YANCOAL
兖煤澳大利亚有限公司
MOOLARBEN COAL

UG4 LONGWALLS 401 TO 408 WATER MANAGEMENT PLAN

Version	Effective Date *(Month /YYYY)*	Revision Detail *(Inlcude the main areas reviewed, trigger/ why the trigger)*	*Author(s)* *(Name/s)*	Review Team *(Name/s)*
1	July 2022	Approved	MCO, WRM, AGE and MSEC	MCO
2	October 2023	Administrative Updates	MCO	MCO

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1.0 INTRODUCTION

The Moolarben Coal Complex is an open cut and underground coal mining operation located approximately 40 kilometres (km) north of Mudgee in the Western Coalfield of New South Wales (NSW) (**Figure 1**).

Moolarben Coal Operations Pty Ltd (MCO) is the operator of the Moolarben Coal Complex on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben [YM] Pty Ltd and a consortium of Korean power companies). MCO, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited.

The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities) (**Figure 2**). Since the commencement of coal mining operations in 2010, mining activities have occurred within OC1, OC2, OC3, OC4, and UG1 (**Figure 2**).

The UG4 Underground Mine (UG4) is a component of the Moolarben Coal Project Stage 1 Approval (05_0117) (**Figure 2**). First workings for UG4 North Mains commenced in October 2020. Secondary extraction in UG4 of the first Longwall LW401 is scheduled to commence in 2022 (**Table 3**).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 and would continue to be carried out in accordance with Project Approval (05_0117) (Moolarben Coal Project Stage 1) as modified and Project Approval (08_0135) (Moolarben Coal Project Stage 2) as modified, granted under the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

1.1 PURPOSE AND SCOPE

This UG4 Longwalls 401 to 408 Water Management Plan (LW401-408 WMP) has been prepared to satisfy the requirements of Schedule 3, Condition 77(h) of Project Approval (05_0117) for the management of potential impacts to watercourses and aquifers due to secondary extraction of Longwalls 401 to 408.

The approved complex-wide Water Management Plan (WAMP) (as amended from time to time), developed in consultation with the Department of Planning and Environment - Water, is implemented to manage surface water and groundwater related impacts across the Moolarben Coal Complex (including the Longwalls 401-408 Study Area). To avoid duplication of existing Environmental Management Plans, this LW401-408 WMP references components of the approved complex-wide WAMP.

This LW401-408 WMP has been prepared by MCO with input from suitably qualified experts (WRM Water & Environment [WRM] [surface water], AGE [groundwater] and Mine Subsidence Engineering Consultants [MSEC]). The appointment of the team of suitably qualified and experienced persons was endorsed by the Secretary of the DPE on the 26 April 2021 (**Attachment 2** of the Extraction Plan).

In summary:

Purpose: This LW401-408 WMP outlines the management of potential environmental consequences on watercourses and aquifers resulting from the extraction of Longwalls 401- 408.

Scope: This LW401-408 WMP considers the watercourses and aquifers within the Longwalls 401-408 Study Area[1] (**Figure 4**).

Longwalls 401- 408 form part of the approved UG4 Underground Mine at the Moolarben Coal Complex.

1.2 STRUCTURE OF THE LONGWALLS 401-408 WATER MANAGEMENT PLAN

The remainder of the LW401-408 WMP is structured as follows:

Section 2 Describes the review and update of the LW401-408 WMP.

Section 3 Outlines the statutory requirements applicable to the LW401-408 WMP.

Section 4 Summarises the predicted subsidence impacts and environmental consequences resulting from the secondary extraction of Longwalls 401- 408.

Section 5 Details the performance measures and indicators that will be used to assess environmental performance in relation to watercourses and aquifers.

Section 6 Describes the monitoring program.

Section 7 Describes the potential management and contingency measures and the Trigger Action Response Plan (TARP) management tool.

Section 8 Describes the Annual Review requirements, audits, improvement of environmental performance and preparation for future Extraction Plans.

Section 9 Outlines the management and reporting of incidents.

Section 10 Outlines the management and reporting of complaints.

Section 11 Outlines the management and reporting of any non-compliance with statutory requirements.

Section 12 Lists the documents referred to in **Sections 1** to **11** of this LW401-408 WMP.

[1] Longwalls 401-408 and the area of land within the furthest extent of the 26.5 degree (°) angle of draw and 20 millimetre (mm) predicted subsidence contour.

Figure 1: Regional Location

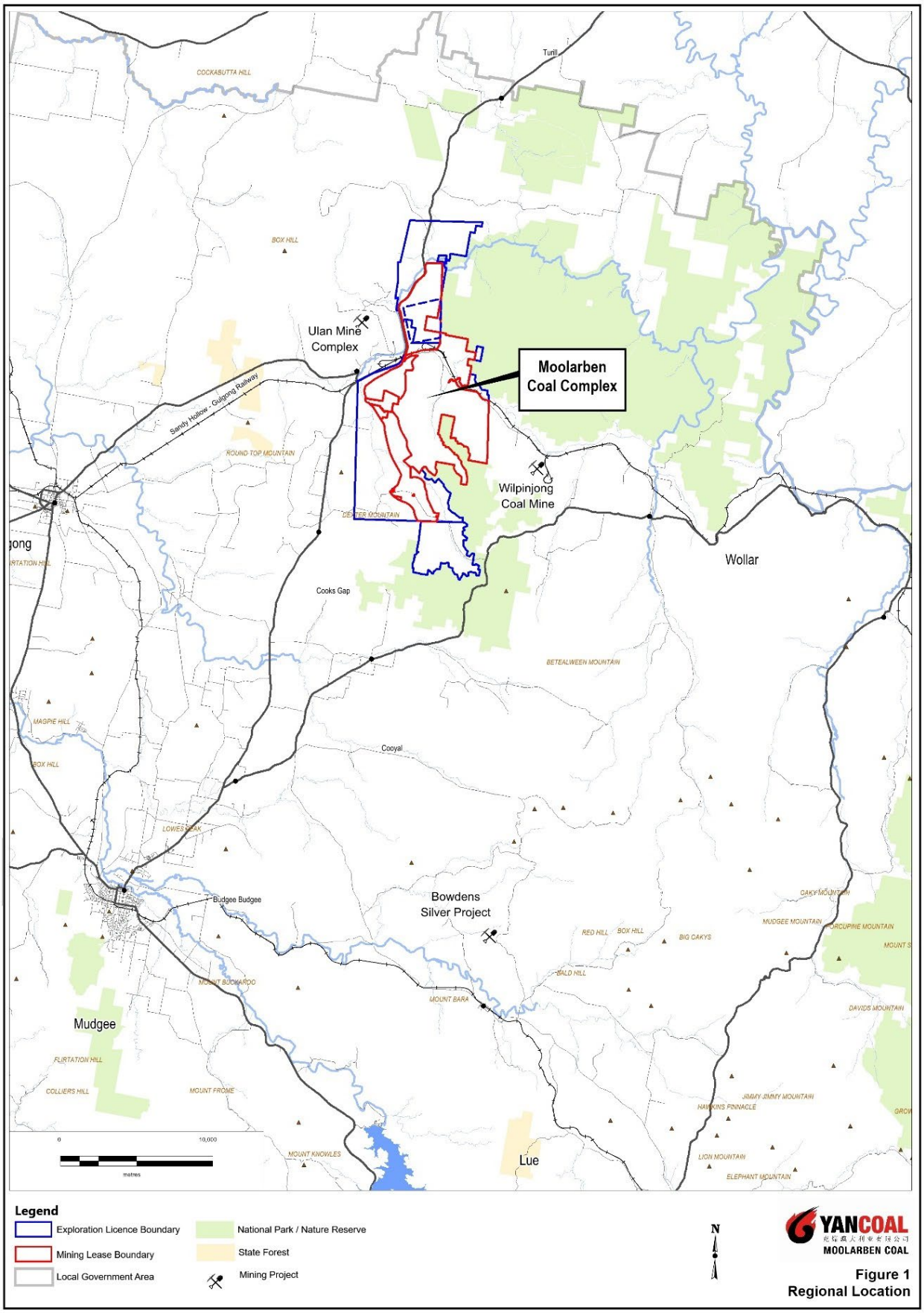

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Figure 2: Moolarben Coal Complex Layout

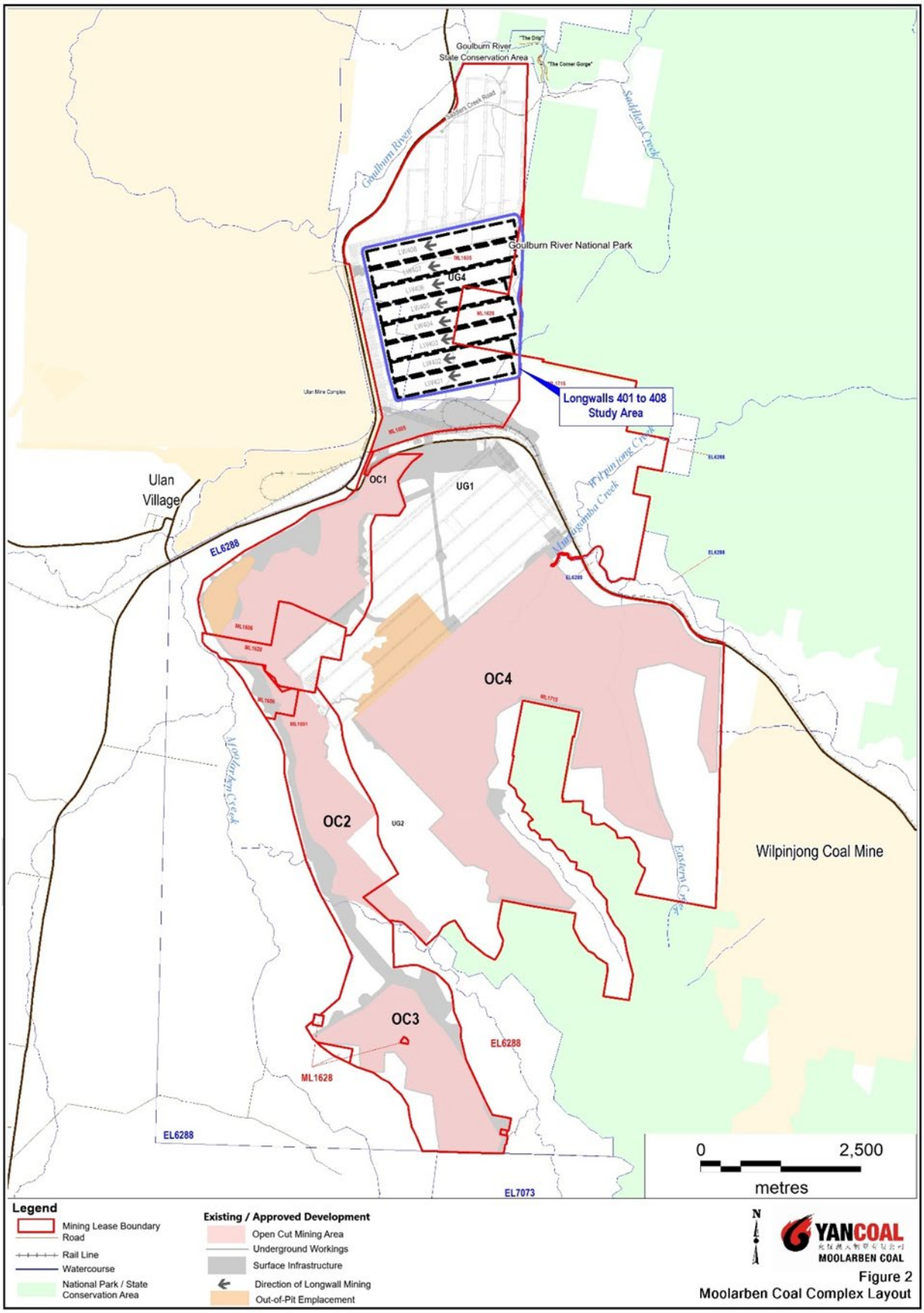

Figure 3: Underground 4 Longwalls 401 to 408 Layout

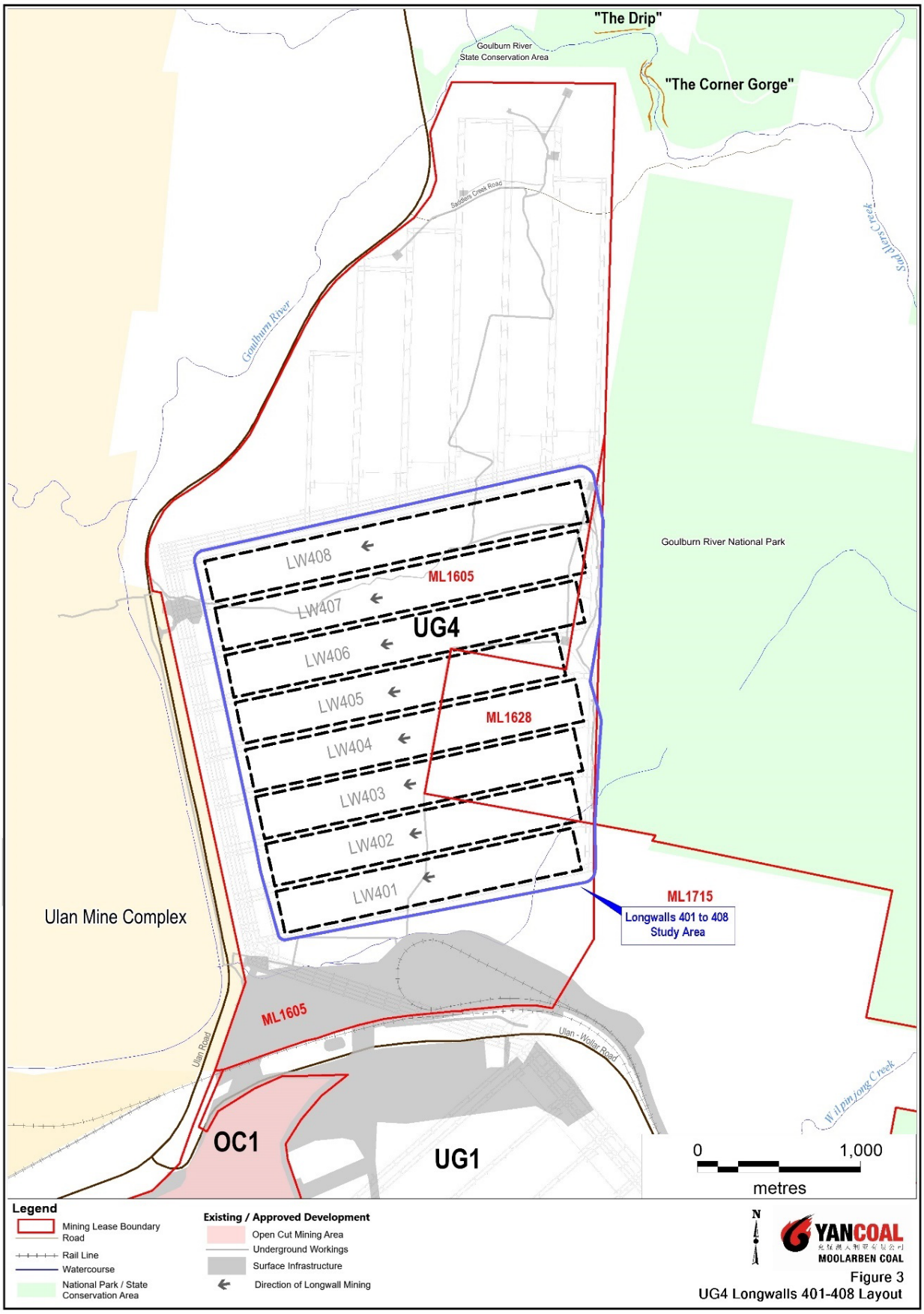

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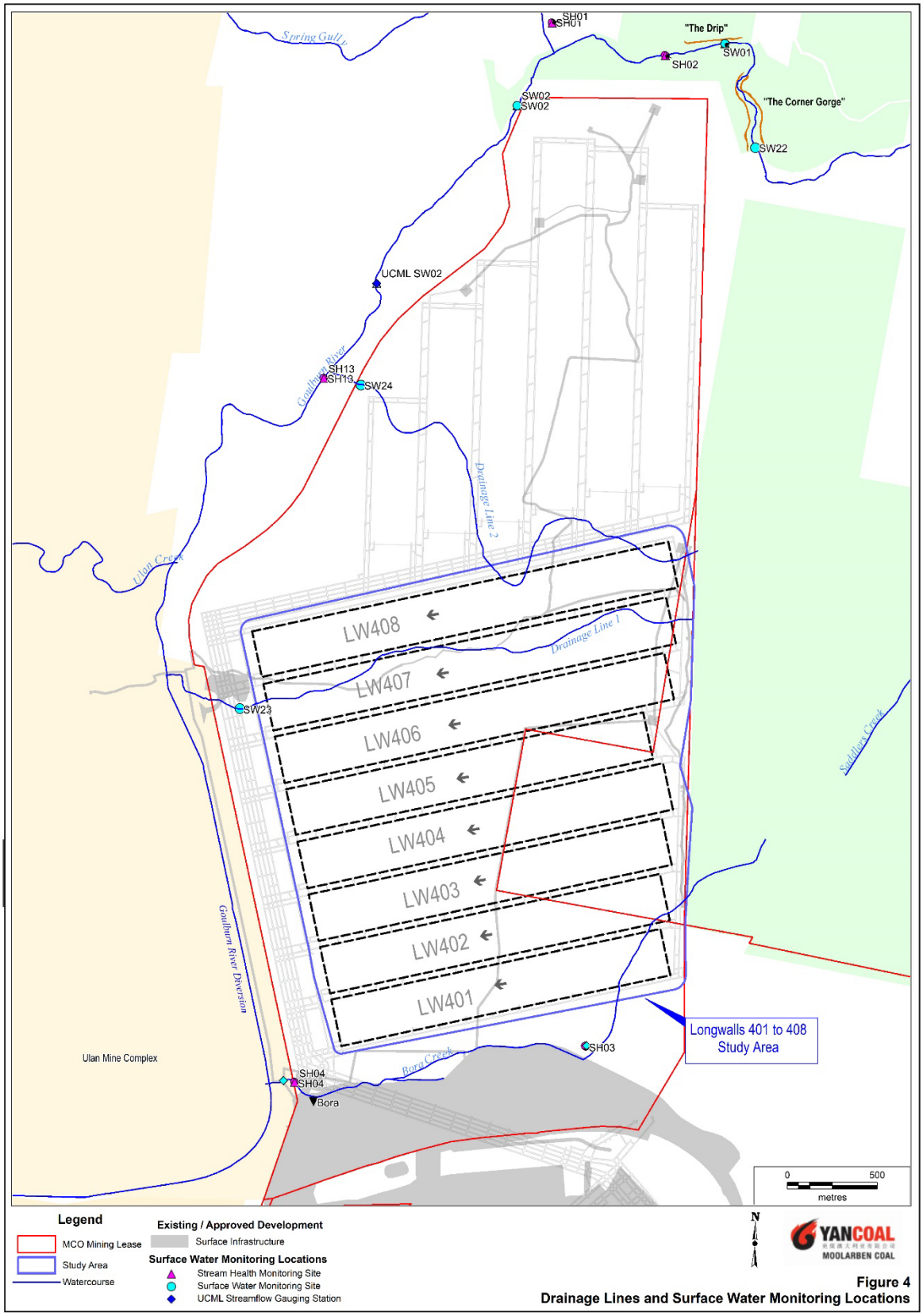
Figure 4 Drainage Lines and Surface Water Monitoring Locations



2.0 WATER MANAGEMENT PLAN REVIEW AND UPDATE

In accordance with Condition 5, Schedule 5 of Project Approval (05_0117), this LW401-408 WMP will be reviewed as followed:

> *5. Within 3 months of the submission of:*
>
> *(a) the submission of annual review under condition 4 above;*
>
> *(b) the submission of an incident report under condition 7 below;*
>
> *(c) the submission of an audit under condition 9 below; or*
>
> *(d) any modification of this approval,*
>
> *the Proponent shall review and, if necessary, revise the strategies, plans, and programs required under this approval to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within four weeks of the review the revised document must be submitted to the Secretary for approval.*

2.1 ACCESS TO INFORMATION

In accordance with Condition 11, Schedule 5 of Project Approval (05_0117), MCO will make the approved LW401-408 WMP publicly available on the MCO website.

3.0 STATUTORY REQUIREMENTS

MCO's statutory obligations are contained in:

- the conditions of the NSW Project Approval (05_0117) (as modified) and NSW Project Approval (08_0135) (as modified);
- the conditions of Commonwealth Approvals (EPBC 2007/3297, EPBC 2013/6926, EPBC 2008/4444, and EPBC 2017/7974);
- relevant licences and permits, including conditions attached to the Environment Protection Licence (EPL) No. 12932 and Mining Leases,
- water access licences (WALs) under the NSW *Water Management Act, 2000* and water licences under the NSW *Water Act, 1912*; and
- other relevant legislation.

Obligations relevant to this LW401-408 WMP are described below.

3.1 EP&A ACT APPROVAL

Condition 77(h), Schedule 3 of Project Approval (05_0117) requires the preparation of a Water Management Plan (i.e. this LW401-408 WMP) as a component of the Extraction Plan. In addition, Conditions 77(n), 77(p) and 78, Schedule 3 and Condition 3, Schedule 5 of Project Approval (05_0117) outline general management plan requirements that are applicable to the preparation of this LW401-408 WMP. **Table 1** presents these requirements and indicates where they are addressed within this LW401-408 WMP.

Table 1 Water Management Plan Requirements

Project Approval (05_0117) Condition	LW401-408 WMP Section
Condition 77, Schedule 3	
77. The Proponent shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Secretary. Each extraction plan must:	
...	
(h) include a Water Management Plan, which has been prepared in consultation with EPA and DPI Water, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on watercourses and aquifers, including:	**This document**
• *surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;*	**Section 5**
• *a program to monitor and report stream flows, assess any changes resulting from subsidence impacts and remediate and improve stream stability;*	**Sections 6, 7 and 8**
• *a program to monitor and report groundwater inflows to underground workings;*	**Sections 6 and 8**
• *a program to predict, manage and monitor impacts on groundwater bores on privately-owned land;*	**Sections 6 and 7**
...	
(n) include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 14 and 15, or where such exceedances seem likely;	**Section 7**
...	
(p) include a program to collect sufficient baseline data for future Extraction Plans.	**Section 8.3**

Table 1 (Continued): Water Management Plan Requirements

Project Approval (05_0117) Condition	LW401-408 WMP Section
(q) include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 18 and 19, or where such exceedances seem likely;	**Section 7**
...	
(p) include a program to collect sufficient baseline data for future Extraction Plans.	**Section 6 and 8.3**
Condition 78, Schedule 3	
78. The Proponent shall ensure that the management plans required under conditions 5(g)-(l) above include:	
(a) an assessment of the potential environmental consequences of the Extraction Plan incorporating any relevant information that has been obtained since this approval; and	**Sections 4**
(b) a detailed description of the measures that would be implemented to remediate predicted impacts.	**Section 7**
Condition 3, Schedule 5	
5. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data	**Sections 4.4 and 4.5.1 to 4.5.3 and 4.6.1 to 4.6.3**
(b) a description of:	
• *the relevant statutory requirements (including any relevant approval, licence or lease conditions);*	**Section 3**
• *any relevant limits or performance measures/criteria;*	**Section 5**
• *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;*	**Section 5**
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	**Sections 7**
(d) a program to monitor and report on the:	**Sections 6 and 8**
• *impacts and environmental performance of the project;*	
• *effectiveness of any management measures (see c above);*	
(e) a contingency plan to manage any unpredicted impacts and their consequences;	**Section 7**
(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	**Sections 6 and 8**
(g) a protocol for managing and reporting any:	
• *incidents;*	**Section 9**
• *complaints;*	**Section 10**
• *non-compliances with statutory requirements; and*	**Section 11**
• *exceedences of the impact assessment criteria and/or performance criteria; and*	**Section 7**
(h) a protocol for periodic review of the plan.	**Section 2**

3.2 OTHER LEGISLATION

MCO will operate the Moolarben Coal Complex consistent with Project Approval (05_0117) and any other legislation that is applicable to an approved Part 3A Project under the EP&A Act.

The following Acts may be applicable to, but are not limited to, the conduct of the Moolarben Coal Complex:

- *Fisheries Management Act, 1994;*
- *Heritage Act, 1977;*

- *Coal Mine Subsidence Compensation Act 2017*
- *Mining Act, 1992;*
- *National Parks and Wildlife Act, 1974;*
- *Biodiversity Conservation Act, 2016;*
- *Protection of the Environment Operations Act, 1997;*
- *Water Act, 1912;*
- *Water Management Act, 2000;*
- *Work Health and Safety Act, 2011*; and
- *Work Health and Safety (Mines and Petroleum Sites) Act, 2013.*

Relevant licences or approvals required under these Acts will be obtained as required.

3.3 WATER LICENCES HELD BY MCO

The water licences held by MCO are listed in **Table 2**. Groundwater use including incidental use or "take" of groundwater will be assessed for each water source affected by the Moolarben Coal Complex and accounted for by way of the groundwater licences held by the Moolarben Coal Complex.

Table 2 Water Licences Held by MCO

Licence Number	Description
WAL36340, 37583 and 19424	Wollar Creek Water Source – Hunter Unregulated and Alluvial Water Sources
WAL37582 and 41888	Upper Goulburn River Water Source – Hunter Unregulated and Alluvial Water Sources
WAL39799	Sydney Basin - North Coast Fractured and Porous Rock Groundwater Source

4.0 PREDICTED SUBSIDENCE IMPACTS AND ENVIRONMENTAL CONSEQUENCES

4.1 LONGWALLS 401- 408 EXTRACTION SCHEDULE

Longwalls 401-408 and the area of land within the furthest extent of the 26.5° angle of draw and 20 mm predicted subsidence contour (i.e. the Longwalls 401-408 Study Area) are shown on **Figure 4**. Longwall extraction will occur from the east to the west. The longwall layout includes approximately 260 m panel widths (void) with 35 m width pillars (solid). The provisional extraction schedule for Longwalls 401-408 is provided in **Table 3**.

Table 3 Provisional Extraction Schedule

Longwall	Estimated Start Date	Estimated Duration (months)	Estimated Completion Date
LW401	June 2022	4	October 2022
LW402	November 2022	4	March 2023
LW403	April 2023	4	August 2023
LW404	August 2023	5	January 2024
LW405	February 2024	4	June 2024
LW406	July 2024	5	December 2024
LW407	January 2025	4	May 2025
LW408	June 2025	4	November 2025

4.2 REVISED SUBSIDENCE AND IMPACT PREDICTIONS

As required by Condition 77(e), Schedule 3 of Project Approval (05_0117), when preparing an Extraction Plan, MCO must revise predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since approval.

The development of this LW401-408 WMP for UG4 has incorporated the revised subsidence predictions and impacts applicable to surface water and groundwater in the *Subsidence Predictions and Impact Assessment for Longwalls 401 to 408* (MSEC, 2021), UG4 Longwalls 401 to 408 Extraction Plan Surface Water Technical Report (WRM, 2021) and *Groundwater Technical Report on UG4 LW401-LW408 Extraction Plan* (AGE, 2021) and summarised in **Section 4.3** to **Section 4.5**.

4.3 ENVIRONMENTAL RISK ASSESSMENT

An Environmental Risk Assessments (ERA) was conducted for four of the key component plans of the UG4 Longwalls 401- 408 Extraction Plan. Water Management Plan, Biodiversity Management Plan, Heritage Management Plan and Land Management Plan, to provide appropriate consideration to risk assessment and risk management in accordance with the Draft DPE and DRE (2015) *Guidelines for the Preparation of Extraction Plans*.

The ERA workshop for LW panels 401-408 was held on 15 June 2021, facilitated by independent specialist, Risk Mentoring. The suitably qualified and experienced experts endorsed by the Secretary of the DPE for the preparation of the UG4 Longwalls 401- 408 Extraction Plan and relevant MCO personnel participated in the ERA. The ERA indicated that risks relevant to surface water and groundwater in the Longwalls 401-408 Study Area were in the “Low” to “Medium” category, and it was expected that the

risks could be managed with implementation of the appropriate mitigation, management and/or control measures

4.4 PREDICTED SUBSIDENCE IMPACTS

The predicted subsidence effects, subsidence impacts and environmental consequences of the Moolarben Coal Complex UG4 Underground Mine were originally assessed, and subsequently approved (the Approved Layout), in the Moolarben Coal Project Environmental Assessment Report (September 2006) (2006 EA).

As described in **Section 4.1**, subsidence impact predictions for the drainage lines in the Longwalls 401-408 Study Area have been revised to reflect the latest longwall layout (the Extraction Plan Layout) (MSEC, 2021) and incorporating any relevant information obtained since approval.

There are no perennial streams within the Study Area. The only named stream within the Study Area is Bora Creek, which is an ephemeral stream and is located above the commencing ends of Longwalls 401 and 402. A number of other small ephemeral drainage lines have been identified above the longwalls and within the Study Area (MESC, 2021). The main drainage lines flowing through the Study Area include Bora Creek, Drainage Line 1 and Drainage Line 2 (**Figure 4**).

The Goulburn River Diversion is the nearest major stream, located on the western side of the Study Area and is 425 m from the finishing end of Longwall 406 at its nearest point. MSEC (2021) noted that the distances to the Goulburn River represent about 5 to 6 times the depth of cover from LW401 to LW408. At these distances conventional mine subsidence ground movements and valley related movements are expected to be less than limits of survey accuracy.

MSEC (2021) completed a comparison of the maximum predicted subsidence parameters for Bora Creek, Drainage Line 1 and Drainage Line 2, resulting from the extraction of Longwalls 401 to 408, with those based on the Approved Layout as shown in Table 4. The values are the maxima along the section of the drainage lines located within the Study Area.

Table 4 Maximum Predicted Systematic Subsidence Parameters along Drainage Lines Resulting from the Extraction of the Approved Layout and Extraction Plan Layout

Layout	Drainage Line	Subsidence[1] (mm)	Tilt[2] (mm/m)	Hogging Curvature[3] (km^{-1})	Sagging Curvature[3] (km^{-1})
Approved Layout	Bora Creek	1800	25	0.50	0.45
	Drainage Line 1	1900	60	>3.0	>3.0
	Drainage Line 2	1000	20	0.75	0.70
Extraction Plan Layout	Bora Creek	1800	25	0.55	0.40
	Drainage Line 1	1900	60	>3.0	>3.0
	Drainage Line 2	1000	20	0.85	0.75

Source: MSEC (2021).
mm/m = millimetres per metre, km^{-1} = 1/kilometres.
1 Subsidence refers to vertical displacements of the ground.
2 Tilt is the change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the distance between those two points.
3 Curvature is the second derivative of subsidence, the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections.

The predicted total subsidence for the drainage lines based on the Extraction Plan Layout is the same as that for the Approved Layout. The predicted total curvature and tilt based on the Extraction Plan Layout is similar to that based on the Approved Layout. (MSEC, 2021).

The maximum predicted total conventional subsidence, tilt and curvature for Bora Creek, drainage line DL1 and DL2 resulting from the extraction of Longwalls 401 to 408, based on the Extraction Plan Layout, are provided in **Table 5**.

Table 5 Maximum Predicted Total Conventional Subsidence, Tilt and Curvature for Drainage Line 6 and 7 Resulting from the Extraction of Longwalls 401 to 408

Location	Subsidence (mm)	Tilt (mm/m)	Hogging Curvature (km^{-1})	Sagging Curvature (km^{-1})
Bora Creek	1800	25	0.55	0.40
Drainage Line 1	1900	60	>3.0	>3.0
Drainage Line 2	1000	20	0.85	0.75

Source: MSEC (2021)

4.5 SURFACE WATER

4.5.1 Baseline Data

The Moolarben Coal Complex is located in the Upper Goulburn River and Wollar Creek catchments (both sub-catchments to the larger Goulburn River and Hunter River catchments), which have catchment areas of approximately 2,455 square kilometres (km^2) and 532 km^2, respectively. Both catchments drain to the Goulburn River which flows in an easterly direction, eventually joining the Hunter River approximately 150 km downstream of the Moolarben Coal Complex.

Moolarben Creek is a tributary of the Upper Goulburn River sub-catchment and flows along the western boundary of the Moolarben Coal Complex. Wilpinjong Creek is a tributary of Wollar Creek sub-catchment and flows along the east and north-east of the Moolarben Coal Complex into Wollar Creek, before joining the Goulburn River approximately 26 km downstream of the Moolarben Coal Complex.

The main drainage lines flowing through the Study Area are Bora Creek, Drainage Line 1 and Drainage Line 2 (**Figure 3**). All drainage lines identified in the vicinity of the Longwalls 401- 408 Study Area are ephemeral as water only flows during, and for short periods after, each rain event. The drainage lines within the Study Area flow to the Goulburn River (MSEC, 2021).

The drainage lines within the Study Area comprise a rounded gravel to sandy and silty base. There is also debris along sections of the streams, including boulders, tree branches and other vegetation. The valley profiles of the drainage lines are predominantly broad and shallow with some incised sections. The natural grades of the main drainage lines within the Study Area typically vary between 5 mm/m (i.e. 0.5 % or 1 in 200) and 100 mm/m (i.e. 10 % or 1 in 10), with average natural grades of approximately 20 mm/m (i.e. 2 % or 1 in 50) (MSEC, 2021).

4.5.2 Summary of Subsidence Impacts to Drainage Lines

MSEC (2021) concluded the maximum predicted total subsidence parameters for the drainage lines based on the Approved Layout are the same as those for the Extraction Plan Layout for Longwalls 401 to 408 (Table 4). The potential impacts for the drainage lines, based on the Extraction Plan Layout are

the same as those assessed based on the Approved Layout. The following summary outlines the potential impacts to the drainage lines in the Study Area (MSEC, 2021):

- The drainage lines within the Study Area are ephemeral as water only flows during and for short periods after each rain event. Ponding naturally develops along some sections of the drainage lines, for short periods of time, after major rain events. Additional ponding may occur along the drainage lines resulting from the extraction of Longwalls 401 to 408, predominantly upstream of the chain pillars.
- Sections of beds downstream of the additional ponding areas may erode during subsequent rain events, especially during times of high flow. It is expected that, over time, the gradients along the drainage lines would approach grades similar to those that existed before mining. The extent of additional ponding along the drainage lines would, therefore, be expected to decrease with time.
- Fracturing, dilation and buckling of the bedrock would occur as a result of the extraction of these longwalls. Surface cracking is expected to develop in the bases of the drainage lines.
- In times of heavy rainfall, the majority of the surface water runoff would be expected to flow over the surface cracking in the beds and only a small proportion of the flow would be diverted into the fractured and dilated strata below. In times of low flow, however, a larger proportion of the surface water flow could be diverted into the strata below the beds and this could affect the quality and quantity of this water flowing through the cracked strata beds. Nevertheless, during high flow or low flow times, this small quantity is expected to have little impact on the overall quality of water flowing out of the drainage lines.

WRM (2021) considered the potential impacts to Bora Creek and Drainage Lines 1 and 2 as a result of the extraction of Longwalls 401 – 408 and noted:

- The predicted maximum subsidence impacts would occur only within about 100 m of where the drainage lines cross the chain pillars, as this is where maximum tilt and curvature values occur. There is negligible change in drainage characteristics in reaches where uniform subsidence occurs.
- Only the upper reaches of Bora Creek would be affected. The lower reaches of Bora Creek between LW401 and its confluence with the Goulburn River Diversion would be unaffected by subsidence.

4.5.3 Summary of Subsidence Impacts to Water Storage Dams

There are five farm dams within the Study Area (D6, D7, D11, D12 and D13) (Figure 8 of the Extraction Plan). The dams are shallow with maximum dimensions of approximately 10 m to 20 m and were previously used for livestock watering but are no longer in use. The farm dams are located on land owned by MCO (MSEC, 2021).

The maximum predicted total subsidence parameters for the MCO farm dams within the Study Area based on the Extraction Plan Layout are less than the parameters for the Approved Layout for Longwalls 401 to 408. The changes to the predicted subsidence parameters for the dams do not change the impact assessments for the dams. Farm dams in the Study Area would be subject to minor changes in freeboard and potential leakage of water due to surface cracking (MSEC, 2021).

Where not decommissioned, farm dams in the Study Area would be visually monitored as the longwalls are extracted, such that any impacts can be identified and remediated accordingly. In this way the farm dams within the Study Area can be maintained in a safe condition throughout the mining period (MSEC, 2021).

Three dams D8, D9 and D10 are located outside the Study Area boundary and are not expected to be subjected to measurable conventional vertical subsidence, tilt, curvature or strain. Further information regarding UCMPL infrastructure and management is provided in *The UG4 Longwalls 401 to 408 Built Features Management Plan – Ulan Coal Mines Pty Limited* (LW401-408 BFMP-UCMPL) (**Appendix 3**).

4.5.4 The Goulburn River, The Drip and the Goulburn River Gorge

The Goulburn River is located on the western side of Longwalls 401 to 408 at distances of 425 m to 500 m from the longwall finishing ends. The river flows in a northerly direction at this location and comprises a diverted section of the river. The distances to the Goulburn River/Diversion represent about 5 to 6 times the depth of cover from Longwalls 401 to 408. At these distances conventional mine subsidence ground movements and valley related movements are expected to be less than limits of survey accuracy. However, the river may experience far-field horizontal movements.

The subsidence impacts to the Goulburn River based on the Approved Layout do not change based on the Extraction Plan Layout. It is unlikely that fracturing of the bed of the Goulburn River would occur due to the extraction of the Extraction Plan Layout. If fracturing does occur, it is likely that the fractures will be localised in nature and relatively minor in size, and they will only be visible in areas where the bedrock is exposed. It is expected that the majority of the bedrock in the bed of the river will be covered with alluvial deposits, which would cover any minor fractures that may develop in the bedrock. Minor fractures that potentially develop outside extracted longwalls are not generally associated with any increased rate of diversion of surface water into near-surface substrata (MSEC, 2021).

The Drip and Corner Gorge (also called Goulburn River Gorge) are located over 2.7 km and 2.2 km respectively from Longwall 408. At over 2.2 km from Longwall 408, The Drip and Corner Gorge will not experience measurable conventional tilts, curvatures or strains from the extraction of Longwalls 401 to 408. The database of observed far-field horizontal movements beyond approximately 2.2 km are within the order of survey tolerance or accuracy. No far-field movement observations greater than survey accuracy of 25 mm beyond approximately 550 m from an active longwall have been recorded at the MCC during the extraction of Longwalls 101 to 103. Measurable far-field horizontal movements are therefore not expected at The Drip and Corner Gorge. At a distances of 2.2 km or more, impacts to The Drip and Corner Gorge due to the extraction of Longwalls 401 to 408 are considered to be unlikely to occur (MSEC, 2021).

4.6 GROUNDWATER

4.6.1 Baseline Data

Previous groundwater assessments have extensively detailed the hydrogeological regime and groundwater quality within and surrounding the Moolarben Coal Complex. Previous assessments include:

- *Moolarben Coal Project – Groundwater Assessment* (Peter Dundon and Associates Pty Ltd, 2006);
- *Moolarben Stage 2 Groundwater Assessment* (Aquaterra Consulting Pty Ltd, 2008);
- *Moolarben Complex Stage 2 – Preferred Project Report – Groundwater Impact Assessment* (RPS Aquaterra, 2011);

- *Moolarben Coal Complex Stage 1 Optimisation Modification Groundwater Assessment* (Australasian Groundwater & Environmental Consultants Pty Ltd, 2013);
- *Moolarben Coal Complex UG1 Optimisation Modification – Environmental Assessment – Groundwater Assessment* (Dundon Consulting Pty Limited, 2015);
- *Moolarben Coal Complex UG1 Optimisation Modification Groundwater Modelling Assessment* (HydroSimulations, 2015); and
- *Moolarben Coal Open Cut Optimisation Groundwater Assessment (Hydrosimulations, 2017)*.

Various groundwater studies have also been completed for the UMC and Wilpinjong Coal Mine. Comprehensive groundwater monitoring is undertaken at MCC in accordance with the approved Groundwater Management Plan. Key existing MCC groundwater monitoring sites in the vicinity of UG4 are shown on **Figure 5** and summarised in **Table 6**.

4.6.2 Hydrogeological Regime

The Moolarben Coal Complex area is located in the Western Coalfield on the north-western edge of the Sydney-Gunnedah Basin. The main hydrogeological units within and surrounding the Moolarben Coal Complex include:

- Quaternary alluvium associated with the present day drainage system;
- Tertiary alluvium associated with the identified palaeochannel that is not related to the present day drainage system;
- Narrabeen Group - Triassic sandstone consisting of Quartzose Triassic and Lithic Triassic sandstone;
- Illawarra Coal Measures - Permian coal measures, which includes the Ulan Seam near the base of the unit;
- Marrangaroo Conglomerate – Permian aged conglomerate; and
- Basement - Units that include Carboniferous volcanics and the Gulgong granite.

Quaternary alluvial deposits in the vicinity of the Moolarben Coal Complex are associated with Lagoon Creek, Goulburn River, Moolarben Creek and Wilpinjong Creek.

Tertiary sediments associated with palaeochannels are remnants of inactive river or stream channels that have been later filled in or buried by younger sediment. The infill sediments consist of poorly-sorted semi-consolidated quartzose sands and gravels in a clayey matrix. The sediments are unsaturated across a large proportion of the footprint of the palaeochannel.

Tertiary sediments are located within the palaeochannel to the south of UG4. The sediments vary in thickness with a maximum thickness of 50-60 m, located to the south of Longwall 401. The presence of the palaeochannel sediments should result in less subsidence within these alluvial and unconsolidated sediment areas and reduced far-field movements within and beyond these channels (MSEC, 2021).

The Triassic aged sandstones overly the Permian coal measures and are present over eastern portions of LW401 to LW408. Large extents of the Triassic strata are unsaturated, either naturally or from dewatering caused by previous mining activities. Where saturated, the Triassic aged sandstones above LW401 – 408 host the regional water table. The depth to the water table typically ranges from approximately 50 – 65 metres below ground (mbgl) at the eastern end of these panels. Triassic

groundwater monitoring bore PZ 103C suggests that the shallowest depth to water in the PZ401-408 area occurs at approximately 25 mbgl, which at that location occurs near the very base of the Triassic sandstone.

The Triassic aged sandstones provide some water supply potential, however the sandstone is generally low yielding. The Triassic sandstone supports a small number of stock and domestic bores on private properties to the north of the Moolarben Complex. Groundwater perching within the Triassic sandstones supports the local and culturally sensitive water feature on the Goulburn River known as The Drip.

The Permian aged Illawarra Coal Measures underlie the Triassic Narrabeen Group and comprise interbedded claystones, siltstones, sandstones and coal seams, including the Ulan Seam which will be mined at UG4.

The Permian strata consists of very low permeability and very low yielding sandstone and siltstone, that comprises the majority of the Permian interburden / overburden. Low to moderately permeable coal seams make up the remainder of the Illawarra Coal Measures. The coal seams are the principal water bearing strata within the Illawarra coal measures. The Permian coal measures are hydraulically confined to semi-confined within the region. However, the coal measures are depressurised locally due to historic and current mining activities.

Underlying the Ulan Seam is the Marrangaroo Conglomerate, which comprises weakly cemented conglomerates and medium to coarse grained sandstones.

Recharge to the groundwater system occurs by the direct infiltration of rainfall and downward percolation through the near surface weathered rock and alluvium where present. Recharge to the deeper units within the Permian coal measures occurs by downward seepage into the units where they subcrop beneath the alluvium or weathered rock cover.

The Goulburn River is the main watercourse in the vicinity of UG4 and has been heavily modified by the Goulburn River Diversion adjacent to UG4. The Goulburn River is likely a losing stream along the full length of the Goulburn River Diversion and which modelling suggests is disconnected in many sections. Further downstream of the Goulburn River diversion, there is evidence to suggest that the regional groundwater system has a shallow gradient either towards or away from the Goulburn River, dependent upon location.

There is no ‘highly productive’ groundwater, as defined under the *NSW Aquifer Interference Policy*, mapped in the vicinity of the Moolarben Coal Complex. The nearest ‘highly productive’ groundwater is a portion of the alluvial aquifer associated with Wilpinjong Creek downstream of the Wilpinjong Coal Mine. The aquifers in the vicinity of LW401-408 are “less productive” as per the Aquifer Interference Policy (AIP) classification.

There are no high priority culturally significant sites listed in the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009. However, a spring known as The Drip is a groundwater dependent ecosystem (GDE) with local cultural significance located over 2km from LW401-408. The groundwater seepage is observed in a cliff on the northern side of the Goulburn River. The seepage is derived from the perching of groundwater in the Triassic Narrabeen Group sediments above less permeable horizons in the Triassic sequence to the north of the Goulburn River. The perched aquifer is effectively disconnected from the underling regional watertable and neither depressurisation of the

lower hydrostratgraphic units, or a lowering of the regional water table caused by mining at LW401 to 408 will impact the water supply to The Drip.

Table 6 UG4 Groundwater Monitoring Network

Piezometer	Type	Lithology Screened	Screened Interval (mbgl)	Ground Elevation (mAHD)
PZ101B*	Standpipe	Permian OB	54 – 60	403.28
PZ101C	Standpipe	Lower Triassic	24 – 30	403.00
PZ102A*	Standpipe**	Marrangaroo Congl.	116 – 125	408.54
PZ103A*	Standpipe**	Ulan seam	118 – 127	425.21
PZ103C	Standpipe	Lower Triassic	24 – 30	425.00
PZ105A	Vibrating Wire Piezometer	Permian OB	28	388.93
		Permian OB	80	
		Ulan Seam	118	
PZ105C	Standpipe	Lower Triassic	20 – 28	389.00
PZ128	Vibrating Wire Piezometer	Triassic	20	409.52
		Permian OB	36	
		Permian OB	55	
PZ129	Vibrating Wire Piezometer	Triassic	35	417.95
		Permian OB	53	
		Permian OB	74	
PZ191*	Standpipe	Ulan seam	60 – 72	417.69
PZ192	Vibrating Wire Piezometer	Triassic	68	453.70
		Ulan seam roof	166	
		Ulan seam base	178	
PZ193	Vibrating Wire Piezometer	Permian OB	80	461.40
		Ulan seam roof	162	
		Ulan seam base	184	
PZ194	Vibrating Wire Piezometer	Triassic	78	429.19
		Ulan seam roof	173	
		Ulan seam base	196	
PZ194B	Standpipe	Permian	82-88	493.00
PZ194C	Standpipe	Triassic	97-109	493.00
PZ195	Vibrating Wire Piezometer	Top Permian	72	471.40
		Ulan seam roof	162	
		Ulan seam base	175	
PZ195B	Standpipe	Permian	61-66	471.43
PZ195C	Standpipe	Triassic	79-91	486.7
PZ229	Vibrating Wire Piezometer	Jurassic	84	492.64
		Triassic	140	
		Triassic	198	
		Permian	253	
		Permian	316	

Piezometer	Type	Lithology Screened	Screened Interval (mbgl)	Ground Elevation (mAHD)
PZ232	Vibrating Wire Piezometer	Triassic	45	484.62
		Triassic	75	
		Permian OB	96	
		Permian OB	132	
PZ235A	Standpipe	Triassic	44-49	436.17
PZ235B	Vibrating Wire Piezometer	Permian OB	68	434.86
		Permian OB	96	
		Ulan seam	147	
PZ236A	Standpipe	Triassic	54-60	436.70
PZ236B	Vibrating Wire Piezometer	Permian OB	85	436.72
		Permian OB	110	
		Ulan seam	157	

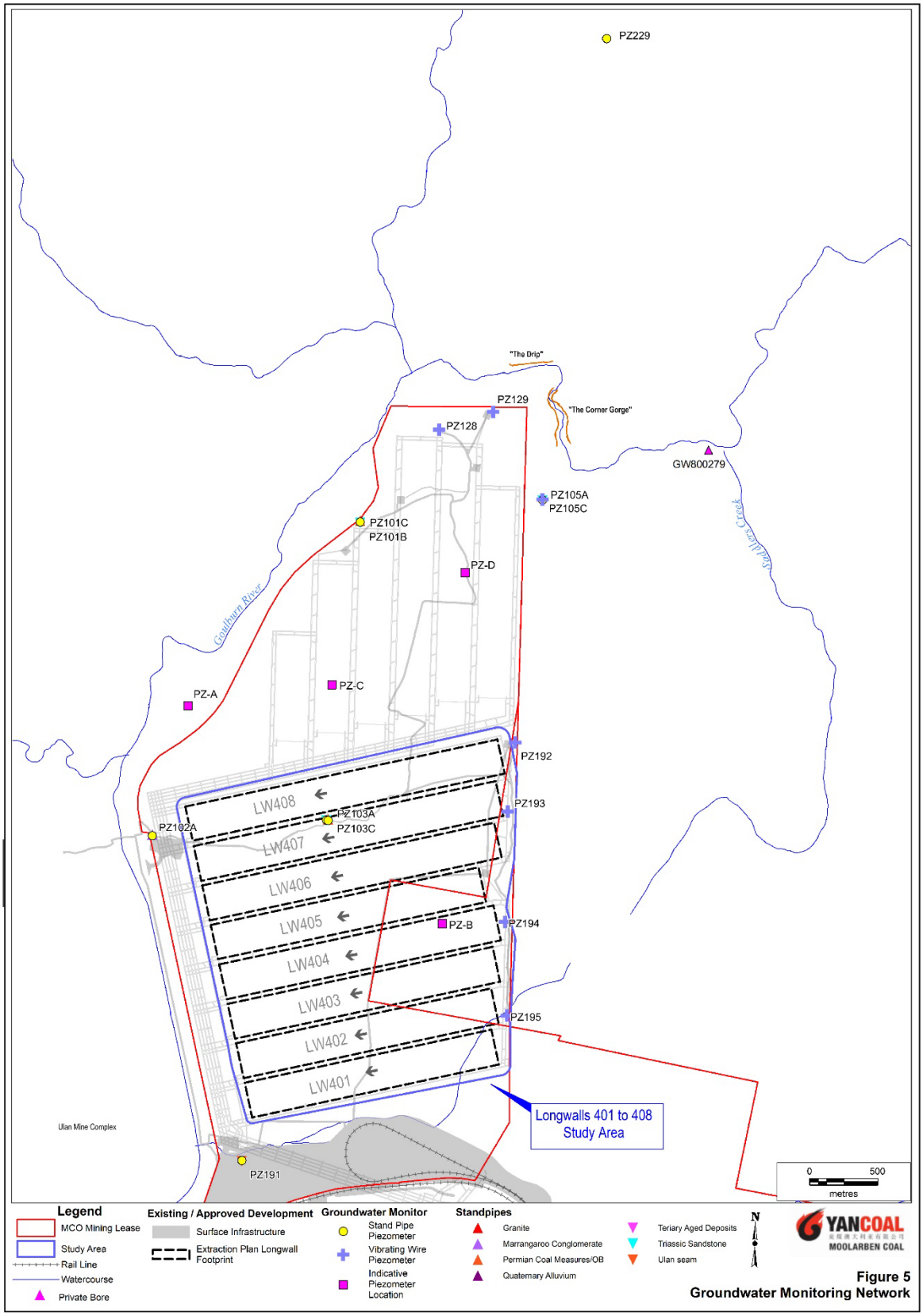
mAHD = metres Australian Height Datum, mbgl = metres below ground level.
* To be decommissioned prior to extraction for safety of underground operations or where impacted by subsidence. Will continue to be monitored until decommissioned.
** PZ102A and PZ103A to be replaced by Vibrating Wire Piezometers (Section 6.3)

4.6.3 Private Bores

No private bores are predicted to experience greater than minimal impact (i.e. drawdown greater than 2 m, as defined in the *NSW Aquifer Interference Policy*) due to the Moolarben Coal Complex.

There is one privately owned bore (GW800279) in the vicinity of the Moolarben Coal Complex, located approximately 2.5 km to the north east of UG4 Longwalls 401-408 (**Figure 5**). The bore is a relatively shallow bore (24 m) developed in Triassic strata and connected to the river alluvium. The predicted drawdown is less than the 2 m minimal impact considerations as specified under the AIP (AGE, 2021).

Figure 5 Groundwater Monitoring Locations Relevant to Longwalls 401 to 408



4.6.4 Predicted Impacts

Potential groundwater impacts due to the extraction of Longwalls 401- 408 were original assessed, and subsequently approved as part of the Moolarben Coal Stage 1 (Project Approval 05_0135).

AGE (2021) has prepared updated groundwater predictions for LW401 – 408 based on contemporary groundwater understanding, monitoring results and an updated numerical groundwater model. The groundwater modelling indicates that the Extraction Plan Layout would result in the same, or lower, potential impacts in comparison to the Approved Layout. Key outcomes of the updated groundwater modelling for LW401 – 408 are (AGE, 2021):

- Continuous fracturing above the longwall panels is not predicted to reach the surface, although fracturing would result in full depressurisation of the strata above the longwall panels.
- Predicted drawdowns in the Triassic (base of lithic) is predicted to remain localised to the vicinity of LW401 – 408 with 1 metre of drawdown generally limited to less than 700m.
- Depressurisation is predicted in the Permian coal measures; however, the consequence of depressurising the coal measures is insignificant as there is limited potential to develop the Permian coal measures for water supply purposes.
- No private bores are likely to be affected by 2 m drawdown or more due to the Moolarben Coal Complex, including Mining of LW401 – LW408.
- No predicted impact on the perched aquifer water supply to the Drip from LW401-408.
- Negligible change to baseflow in the Goulburn River.
- The predicted maximum takes due to MCO including LW401-408 are:
    - 4,427 ML from Sydney Basin-North Coast Groundwater Source
    - 25 ML from the Upper Goulburn River Water Source
    - 184 ML from the Wollar Creek Water Source
- MCO and Yancoal hold sufficient licences to account for the predicted water take.

5.0 PERFORMANCE MEASURES, PERFORMANCE INDICATORS AND INVESTIGATION TRIGGER LEVELS

5.1 SUBSIDENCE IMPACT PERFORMANCE MEASURES

This LW401-408 WMP has been developed to manage the potential environmental consequences of the secondary extraction of Longwalls 401- 408 on the Goulburn River and the bed of the Goulburn River in accordance with Condition 77(h), Schedule 3 of Project Approval (05_0117).

In accordance with Condition 73, Schedule 3 of Project Approval (05_0117), MCO must ensure that there is no exceedance of the subsidence impact performance measures listed in Table 14 of Condition 73, Schedule 3 of Project Approval (05_0117). The subsidence impact performance measure relevant to water resources in the Longwalls 401- 408 Study Area is listed in **Table 7**.

Table 7 Water Subsidence Impact Performance Measure

Feature	Subsidence Impact Performance Measure
The Drip and Goulburn River Gorge	Nil impact or environmental consequences.
Goulburn River and the bed of the Goulburn River	Negligible impact or environmental consequences.

Source: Table 14 of Condition 73, Schedule 3 of Project Approval (05_0117).

The Drip and Corner Gorge are located at distances of 2.2 km or more from Longwalls 401 – 408. At these distances, MSEC (2021) determined that the Drip and Corner Gorge will not experience measurable conventional tilts, curvatures or strains and that impacts due to the extraction of Longwalls 401 to 408 are unlikely to occur (**Section 4.5.4**).

In accordance with Table 11 of Condition 32, Schedule 3 of Project Approval (05_0117), the Performance Measure of nil impact on the water supply to the Drip has also been considered. AGE (2021) determined that discharges at the Drip are derived from perched groundwater aquifers in the Triassic Narrabeen Group sediments that are disconnected from the underlying groundwater table and therefore mining at UG4 LW401-408 would not impact the water supply to the Drip (**Section 4.6.4**). AGE (2021) recommends photographic monitoring of the Drip be undertaken every two months.

MSEC (2021) determined that subsidence impacts to the Goulburn River would be negligible (i.e. are expected to be less than limits of survey accuracy) (**Section 4.5.4**). Notwithstanding, WRM (2021) has developed a monitoring and trigger action response plan to monitor the Goulburn River.

Project Approval (05_0117) does not include any specific performance measures for the drainage lines within the Study Area. However, WRM (2021) have recommended monitoring and management of impacts to Bora Creek on the basis that it contains a stream health monitoring site and licensed discharge point.

Table 8 Surface Water Subsidence Management Objectives and Performance Indicators

Feature	Project Approval Performance Measure	Performance Indicators
Goulburn River and the bed of the Goulburn River	Negligible impact or environmental consequences	• Unpredicted impacts on Goulburn River (cracking and or noticeable changes in erosion or pools)*
The Drip	Nil impact on the water supply to the Drip	• Unpredicted loss of water supply to the Drip
Bora Creek	Not applicable	• Change in visible bed or bank erosion • Development of or change in headcut erosion along Bora Creek
		• Change in vegetation character such as vegetation loss through erosion or drowning by ponded water • Extent and duration of water ponding
		• Receiving water quality
		• Appearance of unsealed surface cracking across the bed of Bora Creek

Note: * Performance indicators for relevant groundwater monitoring sites north of LW408 will be established prior to mining LW405.

5.2 SURFACE WATER QUALITY TRIGGER INVESTIGATION LEVELS

The complex-wide SWMP includes water quality investigation trigger levels. As Bora Creek, DL1 and DL2 are tributaries of the Goulburn River, the water quality investigation trigger levels established for Goulburn River at monitoring site SW01 (**Figure 4** and **Table 8**) (based on analysis of surface water quality monitoring data) are relevant to this LW401-408 WMP, to confirm subsidence impacts from Longwalls 401- 408 do not result in adverse water quality impacts to the downstream environment.

Table 9 Surface Water Quality Trigger Investigation Levels

Waterway	Monitoring Site	pH		EC (µs/cm)		Turbidity (NTU)	
		20th/80th %ile Trigger Values	ANZECC Guideline	80th %ile Trigger Value	ANZECC Guideline	80th %ile Trigger Value	ANZECC Guideline
Goulburn River	SW01	6.5 – 8.5	6.5 – 8.0	900*	350	11	25
Drainage Line 1 and 2**	SW23 SW24	TBC	6.5 – 8.0	TBC	350	TBC	25

Note: The shaded cells indicate the adopted water quality trigger level. ** EC trigger levels reflect approved discharge limits at the Ulan Mine Complex (Ulan's discharge points are located upstream of SW01).* %ile = percentile, EC = electrical conductivity, µS/cm = microSiemens per centimetre and NTU = Nephelometric Turbidity Units.

** Preliminary Investigation Triggers for Drainage Line 1 and Drainage Line 2 will be based on ANZG (2018)/ANZECC (2000) default guideline values until updated sufficient baseline data is collected. Triggers will be applicable from the commencement of LW406.

Given the ephemeral nature of the drainage lines DL1 and DL2, with flow related to large rain events, it is likely that water quality will exceed default guideline values.

5.3 GROUNDWATER TRIGGER INVESTIGATION LEVELS

A summary of groundwater levels and quality investigation triggers relevant to Longwalls 401- 408 is provided below. The water quality triggers are consistent with the complex-wide Groundwater Management Plan.

Salinity and pH Triggers

Salinity and pH investigation trigger levels are defined in **Table 10** and are a sub-set of those in the complex-wide Groundwater Management Plan.

Table 10 Salinity and pH Trigger levels

Bore	Depth (m)	Lithology Screened	Salinity Triggers			pH Trigger Level (5th to 95th percentile)[1]
			Historical lab EC (5th to 95th percentile) (µS/cm)[1]	EC Trigger Level (µS/cm)	Beneficial Use Category Based on Lab EC 95th Percentile	
PZ101C	30	Lower Triassic	610 – 810 (655)	810	Marginal Potable	6.1 – 7.7 (6.7)
PZ103C	30	Lower Triassic	310 – 448 (350)	448	Potable	5.2 – 6.8 (5.6)[2]
PZ105C	28	Lower Triassic	198 – 319 (265)	319	Potable	5.3 – 7.4 (6.1)

[1] Historical values in brackets are median values.

[2] Revised trigger levels at PZ103C are based on the 10th and 90th percentile of historical field pH data.

Groundwater Level Triggers

Triggers for measured groundwater levels have been developed based on the minimal impact considerations in the *NSW Aquifer Interference Policy*.

There is no 'highly productive' groundwater, as defined under the *NSW Aquifer Interference Policy*, mapped in the vicinity of the Moolarben Coal Complex. The nearest 'highly productive' groundwater is a portion of the alluvial aquifer associated with Wilpinjong Creek downstream of the Wilpinjong Coal Mine.

The *NSW Aquifer Interference Policy* describes the following minimal impact considerations for less productive groundwater sources:

> *Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any:*
>
> *(a) high priority groundwater dependent ecosystem; or*
>
> *(b) high priority culturally significant site;*
>
> *listed in the schedule of the relevant water sharing plan.*
>
> *A maximum of a 2m decline cumulatively at any water supply work.*

There are no high priority groundwater dependent ecosystems or high priority culturally significant sites identified in the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009 or Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016 in the vicinity of the Moolarben Coal Complex.

The groundwater investigation protocol detailed in the approved complex-wide GWMP would be initiated in cases where groundwater monitoring identifies the potential for a greater than 2 m reduction in the groundwater level at a private bore, determined against groundwater level hydrograph trends.

The Goulburn River has been heavily modified by the Goulburn River Diversion adjacent to UG4. Historical depressurisation of the groundwater system has resulted in the groundwater levels being lowered substantially below the base of the river in the vicinity of LW401 – LW408. Accordingly, the proposed groundwater monitoring program is focused on measuring potential impacts on the Goulburn River downstream of UG4 (i.e. the natural part of the Goulburn River downstream of the diversion, where some baseflow interaction is understood to occur).

Groundwater Level Investigation Triggers relevant to the extraction of LW401 to 408 have been developed based on the updated groundwater model predictions with the objective of identifying any non-natural or expected (approved) impacts from LW401-LW408 and which may adversely affect local water supply work (as per Table 1: Less Productive Groundwater Sources of the *NSW Aquifer Interference Policy*. Groundwater level investigation triggers are based on the greater of the predicted groundwater drawdown, or 2 m drawdown below the minimum observed water level and are presented in **Table 11.** These trigger levels will be updated prior to mining of LW409 – 414, which are expected to result in additional drawdown at these monitoring bores.

Table 11 Trigger Groundwater Levels – Triassic Bores

Piezometer	Screened Interval	Screened Depth (mbgl)	Minimum Observed Groundwater Level		Trigger Level (mAHD)
			mbgl	mAHD	
PZ101C	Triassic	30	23.0	380.0	378.0
PZ105C	Triassic	28	15.3	373.7	371.7
PZ129	Triassic	35 (vwp)	30.0	388.0	386

mAHD = metres Australian Height Datum, mbgl = metres below ground level, vwp = vibrating wire piezometer

The above trigger levels are intended to trigger an investigation to determine whether the cause of the groundwater level/pressure decline is caused by MCO's mining activity, excluding borefield pumping, and to recommend an appropriate response action. The Trigger Action Response Plan would be implemented following two consecutive monthly monitoring rounds.

Additional Groundwater Monitoring Locations

Groundwater Investigation Trigger levels would be established for new monitoring bores PZ-A and two new bores north of LW408 (Section 6.3) monitoring the regional water table once 12 months of baseline data is collected. Investigation Triggers will consider hydraulic gradient and licencing of baseflow losses. Performance Indicators and Investigation Triggers will be established prior to mining of LW405.

6.0 MONITORING

6.1 POTENTIAL SUBSIDENCE IMPACTS

A monitoring program has commenced to monitor the impact of the secondary extraction of Longwalls 401- 408. The key components of the monitoring program are summarised in **Table 12**.

Table 12 Subsidence Monitoring Program for Surface Water Features

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Pre-mining			
Goulburn River	Undertake a baseline inspection at access points along Goulburn River Diversion and Goulburn River adjacent to LW401 – 408 and downstream to Corner Gorge, noting the condition of vegetation in the channel and any areas of active erosion, sediment deposition, water ponding or streambed cracking. Collect photographic record of channel condition.	Prior to completion of LW401	Environment and Community Manager
Visual inspection of upper reaches of Bora Creek and DL1 and DL2	Undertake a baseline inspection along the upper reaches of Bora Creek over LW401 and LW402 and drainage lines DL1 and DL2 above LW407 and LW408 respectively. Note the condition of vegetation in the channel and any areas of active erosion, sediment deposition, water ponding or streambed cracking. Collect photographic record of channel condition along Bora Creek over LW401 and LW402 and drainage lines DL1 and DL2 above LW407 and LW408 respectively.	Prior to commencement of LW401 for Bora Creek Prior to commencement of LW406 for drainage line DL1. Prior to the commencement of LW408 for DL2 .	
During and Post Mining			
Goulburn River	Undertake periodic visual inspection and update photographic record of access points along the Goulburn River Diversion and Goulburn River adjacent to LW401 to LW408.	6 monthly until 1 year after completion of Longwall 408 extraction	Environment and Community Manager
Visual inspection of upper reaches of Bora Creek and DL1 and DL2	Undertake post mining inspection along the upper reaches of Bora Creek over LW401 and LW402 and drainage lines DL1 and DL2 above LW407 and LW408 respectively and update photographic record.	Within three months of undermining Bora Creek and drainage lines DL1 & DL2. An inspection every six months for one year after longwall undermines Bora Creek and drainage lines DL1 and DL2.	

Subsidence parameters will be measured in accordance with the Longwalls 401 to 408 Subsidence Monitoring Program (Appendix G).

6.2 SURFACE WATER FLOW AND QUALITY

Surface water monitoring for receiving watercourses is undertaken for flow, water quality, stream health and channel stability as described in the approved complex-wide SWMP. Water quality sampling of receiving streams will continue to be undertaken in accordance with the approved complex-wide SWMP. Appropriate existing water quality monitoring at location downstream of Bora Creek, Drainage line 1 and 2 on the Goulburn River (SW01 and SW02) and additional indicative locations (SW22, SW23 and SW24) are shown on **Figure 4**. Monitoring parameters are detailed within the SWMP. The existing sites are replicated in **Table 13** below along with additional monitoring sites.

Table 13 Complex Wide SWMP - Table 15 Extract - Monitoring Program

Site	Frequency	Parameters	Site Justification
SW01	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Located downstream of LW401-408 mining operations and downstream of open cut and CHPP on Goulburn River
	Six monthly (in addition to above)	Al, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Sr, DO, Total P and Total N	
	After rainfall event (>30mm in 24 hours)	Flow – Observation pH, EC, TSS, TDS, Zn, Fe	
SW02	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Located downstream of LW401-408 mining operations and downstream of open cut and CHPP on Goulburn River
	Six monthly (in addition to above)	Al, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Sr, DO, Total P and Total N	
	After rainfall event (>30mm in 24 hours)	Flow – Observation pH, EC, TSS, TDS, Zn, Fe	
SW22*	Monthly (if flowing)	Flow – Measurement** pH, EC, TSS, TDS, temperature, turbidity	Located downstream of LW401-408 mining operations and downstream of open cut and CHPP on Goulburn River
	Six monthly (in addition to above)	Al, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Sr, DO, Total P and Total N	
	After rainfall event (>30mm in 24 hours)	Flow – Observation pH, EC, TSS, TDS, Zn, Fe	
SW23*	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Located downstream of UG4 LW407 on drainage Line 1.
	Six monthly (in addition to above)	Al, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Sr, DO, Total P and Total N	
	After rainfall event (>30mm in 24 hours)	Flow – Observation pH, EC, TSS, TDS, Zn, Fe	
SW24*	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	

Site	Frequency	Parameters	Site Justification
	Six monthly (in addition to above)	Al, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Sr, DO, Total P and Total N	Located downstream of UG4 LW408 on drainage Line 2.
	After rainfall event (>30mm in 24 hours)	Flow – Observation pH, EC, TSS, TDS, Zn, Fe	

Note: * Sites SW22, SW23 and SW24 will be established prior to the commencement of LW401. Indicative locations are shown in Figure 4.
** Establishment of a surface water monitoring station at SW22 to be investigated.

Rainfall event sampling is to occur where safe access is available within 48 hours of the rainfall event as determined by the rainfall data at the weather station (WS03) established on Ulan Road.

Stream flow and quality data will be obtained from UCML for UCML SW02 in accordance with a data sharing agreement between the mines. MCO will investigate the feasibility of installing a water monitoring station including flow, pH, EC and temperature downstream of the Drip (subject to necessary approvals), and develop a rating curve.

6.3 GROUNDWATER

Groundwater monitoring is undertaken for groundwater extraction, groundwater levels, groundwater quality and leachate/seepage losses from water storages as described in section 6.0 of the complex-wide GWMP.

The existing baseline groundwater monitoring program in the vicinity of UG4 is discussed in **Section 4.6.1** and shown on **Figure 5**.

Additional Monitoring Sites

AGE has recommended a number of updated/additional monitoring sites to be established as part of this Extraction Plan. These additional monitoring points are focused on measuring potential impacts on the Goulburn River downstream of UG4 (i.e. the natural part of the Goulburn River downstream of the diversion, where some baseflow interaction is understood to occur). The following additional monitoring points are proposed to be included (subject to necessary access and approvals) and are indicatively shown in **Figure 5** (AGE, 2021):

- Additional Monitoring Point 1 (PZ-A): targeting shallow groundwater.
- Additional Monitoring Point 2 (PZ-B/PZ232): A multi-level VWP above LW404 to improve the understanding of the height of continuous fracturing which develops as longwall mining advances. This data would inform future extraction plans.
- Additional Monitoring Point 3: A new VWP has been established (PZ229) with sensors in the Triassic and Permian north of the Goulburn River.
- Additional Monitoring Point 4: A VWP at PZ194 (PZ194B and PZ194C) with sensors in the base of Triassic, base of Permian and Ulan Seam with co-located open standpipes at the base of the Triassic and in the Permian.

- Additional Monitoring Point 5: A VWP at PZ195 (PZ195B and PZ195C) with sensors in the base of Triassic, base of Permian and Ulan Seam with co-located open standpipes at the base of the Triassic and in the Permian.
- Additional Monitoring Point 6 (PZ-C/ PZ235): Site approximately 500 m north of LW408 including open hole in Triassic sandstone and VWP in Permian overburden and Ulan Seam
- Additional Monitoring Point 7 (PZ-D/PZ236): located between PZ192 and PZ105C in the vicinity of LW414 and LW413 including open hole in Triassic sandstone and VWP in Permian overburden and Ulan Seam
- Additional Monitoring Point 8 and 9 (PZ-E & F): Additional groundwater monitoring sites proximal to the Goulburn River upstream and downstream of the Drip including monitoring the alluvium (if present), Triassic sandstone and Permian overburden. Locations and arrangement subject to confirmation.

In addition to the above, PZ102A and PZ103A would be re-purposed by establishing VWPs to monitor water levels in the Triassic and Upper Permian. PZ102B intersects planned underground workings and PZ103B is blocked, and therefore have been decommissioned. Monitoring sites impacted by subsidence will be decommissioned to reduce risk of hydraulic connection.

MCO will endeavour to replace PZ102A and PZ103A and install additional monitoring locations by 31 December 2022 subject to necessary access and approvals.

Photographic monitoring of the Drip will also be undertaken every two months.

Groundwater Monitoring Frequency

Piezometers listed in Table 6 and additional monitoring points will be monitored for level/pressure manually on a monthly basis, or continuously by means of automatic dataloggers. Monitoring at piezometer locations proximal to mine workings will be discontinued as mining progresses in these areas.

Groundwater quality will be monitored in the standpipe bores listed in **Table 6** and additional alluvial and Triassic monitoring points. Samples are taken six-monthly and sent for laboratory analysis (**Table 14**). Field measurements of EC and pH are recorded at the time of water quality sampling conducted for relevant bores.

Table 14 Groundwater Quality Monitoring

Class	Parameters
Physical parameters	EC, Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and pH
Major cations	calcium, magnesium, sodium, potassium
Major anions	carbonate, bicarbonate, chloride and sulphate
Dissolved metals	aluminium, arsenic, boron, cobalt, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver and zinc
Nutrients	ammonia, nitrate, phosphorus, reactive phosphorus

Groundwater Inflows

Groundwater inflows are determined by monitoring of dewatering (with flow meters), less metered supply inflows, estimated water stored underground, water loss in workings, and calculated recirculation from adjacent Open Cut workings. Groundwater take will be partitioned into the various water sharing plan sources using the relative proportions predicted in the groundwater model. Partitioning may be adjusted based on monitoring data, water geochemistry or expert input.

6.4 SUBSIDENCE – ENVIRONMENTAL CONSEQUENCES

MCO will compare the results of the subsidence impact monitoring against the water performance measure and indicators (**Section 5.1**).

In the event that any observed subsidence impact exceeds a performance indicator, additional monitoring and assessment will be undertaken (**Section 7**).

In the event that any observed subsidence impacts exceed the performance measure, MCO will assess the consequences of the exceedance in accordance with the measures described in **Section 8**.

7.0 TRIGGER ACTION AND RESPONSE PLAN

Water management at the Moolarben Coal Complex is currently undertaken in accordance with the approved complex-wide WAMP and associated subplans (Site Water Balance, SWMP and GWMP). Sections 4.0 and 8.0 of the approved complex-wide SWMP provide details of the management system and management measures for surface water, respectively. Section 8.0 of the approved complex-wide GWMP describes management measures for groundwater systems.

In addition to the management systems and measures detailed in the approved complex-wide SWMP and GWMP, WRM (2021) and AGE (2021) have recommended measures which are specific to Longwalls 401- 408 that will be implemented, where appropriate.

7.1 SUBSIDENCE

Potential management measures to mitigate/remediate subsidence consequences are provided in **Table 15**. The implementation of these management measures will be considered with regard to the specific circumstances of the subsidence impact (e.g. the location, nature and extent of the impact) and the assessment of environmental consequences. The implementation of management measures will be related to the scale of impact and the ability to, and value in, undertaking mitigation measures on a case by case basis.

The requirement and methodology for any subsidence remediation techniques will be determined in consideration of:

- Potential impacts of the unmitigated impact, including potential risks to public safety and the potential for self-healing or long-term degradation.
- Potential impacts of the remediation technique, including site accessibility.

7.2 SURFACE WATER AND GROUNDWATER

Details of trigger events, investigations required, notifications to be undertaken, management and contingency actions for surface water and groundwater are provided in **Table 16**.

An investigation will be initiated where the monitoring identifies results outside the trigger levels (or ranges) described in **Sections 5.2** and **5.3**.

Review of Groundwater Model

As provided in Section 5.1 of the complex-wide GWMP and consistent with the commitments within Project Approval 08_0135, a groundwater modelling review and model recalibration (where required) will be conducted 2 years (and 5 yearly thereafter) after commencing Stage 2 coal extraction. A groundwater model review and model recalibration (where required) will be undertaken by April 2023 (unless otherwise agreed with the DPE). An updated Groundwater Technical Report and Peer Review will be provided to the DPE by April 2023 unless otherwise agreed. Should any groundwater modelling review indicate a significant variance from the model predictions, MCO will initiate an investigation by a suitably qualified and experienced specialist and where required obtain additional groundwater licence allocations and/or implement remedial actions developed in consultation with DPE.

Water Take

Groundwater extraction (take) is determined as described in Section 6.0 of the complex-wide GWMP and is reported in the Annual Review (Section 8.1). If water take exceeds the Available Water, an investigation will be undertaken and relevant non-compliances reported in accordance with Section 11. Available water for each licence will vary from year to year as a result of Available Water Determinations, water trading and carry-over provisions. Where mining related activities have resulted in water take in excess of Available Water, MCO will investigate reasonable and feasible contingency and remedial measures."

Table 15 Subsidence Trigger Action Response Plan

Performance Criteria	Trigger Event	Action	Response
Goulburn River			
Unpredicted impacts on Goulburn River (cracking and or noticeable changes in erosion or pools)	Visible cracking of bed or banks, or notable change in erosion or existing pools identified during monitoring inspections	1. Check and Validate Data 2. Notify ECM or delegate. 3. Undertake investigation to confirm if investigation trigger exceedance is mining related: a. If necessary, engage a suitably qualified person (s)to determine if impact is related to UG4 LW401-408 extraction. b. Review subsidence monitoring results and any other relevant data, c. If investigation confirms trigger exceedance is not mining-related, record data and cease investigation. d. Engage suitably qualified person(s) to determine any potential downstream impacts and provide advice on appropriate remediation works. 4. If trigger exceedance is mining-related, confirm if mining-related activities have caused, or have the potential to cause, material environmental harm (i.e. exceedance of performance criteria). a. If so, notify DPE and other relevant agencies immediately. b. If not, notify DPE and other relevant agencies as soon as practicable. 5. Notify DPE and other relevant agencies if performance measures are exceeded as soon as practicable. 6. Complete Preliminary investigation report and provide to DPE and relevant agencies within 7 days of identifying the incident.	Where mining-related activities have resulted in exceedances of the Project Approval performance measures, implement contingency and remedial measures in consultation with DPE.
The Drip			
No change in water supply to the Drip due to MCO mining	Unpredicted loss of water supply to the Drip observed during photographic monitoring	1. Check and Validate Data 2. Notify ECM or delegate. 3. Undertake investigation to confirm if investigation trigger exceedance is mining related: a. If necessary, engage a suitably qualified person (s)to determine if impact is related to UG4 LW401-408 extraction. b. Review subsidence monitoring results, weather, groundwater monitoring data and any other relevant data, c. If investigation confirms trigger exceedance is not mining-related, record data and cease investigation. 4. If trigger exceedance is mining-related, confirm if mining-related activities have caused, or have the potential to cause, material environmental harm (i.e. exceedance of performance criteria). a. If so, notify DPE and other relevant agencies immediately. b. If not, notify DPE and other relevant agencies as soon as practicable. 5. Notify DPE and other relevant agencies if performance measures are exceeded as soon as practicable. 6. Complete Preliminary investigation report and provide to DPE and relevant agencies within 7 days of identifying the incident.	Where mining-related activities have resulted in exceedances of the Project Approval performance measures, implement contingency and remedial measures in consultation with DPE.

Performance Criteria	Trigger Event	Action	Response
Bora Creek			
Unpredicted impacts on Bora Creek	Noticeable new areas of erosion or expansion of existing erosion, initiation of headcut or noticeable upstream advance of existing headcut or development of new pools or drainage of existing pools	1. Obtain survey of ponded area to identify ponding depth and extent. 2. Obtain specialist advice on appropriate remediation works where required. 3. Investigate potential management strategies. Preferred management strategies would include slope stabilisation, drainage works to restore drainage characteristics, revegetation and bed control using natural materials such as local rock and large woody debris. 4. Note that disturbance of existing vegetation increases the risk of erosion. Hence, machinery access for remediation works can potentially cause greater impacts than those caused by subsidence.	Where mining-related activities have resulted in trigger exceedances, implement contingency and remedial measures based on investigation.

Table 16 Surface Water and Groundwater Trigger Action Response Plan

Performance Criteria	Trigger Event	Action	Response
Surface Water			
No significant adverse mining related effects to downstream water quality (when compared to baseline and/or ANZECC limits).	Two consecutive monthly surface water quality monitoring results exceed (or below in event of a trigger of the lower pH limit) investigation triggers at trigger monitoring location SW01.	1. Check and validate data. 2. Notify ECM or delegate. 3. Undertake investigation to confirm if investigation trigger exceedance is mining-related: a. If necessary, engage a suitably qualified person. b. Review water quality relative to upstream quality, if water quality upstream of operations is greater than trigger location, cease investigation. c. Confirm if discharge has occurred in the previous 2 months prior to trigger. d. Consider other relevant recent conditions, including climate, flow, water releases, land-use activities. e. Consider other relevant monitoring data, e.g. for releases and stream health. f. If investigation confirms trigger exceedance is not mining-related, record data and cease investigation. 4. If trigger exceedance is mining related, confirm if mining-related activities have caused, or have the potential to cause, material environmental harm (i.e. exceedance of performance criteria). a. If so, notify DPE and other relevant agencies immediately. b. If not, notify DPE and other relevant agencies as soon as practicable. 5. Notify DPE and other relevant agencies if performance measures are exceeded as soon as practicable. 6. Complete Preliminary investigation report and provide to DPE and relevant agencies within 7 days of identifying the incident.	Where mining-related activities have resulted in trigger exceedances, implement contingency and remedial measures based on investigation. Potential measures are described in the SWMP.
Unpredicted impacts on DL1 and DL2	Two consecutive monthly surface water quality monitoring results exceed (or below in event of a trigger of the lower pH limit) investigation triggers at SW23 or SW24 after commencement of LW406.	1. Check and validate data. 2. Notify ECM or delegate. 3. Undertake investigation to confirm if investigation trigger exceedance is mining related: a. If necessary, engage a suitably qualified person. b. Review water quality relative to upstream Goulburn River quality, if water quality upstream of DL1 or DL2 is greater than trigger location, cease investigation. c. Consider other relevant recent conditions, including climate, flow, land-use activities. d. Undertake inspection along the undermined reaches of drainage lines DL1 and DL2 that have been undermined. e. If investigation confirms trigger exceedance is not mining-related, record data and cease investigation. 4. If trigger exceedance is mining related obtain specialist advice on appropriate remediation works where required. 5. Investigate potential management strategies. Preferred management strategies would include slope stabilisation, drainage works to restore drainage characteristics, revegetation and bed control using natural materials such as local rock and large woody debris. Note that disturbance of existing vegetation increases the risk of erosion. Hence, machinery access for remediation works can potentially cause greater impacts than those caused by subsidence.	Where mining-related activities have resulted in trigger exceedances, implement contingency and remedial measures based on investigation.

Performance Criteria	Trigger Event	Action	Response
Groundwater Quality			
No greater than minimal impact for water users or high priority GDEs (as defined in the AIP for less productive groundwater) due to mining-related activities (i.e no change in beneficial use category).	Two consecutive groundwater quality monitoring results exceed (or below in the event of a lower pH trigger limit) investigation triggers at monitoring location.	1. Check and validate data. 2. Notify ECM or delegate. 3. Undertake investigation to confirm if investigation trigger exceedance is mining-related: a. If necessary, engage a suitably qualified person. b. Consider relevant recent conditions, including climate and land-use activities. c. Consider relevant monitoring data, e.g. other monitoring bores. d. If investigation confirms trigger exceedance is not mining-related, record data and cease investigation. 4. If trigger exceedance is mining-related, confirm if mining-related activities have caused, or have the potential to cause, material environmental harm (i.e. exceedance of performance criteria). a. If so, notify DPE and other relevant agencies immediately. b. If not, notify DPE and other relevant agencies as soon as practicable. 5. Notify DPE and other relevant agencies if performance measures are exceeded as soon as practicable. 6. Complete Preliminary investigation report and provide to DPE and relevant agencies within 7 days of identifying the incident.	Where mining-related impacts have resulted in trigger exceedances, implement contingency and remedial measures based on investigation. Potential measures are described in the GWMP.
Groundwater Level			
No greater than minimal impacts to water users or high priority GDEs (as defined in the AIP for less productive groundwater) due to mining impacts.	Two consecutive groundwater level monitoring results exceed investigation trigger at monitoring locations.	1. Check and validate data. 2. Notify ECM or delegate. 3. Undertake investigation to confirm if investigation trigger exceedance is mining-related: a. If necessary, engage a suitably qualified person. b. Consider relevant recent conditions, including climate and land-use activities. c. Consider relevant monitoring data, e.g. other monitoring bores. d. If investigation confirms trigger exceedance is not mining-related, record data and cease investigation. 4. If trigger exceedance is mining-related, confirm if mining-related activities have caused, or have the potential to cause, material environmental harm (i.e. exceedance of performance criteria). a. If so, notify DPE and other relevant agencies immediately. b. If not, notify DPE and other relevant agencies as soon as practicable. 5. Notify DPE and other relevant agencies if performance measures are exceeded as soon as practicable. 6. Complete Preliminary investigation report and provide to DPE and relevant agencies within 7 days of identifying the incident. 7. A detailed Investigation Report (inclusive of any management/mitigation measures) would be provided to the DPE within 3 months of an incident occurring where a performance measure is exceeded.	Where mining-related impacts have resulted in trigger exceedances, implement contingency and remedial measures based on investigation. Potential measures are described in the GWMP.

ECM = Environment & Community Manager, DPE = Department of Planning and Environment, EPA = Environment Protection Authority

8.0 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

8.1 ANNUAL REVIEW

In accordance with Condition 4, Schedule 5 of Project Approval (05_0117) (as modified), MCO will conduct an annual review of operations conducted at the Moolarben Coal Complex (including the performance of this LW401-408 WMP) prior to 31 March for the preceding calendar year, or as otherwise agreed by the Secretary of the DPE.

The Annual Review will:

- describe the works carried out in the previous calendar year, and the development proposed to be carried out over the current calendar year;
- include a comprehensive review of the monitoring results and complaints records of the Moolarben Coal Complex over the previous calendar year, including a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - monitoring results of previous years; and
  - relevant predictions in the EA;
- identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the Moolarben Coal Complex;
- identify any discrepancies between the predicted and actual impacts of the Moolarben Coal Complex, and analyse the potential cause of any significant discrepancies; and
- describe what measures will be implemented over the next year to improve the environmental performance of the Moolarben Coal Complex.

In accordance with Condition 11, Schedule 5 of Project Approval (05_0117), the Annual Review will be made available on the MCO website. As described in **Section 2**, this LW401-408 WMP will be reviewed within three months of the submission of an Annual Review, and, if necessary, revised to ensure the plan is updated on a regular basis and to incorporate any recommended measures to improve environmental performance.

8.2 AUDITS

In accordance with Condition 9, Schedule 5 of Project Approval (05_0117), an independent environmental audit was conducted by the end of December 2015 and every three years thereafter. A copy of the independent environmental audit will be provided to the Secretary of the DPE and made available on the MCO website.

The independent environmental audit will be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary of the DPE. Notwithstanding the three-yearly timing, an audit must also be carried out prior to the completion of longwall panels 404 and 408, the precise timing of these audits will be determined in consultation with the DPE. The independent environmental audit will assess the environmental performance of the

Project and assess whether it is complying with the requirements of Project Approval (05_0117), and any other relevant approvals, and recommend measures or actions to improve the environmental performance of the Moolarben Coal Complex.

As described in Section 2, this LW401-408 WMP will be reviewed within three months of the submission of an independent environmental audit, and, if necessary, revised to ensure the plan is updated on a regular basis and to incorporate any practicable recommended measures to improve environmental performance.

8.3 FUTURE EXTRACTION PLANS

In accordance with Condition 77(p), Schedule 3 of Project Approval (05_0117), MCO will collect baseline data for future Extraction Plans. In addition to the baseline data collection, consideration of the environmental performance and management measures, in accordance with the review(s) conducted as part of this LW401-408 WMP, will inform the appropriate type and frequency of monitoring of the assets relevant to the next Extraction Plan.

9.0 INCIDENTS

An incident is defined in Project Approval (05_0117) as a set of circumstances that:

- causes or threatens to cause material harm to the environment; and/or
- breaches or exceeds the limits or performance measures/criteria in Project Approval (05_0117) (as modified).

In the event that an incident which causes, or threatens to cause, material harm to the environment occurs, the incident will be managed in accordance with the Pollution Incident Response Management Plan.

The reporting of incidents will be conducted in accordance with Condition 7, Schedule 5 of Project Approval (05_0117).

MCO will notify the Secretary of DPE and any other relevant agencies of any incident associated with the UG4 LW401-408 which causes or threatens to cause material harm to the environment immediately after MCO confirms that an incident has occurred. For any other incident associated with the UG4 LW401-408, MCO will notify the Secretary and any other relevant agencies as soon as practicable after becoming aware of the incident. Within seven days of the date of the incident, MCO will provide the Secretary of DPE and any relevant agencies with a detailed report on the incident. The report will:

- describe the date, time and nature of the exceedance/incident;
- identify the cause (or likely cause) of the exceedance/incident;
- describe what action has been taken to date; and
- describe the proposed measures to address the exceedance/incident.

10.0 COMPLAINTS

MCO maintains a Community Complaints Line (Phone Number: 1800 556 484) that is dedicated to the receipt of community complaints. The Community Complaints Line is publicly advertised and operates 24 hours per day, seven days a week, to receive any complaints from neighbouring residents or other stakeholders.

MCO has developed a Community Complaints Procedure which details the process to be followed when receiving, responding to and recording community complaints. The Community Complaints Procedure is supported by a Complaints Database.

The Community Complaints Procedure is a component of the MCO Environmental Management Strategy which requires the recording of relevant information including:

- the nature of the complaint;
- method of the complaint;
- relevant monitoring results and meteorological data at the time of the complaint;
- site investigation outcomes;
- any necessary site activity and activity changes;
- any necessary actions assigned; and
- communication of the investigation outcome(s) to the complainant.

In accordance with Condition 11, Schedule 5 of Project Approval (05_0117), the complaints register will be updated monthly and made available on the MCO website.

11.0 NON COMPLIANCE WITH STATUTORY REQUIREMENTS

A protocol for the managing and reporting of non-compliances with statutory requirements has been developed as a component of MCO's Environmental Management Strategy and is described below.

Compliance with all approvals, plans and procedures will be the responsibility of all personnel (staff and contractors) employed on or in association with the Moolarben Coal Complex.

The Environmental and Community Manager (or delegate) will undertake regular inspections, internal audits and initiate directions identifying any remediation/rectification work required.

As described in **Section 9**, MCO will notify the Secretary of the DPE, and any other relevant agencies, of any incident associated with MCO as soon as practicable after MCO becomes aware of the incident. Within seven days of the date of the incident, MCO will provide the Secretary of the DPE, and any relevant agencies, with a detailed report on the incident.

A review of MCO's compliance with all conditions of Project Approval (05_0117) will be undertaken prior to (and included within) each Annual Review. The Annual Review will be made publicly available on the MCO website.

As described in **Section 8.2**, an independent environmental audit was conducted by the end of December 2015 and undertaken every three years thereafter. A copy of the audit report will be submitted to the Secretary of the DPE and made publicly available on the MCO website.

12.0 REFERENCES

Aquaterra Consulting Pty Ltd (2008) *Moolarben Stage 2 Groundwater Assessment*.

Australasian Groundwater and Environmental Consultants Pty Ltd (2013*) Moolarben Coal Project – Stage 1 Optimisation Modification Groundwater Assessment*.

Australasian Groundwater & Environmental Consultants Pty Ltd (2021) *Groundwater Technical Report for Moolarben UG4 LW401 to 408 Extraction Plan, Edition V01.06*

Dundon Consulting Pty Limited (2015); *Moolarben Coal Complex UG1 Optimisation Modification – Environmental Assessment – Groundwater Assessment*

Department of Planning and Environment and NSW Trade & Investment – Division of Resources and Energy (2015) *Guidelines for the Preparation of Extraction Plans Required under Conditions of Development Consents, Project Approvals and Mining Lease Conditions for Underground Coal Mining*. Version 5. Draft.

HydroSimulations (2015) *Moolarben Coal Complex UG1 Optimisation Modification Groundwater Modelling Assessment*

HydroSimulations (2017) *Moolarben Coal Open Cut Optimisation Groundwater Assessment*

Mine Subsidence Engineering Consultants (2020) Moolarben Coal Complex: Moolarben Project Stage 1 – Longwalls 401 to 408 Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Extraction Plan.

Moolarben Coal Operations Pty Ltd (2006) *Moolarben Coal Project – Stage 1 Environmental Assessment*.

Peter Dundon and Associates Pty Ltd (2006) *Moolarben Coal Project Groundwater Assessment*.

RPS Aquaterra (2011) *Moolarben Complex Stage 2 – Preferred Project Report – Groundwater Impact Assessment.*

WRM Water and Environment (2021) *UG4 Longwalls 401 to 408 Extraction Plan Surface Water Technical Report*

ATTACHMENT 1

LONGWALLS 401 TO 408 WATER MANAGEMENT PLAN
SUBSIDENCE IMPACT REGISTER TEMPLATE

UG4 Longwalls 401 to 408 Water Management Plan – Subsidence Impact Register Template

Impact Register Number	Impacted Water Feature	Impact Description	Does Impact Exceed the Performance Measure/Indicators? (Yes/No)	Were Management Measures Implemented? (Yes/No)	Were Management Measures Effective? (Yes/No)