



Centennial Mandalong Pty Limited

**Mandalong Mine
Water Management Plan**

April 2026

DOCUMENT CONTROL

DOCUMENT DETAILS	Name		Mandalong Mine: Water Management Plan	
	Author		Tegan Hopwood, Adrienne Harvey (GHD Pty Ltd)	
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DETAILS OF CHANGE	Revision	Trigger	Date	Brief details of change
	0		22/11/2016	Original water management plan
	1		05/05/2017	Revised to include site-specific guideline values for surface water quality in Morans Creek
	2		17/11/2017	Revised to make the water management plan consistent with relevant extraction plans, particularly with regard to watercourse stability and flooding
	3		13/06/2018	Revised following an uncontrolled discharge event at the Mandalong South Surface Site to include water management measures to minimise the risk of future incidents at the site
	4	SSD-5144 Mod 6	12/08/2019	Revised following approval for Modification 6 to development consent SSD-5144 allowing for controlled discharges from the Sediment Dam at the Mandalong South Surface Site
	5	SSD-5144 Mod 9	25/10/2021	Revised following approval for Modification 9 to development consent SSD-5144
	6	SSD-5144 Mod 10	20/12/2022	Revised following approval for Modification 10 to development consent SSD-5144 and March 2022 Mandalong South Surface Site Stockpile Dam discharge events
	7		13/04/2026	Revise plan to include water management relating to Cooranbong Entry Site

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Glossary

Alkalinity	A measure of the ability of an aqueous solution to neutralise acids. Alkalinity of natural waters is due primarily to the presence of hydroxides, bicarbonates and carbonates. It is expressed in units of calcium carbonate (CaCO_3).
Alluvial	Deposition from running waters.
Ambient	Pertaining to the surrounding environment or prevailing conditions.
Annual exceedance probability	The probability of a flood event occurring in any year, e.g. a large flood which may be calculated to have a 1% chance to occur in any one year is described as having a 1% annual exceedance probability.
Aquifer	An underground layer of permeable material from which groundwater can be usefully extracted.
Australian Height Datum	A common national surface level datum approximately corresponding to sea level
Average recurrence interval	A statistical estimate of the average period in years between the occurrence of a flood of a given size or larger, e.g. floods with a discharge equivalent to the 1 in 100 year average recurrence interval flood event will occur on average once every 100 years.
Baseflow	The component of flow in a watercourse that is driven from the discharge of underground water.
Baseline monitoring	Monitoring conducted over time to collect a body of information to define specific characteristics of an area (e.g. species occurrence or water quality) prior to the commencement of a specific activity.
Bore	Constructed connection between the surface and a groundwater source that enables groundwater to be transferred to the surface either naturally or through artificial means.
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular location.
Clean water	Water that has not come into physical contact with coal or mined carbonaceous material.
Dewatering	The removal or pumping of water from an above or below ground storage, including the mine water within the water collection system of mine workings. Water removed from mine workings is regarded as dewatering unless the workings are flooded and at equilibrium with the surrounding strata (in which case the removal is considered groundwater extraction).
Dirty water	Water that has an elevated sediment load.
Discharge	The quantity of water per unit of time flowing in a stream, for example cubic metres per second or megalitres per day.
Electrical conductivity	A measure of the concentration of dissolved salts in water.

Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or overland runoff before entering a watercourse and/or coastal inundation resulting from super elevated sea levels and/or waves overtopping coastline defences.
Floodplain	Area of land that is periodically inundated by floods up to the probable maximum flood event.
Geomorphology	Scientific study of landforms, their evolution and the processes that shape them. In this report relates to the form and structure of waterways.
Goaf	The part of a mine from which the mineral has been partially or wholly removed, including the waste left in workings.
Groundwater	Water occurring naturally below ground level.
Groundwater extraction	For the purposes of this plan, groundwater extraction has been defined as the removal of groundwater from a groundwater source or aquifer, either via direct removal for use via a production bore or via incidental flow of groundwater from the aquifer into the mine workings during and after mining. Groundwater extraction includes the pumping of underground water from flooded mine workings in equilibrium with the surrounding strata as well as the removal of water from perched aquifers recharged directly from rainfall infiltration.
Guideline value	The concentration or load of physicochemical characteristics of an aquatic ecosystem, below which there exists a low risk that adverse ecological effects will occur. They indicate a risk of impact if exceeded and should 'trigger' action to conduct further investigations or to implement management or remedial processes.
Hardness	The concentration of multivalent cations present in water. Generally, hardness is a measure of the concentration of calcium and magnesium ions in water and is expressed in units of calcium carbonate (CaCO_3) equivalent. Hardness may influence the toxicity and bioavailability of substances in water.
Ion	Electrically charged atom.
Licensed discharge point	A location where the premises discharge water in accordance with conditions stipulated within the site Environmental Protection Licence.
Macroinvertebrate	An animal species that does not develop a vertebral column that is large enough to be seen without the use of a microscope. These animals generally include insects, crustaceans, molluscs, arachnids and annelids.
Median	The middle value, such that there is an equal number of higher and lower values. Also referred to as the 50th percentile.
Percentile	The value of a variable below which a certain percent of observations fall. For example, the 80th percentile is the value below which 80 percent of values are found.
pH	The value taken to represent the acidity or alkalinity of an aqueous solution. It is defined as the negative logarithm of the hydrogen ion concentration of the solution.

Potable water	Water of a quality suitable for drinking.
Riparian	Pertaining to, or situated on, the bank of a river or other water body.
Runoff	The amount of rainfall which actually ends up as streamflow, also known as rainfall excess.
Run of mine	Raw coal production (unprocessed).
Sediment	Soil or other particles that settle to the bottom of lakes, rivers, oceans and other waters.
Stream order	Stream classification system, where order 1 is for headwater (new) streams at the top of a catchment. Order number increases downstream using a defined methodology related to the branching of streams.
Subsidence	The vertical difference between the pre-mining surface level and the post-mining surface level at a point.
Surface water	Water that is derived from precipitation or pumped from underground and may be stored in dams, rivers, creeks and drainage lines.
Topography	Representation of the features and configuration of land surfaces.
Total Kjeldahl nitrogen	The sum of the concentrations of organic nitrogen, ammonia (NH_3) and ammonium (NH_4^+) in water.
Total nitrogen	A measure of organic and inorganic nitrogen forms in water. The sum of concentrations of total kjeldahl nitrogen and nitrate + nitrite.
Total phosphorus	A measure of organic and inorganic phosphorus forms in particulate and soluble forms.
Total suspended solids	A measure of the filterable matter suspended in water.
Toxicity	The inherent potential or capacity of a substance to cause adverse effects in a living organism.
Tributary	A stream or river that flows into a main river or lake.
Turbidity	A measure of clarity (turbidity) of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

Abbreviations

AEP	Annual exceedance probability
AHD	Australian Height Datum
ARI	Average recurrence interval
AUSRIVAS	Australian Rivers Assessment System
BOD	Biochemical oxygen demand
BOM	Bureau of Meteorology
c/t	Cut through
CEMP	Construction environmental management plan
Centennial	Centennial Coal Company Pty Limited
Centennial Mandalong	Centennial Mandalong Pty Limited
CES	Cooranbong Entry Site
CRD	Cumulative rainfall departure
DCCEEW-Water	NSW Department of Climate Change, Energy, the Environment and Water
DES	Delta Entry Site
DGV	Default guideline value
DPE Water	Department of planning and environment - water
DPHI	Department of Planning, Housing and Infrastructure
DPIRD	Department of Primary Industries and Regional Development
DPI Water	Department of Primary Industries – Water Group
EC	Electrical conductivity
EIS	Environmental impact statement
EPA	Environment Protection Authority
EPL	Environment protection licence
GDE	Groundwater dependent ecosystem
GPT	Gross pollutant trap
ha	Hectare
HARTT	Hydrograph Analysis: Rainfall and Time Trends

HWC	Hunter Water Corporation
km	Kilometre
kV	Kilovolt
L/s	Litre per second
LDP	Licensed discharge point
LOR	Limit of reporting
m	Metre
m/year	Metre per year
m ³ /s	Cubic metre per second
mg/L	Milligram per litre
ML	Megalitre
ML/day	Megalitre per day
ML/year	Megalitre per year
mm	Millimetre
mm/day	Millimetre per day
MMAS	Mandalong Mine Access Site
MSSS	Mandalong South Surface Site
Mtpa	Million tonnes per annum
NTU	Nephelometric turbidity unit
PIRMP	Pollution Incident Response Management Plan
RCE	Riparian, channel and environment
ROM	Run of mine
SILO	Scientific Information for Land Owners
SSGV	Site-specific guideline value
TARP	Trigger action response plan
TDS	Total dissolved solids
TKN	Total Kjeldahl nitrogen
TSS	Total suspended solids

WMP	Water management plan
$\mu\text{S}/\text{cm}$	Microsiemens per centimetre

1. Introduction

Mandalong Mine is an underground coal mine located approximately 35 km south-west of Newcastle on the western side of Lake Macquarie. Centennial Mandalong Pty Limited (Centennial Mandalong) acquired Mandalong Mine in 2002, with mining operations commencing in 2005. Operations at Mandalong Mine consist of underground mine workings and surface facilities located at three sites: Mandalong Mine Access Site (MMAS), Mandalong South Surface Site (MSSS) and Delta Entry Site (DES).

The coal handling and processing facilities associated with Mandalong Mine, Cooranbong Entry Site (CES), form part of the Northern Coal Logistics Project (NCLP). Water management aspects related to the coal handling and processing facilities at CES and the haul road are described within this Water Management Plan (WMP). Aspects relating to Northern Coal Services are contained within the Newstan Complex Water Management Plan (2024).

A summary of site responsibilities is included in Table 1.1. The location of the surface sites and the Mandalong Mine Holding Boundary are shown in Figure 1.1, while the location of the mine workings are shown in Figure 1.2.

Table 1.1 Summary of site responsibilities

Management component	Site					
	Mandalong Mine Access Site	Mandalong South Surface Site	Delta Entry Site	Cooranbong Entry Site	Northern Coal Services	Hawkmount Quarry
Project approval	SSD-5144		DA 35-2-2004	SSD-5145		
Site ownership	Centennial Mandalong				Northern Coal Services Pty Limited	LMCC
Operations management	Centennial Mandalong				Northern Coal Services Pty Limited	LMCC*
Environmental management and responsibility	Centennial Mandalong				Centennial Newstan	LMCC*

*If reject emplacement commences at Hawkmount Quarry, responsibilities of operations management and environmental management will be transferred from Lake Macquarie City Council (LMCC) to Centennial Newstan Pty Limited.

1.1 Purpose of this plan

This WMP applies to all operations at Mandalong Mine and CES and include the existing and approved mining operations and associated infrastructure within the site boundary, which encompasses the mining leases of ML1443, ML1543, ML1553, ML1722 and ML1744. The WMP will be progressively developed as water management requirements change over time.

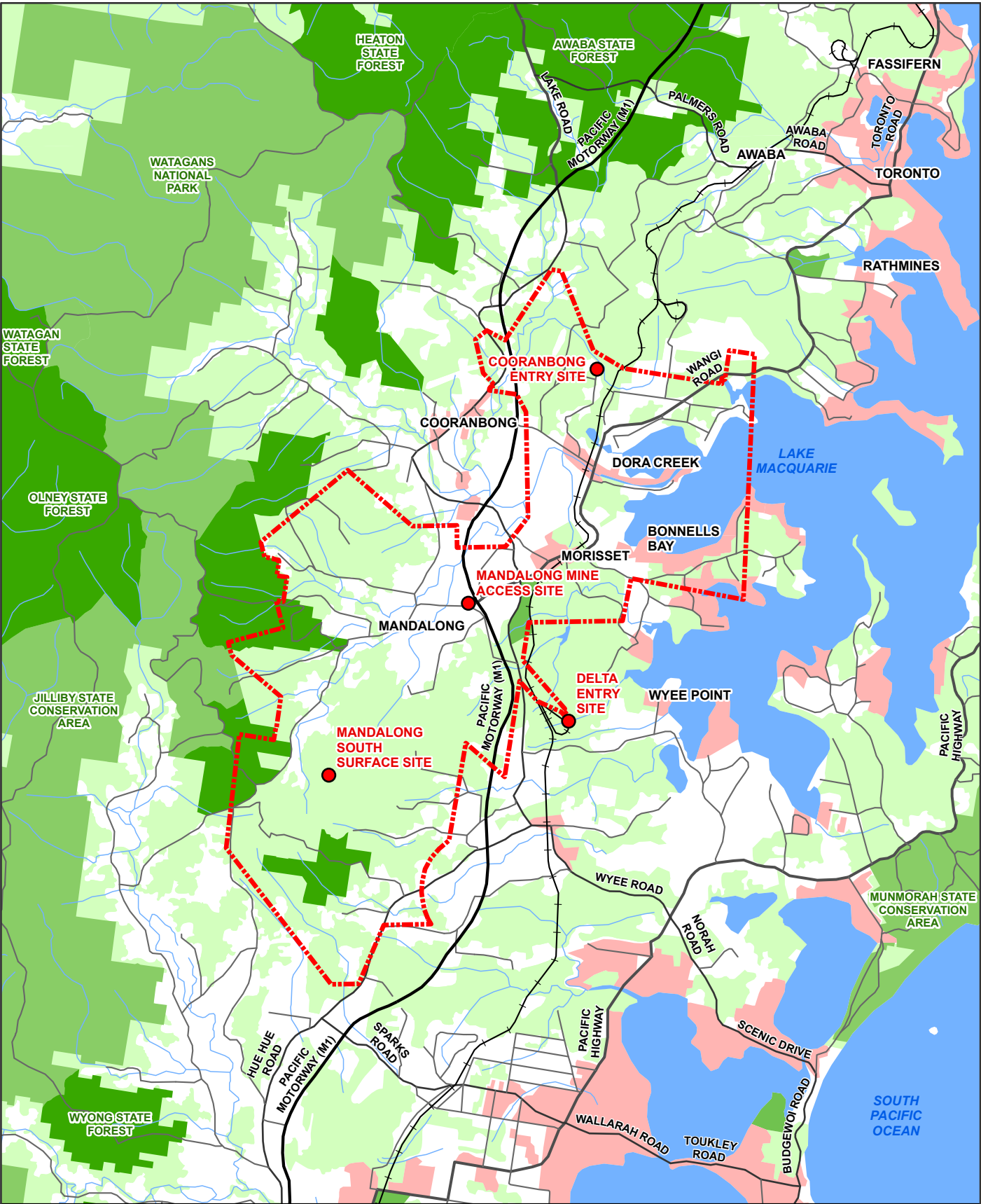
In accordance with the conditions of development consent SSD-5144 for Mandalong Mine and SSD-5145 for CES, this WMP has been prepared by Tegan Hopwood and Adrienne Harvey and reviewed by Dr Stuart Gray and Zoe Lagerroth of GHD Pty Ltd in consultation with Centennial Mandalong, whose appointment has been approved by the Secretary (refer to Appendix A).

The original WMP developed for SSD-5144 was provided to the NSW Environment Protection Authority (EPA), the former NSW Department of Primary Industries – Fisheries (DPI – Fisheries) (now Department of Primary Industries and Regional Development (DPIRD)) and former NSW Department of Primary Industries – Water Group (DPI Water) (now the Department of Planning, Housing and Infrastructure (DPHI)) for consultation on 23 February 2016. Responses were received from the EPA on 2 March 2016 and DPI Water on 21 March 2016. Following additional updates to the plan (Revision 6), consultation was sought with the EPA and Department of Planning and Environment – Water (DPE Water) on 18 August 2022. Responses were received from the EPA on 24 August 2022 and DPE Water on 17 November 2022.

Revision 7 of this WMP seeks to replace the previous Northern Operations Regional WMP (2017) and Northern Operations Discharge Management Plan (2016), for those aspects relating to Mandalong Mine and CES. No further reference to these documents has been made throughout this WMP. Decoupling of the Mandalong Mine and CES WMP from the NCLP was approved by DPHI in the Plan de-coupling approval letter, dated 10 January 2024 . It is noted that aspects relating to Northern Coal Services under SSD 5145 are included within the Newstan Complex WMP.

Details of consultation with the regulators is provided in Appendix A. The consultation comments are provided in Appendix B, along with where these comments have been addressed in the WMP.

The approved Mandalong Mine WMP will be implemented at Mandalong Mine, inclusive of MMAS, MSSS, DES and CES.



1:150,000 for A4

0 500 1000 2000 3000 4000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

- Site Locations
- Mandalong Mine Holding Boundary
- Existing Rail
- Freeway
- Principal road
- Secondary road
- Minor road
- Watercourse
- Watercourse area
- Built up area
- Nature conservation
- State forest
- Forest or shrub

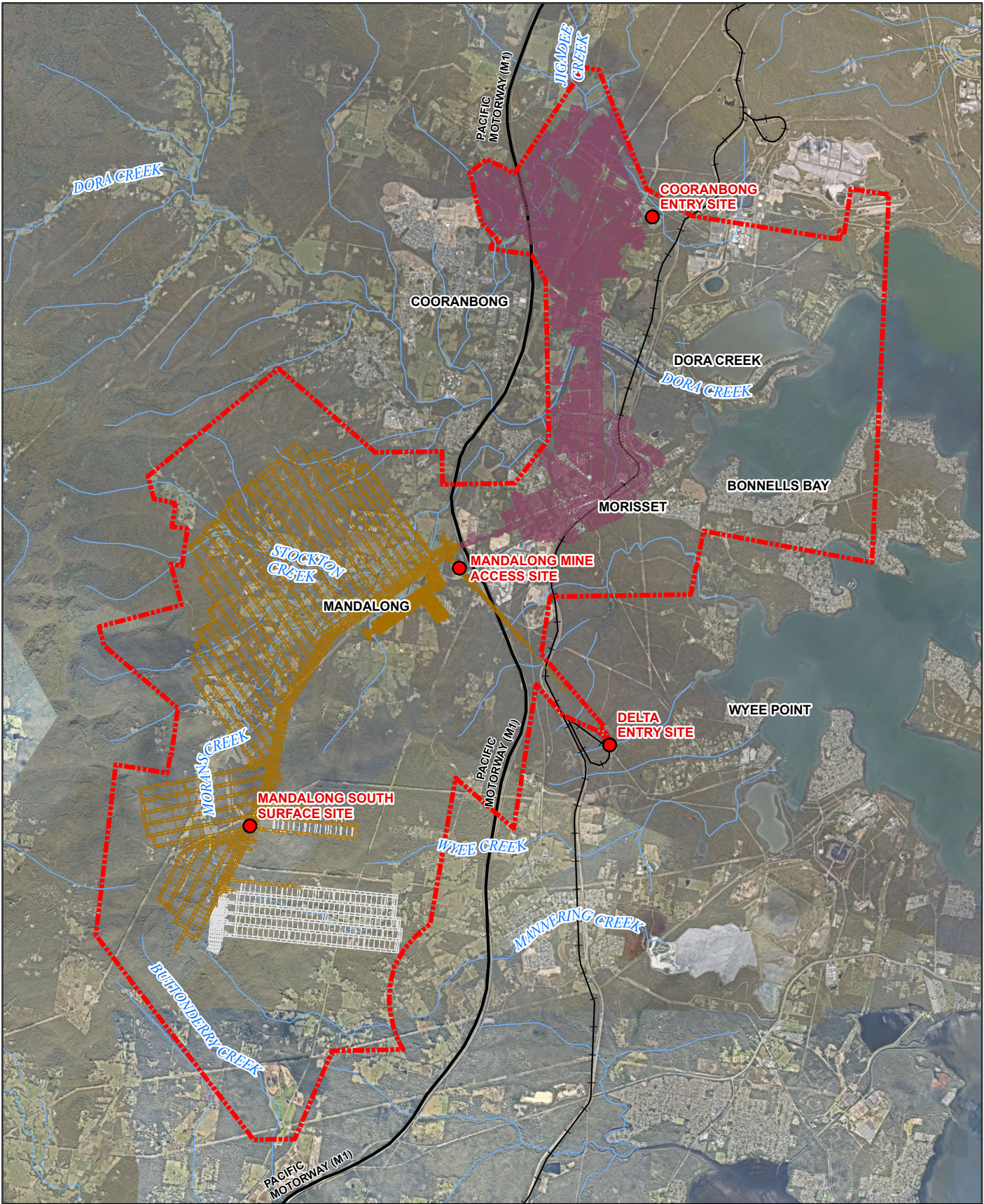
LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine
Water Management Plan

Site locality plan

CENTENNIAL

DATE	20/05/2025
Figure	1.1



1:100,000 for A4

0 375 750 1500 2250 3000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

LEGEND

Site Locations

Mandalong Mine Holding Boundary

Cooranbong underground mine workings

Approved Mandalong Mine Workings

Existing Mandalong Mine Workings

Future Mandalong Mine Workings

Existing Rail

Freeway

Watercourse

LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine Water Management Plan

Mine layout

DATE	20/05/2025	Figure 1.2
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1.2 Overview of site operations

1.2.1 Site features

1.2.1.1 Mandalong Mine Access Site

The MMAS is located on the western side of the M1 Motorway, in Mandalong NSW. The MMAS includes a decline tunnel, administration building and bathhouse, carpark, mechanical workshop and store, two mine ventilation fans, diesel refuelling station, hydrocarbon storage shed, equipment and materials storage areas, gas drainage, machinery washdown bay, fire-fighting and emergency equipment store, compressor shed, core shed, tube bundle shed, electrical sub-station and solsenic mixing plant. The site has existing connections to the Hunter Water Corporation (HWC) reticulated potable water and sewer systems. The site surface features associated with MMAS are provided in Figure 1.3.

1.2.1.2 Mandalong South Surface Site

The MSSS is located off Mandalong Road above the Mandalong Mine main headings. Construction of the MSSS commenced in 2017. The site includes a 4.5 m diameter downcast ventilation shaft and a 5.5 m diameter upcast shaft, with surface fans installed at the upcast mine shaft. Service boreholes are installed at the site to transfer materials and mine water as required, along with numerous other items of surface infrastructure required to service the mining operation. An access road has been constructed from Mandalong Road to the site. The site surface features associated with MSSS are provided in Figure 1.4.

1.2.1.3 Delta Entry Site

The DES is located on the eastern side of the M1 Motorway approximately 2.5 km north of Wyee. It comprises the Mandalong Coal Delivery System, which links the underground workings of Mandalong Mine to the Wyee coal unloader by an underground tunnel. The site includes a conveyor drift, coal transfer building and coal sizing unit. Coal is transferred from the DES to Vales Point Power Station via an overland conveyor. The site has existing connections to the HWC reticulated potable water and sewer systems. The site surface features associated with DES are provided in Figure 1.5.

1.2.1.4 Cooranbong Entry Site

CES is located on the eastern side of the M1 motorway, approximately 4.6 km north east of Cooranbong. CES includes a coal handling plant (CHP), mechanical workshops and service buildings, administration buildings and bathhouse, two mine ventilation fans, carpark, equipment and materials storage areas, machinery washdown bay, fire-fighting and emergency equipment store and water management infrastructure. The site surface features associated with CES are provided in Figure 1.6.

1.2.2 Coal production

Mandalong Mine currently has approval to extract up to 6.5 million tonnes per annum (Mtpa) of run of mine (ROM) coal from the West Wallarah Seam utilising longwall and bord and pillar methods. ROM coal is supplied directly to the CES and the DES by an underground conveyor (termed the Mandalong Coal Delivery System). Transfer rates to CES and DES are each up to 6 Mtpa of ROM coal. The CHP at CES, comprises aerial conveyor systems, rotary breaker and sizer, crushing plant, coal bins (2,000 tonne ROM coal bin and 2,000 tonne product coal bin), coal stockpiles (3,000 tonne and 100,000 tonne ROM coal stockpiles and 1,500 tonne emergency coal stockpile) and an automatic truck loading facility.



1:3,000 for A4

012.5255075100

Metres

Map Projection: Transverse Mercator

Horizontal Datum: GDA2020

Grid: GDA2020 MGA Zone 56

N

LEGEND Licensed discharge point Surface water storage
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1:3,000 for A4

012.5255075100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

Licensed discharge point

Surface water storage

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LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine
Water Management Plan
Site features -
Mandalong South Surface Site

DATE25/08/2025

Figure 1.4

N:\AU\Newcastle\Projects\22\0105001\GIS\Maps\Deliverables\Hunter\Mandalong\12649045\Mandalong_WMP_A\Mandalong_WMP_0.aprx

© GHD: Licensed discharge point, Surface water storage; Nearmap: Imagery (Date extracted:25/08/2025)



LEGEND

Surface water storage

Railway

Roads

© 2025. Whilst every care has been taken to prepare this map, GHD, LPI and Geoscience Australia make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine

Water Management Plan

Site features -

Delta Entry Site

DATE 20/05/2025

Figure 1.5



LEGEND

- Licensed discharge point
- Surface water storage

© 2025. Whilst every care has been taken to prepare this map, GHD, LPI and Geoscience Australia make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

**Mandalong Mine
Water Management Plan**

**Site features -
Cooranbong Entry Site**

DATE 21/05/2025

Figure 1.6

1.2.3 History

A summary of the history of Mandalong Mine operations (inclusive of CES) is provided in Table 1.2.

Table 1.2 History of Mandalong Mine

Date	History
1998	Original approval for Mandalong Mine (then known as Cooranbong Colliery Extension) granted.
1999	WMP first prepared.
2002	Mandalong Mine was acquired by Centennial Mandalong.
2005	Mining operations commenced at Mandalong Mine.
2006	Coal supply to Vales Point Power Station commenced.
2013	Environmental Impact Statement (EIS) for Mandalong Southern Extension Project was submitted.
2013	Construction of VAM-RAB (methane abatement) trial facility completed.
2013-2015	Significant modifications to water management system at CES completed, including an increase in borehole dewatering capacity from 1 ML/day to 5 ML/day
October 2014	WMP was revised.
October 2015	Mandalong Southern Extension Project was approved (development consent SSD-5144).
June 2016	Modification 1 to development consent SSD-5144 was approved to relocate transmission line TL24.
September 2016	Modification 2 to development consent SSD-5144 was approved to extend the development of first workings for longwall panels 22 and 23.
November 2016	Modification 3 to development consent SSD-5144 was approved to increase the annual production limit from 6 Mtpa to 6.5 Mtpa.
March 2017	Modification 4 to development consent SSD-5144 was approved to extend longwall panels 22 and 23.
August 2017	Modification 5 to development consent SSD-5144 was approved to extend longwall panel 24 and add longwall panel 24A.
April 2019	Modification 6 to development consent SSD-5144 was approved for controlled discharge of water from the Sediment Dam at the MSSS.
July 2019	Modification 7 to development consent SSD-5144 was approved for a 33 kV powerline from the MMAS to the MSSS.
January 2020	Modification 8 to development consent SSD-5144 was approved to increase number of personnel and upgrade to existing substation and car parking facilities at the MMAS.
April 2021	Modification 9 to development consent SSD-5144 was approved to reorientate its former Longwalls 30-37 and reduce the number of longwalls in this area from eight to four.
February 2022	Modification 10 to development consent SSD-5144 was approved for the addition of Longwall 34.

1.3 Approvals and licensing requirements

1.3.1 SSD-5144 development consent

The WMP addresses specific water components of the conditions of development consent SSD-5144, which was granted by the Planning and Assessment Commission on 12 October 2015 for the Mandalong Southern Extension Project. Development consent SSD-5144 has had 10 modifications since October 2015 as summarised in Table 1.2.

Operations at the DES are currently regulated by two development consents. Development consent DA 35-2-2004 is held by Centennial Mandalong for the transportation of coal to the DES via the underground Mandalong Coal Delivery System. Development consent DA 2501/2004 is held by Delta Electricity for the Wyee Coal Handling Plant at the DES.

The relevant requirements of the WMP specified by development consent SSD-5144 are outlined in Table 1.3, along with the sections of the plan where these have been addressed.

Table 1.3 Development consent SSD-5144 conditions

Condition		Where addressed
Water Supply		
Schedule 3 12.	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of mining operations to match its available water supply <i>Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.</i>	Section 1.3.5 Section 3.6.1
Water Pollution		
Schedule 3 13.	Unless an EPL authorises otherwise, the Applicant must comply with Section 120 of the POEO Act.	Section 1.3.4
Schedule 3 14.	The Applicant must implement all reasonable and feasible measures to reduce water pollution associated with the discharge of surface water or mine-water (particularly salinity and dissolved or suspended metals associated with groundwater pumped from underground mine workings) required to comply with any EPL applying to the development.	Section 3 Section 6
Mine-Water Discharges Management Plan		
Schedule 3 15.	The Applicant must prepare a Mine-Water Discharge Management Plan for the development to the satisfaction of the Secretary. This plan must:	This WMP
Schedule 3 15. (a)	Be prepared by suitably qualified and experience persons whose appointment has been approved by the Secretary;	Section 1.1 Appendix A (to be included once consultation occurs).

Condition		Where addressed
Schedule 3 15. (b)	Be submitted to the Secretary for approval by 30 June 2016 unless otherwise agreed by the Secretary;	Historical requirement. The previous plan has been consolidated, as described in Section 1.1 and Appendix A
Schedule 3 15. (c)	describe the measures that would be implemented to ensure compliance with conditions 13 and 14 and relevant performance measures in Table 4;	Section 4 Section 6
Schedule 3 15. (d)	include targets, developed in co-operation with the EPA, to reduce acute and chronic toxicity from mine-water discharges from the CES to achieve the in-stream water quality and aquatic ecology objectives and criteria required by condition 16 below;	Section 6.1 Section 6.1.7
Schedule 3 15. (e)	include measures, developed in co-operation with the EPA to be implemented over 2-year, 10-year and life-of-project timeframes to reduce the salinity and metals toxicity in mine-water discharged from the CES to achieve these targets; and	Section 3.5.2
Schedule 3 15. (f)	take into account relevant requirements of the Water Management Plan required by condition 17 below.	See 'Water Management Plan' conditions below
Water Management Performance Measures		
Schedule 3 16.	The Applicant must comply with the performance measures in Table 4 [Water Management Performance Measures], to the satisfaction of the Secretary.	Table 1.4
Water Management Plan		
Schedule 3 17.	The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. This plan must:	
Schedule 3 17. (a)	Be prepared in consultation with DPE Water and the EPA, by suitably qualified and experienced persons whose appointment has been approved by the Secretary;	Section 1.1 Appendix A Appendix B
Schedule 3 17. (b)	Be submitted to the Secretary for approval prior to commencement of construction of the MSSS, or by 31 March 2016, whichever is sooner;	Appendix A
Schedule 3 17. (c)	Include detailed performance criteria and describe measures to ensure that the Applicant complies with the Water Management Performance Measures in Table 4;	Section 6.1 Appendix G
Schedule 3 17. (d)	Include the following, in addition to the standard requirements for management plans (see condition 2 of Schedule 6):	
Schedule 3 17. (d) (i)	A <u>Site Water Balance</u> , that includes details of:	
	Water use and management on site;	Section 3.5.2

Condition		Where addressed
	Any off-site water discharges;	
	Reporting procedures, including the preparation of a site water balance for each calendar year of the development; and	Section 7.12
	Investigates and implements all reasonable and feasible measures to minimise potable water use and to recycle water;	Section 3.6.1
Schedule 3 17. (d) (ii)	A <u>Surface Water Management Plan</u> , that includes:	
	Detailed baseline data on water flows and quality in the watercourses that could be affected by the development;	Section 5.1
	A detailed description of the development's water management systems, including the: - Clean water diversion systems; - Erosion and sediment controls; - Measures applying reasonable endeavours to reuse water held in the MSSS Sediment Dam, such as through the use of irrigation and/or evaporation, prior to discharge under condition 17A of this Schedule; and - Mine water management systems;	Section 3
	Detailed performance criteria, including trigger levels, for investigating any potentially adverse impacts associated with: - The water management systems; - Downstream surface water quality; - Downstream watercourse channel stability; - Stream and riparian vegetation health; and - Downstream flooding impacts;	Section 6.1 Section 6.1.7
	A program to monitor and report on: - The effectiveness of the water management systems; - Surface water flows and water quality, and the condition of stream and riparian vegetation in the watercourses on site and downstream of the site; - Macroinvertebrate health and ecotoxicity parameters downstream of mine-water discharges; and - Downstream flooding impacts;	Section 4 Section 7
	Reporting procedures for the results of the monitoring program;	Section 7.1 - 7.3
	A plan to respond to any exceedances of the performance criteria and mitigate any adverse surface water impacts of the development.	Section 6.3 Appendix G
	The Applicant must implement the approved management plan as approved from time to time by the Secretary.	Section 1

Condition		Where addressed
Temporary Discharge of Water at MSSS		
Schedule 3 17A.	The Applicant may discharge collected surface water from the MSSS Sediment Dam via Licenced Discharge Point LDP004 (EPL 365) until 30 June 2021. Any such discharge must be in accordance with conditions 14 and 17 of this Schedule.	Section 3.2.2
Management Plan Requirements		
Schedule 6 2.	The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
Schedule 6 2. (a)	Detailed baseline data;	Section 5
Schedule 6 2. (b)	A description of: - The relevant statutory requirements (including any relevant approval, licence or lease conditions); - Any relevant limits or performance measures/criteria; and - The specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development of any management measures;	Section 1.3 Section 6.1 Section 6.1.7
Schedule 6 2. (c)	A description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 3 Section 6.1
Schedule 6 2. (d)	A program to monitor and report on the: - Impacts and environmental performance of the development; and - Effectiveness of any management measures.	Section 4 Section 7.3
Schedule 6 2. (e)	A contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 6.3 Appendix G
Schedule 6 2. (f)	A program to investigate and implement ways to improve the environmental performance of the development over time;	Section 6
Schedule 6 2. (g)	A protocol for managing and reporting any: - Incidents; - Complaints; - Non-compliances with statutory requirements; and - Exceedances of the impact assessment criteria and/or performance criteria; and	Section 7.4 Section 7.5 Section 6
Schedule 6 2. (h)	A protocol for periodic review of the plan.	Section 7.13

Condition		Where addressed
Environmental Management, Reporting and Auditing		
Schedule 6 7	Revision of Strategies, Plans and Programs Within 3 months of: (a) the submission of an incident report under condition 10 below; (b) the submission of an annual review under condition 12 below; (c) the submission of an audit report under condition 13 below; or (d) the approval of a modification to this consent, the Applicant must review, and if necessary revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary. Within 4 weeks of conducting any such review, the Applicant must advise the Secretary of the outcomes of the review, and provide any revised documents to the Secretary for review and approval.	Section 7.13
Schedule 6 9	Community Consultative Committee The Applicant must establish a Community Consultative Committee (CCC) for the development to the satisfaction of the Secretary. This CCC must be operated in general accordance with the Community Consultative Committee (CCC) Guidelines for State Significant Projects (Department of Planning, 2016) or its latest version.	Section 7.7
Schedule 6 10	REPORTING Incident Reporting The Applicant must immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification must be in writing via the Major Projects Website and identify the development (including the development application number and name) and set out the location and nature of the incident. Within 7 days of the date of the incident, the Applicant must provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.	Section 7.4
Schedule 6 10A	Non-Compliance Notification Within seven days of becoming aware of a non-compliance, the Applicant must notify the Department of the non-compliance. The notification must be in writing via the Major Projects Website and identify the development (including the development application number and name), set out the condition of this consent that the development is non-compliant with, the way in which 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.	Section 7.4

Condition		Where addressed
Schedule 6 11	Regular Reporting The Applicant must regularly report the environmental performance of the development on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this consent.	Section 7.3
Schedule 6 12	ANNUAL REVIEW 12. By the end of March each year, or as otherwise agreed by the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development to the satisfaction of the Secretary. This review must: (a) describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the current calendar year; (b) include a comprehensive review of the monitoring results and complaints records of the development over the past calendar year, which includes a comparison of these results against the: (i) relevant statutory requirements, limits or performance measures/criteria; (ii) requirements of any plan or program required under this consent; (iii) monitoring results of previous years; and (iv) relevant predictions in the documents identified in condition 2(a) and (b) of Schedule 2; (c) identify any non-compliance over the past calendar year, and describe what actions were (or are being) taken to ensure compliance; (d) identify any trends in the monitoring data over the life of the development; (e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and (f) describe what measures will be implemented over the current calendar year to improve the environmental performance of the development.	Section 7.1

Condition		Where addressed
Schedule 6 13	INDEPENDENT ENVIRONMENTAL AUDIT By 31 March 2016, and every 3 years thereafter, unless the Secretary directs otherwise, the Applicant must commission, commence and pay the full cost of an Independent Environmental Audit of the development. This audit must: (a) be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary; (b) include consultation with the relevant agencies; (c) assess the environmental performance of the development and assess whether it is complying with the requirements in this consent and any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals); (d) review the adequacy of strategies, plans or programs required under the abovementioned approvals; (e) recommend appropriate measures or actions to improve the environmental performance of the development, and/or any assessment, plan or program required under the abovementioned approvals; and (f) be conducted and reported to the satisfaction of the Secretary.	Section 7.6
Schedule 6 15	ACCESS TO INFORMATION Within 3 months of the date of this consent, the Applicant must: (a) make copies of the following publicly available on its website: (i) the documents referred to in condition 2(a) and (b) of Schedule 2; (ii) all current statutory approvals for the development; (iii) all approved strategies, plans and programs required under the conditions of this consent; (iv) a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs; (v) a complaints register, updated monthly; (vi) minutes of CCC meetings for the last 2 years; (vii) the annual reviews of the development; (viii) any independent environmental audit of the development, and the Applicant's response to the recommendations in any audit; (ix) any other matter required by the Secretary; and (b) keep this information up-to-date, to the satisfaction of the Secretary.	Section 7.3 Section 7.5 Section 7.7 Section 7.1 Section 7.6

1.3.1.1 Water management performance measures

The water management performance measures specified by development consent SSD-5144 (Table 4: Water Management Performance Measures) are presented in Table 1.4, along with the sections of the WMP where these have been addressed.

Table 1.4 Water management performance measures specified by SSD-5144

Feature	Performance measure	Where addressed
Potable water	Minimise the use of potable water from the public supply for purposes where non-potable water is acceptable.	Section 3.6 Section 6.2.1
MMAS MSSS	Design, install and maintain erosion and sediment controls generally in accordance with the series <i>Managing Urban Stormwater: Soils and Construction</i> including <i>Volume 1</i> , <i>Volume 2A – Installation of Services</i> and <i>Volume 2C – Unsealed Roads</i> .	Section 3.8 Section 6.2.1
	Design, install and maintain any infrastructure within 40 m of watercourses generally in accordance with the <i>Guidelines for Controlled Activities on Waterfront Land</i> (DPI 2007), or the latest version.	Section 6.2.2
	Design, install and maintain creek crossings generally in accordance with the <i>Policy and Guidelines for Fish Friendly Waterway Crossings</i> (DPI Fisheries 2003) and <i>Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings</i> (DPI Fisheries 2003), or the latest versions.	Section 6.2.2
Sediment dams	Maintain dams generally in accordance with the series <i>Managing Urban Stormwater: Soils and Construction – Volume 1</i> and <i>Volume 2E – Mines and Quarries</i> .	Section 3.8 Section 6.2.1
Clean water diversions	Design, install and maintain new clean water diversion structures to convey the 100 year ARI [average recurrence interval] flood.	Section 6.2.1
	Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site.	Section 6.2.1
Mine water storages	Design, install and maintain mine water storage infrastructure to ensure no unlicensed or uncontrolled discharge of mine water off-site.	No mine water storages exist at MMAS, MSSS or DES.
Aquatic and riparian ecosystems (including affected sections of unnamed watercourses receiving discharges from the CES, Muddy Creek and Muddy Lake)	Maintain or improve baseline channel stability.	Section 6.1.1 Section 6.2.5
	Develop site-specific in-stream water quality and aquatic ecology (macroinvertebrate health and ecotoxicity assessment) objectives and criteria in consultation with the EPA and in accordance with any EPL applying to the CES.	

Feature	Performance measure	Where addressed
Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards.	Section 6.2.1

1.3.1.2 Mandalong Southern Extension Project Statement of Commitments

In addition to the conditions of development consent SSD-5144 indicated in Table 1.3, Centennial Mandalong also committed to the management strategies and monitoring activities outlined in Table 1.5 as part of the Mandalong Southern Extension Project and subsequent modifications.

Table 1.5 Statement of commitments

Commitment	Where addressed
Environmental management and reporting	
Centennial Mandalong will include a process to review the groundwater, surface water and flood models as part of the Water Management Plan.	Section 7
Centennial will consult with NSW Fisheries in the development of the Water Management Plan.	Appendix A
Groundwater	
Centennial Mandalong will commit to implement “make good provisions” to any water supply work where the drawdown impacts exceed the 2 m criteria as specified by the NSW Aquifer Interference Policy.	Section 6.2.3 Appendix G
Each year, Centennial Mandalong will engage a specialist to undertake an analysis of alluvial groundwater levels to identify non-rainfall related trends.	Section 7.11
Surface water	
For each Extraction Plan, Centennial Mandalong will include in the Water Management Plan (Condition 6 of Schedule 4) the following: - Monitoring of the watercourses within the Southern Extension Area to be undermined, particularly in locations identified as potential scouring points, to evaluate watercourse stability. Monitoring will be undertaken before and after undermining of the areas, with additional inspection of these locations following significant rainfall events. - Surface water quality monitoring at the same locations within the Southern Extension Area used to gather background information. - Continuous stream flow monitoring on Morans Creek, Mannering Creek, and Wyee Creek will be undertaken 2 years prior to mining and for 2 years after the completion of mining the adjacent longwall panel. - TARPs for the management of subsidence impacts on watercourses in consultation with relevant government agencies.	Section 4.1 Section 4.2 Section 5.1 Appendix G
Centennial Mandalong will undertake any works within watercourses and on the floodplain in accordance with the <i>Guidelines for Controlled Activities on Waterfront Land</i> (2012).	Section 6.2.2

Commitment	Where addressed
Water management	
If the quality of mine water collected in the Borehole Dam is not suitable for discharge from the CES, the water will be pumped back underground for recirculation (additional filtration and sediment settlement) through the Cooranbong Colliery goaf storage area before returning to the Borehole Dam.	Section 3
The storage volume of the Borehole Dam at the CES will be increased to increase the settling capacity. In addition, baffles will be retrofitted in the Borehole Dam to provide increased residence time and a flocculent will be introduced.	Section 3.2.4
Aquatic macroinvertebrate monitoring and sediment sampling will be undertaken every six months (spring and autumn).	Section 4.5.2 Aquatic ecology monitoring for MSSS is no longer conducted
Modification 6	
Establish additional water quality monitoring locations (Sediment Dam and MCUS) and undertake water quality monitoring in accordance with Table 4 of the SEE [Statement of Environmental Effects].	Section 4.2 Section 4.3
Implement quarterly water quality and annual aquatic ecology monitoring in Morans Creek upstream and downstream of the confluence of the unnamed creek to assess any downstream impacts due to discharges.	Section 4.2 Section 5.3.1
Undertake weekly site inspections at MSSS and following 40 mm of rainfall in the preceding 24 hours to inspect the capacity, structural integrity and effectiveness of the Gross Pollutant Trap and Sediment Dam.	Section 4.1
Review and revise where necessary the site's Water Management Plan to reflect the outcomes of the modification.	Revision 4 to this WMP
Undertake six-monthly visual and photographic inspections of the unnamed creek on Centennial-owned land to assess for evidence of scouring. Implement appropriate mitigation measures should evidence of scouring be detected.	Section 4.5.1 Appendix G

1.3.2 SSD-5145 development consent

Development consent SSD-5145 was granted by the Minister for Planning on 29 September 2015 for the NCLP, which allows coal transportation and processing operations on site until 31 December 2045. Northern Coal Services Modification 1 was approved by the Department of Planning and Environment on 25 January 2018. A subsequent modification application was made (Modification 2) for various ROM coal transport between Myuna Colliery, CES and Northern Coal Services, however, was withdrawn. Modification 3 was approved in November 2022 for the purpose of reforms to the rehabilitation management and performance conditions in accordance with the contemporary requirements under the Mining Act 1992. Modification 5 was approved on 26 June 2025, allowing beneficial use of coal washery rejects, and increased coal and reject transport to Eraring Power Station from CES.

The conditions relevant to water management for the NCLP set out by SSD-5145 are outlined in Table 1.6, along with where they are addressed (where relevant to CES) throughout this WMP.

Table 1.6 Development consent SSD-5145 conditions (relevant for CES)

Condition		Where addressed
Waters Supply		
Schedule 3 Condition 12	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of its operations to match its available water supply. Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.	Section 1.3.5 Section 3.6.1
Water Pollution		
Schedule 3 Condition 13	Unless an EPL authorises otherwise, the Applicant must comply with Section 120 of the POEO Act.	Section 1.3.4
Schedule 3 Condition 14	The Applicant must implement all reasonable and feasible measures to reduce water pollution associated with the discharge of mine-water (particularly salinity and dissolved or suspended metals associated with groundwater pumped from underground mine workings) required to comply with any EPL applying to the development.	Section 3 Section 6
Mine Water Discharge Management Plan		
Schedule 3 Condition 15	The Applicant shall prepare and implement a Mine-Water Discharges Management Plan for the development to the satisfaction of the Secretary. This plan must:	This WMP
(a)	be prepared in consultation with the EPA, by suitably qualified and experienced persons whose appointment has been approved by the Secretary;	Section 1.1 Appendix A (to be included once consultation occurs)
(b)	be submitted to the Secretary for approval by 30 June 2016 unless otherwise agreed by the Secretary;	Historical requirement. The previous plan has been consolidated, as described in Section 1.1 and Appendix A
(c)	describe the measures that would be implemented to ensure compliance with conditions 13 and 14 and relevant performance measures in Table 5;	Section 4 Section 6

Condition		Where addressed
(d)	include targets, developed in co-operation with the EPA, to reduce acute and chronic toxicity from mine-water discharged from both the NCSS and CES to achieve the in-stream water quality and aquatic ecology objectives and criteria required by condition 16 below;	Section 6.1 Section 6.1.7 Matters relating to Northern Coal Services are included in the Newstan Complex WMP
(e)	include measures, developed in co-operation with the EPA to be implemented over 2-year, 10-year and life-of-project timeframes to reduce the salinity and metals toxicity in mine-water discharged from both the NCSS and CES to achieve these targets; and	Section 3.5.2 Matters relating to Northern Coal Services are included in the Newstan Complex WMP
(f)	take into account relevant requirements of the Water Management Plan required by condition 17 below.	Matters relating to Northern Coal Services are included in the Newstan Complex WMP See 'Water Management Plan' conditions below for CES
Water Management Performance Measures		
Schedule 3 Condition 16	The Applicant must comply with the performance measures in Table 5, to the satisfaction of the Secretary.	Table 1.4
Schedule 3 Condition 16 Table 5	<i>Table 5: Water Management Performance Measures</i>	Section 3.6 Section 6.2.1
	Potable Water Minimise the use of potable water from the public supply for purposes where non-potable water is acceptable.	

Condition		Where addressed
	Site (as a whole) Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction including Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads. Design, install and maintain any infrastructure within 40 m of watercourses generally in accordance with the Guidelines for Controlled Activities on Waterfront Land (DPI 2012), or the latest version. Design, install and maintain creek crossings generally in accordance with the Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries 2003) and Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003), or the latest versions.	Section 3.8 Section 6.2.1 Section 6.2.2
	Sediment Dams Maintain dams generally in accordance with the series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries.	Section 3.8 Section 6.2.1
	Clean water diversions Design, install and maintain new clean water diversion structures to convey the 100 year ARI flood. Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site.	Section 6.2.1
	Mine-water storages Design, install and maintain mine-water storage infrastructure to ensure no unlicensed or uncontrolled discharge of mine-water offsite.	Underground (mine) water is managed in accordance with Section 3.3.1. Discharges are managed in accordance with Section 3.5 with performance criteria in Section 6.2.4.
	Aquatic and riparian ecosystems (including affected sections of LT, Stony and Lords Creeks, unnamed watercourses receiving discharges from Hawkmount Quarry and CES, Muddy Creek and Muddy Lake) Maintain or improve baseline channel stability Develop site-specific in-stream water quality and aquatic ecology (macroinvertebrate health and ecotoxicity assessment) objectives and criteria in consultation with the EPA and	Performance criteria included in Section 6.1.7 Hawkmount Quarry is not managed by Centennial (see Table 1.1)

Condition		Where addressed
	Chemical and hydrocarbon storage Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards.	Section 3.8.8 Section 6.2.1
Water Management Plan		
Schedule Condition 17	3 The Applicant must prepare and a Water Management Plan for the development to the satisfaction of the Secretary. This plan must:	This WMP
Schedule Condition 17 (a)	3 Be prepared in consultation with DPE Water and the EPA, by suitably qualified and experienced persons whose appointment has been approved by the Secretary;	Section 1.1 Appendix A Appendix B
Schedule Condition 17 (b)	3 Be submitted to the Secretary for approval by 31 March 2016, unless otherwise agreed by the Secretary;	Appendix A
Schedule Condition 17 (c)	3 Include detailed performance criteria and describe measures to ensure that the Applicant complies with the Water Management Performance Measures listed in Table 5 of development consent SSD-5145.	Section 6.1 Appendix G
Schedule Condition 17 (d)	3 Include the following, in addition to the standard requirements for management plans (see condition 2 of Schedule 5):	-
Site Water Balance		
Schedule Condition 17 (d) (i)	3 a Site Water Balance, that includes details of: water use and management on site;	Section 3.5.2
	any off-site water discharges; and	
	reporting procedures, including the preparation of a site water balance for each calendar year of the development; and	Section 7.12
	investigates and implements all reasonable and feasible measures to minimise potable water use and to recycle water.	Section 3.6.1
Surface water management plan		
Schedule Condition 17 (d) (ii)	3 a Surface Water Management Plan, that includes: Detailed baseline data on water flows and quality in the watercourses that could be affected by the development.	Section 5.1
	a detailed description of the development's water management systems, including the: - clean water diversion systems; - erosion and sediment controls; and - mine-water management systems;	Section 3

Condition		Where addressed
	detailed plans including design objectives and performance criteria for: - Design and management for the emplacement of coal stockpiles and any potential acid-forming materials; - The proposed piping of LT Creek to enable the construction of coal stockpiles; and - Management of sodic and dispersible soils.	Section 3.8 Aspects relating to Northern Coal Services and LT Creek are described within the Newstan Complex WMP.
	detailed performance criteria, including trigger levels, for investigating any potentially adverse impacts associated with: - The water management systems; - Downstream surface water quality; - Downstream watercourse channel stability, particularly for the Fassifern Archery Club section of LT Creek; - Downstream flooding impacts; and - Stream and riparian vegetation health.	Section 6.1 and Section 6.1.7 Aspects relating to Northern Coal Services and LT Creek are described within the Newstan Complex WMP
	A program to monitor and report on: - The effectiveness of the water management systems. - Surface water flows and water quality, and the condition of stream and riparian vegetation in the watercourses on site and downstream of the site. - Macroinvertebrate health and ecotoxicity parameters downstream of mine water discharges. - Downstream flooding impacts.	Monitoring - Section 4.2, 4.4, 4.5 Reporting - Section 7 Performance criteria – Section 6.1
	Reporting procedures for the results of the monitoring program; and	Section 7.1 - 7.3
	A plan to respond to any exceedances of the performance criteria and mitigate any adverse surface water impacts of the development.	Section 6.3 Appendix G
	The applicant must implement the plan as approved by the Secretary	Section 1
Management plan requirements		
Schedule 5	The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
Schedule 5 2 (a)	detailed baseline data;	Section 5

Condition		Where addressed
Schedule 5 2 (b)	a description of: - the relevant statutory requirements (including any relevant approval, licence or lease conditions); - any relevant limits or performance measures/criteria; and - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	Section 1.3 Section 6.1 Section 6.1.7
Schedule 5 2 (c)	a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 3 Section 6.1
Schedule 5 2 (d)	a program to monitor and report on the: - impacts and environmental performance of the development; and - effectiveness of any management measures;	Section 4 Section 7.3
Schedule 5 2 (f)	a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 6.3 Appendix G
Schedule 5 2 (g)	A protocol for managing and reporting any: - Incidents; - Complaints; - Non-compliances with statutory requirements; and Exceedances of the impact assessment criteria and/or performance criteria; and	Section 7.4 Section 7.5 Section 6
Schedule 5 2 (h)	a protocol for periodic review of the plan.	Section 7.13
Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans		

1.3.3 Environment Protection and Biodiversity Conservation Approval

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides a legal framework to protect and manage nationally and internationally significant flora, fauna, ecological communities and heritage places defined as 'matters of national environmental significance'.

In addition to the conditions of development consent SSD-5145 indicated in Table 1.6, approval of the NCLP for CES is also conditioned under EPBC approval. This is due to the presence of a Green and Golden Bell Frog (*Litoria aurea*) population in Muddy Lake downstream of LDP001, and the proposed increase of LDP001 discharge volume from 5 ML/day to 8 ML/day, under the NCLP. Based on recent hydrogeological modelling, this increase in discharge volume is unlikely to occur.

Approval under Part 9 of the EPBC Act for the NCLP (referral 2013/6906) was granted on 2 March 2016 with the controlling provision for listed threatened species and communities (under section 18 and 18A).

Condition 2 of the EPBC Act approval requires that for the life of the approval, the approval holder must ensure that the project does not result in a decline in the Green and Golden Bell Frog (*Litoria aurea*) population or habitat. Condition 3 pertains to the identification of habitat and the commencement of a monitoring program for the species. Condition 5 relates to the preparation and implementation of a Biodiversity Monitoring Plan. The Muddy Lake Green and Golden Bell Frog Management Plan (GHD 2021b) was developed to outline the ongoing monitoring requirements.

A Green and Golden Bell Frog Research Program has been developed (refer to the Muddy Lake Green and Golden Bell Frog Management Plan, GHD 2021b and Section 5.3.1) and is implemented by Centennial Mandalong.

It is noted that while matters relating to CES discharge are covered under this WMP, there are additional provisions for Newstan Complex relating to Green and Golden Bell Frog terrestrial ecology monitoring conditions outlined in EPL 395 Clean Up Notice 1553877 relating to the Awaba Seep (refer to Newstan Complex WMP and the Newstan Complex Biodiversity Management Plan).

1.3.4 Environment protection licence

Development consents SSD-5144 and SSD-5145 require that unless an EPL authorises otherwise, the Applicant must comply with Section 120 of the POEO Act. Mandalong Mine currently holds EPL 365, with water currently licensed to be discharged through the following licensed discharge points (LDPs):

- LDP001 – Located at CES, at the end of the discharge pipeline adjacent to an unnamed tributary of Muddy Lake. The pipeline receives mine water from the Borehole Dam or surface water from Sediment Dams 1 and 2.
- LDP002 – Located at CES, at the outlet of the 5 ML Dam which discharges into the unnamed tributary of Muddy Lake.
- LDP003 – Located at the MMAS, at the outlet of the Sediment Control Dam which discharges into low-lying vegetation.
- LDP004 – Located at the MSSS, at the outlet of the Sediment Dam which discharges into an unnamed tributary of Morans Creek. Project approval under SSD-5144 to discharge collected surface water expired 30 June 2021, however this LDP remains as an emergency discharge location as described in Section 3.2.2.2.

1.3.5 Groundwater bore licences

The *North Coast Fractured and Porous Rock Groundwater Sources Water Sharing Plan* commenced on 1 July 2016 and regulates the interception and extraction of groundwater from the fractured and porous rock aquifer within the water sharing plan boundary, which includes Mandalong Mine. Alluvial groundwater at Mandalong Mine is managed under the *Hunter Unregulated and Alluvial Water Sources Water Sharing Plan 2022*.

Centennial Mandalong currently holds one water access licence (WAL 39767) to extract up to 1825 ML/year via the Cooranbong bore (water supply works approval 20WA218789) from the Cooranbong underground storage area and transfer into the Borehole Dam at CES. The annual groundwater take from the fractured and porous rock groundwater sources via the Cooranbong bore is calculated annually and reported in the annual water balance review for Mandalong Mine.

A number of licences are held by Centennial Mandalong under the *Water Act 1912* for groundwater monitoring bores. The details of these bores are provided in Section 4.6.

1.4 Water Management Plan objectives

The WMP has been developed to address the legislative, approvals and licensing requirements presented in Section 1.3. The objectives of the WMP are:

- Collate and review existing information and studies relating to the operation of the water management system at Mandalong Mine.
- Establish an understanding of the water management system at the site.
- Categorise the existing conditions that are specific to water management requirements.
- Develop catchment plans for both the existing and the approved site layouts.
- Identify and maximise the separation of the clean, dirty and coal-contact water management systems.
- Undertake a review of the capacity of dirty and contaminated surface water storages in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004) and *Volume 2E* (DECC 2008).
- Determine the suitability of flooding management and waterway conditions.
- Undertake a surface water quality assessment and review existing water quality assessment criteria.
- Develop a groundwater monitoring program (levels and quality) and set trigger values to assess impacts of mine operations on the groundwater environment and receptors.
- Minimise water discharges from the site by maximising, where practicable, opportunities for the reuse and recycling of water on site.
- Manage discharges to natural waterways in accordance with relevant EPL conditions or as agreed with the EPA.
- Determine the future water management requirements.
- Review and develop water monitoring requirements.
- Review relevant statutory requirements, including relevant approval and licence conditions.
- Identify discharge requirements, including predicted water quantity and quality, over life-of-project timeframes.
- Identify targets to reduce acute and chronic toxicity from mine water discharges.
- Describe measures that may be implemented to reduce water pollution associated with mine water discharges and to ensure compliance with conditions of EPLs and development consents for each site.
- Develop a program to monitor the effectiveness of management measures.
- Develop trigger action response plans (TARPs) that outline the triggers and appropriate responses to manage any potentially adverse impacts on the receiving environment due to mine water discharges.

1.5 Relationship to other plans

Water management at Mandalong Mine is covered by two separate scales of management plan. Water is managed at an operational level via implementation of this site-specific WMP. In addition, Development consent SSD-5144 requires an extraction plan for all second workings at Mandalong Mine, which must include a WMP.

1.5.1 Extraction plans

Extraction plans are developed for all secondary workings of each longwall panel prior to mining. Generally, extraction plans describe the applicable regulatory framework, mine planning and management and monitoring measures to be implemented to ensure the protection of all surface/subsurface natural and built features and the protection of public safety during extraction. Each extraction plan for Mandalong Mine includes a separate WMP to manage potential subsidence-related impacts to water resources. A biodiversity management plan is also included as a sub-plan to each extraction plan. These plans are progressively developed and are available on the Department's planning portal.

1.5.2 Mandalong Mine: Groundwater Monitoring and Modelling Plan

The *Mandalong Mine: Groundwater Monitoring and Modelling Plan* was developed for Exploration Lease 6317 to ensure that sufficient groundwater data exists so that the hydrogeological model adequately predicts impacts of mining on groundwater resources. The plan describes the existing hydrogeological environment of the area, the hydrogeological model and monitoring program.

2. Environment

2.1 Climate

2.1.1 Rainfall

Mandalong Mine has three site-based rainfall and weather stations, located at CES, MMAS and MSSS. Site-specific rainfall data at CES have been collected on a daily basis since 2010, rainfall data at MMAS have been collected since 1998, and rainfall data at MSSS have been collected since 2022. For assessments requiring a large historical set of rainfall data (i.e. greater than 50 years), patched point data are obtained from the Scientific Information for Land Owners (SILO) database operated by the Queensland Department of Environment and Science. SILO patched point data are based on historical data from a particular Bureau of Meteorology (BOM) station with missing data 'patched in' by interpolation with nearby stations.

For this WMP, SILO data were obtained for the Cooranbong (Avondale) Station (BOM station number 61012), which is located approximately 2.4 km north of the site-specific weather station at CES. Figure 2.1 presents the historical SILO patched point daily rainfall data from the Cooranbong (Avondale) Station between 1889 and 2023.

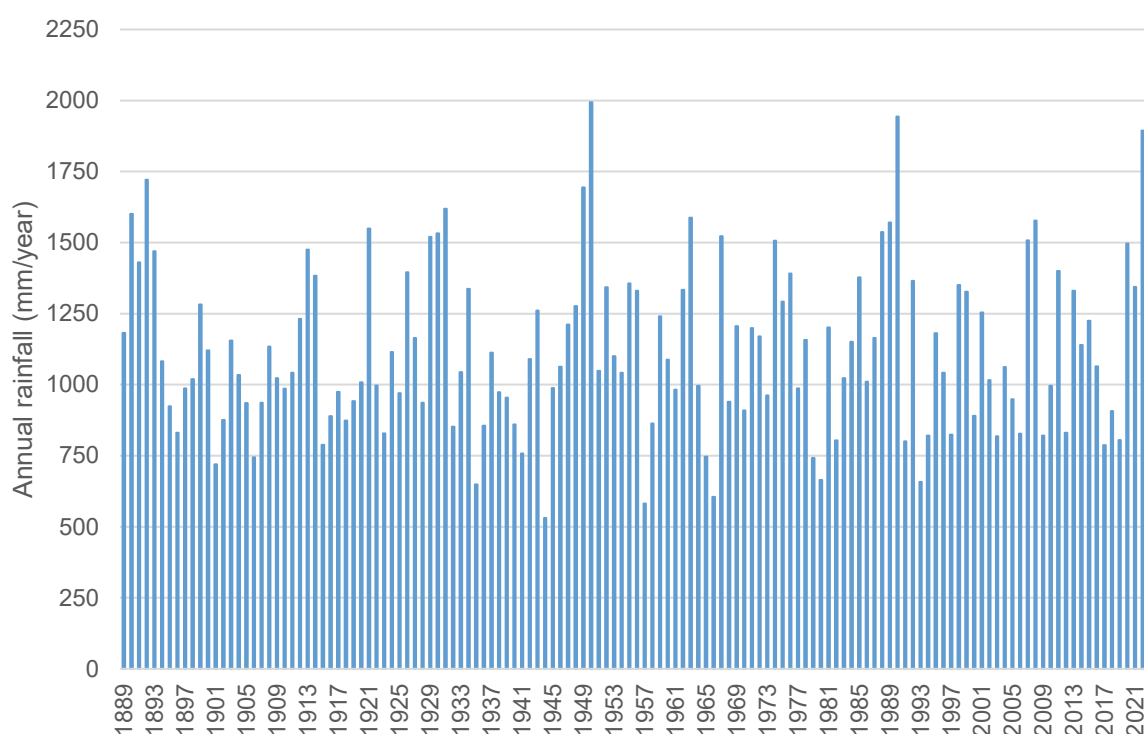


Figure 2.1 Historical daily rainfall at Cooranbong (Avondale) Station

The annual statistics associated with the SILO patched point daily rainfall data from the Cooranbong (Avondale) Station presented in Figure 2.1 are:

- Minimum rainfall total – 531 mm in 1944.
- Average rainfall total – 1116 mm.
- Median rainfall total – 1061 mm.
- Maximum rainfall total – 1994 mm in 1950.

2.1.2 Evaporation

Evaporation estimates are not collected by Mandalong Mine. Information provided at the closest BOM station which records evaporation, Peats Ridge (Waratah Road) Station (station number 61351), was reviewed and average monthly evaporation rates were determined. The average daily evaporation rates are presented in Figure 2.2, based on 31 years of data from 1981 to 2012.

Total average annual evaporation is approximately 1172 mm, compared to the annual average rainfall total of approximately 1116 mm. This gives an annual deficit (difference between annual rainfall and annual evaporation) of approximately 56 mm.

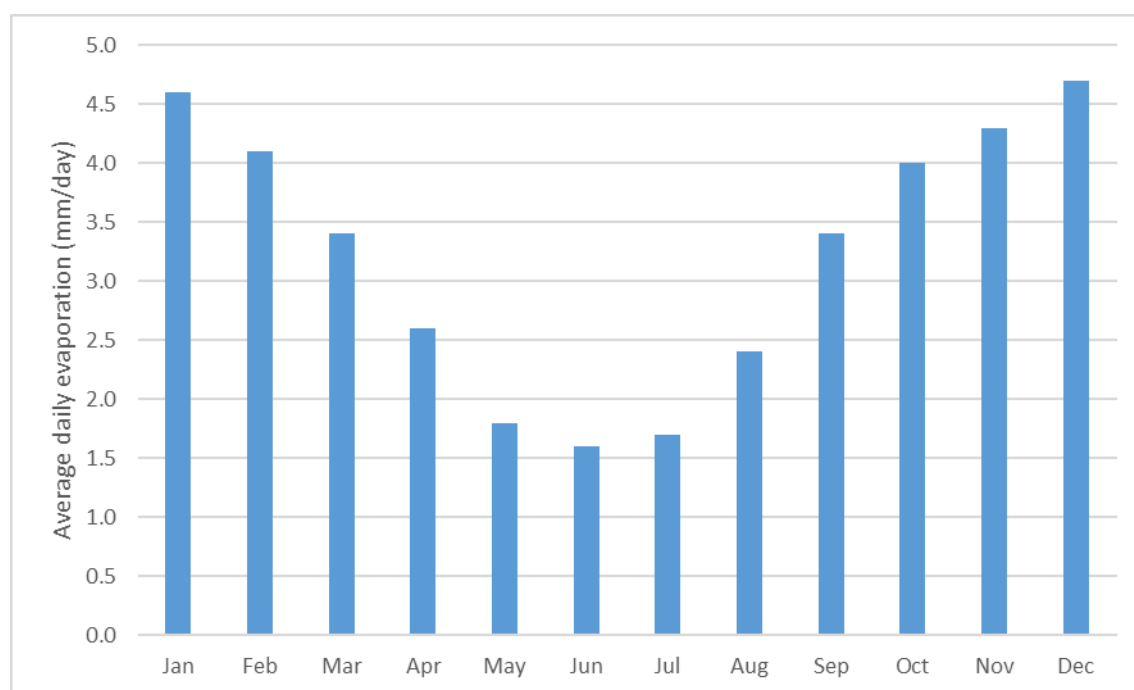


Figure 2.2 Average daily evaporation each month from Peats Ridge (Waratah Road) Station

2.2 Topography and hydrology

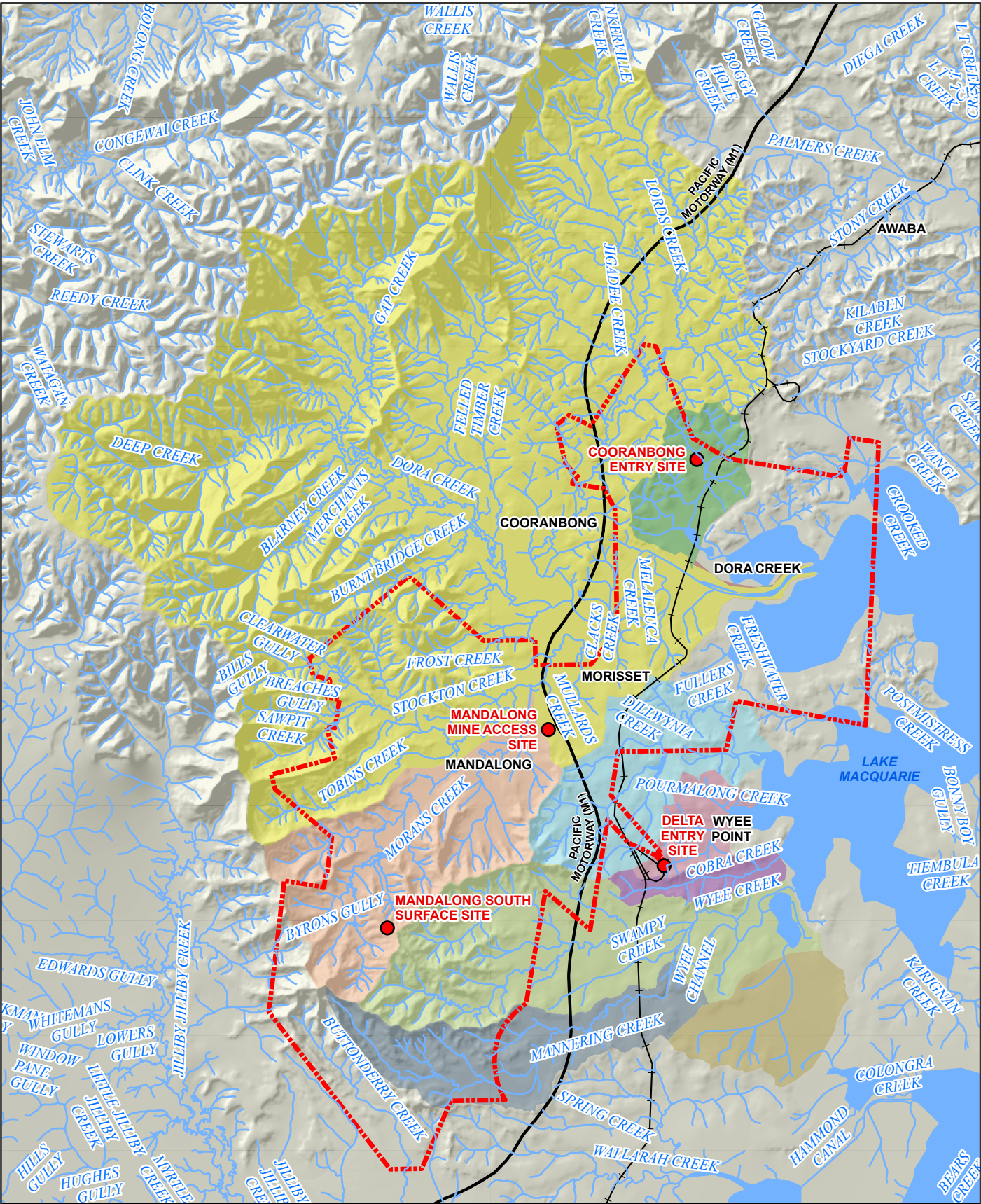
The topography of Mandalong Mine site includes ridgelines and valleys, with elevations from 0 m Australian Height Datum (AHD) at Lake Macquarie to over 200 m AHD at the peak of hills to the south-west.

Each of the surface facilities sites associated with Mandalong Mine are located in catchments that contribute to Lake Macquarie. Figure 2.3 indicates the watercourses and catchments that each of the sites interact with.

The MMAS and MSSS are located within the Morans Creek catchment. Morans Creek generally flows in a north-easterly direction, with its upper reaches receiving runoff from the MSSS. In the lower reaches, approximately 600 m from the confluence with Stockton Creek, Morans Creek receives runoff from the MMAS. Stockton Creek flows in a north-easterly direction to join Dora Creek, which is a major tributary of Lake Macquarie and flows easterly into the lake at the village of Dora Creek.

The DES is located to the south of the Dora Creek catchment and drains to an unnamed tributary that flows into Lake Macquarie to the west of the village of Wyee Point.

CES is located on an unnamed creek which contributes to Muddy Lake, flowing into Lake Eraring, which is part of Lake Macquarie. This site is located adjacent to the Dora Creek catchment and completely within the unnamed creek catchment.



1:130,000 for A4

0 500 1000 2000 3000 4000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

- Site Locations
- Mandalong Mine Holding Boundary
- Existing Rail
- Freeway
- Watercourse area
- Creek catchment
- Cobra Creek
- Dora Creek
- Manning Creek
- Manning Lake
- Morans Creek
- Muddy Lake
- Overall to Dora Creek
- Pourmalong Creek
- Stockton Creek
- Unnamed Creek
- Wyee Creek

LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine

Water Management Plan

Watercourses and catchments

CENTENNIAL

DATE 20/05/2025

Figure 2.3

\\ghdnet\ghd\AU\Newcastle\Projects\22\10105001\GIS\Maps\Deliverables\Hunter\Mandalong\12649045\Mandalong_WMP_A\Mandalong_WMP_0.aprx

© Centennial: Boundary; GHD: Site locations, Creek catchments; Spatial Services NSW: NSW Foundational Spatial Data Framework datasets

2.3 Wetlands

A number of wetlands are identified within or downstream of MMAS and CES (as per NSW Wetland Mapping by DCCEEW (DCCEEW 2024) and Estuarine Macrophyte Mapping by Fisheries NSW (Fisheries NSW 2025). The wetland areas identified include:

- Estuarine Wetlands on Dora Creek and Stockton Creek.
- Coastal Bays associated with Lake Macquarie (e.g. Bonnell's Bay).
- Muddy Lake, which is a part fresh, part salt lake connected to Lake Eraring.

The NCLP EIS (SLR 2014) indicated that increased discharges were unlikely to impact wetlands based on predicted changes to water quality and bank stability. There are mangroves mapped in Muddy Lake east (on NSW Fisheries estuarine macrophyte mapping), downstream of LDP001 and LDP002, and mangroves, saltmarsh and *Zostera* (i.e. seagrass) mapped downstream in Lake Eraring.

2.4 Soils

A number of soil landscapes exist throughout the Mandalong Mine facilities, as identified by Soil Landscapes of the Gosford-Lake Macquarie 1:100 000 Sheet (Murphy 1993) and summarised in Table 2.1.

The upper slopes surrounding Mandalong Mine are predominantly Mandalong and Woodbury Bridge soil landscapes, with the foot slopes predominantly Gorokan Soil landscapes. The floodplain areas are typically Yarramalong, Wyon and Doyalson soil landscapes. These soil types typically exhibit between moderate and very high erodibility, with a corresponding erosion hazard between slight to moderate and extreme. Erodibility describes the susceptibility of soil to mobilise as a result of rainfall and runoff; erosion hazard describes the likelihood for erosion to occur within a given area.

Sediment and erosion risks and management measures are outlined in Section 3.8. Where specific management measures are required to be implemented these are addressed in Section 4.1.

Table 2.1 Soil landscapes

Soil Landscape	Landscape	Soils	Limitations
Watagan	Rolling to very steep hills Local relief 50-220 m Slopes >25%	Deep (>150 cm) yellow and red Podzolic soils, yellow Earths, Siliceous sands, and Alluvial soils	Mass movement hazard, steep slopes
Mandalong	Rolling to steep low hills Local relief to 120 m Slope gradients 20-60%	Deep (100->150 cm) red, brown and yellow Podzolic soils	Mass movement hazard, steep slopes, erosion hazard, foundation hazard, low weight bearing strength, acid, sodic, low fertility
Woodburys Bridge	Gently undulating rises to rolling low hills Local relief 40–80 m Slope gradients up to 20%	Deep (>150 cm) red Podzolic soils with some Soloths;	Erosion hazard, foundation hazard, acid soils, and low wet bearing strengths
Gorokan	Undulating low hills Local relief to 30 m Slope gradients up to 15%	Moderately deep (50–150cm) Soloths, yellow Podzolic soils	High erosion hazard, foundation hazard, strongly acid, low fertility, plastic, impermeable soils.
Yarramalong	Local relief to 10 m Slope gradients up to 5%	Deep (>150 cm) Alluvial soils and Siliceous Sands, red and yellow Earths, yellow and brown Podzolic soils	Flooding, foundation hazard, seasonal waterlogging, stream bank erosion, low fertility.
Wyong	Local relief to 10 m Slope gradients up to 3%	Deep (>200 cm) yellow and brown Podzolic soils, Soloths, and humus Podzols	Flooding, permanent waterlogging, foundation hazard, stream bank erosion, acid sulphate, and low fertility.
Doyalson	Local relief to 30 m Slope gradients up to 10%	Moderately deep (50–>150 cm) yellow and grey Earths, yellow and red Podzolic soils, and Soloths	Erosion hazard, foundation hazard, mine subsidence district, seasonal waterlogging, and low fertility.

2.5 Geology

Mandalong Mine is located in the Newcastle Coalfield, which occupies the north-eastern portion of the Sydney Basin. The Mandalong Mine site is underlain by Triassic claystone, sandstone and conglomerate, as well as Quaternary alluvial sediments along watercourses. The Triassic rocks are underlain by the Permian Newcastle Coal Measures, which regionally dip to the south at approximately 1 to 2 degrees.

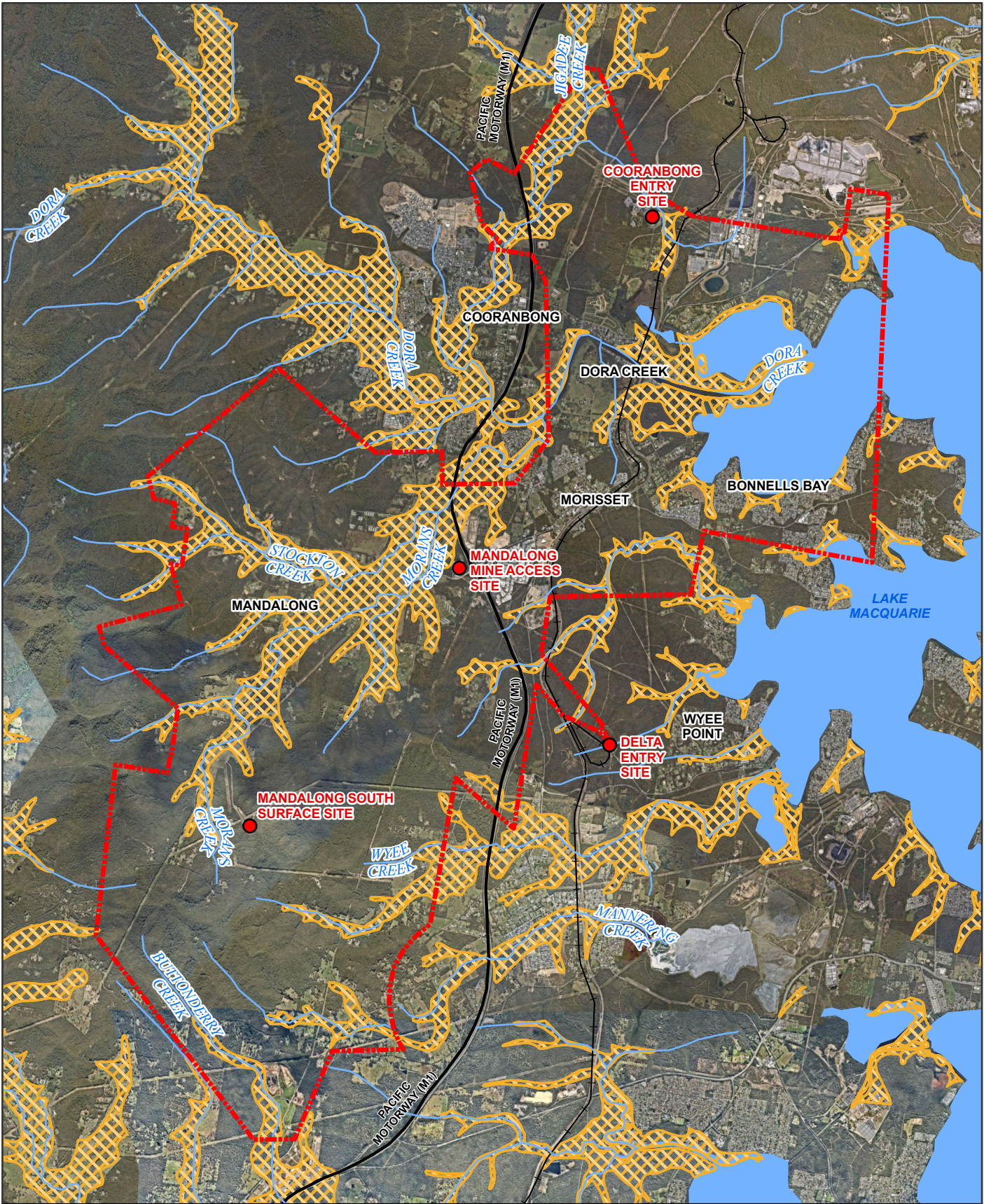
The stratigraphy at Mandalong Mine is summarised in Table 2.2. This information has been sourced from the *Newcastle Coalfield Regional Geology 1:100,000* map (Hawley et al. 1995) and exploration logs for Mandalong Mine.

Table 2.2 Stratigraphic sequence

Period	Stratigraphy		Formation	Lithology
	Group	Subgroup		
Quaternary				Alluvium
Triassic	Narrabeen	Clifton	Patonga Claystone Tuggerah Formation Munmorah Conglomerate Dooralong Shale	Conglomerate, sandstone, siltstone, claystone
Permian	Newcastle Coal Measures	Moon Island Beach	West Wallarah Seam	Conglomerate, sandstone, siltstone, tuff, coal

The approximate boundaries of the Quaternary alluvial sediments in the vicinity of the Mandalong Mine site are shown in Figure 2.4 and have been derived from the *Soil landscapes of the Newcastle 1:100,000 Sheet* (Matthei 1995) and the *Soil Landscapes of the Gosford-Lake Macquarie 1:100,000 Sheet* (Murphy 1993).

The Newcastle Coal Measures are overlain by the Triassic Narrabeen Group. The Narrabeen Group comprises variable sequences of interbedded claystones, siltstones and fine to coarse grained sandstones. The Munmorah Conglomerate is a sandstone-dominated formation within the Narrabeen Group which typically occurs between 60 m and 140 m above the Newcastle Coal Measures (or a depth of approximately 40 m to 340 m below ground level). The Munmorah Conglomerate at Mandalong Mine has been found to contain a thick pebbly sandstone/conglomerate layer which is geotechnically important in reducing surface subsidence impacts over longwall panels.



1:100,000 for A4

0 375 750 1500 2250 3000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

- Site Locations
- Mandalong Mine Holding Boundary
- Alluvial Soils (Lake Macquarie)
- Existing Rail
- Freeway
- Watercourse
- Watercourse area

LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine
Water Management Plan

Location of alluvium

DATE	20/05/2025	Figure 2.4
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2.6 Hydrogeology

2.6.1 Groundwater sources

The groundwater sources in the vicinity of the Mandalong Mine site are generally low yielding and predominantly within the Quaternary alluvium, weathered and/or fractured sandstone and coal seams. They would be classified as 'less productive', in accordance with the NSW Aquifer Interference Policy as yields are generally less than 5 L/s and/or the total dissolved solids (TDS) concentration is typically greater than 1500 mg/L.

Within the alluvial water sources:

- Water table depths range from less than 1 m and up to 3 m below ground level with an aquifer thickness less than 20 m.
- Water quality is moderately acidic to slightly alkaline, brackish to saline, extremely hard and of sodium chloride type.
- The environmental value of the alluvial groundwater is considered to be 'primary industry', with the saline groundwater generally suitable for stock watering.

Within the porous and fractured rock water sources:

- Groundwater levels within the coal seams generally reflect natural topography and the orientation of the seams.
- In areas of no depressurisation, the groundwater head of the seam is typically 0 m AHD due to the coastal environment.
- Great Northern Seam is hydraulically connected to the West Wallarah Seam and subcrops to the north of Mandalong Mine.
- A variable hydraulic conductivity exists for the seam, ranging from 10^{-9} m/s to 10^{-5} m/s (0.03 m/year to 300 m/year). Areas of higher hydraulic conductivity coincide with areas where the coal is more intensively jointed or fractured (Pacific Power International 1997).
- Groundwater inflows into the existing Mandalong Mine workings are slightly alkaline and brackish to saline.
- The overburden and inter-seam strata within the Newcastle Coalfield tend to have very low hydraulic conductivities (in the order of 0.0003 m/year to 0.03 m/year), unless joints or fracturing creates a secondary permeability (Pacific Power International 1997).
- Groundwater within the sandstone/siltstone of the Tuggerah Formation and Munmorah Conglomerate has been found to be saline and slightly acidic to strongly alkaline.

2.6.2 Groundwater users

From previous searches of the NSW groundwater bore database operated by the NSW Department of Planning, Industry and Environment – Water, the characteristics of groundwater users within the influenced groundwater sources have been determined, as shown in Table 2.3.

Approximate groundwater bore locations identified from searches of the NSW groundwater bore database are shown in Figure 2.5. Bore details are provided in Appendix C.

Table 2.3 Registered groundwater bores

Mine Workings	Number of bores	Uses	Location
Mandalong Mine	101 bores within 5 km radius of the existing and approved Mandalong Mine workings	The majority of bores (53) are registered as monitoring bores The remaining (48) bores registered for domestic, irrigation and/or stock use, farming, irrigation, test, and poultry purposes.	The registered domestic and stock bores that were identified primarily extract groundwater from the Triassic sandstone and conglomerate formations with yields generally less than 1 L/s. The search identified 6 registered bores within 1 km of the Mandalong Mine workings for the purpose of water supply, including GW034950, GW061226, GW200915, GW078601, GW078084 and GW021578. Stock and domestic bore GW052255 was also identified within 1 km of mine workings. The search identified six registered bores within 2 km proximity of the Longwall 39-43 Extraction Plan Area. GW053092 (irrigation) was identified approximately 1.2 km east of the Longwall 39 – 43 Extraction Plan Area. GW201704 (monitoring) was identified approximately 1.2 km south of the Longwall 39 – 43 Extraction Plan Area. GW015275 (water supply) was identified approximately 1.3 km east of the Longwall 39 – 43 Extraction Plan Area. Monitoring bores GW201651, GW201652 and GW201653 were identified approximately 1.8 km northwest of the Longwall 39 – 43 Extraction Plan area.
Cooranbong Entry Site	129 bores within 5 km radius of the existing Cooranbong Mine workings	The majority of bores (91) registered as monitoring bores The remaining (38) bores are registered for domestic, domestic and stock, irrigation and/or stock use, farming, irrigation, test, dewatering, water supply, poultry, and unknown purposes.	The majority of the water supply bores extract groundwater from sand, sandstone, conglomerate, and shale formations, with yields generally less than 3 L/s. The search identified 18 registered bores within 500 meters of proximity and five registered bores located across the Cooranbong Mine workings. Bores GW053438 and GW059558 (irrigation), GW078608, GW064143 and GW062618 (water supply), intersect the Cooranbong Mine workings.

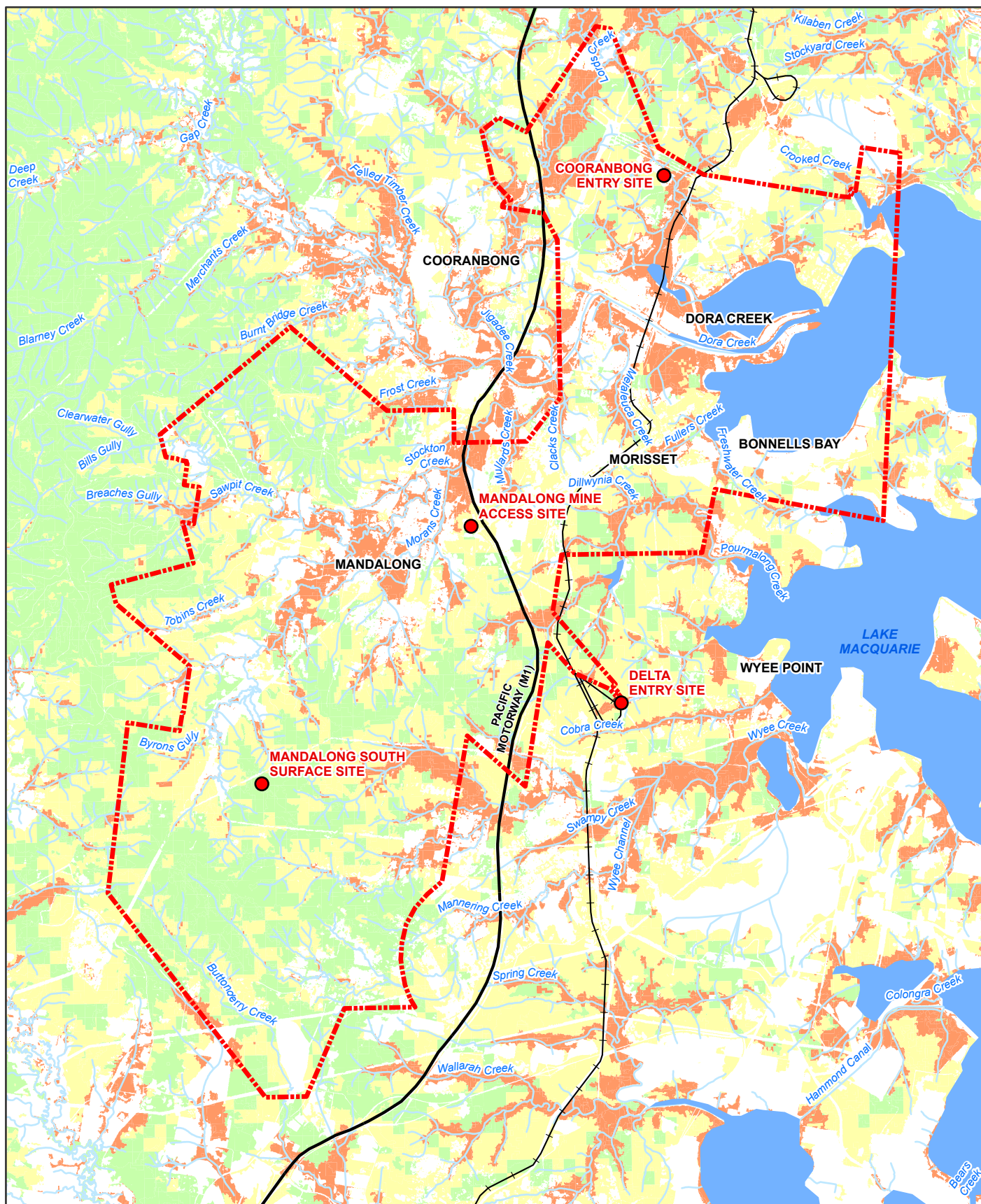
2.6.3 Groundwater dependent ecosystems

A review of the Hunter Unregulated and Alluvial Water Sources 2022 Groundwater Dependent Ecosystems Map (DPE 2022) indicates there are high priority GDEs overlying the Mandalong Mine holding boundary.

The high and medium potential vegetation groundwater dependent ecosystems (GDEs) within the Mandalong Mine site are listed in Table 2.4. These potential GDEs generally coincide with the creeks and drainage lines within the Mandalong Mine site. The potential GDEs are mapped on Figure 2.6.

Table 2.4 Groundwater dependent ecosystem summary

Plant community type	Vegetation	Probability
Coastal Creekline Dry Shrubby Swamp Forest	Forested wetlands	High
Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest	Woodland forest	High/medium
Hunter Coast Ranges Turpentine Wet Forest	Woodland forest	High/medium
Lower North Riverflat Eucalypt-Paperbark Forest	Forested wetlands	High
Lower North Spotted Gum-Mahogany-Ironbark Sheltered Forest	Woodland forest	High/medium
Lower North Wet Gully Palm Rainforest	Rainforest	High/medium
Sydney Coastal Sandstone Riparian Forest	Woodland forest	High/medium
Coastal Sands Littoral Scrub-Forest	Woodland forest	Medium
Hunter Coast Lowland Apple-Bloodwood Forest	Woodland forest	Medium
Hunter Coast Lowland Flats Damp Forest	Woodland forest	Medium
Hunter Coast Lowland Spotted Gum Moist Forest	Woodland forest	Medium
Lower North Ranges Turpentine Moist Forest	Woodland forest	Medium
Lower North White Mahogany-Spotted Gum Moist Forest	Woodland forest	Medium
Northern Foothills Blackbutt Grassy Forest	Woodland forest	Medium
Northern Hinterland Blackbutt-Forest Oak Wet Forest	Woodland forest	Medium
Northern Lowland Viney Wet Forest	Woodland forest	Medium



1:100,000 for A4 0 375 750 1500 2250 3000 Metres Map Projection: Transverse Mercator Horizontal Datum: GDA2020 Grid: GDA2020 MGA Zone 56		LEGEND ● Site Locations ▭ Mandalong Mine Holding Boundary — Existing Rail — Freeway — Watercourse Watercourse area GDE Probability (Hunter & Central Rivers) High Medium Low	
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Mandalong Mine Water Management Plan Groundwater dependent ecosystems		CENTENNIAL DATE 20/05/2025 Figure 2.6	

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3. Water management

3.1 Water management overview

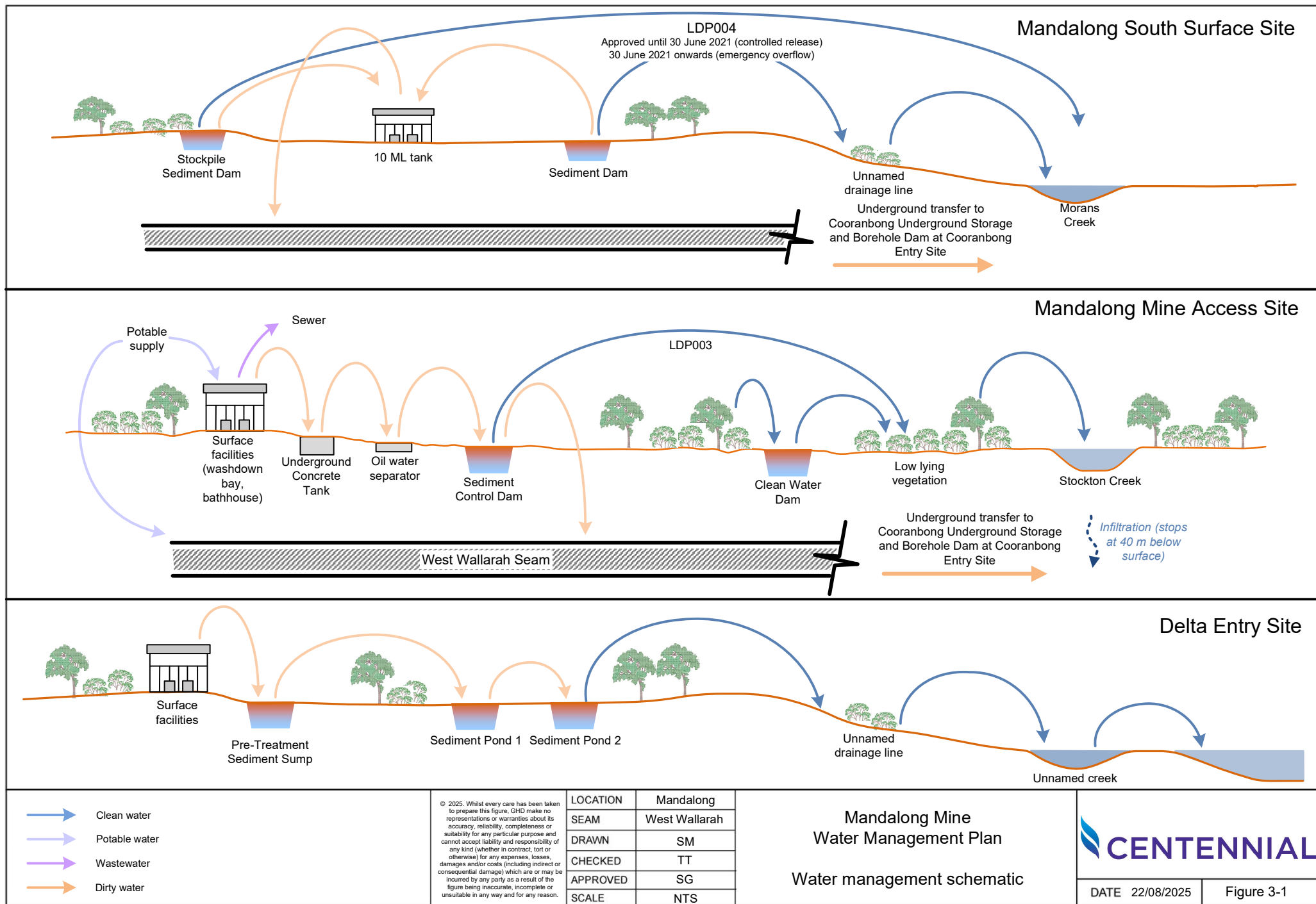
The water management system at Mandalong Mine is comprised of clean and dirty surface, potable, waste and underground elements. Sources of water include potable water supply, rainfall, runoff and groundwater inflow to the underground mine workings. The primary water demands are for underground operations, surface dust suppression, machinery washdown, fire-fighting storage and staff amenities.

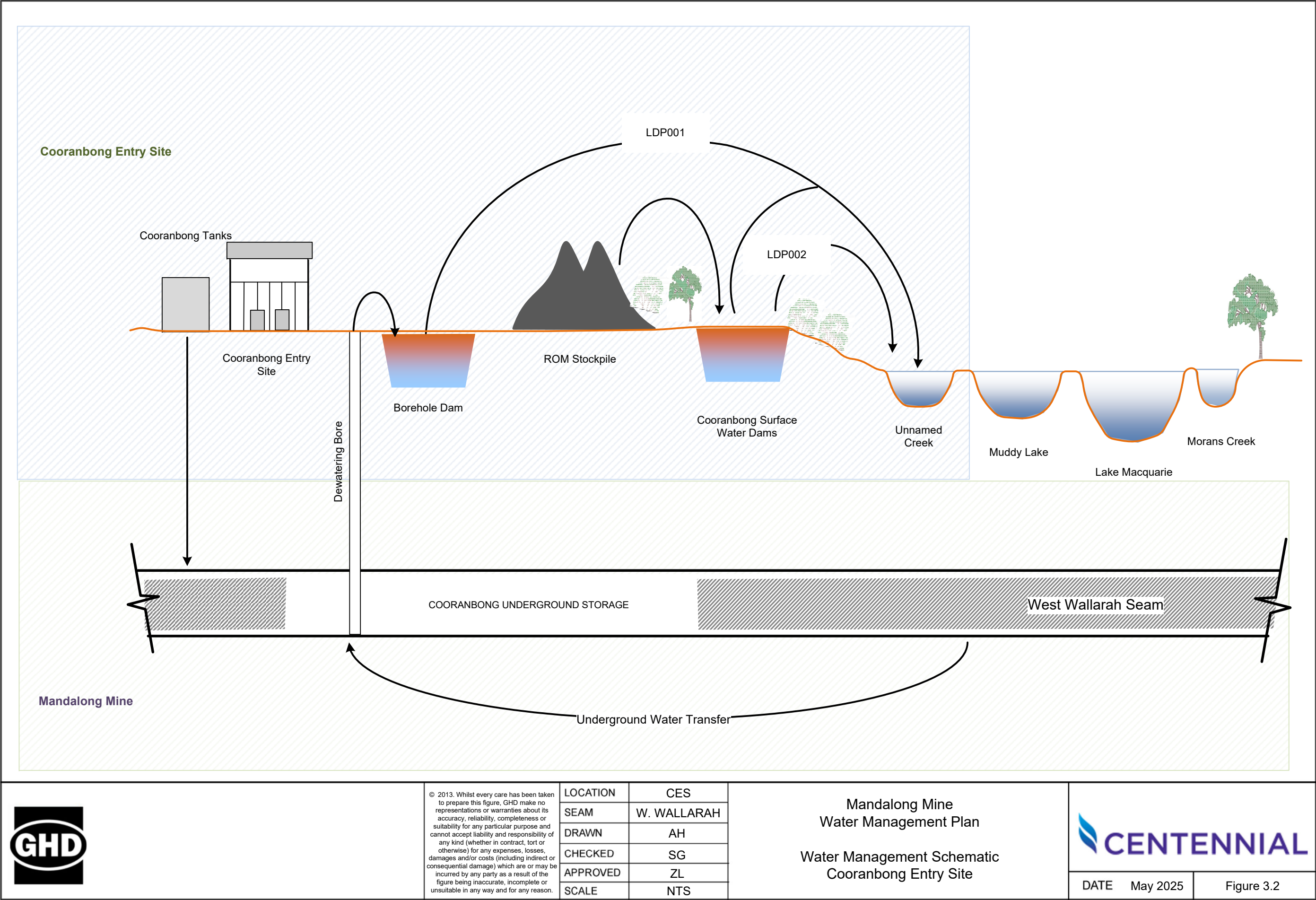
Surface water runoff from areas where there is no coal storage, transportation, handling or processing or any disturbance is considered to be clean water, as it is unlikely to be contaminated with coal fines or sediment. Runoff is diverted around dirty water and coal-contact catchments to avoid mixing with clean water runoff. Clean water runoff is typically from natural and impervious catchments such as areas of vegetation, sealed roads and sealed car parks.

Dirty water is runoff from disturbed areas and areas likely to contain suspended sediment, oils, grease and hydrocarbons. This typically includes workshop and fuel storage areas. Coal-contact water is runoff from catchments where coal storage, transportation, handling or processing occurs and is managed within the dirty water management systems.

The Borehole Dam, located upslope of the main CES, is considered to be part of the Mandalong Mine water management system. This dam receives mine water extracted from the Cooranbong underground storage via the dewatering bore. A pipeline operates to direct water from the Borehole Dam directly to LDP001 at CES. This transfer, from the Borehole Dam to LDP001 at CES forms the majority of daily discharges from LDP001.

Schematics of the overall water management systems at the MMAS, MSSS and DES are provided in Figure 3.1, while a schematic of the overall water management system at CES is shown on Figure 3.2.





3.2 Surface water management

3.2.1 Mandalong Mine Access Site

The surface water management features for the MMAS are presented on Figure 3.3. Both clean and dirty surface water runoff is managed at the MMAS. Due to all coal being processed and managed at CES, there is no coal-contact water managed at the MMAS. Also, there is no discharge of water from the underground workings to the surface of the MMAS.

3.2.1.1 Clean water management

Diversion drains to the east and west of the MMAS divert clean runoff from external catchments around the site. This includes runoff from vegetated areas to the south and west, which is diverted around the western perimeter of the site and runoff from Mandalong Road and the M1 Motorway on-ramps, which is diverted around the eastern perimeter of the site. Rain falling on vegetated and sealed surfaces in the western part of the site generates clean water runoff that is directed to the Clean Water Dam on the western side of the site. Runoff from the south-eastern portion of the site including vegetated areas and the contractors' carpark and runoff from the main carpark is diverted via a pit and pipe around dirty water catchments and discharged downstream of the Sediment Control Dam.

Table 3.1 summarises the features of the clean water diversions in place at the MMAS.

Table 3.1 Clean water diversions – Mandalong Mine Access Site

Location	Type	Catchment area diverted	Channel top width	Depth	Required capacity	Design compliance
East and west diversion	Open channel	4.09 ha	4.0 m	0.5 m	1.4 m ³ /s	5% annual exceedance probability (AEP)
Carpark and roof network	Pipe network	3.27 ha	N/A	N/A	1.2 m ³ /s	5% AEP

Table 3.2 summarises the features of the clean water storages in place at the MMAS.

Table 3.2 Clean water storages – Mandalong Mine Access Site

Dam	Maximum capacity at outlet level	Re-use function	Overflow type	Discharge to
Clean Water Dam	0.9 ML	Fire-fighting	Weir	Stockton Creek catchment

3.2.1.2 Dirty water management

Runoff from disturbed and/or workshop areas is categorised as dirty water. This runoff is directed to a number of dirty water management structures, including a gross pollutant trap (GPT) and oil-water separator, with runoff then directed to the Sediment Control Dam.

The oil-water separator on the GPT removes hydrocarbons from runoff that originates at the fuel/oil storage, workshop, washdown buildings and equipment yard.

The Sediment Control Dam receives treated water from the GPT and oil-water separator and remaining surface catchment of the pit top. The Sediment Control Dam treats dirty water through settling prior to the discharge via a low-flow pipe outlet through LDP003 to low-lying vegetation.

A reconfiguration of the Sediment Control Dam and Macrophyte Pond was completed in 2018. The reconfiguration has combined the two parallel storages, increasing the volume from 0.6 ML to 2.0 ML, with an extended storage volume of 2.3 ML.

Table 3.3 summarises the features of the dirty water storages in place at the MMAS.

Table 3.3 Dirty water storages – Mandalong Mine Access Site

Storage	Maximum capacity at outlet level	Function	Treatment	Required capacity	Overflow type	Discharge to
Sediment Control Dam	2.0 ML	Sediment control	Settlement through gravity and chemical dosing	95th percentile, five day rainfall depth	Pipe and spillway	Morans Creek catchment via LDP003
GPT and Oil-water separator	0.18 ML	Oil-water separation and capture coarse material	Coalescing plate	95th percentile, five day rainfall depth	Pipe	Sediment Control Dam



LEGEND	
	Licensed discharge point
	Clean water surface channel
	Clean water pipe network
	Dirty water surface channel
	Dirty water pipe network
	Surface water storage
	Clean Water Dam Catchment
	Divert to creek Catchment
	GPT Catchment
	2m contour

LOCATION		Mandalong
SEAM	N/A	
DRAWN	BK	
CHECKED	ZL	
APPROVED	SG	
SCALE	Refer to scalebar	

Mandalong Mine	
Water Management Plan	
Surface Water Management System -	
Mandalong Mine Access Site	

DATE 20/05/2025	Figure 3.3

3.2.2 Mandalong South Surface Site

The conceptual surface water management features for MSSS are presented in Figure 3.4. Both clean and dirty water is managed at the MSSS. There is no discharge of water from the underground workings to the surface at the MSSS. A surface to seam borehole transfers water from the 10 ML tank to the underground workings. The MSSS does not contain any coal handling or processing facilities. It is noted that once construction is complete at MSSS, the site will be sealed resulting in a reduction in the overall dirty water catchment.

3.2.2.1 Clean water management

Clean water diversion drains are located along the eastern perimeter of the site, to divert clean water runoff from upstream vegetated areas around the site and contribute to the Morans Creek catchment. The diversion drain has been designed with the capacity to cater for the peak 100 year ARI rainfall event (equivalent to the 1% AEP event). The drain has also been constructed and lined such that it is stable under these conditions. Table 3.4 summarises the features of the clean water diversions constructed at MSSS.

Table 3.4 Clean water diversions – Mandalong South Surface Site

Diversion	Type	Catchment area diverted	Channel top width	Depth	Required capacity	Design compliance
North-east diversion	Open channel	0.3 ha	2.5 m	0.5 m	0.2 m ³ /s	1% AEP
South-east diversion	Open channel	0.1 ha	2.5 m	0.5 m	0.1 m ³ /s	1% AEP

3.2.2.2 Dirty water management

Runoff from disturbed and/or workshop areas is categorised as dirty water. Dirty water is captured by diversion drains that direct runoff from the operational areas (upper and lower pads) to be contained within the Sediment Dam and Stockpile Sediment Dam.

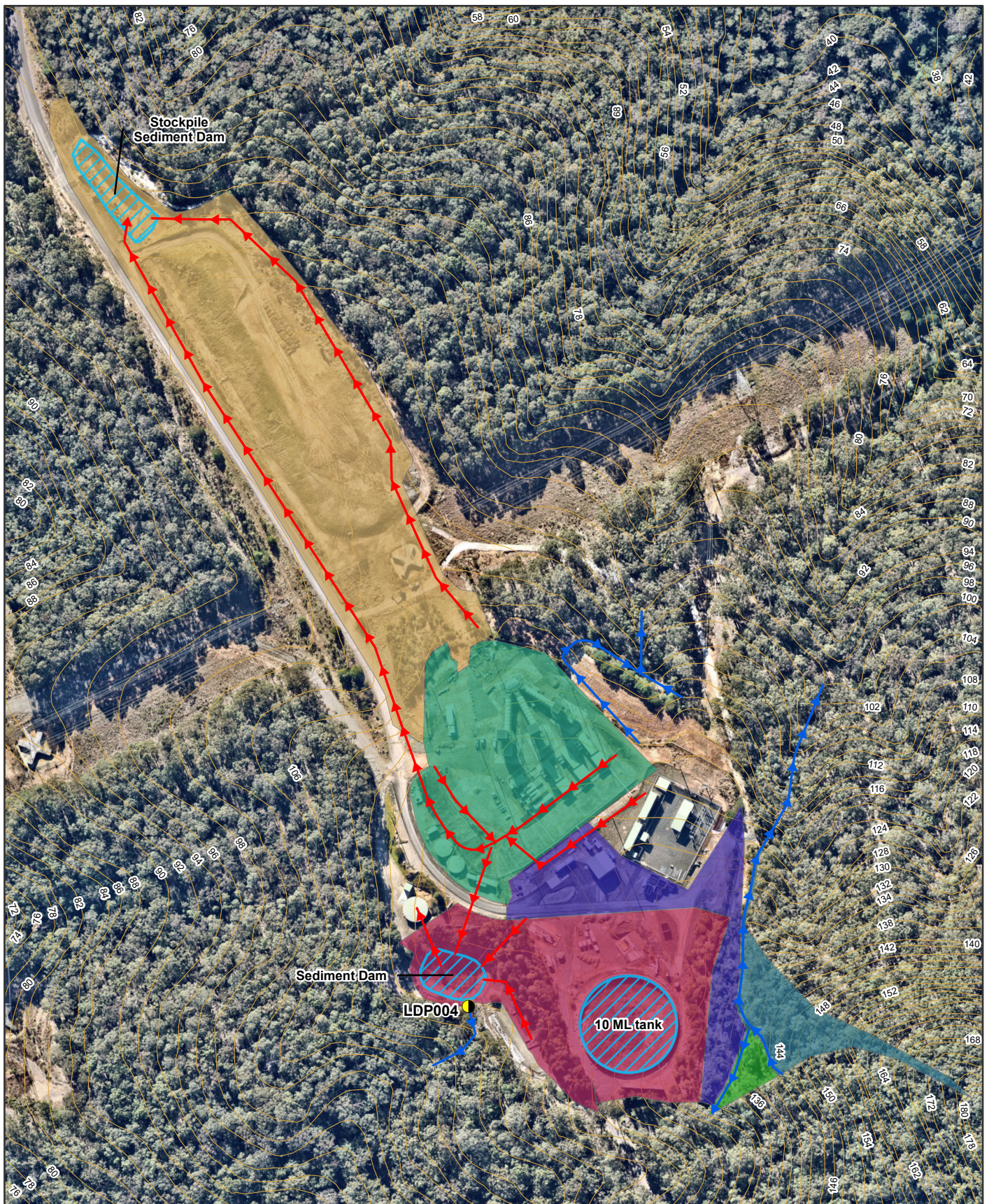
The Stockpile Sediment Dam was constructed in 2019 to collect catchment runoff from the stockpile catchment. The collected runoff water is then pumped directly to the 10 ML tank.

In 2020, the existing 10 ML tank that was used during shaft construction was integrated into the operational water management system at MSSS. Water from the Sediment Dam and Stockpile Sediment Dam may be pumped to the 10 ML tank, and from there transferred to the underground workings under gravity by the surface to seam borehole.

The MSSS Stockpile Dam is proposed to be filled and rehabilitated in 2026 / 2027, pending water quality and successful rehabilitation of the MSSS stockpile, with the bottom pad and stockpile flows diverted to clean water. Once the Stockpile Dam is removed, the 10ML tank would also be decommissioned.

Controlled discharges via LDP004 were licensed by EPL 365 and approved until 30 June 2021. Following commissioning of the surface to seam borehole, LDP004 remains as an emergency LDP that may discharge in the unlikely event of rainfall event that exceeds the design criteria of the water management system.

Table 3.5 summarises the features of the dirty water storages at the MSSS.



1:3,000 for A4 0 12.5 25 50 75 100 Metres Map Projection: Transverse Mercator Horizontal Datum: GDA2020 Grid: GDA2020 MGA Zone 56		LEGEND Licensed discharge point Clean water surface channel Dirty water surface channel Surface water storage Lower pad catchment NE diversion catchment SE diversion catchment Sediment Dam catchment Stockpile Sediment Dam catchment 2m contour	
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Mandalong Mine Water Management Plan Surface Water Management System - Mandalong Mine Surface Site		CENTENNIAL	
DATE 25/08/2025		Figure 3.4	

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Table 3.5 Dirty water storages – Mandalong South Surface Site

Storage	Maximum capacity at outlet level	Re-use Function	Treatment	Required capacity	Overflow type	Discharge to
Sediment Dam	1.7 ML	Sediment control	Settlement through gravity	95th percentile, five-day rainfall depth	Stabilised spillway	Unnamed creek via LDP004
Stockpile Sediment Dam	1.3 ML	Sediment control	Settlement through gravity	95th percentile, five-day rainfall depth	Stabilised spillway	Morans Creek
10 ML tank	8.6 ML	Transfer to underground workings	N/A	N/A	Gravity overflow	Overflow to Sediment Dam

3.2.3 Delta Entry Site

The surface water management features for the DES are presented on Figure 3.5. Both clean, dirty and coal-contact water is managed at the DES. There is no discharge of water from the underground workings to the surface at the DES.

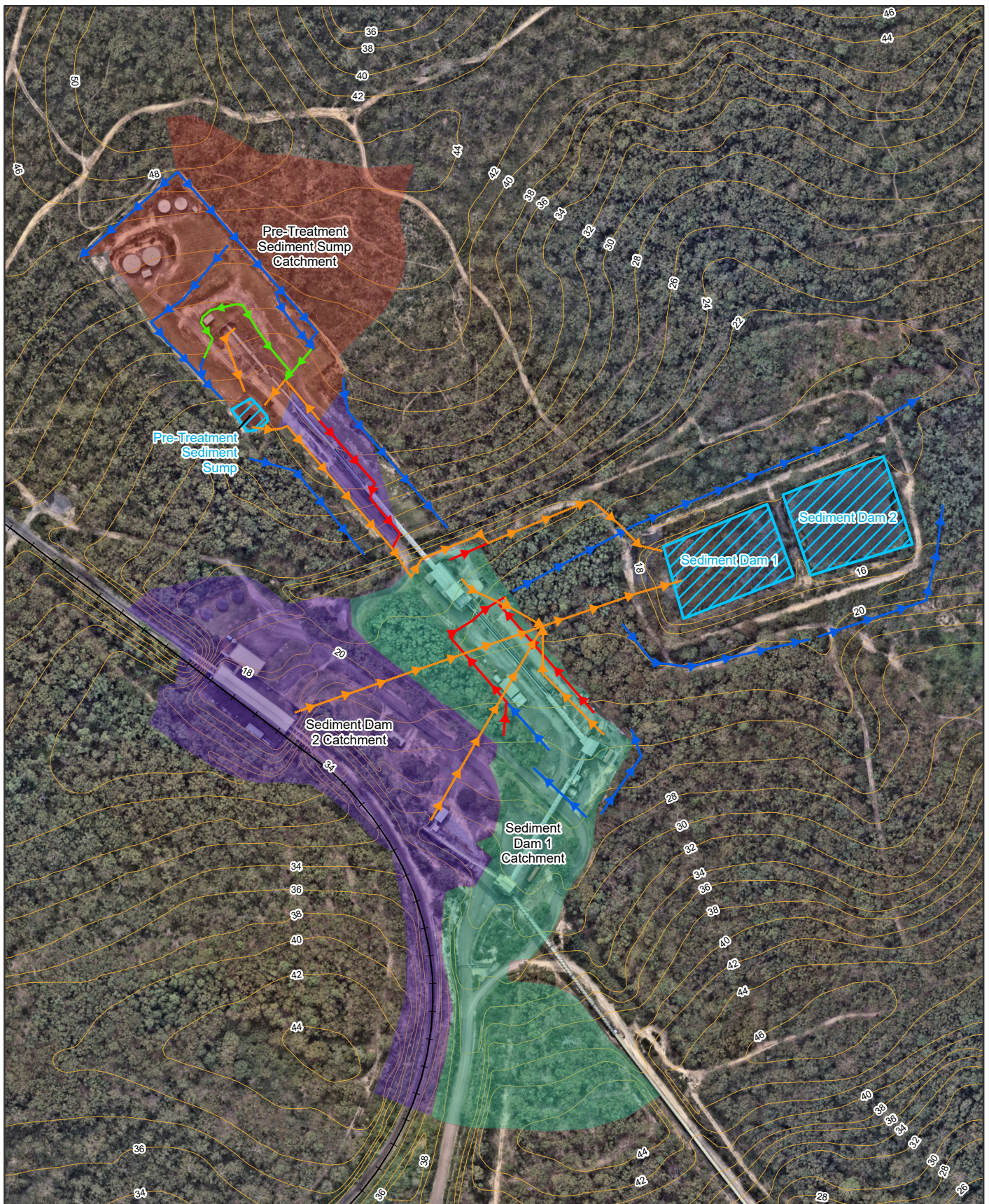
3.2.3.1 Clean water management

Diversion drains to the north and east of the DES divert clean runoff from external catchments around the site. Some small sections of a pit and pipe network exist through the site to convey runoff from clean catchments across dirty or coal-contact catchment areas.

Table 3.6 summarises the features of the clean water diversions in place at the DES.

Table 3.6 Clean water diversions – Delta Entry Site

Diversion	Type	Catchment area diverted	Channel top width	Depth	Required capacity	Design compliance
North and east	Open channel	22.34 ha	Varies (min 6.0 m)	Varies (min 0.9 m)	4.3 m ³ /s	5% AEP



1:3,500 for A4 015306090120 Metres Map Projection: Transverse Mercator Horizontal Datum: GDA2020 Grid: GDA2020 MGA Zone 56		N 	LEGEND  Clean Water Surface Channel  Clean Water Pipe Network  Dirty Water Surface Channel  Dirty Water Pipe Network  Surface Water Storages  Pre-Treatment Sediment Sump catchment  Sediment Dam 1 Catchment  Sediment Dam 2 Catchment  2m contour  Railway		
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	SEAM	N/A			
	DRAWN	BK			
	CHECKED	ZL			
	APPROVED	SG			
	SCALE	Refer to scalebar	DATE 20/05/2025	Figure 3.5	

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3.2.3.2 Dirty and coal-contact water management

Runoff from disturbed and coal-contact areas is directed to a number of dirty water management structures. Dirty water is collected by the Delta drift sediment control dam and final sediment sump before being directed offsite to the 9 ML Sediment Control Dam. The 9 ML Sediment Control Dam is the final storage volume at the end of the dirty water treatment system and treats dirty water through settling prior to discharge from the outlet.

The 9 ML Sediment Control Dam (also known as Settlement Ponds 1 and 2) is operated by Delta Electricity. Centennial Mandalong maintains this dam in accordance with a Variation Agreement dated 30 June 2004.

Coal-contact runoff is directed to treatment structures that promote the settling of coal fines. These structures are sediment control sumps at the transfer building and conveyor gantry.

Table 3.7 summarises the features of the dirty water storages in place at the DES.

Table 3.7 Dirty water storages – Delta Entry Site

Storage	Maximum capacity at outlet level	Re-use Function	Treatment	Required capacity	Overflow type	Discharge to
Pre-treatment Sump	0.3 ML	Sediment capture	Gravity separation	95th percentile, five day rainfall depth	Pipe	Settlement Ponds 1 and 2
9 ML Sediment Control Dam (Settlement Ponds 1 and 2)	9.0 ML	Sediment capture	Gravity separation	95th percentile, five day rainfall depth	Weir	Unnamed creek

3.2.4 Cooranbong Entry Site

3.2.4.1 Clean water management

Figure 3.6 presents the clean water management system at CES.

Clean water is diverted around CES with diversions in place around the ROM Coal Stockpile, through the western sector of the site and around the north-east boundary of the site. Within CES, the clean water runoff from the upslope catchment to the west of the site is directed to an unnamed watercourse on the northern side of the site and upslope of Cooranbong LDP001.

Table 3.8 outlines each of the clean water diversion structures at CES.

Table 3.8 Clean water diversions – Cooranbong Entry Site

Location	Type	Catchment diverted (ha)	Top Width (m)	Depth (m)	Required Capacity (m3/s)	Design compliance
Northern stockpile diversion	Open channel	3.0	3.4	0.5	1.1	20 year average recurrence interval (ARI)
Southern stockpile diversion	Open channel	28	7.0	1.0	7.2	20 year ARI

Location	Type	Catchment diverted (ha)	Top Width (m)	Depth (m)	Required Capacity (m3/s)	Design compliance
Southern pit top diversion (including Rehabilitation Dam catchment)	Open channel	5.0	4.0	0.6	1.7	20 year ARI

Clean water storages at CES are summarised in Table 3.9.

Table 3.9 Clean water storages – Cooranbong Entry Site

Storage	Maximum capacity at outlet level (ML)	Re-use function	Overflow type	Discharges to
Construction Dam	5.7	No function	Weir	Unnamed tributary of Muddy Lake
Rehabilitation Dam	0.2	No function	Weir	Unnamed tributary of Muddy Lake

The Construction Dam is largely grown over with reeds though still exists as a storage to be drawn upon. Runoff from the vegetated western region of the site as well as a proportion of the southern hardstand areas is directed to the Construction Dam. The capacity of the Construction Dam has been estimated as 5.7 ML and to date the dam has been operating with overflows occurring via a weir, contributing to the existing waterway flowing onto Muddy Lake located to the south.

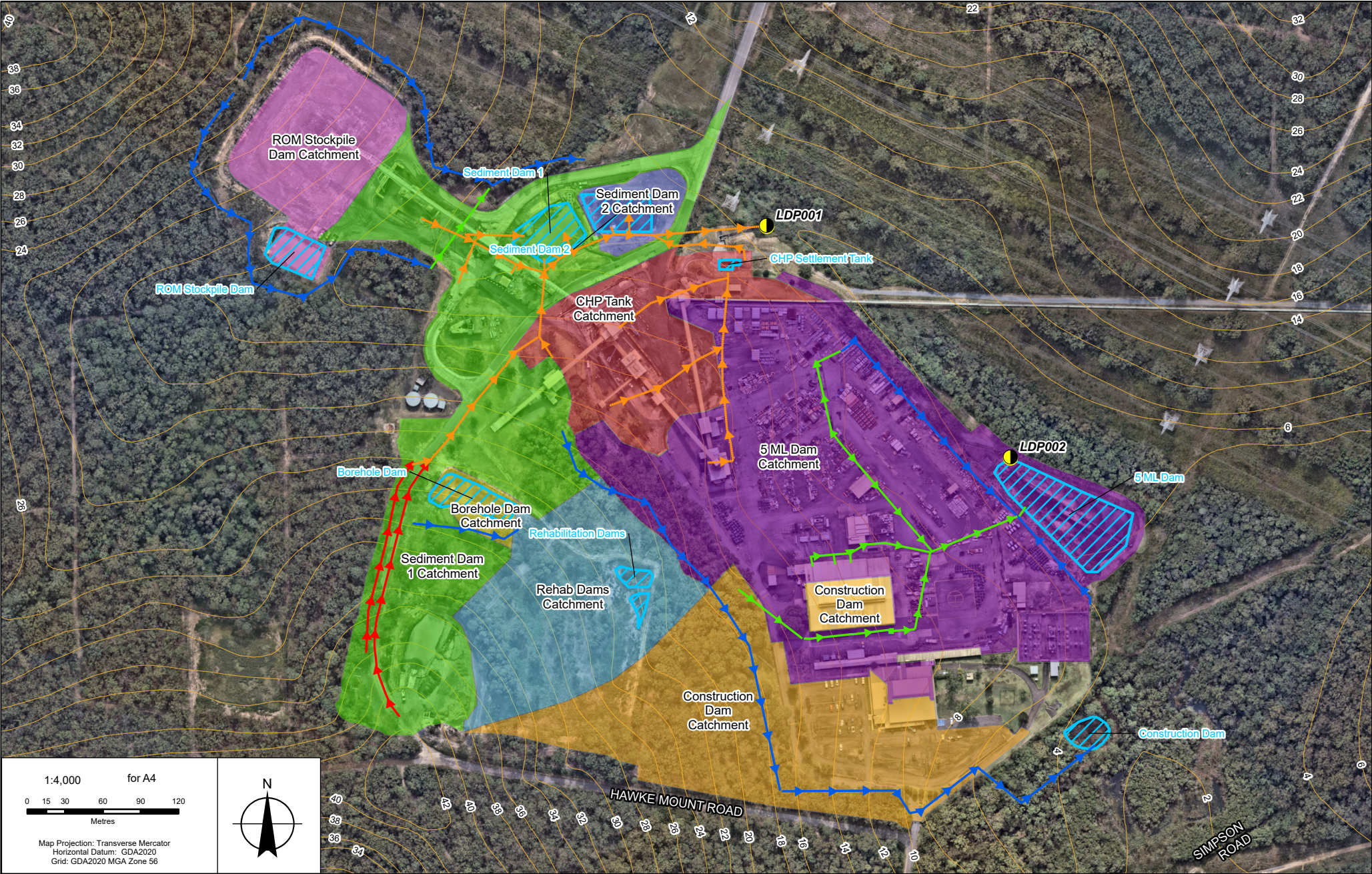
The Rehabilitation Dam is located to the south-west of the pit top area. The dam captures runoff from rehabilitation areas and provides attenuation of runoff.

3.2.4.2 Dirty water management

The dirty water management storages associated with CES are shown in Figure 3.6. Table 3.10 provides a summary of the existing dirty surface water storages present at CES.

CHP Settlement Tank

Runoff contaminated with coal fines from the CHP, conveyor gantries and the temporary coal stockpiles to the south of Sediment Dams 1 and 2 is directed to the CHP Settlement Tank (sump) to remove the coarser coal fraction. Water is dewatered from this tank back to the Sediment Dam 1 for further settlement of coal fines through increased retention times or directly to the Cooranbong Underground Storage. When the tank reaches capacity it then discharges to the 5 ML Dam where it is managed.



LEGEND

- Licensed discharge point
- Clean Water Surface Channel
- Clean Water Pipe Network
- Dirty Water Surface Channel
- Dirty Water Pipe Network
- Surface water storage
- ROM Stockpile Dam Catchment
- 5 ML Dam Catchment
- Borehole Dam Catchment
- CHP Tank Catchment
- Construction Dam Catchment
- Rehab Dams Catchment
- Sediment Dam 1 Catchment
- Sediment Dam 2 Catchment
- 2m contour

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LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine Water Management Plan

Surface Water Management System - Cooranbong Entry Site

DATE 20/05/2025	Figure 3.6
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Table 3.10 Dirty water storages – Cooranbong Entry Site

Storage	Maximum capacity at outlet level (ML)	Function	Treatment	Required capacity	Dewatering and Overflow type	Discharge to
CHP Settlement Tank	0.3	Capture coarse material from stockpile area	Settlement	5 day, 95th percentile rainfall depth	Pumped to Sediment Dam 1 and Cooranbong Underground Storage	Overflows to 5 ML Dam
5 ML Dam	6.1	Capture water from the laydown and hardstand area	Settlement aided by flocculant		Pumped to Cooranbong Underground Storage or Sediment Dam 1	Cooranbong LDP002 (via overflow culvert)
ROM Stockpile Dam	1.9	Capture dirty water and coarse material from stockpile	Settlement		Manually operated valve / Weir	Sediment Dam 1
Sediment Dam 1	5	Dirty water storage	Settlement		Decanted to Cooranbong Underground Storage / Weir	Sediment Dam 2
Sediment Dam 2	2.58	Dirty water storage	Settlement		1. Decanted to Cooranbong Underground Storage 2. Pumped to Sediment Dam 1 3. Emergency overflow	Cooranbong LDP001 (via culvert)
Borehole Dam	2.36	Dewatering point for underground water (via dewatering borehole)	Periodically monitored (no treatment typically required)	N/A	Overflow weir to Sediment Dam 1	Cooranbong LDP001 (via culvert)

5 ML Dam

The 5 ML Dam collects runoff from the eastern hardstand area and overflows from the CHP Settlement Tank. Potential hydrocarbon contamination in runoff from the workshop, equipment storage and washdown bay areas is treated by an oil-water separator prior to runoff reaching the 5 ML Dam.

A dewatering pump established on the 5 ML Dam allows low water levels to be maintained in the dam. Dewatering occurs to the Cooranbong Underground Storage via the Cooranbong dewatering borehole or to Sediment Dam 1 to promote volume retention times of the dirty water and to allow for a maximum capture volume in the event of moderate to significant rainfall events. Overflow from the 5 ML Dam is via LDP002.

ROM Stockpile Dam

The ROM Stockpile Dam and a connected drive-in coarse sediment sump were constructed to capture and treat dirty water runoff from the ROM Coal Stockpile. A dish drain is maintained at the front of the ROM stockpile to direct surface runoff from the stockpile area to the sump and dam to be captured. The overflow from the ROM Stockpile Dam is directed to Sediment Dam 1.

Sediment Dams 1 and 2

Runoff from the coal handling areas and conveyors to the east of the ROM Coal Stockpile contribute to Sediment Dams 1 and 2 via a series of coarse sediment sumps connected to a stormwater pit and pipe network. To keep the stored volume within the sediment dams at a low level, water is decanted from Sediment Dams 1 and 2 to the Cooranbong Underground Storage via the Cooranbong dewatering borehole. This low level minimises the risk of overflow of water from Sediment Dam 2 to Cooranbong LDP001 in the event of moderate to significant rainfall. Sediment Dams 1 and 2 have a combined capacity of 7.6 ML, connected by a concrete weir. Additional inflows to Sediment Dam 1 are received from the CHP Settlement Tank and 5 ML Dam.

Borehole Dam

The Borehole Dam is the storage located upslope of the main CES and receives water extracted from the Cooranbong Underground Storage via the Cooranbong dewatering borehole. The Borehole Dam outlet was relocated to provide additional settling capacity in February 2016. Mine water discharged from the Borehole Dam is directed via pipelines to either Sediment Dam 1 or directly to Cooranbong LDP001.

If the quality of mine water collected in the Borehole Dam is not suitable for discharge from CES, the water will be pumped back underground for recirculation (additional filtration and sediment settlement) through the Cooranbong Underground Storage before returning to the Borehole Dam.

Dewatering borehole

The Cooranbong dewatering borehole (WAL 39767) extracts water from the Cooranbong Underground Storage area. The dewatering borehole is located along the M1 located to the west of the CES. The extracted water is transferred by overland pipe to CES to the east and discharges into the Borehole Dam before discharging through Cooranbong LDP001. The approved extraction volume of 1,825 ML/year enables Mandalong Mine to sustainably manage the accumulation of water in the underground workings and align discharge volumes with Cooranbong LDP001 which has a volumetric limit of 5 ML/day.

Cooranbong Private Haul Road

Water upstream of the Cooranbong Private Haul Road is diverted away from the road by a series of catch drains. Water from the haul road and shoulder batters is captured and diverted to six sediment basins constructed along the haul road in accordance with the Managing Urban Stormwater: Soils and Construction (Landcom, 2004).

Storage catchment and current capacity for the Cooranbong Private Haul Road are summarised in Table 3.11. Catchments and flow paths for the haul road are shown in Figure 3.7 to Figure 3.11.

Table 3.11 Sediment Basins on Cooranbong Private Haul Road

Storage	Catchment area (ha)	Required capacity (m3)	Required compliance
Sediment Basin 1	4.0	1,755	5 day, 95th percentile rainfall depth. Cleanout undertaken if inspections determine a cleanout is required.
Sediment Basin 2	2.84	1,229	
Sediment Basin 3	0.7	306	
Sediment Basin 4	0.7	306	
Sediment Basin 5	2.5	1,096	
Sediment Basin 6	1.3	570	

On-going maintenance is undertaken including removal of any coal spilt from the haul trucks on the road and the addition of flocculants on an as-needs basis to the sediment basins, to minimise potential sediment loads in overflow water. A wheel wash facility is in use at CES and is maintained by contractors.



1:3,000 for A4

0 12.5 25 50 75 100 Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

- Sediment Basin
- Surface Water Catchment
- 0.5m Road Design Contours (Detailed)
- Contours (10m)
- Clean Water Surface Diversion
- Clean Water Pipe Diversion
- Dirty Water Surface Diversion
- Dirty Water Pipe Diversion
- +— Railway
- RoadSegment_NSWSS_20240117

LOCATION Mandalong

SEAM N/A

DRAWN BK

CHECKED ZL

APPROVED SG

SCALE Refer to scalebar

Mandalong Mine
Water Management Plan
Cooranbong Private Haul Road
Sediment Basins - Sheet 1

CENTENNIAL

DATE 21/05/2025 Figure 3.7



1:5,000 for A4

0 20 40 80 120 160

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

Sediment Basin	Contours (10m)	Dirty Water Surface Diversion
Surface Water Catchment	Clean Water Surface Diversion	Dirty Water Pipe Diversion
0.5m Road Design Contours (Detailed)	Clean Water Pipe Diversion	RoadSegment__NSWSS_20240117

LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine
Water Management Plan

Cooranbong Private Haul Road
Sediment Basins - Sheet 2

CENTENNIAL

DATE	21/05/2025	Figure 3.8
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1:1,500 for A4

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

- Sediment Basin
- Surface Water Catchment
- Dirty Water Surface Diversion
- Dirty Water Pipe Diversion
- 0.5m Road Design Contours (Detailed)
- Contours (10m)

RoadSegment__NSWSS_20240117

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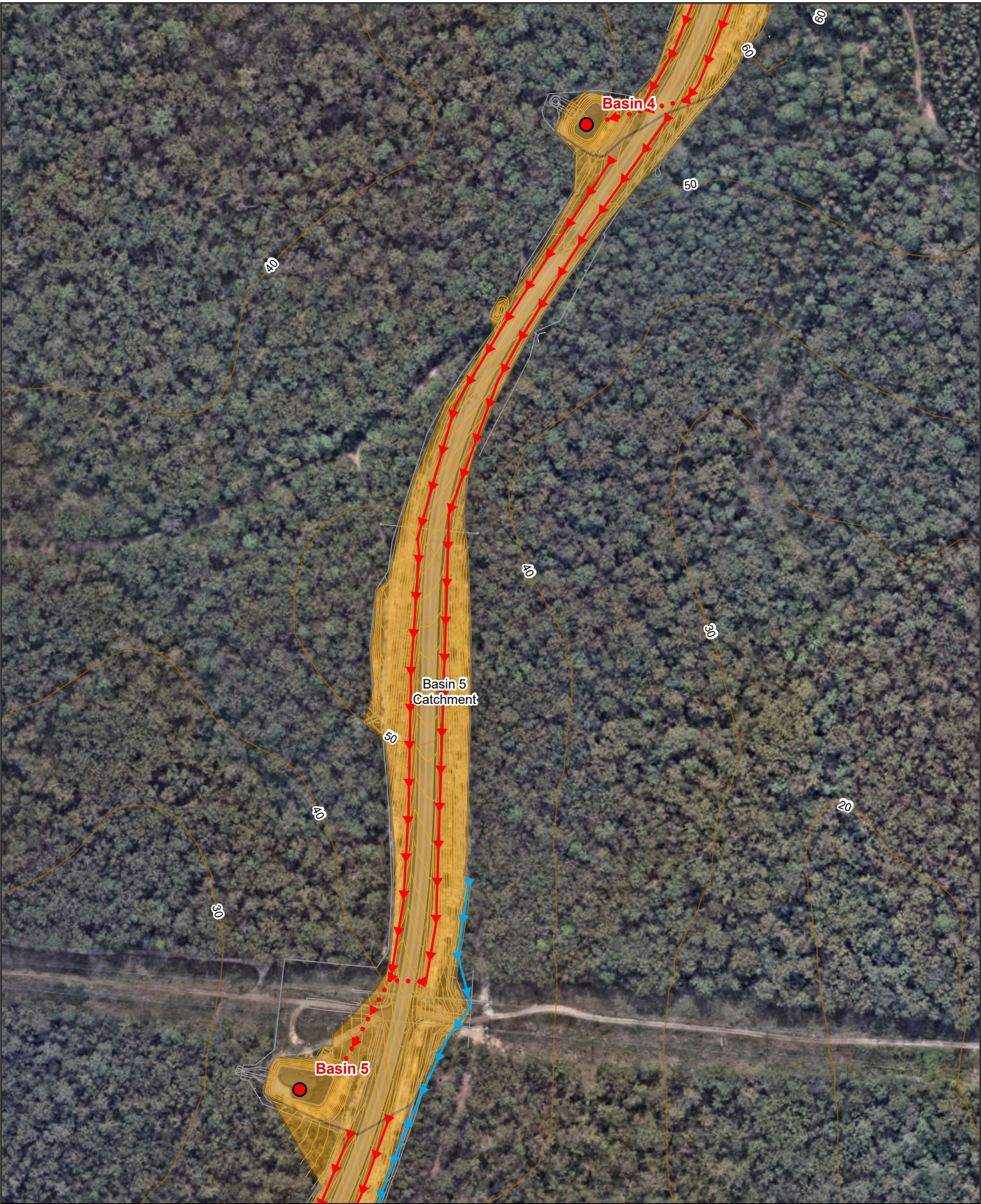
LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine
Water Management Plan

Cooranbong Private Haul Road
Sediment Basins - Sheet 3

CENTENNIAL

DATE	21/05/2025	Figure 3.9
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1:3,000 for A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

- Sediment Basin
- Surface Water Catchment
- 0.5m Road Design Contours (Detailed)
- Contours (10m)
- Clean Water Surface Diversion
- Dirty Water Surface Diversion
- Dirty Water Pipe Diversion

RoadSegment_NSWSS_20240117

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LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

**Mandalong Mine
Water Management Plan**

**Cooranbong Private Haul Road
Sediment Basins - Sheet 4**

CENTENNIAL

DATE	21/05/2025	Figure 3.10
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1:2,000 for A4

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

Sediment Basin	Contours (10m)	Dirty Water Surface Diversion
Surface Water Catchment	Clean Water Surface Diversion	Dirty Water Pipe Diversion
0.5m Road Design Contours (Detailed)	Clean Water Pipe Diversion	RoadSegment__NSWSS_20240117

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	SEAM	N/A
	DRAWN	BK
	CHECKED	ZL
	APPROVED	SG
	SCALE	Refer to scalebar

Mandalong Mine
Water Management Plan

Cooranbong Private Haul Road
Sediment Basins - Sheet 5

CENTENNIAL

DATE 21/05/2025

Figure 3.11

3.2.4.3 Muddy Lake

Muddy Lake is a receptor of discharges from LDP001. Muddy Lake is located approximately 1.5 km to the south of CES and discharges into Lake Macquarie just to the north of the Dora Creek village. Flows from Muddy Lake enter Lake Macquarie via an aqueduct that is suspended over the Eraring Power Station cooling water canal. It receives flows from tributaries of an unnamed creek to the north-east of CES. The water cycle schematic for Muddy Lake is presented in Figure 3.12. A plan of the key features at Muddy Lake are provided in Figure 3.13.

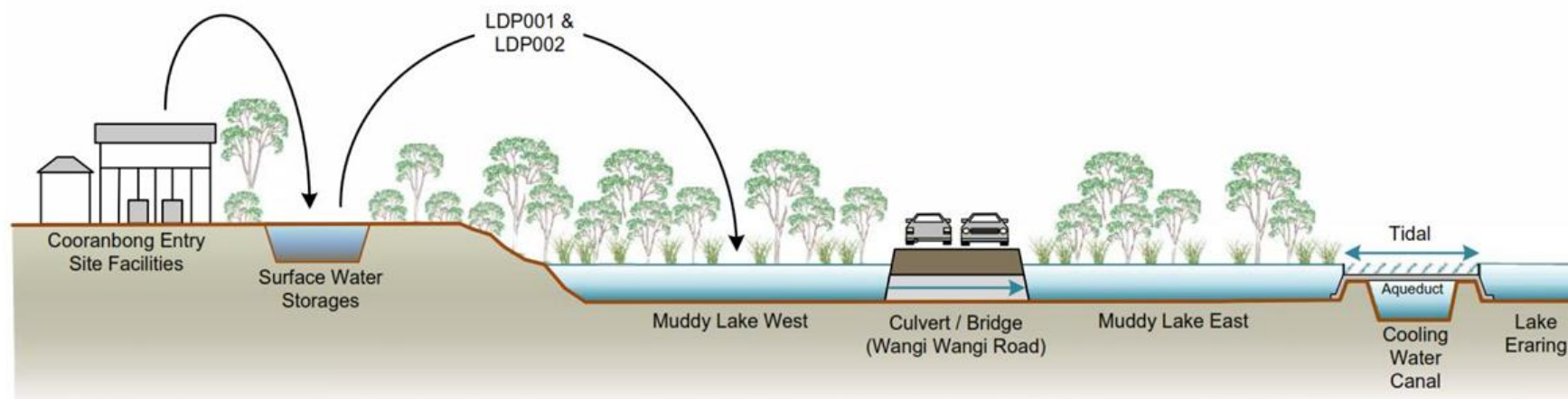


Figure 3.12 Water cycle schematic – Muddy Lake



LEGEND

- Tide monitoring locations
- Infrastructure
- Surveyed water level
- Detailed Survey Contours (0.5m)
- Railway
- Watercourse
- Waterbody

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LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine
Water Management Plan

Muddy Lake key features

DATE 20/05/2025	Figure 3.13
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The aqueduct located at the south-east end of Muddy Lake transfers water to and from Lake Eraring. Water not only flows from Muddy Lake into Lake Eraring, it also flows from Lake Eraring into Muddy Lake under localised tidal influences. The aqueduct connecting Muddy Lake with Lake Macquarie is shown in Figure 3.14 and Figure 3.15. Key infrastructure properties of the aqueduct, that influence flow capacity is listed in Table 3.12.

As the channel invert is well below the tidal range observed at the aqueduct, there is unlikely to be an impediment to flow to or from Muddy Lake. Tide data for Lake Macquarie were sourced from Manly Hydraulics Laboratory for a point local to Dora Creek. Kalang Road station (no. 211475) water level data were considered in the assessment of Muddy Lake operation, with a height correction of -0.08 m considered (OEH, 2016). Tide data were critical for the further assessment of Muddy Lake as it provides a boundary condition for flows from the waterbody and constrains connectivity to Lake Eraring and Lake Macquarie.

Table 3.12 Muddy Lake infrastructure details

Detail	Properties
Conduit type	Two open rectangular channels
Approximate invert	-0.6 m AHD (assuming flat channel and top of channel at 1.5 m AHD).
Width of channel	8.0 m (each channel)
Length of channel	78 m
Depth of channel	2.1 m
Maximum capacity of each channel	43.84 m ³ /s

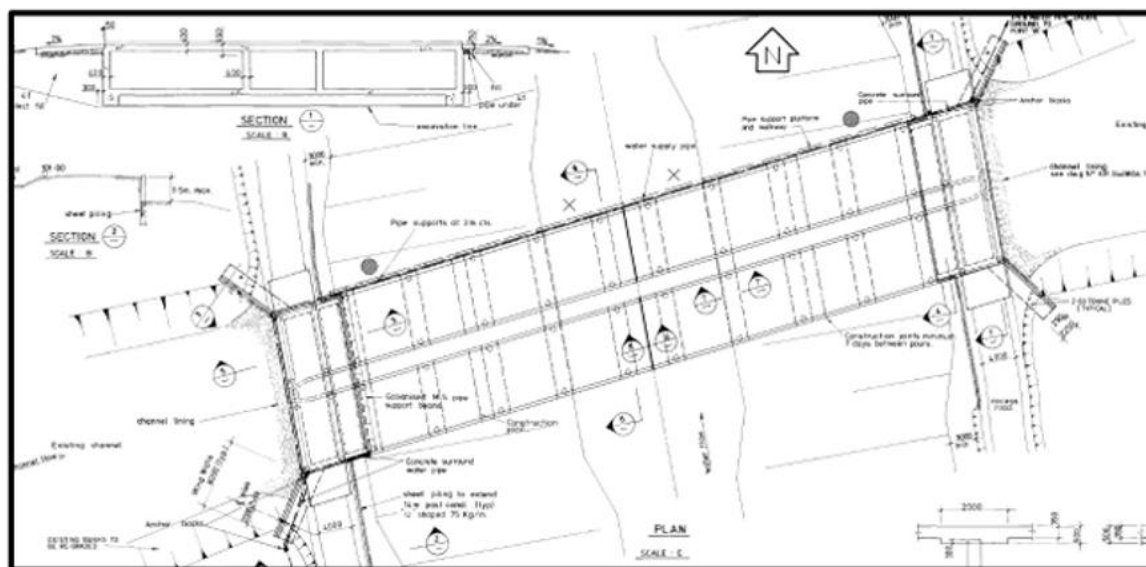


Figure 3.14 Aqueduct plan (Electricity Commission of NSW, 1978)

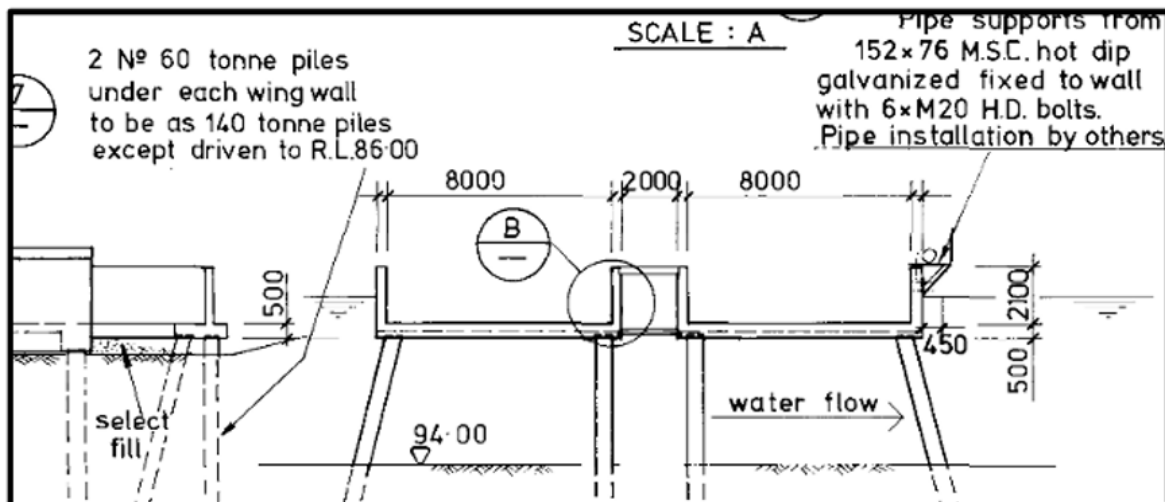


Figure 3.15 Aqueduct cross section (Electricity Commission of NSW, 1978)

3.3 Underground water management

3.3.1 Underground water management system

The underground water management system receives water from the Mandalong, Cooranbong and Delta underground workings. This water is transferred to a goaf (the Cooranbong underground storage) via a series of collection points and pumps from various working areas underground. The goaf has a large volume and provides a filtration and sediment settlement function prior to being pumped to the Borehole Dam at CES.

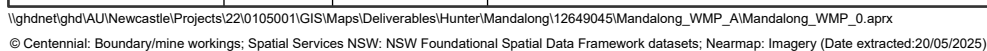
The inputs to the underground water management system consists of the following:

- Groundwater seepage from the coal seam and adjacent strata.
- Supply of potable water to mining equipment within the Mandalong workings (approximately 0.7 ML/day) and subsequent transfer of dirty mine water to the Cooranbong underground storage area (approximately 0.4 ML/day to 0.7 ML/day).
- Transfer of surface water from Sediment Dams 1 and 2 at CES (approximately 80 ML/year).
- Transfer of surface water from the 5 ML Dam at CES (approximately 50 ML/year).
- Transfer of water from the GPT at CES (also referred to as Coal Handling Plant Settlement Tank).
- Transfer of surface water from MMAS Sediment Dam to the Cooranbong Underground Storage
- Transfer of surface water from the MSSS 10 ML Tank to the underground workings

As shown in Figure 3.16, dirty water from the Mandalong workings is pumped at a rate of approximately 0.4 ML/day from the 69 cut through (c/t) area into the Cooranbong underground storage. Some of the water within the Mandalong workings (originating from potable supply and groundwater seepage) remains within the longwall goaf areas.

The water transferred from the Mandalong workings is allowed to settle at the Cooranbong settlement area. Water is then pumped at a rate of approximately 0.4 ML/day to 0.7 ML/day from 151 c/t pump station to the Cooranbong underground storage dam. The Cooranbong dewatering bore extracts water from this underground storage dam, which is transferred to the Borehole Dam at CES.

Water that is transferred from CES enters the Cooranbong underground storage via a series of passive infiltration bores. The location of this transfer is shown in Figure 3.17. This water then drains under gravity to the Cooranbong underground storage dam.



3.3.2 Groundwater inflow predictions

A hydrogeological model was developed as part of the Mandalong Southern Extension Project. The model has since been updated to reflect modifications in the mine plan and schedule, and re-calibrated to update groundwater inflow estimates on several occasions, most recently in 2025 (GHD 2025). The model predicts the lateral zone of impact through depressurisation of aquifers from current and future mining activities and future groundwater inflow.

Figure 3.17 presents the groundwater inflows predicted by hydrogeological modelling for Mandalong Mine. Current groundwater inflows into the active mining areas are estimated to be approximately 0.4 ML/day (GHD 2025), which is a reasonable match with the 0.75 ML/day inflow predicted by the hydrogeological model (GHD 2025). The hydrogeological model predicts that inflows into the mine are expected to peak in January 2038 at approximately 0.9 ML/day (GHD 2025). However, the annual average groundwater inflows would peak in 2037 at approximately 1.028 ML/day.

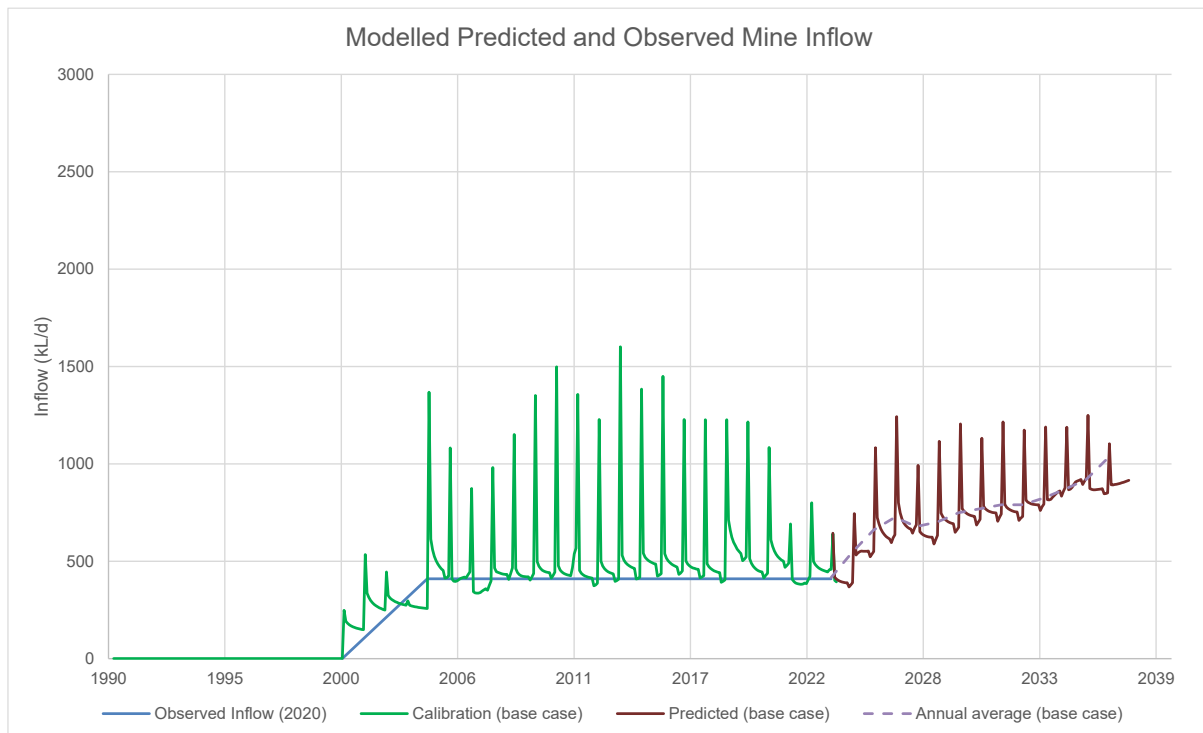


Figure 3.17 Predicted groundwater inflows into underground workings

3.4 Potable and wastewater systems

Potable water is provided via connections to HWC's reticulated potable water supply system at the MMAS. From the surface, potable water is transferred underground where it is used for process water. Grey water and sewage generated by onsite staff amenities at the MMAS is serviced via connection to HWC's reticulated sewer system.

Drinking water at MSSS will be sourced from truck deliveries of bottled water. No bathhouse facilities are available at MSSS. Non-potable water will be available from tanks at the site supplied by underground mine water. This water will predominately supply fire-fighting requirements and other activities. Wastewater is serviced by a pump-out on-site septic system.

Potable water is provided via connections to HWC's reticulated potable water supply system at the DES. Grey water and sewage generated by onsite staff amenities at the DES is serviced via connection to HWC's reticulated sewer system.

Potable water is provided via connections to the Hunter Water Corporation (HWC) reticulated potable water supply system at CES. From the surface potable water is transferred underground where it is used for process water. Grey water and sewage generated at CES is serviced by a pump-out system managed by a contractor.

3.5 Discharge management

The primary objective of the water management systems at each of Centennial's northern operations is the separation of clean and dirty water in order to manage transfers between the respective underground workings and surface storages and impacts to water quality. Within each of the water management systems, there are five categories of water including underground (mine) water, dirty water, clean water, wastewater and potable water. Sources of water at the surface sites include potable water supply, rainfall, catchment runoff and groundwater inflow to the underground mine workings. The primary water demands are for underground operations, surface dust suppression, machinery washdown, fire-fighting storage, operation of coal preparation plant and staff amenities.

Surface water runoff from areas where there is no coal storage, transportation, handling or processing or any disturbance activities is considered to be clean water, as it is unlikely to be contaminated with coal fines or sediment. Clean water runoff is diverted around dirty water and coal-contact catchments to avoid mixing with dirty water. Clean water runoff is typically from natural and impervious catchments such as areas of vegetation, sealed roads and sealed car parks.

Dirty water is runoff from disturbed areas and areas likely to contain suspended sediment, oils, grease and hydrocarbons. This typically includes workshop and fuel storage areas. Coal-contact water is runoff from catchments where coal storage, transportation, handling or processing occurs. Coal-contact water is managed within the dirty water management systems.

3.5.1 Summary of current discharge requirements

A summary of the current discharge requirements for Mandalong Mine, MSSS and CES in accordance with EPL 365 are provided in Table 3.13. Where LDPs discharge primarily due to catchment runoff, a volumetric discharge limit is not provided and 'rainfall based' discharge is noted. For LDP001, where groundwater extraction contributes to the discharge, an indication of the required volumetric limit is provided. The water management systems associated with each of these existing LDPs and anticipated life-of-project discharge requirements for each site are described in further detail in the following sections.

Table 3.13 Summary of current discharge requirements

Site	LDP	Current volumetric limit	Recommended volumetric limit
CES	LDP001	5 ML/day	Maintain at current limit
	LDP002	No limit specified	Rainfall-based
MMAS	LDP003	No limit specified	Rainfall-based
MSSS	LDP004	No limit specified	Rainfall-based

3.5.2 Discharge quality measures

Development Consent SSD-5144, Schedule 3, Condition 15(e) 'requires the inclusion of measures, developed in co-operation with the EPA to be implemented over 2-year, 10-year and life-of-project timeframes to reduce the salinity and metals toxicity in mine-water discharged from the CES to achieve these targets'. The condition referred to the initial Centennial Coal Pty Ltd Northern Operations Discharge Management Plan (GHD 2023) dated 23/09/2016 with consultation received by DPI Water in a letter dated 10 October 2017 that stated 'No specific programs for the 2-year, 10-year and life-of-project timeframes [were detailed] to reduce the salinity and metals toxicity in mine-water discharged'.

Centennial responded with 'Currently there is no update to the correspondence between EPA and Centennial Coal from the letter in August 2016. Centennial is currently undertaking the Green and Golden Bell Frog Research Program required under the EPBC Act approval for the Northern Coal Logistics Project. Following the outcomes of this program and identification of habitat impact thresholds, further consultation with the EPA will be undertaken'. The conditions of the EPBC Act approval requiring the implementation of a 'Biodiversity Monitoring Plan' are satisfied by the Muddy Lake Green and Golden Bell Frog Management Plan (GHD 2021b), which was developed in 2021 and included discharge management measures of:

- Any long-term halts (more than four weeks) to discharges has the potential to affect habitat quality of the Muddy Lake Green and Golden Bell Frog population. Increased monitoring of the population is recommended for the spring-autumn period following long-term halts to discharges (i.e., the detailed monitoring program is to be implemented).
- If discharges are to be increased, the detailed monitoring program is to be implemented on an annual basis.
- Monitoring of water quality during aquatic ecology surveys and targeted bell frog surveys.

It is noted that the NCLP EIS proposed an increased LDP001 discharge limit of 8 ML/day, with discharges modelled at 7 ML/day on average. Between January 2011 and August 2015, 1.6 ML/day on average was discharged via LDP001. However, since the EIS was approved in September 2015, the average discharge volumes through LDP001 have only increased slightly to 2.04 ML/day on average and have not exceeded the original LDP001 limit of 5 ML/day. As shown in Table 3.14, discharge volumes are anticipated to remain below 2.1 ML/day on average, based on lower predicted groundwater inflows in 2037 (the peak year of groundwater inflows). Therefore, discharge volumes are anticipated to be less than originally predicted in the EIS.

Triggers and corrective actions are included for the above discharge measures which aim to mitigate impact on the Green and Golden Bell Frog. The results from annual reporting against discharge measures is reported in the Mandalong Annual Review (see Section 7.1) which indicate that saline water in Muddy Lake may benefit the species as salinity inhibits the growth and spread of *Chytrid* fungus. Therefore, a program to 'reduce salinity' of the mine water discharges may have adverse effects.

Trigger levels and performance criteria for discharges with regard to metal toxicity are provided in Section 6, with management measures in the form of TARPs provided in Appendix G.

3.6 Site water balance

A site water balance model was previously developed for Mandalong Mine as part of the Mandalong Southern Extension Project (GHD 2013) to quantify water transfers within the site under existing and future operational conditions using various rainfall patterns. The site water balance is reviewed on an annual basis to assist in the management and reporting of water use at the site. The water balance was updated to reflect the latest (annual average) groundwater inflow predictions (refer to Section 3.3.2) and to reflect the current mine plan and schedule. A schematic of the overall water management system is presented in Figure 3.18.

A summary of the predicted average annual inputs and outputs for the Mandalong Mine water management system for existing and future conditions is provided in Table 3.14. For the purpose of the site water balance model, the inflows and outflows include those parts of Cooranbong Entry Site that form part of the NCS. The future conditions for the water balance model were based on the predicted site conditions in 2037 when groundwater inflows into the active underground workings are predicted to peak.

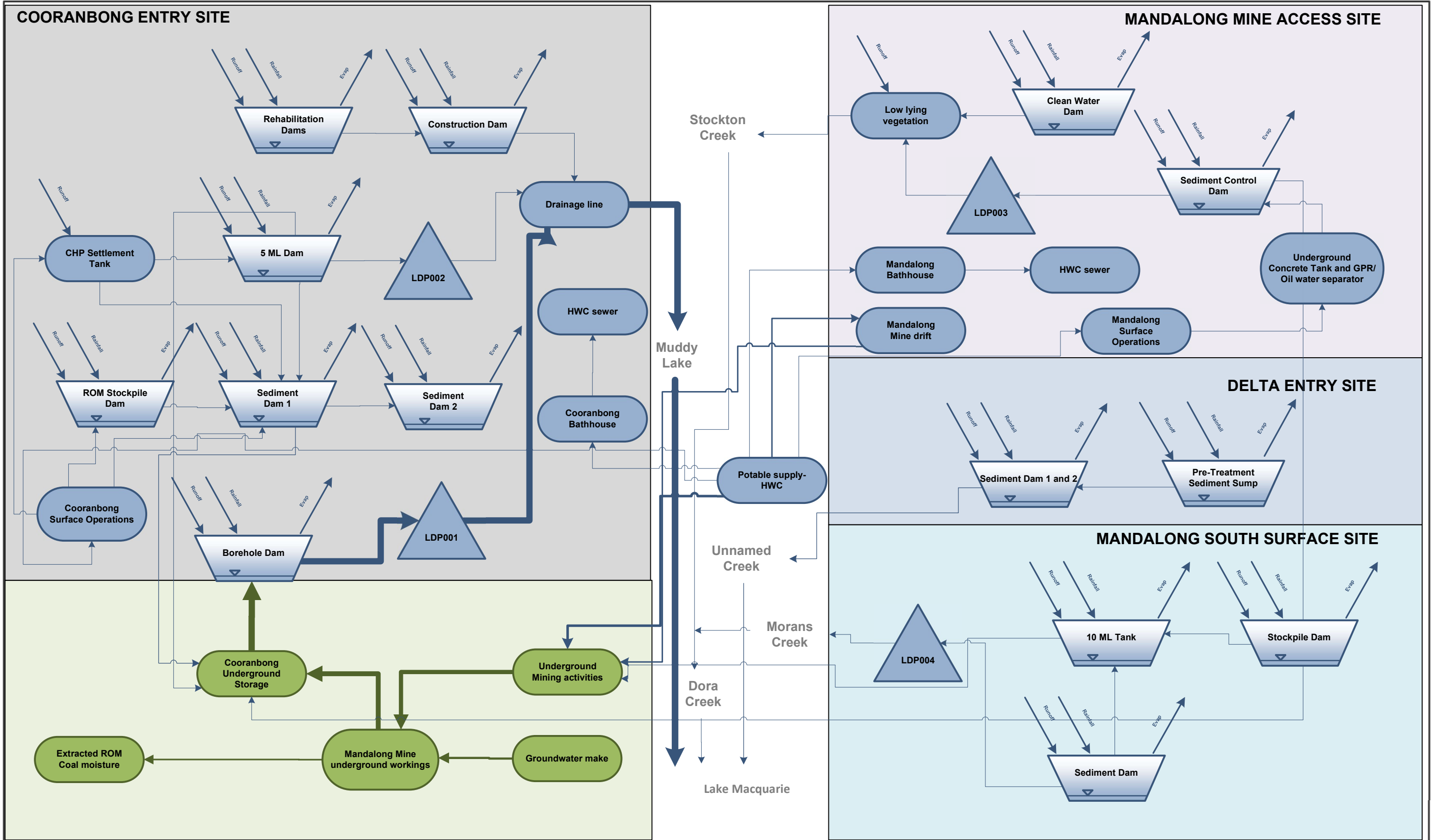


Table 3.14 Summary of site water balance results

	Existing conditions (2025) (ML/year)	Future conditions (2037 (ML/year)
INPUTS		
Direct rainfall onto storages	25	25
Catchment runoff	248	245
Potable water supply	511	510
Groundwater inflows into underground workings	200	374
TOTAL INPUTS	984	1154
OUTPUTS		
Evaporation	26	25
Sewage to HWC	12	12
Discharge through LDP001 (Cooranbong Entry Site)	845	842
Discharge through LDP002 (Cooranbong Entry Site)	6	6
Discharge from Construction Dam (Cooranbong Entry Site)	28	27
Discharge from Delta Entry Site	72	71
Discharge from LDP003 (Mandalong Mine Access Site)	0	0
Discharge from LDP004 (Mandalong South Surface Site)	1	1
Extracted ROM coal moisture	54	52
TOTAL OUTPUTS	1043	1037
CHANGE IN STORAGE		
Cooranbong underground storage	-59	117
Surface water storages	0	0
TOTAL CHANGE IN STORAGE	-59	117
BALANCE		
Inputs – outputs – change in storage	0	0

3.6.1 Water supply security

Water is supplied primarily by potable water from HWC's reticulated potable water supply system. External water supply is minimised by reuse and recirculation of water. However, potable water is required for some processes, such as underground mining equipment use and washdown, as recycled water (reused mine water) generally has unsuitable and inconsistent quality.

Given the security of potable water from HWC, there are no significant water supply risks associated with achieving appropriate environmental management requirements.

A water efficiency audit report was undertaken in consultation with Hunter Water in 2018. The audit recommended further potential water saving opportunities in consistent shower flowrates, optimised nozzles for boot washes, leak checking and repair and tap flow regulators. Mandatory actions were implemented by 31 December 2019 (Centennial 2021).

3.6.2 Discharge frequency

The annual average water balance results presented in Table 3.14 represent the average conditions but do not necessarily reflect the potential for off-site discharges due to rare rainfall events that exceeds the design capacity of the water management system.

The frequency of potential discharges are estimated based on water balance modelling in Table 3.15, in terms of:

- Annual exceedance probability of overflow. This quantifies the expected likelihood of any overflows during a given year based on modelling results.
- Maximum modelled annual overflow volume and maximum modelled annual overflow days. This is a secondary measure of the severity of potential overflows. Given the relatively low likelihood and volume of overflows compared to runoff from the surrounding clean water catchment, this is not considered a particularly useful performance measure, but is included for completeness.

Table 3.15 Summary of discharge forecasts

Storage/LDP	Annual exceedance probability of discharge	Maximum modelled annual overflow volume (ML)		Maximum modelled annual overflow days
Borehole Dam and CES Sediment Dam 1 (LDP001)	100%	869.7	365	
CES 5 ML Dam (LDP002)	70%	35	5	
MMAS Sediment Control Dam (LDP003)	10%	1.5		1
MSSS Sediment Dam (LDP004)	20%	8.9		3
MSSS Stockpile Sediment Dam	<1%	0		0

3.7 Mandalong Valley flooding

Umwelt (2013) characterised the Mandalong Valley Floodplain as part of the Mandalong Southern Extension Project EIS. Flooding is well experienced within the valley. Within the Mandalong Valley it is estimated that the June 2007 flood event was between a 50 year and 100 year ARI flood event (equivalent to the 2% and 1% AEP events respectively). Umwelt (2013) summarised a number of anecdotal pieces of evidence (in the form of photographs) from the 2007 event:

- Properties adjacent to Mandalong Road and Chapmans Road would experience flooding.
- Flooding occurs over Mandalong Road where it crosses a tributary of Morans Creek.
- Overbank flooding experienced down Morans Creek.

A flood model has been developed for the Mandalong Valley to identify and quantify the potential changes to the nature of flooding as a result of mining activities at Mandalong Mine. An outcome from recent studies into the southern extension of the underground workings indicated there is no expected change in flood behaviour from major events that may pose a risk to habitable areas.

3.8 Erosion and sediment control

As part of surface water management, erosion and sediment control is critical to minimise excessive soil loss as a result of construction activities that require disturbance of existing groundcover. Erosion and sediment controls are implemented for all phases of operation including construction/maintenance activities, operational activities and during rehabilitation to mitigate the impacts of the operations on watercourses and the surrounding environment.

Erosion and sediment control measures are focused on prevention of erosion through development of erosion and sediment control plans (ESCPs) that:

- Identify activities with the potential to cause erosion and generate sediment.
- Plan activities to minimise the area of disturbance.
- Install erosion and sediment controls prior to commencement of disturbance activities.
- Maintain erosion and sediment control structures.
- Design erosion and sediment control structures with the capacity to handle the critical 20 year ARI rainfall event.

A range of erosion and sediment control measures are employed including:

- Erosion matting.
- Clean and dirty water diversions.
- Sediment filter fences.
- Rock check dams.
- Sandbag weirs.
- Temporary drains.

Inspections of all water management and sediment control structures are undertaken following heavy rainfall events (see Section 4.1).

3.8.1 Requirements and guidelines

All erosion and sediment control measures are to be designed and implemented according to the requirements and guidelines provided in:

- Managing Urban Stormwater: Soils and Construction, Volume 1 (Landcom, 2004).
- Managing Urban Stormwater: Soils and Construction, Mines and Quarries Volume 2E (DECC, 2008).
- Best Practice Erosion and Sediment Control (IECA, 2008).

3.8.2 Disturbance and sediment generating activities

Disturbance and sediment generating activities that are likely to require erosion or sediment controls may include:

- Rehabilitation activities.
- Site reshaping.
- Temporary stockpiles.
- Dewatering activities.
- Temporary open channel diversions.
- Instream watercourse works.

3.8.3 Erosion risk

Disturbance activities are a function of the daily operations, with the resulting erosion risk varying throughout the year in response to changes in rainfall. The initial erosion risk has been estimated based on the:

- Average monthly rainfall.
- Area of disturbance (considered as the total water management system catchment).
- Soil Loss Classes (refer to Table 4.2 from Landcom, 2004).

The erosion risk ratings for Mandalong Mine are provided in Table 3.16. The average monthly rainfall is given by the BOM Avondale climate station (61012). The initial erosion risk is principally affected by the average rainfall, with high to very high erosion risk identified for summer months and early autumn (i.e. November to May), with the initial erosion risk reducing to low-moderate during the winter and spring months (i.e. July to October).

When disturbance activities are undertaken within higher risk months, it is recommended that additional management measures be undertaken to ensure that the erosion and sediment controls are capable of operating effectively.

Table 3.16 Erosion risk

Month	Average rainfall (mm)	Erosion risk rating
January	108.9	Very high
February	135.4	Very high
March	128.1	Very high
April	117.1	Very high

Month	Average rainfall (mm)	Erosion risk rating
May	93.9	Very high
June	101.7	Moderate
July	70.8	Low moderate
August	59.7	Low moderate
September	59.0	Low moderate
October	69.8	Moderate
November	81.3	High
December	96.6	High

3.8.4 Soil landscapes

Soil landscapes regionally vary among sites within the northern region. Table 3.17 summarises the various soil landscapes and associated erosion hazard within each site. From Table 3.17 it can be seen that the erosion hazard associated with the soil landscapes at Mandalong Mine vary from slight-moderate to extreme erosion hazard.

Table 3.17 Applicable soil landscapes for erosion risk

Site	Soil landscape	Typical terrain	Erosion hazard
Mandalong Mine	Watagan	Hill top	Extreme
	Mandalong	Upper slopes	Very high
	Woodburys Bridge	Upper slopes	Moderate
	Gorokan	Foot slopes	Extreme
	Yarramalong	Floodplain	Slight to moderate
	Wyong	Floodplain	Slight to moderate
	Doyalson	Floodplain	Moderate

3.8.5 Land-based salinity processes

Land-based salinity results from the accumulation of soluble salts on the soil surface. Commonly these salts are chloride, sulphates or carbonates of sodium, calcium and magnesium (Landcom 2004). Two key activities that can increase salinity processes on the land include,

- Removal of vegetation resulting in a rising groundwater table.
- Exposing sodic or saline sub-soils through disturbance activities.

The increase in salinity processes on the land can result in degraded water quality in nearby waterways as result of runoff from soluble salts on the soil surface of, primarily, areas undergoing disturbed activities.

The following points provide appropriate management techniques to remove or mitigate land based salinity processes (WSROC 2003):

- Identify soil types and landscapes. Identify salinity hazard landscapes.
- Practise good soil management techniques during construction.
- Minimise water inputs, maintain natural/existing water balance and use caution in implementing infiltration as a water management solution.
- Carefully manage areas of existing land-based salinity.
- Avoid excessive clearing during disturbance activities and retain or re-establish native vegetation, specifically deep-rooted vegetation.

3.8.6 Environmental constraints

Environmental constraints that should be considered when estimating the potential sediment loads associated with a proposed activity are presented in Table 3.18.

Table 3.18 Mandalong Mine environmental constraints and characteristics

Component	Range of parameters
Works period and site sensitivity (DECC, 2008)	Many mining operations are likely to be greater than three years. Downstream environment defined as sensitive*
Rainfall factor – R	2,416
Soil erodibility factor – K	0.08
Slope and flow length	Maximum flow length should not exceed 80 m Typical slopes are between 0.5% to 3%
Sediment basin requirement threshold	Predicted soil loss > 150 m ³ /year (based on RUSLE equation results)
Sediment basin type for construction	'Wet Basin' – Type D, 5 day 95th percentile
Sediment volume allowance for sediment basins	Dependent upon operations and clean out frequency – two to six months
Soil hydrologic type	Type D
Volumetric coefficient of runoff	0.79 (DECC, 2008 recommends 0.9 for hardstand areas)

* Lake Macquarie City Council considers Lake Macquarie to be a sensitive environment.

3.8.7 Typical controls

Prior to any construction activity, temporary erosion and sediment controls shall be installed. The following are temporary erosion and sediment control that are currently being utilised at northern operations. The installation of these controls should be in accordance with the specification detailed in the Managing Urban Stormwater, Soils and Construction (Landcom 2004) standard drawings.

3.8.7.1 Sediment fence

Sediment fences trap sediment that is mobilised by runoff across a disturbed area. Sediment fences should only be temporary and require regular maintenance to remain effective.

Sediment fences are to be installed along the contour downslope of disturbed areas. Sediment fences are not to be located within (or adjacent to) concentrated flow paths, but in positions that provide adequate vegetative filtering of sheet flows downslope of the disturbed area. Sediment fences shall be installed in accordance with the Sediment Fence Standard Drawing (SD6-8: Landcom, 2004).

3.8.7.2 Inlet pit protection

Where disturbance activities are to be carried out within the vicinity of an existing stormwater drainage network (i.e. a pit and pipe system), it is recommended that inlet pit protection measures are used. Pit protection measures provide a filter for sediment-laden runoff, reducing the risk of stormwater pipes being blocked with accumulated sediment. Inlet pit protection shall be installed in accordance with the Inlet Pit Protection Standard Drawing (SD6-11: Landcom, 2004).

3.8.7.3 Sediment traps and basins

Where disturbance activities exceed the manageable capacity of sediment fences, with respect to duration or extent, it is recommended that sediment traps and/or basins be installed. Sediment traps and basins can be constructed from available construction materials or by shaping an earth embankment. It is expected that sediment traps and basins would be installed and operated similar to a Type D Sediment Basin (SD6-4: Landcom, 2004).

3.8.7.4 Flow breaks (low flow channels)

The use of flow breaks decrease flow velocities within low flow channels, reducing the potential for the low flow channels to erode and scour and reduce the migration of sediment from disturbed areas. Flow breaks can be constructed from earth, natural materials (logs, mulch and so on) or from proprietary products. Breaks should be used in a similar manner to a sediment fence, however flow breaks are typically more porous than sediment fences, allowing water to flow through faster.

3.8.7.5 Rolled erosion control products

Rolled erosion control products (RECPs) reduce erosion by completely covering the disturbed area. RECPs are easily applied to disturbed areas in an emergency or where the area requires temporary stabilisation for an extended period of time. RECPs typically require little maintenance. RECPs may consist of processed natural or synthetic fibres bound together to form a continuous mat. They may also be used to facilitate vegetation establishment by temporarily or permanently reinforcing the soil surface during and after vegetation maturation.

3.8.8 Implementation

The following points provide a typical implementation strategy for managing erosion and sediment controls:

1. Sediment controls are to be implemented in the area of any ground disturbance, prior to the disturbance activity occurring. A sediment fence or appropriately designed sediment control structure must be erected downslope of the area of disturbance.
2. Dirty runoff water should be directed to the sediment controls. Small areas of ground disturbance may be managed in situ by using appropriate sediment source controls.
3. Dirty runoff that may be exposed to hydrocarbons must be treated with an oil/water separator, where practicable. The collected hydrocarbon wastes must be disposed off-site by a licensed waste operator.
4. Areas where contamination of water by hydrocarbons must be minimised. Servicing of vehicles must be conducted within appropriate areas designed to treat potential hydrocarbon spills.

5. Equipment and materials should be cleaned in the designated washdown areas. Primary washdown of underground mining equipment should, where practicable, be conducted within the primary washdown bay underground.
6. Washdown of underground mining equipment on surface may only be conducted in the approved and signposted washdown areas.
7. All emergency discharge sites are to include flow dissipaters to reduce scouring directly downstream of the discharge point.
8. All erosion and sediment controls are to remain in place until the area of disturbance can be satisfactorily rehabilitated and stabilised.

Table 3.19 summarises the acceptable water quality objectives for disturbance activities when works may occur outside the catchment of an LDP.

Table 3.19 Water quality objectives

Parameter	Units	Concentration limit
pH	pH units	6.5–8.5
Oil and grease	mg/L	10
Total suspended solids	mg/L	50

4. Monitoring requirements

4.1 Inspections

Centennial Mandalong undertake site inspections on the water management structures at MMAS, MSSS, CES and DES. Site inspections are completed by the Environment and Community Coordinator or their delegate and occur at a minimum:

- Weekly at the MMAS, MSSS and CES, and monthly at the DES.
- As soon as practicable following rainfall events that exceed 40 mm in 24 hours.

An example of an inspection is undertaking the following activities:

- Inspecting water management and sediment control structures for capacity, structural integrity and effectiveness.
- Recording and reporting on the condition of each water management and sediment control structure in place.
- Recording where around the site sediment is deposited.

Maintenance of the water management and sediment control structures will be implemented when visual defects are observed.

4.2 Surface water quality

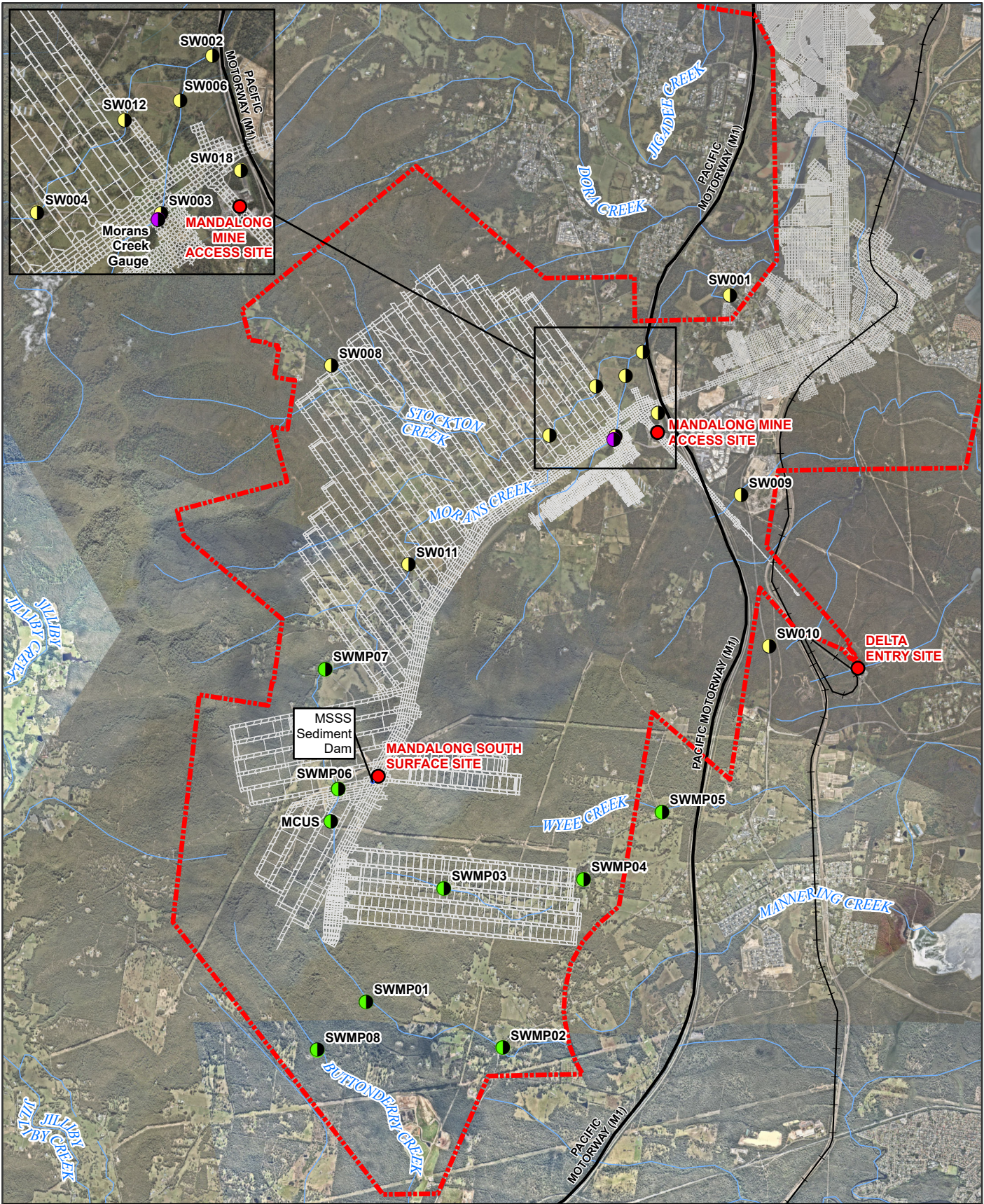
4.2.1 Mandalong Mine surface water monitoring

Surface water quality monitoring points are located in the Mandalong Valley within the upper, mid and lower reaches of Morans Creek and Stockton Creek. Regular monitoring of these locations has been undertaken since August 1999. In addition to these primary surface water sampling locations, surface water monitoring is also undertaken at locations in Pourmalong Creek on the north and south arm. As part of potential subsidence related impacts surface water monitoring is also undertaken within Mannering Creek and Wyee Creek. Sampling of these locations began in June 2011.

No surface water quality monitoring has been undertaken at DES.

The sampling locations for surface water quality are provided in Figure 4.1, with the details of each location provided in Table 4.1.

Water quality sampling frequency and monitored parameters for each location is summarised in Table 4.2.



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0 250 500 1000 1500 2000 Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

- Site Locations
- Mandalong Mine Holding Boundary
- Mandalong Surface water monitoring locations
- Mandalong South Surface water monitoring locations
- Morans Creek Gauge
- Freeway
- Existing and planned mine workings (currently approved Extraction Plans)
- Existing Rail

LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine
Water Management Plan
Mandalong Mine - Surface water
monitoring locations

CENTENNIAL

DATE 20/05/2025

Figure 4.1

Table 4.1 MMAS and MSSS surface water monitoring locations

Site	Location and creek catchment	GDA2020 MGA Zone 56		Current purpose
		Easting	Northing	
Associated with mine sites and historical subsidence areas				
SW001	Downstream reach of Stockton Creek	357599	6336488	Downstream recovery site – Downstream of Mandalong Mine Holding Boundary. Downstream of underground mining influences on Stockton Creek and Morans Creek prior to the confluence with Dora Creek
SW002	Downstream of confluence of Morans Creek and Stockton Creek	356367	6335680	Downstream recovery site - Downstream of underground mining influences on Stockton Creek and Morans Creek prior to the confluence with Dora Creek
SW003	Mid Morans Creek	355979	6334493	Impact site – Impacts of underground mining on Morans Creek
SW004	Mid Stockton Creek	355044	6334501	Impact site – Impacts of underground mining on Stockton Creek
SW006	Lower Morans Creek	356123	6335343	Downstream recovery site - Downstream of underground mining influences on Morans Creek prior to the confluence with Stockton Creek
SW008	Upper Stockton Creek	351953	6335491	Reference site – Upstream of underground mining extent on Stockton Creek
SW011	Upper Morans Creek	353048	6332673	Impact site – Impacts of underground mining on Morans Creek
SW012	Lower Stockton Creek	355705	6335198	Impact site – Impacts of underground mining on Morans Creek
SW018	Lower Stockton Creek catchment	356582	6334818	Downstream recovery site -downstream of Sediment Control Dam (LDP003) at MMAS on Mullards Creek
SWMP05	Wye Creek at junction of Schofield	356638	6329166	Downstream recovery site - Downstream of underground mining influences on Wye Creek.

Site	Location and creek catchment	GDA2020 MGA Zone 56		Current purpose
		Easting	Northing	
	Road and Manhire Road			Downstream of Mandalong Mine Holding Boundary
SWMP06	Morans Creek at Mandalong Road	352051	6329495	Impact site – Impacts of underground mining on Morans Creek upstream of MSSS influence
SWMP07	Upper Morans Creek catchment	351868	6331191	Downstream recovery site - Downstream of underground mining influences on Morans Creek prior to entering Longwall 24A extent
MCUS	Upper Morans Creek catchment	351947	6329033	Impact site – Impacts of underground mining on Morans Creek upstream of MSSS influence
Associated with future subsidence area				
SWMP01	Mannering Creek within Olney State Forest	352447	6326478	<u>Current</u> Reference site – Baseline data collection prior Longwalls 44 onward extraction <u>Future</u> Impact site - Impacts of underground mining on Mannering Creek following Longwalls 44 - 54 extraction
SWMP02	Mannering Creek at Hue Road	354383	6325832	<u>Current</u> Reference site – Baseline data collection prior to Longwalls 44 - 54 extraction <u>Future</u> Impact site - Impacts of underground mining on Mannering Creek following Longwalls 44 - 54 extraction
SWMP03	Wyee Creek at Wyee Farms Road	353547	6328087	<u>Current</u> Reference site – Baseline data collection prior to Longwalls 39-43 extraction <u>Future</u> Impact site - Impacts of underground mining on Wyee Creek following Longwalls 39-43 extraction

Site	Location and creek catchment	GDA2020 MGA Zone 56		Current purpose
		Easting	Northing	
SWMP04	Wyee Creek at Wyee Farms Road Bridge	355526	6328214	<u>Current</u> Impact site – Baseline data collection prior to Longwalls 39-43 extraction <u>Future</u> Downstream recovery site - Downstream of underground mining influences on Wyee Creek
SWMP08	Buttonderry Creek	351756	6325798	<u>Current</u> Reference site – Baseline data collection prior to Longwalls 44 - 54 extraction <u>Future</u> Impact site - Impacts of underground mining on Buttonderry Creek following Longwalls 44 - 54 extraction
SW009	South Pourmalong Creek	357761	6333659	Baseline data (not currently planned to be undermined)
SW010	North Pourmalong Creek	358155	6331520	Baseline data (not currently planned to be undermined)

* minor disturbance related to development of decline in 2004.

Table 4.2 Surface water quality monitoring frequency and parameters (MMAS and MSSS)

Location	Frequency	Parameters	Rationale
Stockton Creek			
SW004 SW008 SW012	Quarterly	Physicochemical parameters: EC, pH, TDS, TSS, turbidity.	Reduced suite of analysis as active mining under these locations (catchment) ceased in 2019
	Annual	Major ions: alkalinity, calcium, chloride, hardness, magnesium, potassium, sodium, sulfate. Nutrients: ammonia, BOD, nitrate + nitrite, TKN, total nitrogen, total phosphorus. Metals (filtered and total): aluminium, arsenic, barium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, zinc. Others: fluoride.	
SW001 SW002 SW018	Quarterly and following LDP003 discharge event	Same as above with cyanide additional.	These locations receive surface water influence from Stockton and Morans Creeks as well as MMAS LDP003 (when discharging)
Morans Creek and Pourmalong Creek			
MCUS SWMP06 SWMP07 SW011 SW003 SW006 SW009 SW010	Quarterly	Physicochemical parameters: EC, pH, TDS, TSS, turbidity. Major ions: alkalinity, calcium, chloride, hardness, magnesium, potassium, sodium, sulfate. Nutrients: ammonia, BOD, nitrate + nitrite, TKN, total nitrogen, total phosphorus. Metals (filtered and total): aluminium, arsenic, barium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, zinc. Others: fluoride.	Active mining exists in the catchments for these locations

Location	Frequency	Parameters	Rationale
Wyee Creek, Mannering Creek, and Buttonderry Creek			
SWMP01 SWMP02 SWMP03 SWMP04 SWMP05* SWMP08	Annual (*Quarterly for SWMP05)	Physicochemical parameters: EC, pH, TDS, TSS, turbidity. Major ions: alkalinity, calcium, chloride, hardness, magnesium, potassium, sodium, sulfate. Nutrients: ammonia, BOD, nitrate + nitrite, TKN, total nitrogen, total phosphorus. Metals (filtered and total): aluminium, arsenic, barium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, zinc. Others: fluoride.	Sufficient baseline data for derivation of site-specific guideline values is held for these locations. Frequency will move to quarterly once active mining begins in the catchment (i.e., as SWMP05 has)

4.2.2 Cooranbong Entry Site surface water monitoring

Surface water quality at CES is currently monitored at the locations in Table 4.3. These monitoring locations are shown on Figure 4.2.

Table 4.3 CES surface water monitoring locations

Site	Location and creek catchment	Monitoring site type	GDA2020 MGA Zone 56	
			X coordinate	Y coordinate
SW013	Unnamed creek upstream of CES	Reference	360844	6341303
SW015	Unnamed creek upstream of CES		359633	6342115
CCSR1	Unnamed creek downstream of CES at Simpson Road	Downstream impact	360423	6340873
SW016	Muddy Lake, 1,000 m downstream of Simpson Road and causeway crossing	Downstream recovery	359987	6339755
SW017	Muddy Lake, North Dora Creek Village adjacent to Wangi Road crossing		360360	6338956

Table 4.4 summarises the parameters and frequency of water quality monitoring.

Table 4.4 Cooranbong Entry Site surface water monitoring frequency and parameters

Location	Frequency	Parameters	Rationale
SW013, SW015, CCSR1, SW016, SW017	Monthly	Physicochemical parameters: EC, pH, oil and grease, TSS and turbidity. Nutrients: ammonia, total nitrogen, total phosphorus. Major ions: calcium, chloride, magnesium, potassium, sodium and total alkalinity. Metals (dissolved and totals): aluminium, arsenic, boron, cobalt, cadmium, chromium, copper, iron, lead, manganese, nickel and zinc.	Monthly monitoring in Unnamed creek is appropriate due to daily discharge from CES LDP001. Monthly monitoring of water quality at reference sites allows for consideration of environmental influence or catchment conditions on water quality.



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0 75 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

LEGEND

Site Locations

Mandalong Mine Holding Boundary

On-site impact site

Downstream impact site

Downstream recovery site

Reference site

Reference - historical

Existing Rail

Watercourse

Watercourse area

LOCATION

Mandalong

SEAM

N/A

DRAWN

BK

CHECKED

ZL

APPROVED

SG

SCALE

Refer to scalebar

Mandalong Mine

Water Management Plan

Cooranbong Entry Site - Surface

water monitoring locations

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Figure 4.2

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© Centennial: Boundary/mine workings; Spatial Services NSW: NSW Foundational Spatial Data Framework datasets; Nearmap: Imagery (Date extracted:21/05/2025)

4.3 Discharge water monitoring

Discharge water quality monitoring is undertaken at LDP001 and LDP002 at CES, LDP003 at the MMAS, and LDP004 at the MSSS in accordance with the requirements of EPL 365. Additional water quality monitoring of the Sediment Dam at the MSSS is undertaken during discharge. *Emergency / overflow discharge point only

Table 4.6 outlines the discharge water quality monitoring requirements.

Table 4.5 Discharge water monitoring locations

Site	Location and creek catchment	GDA2020 MGA Zone 56	
		Easting	Northing
LDP001	CES discharge, discharges into the unnamed creek	360121	6341407
LDP002*	CES discharge, discharges into the unnamed creek	360315	6341224
LDP003*	MMAS Sediment Control Dam outlet, discharges into low-lying vegetation	356601	6334723
LDP004*	MSSS Sediment Dam, discharges into unnamed tributary of Morans Creek	352547	6329580

*Emergency / overflow discharge point only

Table 4.6 Discharge water quality monitoring frequency and parameters

Location	Frequency	Parameters
LDP001	Daily during discharge	Flow volume
	Monthly during discharge	Physicochemical parameters: EC, pH, oil and grease, TSS and turbidity Nutrients: total nitrogen including ammonia Major ions: calcium, chloride, magnesium, potassium, sodium and total alkalinity Metals (dissolved and totals): aluminium, arsenic, boron, cobalt, cadmium, chromium, copper, iron, lead, manganese, nickel and zinc
	Annual ¹	Metals (dissolved): mercury and selenium
LDP002	Within twelve hours of discharge and weekly thereafter during discharge	Physicochemical parameters: EC, pH, oil and grease, TSS and turbidity

Location	Frequency	Parameters
	Monthly during discharge	Nutrients: total nitrogen including ammonia Major ions: calcium, chloride, magnesium, potassium, sodium and total alkalinity. Metals (dissolved and totals): aluminium, arsenic, boron, cobalt, cadmium, chromium, copper, iron, lead, manganese, nickel and zinc.
LDP003 (MMAS Sediment Control Dam outlet)	Daily during discharge	Oil and grease, pH, TSS
LDP004 (MSSS Sediment Dam outlet)		
MSSS Sediment Dam	Daily during discharge from LDP004	Physicochemical parameters: EC, pH, oil and grease, TSS, turbidity.
	Monthly during discharge from LDP004	Nutrients: ammonia, total nitrogen, total phosphorus. Major ions: alkalinity, calcium, chloride, magnesium, potassium, sodium, sulfate. Metals (filtered and total): aluminium, arsenic, barium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, zinc.

¹ Required for national pollution inventory (NPI) reporting

4.4 Surface water flow

There exists two public watercourse stream gauges located on Jilliby Creek (ID 211010) and Wyee Creek (ID 211001). Both are not continuously monitored sites and the data are considered to be unreliable. Centennial Mandalong installed a flow and level gauge on Morans Creek in 2006 and recorded data up until 2009. The gauge is located adjacent to monitoring point SW003, as shown in Figure 4.1. Centennial Mandalong has replaced this flow gauge in August 2017 to continue monitoring flows within Morans Creek during longwall development and extraction.

Field flow monitoring on various creeks is undertaken as part of visual inspections during water quality sampling. Visual flow monitoring is undertaken on Wyee Creek, Morans Creek, Mannering Creek and Buttonderry Creek on a quarterly basis, and will occur for two years prior to mining.

4.5 Stream health monitoring

4.5.1 Geomorphic condition and watercourse stability

4.5.1.1 MMAS

Geomorphic condition and watercourse stability monitoring is undertaken for each reach above longwall panels to define the pre-mining channel condition and subsidence induced changes to stream characteristics. The monitoring locations for assessing watercourse stability are presented in Figure 4.3. The coordinates of monitoring locations are provided in Appendix D.

Visual monitoring of watercourses is carried out by suitably qualified professionals and is undertaken:

- Immediately prior to longwall extraction.
- Immediately after a longwall extraction and before the following longwall extraction.
- Six to 12 months following longwall extraction.

The assessment methodology consists of surveying subsidence along waterways to measure vertical subsidence movement to derive longitudinal grades. Stream condition surveys are undertaken at photographic monitoring points. These monitoring points are located in areas of highest potential differential subsidence, typically above the centre of the longwall panels and intersection with creek beds, to monitor the effects of subsidence on stream condition and changes in stream grade. Observations on the stream's condition recorded at these points include stream geomorphology (including subsidence, scouring and ponding), bank height and width, bed condition (where observable), erosion, channel flood brake out, changes to vegetation communities and subsidence deformation.

Pre-mining surveys are conducted prior to the commencement of each longwall panel.

The stream condition and watercourse stability surveys are undertaken biannually or following a flood event.

Visual and photographic monitoring is undertaken six monthly at the locations presented in Figure 4.3.

As described in Section 4.8, the biannual Mandalong Mine flood path inspections aim to identify the impacts which may trigger mitigation. Annual flood path condition reports are prepared with the key findings reported in the Annual Review for Mandalong Mine.

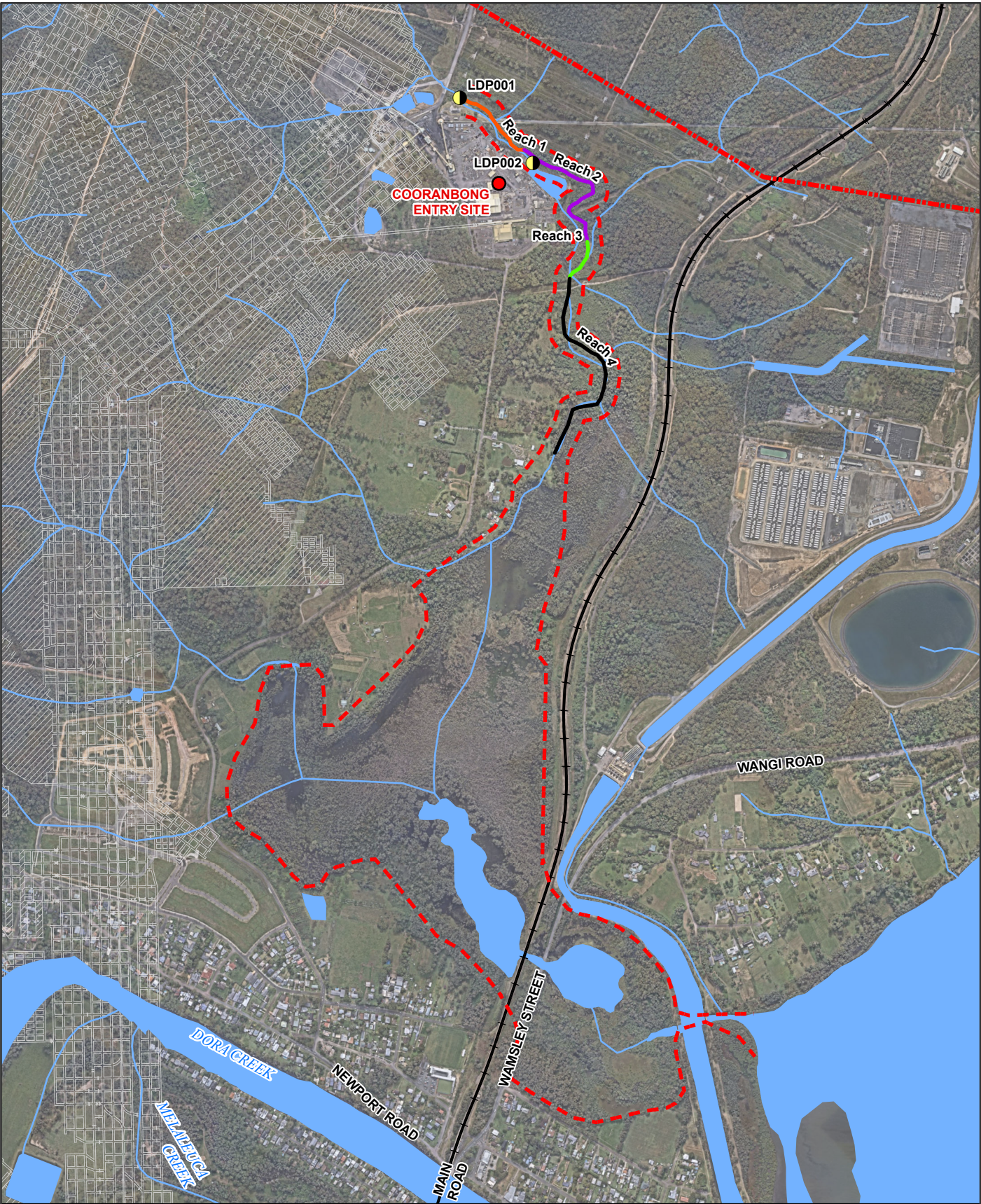
4.5.1.2 CES

Geomorphic condition and watercourse stability for CES is to be assessed in the unnamed creek downstream of discharges from Cooranbong LDP001 and LDP002.

Monitoring requirements for geomorphic condition and watercourse stability are outlined in Table 4.7. Watercourse monitoring extents are shown in Figure 4.4.

Table 4.7 Geomorphic and watercourse stability monitoring for CES

Point	Discharge frequency	Monitoring requirement	Monitored features	Length of monitoring from discharge point (m)
LDP001	Daily	Following increased discharges greater than 5 ML/day, monthly monitoring for a period of six months then review.	Photographs, visual inspections aided by indicators. Cross section survey upstream of service road (CCSR1).	750 (to CCSR1)
LDP002	Emergency	Following discharge event.	Photographs, visual inspection aided by indicator.	350 (to CCSR1)



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

Licensed Discharge Point

Site Locations

Mandalong Mine Holding Boundary

Reach

Reach 1

Reach 2

Reach 3

Reach 4

Approximate Edge of Riparian Zone

Existing Rail

Watercourse

Watercourse area

LOCATION

Mandalong

SEAM

N/A

DRAWN

BK

CHECKED

ZL

APPROVED

SG

SCALE

Refer to scalebar

Mandalong Mine
Water Management Plan
Cooranbong Entry Site - Watercourse
stability monitoring locations

CENTENNIAL

DATE 20/05/2025

Figure 4.4

4.5.2 Aquatic ecology monitoring

4.5.2.1 MMAS and MSSS

There are no current requirements for aquatic ecology monitoring at MMAS.

Aquatic ecology monitoring downstream of the discharges from MSSS was undertaken until 2021. Following spring 2021 monitoring it was determined that there was no need for ongoing monitoring in relation to MSSS Sediment Dam (GHD 2022).

Aquatic ecology monitoring is undertaken in waterways overlying longwalls 39 to 43 and longwalls 57-60 (i.e. waterways potentially influenced by mining through subsidence) as presented in the annual reviews. The details of this aquatic ecology monitoring as part of subsidence monitoring are provided in the Mandalong Longwall 39-43 Extraction Plan Biodiversity Management Plan (RPS 2024, 2023).

4.5.2.2 CES

Aquatic ecology monitoring has occurred within waterways downstream of CES discharges, biannually (autumn and spring) since 2012. Over time, the CES monitoring locations have been rationalised to the five sites outlined in *Emergency / overflow discharge point only

Table 4.6 and Figure 4.5. This includes one, geographically relevant, reference monitoring location (WMP18) that is sampled as part of the Awaba Seep aquatic ecology monitoring program. All monitoring sites are located in a lowland coastal catchment.

Table 4.8 Aquatic ecology monitoring locations (including sites from the Awaba Seep aquatic ecology monitoring)

Site	Description	Site type	GDA2020 MGA Zone 56		Altitude (m)
			X coordinate	Y coordinate	
WMP27	Located on Kilaben Creek in the bushland to the north east of CES. Geographically relevant reference stream.	Reference	363216	6343864	39
LDP001	Located immediately downstream of CES licensed discharge point (LDP001).	Impact	360417	6340868	8
CCSR1	Located on the unnamed creek at Simpson Road, downstream of the confluence of the unnamed creek tributaries.	Impact	359986	6339755	1
SW016	Located in the headwaters north-west of Muddy Lake.	Recovery	363216	6343864	1
Awaba Seep monitoring locations included in the CES assessment					
WMP18	Located on Lords Creek. Geographically relevant reference stream.	Reference	360076	6346883	30

The aquatic ecology monitoring methodology includes:

- Sampling, sorting and identification of macroinvertebrates collected from edge habitat in accordance with the Australian Rivers Assessment System (AUSRIVAS) protocols (Turak et al. 2004).
- Assessment of the condition of the aquatic habitat, including instream and riparian vegetation, using modified NSW AUSRIVAS field sheets and riparian, channel and environmental (RCE) inventory (Peterson 1992).
- Measurement of dissolved oxygen, EC, pH, turbidity and temperature.
- Collection of surface water and sediment grab samples for water and sediment quality analysis.
- Calculation of macroinvertebrate metrics (including taxa richness, EPT richness and SIGNAL-2) and multivariate analyses of macroinvertebrate data (including Cluster analysis, ANOSIM or alternative) to compare community health and assemblage between reference and impact / recovery sites

Reporting annually by a suitably qualified professional.

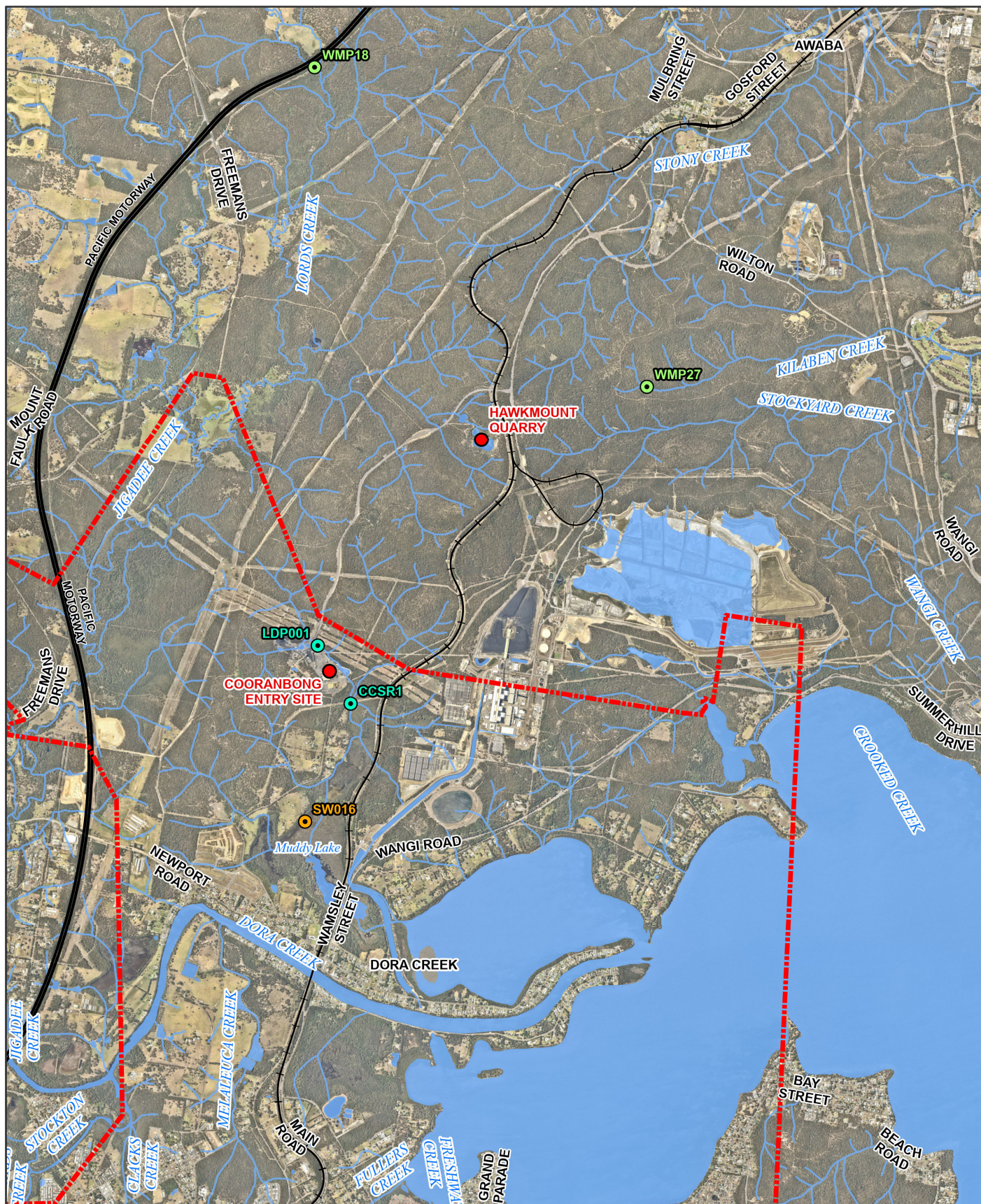
Some changes to the monitoring locations have been made over time to adapt to altered influences / conditions. Historical sites that have been removed from the monitoring program since Revision 6 of the WMP (dated 20/12/2022) are detailed in Table 4.9. These monitoring locations are not shown in Figure 4.5.

The remaining monitoring locations, as detailed in Table 4.8, allow for a robust assessment of potential influences of the CES discharge on the aquatic environment, comprising reference, impact and recovery sites.

Table 4.9 Historical aquatic ecology monitoring locations (sites no longer assessed for CES)

Site	Description	Site type	Reason for removal
SW017	Located on Muddy Lake, east of Wangi Road	Recovery	This site was removed in 2022 due to the severe outbreak of salvinia weed (<i>Salvinia molesta</i>) which degraded the habitat quality in the eastern section of Muddy Lake around Wangi Road. Due to the poor habitat quality (including very low dissolved oxygen), monitoring of macroinvertebrate communities at SW017 is no longer useful for determining impacts from CES discharge.
SP12	Located on a tributary of the unnamed creek, downstream of the Awaba Seep	Awaba Seep impact site	SP12 was historically included in the CES aquatic ecology assessment due to the dominating influence of the Awaba Seep on the water quality of unnamed creek. As the Awaba Seep water quality has improved over time, CES is now the dominant influence on the water quality of the unnamed creek and it's no longer useful to include SP12 in the CES aquatic ecology assessment. SP12 is still monitored under the Awaba Seep monitoring program as detailed in the Newstan Complex WMP, and reported separately.
SW014	Located in the headwaters of the unnamed creek,	Reference	Over time, the water chemistry at SW014 has changed (including increased salinity) and this SW014 is no longer a suitable reference site for

Site	Description	Site type	Reason for removal
	upgradient of Awaba Seep and upstream of CES LDP001		assessing the influence of CES LDP001 discharge.



1:50,000 for A4 021042084012601680 Metres Map Projection: Transverse Mercator Horizontal Datum: GDA2020 Grid: GDA2020 MGA Zone 56		N	LEGEND Site Locations Mandalong Mine Holding Boundary Reference Impact Downstream Recovery Existing Rail Watercourse Watercourse area
© 2026. Whilst every care has been taken to prepare this map, GHD, LPI and Geoscience Australia make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.		LOCATIONMandalong SEAMN/A DRAWNBK CHECKEDZL APPROVEDZL SCALERefer to scalebar	Mandalong Mine Water Management Plan Aquatic ecology monitoring locations
			DATE1/04/2026 Figure 4.5

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© Centennial: Boundary/mine workings; Spatial Services NSW: NSW Foundational Spatial Data Framework datasets; Nearmap: Imagery (Date extracted: 1/04/2026)

4.5.2.3 Green and Golden Bell Frog research program

Terrestrial ecology surveys undertaken in response to submissions received on the EIS for the NCLP (GSSE, 2013) identified a population of Green and Golden Bell Frogs (*Litoria aurea*) inhabiting Muddy Lake. As identified in Section 1.3.3, ongoing monitoring is required to demonstrate that there is no decline in the population during the period of approval.

The methods employed for monitoring the Muddy Lake Green and Golden Bell Frog population comprise four years of single survey monitoring followed by one season of detailed monitoring over multiple sessions (see GHD 2021). Surveys are undertaken in summer.

The single survey monitoring comprises surveys over three nights with the following tasks:

- Habitat assessment
- Visual encounter surveys
- Collection of environmental data (e.g. salinity, pH and weather data)

Detailed monitoring comprises two rounds of surveys over five nights with the following tasks:

- Habitat assessment
- Area-based surveys
- PIT tagging and genetic sampling
- Data analysis
- Collection of environmental data
- Assessment of Chytrid fungus

Reporting is undertaken annually after monitoring, including the following:

- The size and spatial extent of the population
- The age structure and sex ratios of the population
- Changes to the population since the previous sampling event
- Genetic variation in the population (detailed surveys only)
- Habitat condition

4.6 Groundwater monitoring

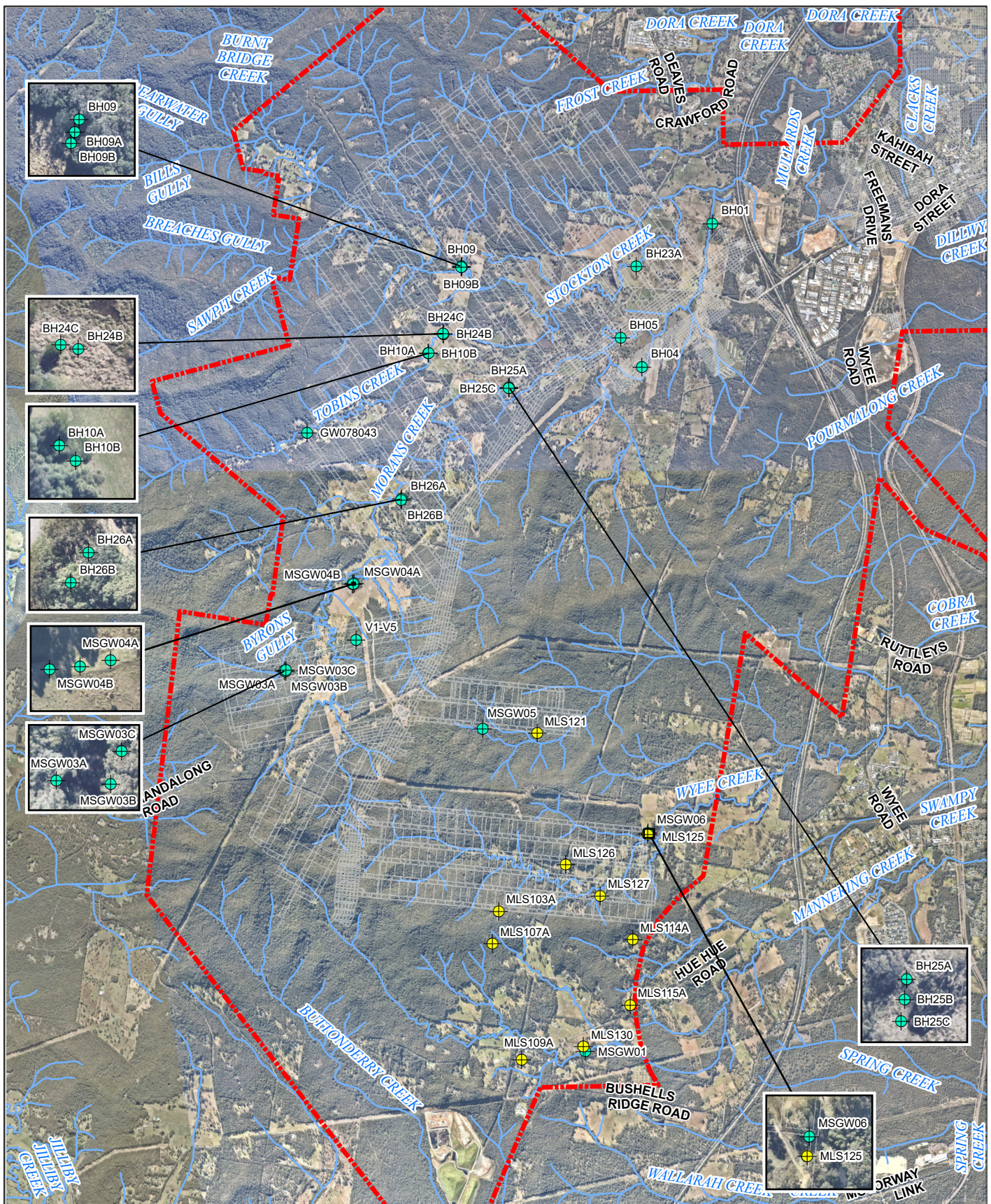
4.6.1 Groundwater levels and quality

The groundwater monitoring network at Mandalong Mine has been progressively established since 1997 and includes monitoring bores installed in alluvial and fractured and porous rock groundwater sources. The groundwater monitoring network also includes monitoring of landholder bore GW078043. The bores are monitored quarterly for groundwater levels and quality (EC and pH) while some bores contain water level loggers for continuous monitoring of groundwater levels.

Monitoring bores in the Mandalong South area are also monitored for major ions and dissolved metals (aluminium, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, and zinc).

Monitoring bore locations are shown in Figure 4.6. Details of the groundwater bores at Mandalong Mine are summarised in Table 4.10. Additional monitoring bores will be installed as part of future extraction plans in the vicinity of GDEs where depth of cover is less than 200 m.

There are a number of bores at which monitoring has ceased. These bores will be decommissioned in accordance with *Minimum Construction Requirements for Water Bores in Australia* (ADIA 2012). The decommissioned boreholes will be fully grouted from the bottom of the hole to the surface to avoid cross contamination between the surface and the screened strata.



1:60,000 for A4 0 255 510 1,020 1,530 2,040 Meters Map Projection: Universal Transverse Mercator Horizontal Datum: Geodetic Datum of Australia 1994 Grid: Map Grid of Australia, Zone 56		LEGEND Mandalong Mine Holding Boundary ● Groundwater Monitoring Bore ● VWP ~ Watercourse	
© 2025. Whilst every care has been taken to prepare this map, GHD, Centennial and LPI make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.		LOCATION Mandalong SEAM West Wallarah DRAWN EI CHECKED AH APPROVED ZL SCALE Refer to scalebar	
Mandalong Mine Water Management Plan Mandalong Mine - Groundwater Monitoring Locations		CENTENNIAL DATE 25/08/2025 Figure 4.6	

GIS File Name: N:\AU\Newcastle\Projects\22\0105001\GIS\Maps\Deliverables\Hunter\Mandalong\12649045\Mandalong_WMP_AI\Mandalong_WMP_0.aprx

© Centennial: Boundary, Mine Plan, Monitoring; 2016. LPI: DTDB, 2012/2015. Nearmap: Imagery (Date extracted:25/08/2025)

Table 4.10 Groundwater monitoring bore details

Bore	Monitoring period	Lithology	Type	Longwall area (LW)	GDA2020 MGA Zone 56	
					X coordinate	Y coordinate
BH01	Aug 1997 – present	Alluvium	bore	–	356129	6335230
BH04	Aug 1997 – present	Alluvium	bore	–	355329	6333605
BH05	Aug 1997 – present	Alluvium	bore	–	355088	6333933
BH09	Aug 1997 – present	Alluvium	bore	LW12	353285	6334744
BH09A	Jun 2010 – present	Mudstone/sandstone	bore	LW12	353282	6334738
BH09B	July 2010 – present	Mudstone/sandstone	bore	LW12	353281	6334733
BH10A	Jun 2010 – present	Mudstone/sandstone	bore	LW16	352905	6333761
BH10B	Jun 2010 – present	Sandstone	bore	LW16	352909	6333757
BH23A	Jan 2006 – present	Mudstone	bore	LW4/5	355267	6334745
BH24B	Jun 2010 – present	Sandstone	bore	LW15	353078	6333978
BH24C	Jun 2010 – present	Mudstone/sandstone	bore	LW15	353072	6333979
BH25A	Jun 2010 – present	Alluvium	bore	LW14	353822	6333371
BH25B	Jun 2010 – present	Sandstone	bore	LW14	353821	6333365
BH25C	Jun 2010 – present	Mudstone/sandstone	bore	LW14	353820	6333359
BH26A	Oct 2011 - present	Alluvium	bore	LW22	352603	6332106
BH26B	Oct 2011 - present	Sandstone	bore	LW22	352596	6332095

Bore	Monitoring period	Lithology	Type	Longwall area (LW)	GDA2020 MGA Zone 56	
					X coordinate	Y coordinate
MSGW01 ¹	September 2011 – present	Mannering Creek alluvium	bore	–	354686	6325840
MSGW03A ¹	September 2011 – present	Morans Creek alluvium	bore	LW26	351273	6330153
MSGW03B ¹	September 2011 – present	Sandstone (Tuggerah)	bore	LW26	351288	6330152
MSGW03C ¹	September 2011 – present	Conglomerate (Munmorah)	bore	LW26	351291	6330161
MSGW04A ¹	September 2011 – present	Morans Creek alluvium	bore	–	352065	6331146
MSGW04B ¹	September 2011 – present	Sandstone (Tuggerah)	bore	–	352045	6331143
MSGW04C ¹	September 2011 – present	Conglomerate (Munmorah)	bore	–	352055	6331144
GW078043	July 2017 – present	Sandstone/Conglomerate	bore	LW24A	351386	6332875
MSGW05 ¹	February 2023 – present	Alluvium	bore	LW58	353522	6329498
MSGW06	April 2024 – present	Alluvium	bore	LW39	355398	6328318
MLS121	August 2023 – present	Sandstone/Shale	VWP	-	354141	6329450
MLS125	March 2024 – present	Unnamed Triassic overburden Conglomerate (Munmorah)	VWP	LW39	355396	6328297

Bore	Monitoring period	Lithology	Type	Longwall area (LW)	GDA2020 MGA Zone 56	
					X coordinate	Y coordinate
MLS127	May 2024 – present	Conglomerate (Munmorah)	VWP	LW42	354857	6327605
MLS103A	July 2024 - present	Unnamed Triassic overburden Conglomerate (Munmorah)	VWP	LW43	353705	6327430
MLS107A	September 2024 - present	Unnamed Triassic overburden Conglomerate (Munmorah)	VWP	LW45	353635	6327061
MLS114A	May 2024 - present	Unnamed Triassic overburden Conglomerate (Munmorah)	VWP	LW44	355226	6327110
MLS126	October 2024 – present	Unnamed Triassic overburden Conglomerate (Munmorah)	VWP	LW41	354463	6327958
MLS109A	May 2025 – present	Unnamed Triassic overburden Conglomerate (Munmorah)	VWP	LW51 and LW52	353966	6325743
MLS115A	May 2025 – present	Unnamed Triassic overburden Conglomerate (Munmorah)	VWP	LW48	355197	6326368
MLS130	March 2025 – present	Unnamed Triassic overburden Conglomerate (Munmorah)	VWP	LW50 and LW51	354667	6325894

1. Mandalong South monitoring bore sampled for full water quality suite.

4.6.2 Underground water transfers

Daily monitoring of the following underground water transfers is undertaken:

- Supply of potable water to mining equipment within the Mandalong workings.
- Transfer of dirty mine water from the 69 c/t area to the Cooranbong underground storage.
- Transfer of water from the 151 c/t area to the Cooranbong underground storage area.
- Transfer of surface water from Sediment Dams 1 and 2 at CES to the Cooranbong underground storage.
- Transfer of surface water from the 5 ML Dam at CES to the Cooranbong underground storage.
- Transfer of surface water from the GPT at CES (also referred to as Coal Handling Plant Settlement Tank) to the Cooranbong underground storage.
- Extraction of water from the Cooranbong underground storage area via the Cooranbong bore and transfer to the Borehole Dam at CES.
- Transfer of surface water from MMAS Sediment Dam to the Cooranbong Underground Storage.
- Transfer of surface water from the MSSS 10 ML Tank to the Mandalong workings.

In addition, monitoring of water levels within the Cooranbong underground storage area is undertaken as required.

4.7 Tunnel erosion

Areas of very high to extreme risk of erodibility have been identified within the Gorokan soil landscape which is present within the southern portion of the mining area. GSS (2013) identified both the top soil and subsoil within the Gorokan landscape as being sodic (i.e. high in sodium) with a poor structure. As the soil profile deepens, the sodic nature increases (based on exchangeable sodium percentage) (GSS 2013).

The field survey of existing and high risk areas of active tunnel erosion is to be undertaken prior to the commencement of any surface disturbance activities or predicted subsidence. This will be managed as part of each extraction plan WMP.

The remediation of areas of tunnel erosion are to occur where the extent of severity of the occurrence is increased. Remediation activities within sodic soil areas should consider:

- Removal of sodic soils and replace with appropriate top soil.
- Addition of ameliorants such as gypsum.
- Using a geotextile to protect the soil and backfill over the affected area.
- Backfill impacted areas with placed rock and geotextile underlay.
- Locally change the configuration of disturbance activities to avoid area following remediation of any effected areas.

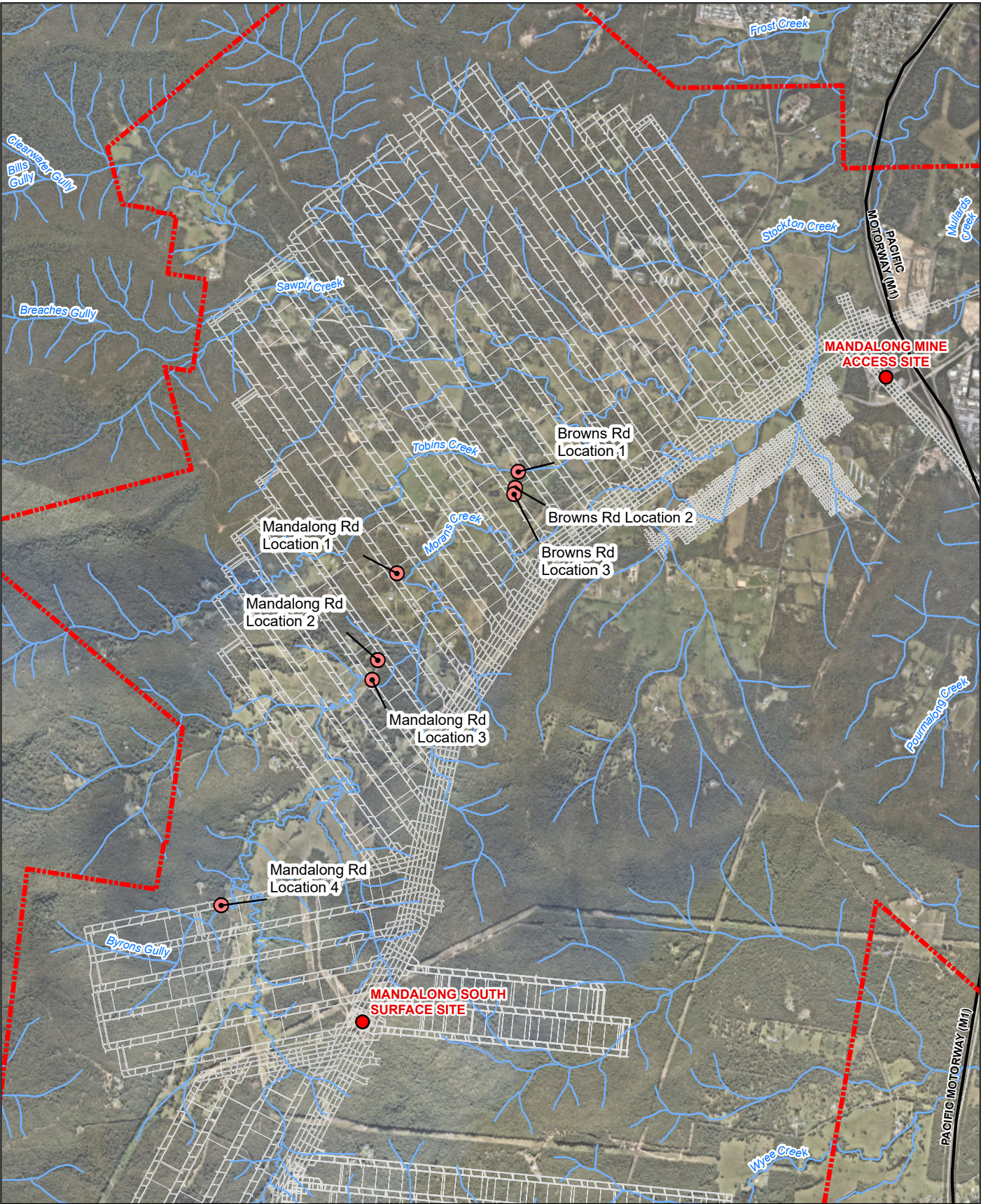
4.8 Flooding and flood monitoring programs

The condition of major flood paths is inspected every six months or following a flood event. The flood paths of the Mandalong Valley were identified *Flood Study Mandalong Coal Mine* (Hughes Trueman 2004) and more recently in the *Surface Water Assessment: Mandalong Southern Extension Project* (Umwelt 2013). The flood study encompassed the Stockton Creek and Morans Creek catchments (and their associated tributaries and floodplains) upstream of the M1 Motorway.

Monitoring of flooding occurs following rainfall events that exceed 100 mm in 24 hours, which is equivalent to the 1% AEP, 24 hour design storm event. Monitoring includes photographic records of flood depth indicators (including estimated flood levels from debris marks) at the locations presented in Figure 4.7 as well as recording of road closures in the area and any anecdotal evidence from community consultation. Given the file size of flood assessment reports (photographs and figures), baseline data is not presented in section 5 for flood monitoring results. The coordinates of flood monitoring locations are provided in Table 4.11.

Table 4.11 Flood monitoring locations

Location	Easting (MGA94z56)	Northing (MGA94z56)
Browns Road Location 1	353796	6333831
Browns Road Location 2	353772	6333707
Browns Road Location 3	353763	6333658
Mandalong Road Location 1	352879	6333062
Mandalong Road Location 2	352734	6332405
Mandalong Road Location 3	352692	6332256
Mandalong Road Location 4	351551	6330555



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0 150 300 600 900 1200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

LEGEND

- Site Locations
- Existing and planned mine workings (currently approved Extraction Plans)
- Freeway
- Watercourse
- Mandalong Mine Holding Boundary
- Existing flood monitoring location

LOCATION	Mandalong
SEAM	N/A
DRAWN	BK
CHECKED	ZL
APPROVED	SG
SCALE	Refer to scalebar

Mandalong Mine
Water Management Plan
Mandalong Mine - Flood
monitoring locations

CENTENNIAL

DATE 21/05/2025

Figure 4.7

5. Baseline data

5.1 Surface water monitoring

5.1.1 Surface water quality

Baseline surface water quality data for this WMP is presented for those locations which were used to derive watercourse quality trigger values in Section 6.1.1. Appendix E presents the baseline data for water quality within Wyee Creek, Mannering Creek, Morans Creek and the unnamed creek. No baseline data is presented for Stockton Creek as mining within the catchment ceased in 2019. Table 5.1 presents the extent of baseline data recorded within these watercourse catchments.

Where the analytical result was below the limit of reporting (LOR) for a particular parameter, then the detection limit was used. Monitoring points SW001 and SW002 on Stockton Creek are influenced by tidal ingress from Lake Macquarie.

Mannering Creek (SWMP01 and SWMP02) and Buttonderry Creek (SWMP08) watercourse quality trigger values will be developed prior to mining commencing in these catchments.

Table 5.1 Period of recorded water quality data

Site	Watercourse	Period from	Period to	Rationale
SW009-SW010	Pourmalong Creek	March 2011	June 2021	Reference data (currently no plan to undermine)
SWMP03–SWMP05	Wyee Creek	June 2011	December 2023	Prior to undermining
SWMP06–SWMP07	Morans Creek	June 2011	June 2016	Prior to discharge from MSSS or undermining
SW014	Unnamed creek (CES)	April 2012	July 2015	Prior to Awaba Seepage influence

5.1.2 Surface water flow

5.1.2.1 Morans Creek

Figure 5.1 and Figure 5.2 presents the level and flow rate recorded by the flow gauge on Morans Creek since it was installed in August 2017. Morans Creek is ephemeral, experiencing periods of no or low flows. Periods of high flows recorded at the Morans Creek gauge are typically less than 30.0 m/s, however, have been recorded up to approximately 69.0 m³/s. The level drop during mid-2020 is likely due to the gauge being reinstalled at a lower elevation in the creek.

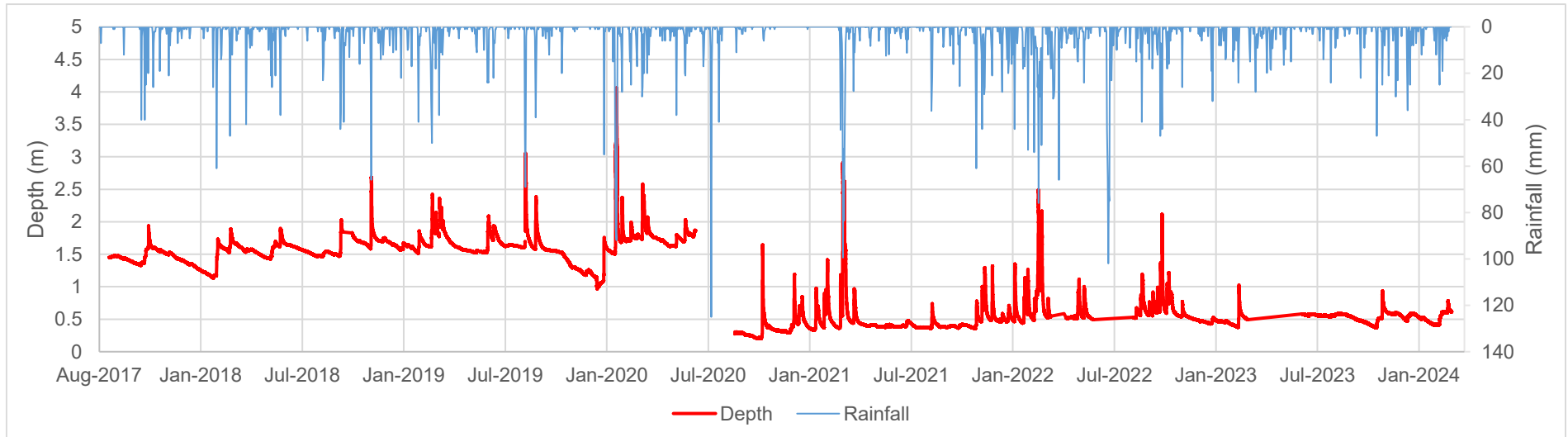


Figure 5.1 Level gauging within Morans Creek from October 2017 to March 2024

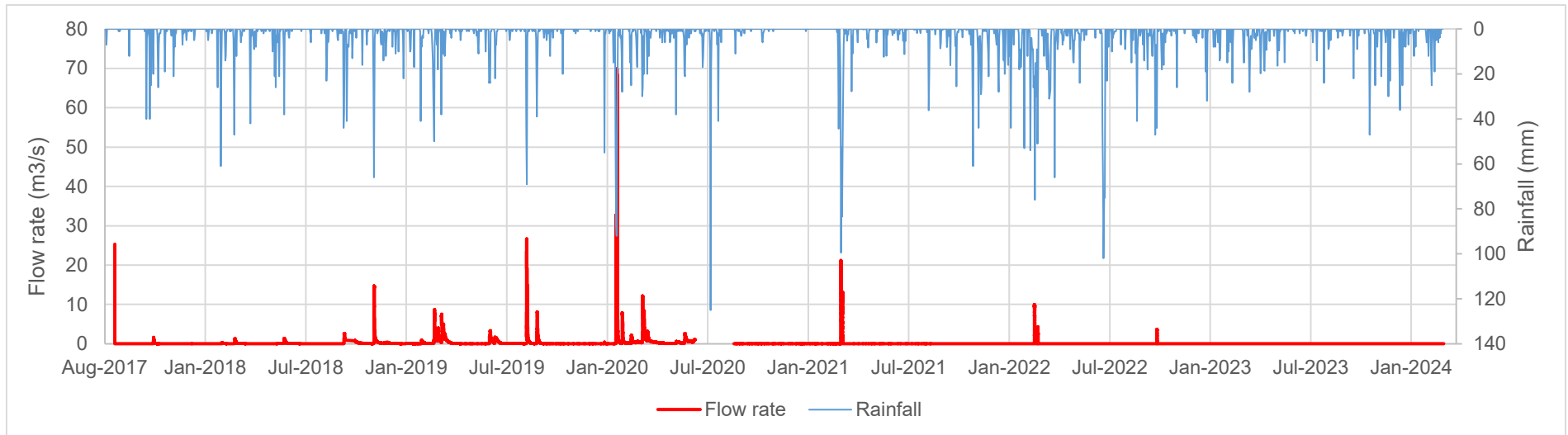


Figure 5.2 Flow gauging within Morans Creek from October 2017 to March 2024

5.1.2.2 Wyee Creek

No continuous flow monitoring baseline data exists for Wyee Creek and no level gauge monitoring is undertaken by WaterNSW. As reported by Umwelt (2013), one historical streamflow gauge was located on Wyee Creek (ID211001), which was operational between 1958 and 1980, however has a limited available data set and is not considered useful.

Instantaneous flow monitoring is undertaken when flow is observed in Wyee Creek during surface water sampling events at SWMP03, SWMP04 and SWMP05. However, field observations indicate that flow is generally “still” or “very slow” with no recorded flow values. The baseline monitoring period in Wyee Creek (prior to mining) is summarised in Table 5.2.

Table 5.2 Summary of flow monitoring – Wyee Creek

Monitoring Location	Number of Monitoring events	Baseline monitoring period	
		From	To
SWMP03	25	8/12/2017	May 2023
SWMP04	25	8/12/2017	May 2023
SWMP05	25	8/12/2017	May 2023

5.1.2.3 Muddy Lake

Muddy Lake was assessed for hydrology and hydraulics as part of the EIS for the NCLP; however, the assessment was limited by the data available at the time. Muddy Lake was surveyed in May 2016. The survey considered the water level and depth of the waterbody which was combined with LIDAR data of the surrounding area to establish an understanding of volumetric capacity of the area.

Water levels were field surveyed at two key points around Muddy Lake which included the aqueduct and Wangi Wangi Road. The period of water level survey was from 3 February through to 31 March 2016. Monitoring over this period was undertaken at least twice a day with water level, rainfall and discharge volume recorded. This was undertaken to develop the following outcomes:

- To determine the influence of discharge from Cooranbong LDP001 on water levels within Muddy Lake.
- To determine the influence on water level within Muddy Lake from Lake Eraring (tidal).
- To determine the likely water level within Muddy Lake as a result of rainfall influence.

The volume estimate was based on simple geometry. The field survey of Muddy Lake enabled a three-dimensional surface to be produced and volume estimated. For the purpose of the volume estimate, Muddy Lake was split into two cells that were dissected by Wangi Wangi Road. Developing an understanding of the lake’s geometry, including volume, enabled a correlation between water levels in the lake and storage volume to be established. The data was input to the existing water balance model developed for CES and run over the Project timeframe to identify key hydrologic outcomes for Muddy Lake that can assist in management of both existing habitats and discharges from CES

The theoretical volume versus water level relationship of Muddy Lake, is shown in where east and west are based on the alignment of Wangi Wangi Road.

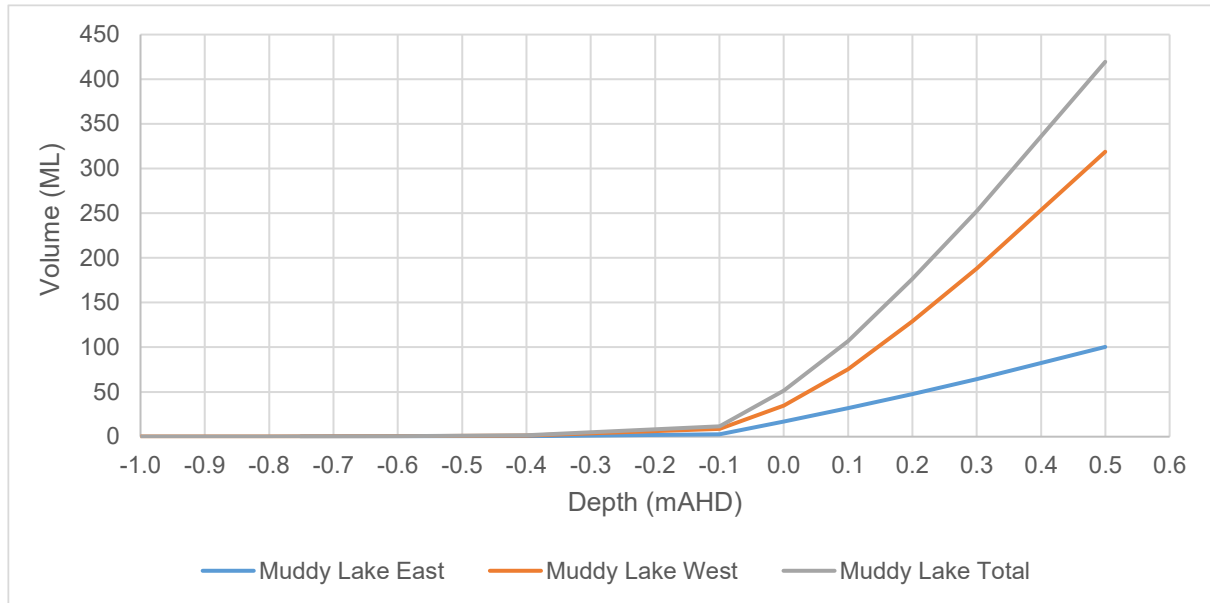


Figure 5.3 Relationship of water level to volume in Muddy Lake

The results of water level survey have been presented in Figure 5.4.

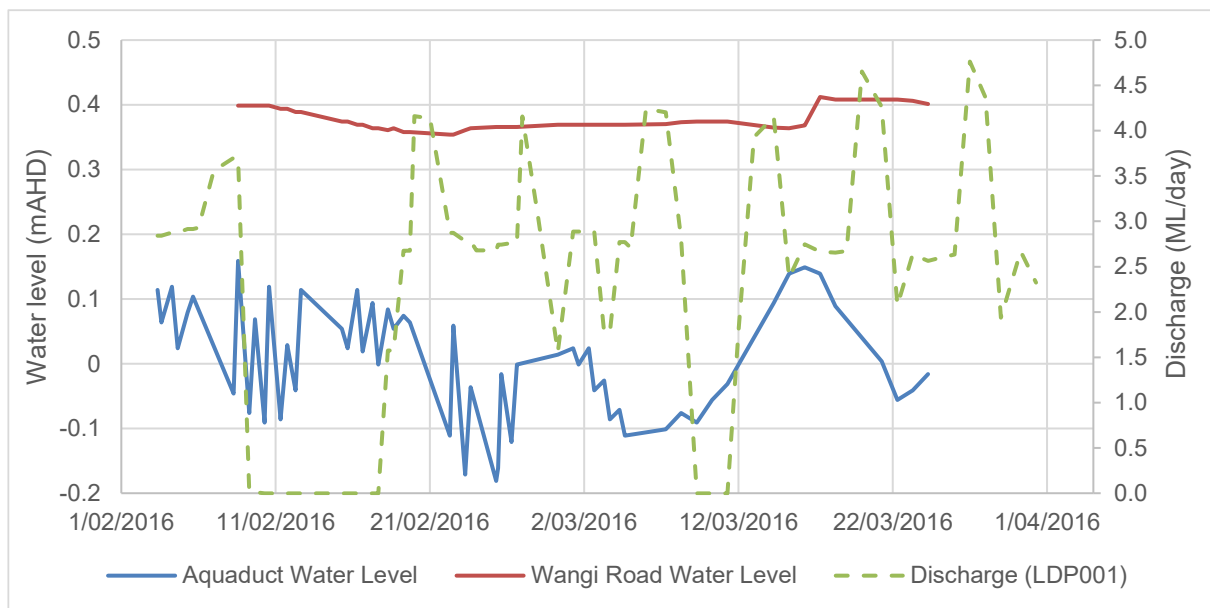


Figure 5.4 Muddy Lake water level survey results compared with Cooranbong LDP001 discharges

The results indicate that water level variability within Muddy Lake depends upon the side of Wangi Wangi Road considered. Typically, a water level of approximately 0.4 m Australian Height Datum (AHD) is likely to occur within Muddy Lake to the west of Wangi Wangi Road whereas a more variable waterbody exists to the east of the Wangi Wangi Road.

5.2 Groundwater

5.2.1 Groundwater levels and quality

Appendix F presents the baseline groundwater level and quality data for monitoring bores. Data have been considered from August 1997 to December 2020.

As discussed in the Mandalong Southern Extension Project response to submissions, there was variability in groundwater EC at a number of monitoring bores at Mandalong Mine. As part of the response to submissions process it was identified that this variability in EC was attributable to sampling of bores by bailing. Since January 2015, monitoring bores at Mandalong Mine have been sampled using low flow techniques where possible (i.e. peristaltic pump or Micro-purge pump). Additionally, bores that were identified as being regularly inundated with surface water have been purged prior to sampling to remove any influence of surface water on monitoring results. Following the update of groundwater monitoring methodology, variability in observed EC has reduced.

HARTT (Hydrograph Analysis: Rainfall and Time Trends) analysis was undertaken for each alluvial groundwater level dataset. The HARTT analysis was used to establish the relationship between groundwater levels and rainfall and detect underlying trends in groundwater level that are independent of rainfall.

A cumulative rainfall departure (CRD) curve is also presented with the groundwater level hydrographs. The CRD curve depicts the monthly accumulation of the difference between the observed monthly rainfall and the long-term average monthly rainfall.

5.2.2 Underground water levels

Water levels in the Cooranbong underground storage area have been monitored by Centennial Mandalong since December 2011. The measured water levels (corrected to AHD) between December 2011 and November 2023 are shown in Figure 5.5. Water levels have been generally decreasing since 2014. During 2020, the dewatering pump failed which resulted in a substantial increase in water levels within the Cooranbong underground storage area. The borehole pump was replaced in 2021, and dewatering activities resumed. Water levels have subsequently begun to decrease.

Based on an assessment of the floor contours of the Cooranbong workings, the underground water storage area has a capacity of approximately 4200 ML (assuming void height of 3 m and void ratio of 0.4). Once the underground water storage reaches full capacity, the water spills to the south back towards the active Mandalong workings.

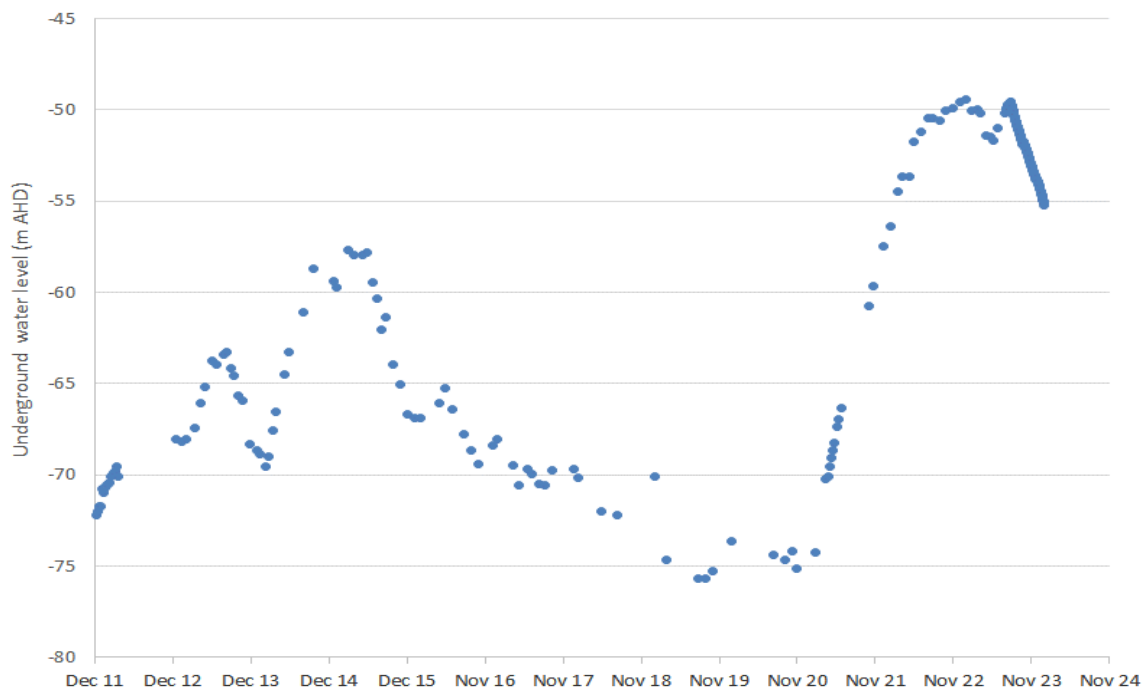


Figure 5.5 Cooranbong underground storage water levels

5.3 Stream health

5.3.1 Cooranbong Entry Site Aquatic Ecology

Aquatic ecology monitoring at CES has occurred biannually since Winter 2012. As described in Section 4.5.2, the locations have been categorised into reference sites (not influenced by mine water discharge), on-site impact sites (downstream of CES discharge) and downstream recovery sites. All sites are considered to be freshwater, however Muddy Lake exhibits estuarine influences with salinity varying spatially in the lower portion of the lake (east of Wangi Wangi Road) due to rainfall and tides. The baseline aquatic ecology data collected at CES sites prior to the approval of the NCLP include:

- Winter 2012.
- Spring 2013.
- Autumn 2014.
- Spring 2014.
- Autumn 2015.

Key outcomes from these investigations included:

- A number of water quality parameter concentrations, namely EC, potassium, sodium, chloride, alkalinity, sulfate, calcium and magnesium were elevated at impact and recovery sites, indicating an influence of mine water discharge from CES LDP001. However, the concentrations were generally similar to previous monitoring rounds indicating that there is no increasing impact at this time due to mine discharge.
- Some differences in freshwater macroinvertebrate community composition were observed between reference, impact and recovery sites however most of these changes were attributable to physical differences between the sites or aquatic habitat differences.
- The health of the freshwater macroinvertebrate community at impact sites was comparable to reference sites based on diversity, numbers of sensitive taxa and AUSRIVAS results. Therefore, water quality effects from the discharge did not appear to be negatively impacting the macroinvertebrate community.
- The results of the toxicity testing of Cooranbong LDP001 discharge indicate no acute toxicity and slight chronic toxicity to the test species, possibly due to elevated dissolved nickel concentration or EC.

Further details regarding the outcomes of subsequent aquatic ecology monitoring at CES (since the approval of the NCLP) can be found in the seasonal monitoring reports prepared following each monitoring event undertaken.

5.3.2 Geomorphic condition and waterway stability

5.3.2.1 *Mandalong Mine Access Site*

Discharges from LDP003 at MMAS are unlikely to change the geomorphic condition or stability of downstream waterways. Discharges from the MMAS are infrequent, low volume and are regulated through energy dissipation (riprap) at the outlet to reduce velocity and scour. As such, the management of discharges from the MMAS, with regard to the monitoring, mitigation and evaluation of potential impacts on geomorphic condition and waterway stability, is not considered further in this WMP.

5.3.2.2 Mandalong South Surface Site

Due to the design of the water management system at the MSSS, it is not expected that discharges during emergency situations will have an adverse impact on the receiving waterway. The proposed location of the MSSS is positioned on a ridgeline in the upper reaches of the Morans Creek catchment, and hence the occupied catchment area is very small and the change in surface runoff is likely to be negligible compared with existing flows in Morans Creek (GSS, 2013).

As such the management of discharges from the MSSS, with regard to the monitoring, mitigation and evaluation of potential impacts on geomorphic condition and waterway stability, is not required.

5.3.2.3 Cooranbong Entry Site

Water discharged via Cooranbong LDP001 enters an unnamed creek and flows into Muddy Lake before reaching Lake Eraring (part of Lake Macquarie) via an aqueduct that connects the two lakes. The geomorphology of these connected features is described in the following sub-sections. Unnamed creek Flow within the unnamed creek downstream of Cooranbong LDP001 discharge site is near permanent during discharge.

GHD completed a water quality assessment of CES in April 2016. As part of this process the baseline condition of the unnamed creek downstream of LDP001 was assessed. Four distinct reaches were identified over this extent. These are described in Table 5.3 and presented in Figure 4.4.

Table 5.3 Geomorphic condition of the unnamed creek downstream of Cooranbong LDP001

Reach	Description
1	At the discharge point, the waterway exhibits a constructed earthen channel, in the order of 5 m wide, with an invert well-vegetated with macrophytes. Banks are graded, stable and consist of cohesive, fine-grained sediments.
2	This reach exhibits a continuous, well-defined channel, 1 m to 5 m wide and 1 m to 2 m deep. The channel displays pools separated by short riffle zones. Velocities under low flow conditions within the pools are negligible. Banks are generally vegetated and consist of cohesive fine-grained sediments. No evidence of any existing bed and bank instabilities were observed.
3	The waterway in this reach has been dammed at the downstream extent. As a result, this reach consists of a ponded environment colonised with macrophytes and melaleuca species on the verges.
4	This reach exhibits a continuous well-defined channel 5 m to 10 m wide exhibiting permanently ponded water 1 m to 2 m deep. Banks are generally graded and consist of cohesive, fine-grained sediments colonised with emergent aquatic vegetation species on the verges. The channel above the normal water level has limited capacity such that higher flows will readily inundate the adjacent swampy floodplains.

6. Response plans

6.1 Triggers

Triggers for watercourse quality, groundwater quality and level, underground water management, and discharge quality and volume (in accordance with EPL 365) are documented within subsequent subsections. The purpose of these triggers is to provide a measurable indicator of when conditions within receiving surface waters and groundwater deviate from expected conditions, or exceed the concentration limits specified by EPL 365. These triggers therefore form the basis of the performance criteria and TARPs as outlined in Appendix G.

6.1.1 Surface water quality

Site-specific guideline values (SSGVs) have been determined for the assessment of surface water quality for receiving waterways potentially influenced by Mandalong operations, including licensed discharge points. The SSGVs have been developed in accordance with the methods outlined in ANZECC (2000). The SSGVs represent ambient water quality such that exceedances of the derived values indicate potential impacts to water quality, and a risk to aquatic biota. These SSGVs are used for internal data review, water management and in aquatic ecology monitoring reporting, where relevant, and do not replace the concentration limits outlined in EPL 365. Therefore, exceedance of the SSGVs does not imply an exceedance of EPL concentration limits.

SSGVs were derived from a comparison of:

- ANZECC (2000) / ANZG (2018) default guideline values (DGVs) for aquatic ecosystem protection, and any updates thereafter.
- Background water quality (based on 80th percentile values, and 20th percentile values for pH) determined from a location on the same waterway (as the source of potential impact), or similar (with a minimum of 24 values).

The selected SSGVs were the ANZECC (2000) / ANZG (2018) DGV for aquatic ecosystem protection, except where the 80th percentile value (and 20th percentile) from the background sites exceeded the DGV, in which case, the 80th / 20th percentile value was used as the SSGV.

Hardness modified guideline values (HMGVs) may apply for cadmium, chromium (III), lead, nickel and zinc and can be calculated for each monitoring location based on the site hardness and algorithms in Tables 3.4.1 of ANZECC (2000). HMGVs have not been incorporated into the SSGVs as the water hardness differs between sites. The exception is CES SSGVs for the unnamed creek which have had the hardness modification incorporated due to the elevated hardness at the background site.

6.1.1.1 Morans Creek (MSSS)

SSGVs have been derived from water quality data collected at upstream monitoring locations SWMP06 and SWMP07. Table 6.1 presents the recommended SSGV, as well as the DGVs and 80th percentile results for SWMP06 and SWMP07 calculated from the baseline dataset June 2011 and June 2016. As samples have been collected for over two years, the dataset covers a range of seasonal, climatic and flow conditions.

The SSGVs in Table 6.1 are applicable to surface water sites SW001, SW002, SW003, SW006, SW011 and SWMP07. The exception to this is the SSGV for EC, which is not applicable to SW001, as this site is influenced by tidal ingress from Lake Macquarie. These SSGVs are applied in the review of water quality data as part of the annual review (refer to Section 7.1).

Table 6.1 Surface water quality trigger values for Morans Creek

Parameter	Units	DGV	SWMP06 80th percentile	SWMP07 80th percentile	Recommended SSGV
Physicochemical parameters					
EC	µS/cm	200	940	755	940 ²
pH	pH units	6.5–9.0	6.2 ¹ –6.7	6.5 ¹ –7.0	6.2–9.0
TSS	mg/L	6	47	16	47
Turbidity	NTU	6	58	53	58
Nutrients					
Ammonia	mg/L	0.9	0.07	0.15	0.9
Total nitrogen	mg/L	0.35	1.18	1.52	1.52
Total phosphorus	mg/L	0.025	0.08	0.11	0.11
Dissolved metals					
Aluminium	mg/L	0.055	0.70	0.78	0.78
Arsenic	mg/L	0.024	0.001	0.001	0.024
Barium	mg/L	–	0.083	0.066	0.083
Boron	mg/L	0.94	0.05	0.05	0.94
Cadmium	mg/L	0.0002	0.0001	0.0001	0.0002
Chromium	mg/L	0.001	0.001	0.001	0.001
Cobalt	mg/L	0.0025	0.009	0.001	0.009
Copper	mg/L	0.0014	0.001	0.002	0.002
Iron	mg/L	0.3	3.61	3.11	3.61
Lead	mg/L	0.0034	0.001	0.001	0.0034
Manganese	mg/L	1.9	0.828	1.744	1.9
Mercury	mg/L	0.0006	0.0001	0.0001	0.0006
Nickel	mg/L	0.011	0.006	0.004	0.011

Parameter	Units	DGV	SWMP06 80th percentile	SWMP07 80th percentile	Recommended SSGV
Selenium	mg/L	0.011	0.01	0.01	0.011
Silver	mg/L	0.00005	0.001	0.001	0.001
Zinc	mg/L	0.008	0.007	0.006	0.008
Other parameters					
Cyanide (total)	mg/L	0.007	0.004	0.004	0.007

1. 20th percentile value.

2. Not applicable to SW001 due to tidal ingress at this site

6.1.1.2 Wyee Creek

SSGVs have been derived for Wyee Creek monitoring sites. SSGVs have been selected based on review of DGVs and baseline data collected prior to commencement of mining of Longwalls 39 – 43 (planned for May 2025). Table 6.2 presents the DGVs and SSGVs which are applicable to SWMP03, SWMP04 and SWMP05 as post Longwalls 39 – 43 performance criteria.

Table 6.2 Surface water quality trigger values for Wyee Creek

Parameter	Units	DGV	SWMP03 80th percentile	SWMP04 80th percentile	SWMP05 80th percentile	Recommended SSGV
Physicochemical parameters						
EC	µS/cm	200	481	846	626	846
pH	pH units	6.5–9.0	6.4 - 6.8	6.5 - 6.9	6.0 - 6.9	6.0 - 9.0
TSS	mg/L	6	23	21	36	36
Turbidity	NTU	6	44	42	101	101
Nutrients						
Ammonia	mg/L	0.9	0.02	0.03	0.02	0.9
Total nitrogen	mg/L	0.35	1.08	2.1	1.5	2.1
Total phosphorus	mg/L	0.025	0.1	0.34	0.17	0.34
Dissolved metals						
Aluminium	mg/L	0.055	0.53	0.61	1.01	1.01

Parameter	Units	DGV	SWMP03 80th percentile	SWMP04 80th percentile	SWMP05 80th percentile	Recommended SSGV
Arsenic	mg/L	0.024	0.001	0.002	0.002	0.024
Barium	mg/L	–	0.08	0.12	0.06	0.12
Boron	mg/L	0.94	0.05	0.05	0.05	0.94
Cadmium	mg/L	0.0002	0.0001	0.0001	0.0001	0.0002
Chromium	mg/L	0.001	0.001	0.001	0.001	0.001
Cobalt	mg/L	0.0025	0.005	0.005	0.002	0.005
Copper	mg/L	0.0014	0.001	0.001	0.002	0.002
Iron	mg/L	0.3	1.5	1.3	1.6	1.6
Lead	mg/L	0.0034	0.001	0.001	0.001	0.0034
Manganese	mg/L	1.9	0.680	0.709	0.078	1.9
Mercury	mg/L	0.0006	0.0001	0.0001	0.0001	0.0006
Nickel	mg/L	0.011	0.005	0.004	0.003	0.011
Selenium	mg/L	0.0112	0.01	0.01	0.01	0.0112
Silver	mg/L	0.00005	0.001	0.001	0.001	0.001
Zinc	mg/L	0.008	0.005	0.0126	0.017	0.017
Other parameters						
Cyanide (total)	mg/L	0.007	0.004	0.004	0.004	0.007

1. 20th percentile value.

2. Guideline value for total selenium.

6.1.1.3 Unnamed Creek (CES)

The SSGVs for the unnamed creek downstream of CES LDP001 are based on ANZECC (2000) / ANZG (2018) DGVs or the 80th percentile value recorded at historical reference site SW014 (see Figure 4.2), with hardness correction factors applied where appropriate (GHD 2016a). Although recent water quality analysis has identified that SW014 may be influenced by the Awaba Seep (GHD 2024), the SSGVs were developed during a drier period when there was no evidence of influence to SW014 (GHD 2016a). The SSGVs are presented in Table 6.3.

The SSGVs derived from unnamed creek site SW014 are applicable to CCSR1, SW016 and SW017 and are used in annual aquatic ecology monitoring reporting for CES LDP001, to assess potential impacts to downstream watercourses.

Table 6.3 Surface water quality trigger values for the unnamed creek

Parameter	SSGV (GHD 2016a)	Justification/basis
pH - Lower (pH units)	6.5	EPL concentration limit
pH - Upper (pH units)	8.5	EPL concentration limit
EC (µS/cm)	3250	3250 µS/cm has been indicated by Dr R. Krassoi (Director of Ecotox Services Australasia, pers. comm) as the threshold at which adverse impacts to the sensitive cladoceran test species is often observed in ecotoxicological assessments.
Oil and grease (mg/L)	10	EPL concentration limit
TSS (mg/L)	50	EPL concentration limit
Turbidity (NTU)	50	NSW Lowland Rivers - disturbed catchment (Table 8.2.11)
Ammonia (mg/L)	0.9	Freshwater guideline Value for 95% Species Protection. Table 3.4.1
Total nitrogen (mg/L)	0.9	80th %ile from background WQ
Total phosphorus (mg/L)	0.06	80th %ile from background WQ
Dissolved aluminium (mg/L)	1.12	80th %ile from background WQ
Dissolved arsenic (mg/L)	0.024	Freshwater guideline value for 95% Species Protection. Guideline for As (III) Table 3.4.1
Dissolved boron (mg/L)	0.94	Updated freshwater guideline value for 95% species protection (ANZG 2021)
Dissolved cadmium (mg/L)	0.0002	Freshwater guideline value for 95% Species Protection: Table 3.4.1 with hardness correction
Dissolved chromium (mg/L)	0.001	Low reliability freshwater guideline value for 95% Species Protection: Table 3.4.1 with hardness correction
Dissolved cobalt (mg/L)	0.0014	ANZECC (2000) Freshwater low reliability GV
Dissolved copper (mg/L)	0.0014	Freshwater guideline value for 95% Species Protection: Table 3.4.1
Dissolved iron (mg/L)	2.12	80th %ile from background WQ
Dissolved lead (mg/L)	0.039	Freshwater guideline value for 95% Species Protection: Table 3.4.1 with hardness correction

Parameter	SSGV (GHD 2016a)	Justification/basis
Dissolved manganese (mg/L)	1.9	Freshwater guideline value for 95% Species Protection: Table 3.4.1
Dissolved mercury (mg/L)	0.0006	Freshwater guideline value for 95% Species Protection: Table 3.4.1 (ANZECC 2000)
Dissolved nickel (mg/L)	0.017	Freshwater guideline value for 95% Species Protection: Table 3.4.1 with hardness correction
Dissolved zinc (mg/L)	0.008	Freshwater guideline value for 95% Species Protection: Table 3.4.1 with hardness correction
Total selenium (mg/L)	0.011	Freshwater guideline value for 95% Species Protection: Table 3.4.1

6.1.2 Groundwater levels

Based on the statistical analysis of alluvial groundwater levels, alluvial groundwater is highly responsive to rainfall and generally not impacted by mining. The exception to this is at bores BH24A and BH25A where alluvial groundwater levels appear to have had a temporary response to mining.

For bores BH24A and BH25A, adopted trigger values are the minimum recorded depth to groundwater prior to impact by mining. Groundwater levels at BH26A and MSGW04A have generally varied by 2 m and therefore the groundwater trigger level for alluvial bore BH26A and MSGW04A has been defined as 2 m below the minimum observed groundwater level. Groundwater levels at MSGW01 have varied by 1.5 m and therefore the groundwater trigger level for alluvial bore MSGW01 has been set as 1.5 m below the minimum observed groundwater level.

Monitoring bore MSGW03A is periodically dry following low or below average rainfall. Therefore, no groundwater level trigger is recommended for MSGW03A, although responses in groundwater level to rainfall will be analysed annually.

Since MSGW05 is a new bore, limited monitoring has been undertaken. As of May 2025, only eight monitoring events had occurred at MSGW05. No trigger value has been assigned due to the limited amount of data. The trigger value will be updated in the following WMP once sufficient data have been collected.

No trigger value has been developed for MSGW04B due to the continually decreasing trend observed since monitoring commenced and the absence of stable criteria.

For alluvial bores not listed above (i.e. those bores that have already been undermined), the adopted trigger value for groundwater level is the minimum recorded groundwater level in the historical dataset. Triggers for groundwater levels are presented in in Table 6.4 (i.e. if monitored level falls below trigger).

Groundwater level data for all monitoring bores are shown in Appendix F.

Table 6.4 Groundwater level trigger values for alluvial bores

Bore	Trigger (m AHD)
BH01	2.10
BH04	7.01
BH05	6.20
BH09	14.52
BH25A	11.51
BH26A	16.86
MSGW01	38.60
MSGW04A	22.00

Water pressure drop within porous and fractured groundwater sources is generally expected up to approximately 230 m above mine workings based on monitoring data to date. Hydrographs within these sources will be reviewed annually in combination with a review of subsidence parameters.

Groundwater level trigger values for bores in the porous and fractured groundwater sources have been defined using predictions in the groundwater model (GHD 2020), with no change in the adopted triggers required based on updated groundwater modelling (GHD 2025). At monitoring bore MSGW04C, groundwater level drawdown of 90 m is predicted. Based on an observed pre-mining groundwater level of 19.1 m AHD, a groundwater level trigger value of -70.9 m AHD is proposed.

Trigger values are not presented for BH09A, BH09B, BH10A, BH23A, BH24B, BH24C, BH25B, BH25C, MSGW03B, MSGW03C, MSGW04B, and GW78043 as mining at the locations ceased most recently in 2020 (MSGW03 bores). These locations are monitored for recovery with trends reported on in Annual Reviews.

These trigger values are summarised in Table 6.5. Further investigations within these sources are triggered if an adjacent landholder complains about declining groundwater levels in their bore.

Table 6.5 Groundwater level trigger values for porous and fractured rock bores

Bore	Trigger (m AHD)
BH26B	17.36
MSGW04C	Bore dry (-70.9)

6.1.3 Groundwater quality

There is considerable natural variability in groundwater pH and EC in both alluvial and porous and fractured rock groundwater sources. In addition, the beneficial uses of this groundwater are limited due to the high EC.

Groundwater quality trigger values provided in Table 6.6 have been developed with reference to historical monitoring data and have been defined for bores in the vicinity of active mining. Groundwater quality trigger values have been recalculated for bores with existing triggers, including BH26A, BH26B, MSGW01, MSGW03A, MSGW03B, MSGW04A and MSGW04B. Groundwater triggers have been recalculated to detect impacts from proposed Longwalls 39-43. Although groundwater trigger exceedances were noted (Stage 1 pH and EC at MSGW03B, Stage 1 pH at BH26B and Stage 1 pH at MSGW04B) in the Annual Groundwater Review (GHD 2024a), the use of the historical monitoring record in recalculation of trigger values is still considered appropriate given the reported variations in groundwater quality observed are within measurement uncertainty and/or natural variability and not considered mining related.

Monitoring bores BH26C, MSGW03C and MSGW04C are no longer monitored for groundwater quality and therefore no triggers have been assigned for these bores.

Table 6.6 Groundwater quality trigger values

Bore	pH (pH units)		EC (µS/cm)	
	Minor 20/80th percentile trigger	Major 0/100th percentile trigger	Minor 80th percentile trigger	Major 100th percentile trigger
Alluvium aquifer				
BH26A	5.6 - 6.2	4.9 - 10.6	13,599	15,770
MSGW01	4.3 – 4.6	3.4 – 5.5	11,032	12,370
MSGW03A	5.7 - 6.1	5.0 - 6.6	4,150	6,370
MSGW04A	6.3 - 6.5	5.7 - 7.6	9,723	10,760
Rock aquifer				
BH26B	6.9 - 7.2	5.4 - 8.1	7,240	8,066
MSGW03B	7.0 - 7.4	6.8 - 8.0	6,828	7,250
MSGW04B	6.7 - 7.1	5.6 - 7.9	8,314	8,970

6.1.4 Underground water management

The spill level of the Cooranbong underground storage area is approximately -50 m AHD. Based on the observed rate of rise in water levels, a 5 m buffer is to be maintained. Hence, the adopted trigger value for the Cooranbong underground storage area is -55 m AHD. Should this trigger level be exceeded, it will be necessary to reduce inputs to the storage and/or increase the extraction rate.

No trigger is defined for underground water transfers. An annual water balance is undertaken to verify exceedance of the licensed volume of groundwater extraction.

6.1.5 Discharge water quality

Water quality concentration limits applicable to LDP001 and LDP002 at CES, LDP003 at the MMAS and LDP004 at the MSSS, specified by EPL 365, are summarised in Table 6.7.

Table 6.7 LDP water quality concentration limits

Parameter	Units	100 percent concentration limit
Oil and grease	mg/L	10
pH	pH units	6.5–8.5
TSS	mg/L	50

6.1.6 Discharge volume limits

Discharge volume limits are outlined in Mandalong Mine EPL 365 for CES. These volume limits are provided in Table 6.8. No volumetric limits for LDP002, LDP003 or LDP004 are specified by EPL 365, as discharges are predominantly rainfall driven.

Table 6.8 EPL discharge volume limits

Site	Point	Existing limit (ML/day)	Condition
Cooranbong Entry Site	LDP001	5	Exceedance of the volume limit for LDP001 is permitted only if the discharge from LDP001 occurs solely as a result of rainfall at the premises exceeding 10 mm during the 24 hours immediately prior to commencement of the discharge.

6.1.7 Stream health

No numerical triggers are applicable to stream health. Performance criteria are based on a change from previous monitoring rounds or with respect to reference sites as provided in Section 6.2.5.

6.2 Performance criteria

Performance criteria have been developed from baseline information and the water management performance measures specified by SSD-5144 and SSD-5145 presented in Table 1.4. The performance criteria have been developed to ensure that impacts as a result of mining operations are not greater than those predicted by the environmental impact assessments for the approved Mandalong Southern Extension Project, and Northern Coal Services Project with respect to the CES. The triggers presented in Section 6.1 have been developed to prompt specific actions (identified in the trigger action response plans (TARPs) provided in Appendix G) to prevent exceedance of the performance criteria.

6.2.1 Surface site operations

The performance criteria for surface water management are outlined in Table 6.9.

Table 6.9 Surface site operations criteria

Aspect	Criteria
Potable water usage	Minimise the use of potable water from the public supply for purposes where non-potable water is acceptable and available.
Surface storages (including sediment dams)	Storages sized in accordance with Landcom (2004) and DECC (2008) and maintained within the capacity of each storage.
Water quality management	Existing clean water diversion structures to be maintained to convey 5% AEP storm event. New clean water diversion structures to be designed, installed and maintained to convey 1% AEP storm event. Dirty water diversion structures to be designed, installed and maintained to convey 5% AEP storm event. Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site.
Erosion and sediment control	Minimise disturbance area. Pit top disturbance and other construction activities is to be managed in accordance with the approach and guidelines outlined in Section 3.8. Design, install and maintain erosion and sediment controls in accordance with Landcom (2004) and DECC (2008). Where construction works are significant an erosion and sediment control plan and construction environmental management plan will be prepared.
Hydrocarbon management	Chemical and hydrocarbon storage to be in accordance Australian Standard AS1940:2004.

6.2.2 Watercourses

Watercourses are to be managed for water quality and hydrology. Criteria for these aspects are provided in Table 6.10. The geomorphic condition and stability for watercourses are further discussed in Section 6.2.5.

Table 6.10 Watercourse criteria

Aspect	Criteria
Waterfront land and watercourses	Design, install and maintain any infrastructure within 40 m of watercourses generally in accordance with NRAR (2018). Design, install and maintain creek crossings in accordance with NSW Fisheries (2003a; 2003b).
Watercourse quality	Water quality parameters are within or below SSGVs provided in Section 6.1.1.
Flooding	Subsidence levels and post-mining out-of-channel flood depths are within predicted levels (as defined by the Flood Assessment Report undertaken for each extraction plan).

6.2.3 Groundwater environment

Based on the triggers derived in Section 6.1.2 and Section 6.1.3, Table 6.11 presents the groundwater environment management criteria for Mandalong Mine.

Table 6.11 Groundwater environment criteria

Aspect	Criteria
Groundwater level	Groundwater level is above levels provided in Table 6.4 and Table 6.5. Maximum 2 m drawdown at any water supply work.
Groundwater quality	Groundwater quality is within or below trigger values provided in Table 6.6. No complaints from landholders regarding groundwater quality.
Underground water level/storage	Water level is maintained below trigger level provided in Section 6.1.4.

6.2.4 Discharge management

Discharge management includes both discharge volume and quality. The criteria applied for Mandalong is presented in Table 6.12.

Table 6.12 Discharge management criteria

Aspect	Criteria
Discharge event	Discharge is to be undertaken in accordance with EPL 365 requirements.
Discharge quality	Within or below EPL 365 limits provided in Table 6.7.

6.2.5 Stream health

To manage stream health, criteria has been developed based on geomorphic condition, waterway stability and aquatic ecology.

Table 6.13 presents the criteria for stream health. The geomorphic condition, watercourse stability and watercourse subsidence criteria are applicable to the watercourse stability of potentially impacted reaches of Morans Creek, Wyee Creek and Mannering Creek. Aquatic ecology criteria are considered for monitoring undertaken downstream of CES LDP001 discharge.

Table 6.13 Stream health criteria

Aspect	Criteria
Geomorphic condition and watercourse stability	
Incisional processes and instabilities Waterway bed condition	Occurrence of erosional processes does not occur as a result of subsidence.
Waterway cross sectional area Stream gradient	Change in cross sectional area and stream gradient does not vary beyond the predictions of the subsidence modelling.
Watercourse subsidence	
Third order and above streams GDEs	No connective cracking between the surface, or the base of the alluvium, and the underground workings. No subsidence impact or environmental consequence greater than minor.
First and second order streams	No subsidence impact or environmental consequences greater than predicted. No connective cracking between the surface and the underground workings.
Aquatic ecology	
Instream/riparian vegetation	Biannual inspections indicate variation in vegetation extent or condition attributed to Mandalong operations. Assessment is qualitative as part of aquatic habitat and waterway condition assessment at aquatic ecology monitoring locations (see Table 4.8).
Water quality	No impairment in water quality parameters at impact sites when compared to reference sites / Unnamed Creek SSGVs (Table 6.3). Water quality parameters are collected at aquatic ecology monitoring locations (see Table 4.8) during biannual aquatic ecology monitoring.
Macroinvertebrate metrics	Macroinvertebrate metric results (taxa richness, EPT richness and SIGNAL-2) at aquatic ecology impact sites are within the range observed at reference sites / baseline dataset.

Notes:

- Classification of streams in accordance with Strahler stream order system.
- Detailed performance indicators (including impact assessment criteria) for each of these performance measures will be detailed in the various management plans that are required under this consent.
- Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.

6.3 Trigger action response plans

TARPs have been prepared for Mandalong Mine, which outline the triggers and appropriate responses to manage any potentially adverse impacts on surface water and groundwater sources due to operational activities. The main aim of the TARPs is the prevention and control of impacts through early detection. TARPs are used for the principal hazards identified in the operation of each site that can be monitored for any changes of conditions that may lead to an impact occurring. Each TARP identifies three hazard levels for each trigger, with each level associated with a range of controls and actions.

A range of triggering events have been developed based on performance criteria, trigger values and baseline monitoring data where appropriate. The TARPs are provided in Appendix G.

Following a potential impact being triggered, responses are generally focused on an investigation into the contributing factors and the implementation of measures to mitigate the impact and prevent the reoccurrence of the impact.

7. Site-specific reviews and reports

7.1 Annual review

Centennial Mandalong prepares an annual review that reviews the performance of operations against the requirements of this WMP, provides an overview of environmental management actions taken and summarises the monitoring results over the 12-month reporting period. The annual review will include the following elements specific to water management:

- Any amendments to licensing or statutory approvals.
- A summary of any complaints or incidents relating to the performance of the water management system over the reporting period.
- A summary of the monitoring results collected over the reporting period and assessment against any relevant criteria (see criteria in Section 6.2) including a summary of outcomes of aquatic ecology, terrestrial ecology and groundwater assessments undertaken by suitably qualified professionals.
- An evaluation of any trends in the monitoring results occurring across the site over the life of the operation.
- Any non-compliance recorded during the reporting period and the actions taken to ensure compliance.
- Identification of any discrepancies between the predicted and actual impacts of operations and an analysis of the potential cause of any significant discrepancies.
- An evaluation of the site water balance.
- Volumes of water extracted under WALs held.
- A summary of the management actions to be implemented over the next year to improve the environmental performance of the site.

7.2 Annual return

EPL 365 requires an annual report on compliance with the requirements of the licence including a summary of environmental monitoring. This report is on a prescribed form provided to each licence holder by the EPA.

7.3 Environmental monitoring

In accordance with Section 66(6) of the POEO Act and requirements issued by the EPA, Centennial Mandalong must publish monitoring data that has been collected as a result of EPL requirements. A summary of all monitoring results is made publicly available on the Centennial Mandalong website and is updated regularly.

7.4 Incident reporting

Any incident which occurs within the Mandalong Mine site boundary must be reported by the employee or contractor who has been associated with or witnessed the incident. The method for reporting incidents is outlined in the PIRMP and Centennial's Incident Reporting Procedure.

In accordance with the requirements of EPL 365, Centennial Mandalong, its employees or contractors must notify the EPA of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident. Notifications must be made by telephoning the Environment Line service on 131 555. Centennial Mandalong must also provide written details about the notification to the EPA within seven days of the incident.

Centennial Mandalong will immediately notify the DPHI and other relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. Other incidents shall be reported to DPHI and other relevant agencies as soon as practicable. Non-compliances shall be reported within seven days of becoming aware of a non-compliance. Detailed reporting on the incident must occur within 7 days of the event and be submitted to DPHI and other relevant agencies for information and comment.

7.5 Complaints

In accordance with the requirements of EPL 365, Centennial Mandalong must keep a record of any complaints made to Centennial Mandalong or any employee or agent of Centennial Mandalong in relation to pollution arising from any site activities. The record of complaint must be kept for at least four years and must include the following details:

- The date and time of the complaint.
- The method by which the complaint was made.
- Any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect.
- The nature of the complaint.
- The action taken by Centennial Mandalong in relation to the complaint, including any follow-up contact with the complainant.
- If no action was taken by Centennial Mandalong, the reasons why no action was taken.

A register of complaints is published on the Centennial Mandalong website and updated monthly.

7.6 Independent environmental audit

Independent environmental audits are undertaken at Mandalong Mine every three years since 2013. Outcomes of the independent environmental audits relevant to the WMP are published on the Centennial Mandalong website.

7.7 Community Consultative Committee

The CCC meets on a regular basis for each of the operations. Some of the information reported at the CCC at a site scale includes:

- Progress at the mine.
- Operational issues.
- Monitoring and environmental performance.
- Community complaints and the response to complaints.

The minutes of the CCC meetings for the last two years are published on the Centennial Mandalong website.

7.8 Flood modelling

A flood model has been developed for the Mandalong Valley to identify and quantify the potential changes to the nature of flooding as a result of mining activities at Mandalong Mine. The two-dimensional hydrodynamic flood model is updated as part of each extraction plan to determine the impacts of mine subsidence on flood levels, creek stability and ponding.

The flood model is validated by comparing flood monitoring results with the modelled predictions. The model results are reviewed against the monitoring data annually, with model recalibration undertaken as required as part of each extraction plan.

7.9 Flood assessment reports

Flood assessment reports are completed for each extraction plan by an independent environmental consultant. The flood assessment report provides a pre- and post-mining flood assessment for the study area and for each property within the study area. The flood assessment report details the predictions associated with post-mining conditions for each extraction plan that will allow for the assessment against the flooding performance criteria in Table 6.10.

7.10 Hydrogeological model

The groundwater model validation program compares groundwater monitoring results with modelled groundwater level predictions on an annual basis. Where the validation process identifies significant variances between monitored and predicted results or that the hydrogeological model is underestimating drawdown in groundwater level, then a recalibration process may be required to be undertaken in consultation with an independent reviewer.

7.11 Groundwater monitoring review

A review of groundwater level and quality monitoring results is prepared annually by a specialist and summarised in the Annual Review. Results are analysed with reference to historical trends, trigger values specified in Section 6.1 and meteorological monitoring data.

7.12 Site water balance

The site water balance will be reviewed and revised annually as a minimum or as necessary when there are changes to operations. The results of the site water balance will be reported in the Annual Review for Mandalong Mine.

7.13 Plan review

The WMP will be considered for review every three years in accordance with the environmental management system management review or as a result of:

- Any regulatory or statutory requirements.
- Any significant change to water management practices.
- Development of any new open cut or underground mining projects.

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Turak, E, Waddell, N and Johnstone, G (2004), *New South Wales (NSW) Australian River Assessment System (AUSRIVAS) Sampling Processing Manual*.

Umwelt (2013), *Mandalong Southern Extension Project: Surface Water Assessment*, prepared by Umwelt (Australia) Pty Ltd for Centennial Mandalong Pty Limited.

APPENDIX A – Correspondence with regulators

SUBMISSION FOR APPROVAL DETAILS	Revision	Circulation date	Feedback date	Approval date
	0	24 March 2016		
	1	24 November 2016	10 October 2017	
	2	17 November 2017		6 December 2017
	3	13 June 2018		15 November 2018
	4	12 August 2019		
	5	25 October 2021	8 March 2022	
	6	18 August 2022	24 August 2022	
	7	7 August 2025	17 March 2026	
CONSULTATION DETAILS	Department		Circulation date	Feedback date
	Environment Protection Authority		23 February 2016	2 March 2016
	Department of Primary Industries – Water		23 February 2016	16 August 2016
	Department of Primary Industries – NSW Fisheries		23 February 2016	
	Environment Protection Authority		18 August 2022	24 August 2022
	Department of Planning and Environment – Water		18 August 2022	17 November 2022
	Department of Planning, Housing and Infrastructure		7 August 2025	17 March 2026

Department of Planning, Housing and Infrastructure

Reference: SSD-5144-PA-147

Jeff Dunwoodie
Environment & Community Superintendent
Centennial Mandalong Pty Limited
17/03/2026

Subject: Mandalong Coal Southern Extension - Water Management Plan

Dear Mr Dunwoodie

I refer to the Water Management Plan (WMP) (Revision 7 dated August 2025) submitted to satisfy conditions 15 and 17 of Schedule 3 of the consent for the Mandalong Southern Extension Project (SSD-5144). It is understood that the WMP has been updated and re-submitted following water discharge-related incidents during May 2025 and to incorporate the:

- Mine-Water Discharge Management Plan (required by condition 15, Schedule 3); and
- water management-related aspects of the Cooranbong Entry Site operations of the Northern Coal Logistics Project (SSD-5145) in accordance with the Department's Plan de-coupling approval letter, dated 10 January 2024.

Overall, the Department considers that the WMP generally satisfies the relevant consent conditions. However, the Department considers that the document should be updated to include:

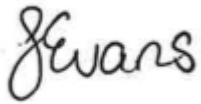
- updated agency names in the abbreviations list and throughout the document;
- justification for the reduced aquatic ecology monitoring program at the Cooranbong Entry Site described in Section 4.5.2 (i.e. from ten to four monitoring sites); and
- an updated Trigger Action Response Plan (TARP) for Stream Health (Appendix G5) to include measurable and quantitative triggers, including an indication of:
 - what constitutes "substantial change" in the instream vegetation TARP; and
 - the nature of the "weight of evidence assessment" in the macroinvertebrate community condition.

You are requested to provide the updated WMP document, or notification that the updated document will not be provided, to the department by 31 March 2026. If you are unable to provide the updated document within this timeframe, you are required to provide, and commit to, a timeframe detailing the provision of this information.

If you wish to discuss the matter further, please contact James McDonough on (02) 9585 6313.

Department of Planning, Housing and Infrastructure

Yours sincerely

A handwritten signature in black ink that reads "J Evans".

Jessie Evans
Director, Resource Assessments
Resource Assessments

As nominee of the Planning Secretary

1 October 2024

Mr James McDonough
Team Leader
Resource Assessments
Energy, Resources and Industry
Department of Planning and Environment
Level 17
4 Parramatta Square,
Parramatta NSW 2150

Dear James

Appointment of Persons for Preparation of the Mandalong Mine Water Management

Centennial Mandalong is currently in the process of updating the Mandalong Mine Water Management Plan (WMP) as required by SSD-5144. The Mandalong Mine WMP update will also incorporate the Cooranbong Entry Site required by the Northern Coal Services SSD-5145.

The Northern Region Mine-Water Discharges Management Plan will also be incorporated into the Mandalong Mine WMP, including the Cooranbong Entry Site required by the Northern Coal Services SSD-5145.

In accordance with SSD-5144 Schedule 3, Condition 17, the Mandalong Mine WMP must be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Secretary. Centennial Mandalong is seeking endorsement from the Secretary for the appointment of the following persons to update the Mandalong Mine WMP –

Zoe Lageroth

Senior Aquatic Ecologist

GHD

Tegan Hopwood

Senior Environmental Scientist – Aquatic Ecology

GHD

Ian Gilmore

Water Engineer

GHD

Centennial Mandalong Pty Limited

ABN 74 101 508 892

PO Box 1000

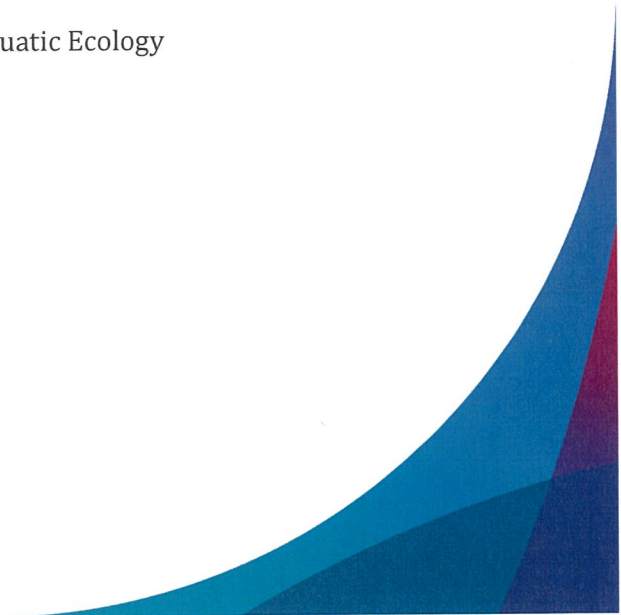
Toronto NSW 2283

T: +61 02 4973 0900

E: info@centennialcoal.com.au

www.centennialcoal.com.au

APP236991



Adrienne Harvey

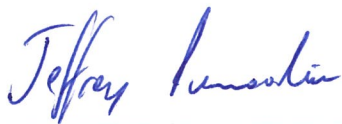
Water Engineer

GHD

Copies of the Curriculum Vitae for the above persons have been attached for your information.

If you have any questions or require any further information in regard to this matter, please contact me on 0448 490 023 or via email Jeffrey.Dunwoodie@centennialcoal.com.au

Yours sincerely



Jeffrey Dunwoodie

Environment & Community Superintendent

Veronica Howat
Assurance Specialist
Centennial Coal
100 Miller Road
Fassifern, NSW, 2283

10/01/2024

Subject: De-coupling of Northern Region Management Plans

Dear Ms Howat

I refer to your submission dated 9 November 2023, requesting the Planning Secretary's approval to de-couple Centennial's Northern Region environmental management plans. The Department has carefully reviewed the request and is satisfied that the Northern Region environmental management plans can be de-coupled as follows:

- Northern Region Air Quality and Greenhouse Gas Management Plan to be separated into the following:
 - Myuna Colliery Air Quality and Greenhouse Gas Management Plan, encompassing Myuna Colliery (MP10_0080);
 - Mandalong Mine Air Quality and Greenhouse Gas Management Plan, encompassing Mandalong Mine (SSD-5144) and the Cooranbong Entry Site (a component of SSD-5145);
 - Newstan Complex Air Quality and Greenhouse Gas Management Plan, encompassing Awaba Colliery (MP10_0038), Newton Colliery (DA73-11-98) and Newstan Colliery Surface Site (a component of SSD-5145);
- Northern Region Noise Management Plan to be separated into the following:
 - Myuna Colliery Noise Management Plan, encompassing Myuna Colliery (MP10_0080);
 - Mandalong Mine Noise Management Plan, encompassing Mandalong Mine (SSD-5144) and the Cooranbong Entry Site (a component of SSD-5145);
 - Newstan Complex Noise Management Plan, encompassing Awaba Colliery (MP10_0038), Newstan Colliery (DA73-11-98) and Newstan Colliery Surface Site (a component of SSD-5145);
- Northern Region Historic Heritage Management Plan to be separated into the following:
 - Myuna Colliery Historic Heritage Management Plan, encompassing Myuna Colliery (MP10_0080);

- Mandalong Mine Historic Heritage Management Plan, encompassing Mandalong Mine (SSD-5144) and Cooranbong Entry Site (a component of SSD-5145);
- Newstan Complex Historic Heritage Management Plan, encompassing Awaba Colliery (MP10_0038), Newstan Colliery (DA73-11-98) and Newstan Colliery Surface Site (a component of SSD-5145));
- Northern Region Water Management Plan to be separated into the following:
 - Myuna Colliery Water Management Plan, encompassing Myuna Colliery (MP10_0080);
 - Mandalong Mine Water Management Plan, encompassing Mandalong Mine (SSD-5144) and Cooranbong Entry Site (a component of SSD-5145));
 - Newstan Complex Water Management Plan, encompassing Awaba Colliery (MP10_0038), Newstan Colliery (DA73-11-98) and Newstan Colliery Surface Site (a component of SSD-5145));
- Northern Region Mine-Water Discharges Management Plan to be incorporated into the following:
 - Mandalong Mine Water Management Plan, encompassing Mandalong Mine (SSD-5144) and Cooranbong Entry Site (a component of SSD-5145)); and
 - Newstan Complex Water Management Plan, encompassing Awaba Colliery (MP10_0038), Newstan Colliery (DA73-11-98) and Newstan Colliery Surface Site (a component of SSD-5145).

The Department notes that Centennial has also requested the Planning Secretary's approval of several nominees to prepare the relevant plans (as listed above). Individual requests for the Secretary's approval of suitability qualified and experienced persons will need to be lodged for each plan in accordance with relevant corresponding consent conditions via the Major Projects planning portal.

If you wish to discuss the matter further, please contact James McDonough on (02) 9585 6313 or james.mcdonough@dpie.nsw.gov.au.

Yours sincerely



Gabrielle Allan
Team Leader
Resource Assessments

As nominee of the Planning Secretary

Department of Planning and Environment

Our ref: OUT22/20474

Jeffrey Dunwoodie
Centennial Coal
PO Box 1000
TORONTO NSW 2283

Email: Jeffrey.Dunwoodie@centennialcoal.com.au

17 November 2022

Subject: **Mandalong Coal Southern Extension (SSD5144)– Water Management Plan update**

Dear Jeffrey Dunwoodie

I refer to your request for advice sent on 18 August 2022 to the Department of Planning and Environment (DPE) Water about the above matter.

The Department of Planning and Environment- Water has no comments on this matter.

Please note from 31 October 2022 the DPE Water Assessments Team is the single point of contact for SSD/SSI post approval consultation requests. DPE Water Licensing and Approvals and the Natural Resources Access Regulator are no longer a point of contact.

Should you have any further queries in relation to this submission please do not hesitate to contact DPE Water Assessments at water.assessments@dpie.nsw.gov.au

Yours sincerely,



Tim Baker
Senior Project Officer, Knowledge Division
Department of Planning and Environment: Water

Jeff Dunwoodie
Environment & Community Superintendent
Centennial Manadalong Pty Limited
PO Box 1000
Toronto, NSW, 2283
22/10/2024

Subject: Appointment of persons to prepare Mandalong Mine Water Management Plan

Dear Mr Dunwoodie

I refer to your request dated 1 October 2024 for the Planning Secretary's endorsement of suitably qualified and experienced persons to prepare the Water Management Plan under condition 17 of Schedule 3 of the consent for the Mandalong Mine (SSD-5144).

The Department has reviewed the information you have provided and is satisfied that the nominees are suitably qualified and experienced. Accordingly, I can advise that the Planning Secretary endorses the appointment of Zoe Lageroth, Tegan Hopwood, Ian Gilmore and Adrienne Harvey of GHD Pty Ltd to prepare the Water Management Plan for the Mandalong Mine.

If you wish to discuss the matter further, please contact James McDonough on (02) 9585 6313.

Yours sincerely

A handwritten signature in black ink that reads "Jessie Evans".

Jessie Evans
Director, Resource Assessments
Resource Assessments

As nominee of the Planning Secretary

Mr Jeffrey Dunwoodie
Environment and Community Coordinator
Centennial Mandalong Pty Ltd

Awabakal Country
PO BOX 1000
Toronto NSW 2283

05/04/2022

Dear Mr Dunwoodie

**Mandalong Coal Southern Extension (SSD-5144)
MSSS Stockpile Dam Discharge Events – 2 and 3 March 2022**

I refer to your incident reports (SSD-5144-PA-62 and SSD-5144-PA-63) submitted to the Department of Planning and Environment (the department) on 9 March 2022 in relation to discharge events from the Mandalong South Surface Site (MSSS) Stockpile Dam on Wednesday 2 March 2022 and Thursday 3 March 2022.

The department has reviewed the report and notes:

- The Mandalong Mine Automatic Weather Station (AWS) recorded a total of:
 - 50.3mm of rainfall between 9:00am Monday 28 February 2022 and 9:00am Wednesday 2 March 2022
 - 126.2mm of rainfall between Monday 28 February 2022 and Thursday 3 March 2022
- The MSSS Stockpile Dam is a temporary sediment dam constructed in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries* (Landcom, 2004) (Blue Book)
 - The contributing catchment area is 2.5ha
 - The dam has been constructed for a 2-day management period, 95th percentile rainfall depth (total 58.8mm)
 - The capacity of the dam is 1.3ML
- The Mandalong AWS is located approximately 6.3km from the MSSS. It is considered that the MSSS experienced an increased level of rainfall depth which would have exceeded the Blue Book design standard for the dam.
- The MSSS Stockpile Dam was maintained at a low level (<20%) prior to the discharge event
- Other actions taken at the time of the discharge event included:
 - Pump (at a rate 30 L/s) from the MSSS Stockpile Dam to the MSSS 10ML tank
 - A second pump (at a rate 30 L/s) from the MSSS Stockpile Dam to the MSSS 10ML tank from 12 noon on 2 March 2022

- Injection of water (at a rate 15 L/s) from 10ML tank into the underground workings via a dedicated borehole
- Flocculant dosing at the MSSS Stockpile Dam
- The volume of water discharged from the MSSS Stockpile Dam on 2 and 3 March 2022 was 0.8ML, with the potential contribution from the discharge estimated to be <0.5% of the total flow in Morans Creek

The department does not require any further information in relation to the matter.

Should you wish to discuss the matter further, please contact Heidi Watters, Team Leader Compliance on 02 65753401 or compliance@planning.nsw.gov.au

Yours sincerely

A handwritten signature in black ink that reads "H Watters".

Heidi Watters
Team Leader Northern
Compliance

As nominee of the Planning Secretary



Planning Services

Resource Assessments

Name: Genevieve Seed

Phone: 9228 6489

Email: genevieve.seed@planning.nsw.gov.au

Mr James Wearne
Group Approvals Manager
Centennial Coal Company Ltd
Level 18 BT Tower
1 Market Street
Sydney NSW 2000

James
Dear Mr Wearne

**Preparation of Management Plans
Mandalong Southern Extension Project (SSD 5144) and
Northern Coal Logistics Project (SSD 5145)**

I refer to your letter dated 30 October 2015 requesting the Secretary's approval for the appointment of consultants to prepare management plans for the Mandalong Southern Extension Project and the Northern Coal Logistics Project.

The Secretary has approved the appointment of:

- Mr Tristan Gribble, to prepare the Noise and Air Quality & Greenhouse Gas Management Plans; and
- Dr Stuart Gray and Mr Lachlan Hammersley, to prepare the Water Management Plans.

If you have any enquiries about this matter, please contact Genevieve Seed.

Yours sincerely

Howard Reed
Howard Reed *2.11.15*
Director
Resource Assessments
As nominee of the Secretary

APPENDIX B – Consultation outcomes

Comment	Response
Department of Primary Industries – Water (16 August 2016)	
The Environmental Impact Statement identified that groundwater inflows are predicted to increase from 712ML/yr at the existing operation to a maximum of 2158ML/yr with the southern extension. The proponent currently has a licence to take groundwater from the fractured rock and porous rock aquifer under the <i>Water Act 1912</i> for 1825ML/yr. The proposal to increase the maximum groundwater take to 5.9ML/d (2154ML/yr) will require the proponent to obtain additional entitlement. There is no discussion within the WMP on how or when this additional entitlement will be sought. DPI Water notes that an embargo order was made on 5 February 2016 covering groundwater within the Hunter water shortage zone, which includes the area of the Mandalong Mine (http://www.water.nsw.gov.au/__data/assets/pdf_file/0008/590921/160205-huntergroundwater-embargo-order.pdf). The proponent is requested to liaise with DPI Water to discuss options for obtaining the necessary entitlement.	As discussed in Section 3.3, the hydrogeological model developed as part of the Mandalong Southern Extension Project has been re-calibrated to updated calculated groundwater make. The re-calibrated model predicts inflows to the mine to peak in 2036 at approximately 2.1 ML/day (GHD 2017). These hydrogeological model predictions were used in the water balance to predict the volume of water transferred from the Cooranbong underground storage, which requires licensing (refer Section 3.5.2). The peak annual volume of groundwater extracted from the Cooranbong underground storage is predicted to be 1265 ML, which is below the current licensed volume of 1825 ML held by Centennial Mandalong under water access licence 39767. As such, no additional entitlements are required for Mandalong Mine.
Surface water flow monitoring detailed within the WMP should be improved. Surface flow is only monitored quarterly with a handheld device at surface monitoring locations. This is insufficient to assess against performance criteria and possible impacts related to both subsidence and water discharges. The monitoring plan should be updated to include appropriate surface flow monitoring to enable assessment against performance criteria.	Centennial have installed new gauging equipment in Morans Creek as discussed in Section 4.3.
The development consent requires development of detailed performance criteria, including trigger levels, for downstream flooding impacts. This has not been addressed in the WMP. The only monitoring proposed is that the condition of major flood paths is inspected every six months or following a flood event. The monitoring program associated with flooding should address downstream flooding impacts.	The WMP has been updated with the TARP for flooding impacts, presented in Appendix G.

Comment	Response
The development consent requires "a program to monitor and report on macroinvertebrate health and ecotoxicity parameters downstream of mine-water discharges." The WMP does not address this condition and states that "as no aquatic ecology monitoring is undertaken at Mandalong Mine, there is no consideration of TARPs covering this aspect with respect to stream health."	This development consent condition specifically applies to CES and LDP001 discharges of mine water from that site. At the time of this comment (2016), CES LDP001 was being managed as part of Northern Coal Services. Details of the aquatic ecology monitoring and TARPs covered under the Northern Operations Discharge Management Plan. Ecotoxicology testing of CES discharge was undertaken in 2011, with the results indicating no acute toxicity and slight chronic toxicity to the test species. Following this, a biannual macroinvertebrate monitoring program was established to monitor any effects from CES LDP001 discharge on aquatic biota, as detailed in Section 5.3.1.
DPI Water notes that as part of development of the Extraction Plan there are additional requirements that need to be addressed within the Water Management Plan, including additional information on groundwater monitoring and responses and flooding assessments. The proponent notes that flooding assessments will be undertaken as part of extraction plans. DPI Water requests that all additional requirements are addressed in an updated WMP as part of the Extraction Plan and this is submitted for further review.	Extraction plans are required to be developed for all secondary workings. Each extraction plan includes a WMP with specific requirements, including on groundwater monitoring and responses and flooding assessments. Refer to specific extraction plans for more information.
With regards to DPI Water concerns regarding water quality, these concerns were addressed by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) in their report "Groundwater RTS Support – Mandalong Mine" (G1445B). Recommendations were proposed by AGE to reduce any human induced sampling error in the future monitoring of the network and to confirm the cause of historical erratic records. DPI Water requests information on whether the recommendations have been implemented.	As discussed in Section 5.2.1, historical variability in EC was attributable to sampling of bores by bailing without initial purging. Since January 2015, monitoring of bores has been undertaken low flow techniques where possible with initial purging until EC and pH stabilise. Additionally, bores that were identified as being regularly submerged by surface water have been frequently purged to remove potential influence of surface water on monitoring results. Following the update of the groundwater monitoring methodology, variability in observed EC has reduced.
Centennial Mandalong committed to installing additional groundwater monitoring bores within areas of groundwater dependant ecosystems. DPI Water requests information about the progress towards fulfilling this commitment.	As discussed in Section 4.6, monitoring bores in the vicinity of GDEs where depth of cover is less than 200 m will be established as part of the relevant extraction plan WMP. Refer to specific extraction plans for more information.

Comment	Response
Centennial Mandalong committed to augmenting the existing groundwater monitoring network within the Southern Extension Area with nested monitored bores at locations where the depth of cover is less than 250 m. This is primarily throughout the north-eastern area within the Wyee and Mannering Creek catchments. Bores are to be monitored for groundwater levels, pH and EC. DPI Water requests information about the progress towards fulfilling this commitment.	Additional monitoring bores are recommended above the Mandalong South workings. The final locations of these monitoring bores are dependent on the final location of exploration drilling, but are recommended to include areas where the depth of cover is less than 250 m.
Centennial Mandalong committed to installing additional groundwater monitoring bores and/or vibrating wire piezometers within the Southern Extension Area to monitor the height of groundwater depressurization prior to extraction of longwalls with lower depth of cover. DPI Water requests information about the progress towards fulfilling this commitment.	
Dr Noel Merrick of Hydroalgorithemics Pty Ltd provided several recommendations in the Mandalong Groundwater Review of 18 Mar 2014 (HA2014/4). DPI Water requests information on whether these recommendations have been implemented.	Outcomes from the review undertaken by Dr Noel Merrick have been addressed as part of the <i>Mandalong Production Tonnage Project: Groundwater and Water Balance Modelling Report</i> (GHD 2016b). This document included refinement of the model grid to allow declining enhanced permeability with height above the mine workings. The comment from Dr Noel Merrick regarding radius of inflow have been addressed as part of <i>Mandalong Longwall Panel 22 to 23 Modification: Water Resources Impact Assessment</i> (GHD 2016c) where the updated modelled radius of drawdown has been presented. Other comments from Dr Noel Merrick have been addressed as part of the response to submission process as noted in Mandalong Groundwater Review of 18 March 2014 (HA2014/4).
The report text and Figure 3-7 Water Cycle Schematic introduces uncertainty with regards to the final destination of water that has been pumped from the underground workings via bore 20BL173524 into the Borehole Dam. It is uncertain under what conditions water is discharged back into the mine or, as stated in the EIS, discharged into LDP001.	All water from the underground that is pumped to the Borehole Dam is discharged via LDP001, which is part of the CES. Refer to <i>Northern Coal Services: Water Management Plan</i> for further information.

Comment	Response
In section 6.1.2 of the report it was mentioned that monitoring of BH22A (Alluvium) would cease. It was noted that a decreasing trend of water levels was observed at this bore. DPI Water considers this bore to be important and insists that monitoring should continue at this bore to confirm stabilisation of the alluvial aquifer water levels as a result of subsidence. Reasonable justification should otherwise be provided by the proponent to show why monitoring could cease at this location.	Visual inspection of the hydrograph for BH22A indicates that over the past two years, levels have stabilised and have been within the range of pre-mining levels. Therefore, monitoring of this bore will cease in 2016.
There is uncertainty if the high electrical conductivity values for surface water monitoring points SW001 and SW002 in Stockton Creek are related to tidal ingress salt water from Warners Bay.	The text in Section 5.1.1 has been amended to make it clear that the water quality at monitoring points SW001 and SW002 are influenced by tidal ingress from Warners Bay.
Implement the recommendations by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) and Hydroalgorithemics.	Refer to previous response regarding the recommendations by AGE and Hydroalgorithemics.
Advise about the progress made towards installing additional groundwater monitoring bores in the Southern Extension area and in the vicinity of Groundwater Dependent Ecosystems as per prior commitments by Centennial Mandalong.	Refer to previous response regarding the installation of additional monitoring bores.
It is recommended that water quality analysis (as per parameters in Table 4-4) be performed monthly for an initial 24 month period on water produced by Bore 20BL173524 and discharged from the mine offsite. The pumping and discharge is to be adequately metered.	Water extracted from the Cooranbong bore includes water from a variety of sources as discussed in the WMP and would not be representative of groundwater inflow quality. Therefore, it is considered that monitoring of water extracted by the bore would provide minimal benefit. Monitoring of water quality from discharge locations is currently undertaken.
The relationships between pumping volumes from Bore 20BL173524, inflow volumes underground and water levels in the underground workings to be monitored and studied further to better understand the underground storage capacity and inflows at the various underground workings.	As specified in Section 4.6.2, underground water transfers and monitoring of underground water levels is undertaken at Mandalong Mine.

Comment	Response
That the water quality graph reporting show the water quality trigger limit values for each parameter.	Water quality trigger values have been added to the baseline water quality graphs for downstream sites in Appendix E.
Confirm tidal influence on water quality influence. Correct the description of these points to be labelled “downstream” and not “upstream”.	Appendix E has been amended to correctly refer to SW001 and SW002 as downstream monitoring points.
NSW Department of Planning and Environment – letter dated 10 October 2017 (responses to components deemed as not satisfactory)	
Section 5 of the Mandalong WMP describes the baseline water quality (72 monitoring sites). Baseline water quality presented in Appendix C. No baseline data on flow monitoring provided in the WMP. It is noted that flow monitoring results for Morans Creek are provided in the Longwall 22-23 Extraction Plan. Section 4.2.1 indicates that flow low monitoring using a hand held impeller will be undertaken on various creeks, including Wyee Creek, Mannering Creek and Buttonderry Creek, which will occur for two years prior to mining. <i>Include baseline flow monitoring data in the Mandalong WMP</i>	Information on baseline flow monitoring at Morans Creek is provided in Section 5.1.
Table 4-1 of the RWMP summarises the performance criteria for surface water management across all sites. These are in-line with Table 4 of the Mandalong consent. Section 6.2 of the Mandalong WMP provides performance criteria for surface site operations, watercourses, groundwater, discharge management and stream health. Performance criteria form the basis of the TARPs in Appendix E of the Mandalong WMP. Table 6-3 does not include required sizing for new clean water diversion structures (i.e. to convey 100 year ARI storm event). Water quality default trigger values (DTVs) included in Table 6-1. Section 6.1.1	Table 6.9 updated with performance criteria stated within <i>Northern Operations: Regional Water Management Plan</i> [which was related to this WMP at the time of this response]. Section 6.1 includes the SSGVs derived for the operations currently with a commitment to include any further SSGVs as part of extraction plan WMPs. Flow monitoring is currently undertaken at Morans Creek. Data for this is provided in Section 5.1.2.

Comment	Response
indicates that site-specific trigger values (SSTVs) will be derived within 2 years or 24 points of data. It is noted that water quality monitoring for Morans and Stockton Creeks has been undertaken since 1999 and for Wyee and Mannering Creeks since 2011. SSTVs should therefore be able to be derived for these creek systems. Criteria for watercourse flow is based on the 50th percentile historical dry weather flow volume. As noted above, Mandalong WMP does not provide any baseline flows for watercourses upon which this criteria could be assessed. Criteria for flooding is based on predicted post-mining out-of-channel flood depths. The Mandalong WMP does not provide data on these predicted depths. No criteria is included for stream and riparian vegetation health. It is noted that this information is included in Table 5-5 of the DMP. <i>Include sizing requirements for new clean water diversion structures (i.e. to convey 100 year ARI storm event) in Table 6-3 of the Mandalong WMP.</i> <i>Include SSTVs for Morans, Stockton, Wyee and Mannering Creeks in Table 6-1 of the Mandalong WMP.</i> <i>In order to allow assessment of performance criteria for water flows and flooding, include data on baseline flows for watercourses and predicted post-mining out-of-channel flood depths in the Mandalong WMP.</i> <i>Include performance criteria for stream and riparian health in the Mandalong WMP (refer to Table 5-5 of the DMP).</i>	Predictions for post-mining out-of-channel flood depths are determined at each extraction plan as part of the Flood Assessment Report. This is further detailed in Section 7.9. Relevant information from Table 5-5 of <i>Northern Operations: Discharge Management Plan</i> is considered within this WMP. Section 6.2.5 includes the necessary performance criteria for stream and riparian health.

Comment	Response
A high level summary of the surface and groundwater monitoring across all sites is provided in Section 5.7 of the RWMP. Site-specific surface water monitoring program described in detail in Section 4.2 of the Mandalong WMP. Program includes weekly inspections for water management structures, quarterly water quality monitoring at all sites and visual watercourse stability monitoring. It is noted that the Extraction Plan for Longwalls 22-23 (April 2017) also indicates that photographic monitoring would be undertaken to monitor stream conditions. This is not reflected in the Mandalong WMP. Section 4.2.1 indicates that flow monitoring using a hand held impeller will be undertaken on various creeks, including Wyee Creek, Mannering Creek and Buttonderry Creek, which will occur for two years prior to mining. In response to concerns raised by DPE Water. Centennial has indicated that it is currently installing new gauging equipment associated with the waterways potentially impacted by underground mining (Appendix A). No detail of this monitoring is provided in the Mandalong WMP. The Mandalong WMP does not include a program to monitor or report on the condition of stream and riparian vegetation in the watercourses on site and downstream of the site. It is noted that the LDP001 is now managed as part of the Northern Coal Services site and that the aquatic ecology and ecotoxicology monitoring program is described in the site specific WMP. Section 4.2.3 of the Mandalong WMP discusses what remediation of tunnel erosion “should” consider and “recommends” tunnel erosion surveys of active existing areas prior to disturbance. No clear commitment of what will be done is included. Site-specific groundwater monitoring program described in detail in Section 4.3 of the Mandalong WMP. It is noted that DPI-Water requested information on the	Additional details added Figure 4.4 and Figure 4.4, including the existing programs on visual monitoring and photographic points presented as part of the WMP for the extraction plan for longwall 22 to longwall 24A. Flow monitoring is discussed in Section 4.3 with baseline flow data presented in Section 5.1.2. Section 4.5 includes additional details on monitoring and reporting systems in place for stream health and riparian vegetation within areas of extraction and downstream. Section 4.5 updated to provide clear commitments regarding tunnel erosion.

Comment	Response
status of installation of additional groundwater bores within the Southern Extension Area. The Department is satisfied that this information will be included in future EPs and updates to the Mandalong WMP as mine progresses into this area. <i>Include photographic monitoring to monitor stream conditions (in accordance with the EP for longwalls 22-23).</i> <i>Include more detailed information of water flow monitoring in the Mandalong WMP.</i> <i>Include a program to monitor and report on the condition of stream and riparian vegetation in the watercourses on site and downstream of the site.</i> <i>Include clear commitments to manage tunnel erosion areas, including pre-disturbance surveys and remediation. Indicate under what circumstances remediation would be undertaken.</i>	
Section 6.2 of the RWMP provides high-level emergency response procedures for unforeseen impacts and pollution incidents. Section 6.3.4 includes incident reporting requirements for the EPA. No incident reporting in accordance with condition 10, Schedule 6 of the Mandalong consent (SSD-5144) included. Appendix E of the Mandalong WMP includes TARPs. - Define “PIRMP” in the first instance. - The Watercourse TARP refers to SSTVs, however these are not included in Section 6.1.1 of the Mandalong WMP (only DTVs listed in Table 6-1). - Trigger 2 of the Watercourse TARP (water quality and flooding) should include notification of the Department in accordance with condition 10, Schedule 6 of the consent.	Comments addressed regarding the definition of PIRMP and incident reporting in the <i>Northern Operations: Regional Water Management Plan</i> [which was related to this WMP at the time of this response]. SSTVs have been included in Section 6.1.1 with references to TARPs where relevant.

Comment	Response
- Trigger 2 of the Groundwater TARP (quality and levels) should include notification of the Department in accordance with condition 10, Schedule 6 of the consent. - TARP response for any exceedances should include preparation of an incident report in accordance with condition 10, Schedule 6 of the consent. <i>Include incident reporting requirements of consent SSD-5144 in the RWMP and the TARPS with the Mandalong WMP</i> <i>Define PIRMP and include in abbreviations list</i> <i>Include SSTVs in the Mandalong WMP and refer to relevant SSTVs and DTVs in the watercourse TARP.</i>	
Both the RWMP and the Mandalong WMP should include a document control register to record the document, approval and circulation details.	Document control register has been added at the start of this document.
Update the figures in the Mandalong WMP to reflect the latest mine plan (i.e. showing Longwalls 22-24).	All figures have been updated with the most recent mine plan.
Update the Mandalong WMP to reflect the water monitoring (including visual monitoring of streams, etc) relevant to Longwalls 22-23, as described in the EP for Longwalls 22-23.	Section 4 has been updated to be consistent with the monitoring requirements of the extraction plan.
NSW Department of Planning and Environment – letter dated 8 March 2022 (responses to components deemed as not sufficient)	
Section 1.2.3 does not confirm if the applicant will comply with the requirement. Include a commitment to comply with Section 120 of the POEO Act.	An explicit requirement to comply with Section 120 of the POEO Act has been added to Section 1.3.2.

Comment	Response
Northern Operations: Discharge Management Plan Northern Coal Services: Water Management Plan has been referenced but it unclear what are reasonable and feasible measures to reduce water pollution associated with the discharge of surface water or mine-water (particularly salinity and dissolved or suspended metals associated with groundwater pumped from underground mine workings) required to comply with any EPL applying to the development. Include a summary of the reasonable and feasible measures to reduce water pollution associated with the discharge of surface water or mine-water (particularly salinity and dissolved or suspended metals associated with groundwater pumped from underground mine workings) required to comply with any EPL applying to the development.	The management actions were previously contained in the <i>Northern Operations: Discharge Management Plan</i>. As of Revision 7 of the Mandalong Mine WMP, the management, monitoring, performance criteria and Trigger Action Response Plans are contained within Section 3.2.4, Section 4.2.2, Section 4.5, Section 4.6.2, Section 6.1, Section 6.2 and Section 6.3.
There are no details on the plan or reference. Include the plan as an appendix and confirm the plan was prepared and approved.	An explicit reference and hyperlink to the <i>Northern Operations: Discharge Management Plan</i> location on Centennial's website has been included. The Mine-Water Discharges Management Plan is separate plan to the Water Management Plan. The approval of the Water Management Plan is independent of the approval of the Mine-Water Discharges Management Plan. Note: These plans have been superseded by Revision 7 of the <i>Mandalong Mine WMP</i>.
Appendix A Appendix B includes comments from 2016 and 2017. There is no recent feedback from DPE Water and the EPA on the most updated plan. Include details that confirm a recent copy of the management plan was sent to DPE Water and the EPA, following the result of incidents.	Evidence of recent correspondence following the result of incidents has now been included in Appendix A. A recent copy of the management plan was sent to DPE Water and the EPA on 18 August 2022, following the result of incidents. A response was received from 24 August 2022. The response required no further action. No response was received from DPE Water within the timeframe by 9 September 2022.

Comment	Response
Furthermore there is no detail to confirm the plan was prepared by a suitably qualified and experienced persons whose appointment has been approved by the Secretary. Include information to confirm a suitably qualified and experienced persons whose appointment has been approved by the Secretary prepared the plan.	Evidence of approval by the Secretary for the appointment of suitably qualified and experienced persons has now been included in Appendix A.
Section 6.2 does not include the requirement or criteria how the applicant will comply with the requirement for sediment dams. Section 6.2 does not include all the performance measures in Table 1-3. There are no criteria on clean water diversions or mine water storages. Include a description on measures to ensure compliance on sediment dams, clean water diversions, Table 4 of SSD-5144.	Table 1.4 summarises how each performance measure has been addressed in the WMP. By exception: Table 6.9 includes requirements for surface storages (including sediment dams) and clean water diversions, there are no mine water storages at MMAS, MSSS or DES.
Figure 3-1 includes bath house facilities but section 3.4 states no bath house facilities will be available at the site. Include consistent information in the plan	Section 3.4 has been updated to explicitly states there are no bathhouse facilities at MSSS.
It is unclear in section 3.5 if the development will investigate and implement measures to minimise potable water use and to recycle water. Include a discussion on what the development has investigated and implemented to minimise potable water use and to recycle water.	Section 3.6.1 has been updated to reflect the investigation and implementation of measures to minimise potable water use and to recycle water in consultation with Hunter Water.
It is unclear in section 3.2.2 if the water held in the MSSS sediment dam is used for irrigation. Include information to confirm if reasonable endeavours to reuse water held in the MSSS sediment dam are applied.	Following the commissioning of the surface to seam borehole, controlled discharge via LDP004 is no longer required. Therefore, the reuse of water at MSSS is no longer required.
It is unclear where in the plan if results of the monitoring program will be reported. Include details of reporting procedures for the results of the monitoring program.	Reporting of the monitoring program is described in Section 7.3.
Include a commitment to implement the approved management plan as approved from time to time by the Secretary.	Section 1 has been updated to include an explicit commitment to implement the approved WMP.

Comment	Response
Section 1.2.3 states the project approval to discharge collected water expired 30 June 2021. However the LDP remains as an emergency discharge location. Include approval details allowing discharge of collected water after 30 June 2021.	Section 1.3.2 has been updated to provide a reference to Section 3.2.2. Following commissioning of the surface to seam borehole, LDP004 remains as an emergency LDP that may discharge in the unlikely event of rainfall event that exceeds the design criteria of the water management system. There is no approval to discharge water that is captured and contained (collected) at MSSS after 30 June 2021.
Section 3.2.2 includes the same information but there is no further details which approval allows the LDP to continue to discharge 1ML/y as per Table 3-8. Include what controls have been implemented to address the incidents that occurred.	The water management system at MSSS has been designed and constructed to capture and contained water up to the relevant design criteria. LDP004 remains as an emergency LDP that may discharge in the unlikely event of rainfall event that exceeds the design criteria of the water management system. Discharge from LDP004 may occur due to rainfall events that exceed the design capacity of the water management system. No additional controls are required, consistent with consultation with Department of Planning and Environment following the discharges that occurred in early 2022. Refer to Appendix A.
There are no details or reference to commitment that [All watercourses subject to mine-water discharges and/or subsidence impacts are Hydraulically and geomorphologically stable, with aquatic ecology and riparian vegetation that is the same, or better than prior to mining]. Include information to ensure this commitment is implemented.	Rehabilitation requirements are addressed in the <i>Mandalong Mine Mining Operations Plan</i>
Include all performance measures as per Table 6, include the requirement Develop site-specific in-stream water quality objectives in accordance with ANZECC 2000 and Using the ANZECC Guidelines and Water Quality Objectives in NSW procedures (DECC 2006), or their latest versions.	An explicit reference to the site-specific in-stream water quality objectives described in Section 6.1.1 has been added to Section 6.2.5.
Include the requirements of Schedule 6 Condition 7 [Revision of Strategies, Plans and Programs]	Table 1.3 has been updated to explicitly include this condition and Section 7.13 has been added.

Comment	Response
The plan does not include any information on the [Community Consultative Committee]	Table 1.3 has been updated to explicitly include this condition and Section 7.7 has been added.
Include the requirement of condition 10 [Incident Reporting], 10A [Non-Compliance Notification], 11 [Regular Reporting]	Table 1.3 has been updated to explicitly include this condition. Reporting of incident reporting and non-compliances has been reproduced in Section 7.4. Reporting of environmental performance has been reproduced in Section 7.3.
Include the requirements consistent with condition 12 [Annual Review]	Table 1.3 has been updated to explicitly include this condition. Condition 12 is included in Table 1.2 of the WMP. Requirements of annual review has been reproduced in Section 7.1.
Include the requirement of the condition and if other audits have occurred.	Table 1.3 has been updated to explicitly include this condition. Independent environmental auditing has been described in Section 7.5.
Include the requirements of the condition 15 [Access to information]	Table 1.3 has been updated to explicitly include this condition.
There is no commitment to implement the requirement [for appropriate management and discharge of mine water at Cooranbong Entry Site]. Only a reference to another plan is stated in the plan. Include details to confirm this commitment will be implemented.	The management actions were previously contained in the <i>Northern Operations: Discharge Management Plan</i> . As of Revision 7 of the Mandalong Mine WMP, the management, monitoring, performance criteria and Trigger Action Response Plans are contained within Section 3.2.4, Section 4.2.2, Section 4.5, Section 4.6.2, Section 6.1, Section 6.2 and Section 6.3.
Include the commitment of modification 7 and how the development will/has implemented measures to address it.	These commitments for construction activities were addressed as part of the construction management plans for the 33kV power supply to MSSS that was completed in 2021. These commitments are no longer relevant to water management at Mandalong Mine.

Comment	Response
NSW Department of Planning, Housing and Infrastructure – letter dated 17 March 2026 (responses to components deemed as not satisfactory)	
The Department considers that the document should be updated to include: – updated agency names in the abbreviations list and throughout the document;.	Agency names have been updated in the abbreviations table and the body of the report, although, the original agency names have been used in the <i>Correspondence with regulators</i> (Appendix A) and <i>Consultation outcomes</i> (Appendix B) and there are some corresponding abbreviations in the Abbreviations Table.
The Department considers that the document should be updated to include: – justification for the reduced aquatic ecology monitoring program at the Cooranbong Entry Site described in Section 4.5.2 (i.e. from ten to four monitoring sites); and	The text in Section 4.5.2, and reference to ten locations previously monitored at CES was misrepresenting the changes, as it included the monitoring locations previously required for MSSS (during period of discharge). The CES aquatic ecology monitoring program has not been materially reduced since Revision 6 of the WMP (dated 20/12/2022). Details of retired CES monitoring locations have been added in Section 4.5.2.
The Department considers that the document should be updated to include: – an updated Trigger Action Response Plan (TARP) for Stream Health (Appendix G5) to include measurable and quantitative triggers, including an indication of: • what constitutes “substantial change” in the instream vegetation TARP	Some changes have been made to the TARP in Appendix G, Table G.5 to clarify. The words “substantial change” have been removed from the Level 2 trigger, as there is no consistent, quantitative definition that could be provided. Under the corrected TARP, the level 2 trigger would be where the investigation / assessment by suitably qualified professionals determines that observed changes to riparian / instream vegetation were due to mine discharge. In absence of direct clearance, the most influential factor on riparian and instream vegetation are generally rainfall conditions (e.g. drought reducing water level, or scouring high-flow events) and season (i.e. temperature). Changes in vegetation are not a reliable indicator of impacts from mine discharge as riparian and instream vegetation growth varies naturally due to changing environmental conditions and, unlike for macroinvertebrates, the linkage between water quality and vegetation condition / type is not well understood.

Comment	Response
	There are many factors that need to be considered when determining if mine discharges have potentially impacted on vegetation communities (e.g. if there have been any changes to the quality or quantity of discharge water, or watercourse stability issues related to discharges). Given this complexity, it is not possible to specify a threshold of change that would be reliable.
The Department considers that the document should be updated to include: – an updated Trigger Action Response Plan (TARP) for Stream Health (Appendix G5) to include measurable and quantitative triggers, including an indication of: • the nature of the “weight of evidence assessment” in the macroinvertebrate community condition.	ANZG (2018) provide the following explanation of the weight of evidence approach: “Weight of evidence describes the process to collect, analyse and evaluate a combination of different qualitative, semi-quantitative or quantitative lines of evidence to make an overall assessment of water/sediment quality and its associated management. It is the central platform for water/sediment quality assessments in the Water Quality Guidelines. Applying a weight-of-evidence process incorporates judgements about the quality, quantity, relevance and congruence of the data contained in the different lines of evidence.” (ANZG 2018) Macroinvertebrates are one line of evidence in the assessment of potential impacts from CES discharges and water quality and sediment quality are other lines of evidence. Various qualitative lines of evidence are also collected during the aquatic ecology assessment including habitat assessment. A footnote has been added to the TARP table (Appendix G, Table G-5) for Macroinvertebrate community condition to better explain the meaning of multiple lines of evidence.

APPENDIX C – NSW Groundwater Bore Database search results

Mandalong Mine
Water Management Plan

Bore	Easting	Northing	Depth (m)	Licence status	Authorised use	Surface water level (m bgl)	Yield (L/s)	Salinity (mg/L)	Aquifer
GW021578	355396	6334454	3.6	Active	Stock, domestic	2.4	0.13	Fair	Sand
GW029567	361864	6340863	3	Cancelled	Domestic, farming, irrigation, stock	2.1	-	Very good	Clay and sandstone
GW033618	358945	6343594	30.4	Current	Stock	-	-	Hard	-
GW033619	359049	6343596	21.3	Active	Stock	-	1.51	Hard	-
GW034950	356963	6335463	76.2	Active	Stock, domestic	14.9	0.25	Poor	Conglomerate
GW043431	359665	6345915	38.1	Active	Stock	1.8	-	-	-
GW044189	353479	6337815	3.6	Active	Stock, domestic	–	–	0–500	–
GW051542	352519	6343007	38	Active	Domestic and Stock	12.2	1.7	Good	Rock
GW052111	359475	6339227	49	Current	Stock	10.5	2.37	Good	Clay
GW052255	356445	6333638	114	Active	Stock	8.7	0.07, 0.1, 0.23	–	Shale, Conglomerate
GW052374	353735	6339759	38	Active	Stock, domestic	18	2.52	–	Sandstone
GW052381	357498	6346746	35	Withdrawn	Domestic and Stock	13	0.76	Good	Clay
GW053438	359235	6339686	53	Lapsed	Domestic, irrigation, stock	-	0.44	1001 - 3000 ppm	
GW054183	352923	6335126	18.3	Active	Domestic	–	–	Fair	–
GW056862	356600	6337214	45	Active	Stock, domestic	–	–	–	–
GW057310	356467	6342726	61	Active	Domestic and Stock	6	0.07		Shale
GW059558	358320	6336592	5	–	Farming	–	–	–	–

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Bore	Easting	Northing	Depth (m)	Licence status	Authorised use	Surface water level (m bgl)	Yield (L/s)	Salinity (mg/L)	Aquifer
GW060965	354299	6338505	33.6	Active	Stock, domestic	29	0.38	Salty	Shale
GW061202	357061	6344737	50.3	Active	Domestic and Stock	21.9	0.3	1001 - 3000 ppm	Siltstone, coal
GW061226	356445	6333638	117.3	Active	Stock, domestic	24.4, 83	3, 0.1, 0.1	3,001–7,000	Sandstone, shale
GW062618	358931	6337371	34.5	Active	Domestic	16.4	34, 53	–	–
GW064033	357483	6338921	49.4	Active	Stock, domestic	12.2	0.06, 0.1, 0.15	501–1,000	Sandstone
GW064116	356486	6339677	21.3	Active	Stock, domestic	–	0.3, 0.6	0–500	Sandstone
GW064143	358504	6338197	24.3	Active	Stock, domestic	–	–	1,001–3,000	Gravel
GW067263	355148	6338979	10	Active	Stock, domestic	3	0.15	–	–
GW078060	360787	6330898	28	Active	Domestic	15	1.25	Fresh	Conglomerate
GW078084	357181	6334696	62	Active	Stock, domestic	5	0.05, 0.1	Fresh	Sandstone
GW078094	360784	6331113	30.4	Active	Domestic, stock	5	0.2, 0.3	480, 500	Sandstone
GW078110	352956	6332939	7.3	Active	Monitoring bore	–	–	5100	Sand
GW078111	353423	6332885	12.2	Active	Monitoring bore	–	–	–	–
GW078113	353009	6333865	12.2	Active	Monitoring bore	2.35	–	1630	Silt, sand
GW078114	355863	6334400	12	Active	Monitoring bore	3.48	–	650	Sand
GW078115	355319	6333746	10.4	Active	Monitoring bore	0.99	–	5370	Sand
GW078116	354978	6333987	8.5	Active	Monitoring bore	1.74	–	10880	Sand

Bore	Easting	Northing	Depth (m)	Licence status	Authorised use	Surface water level (m bgl)	Yield (L/s)	Salinity (mg/L)	Aquifer
GW078117	354252	6334007	13.7	Active	Monitoring bore	1.68	–	2380	Sand
GW078118	353418	6334980	15.8	Active	Monitoring bore	2.38	–	820	Sand
GW078119	353204	6334731	9.1	Active	Monitoring bore	2.66	–	230	Sand
GW078131	353466	6333532	12.5	Active	Monitoring bore	1.58	–	310	Sand
GW078132	353702	6333351	14.6	Active	Monitoring bore	1.65	–	5100	Sand
GW078136	356136	6335236	9	Active	Monitoring bore	4.5	–	370	Sand
GW078137	355416	6334886	5.5	Active	Monitoring bore	5.35	–	2720	Sand
GW078138	356976	6345167	120	Cancelled	Test bore	35	0.8	320 - 470	Sandstone
GW078139	354851	6334477	9.1	Active	Monitoring bore	2.9	–	1560	Sand
GW078140	356434	6333731	180	Cancelled	Test bore	16	0.2	634	Coal
GW078214	360811	6330799	36	Active	Stock, domestic	12, 9	0.63, 2	Fresh	Sandy clay, sandstone
GW078601	354731	6332103	18.85	Active	Stock, domestic	4.5	1.1	1600	Sandstone
GW078608	359054	6338132	60	Active	Stock, domestic	–	–	–	–
GW079772	356385	6333546	234	Cancelled	Test bore	–	0.1, 0.2	2,900, 1,500	Sandstone, coal
GW116289	364516	6341443	52.3	-	Monitoring	25	-	-	Clay
GW116290	364507	6341256	7.1	-	Monitoring	6	-	-	-
GW116291	364615	6341995	19.5	-	Monitoring	5	-	-	-
GW116292	364066	6342391	21	-	Monitoring	14	-	-	Sandstone
GW116406	360418.1	6341117.4	6	-	Monitoring	2.06	-	-	Sandy clay
GW116419	360085.6	6341190.5	15	-	Monitoring	-	-	-	-
GW116425	360244.8	6341138.5	10	-	Monitoring	-	8.28	-	Clay

Bore	Easting	Northing	Depth (m)	Licence status	Authorised use	Surface water level (m bgl)	Yield (L/s)	Salinity (mg/L)	Aquifer
GW200696	359964	6347393	66	Cancelled	Test bore	23	1.5	-	-
GW200765	356404	6339855	8	Active	Domestic	–	-	-	-
GW200915	357208	6335014	60	Active	Stock, domestic	–	-	-	–
GW201396	353820	6333360	9	Active	Monitoring bore	2.5	-	-	Clayey sand, sand
GW201397	353821	6333365	30.5	Active	Monitoring bore	20	-	-	Sandstone
GW201398	353822	6333372	58	Active	Monitoring bore	51	-	-	Sandstone, mudstone
GW201399	352912	6333760	30.1	Active	Monitoring bore	27	-	-	Sandstone, mudstone
GW201400	352906	6333763	63	Active	Monitoring bore	54	-	-	Sandstone, mudstone
GW201401	353283	6334737	32.85	Active	Monitoring bore	29.5	-	-	Sandstone, mudstone
GW201402	353281	6334735	60	Active	Monitoring bore	55	-	-	Sandstone
GW201403	353034	6333976	21	Active	Monitoring bore	16	-	-	Sandstone, mudstone
GW201404	353073	6333977	34.1	Active	Monitoring bore	24	-	-	Sandstone
GW201405	353073	6333978	60	Active	Monitoring bore	56	-	-	Sandstone
GW202027	363829	6334141	3.7	Lapsed	Test bore	0.8	-	-	-
GW202028	363872	6334034	5.5	Lapsed	Test bore	1.6	-	-	-
GW202098	363829	6334141	4	Lapsed	Test bore	0.8	-	-	-
GW202246	363834	6334174	3.5	Lapsed	Test bore	1.2	-	-	-
GW202247	363899	6333964	5	Lapsed	Test bore	3.6	-	-	-
GW202248	363918	6333881	5	Lapsed	Test bore	-	-	-	-

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Bore	Easting	Northing	Depth (m)	Licence status	Authorised use	Surface water level (m bgl)	Yield (L/s)	Salinity (mg/L)	Aquifer
GW202325	360869	6344024	3	Active	Test bore	-	-	-	-
GW202338	359356	6347809	102	Lapsed	Test bore	4	3.3	730 - 2300	Sandstone, siltstone, coal
GW202339	359340	6348185	68.5	Lapsed	Test bore	0.6	10.4	100 - 2100	Sandstone
GW202372	363834	6334174	4	Active	Test bore	1.2	-	-	-
GW202940	361666	6341097	4.5	Active	Monitoring	1.6	-	-	Clayey sand, silty clay
GW202941	361591	6341004	5.5	Active	Monitoring	2.03	-	-	Sand and sandy clay
GW202942	361575	6341085	6	Active	Monitoring	1.81	-	-	Silty clay and clay
GW202943	361566	6340704	8	Active	Monitoring	4.68	-	-	Conglomerate
GW202944	361571	6340770	8.5	Active	Monitoring	5.3	-	-	Conglomerate
GW202945	361591	6340725	9	Active	Monitoring	5.11	-	-	Conglomerate and coal
GW202946	361568	6340833	8.4	Active	Monitoring	4.79	-	-	Coal
GW202947	361596	6340822	9	Active	Monitoring	3.94	-	-	Silty clay and clay
GW202948	361613	6340821	9.5	Active	Monitoring	2.9	-	-	Silty sand and sandy clay
GW202949	361593	6340864	9	Active	Monitoring	4.09	-	-	Clay
GW202950	361523	6340829	9	Active	Monitoring	4.17	-	-	Clay
GW202951	361592	6340796	9	Active	Monitoring	5.82	-	-	-
GW202952	361618	6340813	19	Active	Monitoring	5.35	-	-	Clay
GW202958	361694	6346816	21.74	Active	Monitoring	11.08	-	-	-
GW202963	358946	6343971	38.9	Active	Monitoring	23.78	-	-	-

Bore	Easting	Northing	Depth (m)	Licence status	Authorised use	Surface water level (m bgl)	Yield (L/s)	Salinity (mg/L)	Aquifer
GW202964	359336	6344685	41.25	Active	Monitoring	17.63	-	-	-
GW202965	362741	6346266	32.55	Active	Monitoring	-	-	-	-
GW203292	357414	6347037	88	Current	Stock	10.1	3.6	-	Coal and shale
GW203815	360625.3	6341598.8	36.5	-	Monitoring	-	-	-	-
GW203987	363530.2	6334261.8	36	-	Stock and Domestic	7	0.6	-	Sandstone
GW204485	362091	6338055	5	Current	Domestic	-1.5	0.5	-	Sand
GW204542	362687.3	6342213.3	20.3	-	Monitoring	18	-	-	Conglomerate
GW204548	362352.5	6341934.8	5.9	-	Monitoring	8	-	-	Rock
GW204550	362352.5	6341435.9	6.3	-	Monitoring	6	-	-	Rock
GW204559	363572.3	6341390.3	20.4	-	Monitoring	0.9	-	-	Conglomerate
GW204560	362602	6342147	27	-	Monitoring	-	-	-	-
GW204617	362715	6342536	36.4	-	Monitoring	22	-	-	-
GW204619	362564	6342266	41.2	-	Monitoring	-	-	-	-
GW204674	356407.7	6334621.7	8	—	—	—	-	-	-
GW204675	356655.8	6334623.8	8	—	—	—	-	-	-
GW204677	356575.6	6334661.8	8	—	—	—	-	-	-
GW204689	362927	6342596.7	21.4	-	Monitoring	-	-	-	Conglomerate and sandstone
GW204696	362367	6340788	40.3	-	Monitoring	-	-	-	Sandstone and mudstone
GW204698	362648	6342344	35.2	-	Monitoring	-	-	-	Conglomerate and sandstone
GW204699	362687	6342213	20.3	-	Monitoring	23	-	-	Conglomerate

Bore	Easting	Northing	Depth (m)	Licence status	Authorised use	Surface water level (m bgl)	Yield (L/s)	Salinity (mg/L)	Aquifer
GW204701	363212	6340825	10	-	Monitoring	10	-	-	Conglomerate
GW204872	364491	6341425	54.5	Current	Stock and Domestic	22.9	-	-	Conglomerate
GW204892	363026	6342199	17.5	Expired	Dewatering	6	-	-	Clayey gravel
GW204894	363583	6342086	18.5	Current	Stock	6	-	-	Coal
GW204895	362508	6341548	20	-	Monitoring	12	-	-	Conglomerate
GW204896	363434	6342086	23.5	Current	Stock and Domestic	6	-	-	-
GW204897	364020	6341977	25.5	Current	Stock and Domestic	6	-	-	Coal and sandy clay
GW204898	363434	6342107	29.5	-	Monitoring	5	-	-	Sandstone
GW204933	363310	6341041	10	-	Monitoring	-	-	-	Conglomerate and mudstone
GW204947	362771	6335962	16	-	Water Supply	7.8	-	-	Rock

'-' denotes no data available

APPENDIX D – Watercourse stability monitoring locations

Location	Easting (MGA94z56)	Northing (MGA94z56)	Location	Easting (MGA94z56)	Northing (MGA94z56)
1	351646	6330599	58	353429	6332972
2	351504	6330527	59	353304	6332958
3	351362	6330449	60	353252	6332918
4	351194	6330504	61	353207	6332880
5	351302	6330383	62	353149	6332788
6	351178	6330270	63	353055	6332706
10	350696	6330403	64	353006	6332661
11	350564	6330285	65	353012	6332495
14	350805	6329745	66	353007	6332359
15	350633	6329701	67	353062	6332405
16	351795	6330617	68	353033	6332225
17	351846	6330511	69	353056	6332070
18	351860	6330394	70	352943	6332022
19	351883	6330276	71	352815	6332021
20	351838	6330165	72	352785	6331932
21	351840	6330047	73	352697	6331864
27	351378	6329380	74	352690	6331712
28	351333	6329270	75	352578	6331692
29	351222	6329143	DS1	352543	6329560
32	352003	6329525	DS2	352502	6329527
33	352025	6329412	DS3	352459	6329457
34	352062	6329329	DS4	352433	6329411
35	351971	6329253	DS5	352326	6329372
36	351890	6329153	DS6	352107	6329318
37	351913	6329040	MCT1	352209	6332490
55	353717	6333093	MCT10	352111	6332026

Location	Easting (MGA94z56)	Northing (MGA94z56)	Location	Easting (MGA94z56)	Northing (MGA94z56)
56	353613	6333045	MCT11	351981	6332028
57	353508	6333021	MCT12	351880	6332078
MCT13	351969	6331897	TC2	351989	6333053
MCT14	352328	6331791	TC3	351879	6333014
MCT2	352363	6332484	TC4	351806	6332994
MCT3	352460	6332418	TC5	351774	6333013
MCT4	352706	6332172	TC6	351688	6332949
MCT5	352527	6332105	TC7	351575	6332925
MCT6	352427	6332051	TC8	351486	6332885
MCT7	352367	6332040	TC9	351388	6332859
MCT8	352292	6332070	TCT1	351812	6333229
MCT9	352217	6332060	TCT2	351862	6333090
TC1	352044	6333078	TCT3	351887	6332937
TC10	351334	6332763			

APPENDIX E – Baseline surface water quality data

E.1 Mandalong Mine Access Site

E.1.1 Upstream Stockton Creek

8.1.1.1 Median water quality results

Parameter	Units	SW004		SW008		SW012	
		Count	Median	Count	Median	Count	Median
Physicochemical parameters							
EC	μS/cm	55	577	45	950	48	590.5
Oil and grease	mg/L	54	2	44	2	50	2
pH	pH units	55	6.84	45	6.96	51	6.73
TDS	mg/L					50	350.5
TSS	mg/L	55	11	45	8	51	12
Turbidity	NTU	36	20.2	27	27.1	49	32.6
Major ions							
Chloride	mg/L	8	119.5			7	110
Sulfate	mg/L	2	4.5				
Total hardness	mg/L	8	69.5			7	60
Nutrients							
Ammonia	mg/L	8	0.17			7	0.06
Dissolved metals							
Arsenic	mg/L	8	0.001			7	0.001
Barium	mg/L	8	0.0565			7	0.039
Boron	mg/L	8	0.05			7	0.05
Cadmium	mg/L	8	0.0001			7	0.0001
Hexavalent chromium	mg/L	7	0.01			6	0.01
Copper	mg/L	8	0.001			7	0.001
Iron	mg/L	8	2.345			7	1.83
Lead	mg/L	7	0.001			7	0.001
Manganese	mg/L	8	1.214			7	0.266

Parameter	Units	SW004		SW008		SW012	
		Count	Median	Count	Median	Count	Median
Mercury	mg/L	8	0.0001			7	0.0001
Selenium	mg/L	8	0.01			7	0.01
Silver	mg/L	8	0.001			7	0.001
Zinc	mg/L	8	0.005			7	0.01
Total metals							
Arsenic	mg/L	8	0.002			7	0.002
Barium	mg/L	8	0.0635			7	0.055
Boron	mg/L	8	0.05			7	0.05
Cadmium	mg/L	8	0.0001			7	0.0001
Copper	mg/L	8	0.002			7	0.002
Iron	mg/L	7	4.94			6	5.36
Lead	mg/L	8	0.001			7	0.001
Manganese	mg/L	8	0.806			7	0.199
Mercury	mg/L	7	0.0001			6	0.0001
Selenium	mg/L	7	0.01			6	0.01
Silver	mg/L	8	0.001			7	0.001
Zinc	mg/L	7	0.015			6	0.0135
Other parameters							
Cyanide	mg/L	8	0.004			7	0.004
Fluoride	mg/L	8	0.1			7	0.1

E.1.2 Downstream Stockton Creek

8.1.1.2 Median water quality results

Parameter	Units	SW001		SW002	
		Count	Median	Count	Median
Physicochemical parameters					
EC	μS/cm	59	30700	58	3235
Oil and grease	mg/L	58	2	57	2
pH	pH units	59	7.11	58	6.865
TDS	mg/L			58	1565
TSS	mg/L	59	7	58	10
Turbidity	NTU	40	4.35	58	28.55
Major ions					
Chloride	mg/L	10	7025	10	1741.5
Sulfate	mg/L	2	1133	2	536.5
Total hardness	mg/L	10	2230	10	635.5
Nutrients					
Ammonia	mg/L	10	0.08	10	0.09
Dissolved metals					
Arsenic	mg/L	10	0.001	10	0.002
Barium	mg/L	10	0.0375	10	0.0655
Boron	mg/L	10	1.53	10	0.415
Cadmium	mg/L	10	0.0001	10	0.0001
Hexavalent chromium	mg/L	9	0.01	9	0.01
Copper	mg/L	9	0.001	10	0.001
Iron	mg/L	10	0.755	10	1.22
Lead	mg/L	10	0.001	10	0.001
Manganese	mg/L	10	0.0935	10	0.495
Mercury	mg/L	10	0.0001	10	0.0001

Parameter	Units	SW001		SW002	
		Count	Median	Count	Median
Selenium	mg/L	10	0.01	10	0.01
Silver	mg/L	10	0.001	10	0.001
Zinc	mg/L	10	0.022	10	0.0165
Total metals					
Arsenic	mg/L	10	0.0015	10	0.002
Barium	mg/L	10	0.041	10	0.069
Boron	mg/L	10	1.61	10	0.37
Cadmium	mg/L	10	0.0001	10	0.0001
Copper	mg/L	10	0.0065	10	0.003
Iron	mg/L	9	1.24	9	3.89
Lead	mg/L	10	0.001	10	0.001
Manganese	mg/L	10	0.1045	10	0.212
Mercury	mg/L	9	0.0001	9	0.0001
Selenium	mg/L	9	0.01	9	0.01
Silver	mg/L	10	0.001	10	0.006
Zinc	mg/L	9	0.024	9	0.016
Other parameters					
Cyanide	mg/L	10	0.004	10	0.004
Fluoride	mg/L	10	0.5	10	0.3

E.1.3 Morans Creek

8.1.1.3 Median water quality results

Parameter	Units	SW003		SW006		SW011	
		Count	Median	Count	Median	Count	Median
Physicochemical parameters							
EC	μS/cm	60	378	57	390	38	835.4
Oil and grease	mg/L	59	2	3	2	38	2
pH	pH units	60	6.45	58	6.515	38	6.66
TSS	mg/L	60	10.5	58	15.5	38	29.8
Turbidity	NTU	41	21.7	40	24.15	24	45.88
Major ions							
Chloride	mg/L	10	69.5	1	20.3	6	116
Sulfate	mg/L	2	11.5			1	0
Total hardness	mg/L	10	44			6	50
Nutrients							
Ammonia	mg/L	10	0.025			6	0.11
Dissolved metals							
Arsenic	mg/L	10	0.001			6	0.002
Barium	mg/L	10	0.045			6	0.047
Boron	mg/L	10	0.05			6	0.05
Cadmium	mg/L	10	0.0001			6	0.0001
Hexavalent chromium	mg/L	9	0.01			6	0.01
Copper	mg/L	10	0.001			6	0.001
Iron	mg/L	10	1.24			6	2.54
Lead	mg/L	10	0.001			6	0.001
Manganese	mg/L	10	0.1865			6	1.17
Mercury	mg/L	10	0.0001			6	0.0001
Selenium	mg/L	10	0.01			6	0.01

Parameter	Units	SW003		SW006		SW011	
		Count	Median	Count	Median	Count	Median
Silver	mg/L	10	0.001			6	0.001
Zinc	mg/L	10	0.008			6	0.009
Total metals							
Arsenic	mg/L	10	0.0015			6	0.003
Barium	mg/L	10	0.0555			6	0.088
Boron	mg/L	10	0.05			5	0.05
Cadmium	mg/L	10	0.0001			6	0.0001
Copper	mg/L	10	0.002			6	0.002
Iron	mg/L	9	3.18			6	8.36
Lead	mg/L	10	0.001			6	0.001
Manganese	mg/L	10	0.283			6	2.22
Mercury	mg/L	9	0.0001			6	0.0001
Selenium	mg/L	9	0.01			6	0.01
Silver	mg/L	10	0.001			6	0.001
Zinc	mg/L	9	0.018			6	0.019
Other parameters							
Cyanide	mg/L	10	0.004			6	0.004
Fluoride	mg/L	10	0.1			6	0.1

E.1.4 Pourmalong Creek

8.1.1.4 Median water quality results

Parameter	Units	SW009		SW010	
		Count	Median	Count	Median
Physicochemical parameters					
EC	μS/cm	41	332	31	409
Oil and grease	mg/L	41	6.7	31	2
pH	pH units	41	6.7	31	5.93
TSS	mg/L	41	12	31	10
Turbidity	NTU	40	20.45	31	24
Major ions					
Chloride	mg/L			7	79
Sulfate	mg/L			2	
Total hardness	mg/L			7	43
Nutrients					
Ammonia	mg/L			7	0.01
Dissolved metals					
Arsenic	mg/L			7	0.001
Barium	mg/L			7	0.038
Boron	mg/L			7	0.05
Cadmium	mg/L			7	0.0001
Hexavalent chromium	mg/L			7	0.01
Copper	mg/L			7	0.001
Iron	mg/L	1	1.15	7	1.81
Lead	mg/L			7	0.001
Manganese	mg/L	1	0.061	7	0.094
Mercury	mg/L			7	0.0001
Selenium	mg/L			7	0.01

Parameter	Units	SW009		SW010	
		Count	Median	Count	Median
Silver	mg/L			7	0.001
Zinc	mg/L			7	0.032
Total metals					
Arsenic	mg/L			7	0.001
Barium	mg/L			7	0.051
Boron	mg/L			7	0.05
Cadmium	mg/L			7	0.0001
Copper	mg/L			7	0.004
Iron	mg/L			7	3.48
Lead	mg/L			7	0.002
Manganese	mg/L			7	0.115
Mercury	mg/L			7	0.0001
Selenium	mg/L			7	0.01
Silver	mg/L			7	0.001
Zinc	mg/L			7	0.034
Other parameters					
Cyanide	mg/L			7	0.004
Fluoride	mg/L			7	0.1

E.1.5 Mullards Creek

8.1.1.5 Median water quality results

Parameter	Units	SW018	
		Count	Median
Physicochemical parameters			
EC	μS/cm	19	604
Oil and grease	mg/L	19	2
pH	pH units	19	7.30
TDS	mg/L	19	386
TSS	mg/L	19	24
Turbidity	NTU	19	46.6
Major ions			
Bicarbonate alkalinity	mg/L	16	179
Carbonate alkalinity	mg/L	16	1
Hydroxide alkalinity	mg/L	16	1
Total alkalinity	mg/L	16	179
Calcium	mg/L	17	46
Chloride	mg/L	16	38
Magnesium	mg/L	17	6
Potassium	mg/L	17	8
Sodium	mg/L	17	66
Sulfate	mg/L	16	20
Total hardness	mg/L	19	144
Nutrients			
Ammonia	mg/L	19	0.29
BOD	mg/L	19	9
Nitrate + nitrite	mg/L	19	0.01
TKN	mg/L	19	3.4

Parameter	Units	SW018	
		Count	Median
Total nitrogen	mg/L	19	3.4
Total phosphorus	mg/L	19	2.53
Dissolved metals			
Aluminium	mg/L	18	0.07
Arsenic	mg/L	19	0.002
Barium	mg/L	19	0.026
Boron	mg/L	19	0.14
Cadmium	mg/L	19	0.0001
Chromium	mg/L	18	0.001
Cobalt	mg/L	18	0.002
Copper	mg/L	19	0.001
Iron	mg/L	19	1.84
Lead	mg/L	19	0.001
Manganese	mg/L	19	0.266
Mercury	mg/L	19	0.0001
Nickel	mg/L	18	0.009
Selenium	mg/L	19	0.01
Silver	mg/L	19	0.001
Zinc	mg/L	19	0.021
Total metals			
Aluminium	mg/L	18	0.375
Arsenic	mg/L	19	0.002
Barium	mg/L	19	0.047
Boron	mg/L	19	0.12
Cadmium	mg/L	19	0.0001
Chromium	mg/L	18	0.003

Parameter	Units	SW018	
		Count	Median
Cobalt	mg/L	18	0.002
Copper	mg/L	19	0.003
Iron	mg/L	19	5.39
Lead	mg/L	19	0.002
Manganese	mg/L	19	0.321
Mercury	mg/L	19	0.0001
Nickel	mg/L	18	0.009
Selenium	mg/L	19	0.01
Silver	mg/L	19	0.001
Zinc	mg/L	19	0.057
Other parameters			
Cyanide	mg/L	19	0.004
Fluoride	mg/L	19	0.5

E.2 Mandalong South Surface Site

E.2.1 Mannering Creek

8.1.1.6 Median water quality results

Parameter	Units	SWMP01		SWMP02	
		Count	Median	Count	Median
Physicochemical parameters					
EC	µS/cm	44	500	44	442
Oil and grease	mg/L	43	2	43	2
pH	pH units	44	6.69	44	6.54
TDS	mg/L	44	290.5	44	306.5
TSS	mg/L	44	5	44	12
Turbidity	NTU	44	15.7	44	29.95
Major ions					
Bicarbonate alkalinity	mg/L	44	29.5	44	30.5
Carbonate alkalinity	mg/L	44	1	44	1
Hydroxide alkalinity	mg/L	44	1	44	1
Total alkalinity	mg/L	44	29.5	44	30.5
Calcium	mg/L	44	7	44	5
Chloride	mg/L	44	116	44	108.5
Magnesium	mg/L	44	11	44	9
Potassium	mg/L	44	3	44	4
Sodium	mg/L	44	67	44	61.5
Sulfate	mg/L	12	14.5	13	8
Total hardness	mg/L	44	63	44	50
Nutrients					
Ammonia	mg/L	5	0	5	0.04
BOD	mg/L	44	2	44	2
Nitrate + nitrite	mg/L	44	0.02	44	0.02

Parameter	Units	SWMP01		SWMP02	
		Count	Median	Count	Median
TKN	mg/L	44	0.3	44	1.1
Total nitrogen	mg/L	44	0.4	44	1.1
Total phosphorus	mg/L	44	0.02	44	0.095
Dissolved metals					
Aluminium	mg/L	44	0.105	44	0.42
Arsenic	mg/L	44	0.001	44	0.001
Barium	mg/L	44	0.0495	44	0.059
Boron	mg/L	44	0.05	44	0.05
Cadmium	mg/L	44	0.0001	44	0.0001
Chromium	mg/L	44	0.001	44	0.001
Cobalt	mg/L	44	0.001	44	0.004
Copper	mg/L	44	0.001	44	0.001
Iron	mg/L	43	1.45	43	3.26
Lead	mg/L	44	0.001	44	0.001
Manganese	mg/L	43	0.138	43	0.637
Mercury	mg/L	44	0.0001	44	0.0001
Nickel	mg/L	44	0.002	44	0.003
Selenium	mg/L	44	0.01	44	0.01
Silver	mg/L	44	0.001	44	0.001
Zinc	mg/L	44	0.005	44	0.007
Total metals					
Aluminium	mg/L	44	0.225	44	0.74
Arsenic	mg/L	44	0.001	44	0.001
Barium	mg/L	43	0.054	43	0.065
Boron	mg/L	44	0.05	44	0.05
Cadmium	mg/L	44	0.0001	44	0.0001

Parameter	Units	SWMP01		SWMP02	
		Count	Median	Count	Median
Chromium	mg/L	44	0.001	44	0.001
Cobalt	mg/L	43	0.002	43	0.005
Copper	mg/L	44	0.001	44	0.002
Iron	mg/L	44	3.125	44	5.995
Lead	mg/L	44	0.001	44	0.001
Manganese	mg/L	44	0.148	44	0.676
Mercury	mg/L	44	0.0001	44	0.0001
Nickel	mg/L	44	0.003	44	0.004
Selenium	mg/L	44	0.01	44	0.01
Silver	mg/L	44	0.001	44	0.001
Zinc	mg/L	43	0.005	43	0.011
Other parameters					
Cyanide	mg/L	44	0.004	44	0.004
Fluoride	mg/L	44	0.1	44	0.1

E.2.2 Wyee Creek

8.1.1.7 Median water quality results

Parameter	Units	SWMP03		SWMP04		SWMP05	
		Count	Median	Count	Median	Count	Median
Physicochemical parameters							
EC	μS/cm	47	426	63	582	62	407.5
Oil and grease	mg/L	46	2	61	2	60	2
pH	pH units	47	6.65	63	6.74	62	6.51
TDS	mg/L	47	276	63	372	62	294
TSS	mg/L	47	10	63	14	62	17.5
Turbidity	NTU	47	29.7	63	29.1	62	33.35
Major ions							
Bicarbonate alkalinity	mg/L	47	40	63	38	62	24.5
Carbonate alkalinity	mg/L	47	1	63	1	62	1
Hydroxide alkalinity	mg/L	47	1	63	1	62	1
Total alkalinity	mg/L	47	40	63	38	62	24.5
Calcium	mg/L	47	7	63	6	62	7.5
Chloride	mg/L	47	100	63	141	62	93.5
Magnesium	mg/L	47	10	63	12	62	8.5
Potassium	mg/L	47	3	63	4	62	4
Sodium	mg/L	47	56	63	82	62	51
Sulfate	mg/L	5	10	9	7.5		
Total hardness	mg/L	47	60	63	65	62	53
Nutrients							
Ammonia	mg/L	5	0.02	5	0.03	5	0.02
BOD	mg/L	47	2	63	3	62	2
Nitrate + nitrite	mg/L	47	0.02	63	0.01	62	0.01
TKN	mg/L	47	0.7	63	1.5	62	1.1

Parameter	Units	SWMP03		SWMP04		SWMP05	
		Count	Median	Count	Median	Count	Median
Total nitrogen	mg/L	47	0.8	63	1.5	62	1.1
Total phosphorus	mg/L	47	0.06	63	0.18	62	0.09
Dissolved metals							
Aluminium	mg/L	47	0.27	63	0.29	62	0.43
Arsenic	mg/L	47	0.001	63	0.001	62	0.001
Barium	mg/L	47	0.056	63	0.05	62	0.034
Boron	mg/L	47	0.05	63	0.05	62	0.05
Cadmium	mg/L	47	0.0001	63	0.0001	62	0.0001
Chromium	mg/L	47	0.001	63	0.001	62	0.001
Cobalt	mg/L	47	0.002	63	0.002	62	0.001
Copper	mg/L	47	0.001	63	0.001	62	0.001
Iron	mg/L	46	2.305	62	3.11	61	1.59
Lead	mg/L	47	0.001	63	0.001	62	0.001
Manganese	mg/L	46	0.32	62	0.698	61	0.134
Mercury	mg/L	47	0.0001	63	0.0001	62	0.0001
Nickel	mg/L	47	0.004	63	0.003	62	0.002
Selenium	mg/L	47	0.01	63	0.01	62	0.01
Silver	mg/L	47	0.001	63	0.001	62	0.001
Zinc	mg/L	47	0.005	63	0.007	62	0.009
Total metals							
Aluminium	mg/L	47	0.76	63	0.73	62	1.64
Arsenic	mg/L	47	0.001	63	0.001	62	0.002
Barium	mg/L	46	0.064	62	0.0825	61	0.048
Boron	mg/L	47	0.05	63	0.05	62	0.05
Cadmium	mg/L	47	0.0001	63	0.0001	62	0.0001
Chromium	mg/L	47	0.001	63	0.001	62	0.002

Parameter	Units	SWMP03		SWMP04		SWMP05	
		Count	Median	Count	Median	Count	Median
Cobalt	mg/L	46	0.003	63	0.003	61	0.002
Copper	mg/L	47	0.001	63	0.001	62	0.0025
Iron	mg/L	47	4.97	63	6.23	62	3.845
Lead	mg/L	47	0.001	63	0.001	62	0.001
Manganese	mg/L	47	0.406	63	1.05	62	0.2305
Mercury	mg/L	47	0.0001	63	0.0001	62	0.0001
Nickel	mg/L	47	0.005	63	0.004	62	0.003
Selenium	mg/L	47	0.01	63	0.01	62	0.01
Silver	mg/L	47	0.001	63	0.001	62	0.001
Zinc	mg/L	46	0.008	62	0.015	61	0.019
Other parameters							
Cyanide	mg/L	47	0.004	63	0.004	62	0.004
Fluoride	mg/L	47	0.1	63	0.1	62	0.1

E.2.3 Morans Creek

8.1.1.8 Median water quality results

Parameter	Units	SWMP06		SWMP07	
		Count	Median	Count	Median
Physicochemical parameters					
EC	µS/cm	49	594	52	505.5
Oil and grease	mg/L	48	2	51	2
pH	pH units	49	6.41	52	6.67
TDS	mg/L	49	374	52	314
TSS	mg/L	49	22	52	11.5
Turbidity	NTU	49	31.7	52	29.25
Major ions					
Bicarbonate alkalinity	mg/L	49	30	52	40
Carbonate alkalinity	mg/L	49	1	52	1
Hydroxide alkalinity	mg/L	49	1	52	1
Total alkalinity	mg/L	49	30	52	40
Calcium	mg/L	49	6	52	5
Chloride	mg/L	49	154	52	120
Magnesium	mg/L	49	12	52	10
Potassium	mg/L	49	3	52	4
Sodium	mg/L	49	79	52	75
Sulfate	mg/L			7	9
Total hardness	mg/L	49	64	52	54
Nutrients					
Ammonia	mg/L	5	0.02	5	0
BOD	mg/L	49	2	52	2
Nitrate + nitrite	mg/L	49	0.02	52	0.025
TKN	mg/L	49	0.8	52	0.85

Parameter	Units	SWMP06		SWMP07	
		Count	Median	Count	Median
Total nitrogen	mg/L	49	0.8	52	0.95
Total phosphorus	mg/L	49	0.04	52	0.06
Dissolved metals					
Aluminium	mg/L	49	0.26	52	0.265
Arsenic	mg/L	49	0.001	52	0.001
Barium	mg/L	49	0.068	52	0.0485
Boron	mg/L	49	0.05	52	0.05
Cadmium	mg/L	49	0.0001	52	0.0001
Chromium	mg/L	49	0.001	52	0.001
Cobalt	mg/L	49	0.004	52	0.002
Copper	mg/L	49	0.001	52	0.001
Iron	mg/L	48	2.425	51	2.03
Lead	mg/L	49	0.001	52	0.001
Manganese	mg/L	48	0.314	51	0.456
Mercury	mg/L	49	0.0001	52	0.0001
Nickel	mg/L	49	0.005	52	0.003
Selenium	mg/L	49	0.01	52	0.01
Silver	mg/L	49	0.001	52	0.001
Zinc	mg/L	49	0.005	52	0.005
Total metals					
Aluminium	mg/L	49	0.75	52	0.775
Arsenic	mg/L	49	0.001	52	0.001
Barium	mg/L	48	0.0795	51	0.059
Boron	mg/L	49	0.05	52	0.05
Cadmium	mg/L	49	0.0001	52	0.0001
Chromium	mg/L	49	0.001	52	0.001

Parameter	Units	SWMP06		SWMP07	
		Count	Median	Count	Median
Cobalt	mg/L	48	0.007	52	0.003
Copper	mg/L	49	0.001	52	0.001
Iron	mg/L	49	5.71	52	4.715
Lead	mg/L	49	0.001	52	0.001
Manganese	mg/L	49	0.454	52	0.5615
Mercury	mg/L	49	0.0001	52	0.0001
Nickel	mg/L	49	0.006	52	0.004
Selenium	mg/L	49	0.01	52	0.01
Silver	mg/L	49	0.001	52	0.001
Zinc	mg/L	48	0.008	51	0.008
Other parameters					
Cyanide	mg/L	49	0.004	52	0.004
Fluoride	mg/L	49	0.1	52	0.1

E.2 Cooranbong Entry Site

E.2.1 Unnamed Creek

8.1.1.9 Median water quality results – SW014

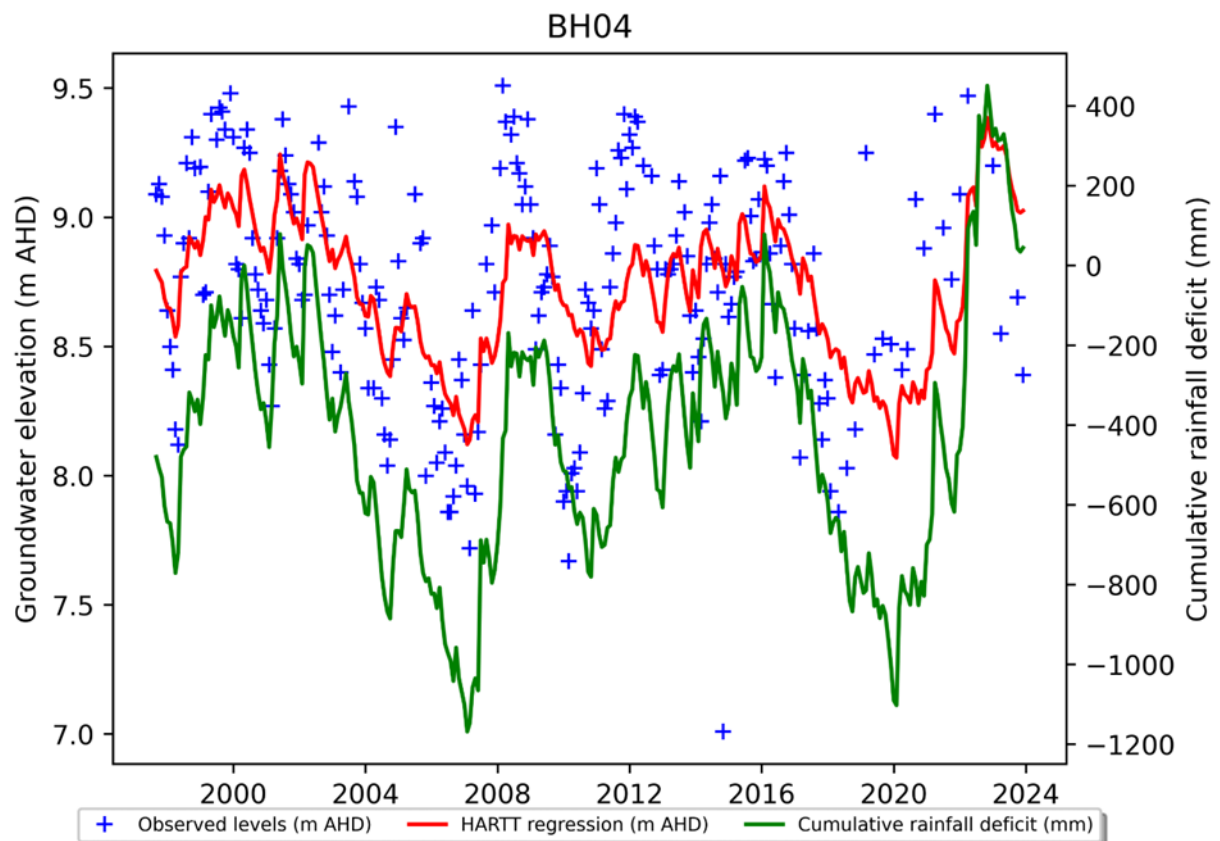
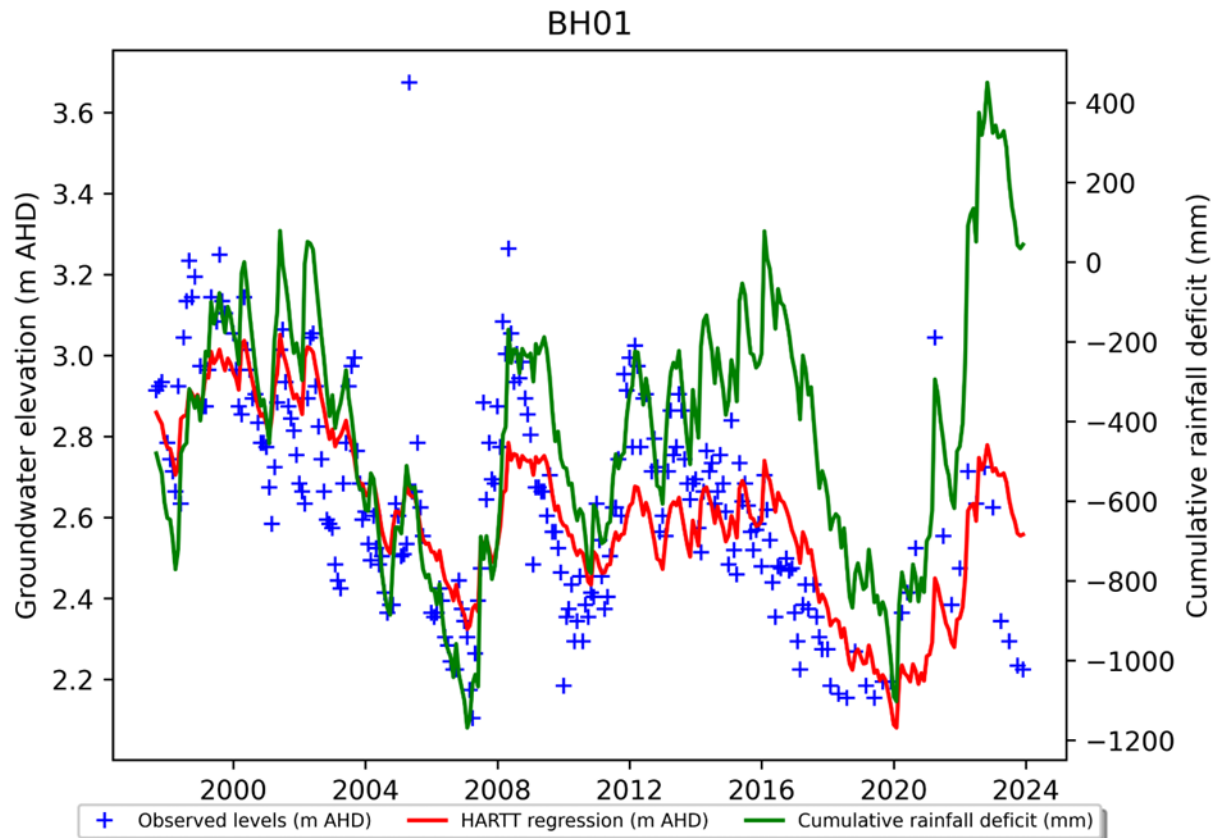
Parameters	Units	Count	Median
Physical / chemical			
EC	µS/cm	42	430.5
pH	pH units	42	7.02
TDS	mg/L	42	287
TSS	mg/L	42	9.5
Turbidity	NTU	6	24.2
Major ions			
Bicarbonate alkalinity	mg/L	42	68
Calcium	mg/L	42	11
Chloride	mg/L	41	68
Magnesium	mg/L	40	12
Potassium	mg/L	41	4
Sodium	mg/L	41	54
Nutrients			
Ammonia	mg/L	41	0.01
TKN	mg/L	42	0.7
Total nitrogen	mg/L	42	0.7
Total phosphorous	mg/L	42	0.03
Dissolved metals			
Aluminium	mg/L	41	0.35
Antimony	mg/L	2	0.001
Arsenic	mg/L	41	0.001
Barium	mg/L	40	0.015
Boron	mg/L	41	0.06

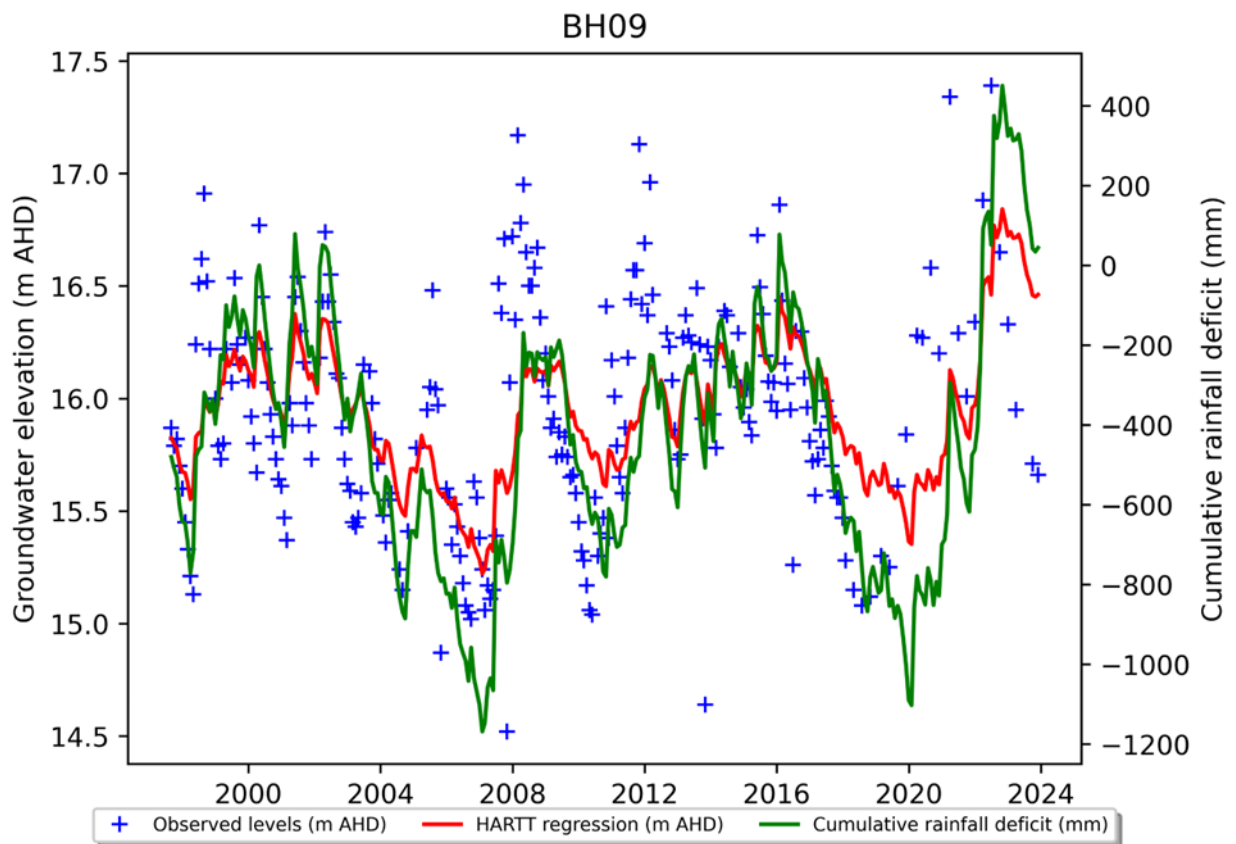
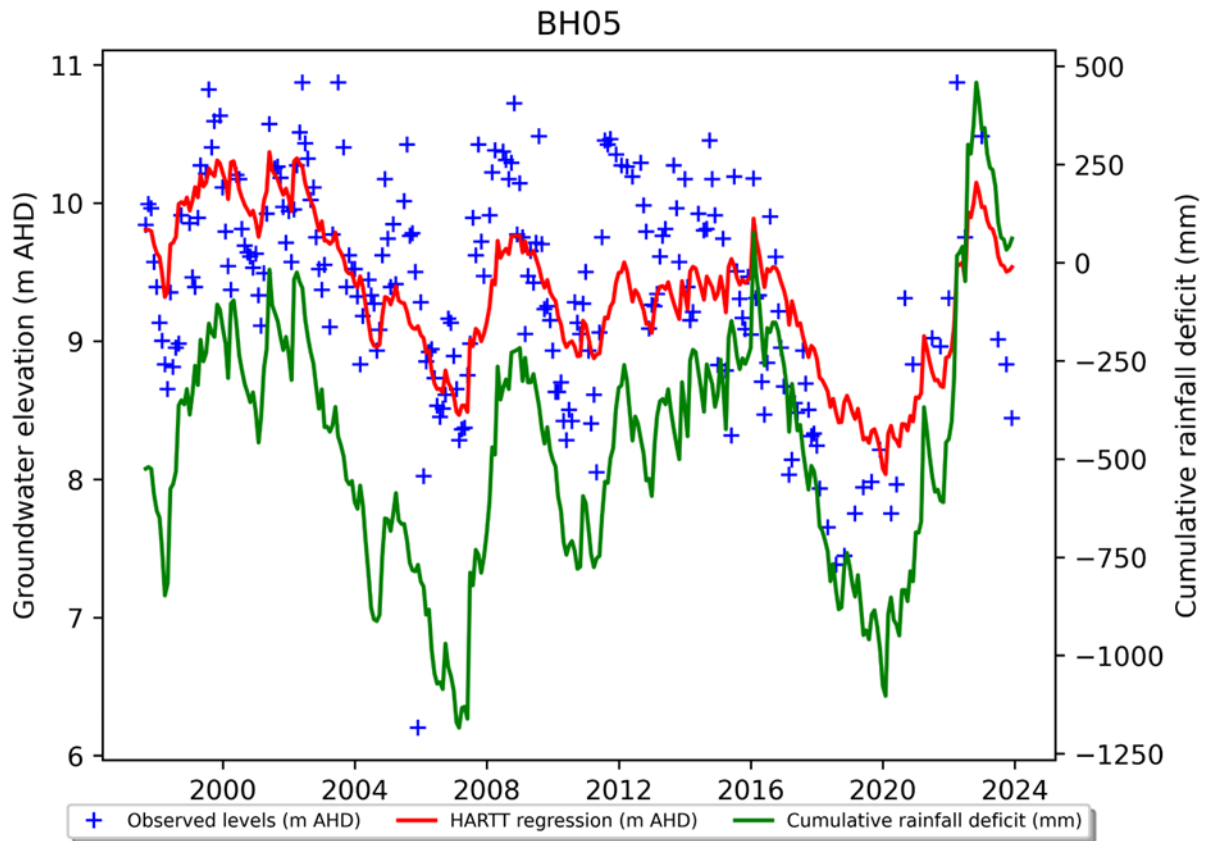
Parameters	Units	Count	Median
Cadmium	mg/L	40	0.0001
Chromium	mg/L	40	0.001
Cobalt	mg/L	40	0.001
Copper	mg/L	41	0.001
Iron	mg/L	39	1.48
Lead	mg/L	41	0.001
Lithium	mg/L	1	0.006
Manganese	mg/L	41	0.019
Mercury	mg/L	40	0.0001
Molybdenum	mg/L	1	0.001
Nickel	mg/L	40	0.002
Silver	mg/L	40	0.01
Titanium	mg/L	1	0.02
Zinc	mg/L	41	0.005
Total metals			
Aluminium	mg/L	41	0.62
Arsenic	mg/L	41	0.001
Cadmium	mg/L	40	0.0001
Copper	mg/L	41	0.001
Lead	mg/L	41	0.001
Mercury	mg/L	40	0.0001
Molybdenum	mg/L	1	0.001
Nickel	mg/L	40	0.002
Selenium	mg/L	40	0.01
Vanadium	mg/L	1	0.01
Zinc	mg/L	41	0.006
Other parameters			

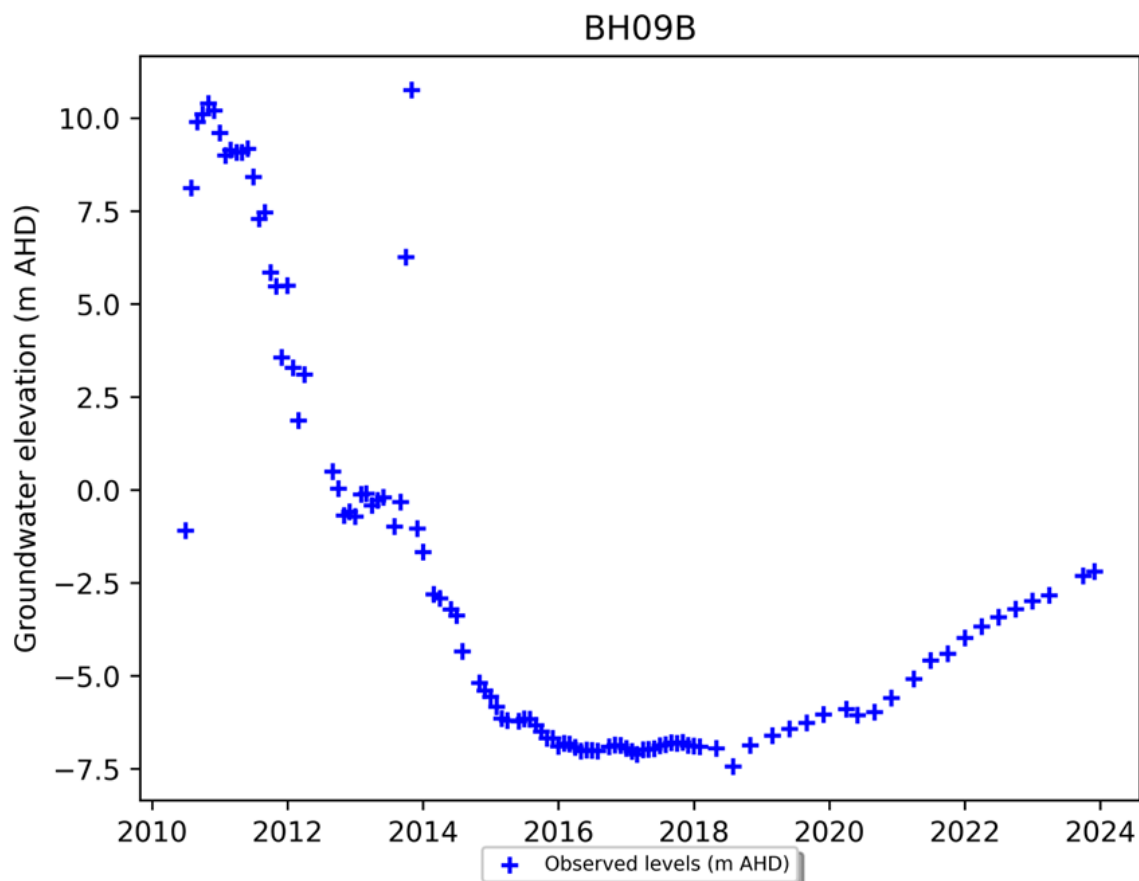
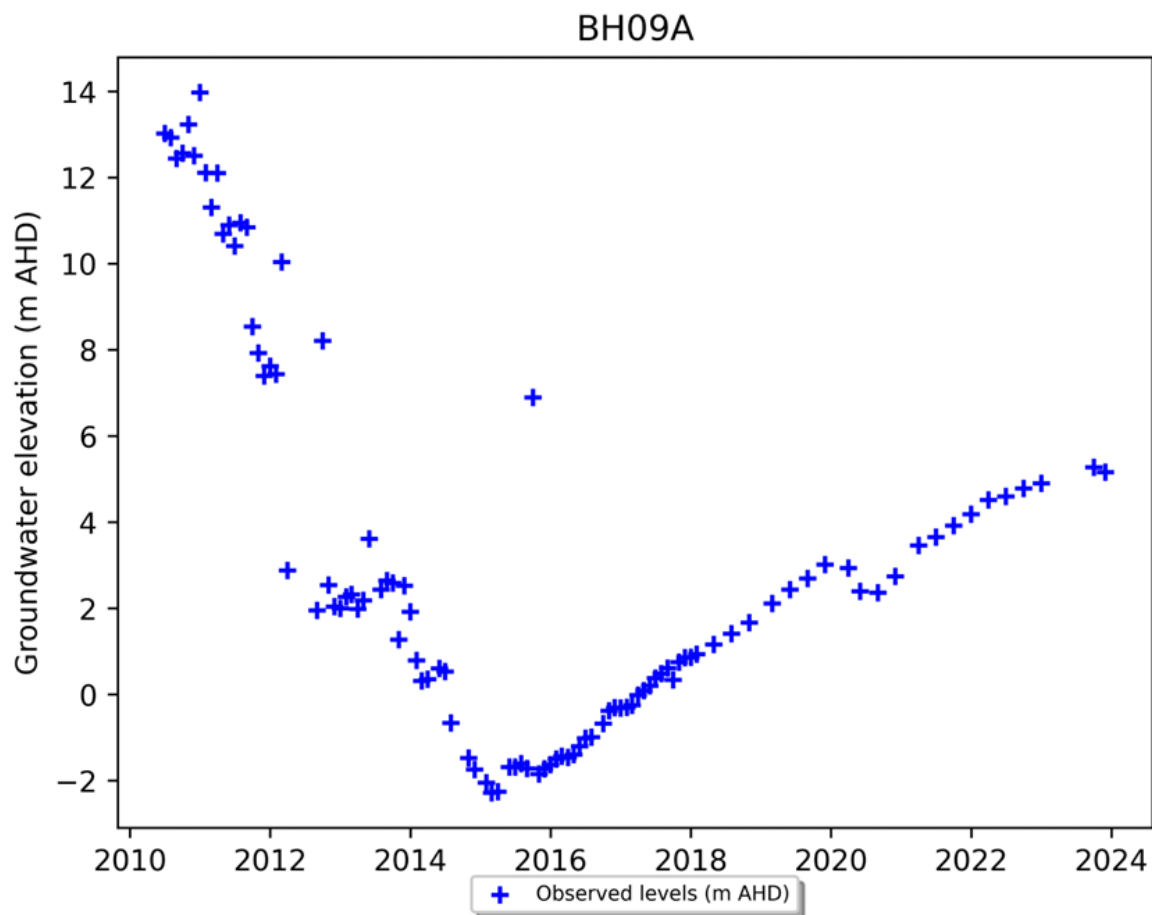
Parameters	Units	Count	Median
Dissolved sulfur	mg/L	36	8
Dissolved silica	mg/L	1	42
Oil & Grease	mg/L	41	2

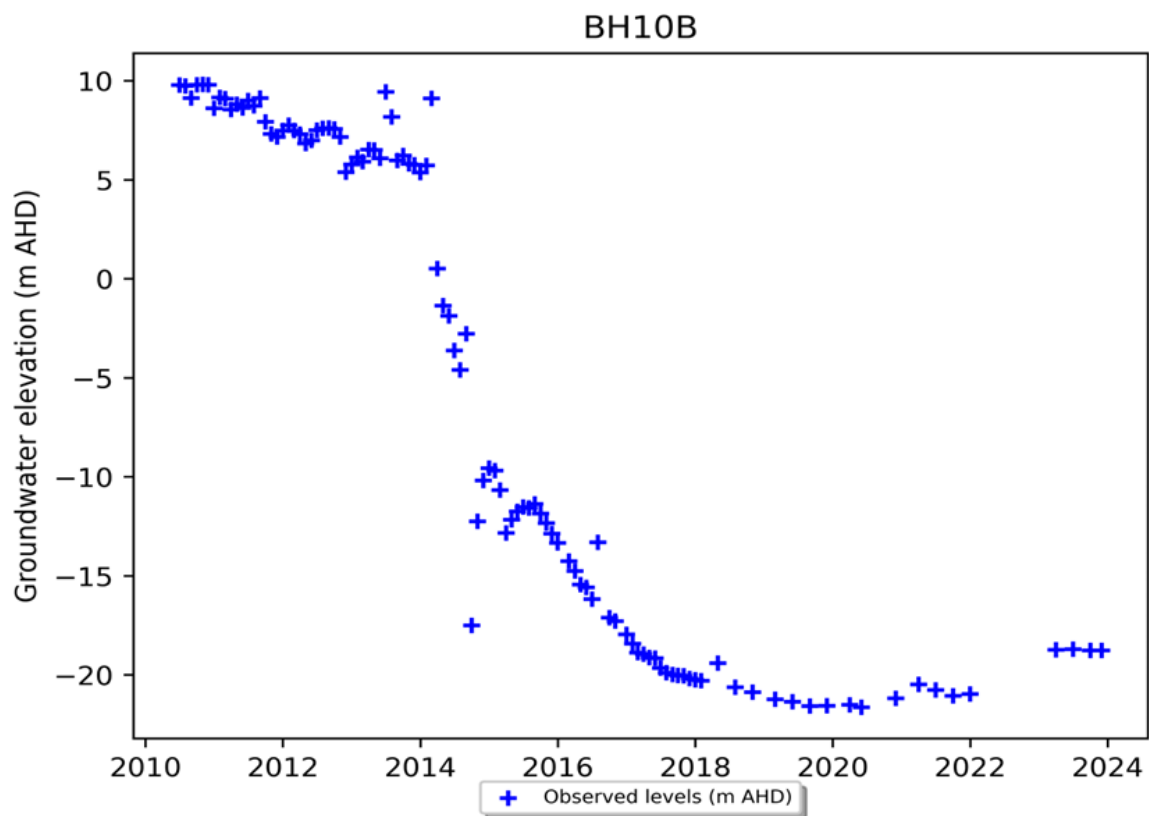
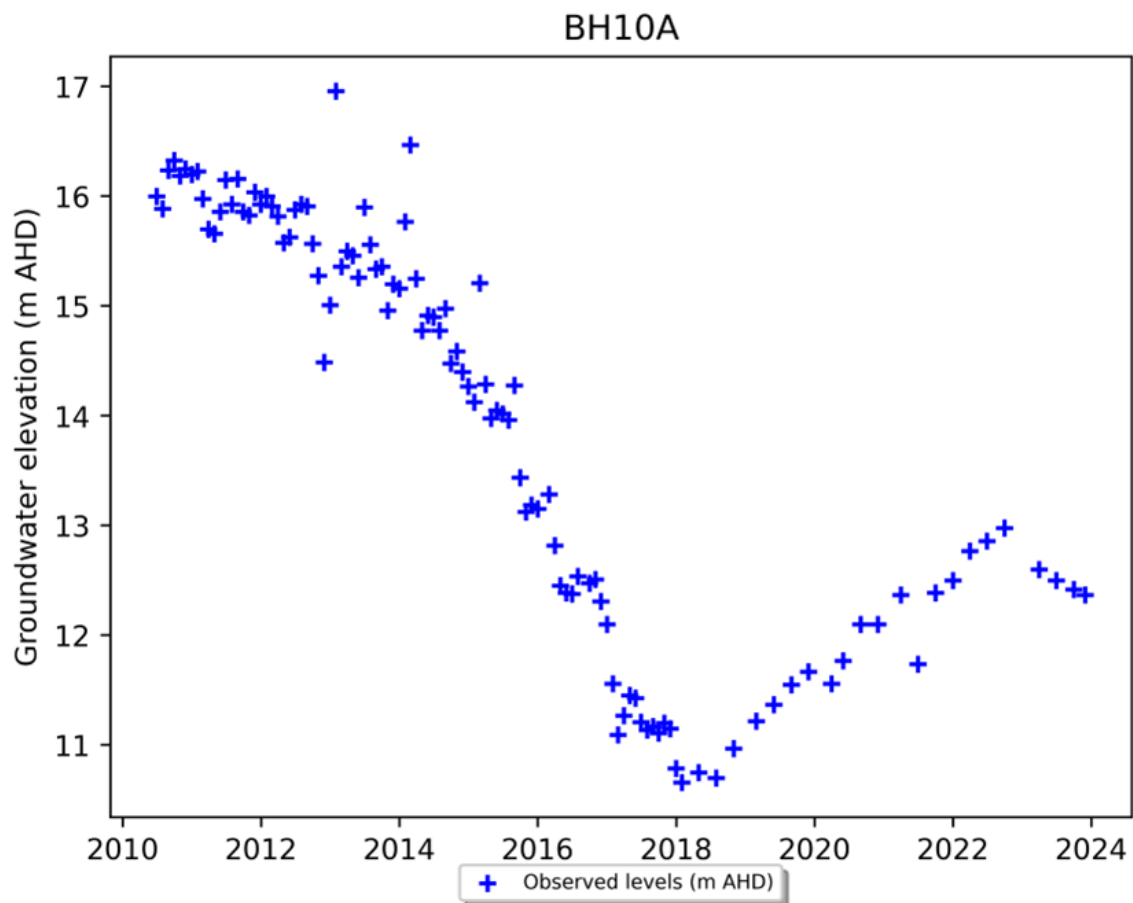
APPENDIX F – Baseline groundwater level and quality data

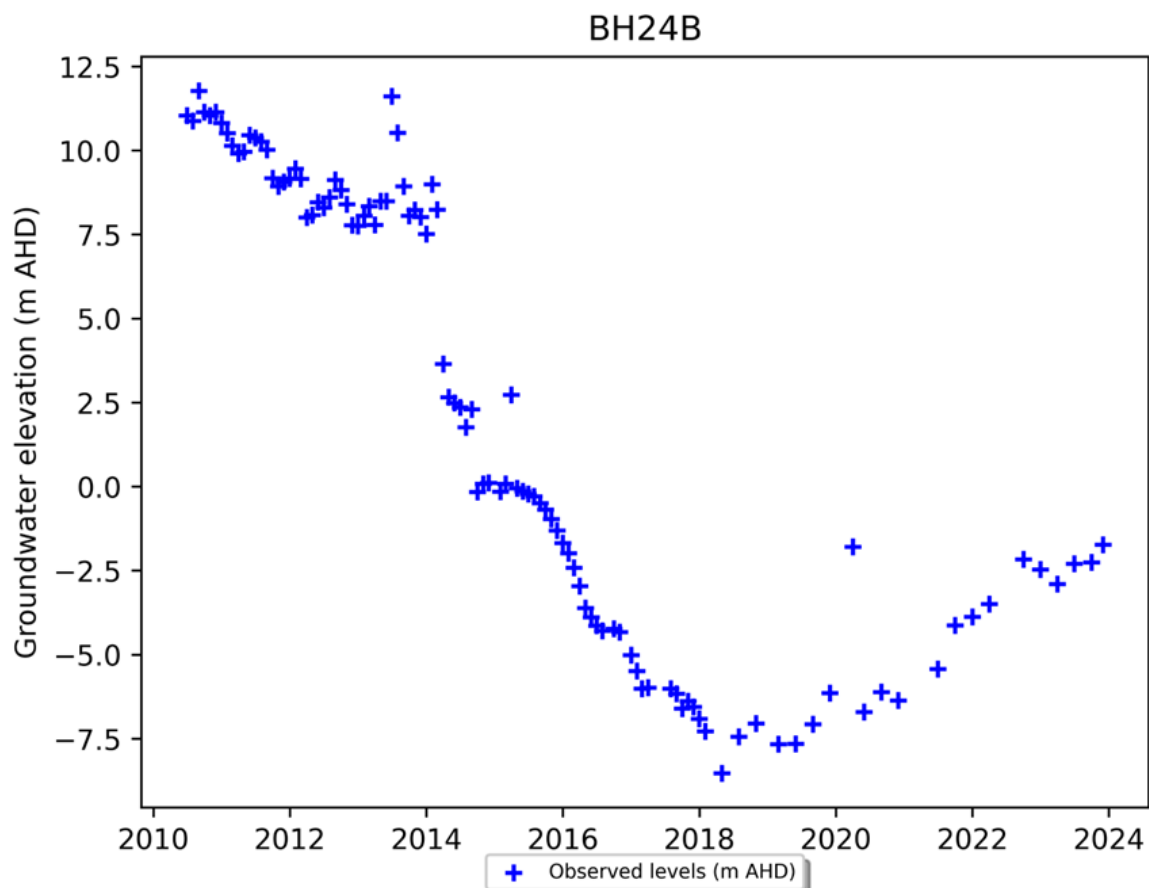
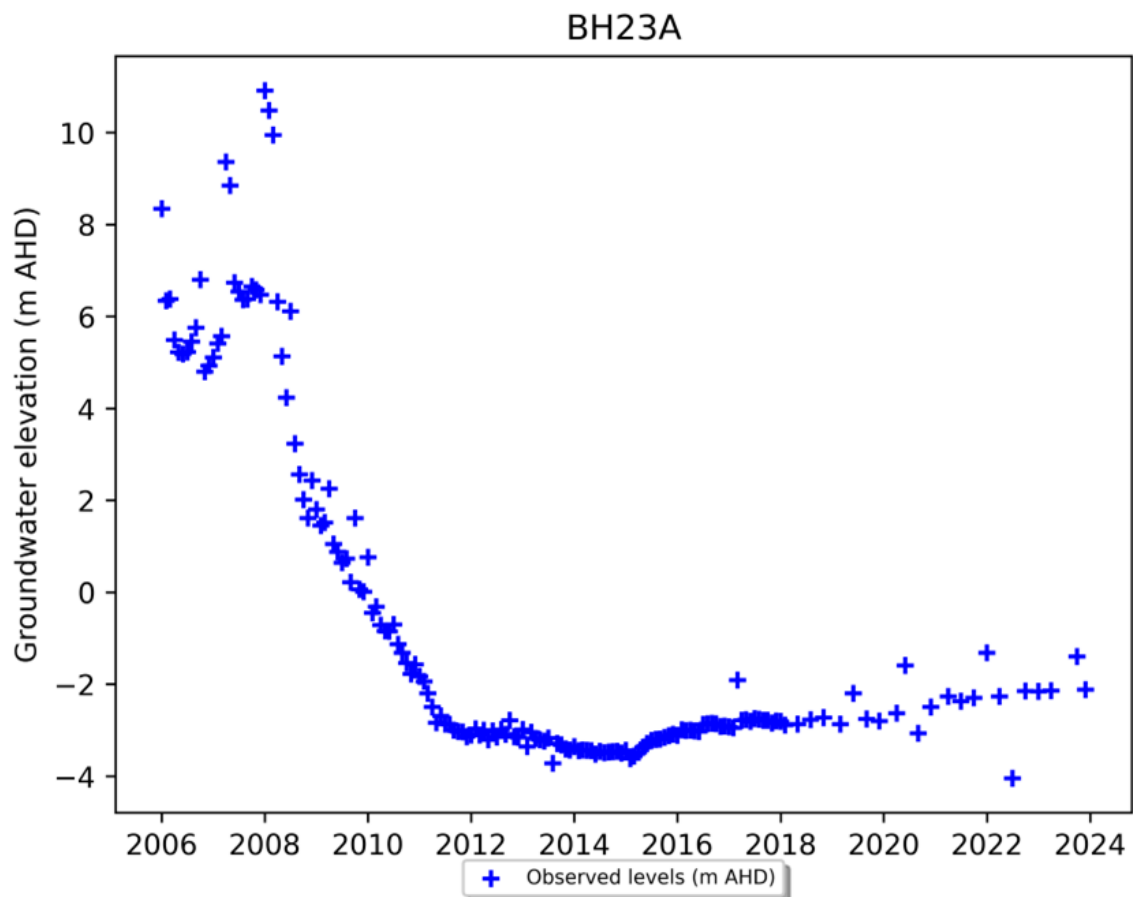
F.1 Groundwater level hydrographs

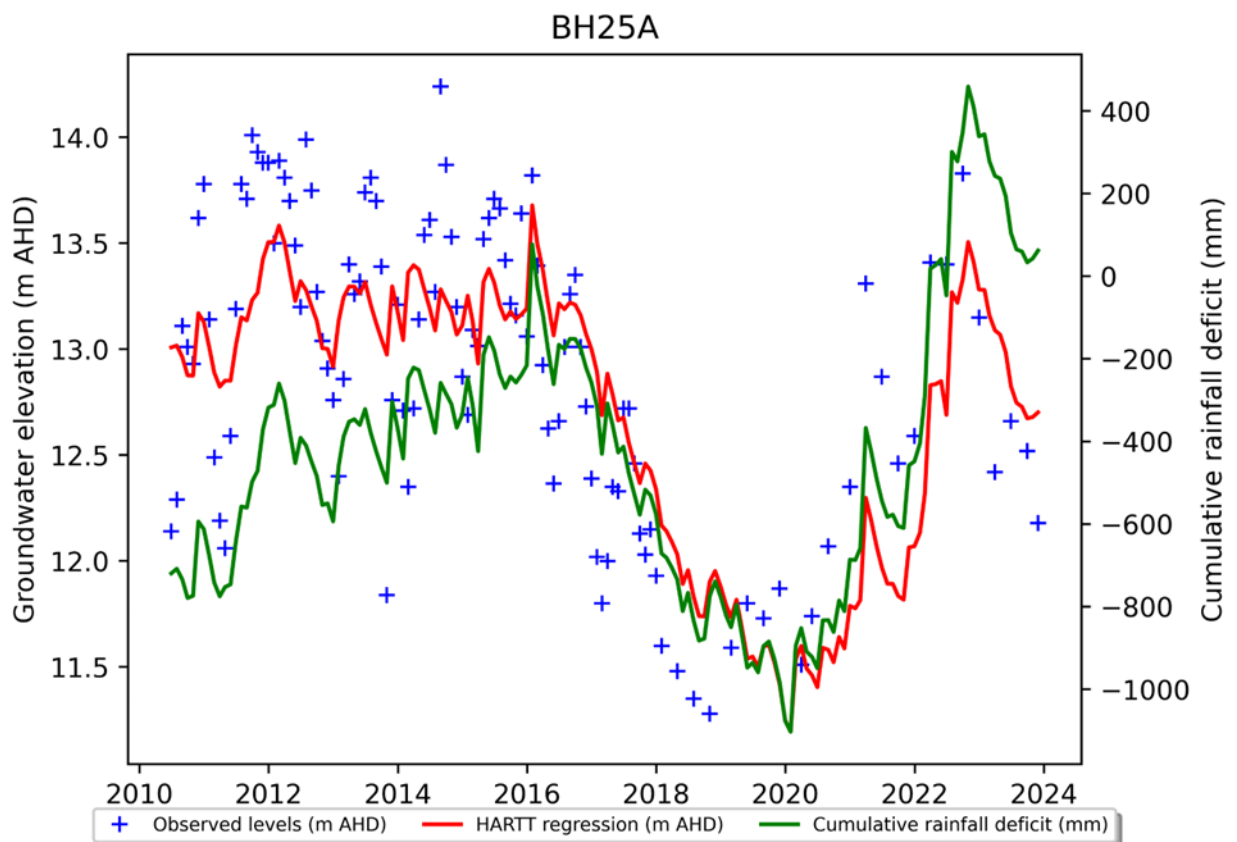
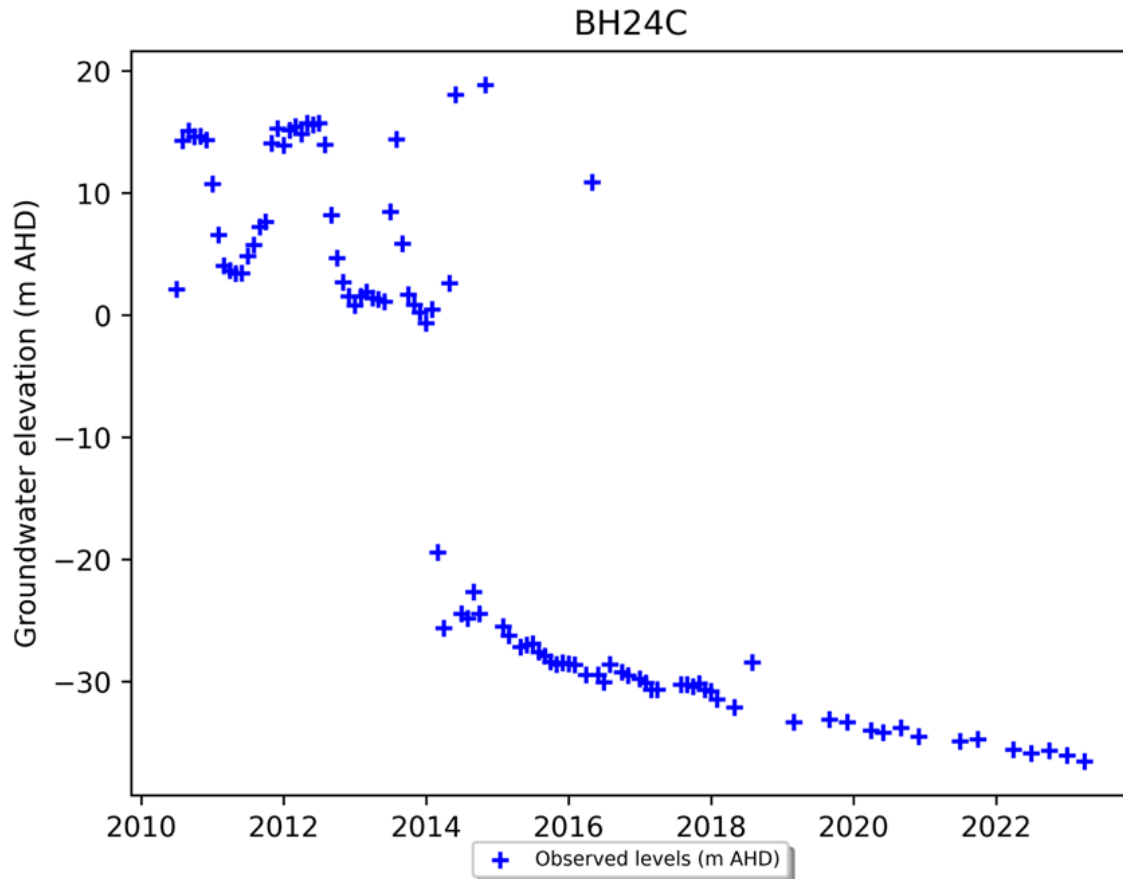


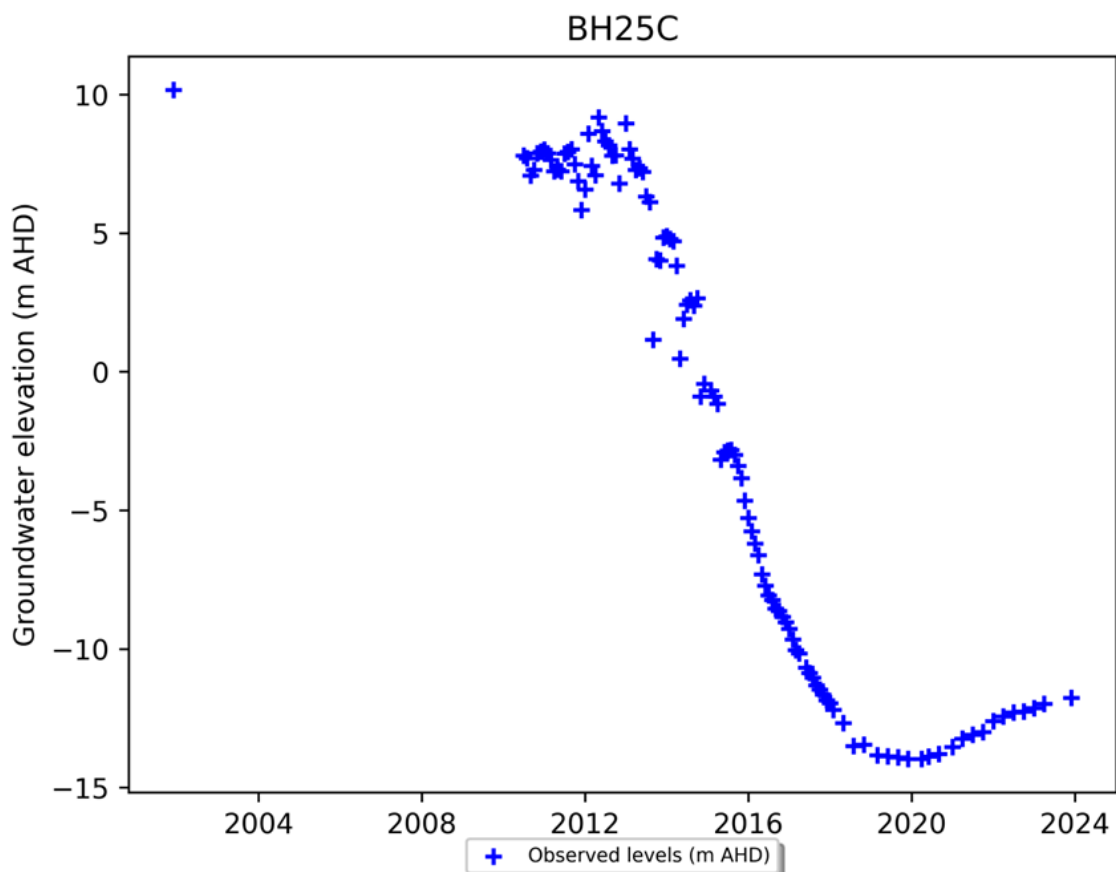
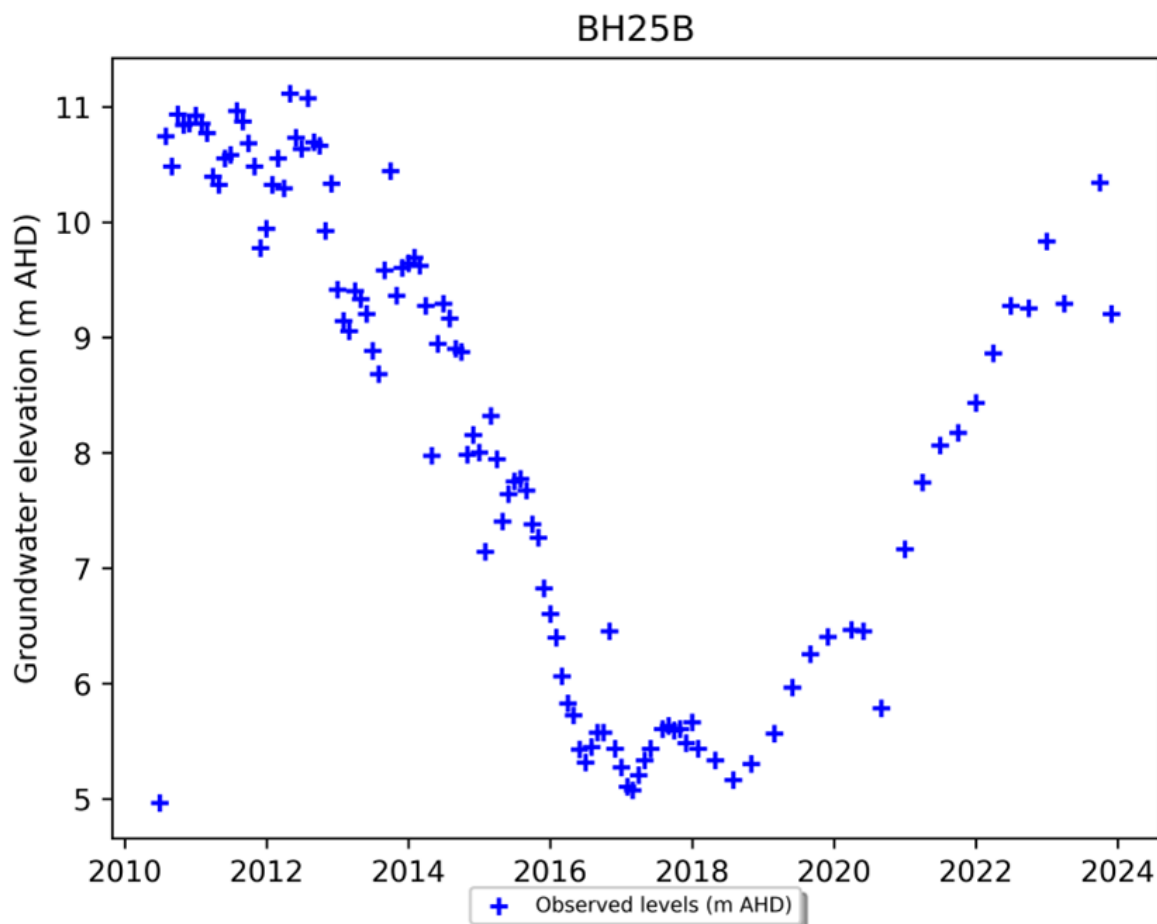


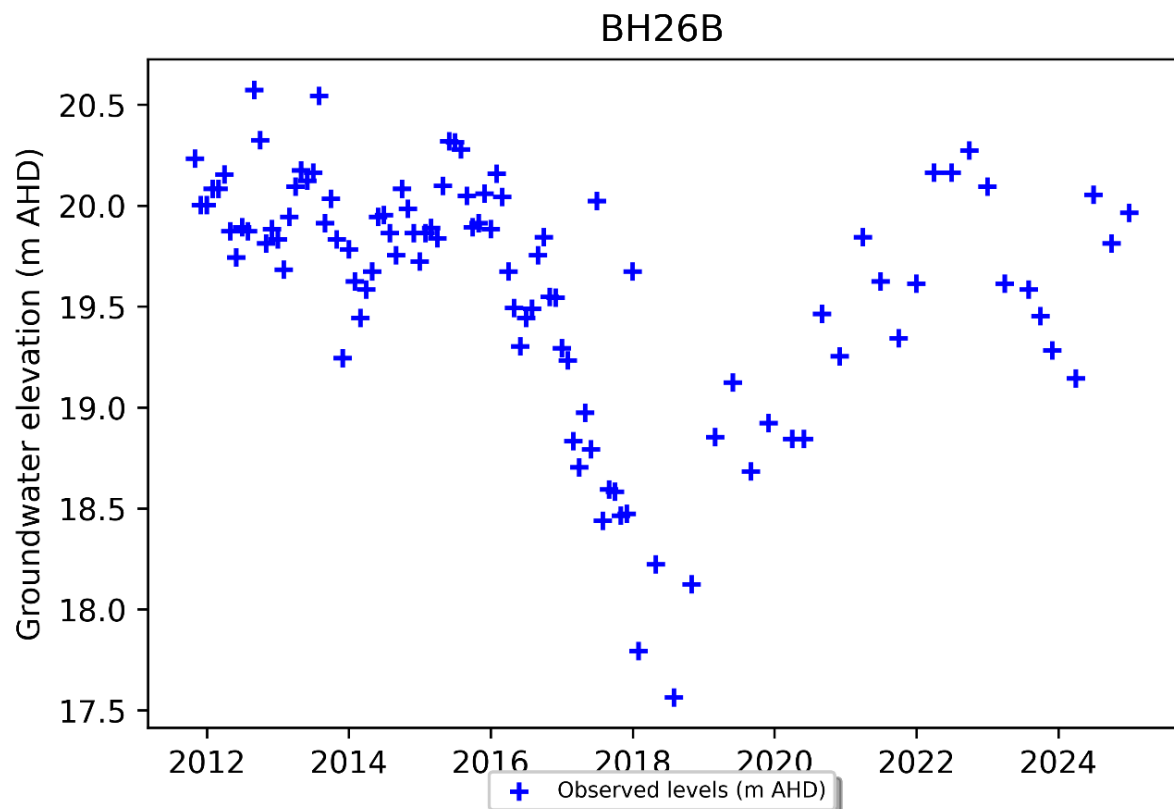
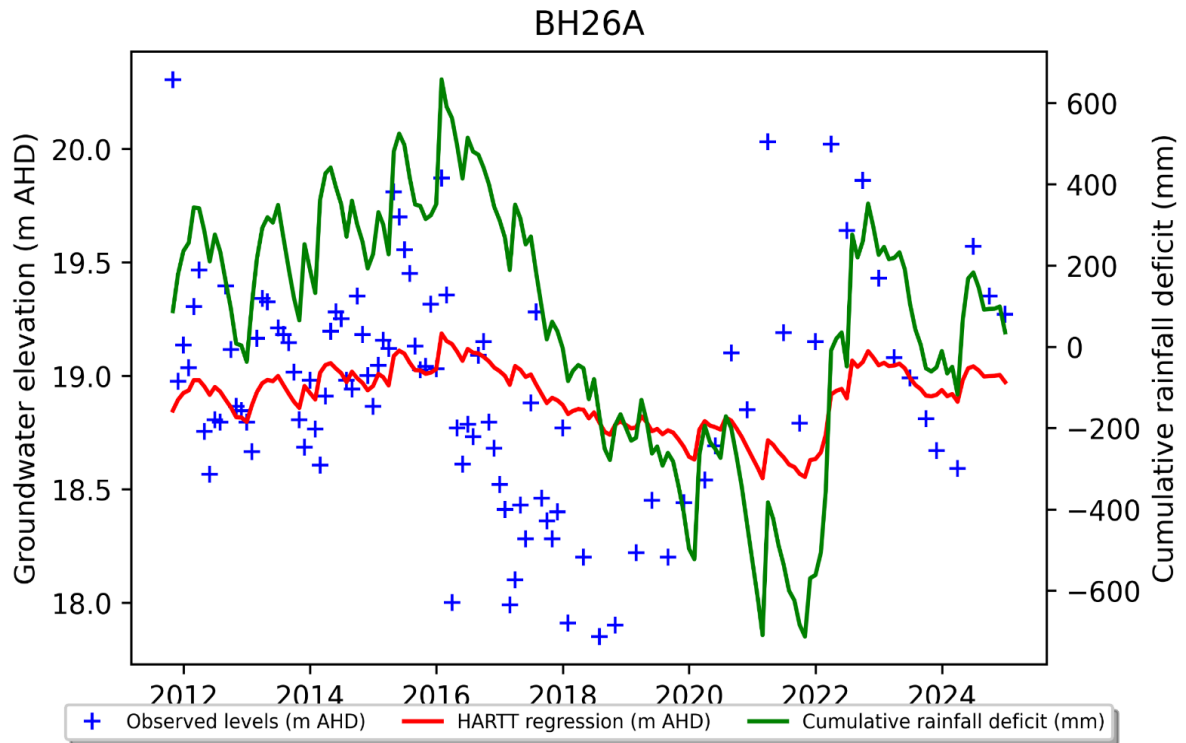


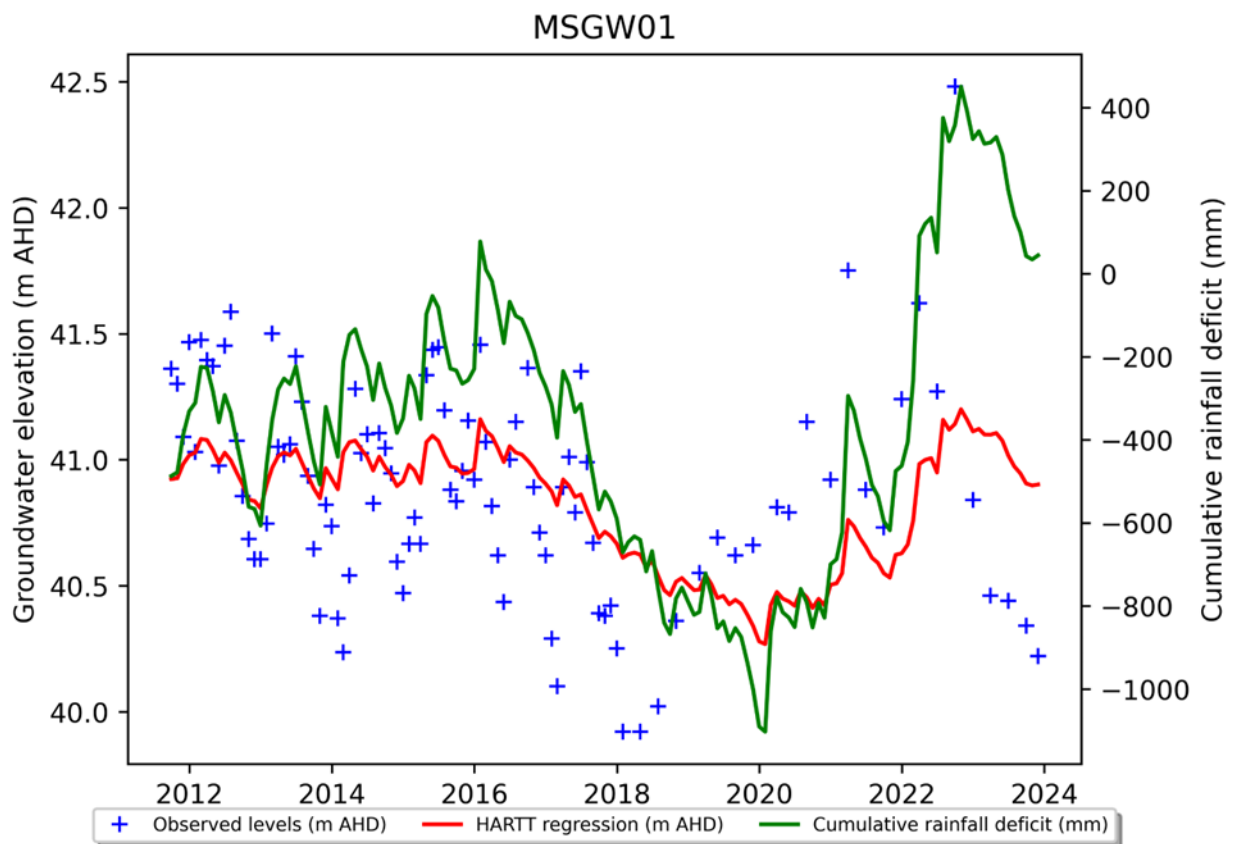
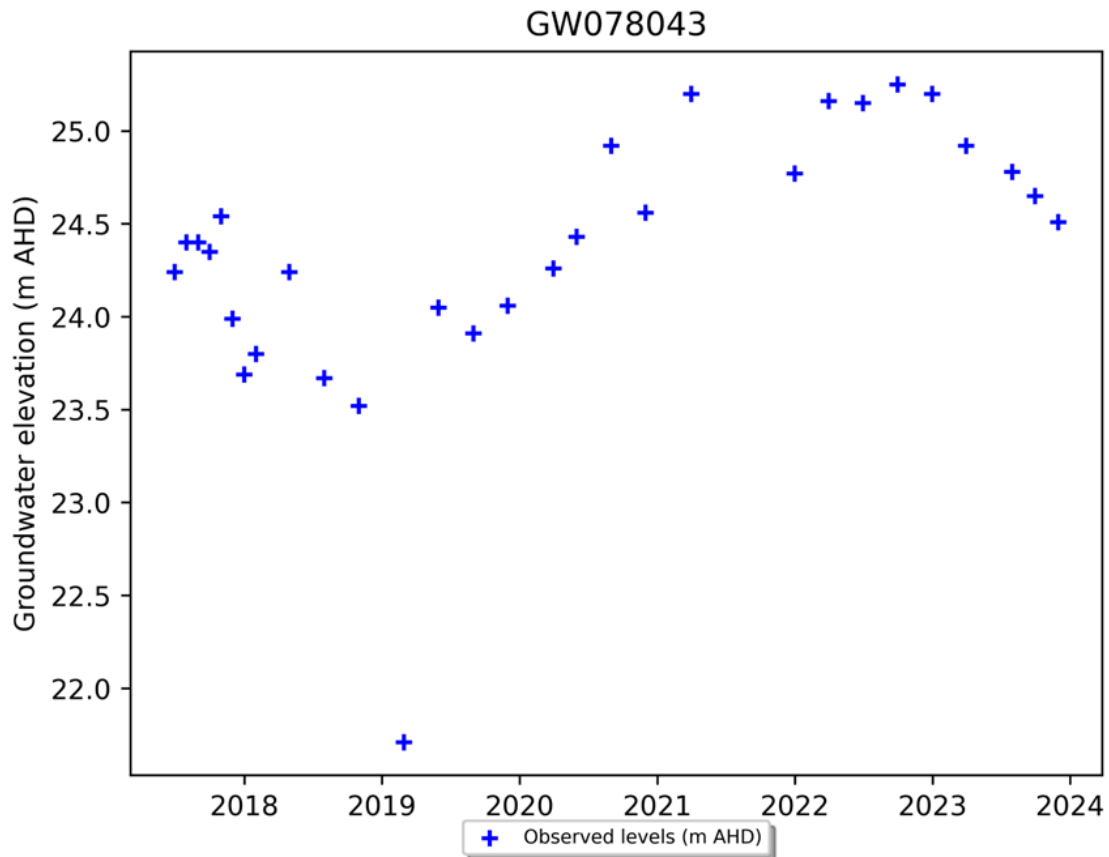


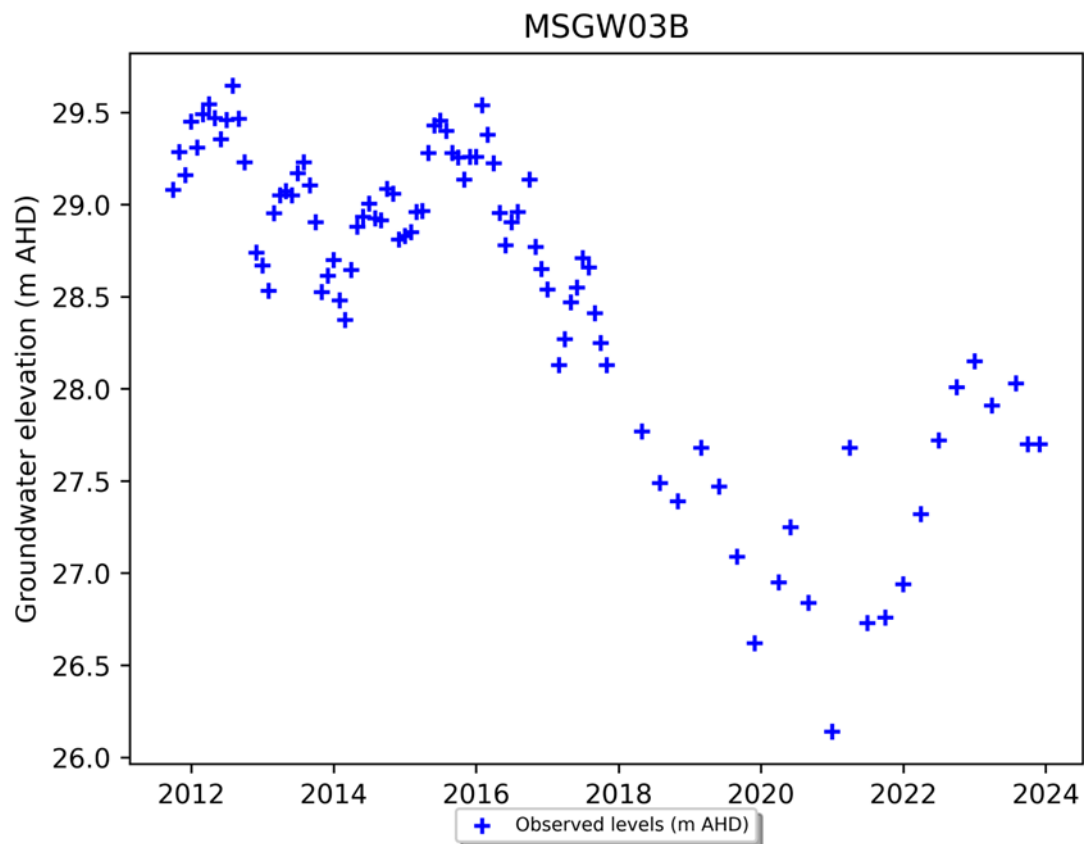
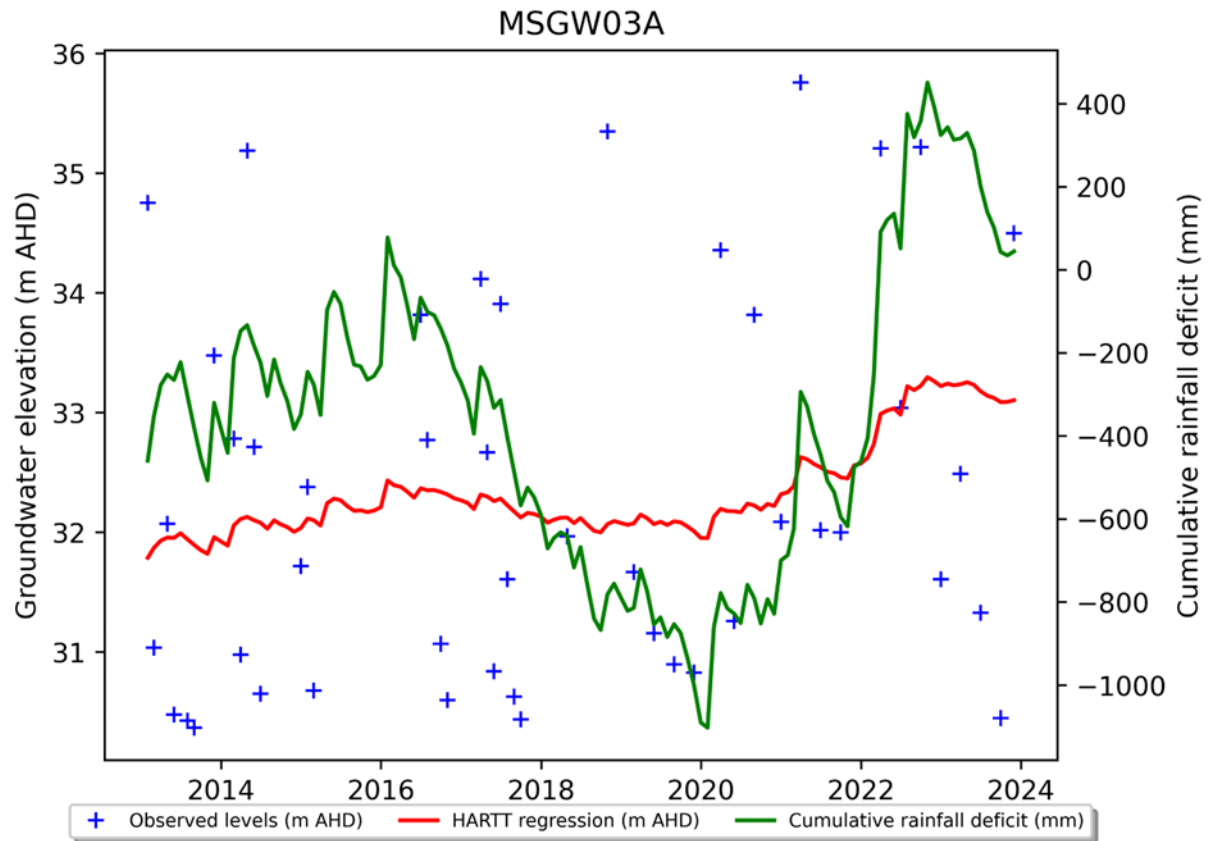


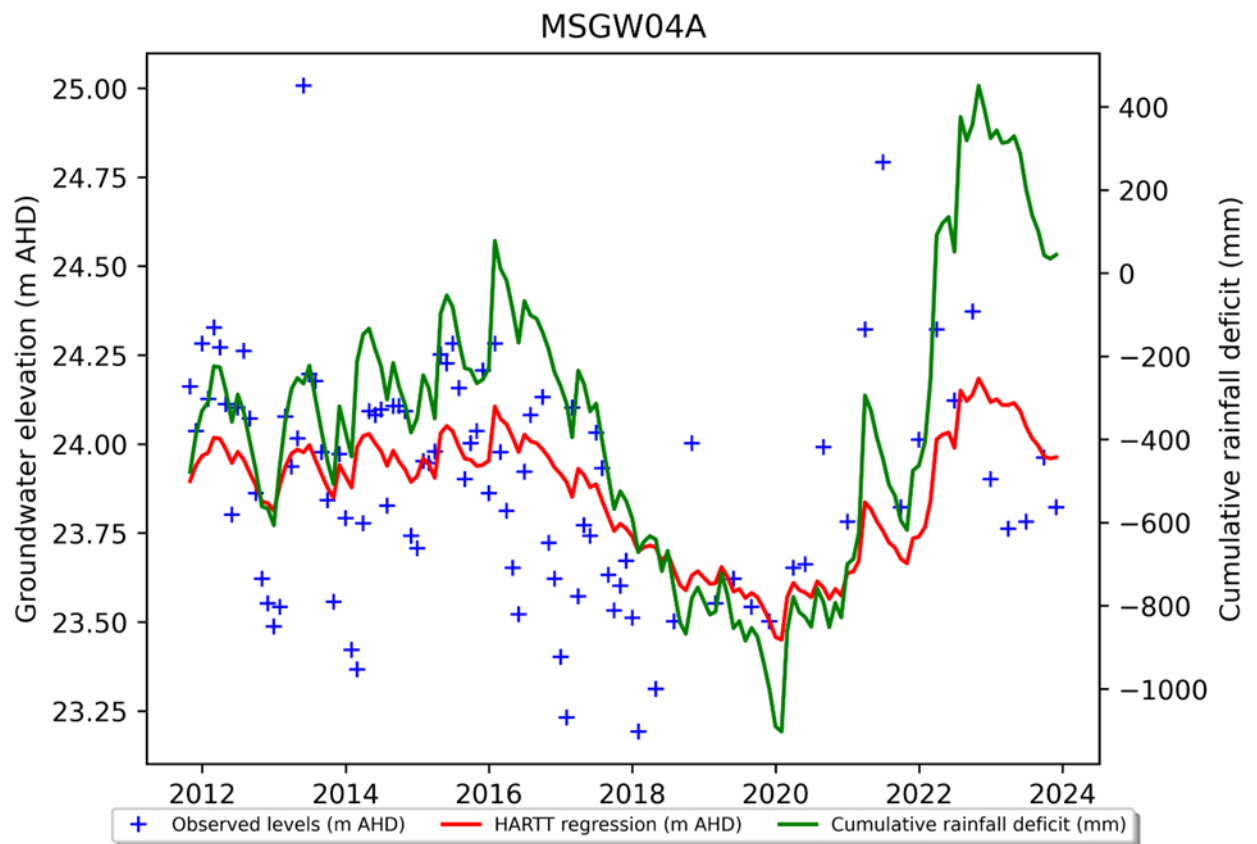
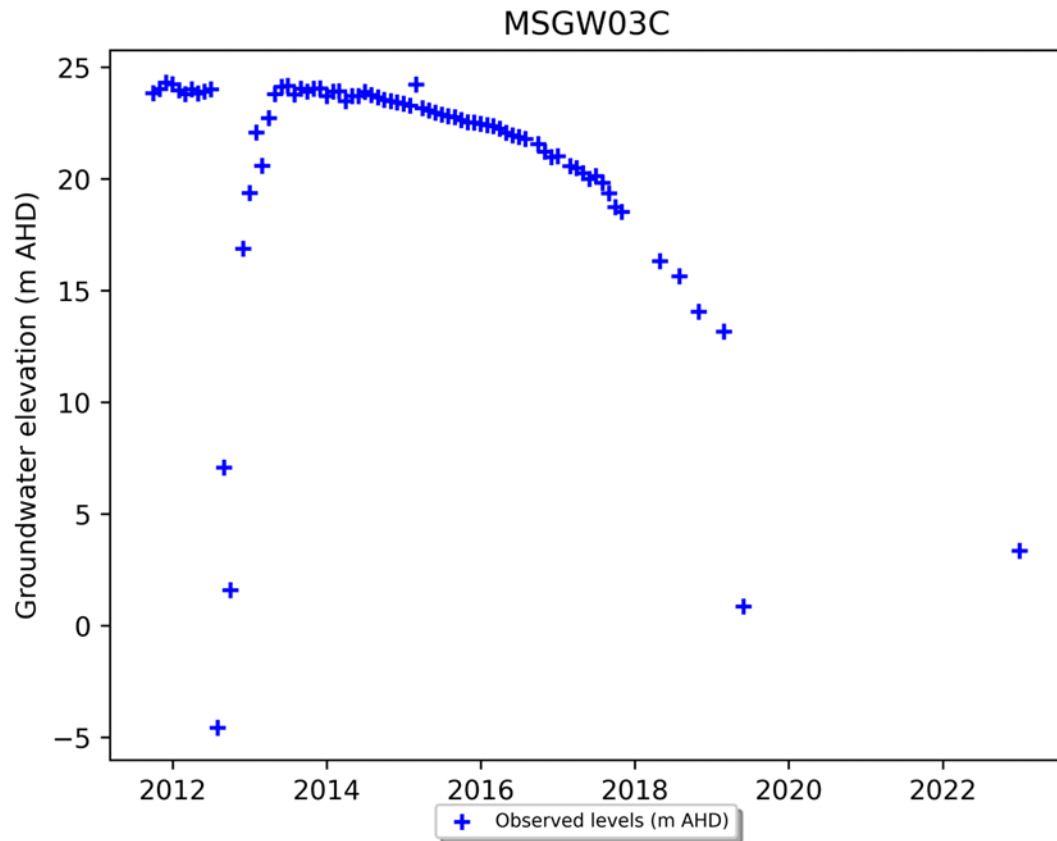


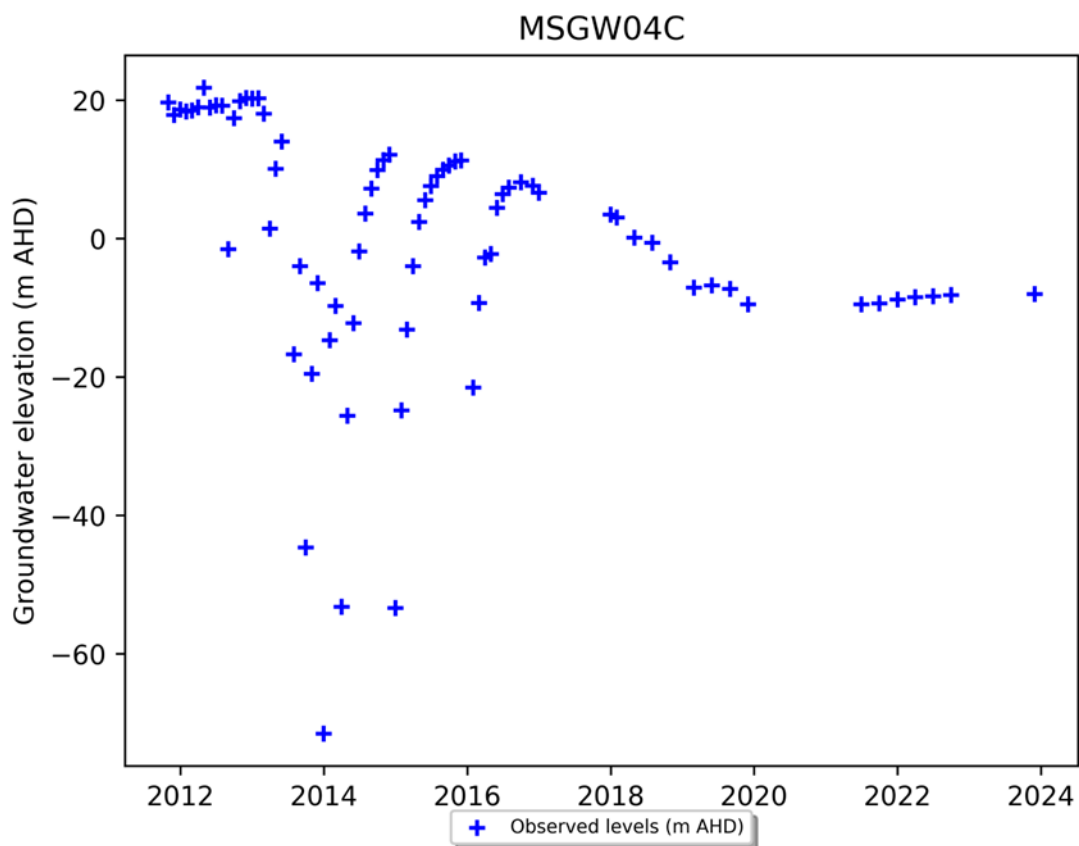
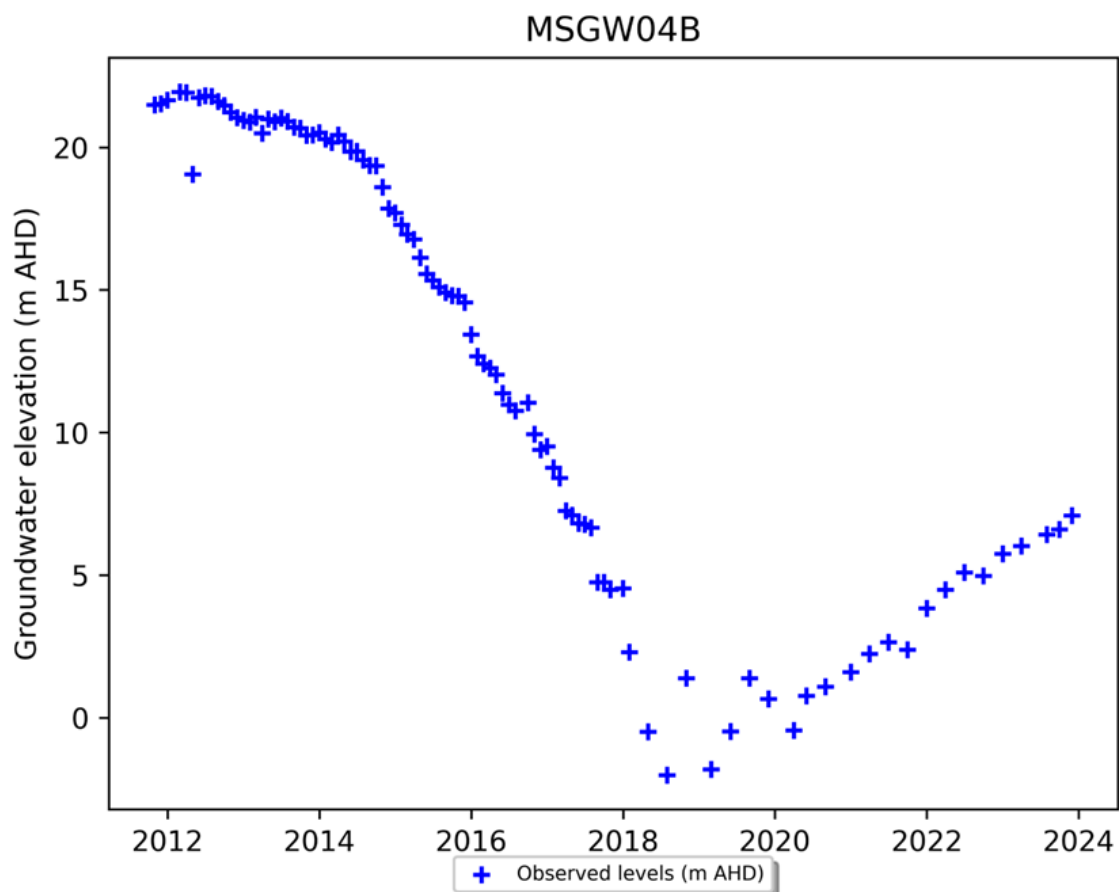


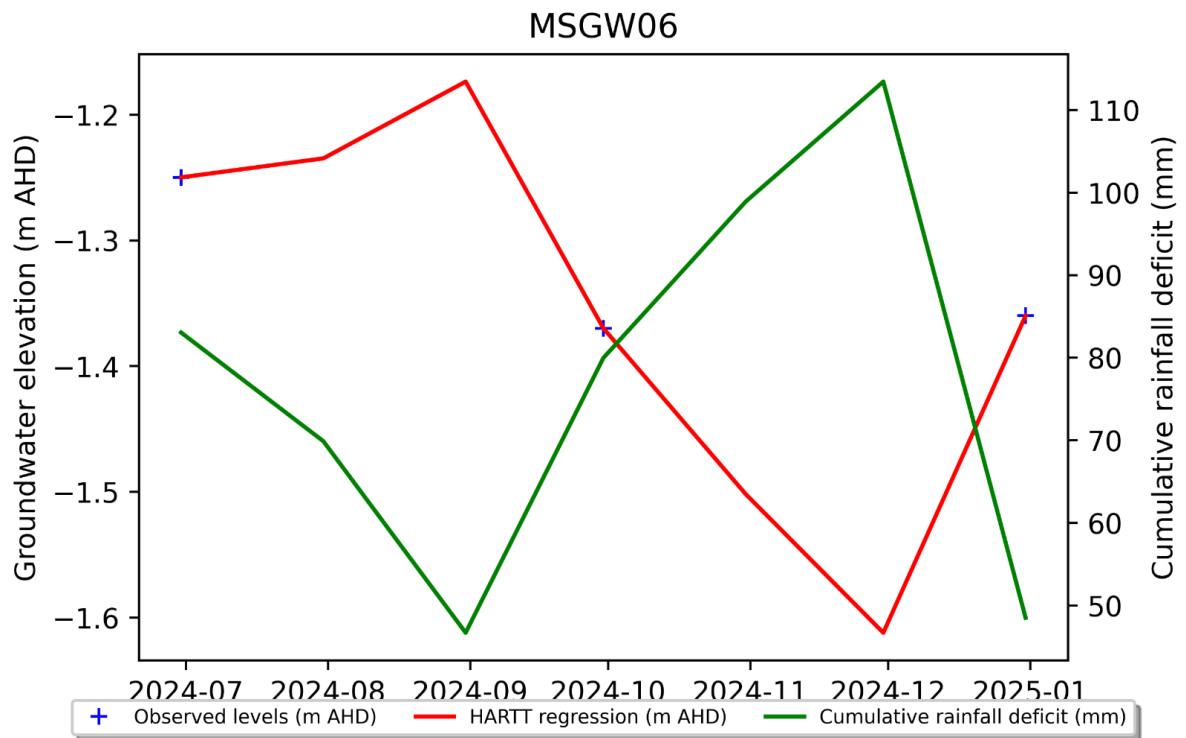
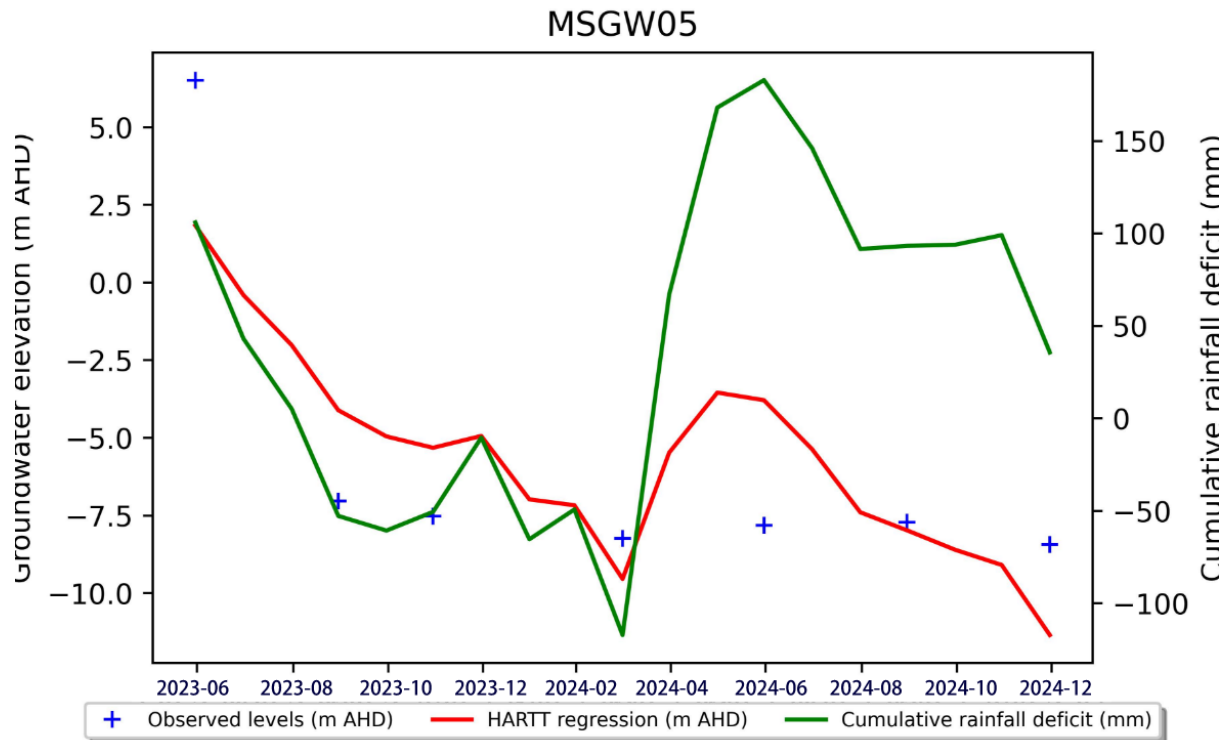












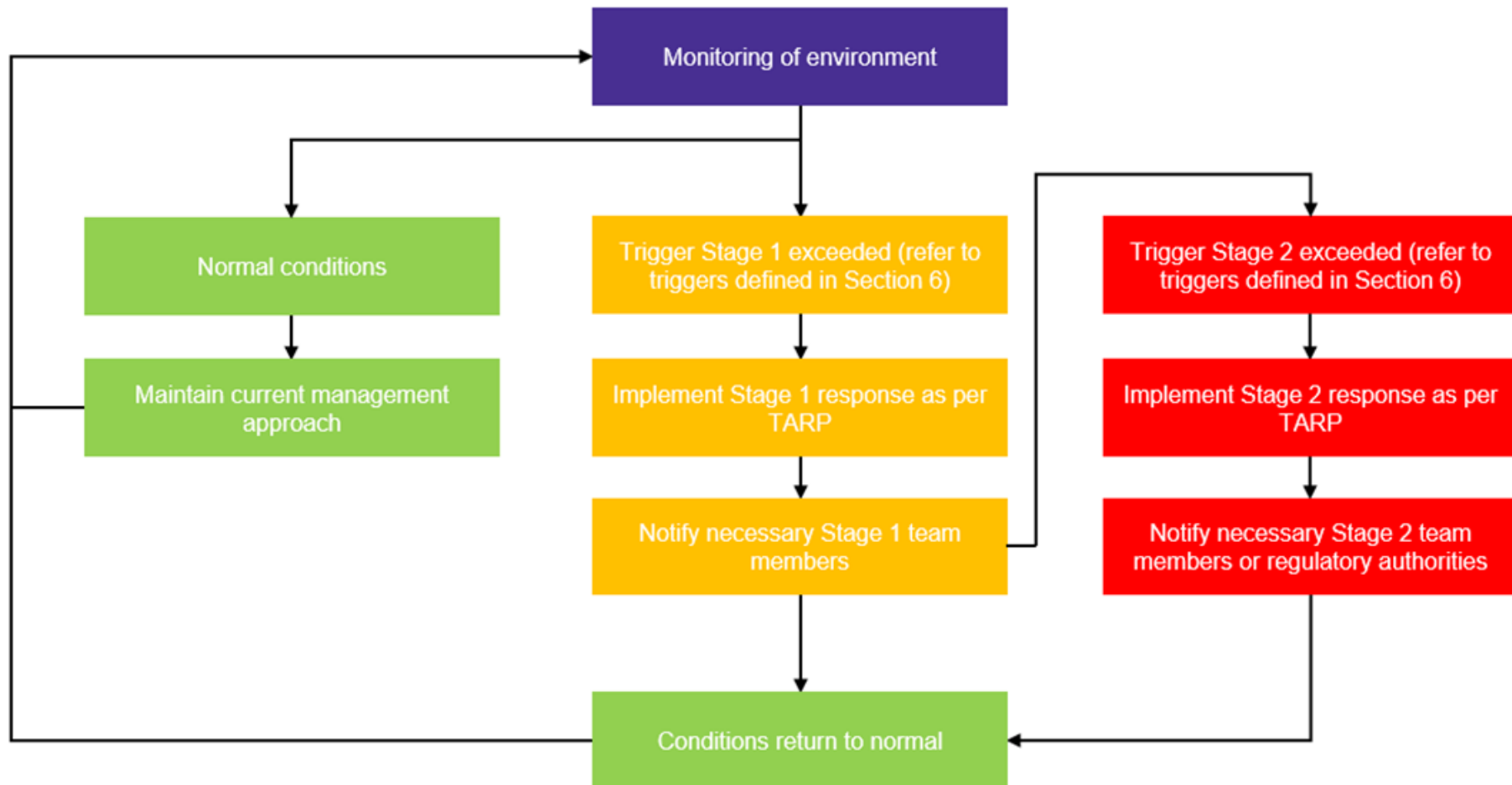
F.2 Groundwater quality

F.2.1 Statistical summary

Bore	pH						EC					
	Count	Minimum	20th percentile	Median	80th percentile	Maximum	Count	Minimum	20th percentile	Median	80th percentile	Maximum
BH01	251	5.47	6.10	6.30	6.56	9.71	248	178.1	432	488.5	524.2	700
BH04	226	4.70	5.90	6.10	6.40	7.86	224	1235	11986	13710	14816	20170
BH05	221	2.52	4.27	4.90	6.50	7.68	219	178	2322.8	13290	16000	21640
BH09	231	5.24	5.96	6.21	6.50	8.71	223	46.8	273	323	423	824
BH09A	46	9.94	11.27	11.66	12.43	12.83	46	5470	6020	6500	7490	11800
BH09B	31	10.04	11.74	12.03	12.49	12.74	31	5750	6280	6880	7550	10800
BH10A	85	6.65	7.22	7.47	7.71	9.32	85	3990	5950	6660	7087	9568
BH10B	52	9.79	10.98	11.41	12.09	12.85	52	3580	4456	5055	5446	7460
BH23A	153	5.65	7.24	7.41	7.55	8.73	153	1120	5222	5900	6249	11200
BH24B	54	5.91	7.89	8.48	10.24	12.06	53	5190	8406	9510	11074	11850
BH24C	45	5.71	7.26	7.80	9.25	12.81	45	2000	7800	9140	10524	13790
BH25A	100	5.46	6.20	6.40	6.64	7.59	101	2750	5780	6490	6940	7980

Bore	pH						EC					
	Count	Minimum	20th percentile	Median	80th percentile	Maximum	Count	Minimum	20th percentile	Median	80th percentile	Maximum
BH25B	94	6.47	6.97	7.12	7.34	8.28	95	2040	6328	7170	7729	9144
BH25C	54	6.61	8.03	8.22	9.44	10.17	55	3570	6152	7320	7510	8260
BH26A	84	4.92	5.57	5.87	6.28	10.57	84	3420	8514	11670	13516	15770
BH26B	84	6.55	6.86	7.06	7.22	8.09	84	3160	5972	6710	7130	8066
GW078043	14	6.07	6.23	6.28	6.47	7.24	14	3634	4641	4851.5	4981	5698
MSGW01	85	4.01	4.30	4.43	4.55	5.47	85	7070	9804	10430	10924	12370
MSGW03A	25	4.97	5.64	5.84	6.02	6.57	24	1592	3030	3689	4658	6370
MSGW03B	43	5.32	7.05	7.21	7.50	8.00	43	4630	5930	6420	6807	7250
MSGW03C	20	6.63	7.03	7.22	9.12	12.01	20	5340	5872	6430	7422	8570
MSGW04A	84	5.70	6.28	6.39	6.52	7.60	83	5780	8520.6	9286	9672	10760
MSGW04B	45	6.56	6.66	6.88	7.07	7.93	45	5190	7268	7880	8342	8970
MSGW04C	23	7.01	7.25	8.00	11.19	12.67	23	4770	5222	6460	7772	9960

APPENDIX G – Trigger action response plans



G.1 Surface site operation

Aspect	Normal	Stage 1	Stage 2	Notifications
Surface water storage volume	Storages capture events up to and including the design criteria.	Trigger: Storage is not dewatered appropriately following storm event, or Storage is not desilted in accordance with design criteria and procedures. Action: Investigate storage operation and dewatering procedures. Undertake dewatering or desilting of relevant storages to areas where capacity exists. Increase inspection frequency as required. Training for staff.	Trigger: Storage is discharging as a result of a storm event less than design criteria with potential impacts offsite. Action: Investigate cause for discharge and if the appropriate procedures were followed. Undertake dewatering or desilting of relevant storages to areas where capacity exists. Undertake water quality sampling of discharge and add flocculant if there is a risk of an offsite impact. Undertake water quality sampling of upstream and downstream receiving environment as appropriate to assess any potential impact. Review adequacy of storage design, dewatering procedure and inspection schedule.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with Pollution Incident Response Management Plan (PIRMP) requirements or if material harm has occurred.

Aspect	Normal	Stage 1	Stage 2	Notifications
Dewatering pump operation	Dewatering pump operates within the pump specification.	Trigger: Power outage. Action: Utilise back up power source or diesel pump if available. Investigate alternate power sources or diesel pumps.	Trigger: Pump operation does not operate due to mechanical failure or pump rate not sufficient to meet demands. Action: Prepare downstream storages to receive overflows. Undertake water quality sampling of relevant storages and add flocculant as necessary. Review adequacy of pump operation and inspection schedule.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.
Clean water diversion	Clean water diverted around dirty water areas.	Trigger: Clean water bypass through dirty water areas. Action: Review catchment plan. Review design capacity of clean water system. Appropriately treat and manage dirty water. Facilitate works to resolve clean water flow diversion failure.	Trigger: Clean water creates flooding problems through site. Action: Evacuate site if danger exists. Establish temporary bunding around clean water source. Utilise earthworks machinery to cut appropriate channel to manage clean water appropriately. Protect equipment and infrastructure. Utilise portable pumps to dewater flooded areas into sediment basins.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.

Aspect	Normal	Stage 1	Stage 2	Notifications
Erosion and sediment control	All controls are appropriately in place and well maintained. Site inspections do not identify any unstable disturbance areas or migration of sediment away from designated development areas.	Trigger: One or more areas of surface erosion in the form of rilling, bank erosion or other movement of sediment from an area of disturbance with no offsite migration. Controls are not maintained or are inappropriately installed. Action: Seek to stabilise the area to stop the erosion process. This can include the use of groundcover or other temporary measures. Investigate works undertaken prior to the disturbance activities. Review adequacy of controls and inspection/maintenance schedule.	Trigger: Controls are not in place. Rainfall event has led to sediment migrating off site. Action: Isolate the area through diverting contributing surface flows to another appropriate control structure. Review adequacy of controls and inspection/maintenance schedule.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.
Hydrocarbon management	All hydrocarbon supplies are stored appropriately.	Trigger: Minor spill occurs on site with limited risk of off-site migration. Action: Implement procedures in the PIRMP. Apply spill kit.	Trigger: Major spill occurs on site with risk of off-site migration. Action: Isolate area and divert contributing surface flows. Engage waste contractor to clean up spill. Investigate potential for contamination of waterways.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.

G.2 Watercourses

Aspect	Normal	Stage 1	Stage 2	Notifications
Water quality	Water quality at monitoring locations are within or below SSGVs provided in Section 6.1.1 or consistent with historical baseline.	Trigger: Water quality is outside or above SSGVs or not consistent with historical baseline for at least one parameter for two consecutive sampling events. Action: Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data) and identify any potentially contributing factors. Investigate the source of the exceedance and develop corrective/preventative actions based on the outcomes of the investigation.	Trigger: Investigation into Stage 1 trigger identifies that trigger exceedance is due to operational activity. Community complaint to Centennial Mandalong regarding surface water quality. Loss of water supply (due to poor water quality) to any adjacent landholders due to operational activities. Action: Determine if an incident has potentially occurred and investigate the source of the exceedance. Increase monitoring frequency and undertake additional monitoring (e.g. water quality, aquatic ecology) where relevant. Implement corrective/preventative actions, in consultation with relevant agencies, based on the outcomes of the investigation and/or additional monitoring. Prioritise actions based on the risk to the environment and likelihood of further impact. Loss of water supply to any adjacent landholders due to operational activities will need to be replaced by Centennial. Review the WMP and related procedures to prevent reoccurrence.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify relevant agencies, DPHI, DCCEEW-Water and EPA as soon as practicable if PIRMP is not triggered.

Aspect	Normal	Stage 1	Stage 2	Notifications
Water flow	Creek flow rates and relationships with rainfall are consistent with historical baseline results.	Trigger: Reduction or loss in flow compared to historical baseline results and reference sites. Action: Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data) and identify any potentially contributing factors. Investigate the source of the reduction in flow and develop corrective/preventative actions based on outcomes.	Trigger: Stage 1 investigation identifies that the reduction or loss in flow is due to operational activities. Community complaint to Centennial Mandalong regarding surface water flow. Action: Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data) and identify any potentially contributing factors. Determine if an incident has potentially occurred and investigate the source of the loss of flow. Implement corrective/preventative actions, in consultation with relevant agencies, based on the outcomes of the investigation. Prioritise actions based on the risk to the environment and likelihood of further impact. Review the WMP and related procedures to prevent reoccurrence.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DPHI, DCCEEW-Water and Resource Regulator as soon as practicable if Stage 2 exceedance is found to be mining-related.

Aspect	Normal	Stage 1	Stage 2	Notifications
Flooding	Subsidence levels are within predictions. No increase in post-mining out-of-channel flood levels than identified by the flood model.	Trigger: Subsidence levels 1.5 times greater than predicted values. Monitoring post the 1% AEP 24-hour storm (100mm in 24 hours) identifies an increase in post-mining out-of-channel flood depths causing ponding above predictions. Action: Determine extent of increase in flood depths and if there is any potential loss of vegetation due to inundation. Consult with ecologist, landowner and relevant agencies on developing mitigation measures required to improve drainage.	Trigger: Subsidence levels two times greater than predicted values. Significant increase in post-mining out-of-channel flood depths causing ponding. Action: Verify whether monitoring results are consistent with flood model predictions and consider recalibration. Refer to relevant extraction plan for potential engineering solutions. Consult with ecologist, landowner and relevant agencies on flood drainage remediation measures and implement, then report on effectiveness of measures.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DCCEEW-Water as soon as practicable.

G.3 Groundwater environment

Aspect	Normal	Stage 1	Stage 2	Notifications
Groundwater level	Monitored groundwater levels are lower than the adopted values specified in Table 6.4 and Table 6.5.	Trigger: Monitored groundwater levels are below the adopted values specified in Table 6.4 and Table 6.5. Action: Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data) and identify any potentially contributing factors. Undertake investigation to determine if the change in groundwater level is due to mining-related activities.	Trigger: Investigation into Stage 1 trigger identifies that trigger exceedance is due to mining-related activities. Community complaint to Centennial Mandalong regarding groundwater levels. Drawdown at any water supply work exceeds 2 m. Action: Verify whether monitoring results are consistent with hydrogeological model predictions and consider recalibration. Loss of alluvial groundwater may need to be licensed under the WSP. Loss of water supply to any adjacent landholder will need to be replaced by Centennial Mandalong. If environmental impacts are unacceptable, remediation options will be considered.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DCCEE-Water and any potentially affected landowners as soon as practicable if investigation triggered by Stage 2 identifies that change in groundwater level is mining-related.

Aspect	Normal	Stage 1	Stage 2	Notifications
Groundwater quality	Groundwater quality is within or below trigger values provided in Table 6.6.	Trigger: Monitored groundwater quality is outside or above the minor trigger values presented in Table 6.6 for three consecutive monitoring rounds. Monitored groundwater quality is outside or above the major trigger values presented in Table 6.6. Action: Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data) and identify any potentially contributing factors. Undertake investigation to determine if the change in groundwater quality is due to mining-related activities.	Trigger: Investigation into Stage 1 trigger identifies that change in groundwater quality is due to mining-related activities. Community complaint to Centennial Mandalong regarding groundwater quality. Action: If environmental impacts are unacceptable and/or if the beneficial use of the groundwater changes, remediation options will be considered. Loss of water supply to any adjacent landholder due to mining-related activities will need to be replaced by Centennial Mandalong.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DCCEEW-Water and any potentially affected landowners as soon as practicable if investigation triggered by Stage 2 identifies that change in groundwater quality is mining-related.

Aspect	Normal	Stage 1	Stage 2	Notifications
Dewatering volume	Dewatering volume is consistent with model predictions and below licensed volumetric limit.	Trigger: Dewatering volume exceeds predicted rates by more than 10% for three consecutive months. Action: Review monitoring/inflow estimation methodology and validate dewatering volume data. Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data) and identify any potentially contributing factors. Undertake investigation to determine cause of the change in dewatering volume.	Trigger: Dewatering volume exceeds predicted rates by more than 20% for three consecutive months. Dewatering volume likely to exceed annual licensed limit. Action: Review monitoring/inflow estimation methodology and validate dewatering volume data. Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data) and identify any potentially contributing factors. Undertake review of hydrogeological model predictions for groundwater inflows into the mine. Update the hydrogeological model and site water balance model if necessary. Modify site water management at the CES where possible to accommodate the change in dewatering volume. Obtain additional groundwater licence allocations if necessary.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify agencies as required under procedure in Section 7.4 if exceedance of limit occurs.

Aspect	Normal	Stage 1	Stage 2	Notifications
Cooranbong underground storage level	Water level below trigger value specified in Section 6.1.4.	Trigger: Water level exceeds trigger value. Action: Reduce any active water transfers into the Cooranbong underground storage where possible. Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data) and identify any potentially contributing factors. Undertake investigation to determine cause of the increase in water level. Increase dewatering rate to reduce water level as necessary, where sufficient capacity exists and/or acceptable disposal is available.	Trigger: Water level continues to increase after Stage 1 actions are implemented. Action: Cease any active water transfers into the Cooranbong underground storage. Increase to the maximum dewatering rate to reduce water level as necessary, where sufficient capacity exists and/or acceptable disposal is available. Retreat mining infrastructure as necessary from down dip.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.

G.4 Discharge management

Aspect	Normal	Stage 1	Stage 2	Notifications
Discharge volume from LDP	No discharges as a result of events up to and including the design criteria.	Trigger: Discharge occurs for less than one day as a result of the storage capacity criteria being exceeded. Action: Investigate storage operation and dewatering procedures. Undertake dewatering of relevant storages to areas where capacity exists. Increase inspection frequency as required. Training for staff.	Trigger: Discharge occurs for more than one day as a result of the storage capacity criteria being exceeded. Action: Investigate cause for discharge and if the appropriate procedures were followed. Undertake dewatering of relevant storages to areas where capacity exists. Review adequacy of storage design, dewatering procedure and inspection schedule.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.
Discharge quality from LDP	Discharge quality is within or below EPL limits presented in Table 6.7.	Trigger: Water quality parameters are equal to EPL limits for one parameter. Action: Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data) and identify any potentially contributing factors. Investigate the cause for discharge quality and if the appropriate procedures were followed. Implement preventative water management actions to improve water quality.	Trigger: Water quality parameters are outside or above EPL limits for one or more parameter. Action: Determine if an incident has potentially occurred. Increase monitoring frequency and undertake additional monitoring where relevant. Implement corrective/preventative actions, in consultation with relevant agencies, based on the outcomes of the investigation and/or additional monitoring. Prioritise actions based on the risk to the environment and likelihood of further impact. Review the WMP and related procedures to prevent reoccurrence.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify appropriate regulatory authorities, DPHI, DCCEEW-Water and EPA as soon as practicable if PIRMP is not triggered.

Aspect	Normal	Stage 1	Stage 2	Notifications
Emergency discharges (LDP004)	No discharge from emergency locations.	Trigger: Discharge from a defined emergency discharge location. Action: Undertake dewatering of relevant storages to areas where capacity exists. Undertake water quality sampling of discharge and add flocculant as necessary.	Trigger: Continued discharge from a defined emergency discharge location. Action: Review recent monitoring results and any relevant operational data (e.g. operational activities, meteorological data). Investigate cause for discharge and if the appropriate procedures were followed. Undertake water quality sampling of discharge and add flocculant as necessary. Undertake water quality sampling of upstream and downstream receiving environment as appropriate to assess any potential impact. Review adequacy of storage design, dewatering procedure and inspection schedule.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred.
Unlicensed discharges.	No discharges from unlicensed locations.	All unlicensed discharges are considered Stage 2 triggers. Trigger: A discharge from a non-EPL defined, emergency discharge location. Action: Undertake review of water management on site. Undertake incident investigation, including ecotoxicology and aquatic ecology monitoring if appropriate.	Stage 1: NA Stage 2: Notify Environment and Community Team Manager immediately. Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to environment to occur. Notify DCCEEW-Water, EPA and DPHI as soon as practicable.	

G.5 Stream health

Aspect	Normal	Stage 1	Stage 2	Notifications
Watercourse instabilities	Watercourse monitoring indicates no areas of instabilities.	Trigger: Monitoring indicates a declining stability trend. Action: Review historical monitoring records. Investigate the factors contributing to the instability, which may include advice from technical specialists. Implement corrective actions as required as soon as practicable to stabilise the surface and/or watercourses based on the outcomes of the investigation. Increase monitoring frequency and undertake additional monitoring (e.g. water quality, aquatic ecology) where relevant.	Trigger: Monitoring indicates a declining stability trend likely caused by site operations. Action: Immediately isolate areas of instability and implement corrective actions to stabilise the surface and/or watercourses. Investigate the factors contributing to the instability, which may include advice from technical specialists. Increase monitoring frequency and undertake additional monitoring (e.g. water quality, aquatic ecology) where relevant. Implement corrective/preventative actions based on the outcomes of the investigation and/or additional monitoring. Prioritise actions based on the risk to the environment and likelihood of further impact.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies in accordance with PIRMP requirements or if material harm has occurred. Notify DCCEEW-Water as soon as practicable if Stage 2 exceedance is found to be mining-related.

Aspect	Normal	Stage 1	Stage 2	Notifications
Instream vegetation	Aquatic and riparian vegetation growth / assemblage consistent with historical observations, as determined by a suitably qualified professional.	Trigger: Visual inspections show a change in extent, density or condition of vegetation, or increased prevalence of exotic species, not specific to season or natural flow event. Action: Review operational activities likely to influence instream vegetation. Review flow and water quality monitoring and rainfall data. Where relevant, review discharge quality and volume data.	Trigger: Visual inspections show a change in extent, density or condition of instream vegetation and investigation indicates that changes are attributed to mine discharges. Action: Review EPL, Consent and PIRMP requirements. Engage a suitably qualified surface water specialist, ecologist or geomorphologist, as appropriate, to undertake a watercourse assessment and make recommendations to mitigate factors contributing to deteriorating vegetation. Prioritise actions based on risk to the environment and likelihood of further impact. Stabilise watercourse banks as necessary.	Stage 1: Notify Environment and Community Coordinator/Mine Manager as soon as practicable. Stage 2: Notify relevant agencies (including DCCEEW) in accordance with PIRMP requirements or if material harm has occurred.

Aspect	Normal	Stage 1	Stage 2	Notifications
Macroinvertebrate community condition	Assessment of macroinvertebrate metrics (taxa richness, EPT richness and SIGNAL-2) and multivariate analyses of macroinvertebrate data (including multivariate analysis such as MDS, Cluster analysis, ANOSIM, SIMPER) indicates no impairment attributable to licensed discharges from the site.	Trigger: Weight of evidence assessment² indicates possible adverse effects associated with mining-related activity, as determined by a suitably qualified aquatic ecologist and the performance criteria in Table 6.13. Action: Undertake further investigation to determine if the effects are the result of mining activities and the significance of the effects.	Trigger: Weight of evidence assessment¹ and/or investigation into stage 1 trigger indicates significant adverse effects associated with mining-related activity. Action: Seek recommendations on additional monitoring or investigation requirements from a suitably qualified water specialist or aquatic ecologist. Prioritise actions based on the risk to the environment and likelihood of further impact.	Stage 1: Notify Environment and Community Team and Mine Manager. Stage 2: Notify relevant agencies in accordance with PIRMP requirements if the investigation determines that the change was caused by site operations or there is material harm.

¹ The weight of evidence assessment includes the assessment of macroinvertebrates community condition alongside other relevant information (i.e. other lines of evidence) such as water quality, aquatic habitat, CES discharge volumes and rainfall volumes. The qualitative and quantitative parameters included in the weight of evidence assessment are detailed in biannual aquatic ecology survey reports (see Section 4.5.2.2)



Centennial Coal Company Limited
P O Box 1000
Toronto NSW 2283
www.centennialcoal.com.au