnedah Leather Processing facility and associated irrigation areas, a recreational airport and agricultural land (grazing, cropping and orchards).
- The Eastern catchment flows past the eastern boundary of the CHPP via the Eastern Drainage Line. The Eastern Drainage Line flows past the eastern boundary of the CHPP, before flowing northwest, under the mine entrance road then connecting with the Western Drain Line. The Eastern catchment is highly modified, including several dams, irrigation areas associated with the Gunnedah Leather processes, a caravan park, quarries and agricultural land (grazing, cropping and orchards).

The local drainage network is considered a “clean water” catchment. However, due to the highly modified nature of the catchments, the local drainage network typically does not comply with the Anzecc guidelines and is typically poorer quality than the water stored at the CHPP. The CHPP has implemented an improved monitoring program to better understand the water quality in the local drainage network and how this poor water quality may impact the site WMS, in particular flows entering site via the Central Drainage Line.

Figure 8 Local Drainage Network

4.6.3 STREAMFLOW

WaterNSW records streamflow at the Gunnedah gauge (419001), just upstream of the Cohens Bridge crossing of the Namoi River. Gauge details are provided in Table 12. Whitehaven does not operate any streamflow gauges for the CHPP.

Table 12 Available Streamflow Data on Namoi River

Stream	Gauge Name	Gauge Number	Catchment Area (Km^2)	Period of Record
Namoi River	Gunnedah	419001	17,100	1968-

Figure 9 and Figure 10 show a time series of daily flow and ranked daily flow (data taken from http://www.bom.gov.au/waterdata/) for the Gunnedah gauge on the Namoi River.

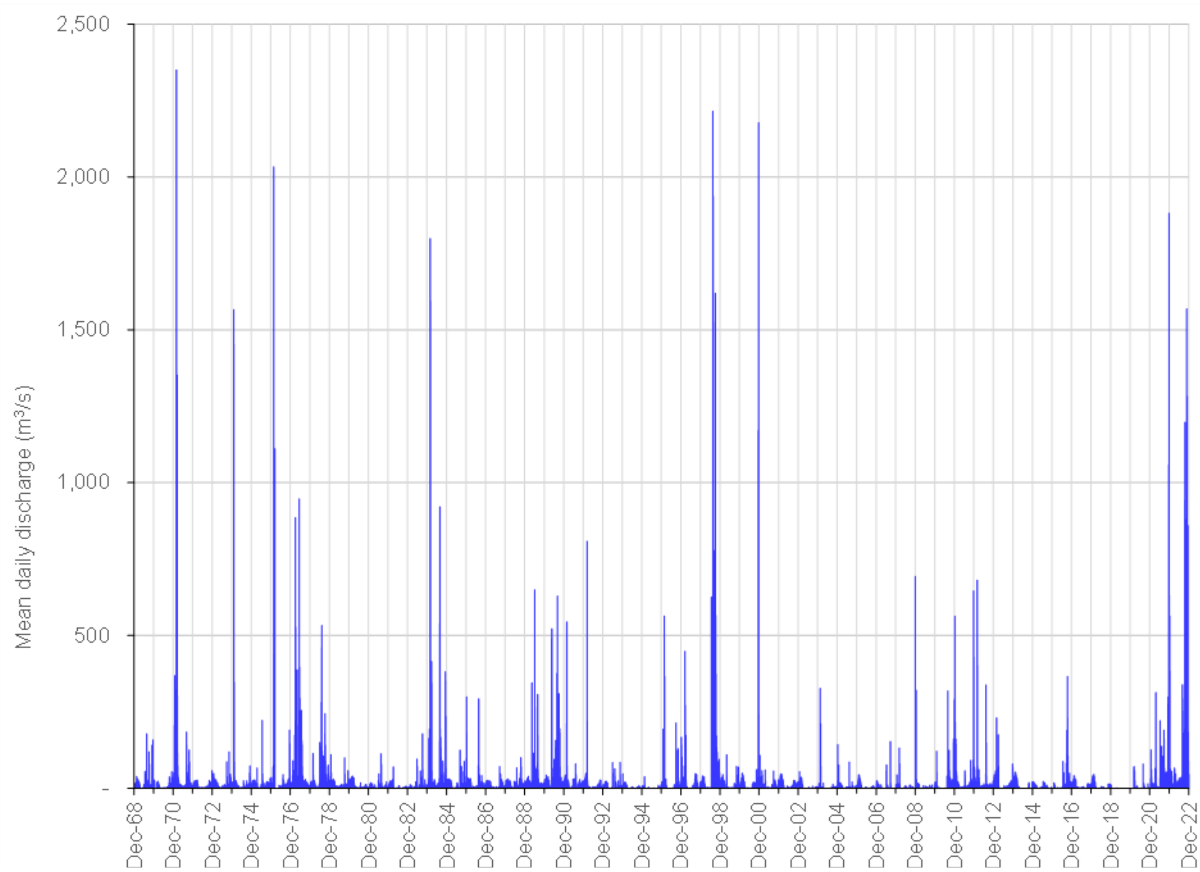

Figure 9 Daily Mean Discharge, Namoi River at Gunnedah (Gauge No. 419001)

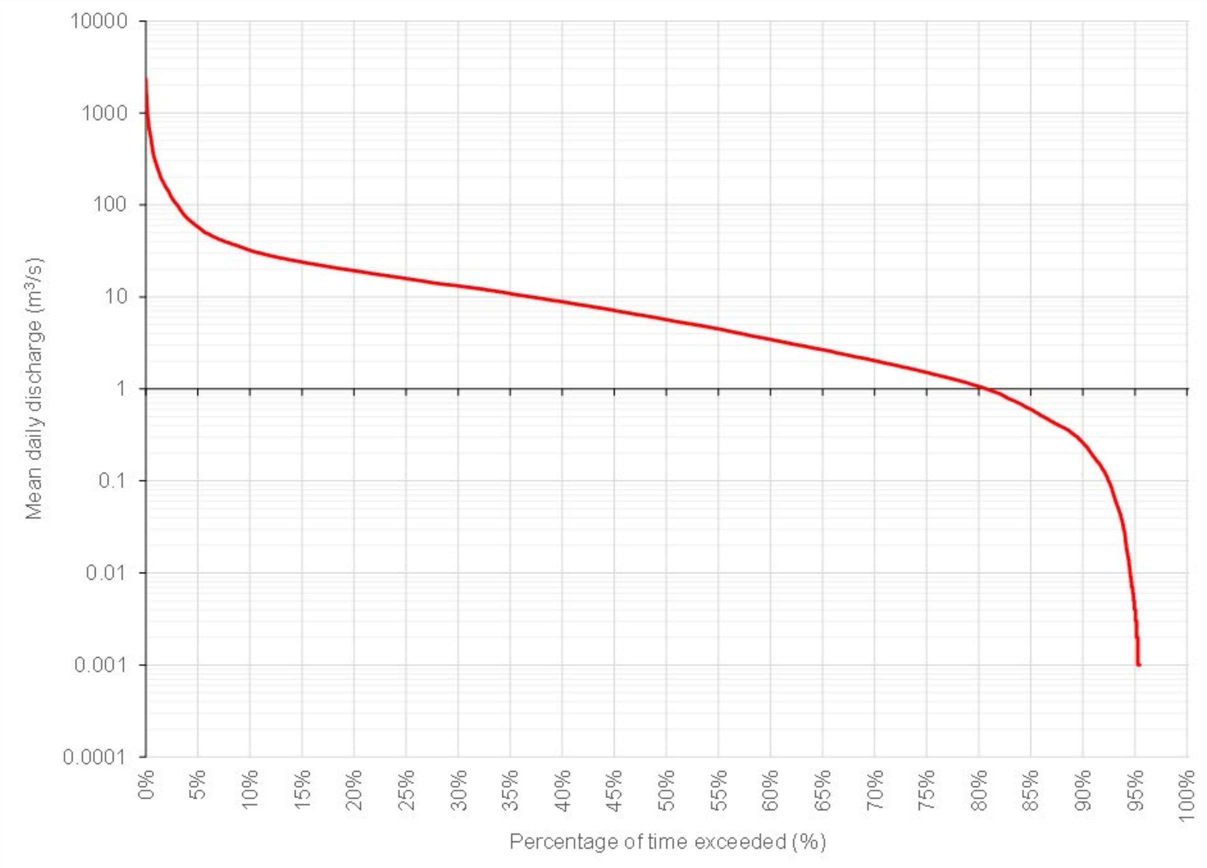

Figure 10 Ranked Flow Plot, Namoi River at Gunnedah (Gauge No. 419001)

4.6.4 RECEIVING WATER QUALITY

Water quality of the Namoi River is generally characterised by elevated electrical conductivity (EC), pH, turbidity and nutrients (TN/TP) relative to Australian and New Zealand Governments (ANZG) (2018) default guideline values (DGVs) for aquatic ecosystems (Table 13).

The Water quality technical report for the Namoi surface water resource plan area (SW14) (DPIE, 2020) provides summary water quality sample data (75th percentile value) for the Namoi River at Gunnedah between 2007 and 2015. This data for the Namoi River at Gunnedah is provided in Table 13, with a comparison to the ANZG DGVs for aquatic ecosystems. The data shows that:

- The 75th percentile sample values for pH, EC, turbidity, TN and TP all exceed the ANZG default trigger values for the protection of aquatic ecosystems.
- The mean daily turbidity in the Namoi River (according to NOW [NOW DI Water] gauging station records) of 141 NTU exceeds the ANZG trigger value for aquatic ecosystems.
- There is a lack of data on the presence of heavy metals, trace elements and hydrocarbons.

Table 13 Summary of Average Water Quality Data

Location (Figure 1)	**Parameter**					
	pH	EC (µS/cm)	TSS (mg/L)	Turbidity (NTU)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
Namoi River at Gunnedah (419001) – ***75th percentile value***	8.2	625	36.0	31.1	0.875	0.116
ANZG Default Guideline Values						
Aquatic Ecosystems	6.5 – 8.0	30 – 350	-	2 – 25	0.25	0.02

4.6.5 SITE WATER QUALITY

Table 14 summarises the surface water quality sampling results over the last five years for the Main Storage Dam (MSD) for pH, electrical conductivity (EC), total suspended solids (TSS), Total Organic Carbon (TOC) and Oil & Grease. Figure 11 shows the pH, EC, TSS, TOC and Oil & Grease readings respectively for the MSD monitoring locations between 2017 and 2021.

4.6.5.1 pH

pH readings range between 7.2 and 8.9 for the MSD. There is a slight downward trend in pH over the last five years, with pH since the beginning of 2021 below target pH. The operation expects this trend to continue, as the operation utilises more water from the Namoi River, which has a lower pH than bore water. High pH water will be dosed prior to any releases to ensure compliance with discharge limits.

4.6.5.2 EC

EC readings range between 1,040 and 2,940 µS/cm for the MSD. EC shows a declining trend over the last 5 years, which is a reflection of the wetter climatic conditions from 2020. The EC in MSD is much lower than EC in the underlying groundwater and in local tributaries.

4.6.5.3 TSS

TSS readings range between 5 mg/L and 53 mg/L for the MSD. There is no discernible trend in TSS over the last five years.

4.6.5.4 TOC

TOC readings range between 1 mg/L and 24 mg/L for the MSD. There is no discernible trend in TOC over the last five years.

4.6.5.5 Oil & Grease

Oil & Grease readings range between 5 mg/L and 7 mg/L for the MSD. Oil & Grease readings are generally below the limit of detection (<5 mg/L) over the last five years.

Table 14 Main Storage Dam Water Quality Data (2017-2022)

Date	Parameter				
	pH	EC (µS/cm)	TSS (mg/L)	Total Organic Carbon (mg/L)	O&G (mg/L)
30/01/2017	8.9	1,580	32	24	<5
9/05/2017	8.3	2,910	34	<1	<5
9/08/2017	8.9	2,940	24	3	<5
8/11/2017	8.6	2,690	28	7	<5
7/02/2018	8.6	2,010	14	4	<5
7/05/2018	8.6	1,320	17	4	<5
8/08/2018	8.2	2,160	5	3	5
2/11/2018	8.6	2,330	34	3	<5
14/02/2019	8.3	1,760	30	3	<5
2/05/2019	8.0	1,140	16	2	<5
7/08/2019	7.8	1,860	23	3	<5
13/11/2019	8.6	1,040	53	3	<5
3/02/2020	7.9	1,440	15	<1	7
4/08/2020	8.6	2,240	13	6	<5
3/11/2020	8.8*	1,940*	32	5	<5
1/02/2021	8.0	1,300*	20	4	<5
3/05/2021	7.7	1,770	23	1	5
11/08/2021	8.4	1,460	14	3	<5
9/12/2021	8.3	1,180	18	9	<5
9/02/2022	8.3	1,310	15	3	<5
24/05/2022	7.6	1,290	22	5	<5
18/07/2022	8.1	1,490	9	2	<5
8/08/2022	7.2	1,260	10	4	<5
17/11/2022	7.2	1,130	17	6	<5

*Lab data as field data contained error

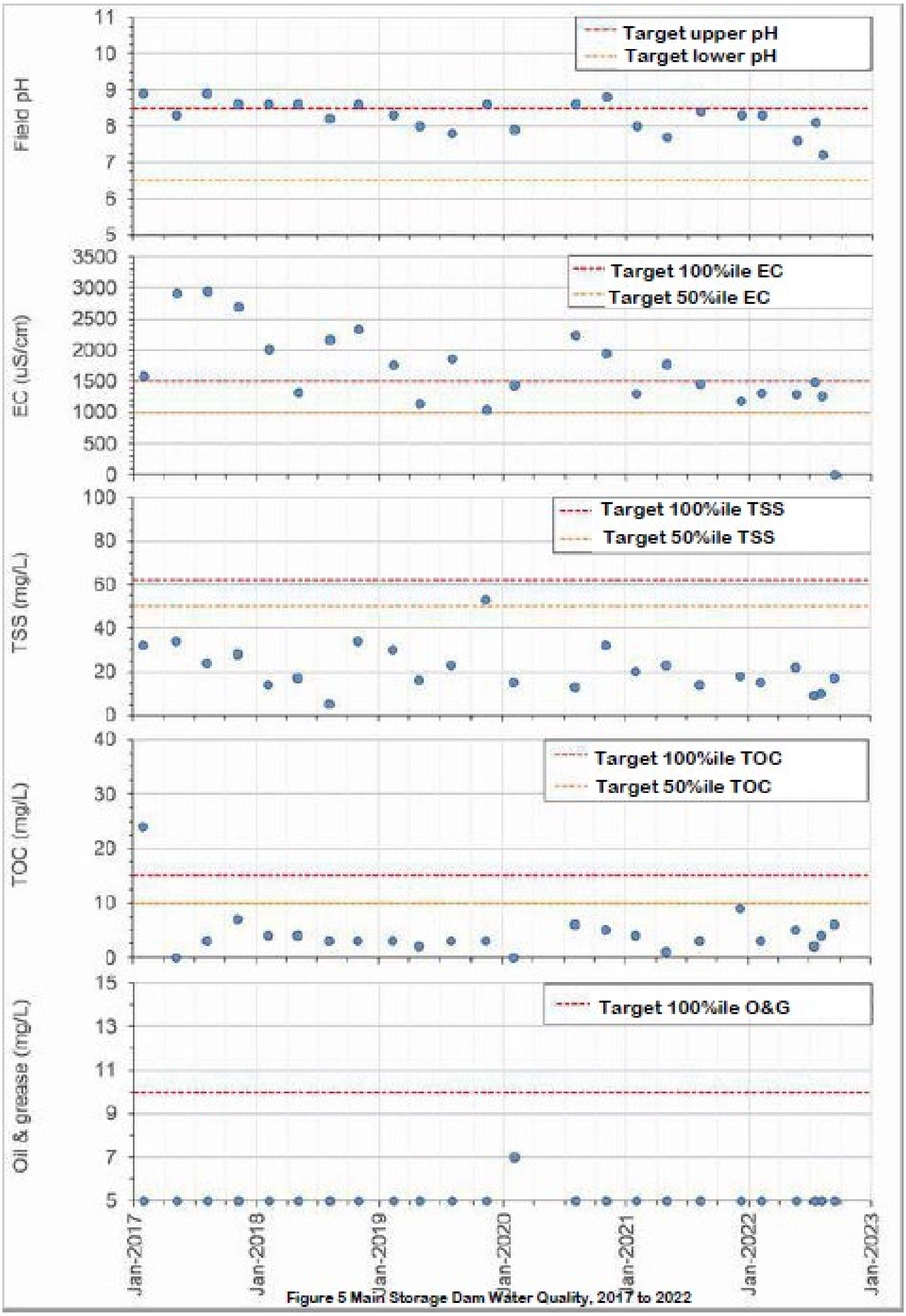

Figure 11 Main Storage Dam Water Quality (2017-2022)

4.7 PERFORMANCE CRITERIA

Impact assessment criteria for surface water is only relevant to water actually discharged from the site. EPL 3637 contains a single LDP for discharge events, which is the MSD. Currently, the EPL does not define concentration or volume limits for discharge waters. However, WHC will target the following concentration limits in Table 15. As shown in Table 14, the ambient water quality of the MSD is generally within the proposed discharge limits.

Note that the MSD is the primary water source for the CHPP, as shown in Section 4.8.6.2, the MSD has a less than 10% AEP spill risk, therefore the MSD is predicted to discharge during wet conditions when there would be significant flows in the receiving environment.

Table 15 Target Concentrations Limits for Discharge Point EPL 6

Parameter	50th Percentile	100th Percentile	Comment
Oil and Grease (mg/L)		10	
pH		6.5-8.5	
Total Suspended Solids (mg/L)	50	62	100th percentile is based on the Namoi River 80th percentile
Total Organic Carbon (mg/L)	10	15	
Electrical Conductivity (µS/cm)	1,000	1,500	50th percentile is based on ANZECC irrigation limit. 100th percentile based on assessment in section 4.7.1

4.7.1 EPL DISCHARGE ASSESSMENT AND PROPOSED SALINITY LIMITS

Table 16 shows an analysis of discharges from the MSD to the Namoi River using the site water balance model. The model was used to assess the impacts on water quality in the Namoi River under a variety of flow conditions, using historical flow data. The historical flow data indicates:

- EC in the Namoi River declines as the flow rate increases
- The 80th percentile EC for all flow conditions is 665 us/cm (based on the mean daily EC at Gauge 419001 between 1995 and 2022)

The water balance model was used to assess the impact of a variety of discharge volumes from the MSD, from 1.6 ML/day to 10 ML/day with a discharge quality of 1,500 us/cm. As show in Table 14, EC in the MSD is typically lower in wet conditions, with all EC recorded data in 2022 below 1,500 us/cm. The EC in the MSD is influence by the EC from the bores used to supply the operation, which typically have EC of around 1,000 us/cm. It is expected that with the construction of the RWD and importing of more water from the Namoi River, the EC at site will improve.

The salinity limits adopted by the operation reflect the following:

- EC in the receiving environmental of the western drainage Line, which the MSD discharge directly into, typically range from 1,000 to 2,000 us/cm
- EC of the groundwater monitoring bores at the CHPP averages 6,000 to 7,000 us/cm, indicating the local groundwater is poorer quality than surface water
- The primary water use in the area is stock watering and irrigation:
  - the ANZECC irrigation limit is 1,000 us/cm
  - DPI fact sheet “Water for livestock: interpreting water quality tests” indicates EC less than 1,600 us/cm is safe for drinking (https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0018/111348/water-for-livestock-interpreting-water-quality-tests.pdf)
- Australia Drinking water guidelines indicate a TDS of < 650 mg/L (1,000 us/cm) is considered good quality.

Table 16 shows the impact on the Namoi River EC from discharges from site. The WB model assumed that discharges would only occur when flow rates in the Namoi River exceed 600 ML/day, i.e. during wet conditions when natural flows occur. The results show that the adopted limits have a negligible impact on the water quality in the Namoi River.

Table 16 Assessment of Discharge from MSD/RWD to the Namoi River

Adopted Namoi River at Gunnedah flow Categories (ML/d)		Background 80th Percentile Concentration (µS/cm)	Increase in Namoi River Concentration at Discharge Volumes from MSD					
Lower Limit (ML/d)	Upper Limit (ML/d)		1.6ML/d Discharge	2ML/d Discharge	4ML/d Discharge	6ML/d Discharge	8ML/d Discharge	10ML/d Discharge
0	600	720.5	-	-	-	-	-	-
600	5,000	490.4	0.23%	0.28%	0.77%	1.16%	1.58%	2.04%
5,000	10,000	390.6	0.09%	0.11%	0.22%	0.33%	0.44%	0.55%
10,000	20,000	346.8	0.05%	0.06%	0.12%	0.19%	0.25%	0.31%
20,000	30,000	314.0	0.03%	0.04%	0.07%	0.11%	0.14%	0.18%
30,000	40,000	277.8	0.02%	0.03%	0.05%	0.08%	0.10%	0.13%
>40,000	-	256.1	0.01%	0.01%	0.03%	0.04%	0.05%	0.07%

4.7.2 SURFACE WATER EXCEEDANCE PROCEDURE

The surface water response plan includes a procedure for managing and reporting any:

- Incidents;
- Complaints;
- Non-compliances with statutory requirements;
- Exceedances of the impact assessment criteria and or performance criteria; and
- A protocol for periodic review of the plan.

Records of any of these items along with the data collected as outlined in this section is maintained and available for review by the appropriate agency/authorities.

If an exceedance of the monitoring criteria for site discharge (listed in 4.7.1) is identified then WHC will follow the procedure listed below:

- Exceedance in monitoring criteria identified;
- Record the timing, location, environmental conditions and any contributing factors to the exceedance;
- Laboratory analysis assessed and re-checked for accuracy/anomaly;
- Sampling point inspected to help ascertain cause of exceedance;
- Advice issued to relevant agencies as soon as is practicable;
- Operational practices reviewed to determine if any current operational practice contributed to the exceedance;
- Implementation of ameliorative measures on site to minimise the potential for future exceedance, which may include clean out, redesign or alteration to structures and/or operational practice;
- Written advice to relevant agencies identifying actions undertaken to reduce future risk of exceedance within required timeframe;
- Where specific cause of exceedance cannot be identified, external advice may be sought; and
- Ongoing future monitoring to ensure ameliorative measures have been successful with concentration criteria being met.

EPL required water monitoring results will be included in the Annual Return and published by WHC as per the requirements of s66(6) of the *Protection of the Environment Operations Act 1997* (**the POEO Act**).

4.7.3 TRIGGER ACTION RESPONSE PLAN – SURFACE WATER

The TARP has been developed to focus on appropriate trigger and response actions for mitigation of impacts to the natural environment as a result of operations at the CHPP.

Monitoring serves to advise of changes to surface water levels and quality that occur, or to raise alert that an abnormal condition relating to CHPP operation has developed.

Each monitoring program has established trigger levels of particular impacts at which a response is needed, and to help define an appropriate response. Management of impacts within predictions follows standard assessment review and response protocols.

The TARP has been designed to allow reference to risks of impact from the CHPP operation to the surrounding environment. These include both predicted and unpredicted impacts:

- Surface water quality; and
- Discharges.

The TARP should be updated to accommodate any surface water and groundwater monitoring locations subject to the findings of the investigations proposed.

The TARP can be found in Table 17.

Table 17 Trigger Action Response Plan – Surface Water

Surface Water	Monitoring		Response		
	Methodology	Purpose	Trigger	Action	Responsibility
Water quality (leaving site)	**Sites:** Discharge point (MSD). **Parameters:** EC, oil and grease, pH, TSS, TOC. **Analysis:** Comparison of results to water quality criteria in Table 15 Review of water quality trends over time. **Frequency:** During flow events (when possible)	To provide baseline water quality data. To identify potential surface water quality impacts as a result of CHPP activities (e.g. surface water discharge, erosion).	Exceedance of proposed target concentration limits in Table 15 Long-term upwards trend comparative to ANZECC quality guideline limits.	Repeat sampling to confirm results exceed trigger level. Hydrologist (or similar specialist) to review sampling and climate data and confirm likely impact or otherwise. If CHPP-related, undertake physical inspection of affected surface and creeks to identify potential source of water quality degradation. Implement appropriate management or contingency response.	Environmental Department.

4.8 SITE WATER BALANCE

4.8.1 OVERVIEW

The water balance model was developed in 2022 using GoldSim and simulates the CHPP water management system using sub-daily time steps. This section of the report summarises the assessment undertaken and its findings.

The CHPP site has a relatively simple water cycle system. The water balance model forecasts the following key water movements within this water cycle:

- Operation of the clean, mine and dirty water management systems (refer Section 3.3 to Section 3.5);
- Demand of the CHPP process and facilities (refer Section 4.8.6);
- Import from bores and the Namoi River (refer Section 4.8.4);
- Uncontrolled discharge from the site (refer Section 4.8.6.2).

4.8.2 MANAGEMENT PRINCIPLES

A water balance must make a number of assumptions to represent the operations on site. These vary for each site and can also vary across a single site. The following general management principles were adopted across all elements of the site:

- Limiting the extent of site disturbance;
- Using the minimum volume of water necessary in the process circuit;
- Optimising the volume of water discharged from the site (in accordance with EPL LDP criteria);
- Segregation of water by quality or source;
  - Reducing contaminant concentrations by suitable treatment methods;
  - Avoiding the accumulation of large volumes of contaminated water on-site;
  - Protecting groundwater resources from contamination.

The CHPP system is constantly losing water through evaporation and through export of the final coal product. Therefore, it is anticipated that the site will generally operate in water deficit, requiring volumes from the licenced bore and Namoi River allocation. The additional reject ponds that were constructed allow increased evaporation time for the fine reject. This gives the site the ability to operate under wetter conditions and acts as a safe guard against uncontrolled discharge from the site.

4.8.3 WATER SYSTEM MODELLING

The forecast model was run for 129 climatic realisations developed using the 132 years of rainfall and evaporation data to assess a wide range of climatic scenarios. Forecast results are provided for the storage behaviour, raw water demand and spill risks between September 2022 and November 2025. The model has been configured to simulate the operations of all major components of the water management system. The simulated inflows and outflows included in the model are given in Table 18.

Water generally moves through the main processing plant and is then pumped to the reject drying ponds. Water evaporates from these ponds and the excess seeps through the pond walls and is collected in settlement ponds. From here, the water is recycled into the processing plant with additional water supplied first from the MSD and the RWD, and then from the licensed sources. Some water is also lost to the product coal which exits the CHPP via train and rejects which are trucked to Tarrawonga. Water is moved around the site using a main pipeline (Ring Main). The main water movements are from the settlement ponds to the CHPP, or to the MSD before then moving to the CHPP. Within the reject pond systems, water is able to freely drain to the settlement ponds.

Table 18 Simulated Inflows and Outflows to the Gunnedah CHPP WMS

Inflows	Outflows
Catchment runoff	Evaporation from water storages
Direct rainfall	Seepage from storages
Raw water supply (river, bore and town water)	Railed coal export losses
Reclaimed water from the CHPP rejects ponds	CHPP dust suppression demand
Coal moisture	Fine and coarse reject losses
	Dam drawdown/releases

4.8.4 SITE INPUTS

4.8.4.1 Rainfall

Long term (greater than 100 years) daily recorded rainfall was used for the forecast WB (Water Balance) model in order to simulate a wide range of possible climatic scenarios. Four BoM meteorological stations with long-term daily rainfall records are located within the vicinity of the site including:

- Gunnedah Pool (station number 55023), which is located approximately 5.5 km to the southeast of the site;
- Curlewis Post Office (station number 55014), which is located approximately 19.9 km to the southeast of the site;
- Boggabri (Retreat) (station number 55044), which is located approximately 28.7 km to the northeast of the site; and
- Boggabri Post Office (station number 55007), which is located approximately 30.5 km to the northwest of the site.

Table 19 shows the average monthly rainfall statistics at the above stations. The average annual rainfalls from the four nearby stations are similar with the annual rainfall ranging from 606 to 632 mm/year. Rainfall data from the Gunnedah Pool station was adopted for the site WB model due to its proximity to the site as well as the length and completeness of the data.

Table 19 Summary of Average Regional Monthly and Annual Rainfall and Rain Days

Month	Gunnedah Pool (55023) 1899-2022		Curlewis Post Office (55014) 1904-2022		Boggabri (Retreat) (55044) 1899-2022		Boggabri Post Office (55007) 1884-2022	
	Rainfall (mm)	Rain Days	Rainfall (mm)	Rain Days	Rainfall (mm)	Rain Days	Rainfall (mm)	Rain Days
January	72.7	6.9	72.0	5.7	73.2	6.1	71.1	6.1
February	66.3	6.4	62.5	5.5	64.4	5.5	65.6	5.3
March	51.6	5.5	47.8	4.8	51.8	5.0	51.7	4.8
April	39.0	4.8	41.8	4.1	39.2	4.0	37.2	4.2
May	42.6	5.5	39.5	4.6	42.4	4.7	43.1	4.7
June	45.4	6.8	42.0	5.4	45.8	5.7	43.4	5.7
July	42.1	6.7	41.7	5.5	42.0	5.7	41.5	5.7
August	41.3	6.7	37.4	5.2	40.1	5.5	39.1	5.3
September	40.2	6.0	39.4	5.0	42.7	5.6	39.5	4.8
October	55.6	7.3	51.5	5.8	51.4	5.8	51.0	5.8
November	63.3	6.9	64.1	5.8	62.1	6.2	61.2	6.0
December	71.5	7.6	66.1	6.3	62.8	6.2	64.0	6.3
Annual	**631.8**	**77.1**	**605.8**	**63.8**	**617.9**	**65.9**	**608.5**	**64.8**

4.8.4.2 Catchment Runoff

Catchment run off is described in section 3.3.

4.8.4.3 Raw Water Supply

Raw Water Supply is outlined in Section 3.3.4.

4.8.5 OUTPUTS

4.8.5.1 Evaporation

Evaporation records are available from the Keepit Dam (station number 55276) and Gunnedah Resource Centre (station number 55024) meteorological stations, which have recorded average annual evaporation of approximately 1,825 mm and 1,853 mm, respectively. The average monthly pan evaporation rates from these meteorological stations can be seen in Table 20 below. This table also shows the average monthly pan evaporation rates from the SILO Point Climate data for Gunnedah Pool (station number 55023).

For the purpose of the water balance, SILO Point Climate daily evaporation data for Gunnedah Pool was used. The SILO Point Climate average annual pan evaporation is approximately 1,810 mm, which is similar to the Keepit Dam and Gunnedah Resource Centre averages (Table 20). The evaporation rate is high throughout the year, with highest evaporation rates occurring in the months between October and March. Morton's Lake evaporation has been used to estimate evaporation loss from storages, which is on average 84% of pan evaporation in the vicinity of the project. Soil moisture evapotranspiration losses in the Australian Water Balance Model (AWBM) model have been estimated using Morton's Wet evapotranspiration, which is on average 98% of Morton's Lake evaporation in the vicinity of the project.

Table 20 Summary of Average Monthly and Annual Regional Class 'A' Pan Evaporation (mm)

Month	Keepit Dam (55276) 1972-2006	Gunnedah Resource Centre (55024) 1973-2019	SILO Data Drill for Gunnedah Pool (55023) 1889-2022
January	255.7	253.6	248.6
February	204.5	209.0	200.4
March	182.1	194.0	183.0
April	124.1	137.5	126.2
May	80.6	87.8	81.3
June	56.1	59.3	56.3
July	63.9	64.3	62.2
August	89.2	93.4	89.1
September	129.3	130.1	127.1
October	172.7	179.2	175.6
November	207.7	212.2	210.2
December	259.4	254.0	250.6
Annual	**1,825.3**	**1874.4**	**1,810.4**

4.8.5.1 CHPP Moisture Loss

Table 21 summarises the CHPP moisture throughput based on the Tarrawonga LOM forecast ROM coal tonnage of 2.5 Mtpa. The balance assumes that all ROM coal is washed through the CHPP and there is no bypass coal.

Table 21 Reported Moisture Contents for the CHPP WMS

Type	Adopted Moisture Content (w/w%)	CHPP Moisture Throughput (ML)	Basis
ROM coal	10	250	Site data and EIS (2002)
Railed product coal	10	-206	Site data
Coarse rejects	10	-25	Assumed value based on ROM coal
Fine rejects slurry	70	-394	EIS (2002)
Consolidated fine rejects trucked back to site	55	206	Whitehaven advice
CHPP balance		**-375**	

4.8.6 MODELLING RESULTS

4.8.6.1 Raw Water Demands

The water demand for the site is dependent on climatic conditions. Estimates of variation in demand are modelled using historic recorded rainfall and evaporation records. Figure 12 summarises water demand from raw water sources for the Gunnedah CHPP. To be conservative, the model has assumed only take from bores, this is to show how much additional water the CHPP requires in excess of Bore water. Figure 12 presents the annual exceedance probability (AEP) plot of the predicted raw water demands for each financial year over the three-year forecast period. The model results show:

- In FY22/23:
  - There was an 85% chance that the annual bore water allocation of 155 ML will be exceeded, and temporary bore water transfers will be required.
  - The additional water can be supplied by carryover or temporary bore water transfers, within the annual extraction limit of 310 ML.
- In FY23/24 and FY24/25:
  - There is an 95% chance that the annual bore water allocation of 155 ML will be exceeded, and temporary bore water transfers will be required.
  - There is a 25% chance that the annual bore water extraction limit of 310 ML will not be sufficient to supply site demands. This additional water would be provided by Namoi River water extraction within the High Security allocation (50 ML) and General Security allocation (1,054 ML) currently held by site.
  - The maximum volume of water required from the Namoi River to meet site requirements is around 40 ML/year, which is less than the High Security allocation (50 ML).

The modelling results show that all extraction of water from bores and the Namoi River will be in compliance with the existing WALs.

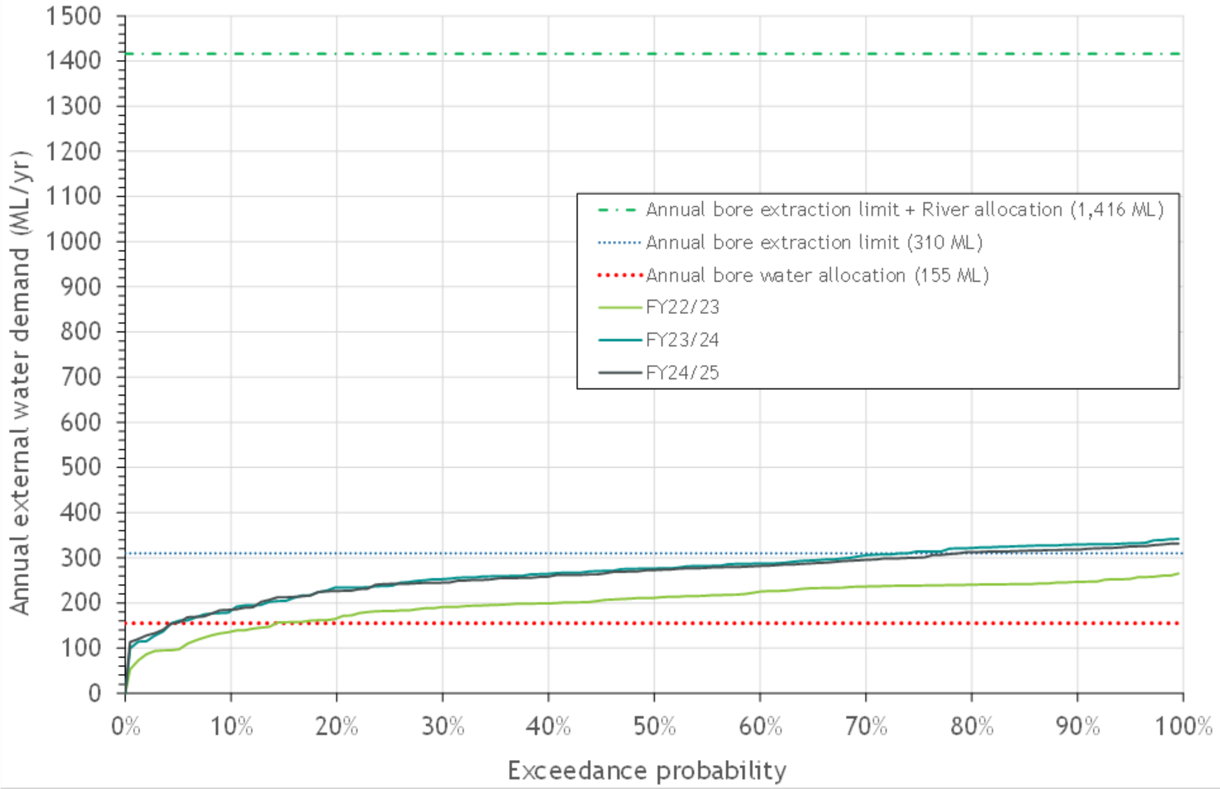

Figure 12 Exceedance Probability Plot of the Raw Water Usage over the Forecast Period (Sep 2022-Jul 2025)

4.8.6.2 Site Spill Risk

Figure 13 shows the simulated MSD inventory and Figure 14 shows the simulated MSD and RWD combined inventory behaviour over the forecast period. The MSD will be maintained at or around 5 ML (operational volume) under median climatic conditions for the majority of the forecast period. This is due to the modelled call for raw water to MSD occurring at 5 ML.

Discharge is permitted from the site as described in EPL 3637. The model assumes that the MSD will overflow to the proposed RWD at the adopted spillway capacity of 30 ML.

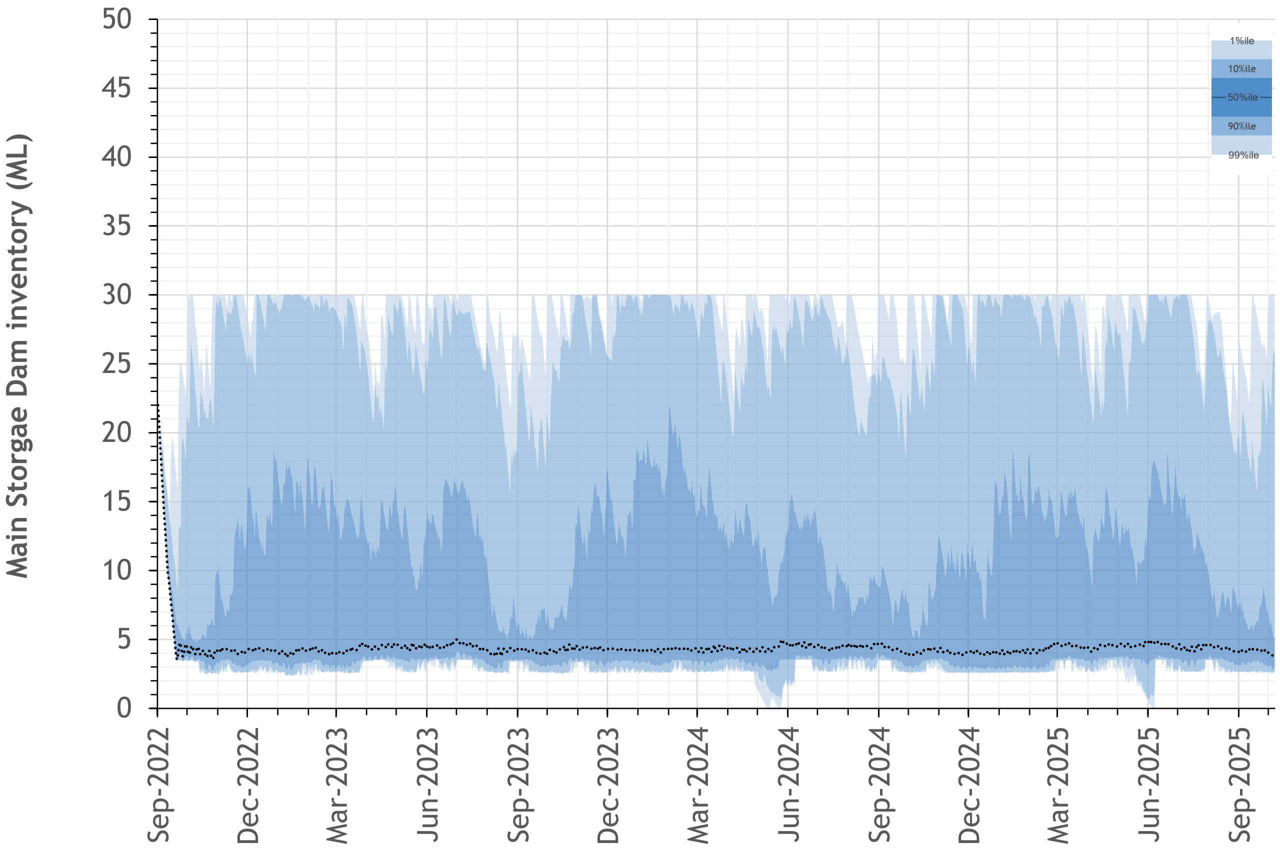

Figure 13 Simulated MSD Inventory Over the Forecast Period

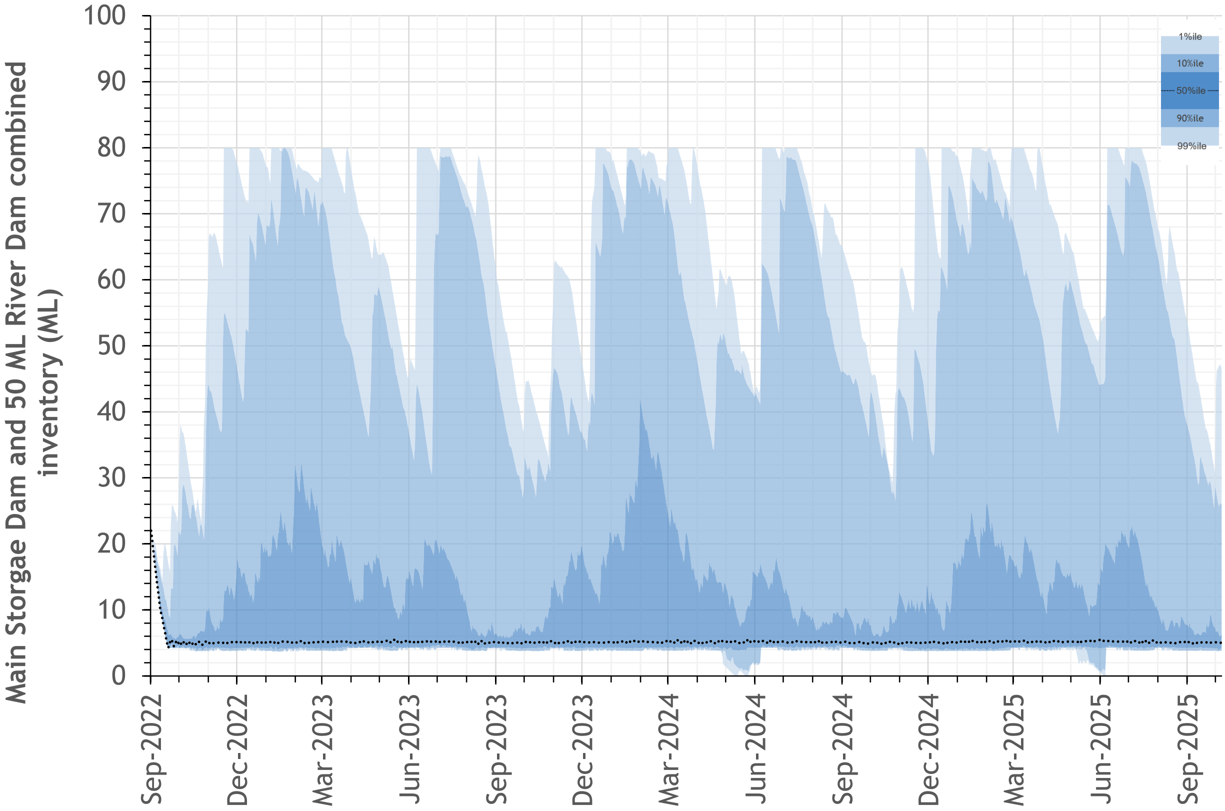

Figure 14 Simulated MSD and RWD Combined Inventory Over the Forecast Period

Figure 15 presents the exceedance probability plot of the predicted annual discharges per financial year from the RWD via EPL 3637 over the forecast period. The model results show the following:

- In FY22/23, there is a 5% chance of discharge via the LDP, with a maximum annual overflow volume of 77 ML.
- In FY23/24, there is a 6% chance of discharge via the LDP, with a maximum annual overflow volume of 80 ML.
- In FY24/25, there is an 8% chance of discharge via the LDP, with a maximum annual overflow volume of 76 ML.

For conservatism, the model is configured so that all of the overflows from the FWD drain into MSD. In reality, high flows within the clean water diversion drain would be diverted towards the Namoi River (rather than drain into MSD). As such, the overflows from MSD and RWD would be significantly less than modelled.

The settling pond (SP) SP northwest and SP east systems do not predict spills for any of the representative year climatic conditions. It is noted that all other systems within the model (FWD, SP south, RP south, RP northwest, RP east) spill internally (if at all) within the WMS and are accounted for in the water balance. The three reject pond systems do not spill over the forecast period for any of the modelled realisations.

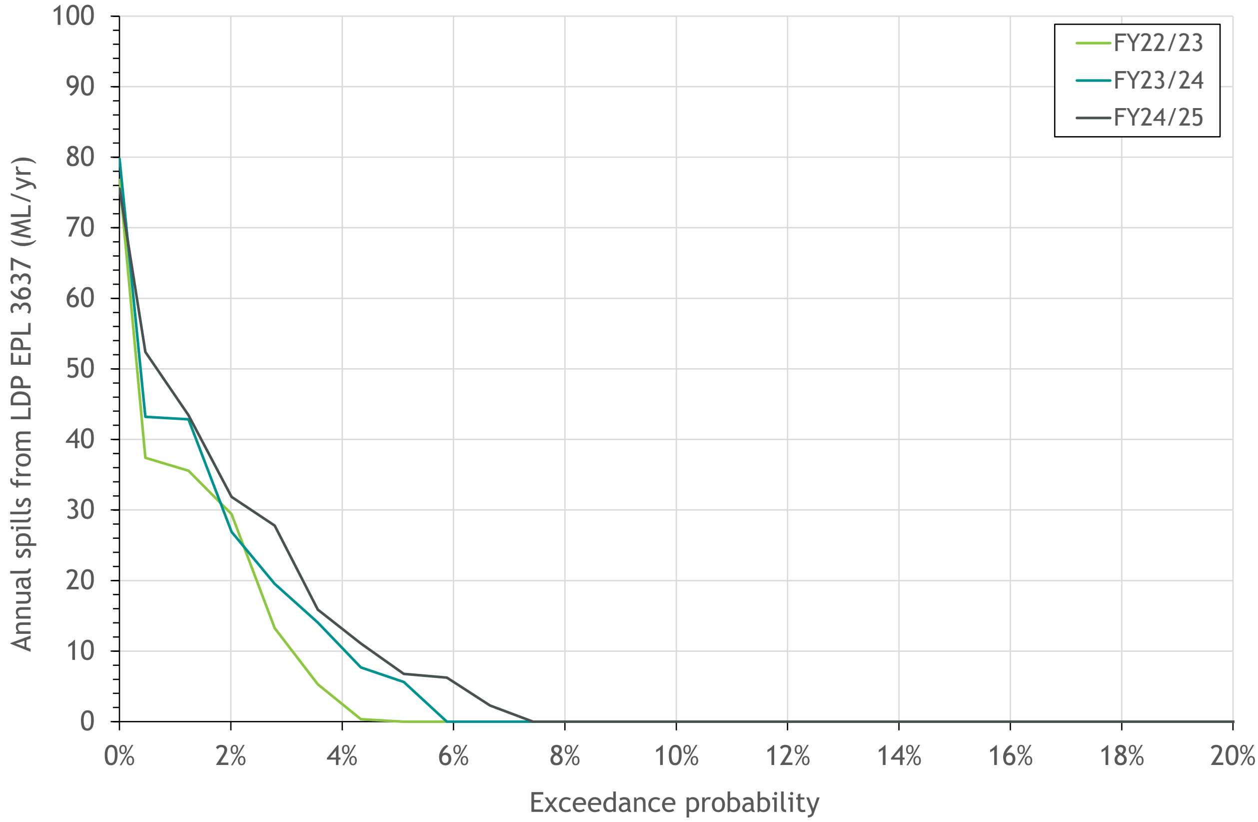

Figure 15 Exceedance Probability Plot of Spills from the LDP from EPL3637 over the forecast Period

4.8.6.3 Water Balance Summary

The Gunnedah CHPP was simulated for a three-year forecast period (from September 2022 to July 2025) to predict the WMS site storage behaviour and raw water demand requirements. The water balance model results show that on average, the annual bore allocation of 155 ML will be exceeded. However, the CHPP will operate with river water as the primary source of water.

The model results also show that the proposed 50 ML RWD provides additional site storage capacity which reduces the site spill risk from the LDP 6 of EPL 3637.

5 GROUNDWATER MANAGEMENT PLAN

5.1 GROUNDWATER MONITORING PROGRAM

The groundwater monitoring network consists of 3 piezometers (see Figure 7) listed in Table 22. The three 'peizos' are located in close proximity to the operations reject and settlement ponds to monitor potential impacts, including

- P1 is located directly adjacent (north) of the settling ponds SP06/07/08/09, which are the settling ponds that will be upgraded as documented in 4.5.5.
- P2 is located directly adjacent (south) of the reject ponds RP 07/08/09/10/10.
- P3 is located directly adjacent (east) of the settling and reject ponds within the rail loop.

All groundwater locations are sampled quarterly for the analytes outlined in Table 23. Groundwater sampling will be undertaken in accordance with AS/NZS 5667.11:1998.

Table 22 Piezometer Information

Site ID	Licence Number	Completion Date	Easting MGA-56	Northing MGA-56	Screen Top (mbgl)	Screen Base (mbgl)	Drilled Depth (mbgl)
P1	90BL254681	6/03/2009	232938.82	6572749.08	1	10	31.3
P2	90BL254680	7/03/2009	232694.13	6572201.91	1	10	30.0
P3	90BL254682	7/03/2009	232541.02	6572090.75	1	10	30.0

Table 23 Ground Water Monitoring Analytes

Bore	Frequency	Parameters
P1 – P3 & Groundwater extraction Bores	Quarterly	Water Level, Temperature, pH, Electrical Conductivity (EC), Lead[a] (mg/L), Calcium (mg/L), Magnesium (mg/L), Sodium (mg/L), Potassium (mg/L), Total Cations (mq/L), Chloride (mg/L), Sulphate (mg/L), Hydroxide Alkalinity (mg/L), Carbonate Alkalinity (mg/L), Bi-Carbonate Alkalinity (mg/L), Alkalinity (mg/L), Total Anions (mq/L), Ionic Balance, Nitrite, Nitrate, Ammonia.

a All metals will be analysed for total and dissolved concentration

5.2 GROUNDWATER BASELINE DATA AND PERFORMANCE CRITERIA

Table 24 shows the historical 5th and 95th percentile water quality in the monitoring peizo's. The historical water quality data indicates the groundwater is significantly poorer quality than the surface water at the CHPP, with EC and sulphates significantly higher than in the MSD. TARPs reference in Table 27 refer to the historical water levels for triggering an investigation into any adverse groundwater impacts.

Table 24 Groundwater Trigger Levels (2009-2022)

Site ID	pH		EC		SO4	
	5th %ile	95th %ile	5th %ile	95th %ile	5th %ile	95th %ile
P1	7.3	8.8	5297	9875	479	1449
P2	6.8	7.6	4854	6047	563	870
P3	6.8	7.9	4786	5936	220	292

Table 25 Groundwater Baseline Standing Water Level and Trigger Levels (2009-2022)

Site ID	No. of Samples	Minimum	Average	Maximum	5th %ile	95th %ile
P1	53	4.1	6.54	8.01	4.287	7.819
P2	51	0.04	0.93	2.04	0.386	1.9
P3	54	0.11	0.81	2.15	0.145	1.725

	Piezometer 1				Piezometer 2				Piezometer 3			
Analyte	No. of Samples	Min	Max	Median	No. of Samples	Min	Max	Median	No.of Samples	Min	Max	Median
Temperature (°C)	53	17.2	25.2	20.7	52	14.8	25.1	20.4	53	7.87	24.9	21.3
pH – Field	54	7.21	8.9	7.96	53	6.54	7.7	7.1	54	6.68	8	7.375
Field Electrical conductivity(µS/cm)	55	729	10500	7050	53	3590	6180	5720	55	2010	6190	5590
Lead (mg/L)	18	<0.001	0.139	<0.001	24	<0.001	<0.001	<0.001	21	<0.001	<0.001	<0.001
Calcium (mg/L)	54	13	71	32.5	53	154	285	240	54	128	267	191
Magnesium (mg/L)	54	86	204	113	53	180	260	232	54	177	241	216
Sodium (mg/L)	54	1280	2320	1570	53	618	791	711	54	614	805	723.5
Potassium (mg/L)	54	17	40	23	53	54	150	120	54	51	124	62.5
Total Cations (meq/L)	48	64.7	122	79.3	47	55.6	70.8	65.6	48	53	67	60.65
Chloride (mg/L)	54	788	3020	1270	53	898	1480	1150	54	1060	1630	1365
Sulphate (mg/L)	7	1290	1610	1350	7	610	776	680	7	256	302	268

Table 26 Groundwater Baseline Quality (2009-2022)

	Piezometer 1				Piezometer 2				Piezometer 3			
Analyte	No. of Samples	Min	Max	Median	No. of Samples	Min	Max	Median	No.of Samples	Min	Max	Median
Hydroxide Alkalinity (mg/L)	51	<1	<1	<1	50	<1	<1	<1	50	<1	<1	<1
Carbonate Alkalinity (mg/L)	33	<1	27	<1	50	<1	<1	<1	50	<1	<1	<1
Bi-Carbonate Alkalinity (mg/L)	53	1040	1500	1310	53	654	955	846	53	501	850	693
Total Alkalinity (mg/L)	53	1040	1500	1330	51	654	955	815	53	501	850	693
Total Anions (meq/L)	48	58.6	121	76.3	42	50.7	71	63.6	48	48.8	64.9	47.9
Ionic Balance (%)	48	0.03	6.41	2.075	42	0.05	6.08	2.18	48	0.03	8.12	2.495
Nitrite	51	0	0.6	0.01	50	0.01	0.57	0.01	51	0.01	0.7	0.01
Nitrate (mg/L)	53	0.01	2.14	0.42	51	0.01	2.82	0.29	53	0.01	28	12.3
Ammonia	50	0.01	3.79	0.03	47	0.01	3.1	0.03	50	0.001	12.2	0.04

5.3 TRIGGER ACTION RESPONSE PLAN – GROUNDWATER

The TARP has been developed to focus on appropriate trigger and response actions for mitigation of impacts to the natural environment as a result of operations at the CHPP.

Monitoring serves to advise of changes to groundwater levels or quality that occur, or to raise alert that an abnormal condition relating to CHPP operation has developed.

Each monitoring program has established trigger levels of particular impacts at which a response is needed, and to help define an appropriate response. Management of impacts within predictions follows standard assessment review and response protocols.

The TARP has been designed to allow reference to risks of impact from the CHPP operation to the surrounding environment. These include both predicted and unpredicted impacts:

- Groundwater level
- Groundwater Quality

The TARP should be updated to accommodate any surface water and groundwater monitoring locations subject to the findings of the investigations proposed.

The TARP can be found in Table 27

In the event that adverse impacts or water quality degradation is identified in groundwater resources, and these impacts are considered associated with the CHPP operation, Whitehaven will commission an assessment of the causes, develop a staged response program satisfactory to DPI Water, EPA and DP&E to mitigate the adverse impacts, and will establish and implement measures to manage further impact.

5.3.1 CONTINGENCY MEASURES

The identification process and response protocol to adverse outcomes are provided in the Trigger Action Response Plan (TARP, refer to Section 5.3). The responses proposed incorporate a staged assessment and development of management measures deemed appropriate for each individual event should it occur.

Specific trigger levels have been designed to alert Whitehaven to observed responses which are outside of normal variation, or where observed parameter values do not follow anticipated trends.

The CHPP site is not anticipated to have a significant effect on groundwater quality and the extraction quantities are limited by licence. Therefore, if changes are identified, they will generally be investigated to identify the likely source. This will lead to an investigation into response measures.

The triggers for instigation of response actions would occur when observed changes to monitored parameters exceed specified levels. Such changes in observed parameters or conditions include:

- Significant change in observed water quality or groundwater levels between sampling rounds;
- Changes in trends over an extended period for groundwater levels and quality; and
- A significant increase or variation from predicted models

5.3.2 MITIGATION/OFFSET MEASURES FOR POTENTIAL GROUNDWATER IMPACTS

Surface water quality at the operation is of superior quality to the underlying groundwater, therefore its unlikely that operation will have impacts to water quality. In the event groundwater levels or quality is impacted at a third party by the operation, the following will occur until the impacts are corrected:

- Provide suitable water treatment for drinking water
- Provide suitable compensatory supply of water for stock or domestic purposes
- For impacts to water level/yield cause by the operation, provide compensation for a deeper bore to improve supply.

Surface Water	Monitoring			Response	
	Methodology	Purpose	Trigger	Action	Responsibility
Groundwater Levels	**Sites:** All monitoring bores. **Parameters:** Water level. **Analysis:** Comparison of recorded water levels taking into account natural variations. **Frequency:** Manual monitoring of groundwater bores quarterly.	To identify water level impacts.	Sustained (3 sample events) drawdown or rise greater than 5th/95th percentile of historic data in Table 25	Engage hydrogeologist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with Notify agencies when exceedance becomes known, and provide updates throughout investigation above, and at conclusion of assessment. Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.	Environmental Department.
Groundwater Quality	**Sites:** All monitoring sites. **Parameters:** Water quality – full laboratory analysis suite (See Table 26) **Analysis:** Comparison of recorded water quality results. **Frequency:** Quarterly.	To identify water quality impacts.	Sustained (3 sample events) exceedance of water quality (5th/95th percentile of historic data) as per Table 24.	Engage hydrogeologist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with Section 5.3.1 Notify agencies when exceedance becomes known, and provide updates throughout investigation above, and at conclusion of assessment. Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.	Environmental Department.

Table 27 Trigger Action Response Plan – Groundwater

6 REPORTING AND REVIEW

Schedule 3 Condition 19 of DA 0079.2002 requires that the WMP be reviewed and if necessary revised within 3 months of the submission of an annual report under Condition 16 of DA 0079.2002.

6.1 REPORTING PROCEDURES

The CHPP will retain an active database of monitoring results which will be updated on a regular basis. Any off-site discharge event will result in the triggering of a sampling event. All sampling results will be made available in the EPL 3637 Annual Return and in accordance with publishing of monitoring data under the terms of the POEO Act.

The ongoing monitoring program and collation of relevant data will provide the basis for continuing improvement in surface water management across the site. This will also contribute to the ongoing improvement of the Trigger Action Response Plans presented in Sections 4.7.3 and 5.3.

6.2 INCIDENTS AND NON-COMPLIANCE REPORTING

In accordance with the requirements of EPL 3637, WHC will notify the EPA of any incidents threatening material harm to the environment immediately after the incident becomes known to site personnel in accordance with the site's Pollution Incident Response Management Plan (**PIRMP**). Details of any incidents will be communicated to the EPA via telephone with a written report provided within 7 days of the incident occurring. Where ameliorative actions may reduce the threat or harm to the environment, they will be implemented as soon as is practicable and described in the written report.

In accordance with the requirements of Condition 20 of Schedule 3 of DA0079.2002, the project will immediately notify the department other relevant agencies after any incident. The notification shall be in writing via the Department Major Projects Website and identify the development (including the application number and name) and set out the location and nature of the incident.

In accordance with the requirements of Condition 21 of Schedule 3 of DA0079.2002, within seven days of becoming aware of a non-compliance, the project shall notify the Department of the non-compliance. The notification shall be in writing via the Department's Major Projects Website and identify the development (including the application number and name), set out the condition of this consent that the development is non-compliant with, why it does not comply and the reasons for the noncompliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.

7 ACCOUNTABILITIES

Role	Accountability
General Manager	▪ Provide resources to implement this plan
Environmental Department	▪ Undertake onsite sampling per this plan ▪ Undertake investigations and reporting as per this plan ▪ Audit site to management plan adherence ▪ Engage suitably qualified contractors/specialists ▪ Monitor water allocations ▪ Monitor collected data against criterion
Technical Expert	▪ Provide expertise, support and recommendations on requested areas ▪ Undertake sampling regime as per the requirements of this plan ▪ Undertake work within the WHC WHS framework ▪ Report any incidents/exceedances to applicable personnel
All Workers	▪ Work within the limits of the Water Management Plan ▪ Operate the site as per the Water management system outlined in this plan ▪ Alert applicable personnel if water is not being correctly managed onsite ▪ Alert applicable personnel of incidents involving water.

8 REFERENCES

ANZECC & ARMCANZ, 2000	Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment Control Council and Agricultural and Resource Management Council of Australia and New Zealand, 2000.
ANZG, 2018	Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Governments and Australian state and territory governments, 2018.
DECCW, 2008	Managing Urban Stormwater, Soils and Construction, Volume 2E Mines and Quarries, Department of Environment and Climate Change, June 2008.
DPIE, 2020	Water quality technical report for the Namoi surface water resources plan area (SW14), Department of Planning, Industry and Environment, February 2020.
Landcom, 2004	Managing Urban Stormwater, Soils and Construction, Volume 1, Landcom, March 2004.
NSW EPA, 2015	Environment Protection Licence – Whitehaven CHPP, NSW Environment Protection Authority, 2015.
RW Corkery & Co, 2008	Statement of Environmental Effects for the Increase in Throughput at the Whitehaven Coal Handling and Preparation Plant and Rail Loading Facility', Report prepared by RW Corkery & CO for Whitehaven Coal Pty Ltd, 2008.

8.1 APPLICABLE LICENCES

- Gunnedah CHPP Environmental Protection Licence 3637
- Gunnedah CHPP Development Approval DA0079.2002

8.2 AUSTRALIAN STANDARDS

- Australian Standards/New Zealand Standards (AS/NZS) 5667.1:1998 Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples.

9 SUPPORTING DOCUMENTATION

The following supporting documentation which includes associated training materials may need to be consulted and, where appropriate, used when applying this Standard and/or any subordinate procedures:

- *WHC-GOC-Water Sampling Procedure*