SURFACE WATER MANAGEMENT PLAN

Version	Issue Date	Approval Date	Section Modified	Reason for Modification	Review Team
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4	February 2020		All	To incorporate approved modifications to Stage 1 (MOD 14) and Stage 2 (MOD 3) of the Project	MCO

Approved:_____ Date:_____

Title: Moolarben Coal Operations-General Manager

Document	Version	Issue	Effective	Review	Author	Approved
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1.0 INTRODUCTION

The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee in the Western Coalfields 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], Sojitz Moolarben Resources Pty Ltd and a consortium of Korean power companies). MCO and MCM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 and would continue to be carried out in accordance with NSW Project Approval (05_0117) (Moolarben Coal Project Stage 1) as modified and NSW Project Approval (08_0135) (Moolarben Coal Project Stage 2) as modified.

Mining operations at the Moolarben Coal Complex are undertaken in accordance with the various approvals under the Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

The current mining operations at the Moolarben Coal Complex are conducted in accordance with the requirements of the conditions of Mining Lease (ML) 1605, ML 1606, ML 1628, ML 1691 and ML 1715 granted under the *Mining Act, 1992*.

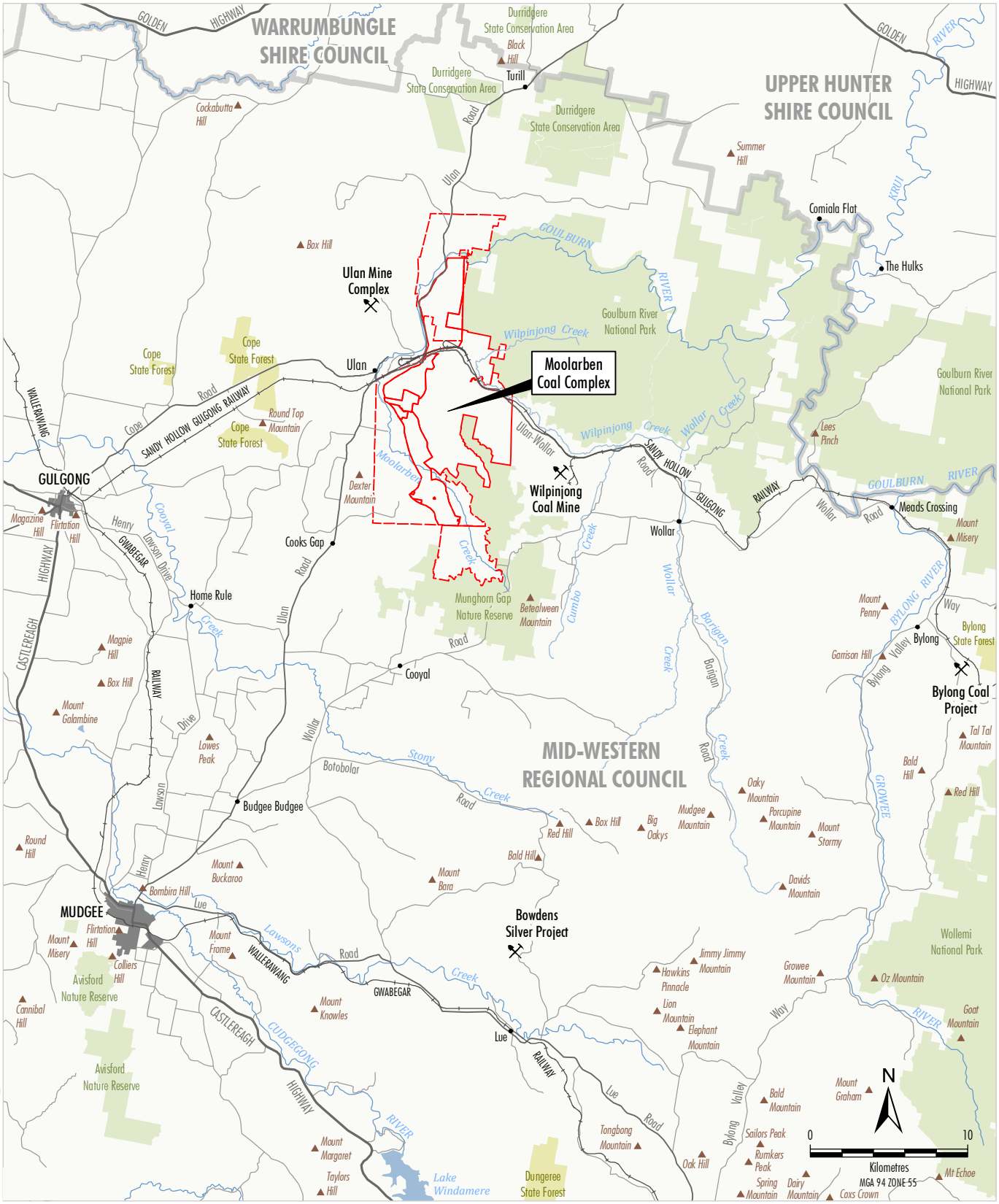
The general arrangement of the Moolarben Coal Complex, showing modifications, is provided in Figure 2.

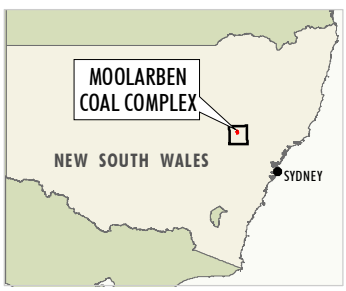
1.1 PURPOSE OF THIS SWMP

This Surface Water Management Plan (SWMP) has been prepared to satisfy the requirements of NSW Project Approval (05_0117) as modified and the requirements of NSW Project Approval (08_0135) as modified.

The SWMP provides a framework which describes how MCO will assess, manage, monitor and mitigate impacts from the surface water system.

The SWMP is a component of the overarching Water Management Plan (WAMP) and provides more detailed technical information and responses to surface water management on site. This SWMP is intended to be a dynamic document.





LEGEND
- State Forest
- NSW National Parks and Wildlife Service
- Local Government Boundary
- Exploration Licence Boundary
- Mining Lease Boundary
- Mining Operation

Source: NSW Land & Property Information (2017); NSW Department of Industry (2017); Office of Environment and Heritage NSW (2017)

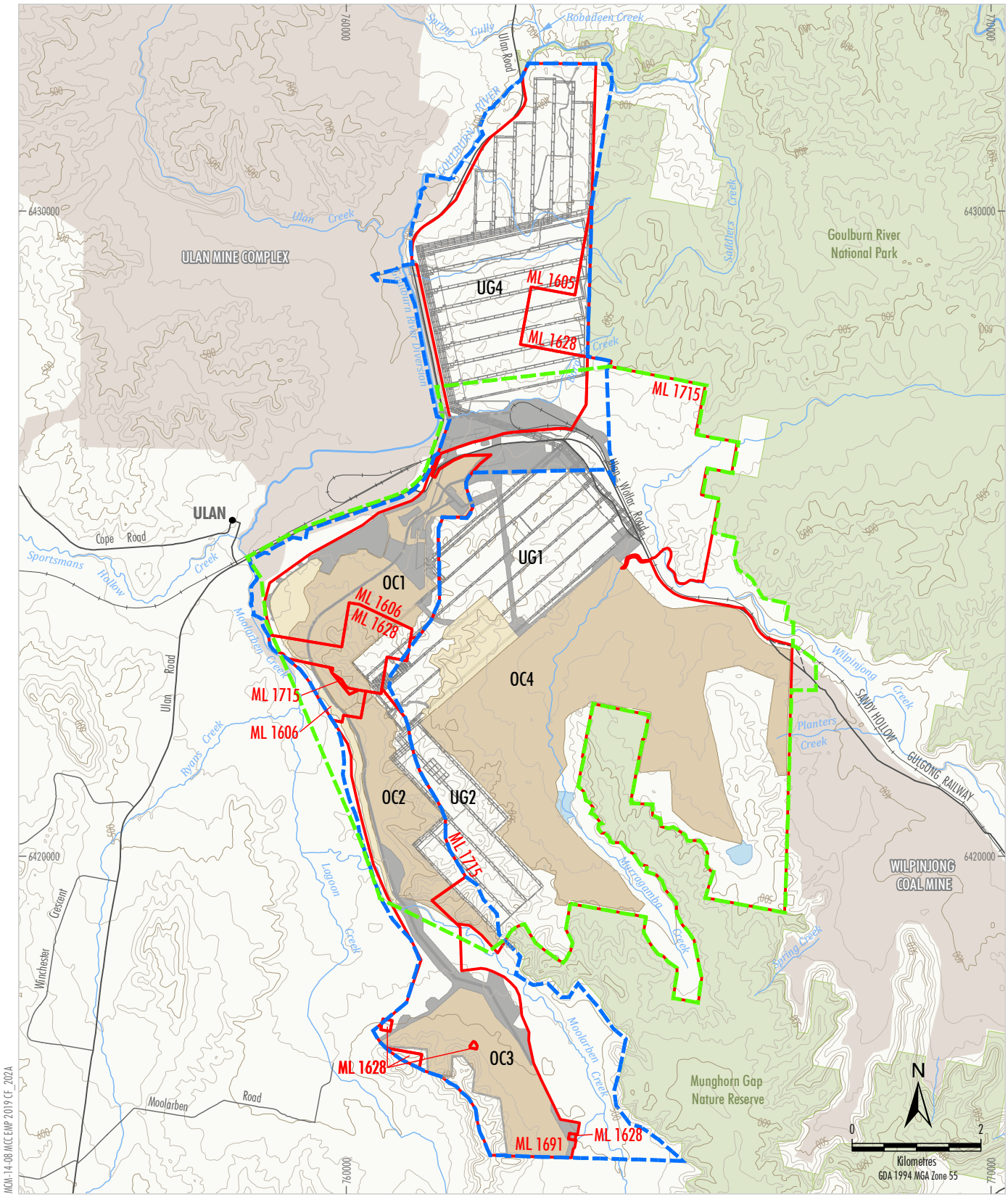
MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Regional Location

MCM-14-08 MCC EMP 2019 CF_201A

Figure 1



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LEGEND

- NSW National Parks and Wildlife Service
- Other Mining Operations
- Mining Lease Boundary

Existing/Approved Development

- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Clean Water Diversion Infrastructure
- Underground Longwall Layout
- Haul Road
- Road Realignment (not yet constructed)
- Approved Stage 1 Project Boundary
- Approved Stage 2 Project Boundary

Source: MCO (June 2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Approved Moolarben Coal Project (Stage 1 and Stage 2) General Arrangement

Figure 2

1.2 ELEMENTS COVERED BY THE SWMP

This SWMP applies to all employees and contractors at the Moolarben Coal Complex and covers all mining related areas within the 'Project Boundary' as defined in the Project Approvals. The SWMP also refers to some areas outside of the Project Boundary consistent with natural hydrological boundaries. The areas covered by the SWMP are described in Section 6.0.

1.3 RELATED WATER MANAGEMENT DOCUMENTS

This SWMP is a component of the overarching WAMP for the Moolarben Coal Complex. A summary of the Moolarben Coal Complex water management documents and how they are related is provided in the WAMP.

1.4 RESPONSIBILITIES

MCO is responsible for compliance with this SWMP. Surface water monitoring is undertaken by MCO in accordance with the Environmental Protection Licence No. 12932 (the EPL), and associated Environmental Management Plans (EMPs).

MCO is responsible for any remedial action that may be required as a result of an exceedance of the water quality performance criteria or monitoring results that are considered unacceptable, where these are directly attributable to the development of the Moolarben Mine Complex. Full details on individual roles and responsibilities are provided in the WAMP and a full description of the water quality monitoring process is provided in Section 6.

2.0 PLANNING AND POLICY

2.1 FEDERAL AND STATE LEGISLATION

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 the Commonwealth Approvals (EPBC 2007/3297, EPBC 2013/6926, EPBC 2017/7974 and EPBC 2008/4444);
- relevant licences (e.g. EPL 12932) and permits, including conditions attached to mining leases; and
- other relevant legislation.

The obligations of Commonwealth Approvals relevant to this SWMP are described in the WAMP.

2.2 PROJECT APPROVAL CONDITIONS

2.2.1 Surface Water Management Plan Requirements

This SWMP has been prepared in accordance with Condition 33, Schedule 3 and Condition 29, Schedule 3 of the NSW Project Approvals (05_0117 and 08_0135, respectively). Tables 1 and 2 present these requirements and indicate where they are addressed within this SWMP.

Table 1: SWMP Requirements in NSW Project Approval 05_0117

NSW Project Approval Condition	SWMP Section
Water management plan	
33. (b) in addition to the standard requirements for management plans (see condition 3 of Schedule 5), this plan must include a:	
...	
(ii) Surface Water Management Plan, that includes:	
• *detailed baseline data on water flows and quality in the water bodies that could be affected by the project;*	Section 3
• *a detailed description of the water management system on site;*	Section 4 & SWB document
• *detailed plans, including design objectives and performance criteria, for the:*	
- *in-pit emplacement areas for tailings, acid forming and potentially acid forming materials;*	Section 5.5
- *final voids (see the Rehabilitation Objectives in Table 13);*	Section 5.4
• *detailed performance criteria for the following, including trigger levels for investigating any potentially adverse impacts associated with the project:*	
- *the water management system;*	Section 7 &
- *downstream surface water quality;*	Section 8
- *downstream flooding impacts and*	
- *stream and riparian vegetation health for Moolarben Creek, Bora Creek and the Goulburn River;*	
• *a program to monitor and report on:*	
- *the effectiveness of the water management system; and*	Section 6
- *surface water flows and quality, stream and riparian vegetation health in the watercourses that could be affected by the project;*	Section 6
- *daily flow levels upstream and downstream of the treated mine water discharge point in the Goulburn River Diversion; and*	Section 6.2
- *downstream flooding impacts;*	Section 6.2 & Section 6.4
• *reporting procedures for the results of the monitoring program; and*	Section 8, 9 & Section 10
• *a plan to respond to any exceedances of the performance criteria, and mitigate any adverse surface water impacts of the project;*	Section 8
...	

Table 2: SWMP Requirements in NSW Project Approval 08_0135

NSW Project Approval Condition	SWMP Section
Water management plan	
29. (e) in addition to the standard requirements for management plans (see condition 3 of Schedule 6), this plan must include a:	
...	
(ii) Surface Water Management Plan, that includes:	
• *detailed baseline data on water flows and quality in the waterbodies that could be affected by the project;*	Section 3.4
• *a detailed description of the water management system on site;*	Section 4
• *detailed plans, including design objectives and performance criteria, for the:*	
- *Murragamba and Eastern Creek realignments;*	
- *in-pit emplacement areas for tailings, acid forming and potentially acid forming materials;*	Section 5.5
- *final voids (see the Rehabilitation Objectives in Table 14);*	Section 5.4
• *detailed performance criteria for the following, including trigger levels for investigating any potentially adverse impacts associated with the project:*	
- *the water management system;*	Section 7 &
- *downstream surface water quality;*	Section 8
- *downstream flooding impacts and*	
- *stream and riparian vegetation health for Moolarben Creek, Bora Creek, Murragamba Creek, Eastern Creek, Wilpinjong Creek and the Goulburn River;*	
• *a program to monitor and report on:*	
- *the effectiveness of the water management system; and*	Section 6.6
- *surface water flows and quality, stream and riparian vegetation health in the watercourses that could be affected by the project; and*	Section 6.7
- *downstream flooding impacts;*	Section 6.2 & Section 6.4
• *reporting procedures for the results of the monitoring program; and*	Section 8, 9 & Section 10
• *a plan to respond to any exceedances of the performance criteria, and mitigate any adverse surface water impacts of the project;*	Section 8
...	

2.2.2 Management Plan Requirements

Condition 3, Schedule 5 of Project Approval (05_0117) and Condition 3, Schedule 6 of Project Approval (08_0135) outline general management plan requirements that are applicable to the preparation of the SWMP. Table 3 presents these requirements and indicates where they are addressed within this SWMP.

Table 3: Management Plan Requirements

NSW Project Approval Condition	SWMP Section
3. 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;	Section 3.4
(b) a description of:	
• *the relevant statutory requirements (including any relevant approval, licence or lease conditions);*	Section 2
• *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;	Section 5, 6 and 7
(d) a program to monitor and report on the:	Section 6, 8, 9 and 10
• *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 8
(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Section 9
(g) a protocol for managing and reporting any:	Section 10
• *incidents;*	
• *complaints;*	
• *non-compliances with statutory requirements; and*	
• *exceedances of the impact assessment criteria and/or performance criteria; and*	
(h) a protocol for periodic review of the plan.	Section 9

2.2.3 Water Management Performance Measures

Condition 32, Schedule 3 of Project Approval (05_0117) and Condition 28, Schedule 5 of Project Approval (08_0135) outline the water management performance measures that are applicable to the Moolarben Coal Complex. These performance measures and where they are addressed within this SWMP are presented in Attachment A of the WAMP.

2.2.4 Surface Water Management Commitments

MCO has made a number of commitments relating to water management in the Moolarben Coal Project Stage 1 and Stage 2 Environmental Assessment documents which are summarised in Appendix 3 of Project Approval (05_0117) and Appendix 3 of Project Approval (08_0135). These commitments, and where they are addressed within this SWMP, are listed in Table 4.

Table 4: Statement of Commitments Relating to Surface Water

Commitment	SWMP Section
NSW Project Approval 05_0117 Commitments	
(7) Mine Water Sharing Plan *Moolarben will seek to enter into a mine water sharing plan in respect of mining operations of the Ulan Coal Mine and Wilpinjong Coal Mine under the auspices of the Director General of the Department of Planning and as may be required by any conditions of project approval for the Moolarben Coal Project.*	Section 2.4.3 of the WAMP
(13) Flows in the Goulburn River – Co-operative Monitoring Program *Moolarben will use its reasonable endeavours to agree and implement a monitoring program in cooperation with the Ulan and Wilpinjong mines (and to the reasonable requirement of the Director General who will consult with the NOW) to identify any potential for any change in the water flows in the Goulburn River due to mining at the Moolarben, Ulan and Wilpinjong mines and as may be required by any conditions of project approval for the Moolarben Coal Project.*	Section 2.4.3 of the WAMP
(14) Mine Water Management and Salinity – Sharing with Ulan and Wilpinjong *Moolarben will use its reasonable endeavours to agree and implement a co-operative arrangement with and enter into a life of mine agreement between the Ulan and Wilpinjong mines (the "Mines") to establish, implement and operate water sharing and use plans and procedures with the objective of minimising the removal by the Mines of water from the environment and the discharge of mine waters by the Mines to the environment and which shall address the ability of the Mines to utilise mine water produced by the Mines between the Mines and as may be required by any conditions of project approval for the Moolarben Coal Project.*	Section 2.4.3 of the WAMP
(18) Additional Management and Mitigation – Modification of Stage 1 *Moolarben commits to implementing the following management and mitigation measures to ensure that impacts associated with modifications to the Moolarben Coal Project are minimised.* • *Erosion and sediment control measures detailed in an approved Erosion and Sediment Control Plan (or equivalent) will be implemented.* • *Management and monitoring of surface water and groundwater will be undertaken in accordance with an approved Water Management Plan, which will be reviewed and updated, as necessary, to include the Open Cut 1 and Open Cut 2 extension areas and additional surface water management infrastructure. As part of this review, MCO will liaise with the NOW on the water licensing requirements for the open cut extension areas.* • *MCO is committed to the effective management of water in the modified landform and where required will develop strategies to this effect, including returning rehabilitated areas to clean water catchments as promptly as practically possible.* • *MCO will abide by the rules of any relevant water sharing plan and return water where required.*	Section 4.3 WAMP Section 4 Section 2.4.1 of the WAMP
NSW Project Approval 08_0135 Commitments	
17 MCM will implement the water management and mitigation measures described in the PPR and subsequent supporting documents.	WAMP
19 MCM will develop a surface water monitoring program to quantify the streamflow and water quality characteristics within Murragamba and Eastern Creeks for existing conditions prior to mining of the creek lines.	Section 6
20 MCM will manage rainfall run-off from MCC mine disturbed areas to prevent contamination of downstream water sources from sediment laden water, unless otherwise approved under a relevant Environment Protection Licence.	Section 4
21 MCM will develop a six monthly water balance for MCC operations to assist in site water management and monitoring protocols. This will be reviewed on a regular basis to account for changing mine water inflows and water management infrastructure as mining progresses. The frequency of this review will be revised after Year 3 of Stage 2 operations to the approval of relevant regulators.	SWB
26 MCM will endeavour to implement an integrated monitoring program for the MCC, with UCML and Wilpinjong Coal Mine for data-sharing.	Section 2.4.3 of the WAMP

	Commitment	SWMP Section
27	*MCM commits to realign and reconstruct the mined sections of Murragamba and Eastern creeks to meet geomorphological, hydraulical and ecological performance and completion criteria developed in consultation with relevant regulators.*	Section 5.8
28	*MCM will develop operational criteria for the realigned sections of Murragamba and Eastern creeks in consultation with relevant regulators and install diversions around the realigned sections of creek until such time as they become operational.*	Section 5.8

2.3 WATER SHARING PLAN

The Moolarben Coal Complex is located within the Upper Goulburn River and Wollar Creek catchments. Surface water (and alluvial water) access and impacts are regulated under the *Water Management Act, 2000, Water Management (General) Regulation, 2001*, the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* (HUWSP) and the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources*.

The HUWSP and the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources* contain various rules applying to the water sources such as access licence dealing rules, water supply works approval rules, water allocation account rules and access rules for rivers and creeks. The rules for the Upper Goulburn River Extraction Management Unit, Upper Goulburn River Water Source and Wollar Creek Water Source (of the HUWSP) and the Sydney Basin – North Coast Groundwater Source of the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources* apply to the Moolarben Coal Complex.

2.4 SURFACE WATER GUIDELINES

Several guidelines apply to the development and management of surface water systems within the local and regional catchment contexts, as outlined in the following sections.

The following guidelines were used in the development of water quality triggers for the Moolarben Coal Complex, along with baseline monitoring data and EPL conditions. These triggers are discussed in Section 7.0.

2.4.1 ANZECC (2000) Guidelines

The Australian and New Zealand Environment Conservation Council (ANZECC) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) provide a national benchmark for assessing water quality in systems throughout Australia and New Zealand. The ANZECC (2000) guidelines provide guidance for developing local guidelines or strategies such as catchment water quality and river flow objectives (see Section 2.4.2).

2.4.2 NSW Water Quality and River Flow Objectives

The NSW Water Quality and River Flow Objectives have been developed to guide plans and actions to achieve healthy waterways in NSW. Each objective is based on providing the right water quality for the environment and the different beneficial uses of the water. They are based on measurable environmental values (EVs), which are those values or uses of water that the community believes are important for a healthy ecosystem for public benefit, welfare, safety or health. The target concentrations for each water quality objective (WQO) are based on ANZECC (2000).

2.4.3 Local Policies and Plans

Hunter-Local Land Services plans and policies have been considered in the development of this SWMP. The key plan is the Hunter-Central Rivers Catchment Action Plan 2013-2023. Further information on the Hunter-Central Rivers Catchment Action Plan (2013-2023) is included in Section 2.4.4 of the WAMP.

2.4.4 Other Legislation

MCO will operate the Moolarben Coal Complex in accordance with the NSW Project Approvals (05_0117 and 08_0135) and Commonwealth Approvals (2007/3297, 2013/6936, 2017/7974 and 2008/4444), as well as any other NSW Acts, Regulations and Guidelines that may be applicable to a Part 3A Project.

A summary of the NSW Acts, Regulations and Guidelines that are relevant to surface water management at the Moolarben Coal Complex is provided in Section 2 of the WAMP.

3.0 SURFACE WATER AND ENVIRONMENTAL SETTING

3.1 REGIONAL DRAINAGE NETWORK

The Moolarben Coal Complex is within the Upper Goulburn River catchment. The Upper Goulburn River has a catchment area of approximately 114 square kilometres to the Ulan-Cassilis Road Bridge. Moolarben Creek is the primary tributary of the upper Goulburn River catchment. Moolarben Creek flows in a northerly direction along the western boundary of the Moolarben Coal Complex and joins Sportsmans Hollow Creek at the village of Ulan to form the headwater of the Goulburn River. Moolarben Dam is located on Moolarben Creek, approximately 1.5 km upstream of the Sportsman Hollow Creek confluence.

Wilpinjong Creek drains in a south-easterly direction along the eastern boundary of the Moolarben Coal Complex and joins Wollar creek, before joining the Goulburn River approximately 26 km downstream of the Moolarben Coal Complex. The Goulburn River flows in an easterly direction, eventually joining the Hunter River approximately 150 km downstream of the Moolarben Coal Complex.

3.2 LOCAL DRAINAGE NETWORK

The local drainage network in the vicinity of the Moolarben Coal Complex is shown in Figure 3. A description of the local drainage network around the Stage 1 and Stage 2 areas is provided below.

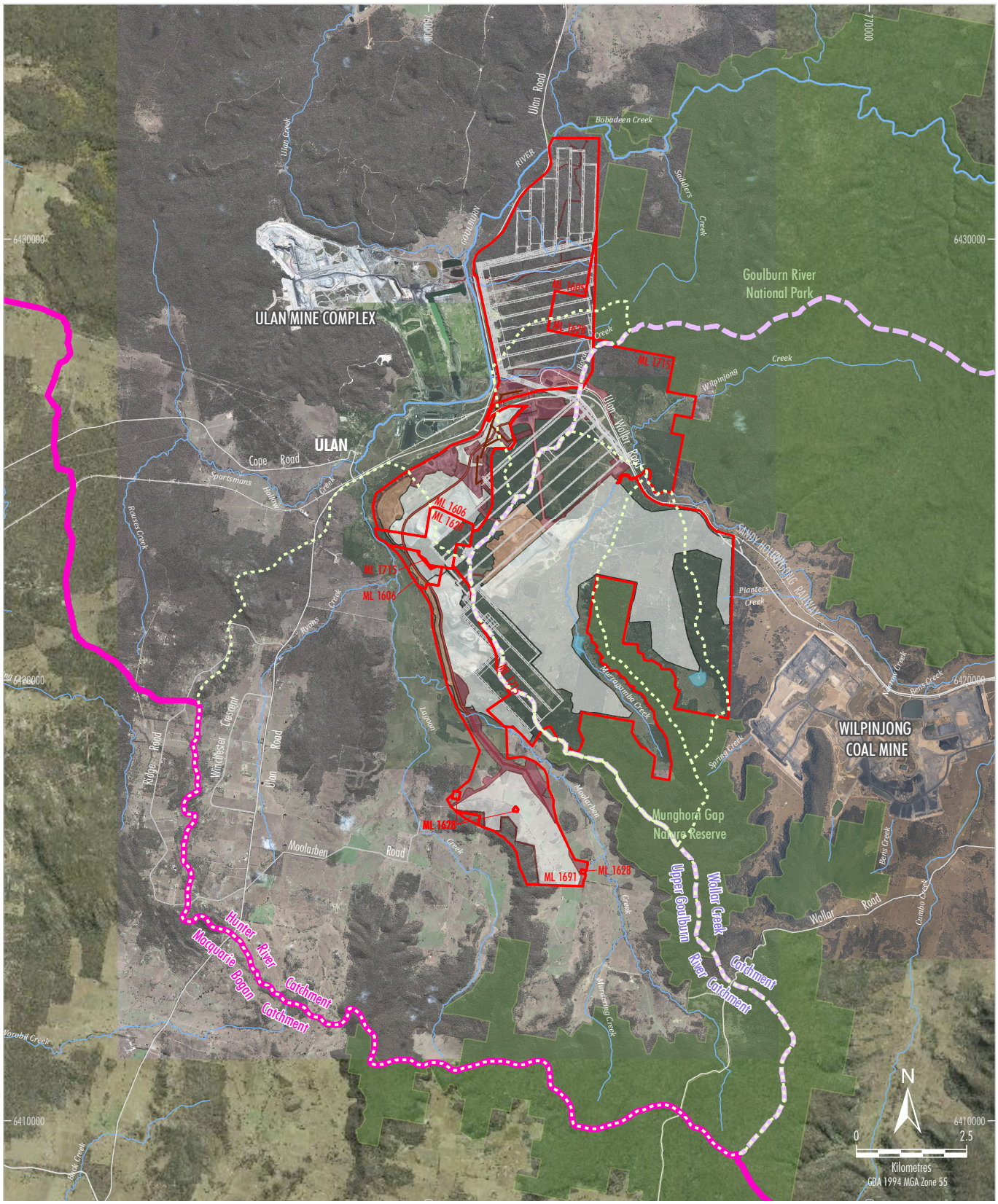
3.2.1 Stage 1 Area

Three watercourses run through the Stage 1 approval area. These are Bora, Spring and Moolarben Creeks. The Goulburn River runs adjacent to the Stage 1 approval area and is a major tributary of the Hunter River, joining it downstream of Denman. There are several other creeks that drain to the Goulburn River that are adjacent to but outside of the Stage 1 approval area. These include Ryan's and Lagoon Creeks (which flow into Moolarben Creek) and Sportsman's Hollow Creek (which discharges to the Goulburn River).

Bora Creek is an ephemeral stream that discharges to the Goulburn River about four kilometres downstream from Ulan. It drains a relatively small catchment that extends to the east of the Goulburn River and includes some of the area covered by the CHPP (Coal Handling Processing Plant) and part of UG4.

The hydrology of the catchment extending upstream from Ulan is dominated by Moolarben Creek. The Moolarben Creek valley between Spring and Lagoon Creeks is relatively narrow, being constrained by elevated slopes and ridgeline. Runoff quickly descends from the ridgeline and discharges across the narrow valley floor and into Moolarben Creek. Topographic relief diminishes along the western boundary with distance downstream, but the floodplain only widens marginally.

During rainfall events, runoff from the steeper slopes beyond and adjacent to the three open cut mine areas, is concentrated in numerous small ephemeral watercourses. These watercourses are typically ill-defined or intermittent at the boundary of the open cut areas where the wooded slopes meet the cleared valley floor. Runoff is discharged across these cleared areas of the catchment as either overland "sheet flow" or via the ill-defined watercourses that ultimately drain to Moolarben Creek and the Goulburn River.



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LEGEND

- Mining Lease Boundary
- Existing/Approved Development
  - Open Cut Mining Area
  - Out-of-pit Emplacement
  - Surface Infrastructure Area
  - Clean Water Diversion Infrastructure
  - Underground Longwall Layout
  - Haul Road
  - Road Realignment (not yet constructed)
- Local Catchment Boundary
- Catchment Divide (Hunter River and Macquarie-Bogan)
- Sub-catchment Divide (Upper Goulburn River and Wollar Creek)

Source: MCO (2017); NSW Dept of Industry (2016); Office of Environment and Heritage NSW (2016) Orthophoto Mosaic: MCO (April 2016 - May 2014); Department Finance, Services & Innovation (2017)

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Regional Drainage Network

Figure 3

3.2.2 Stage 2 Area

Stage 2 is located within the Wollar Creek catchment, which drains to the Goulburn River via the Wilpinjong and Wollar Creeks. The total disturbance area of Stage 2 is approximately 1,450 hectares (ha), which is less than 3% of the total Wollar Creek catchment area. The Stage 2 area covers a large proportion of the catchments of Murragamba Creek and Eastern Creek.

The Murragamba and Eastern creeks catchments cover an area of about 3,400 ha. This is approximately 6% of the total area of the Wollar Creek catchment. Murragamba and Eastern creeks are low order ephemeral drainage systems that only flow in response to rainfall. Both systems have insufficient baseflow to sustain flow in these creek lines. Hence there are no surface water discharges from these creeks into Wilpinjong Creek during periods of low or no rainfall.

3.2.3 Clean Water Diversions

Upslope diversions have been constructed around the OC4 temporary mine infrastructure area, and are being progressively constructed at selected locations around OC4 including the Murragamba Creek clean water diversion system. The requirement for upslope diversions above mine pit areas will be reviewed as mining progresses with consideration of infrastructure life and safety. Where relevant, the SWMP will be updated accordingly.

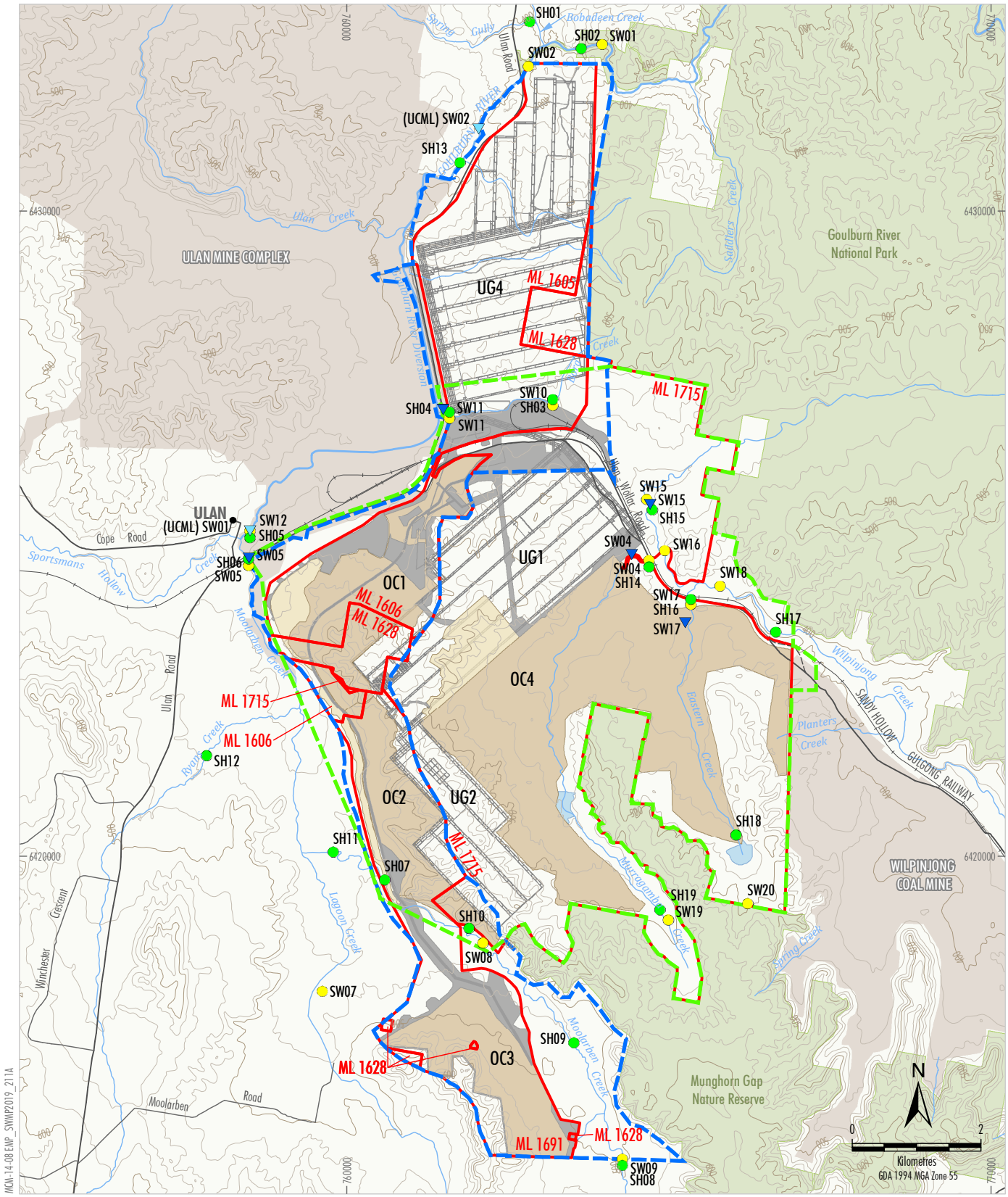
3.3 STREAMFLOW

The nearest long-term streamflow gauging station is Department of Industry – Lands and Water Division's (now NSW Water) Goulburn River at Coggan (gauge no. 210006) located approximately 70 km downstream of the Moolarben Coal Complex. This gauging station has been operating since October 1912.

MCO has collected streamflow data at three monitoring sites (SW05 – Moolarben Creek, SW11 – Bora Creek and SW15 – Wilpinjong Creek), however these units were lost due to flooding in November 2010. SW15 was replaced in May 2013 and SW11 in December 2013. MCO installed another two flow monitoring stations on Murragamba Creek and Eastern Creek in May 2013.

Streamflow data in the Goulburn River and Wilpinjong Creek is also available through a data sharing agreement with Ulan Coal Mines Limited and Wilpinjong Coal Mine respectively. Stream-flow data will be supplemented from other monitoring locations, where required, to inform the determination of stream-flow characteristics.

The streamflow monitoring sites are shown on Figure 4. Table 5 provides details of the streamflow monitoring sites.



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LEGEND

- NSW National Parks and Wildlife Service
- Other Mining Operations
- Mining Lease Boundary

Existing/Approved Development

- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Clean Water Diversion Infrastructure
- Underground Longwall Layout
- Haul Road
- Road Realignment (not yet constructed)
- Approved Stage 1 Project Boundary
- Approved Stage 2 Project Boundary

Baseline Surface Water Monitoring

- MCO Streamflow Gauge
- UCML Streamflow Gauge
- Stream Health Monitoring Site
- Surface Water Monitoring Site

Source: MCO (June 2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

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Baseline Surface Water Monitoring Programme

Figure 4

3.4 BASELINE SURFACE WATER DATA

3.4.1 Flow Monitoring

As indicated in Table 5 and Section 3.3, MCO monitors flow in Wilpinjong Creek (SW15), Murragamba Creek (SW04) and Eastern Creek (SW17). Flow monitoring in Goulburn River is carried out by UCML and additional flow monitoring in Wilpinjong Creek (downstream of the Moolarben Coal Complex) is carried out by the Wilpinjong Coal Mine. MCO has a data sharing agreement with UCML and Wilpinjong Coal Mine and can access flow data for (UCML) SW01 and (UCML) SW02 when required.

A summary of the stream flow monitoring information for the Goulburn River, Wilpinjong Creek, Murragamba Creek and Eastern Creek is provided in the Annual Review.

Table 5: Moolarben Stream Flow Monitoring Sites

Monitoring Site	Description	Easting	Northing	Frequency	Period of Record
Moolarben Coal Complex monitoring sites					
SW05	Moolarben Creek at Ulan-Cassilis Road	758,483	6,424,620	Sub-daily	Feb 2010 to Nov 2010
SW11	Bora Creek at Ulan-Cassilis Road	761,496	6,426,927	Sub-daily	Feb 2010 to Nov 2010 May 2013 to Dec 2016
SW15	Wilpinjong Creek at Red Hill	764,653	6,425,304	Sub-daily	Feb 2010 to Nov 2010 Dec 2013 to current**
SW04*	Murragamba Creek at Wollar Road	764,690	6,424,595	Sub-daily	May 2013 to current**
SW17*	Eastern Creek	765,331	6,423,985	Sub-daily	May 2013 to current**
Ulan Coal monitoring sites					
(UCML) SW02	Goulburn River	762,047	6,431,273	Sub-daily	Nov 2006 to present
UCML SW01	Moolarben Creek at Ulan-Cassilis Road	758,500	6,425,042	Sub-daily	Feb 2010 to Nov 2010

* Due to the ephemeral nature of these streams historic data capture rates are generally below 60%
** SW15 relocated in September 2018, SW04 relocated in January 2018, SW17 relocated in November 17.

3.4.2 Surface Water Quality

Surface water quality monitoring has been undertaken for the Moolarben Coal Complex since 2005. Water quality monitoring has been undertaken in the Goulburn River, Bora Creek, Moolarben Creek, Murragamba Creek, Lagoon Creek and Ryan's Creek (Figure 4).

Table 6 summarises the locations and periods of monitoring for the baseline water monitoring for Goulburn River, Bora Creek and Moolarben Creek. The catchments of the Lagoon Creek, Ryan's Creek, and Eastern Creek monitoring points are not currently affected by mining, therefore their entire period of record are considered baseline data. Background monitoring measures a range of parameters including pH, salinity, Dissolved Oxygen (DO), turbidity, chlorides, sulphates, calcium, potassium, magnesium, sodium, total nitrogen and total phosphorus. Tables 7 to Table 14 summarise the key water quality data from each of the water courses. Due to climatic variability, baseline is not representative of the range of surface water quality.

Water quality monitoring on Wilpinjong Creek and Eastern Creek commenced in 2014, although limited water quality data is currently available at some sites.

Table 6: Baseline Period of Record of Surface Water Quality Monitoring in Watercourses

Watercourse	Monitoring Location	Period of Record
Goulburn River	SW01	February 2005 to February 2018
	SW02	February 2005 to March 2009
	SW12	October 2008 to December 2017
Bora Creek	SW10	October 2008 to March 2009
	SW11	October 2008 to March 2009
Moolarben Creek	SW05	February 2005 to March 2009
	SW08	February 2005 to December 2018
	SW09	February 2005 to December 2018
Murragamba Creek	SW03	February 2005 to March 2010
	SW04	February 2005 to December 2014
	SW19	August 2014 to December 2014
Lagoon Creek	SW07	February 2005 to December 2018
Ryan's Creek	SW06	February 2005 to December 2010
Wilpinjong Creek	SW15	August 2014 to December 2018
	SW16	August 2014 to October 2017
	SW18	September 2014 to December 2018
Eastern Creek	SW17	January 2015 to December 2018
	SW20	January 2015 to December 2018

Table 7: Baseline Goulburn River Water Quality Data

Site	Sampling Period	pH				EC (µS/cm)				TDS (mg/L)				TSS (mg/L)			
		No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile
SW01	Feb 05- Feb 18	218	6.2	6.6	7.1	50	640	750	910	52	310	375	430	52	2	2	4
SW02	Feb 05-Mar 09	53	6.3	6.6	7.0	51	730	840	1,150	53	380	420	520	53	2	4	7
SW12	Oct 08 – Dec 17	169	6.5	7.0	7.5	170	193	482	635	168	250	323	404	138	7	14	56

Table 8: Baseline Bora Creek Water Quality Data

Site	Sampling Period	pH				EC (µS/cm)				TDS (mg/L)				TSS (mg/L)			
		No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile
SW10	Oct 08-Mar 09	Dry the entire sampling period															
SW11	Oct 08-Mar 09	3	6.1	7.0	7.1	3	92	140	146	3	189	215	274	3	25	43	56

Table 9: Baseline Moolarben Creek Water Quality Data

Site	Sampling Period	pH				EC (µS/cm)				TDS (mg/L)				TSS (mg/L)			
		No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile
SW05	Feb 05- Mar 09	53	6.1	6.5	7.0	51	600	830	1,130	53	360	450	585	52	13	36	108
SW08	Feb 05- Dec 18	167	6.0	6.9	7.4	167	2,626	3,540	4,458	167	1,572	1,992	2,676	167	5	9	26
SW09	Feb 05- Dec 18	164	6.4	6.81	7.3	164	2,900	3,840	4,650	164	1,670	2,285	2,923	164	5	12.5	31

Table 10: Baseline Murragamba Creek Water Quality Data

Site	Sampling Period	pH				EC (µS/cm)				TDS (mg/L)				TSS (mg/L)			
		No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile
SW03	Feb 05- Mar 10	64	6.0	6.2	6.8	59	462	720	1,062	64	250	393	570	64	11	30	85
SW04	Feb 05- Dec 14	132	6.3	7.2	7.8	108	367	860	1,804	132	287	473	850	133	8	23	80

Table 11: Baseline Lagoon Creek Water Quality Data

Site	Sampling Period	pH				EC (µS/cm)				TDS (mg/L)				TSS (mg/L)			
		No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile
SW07	Feb 05- Dec 18	149	6.7	7.5	8.0	149	2,220	3,360	4,990	149	1,370	2,110	3,100	149	3	6	24

Table 12: Baseline Ryan's Creek Water Quality Data

Site	Sampling Period	pH				EC (µS/cm)				TDS (mg/L)				TSS (mg/L)			
		No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile
SW06	Feb 05- Dec 14	64	6.1	6.6	7.2	59	236	280	364	64	170	185	220	64	5	10	24

Table 13: Baseline Wilpinjong Creek Water Quality Data

Site	Sampling Period	pH				EC (µS/cm)				TDS (mg/L)				TSS (mg/L)			
		No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile
SW15	Aug 14 – Dec 18	33	6.4	6.8	7.3	33	233	329	437	33	205	241	292	33	5	16	43
SW16	Aug 14 – Oct 17	39	6.5	7.0	7.4	39	331	444	714	39	215	292	434	39	6	12	22
SW18	Sep 14 – Dec 18	12	†	6.1	†	12	†	489	†	12	†	318	†	12	†	15	†

[1] Monitoring location dry at times of sampling (limited data available)
† Value will be calculated when sufficient data is available

Table 14: Baseline Eastern Creek Water Quality Data

Site	Sampling Period	pH				EC (µS/cm)				TDS (mg/L)				TSS (mg/L)			
		No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile	No. of Samples	20th %ile	Median	80th %ile
SW17	Jan 15 – Dec 18	31	6.0	6.6	7.0	31	74	414	633	31	184	314	422	31	15	26	49
SW20	Jan 15 – Dec 18	48[1]	†	-	†	48[1]	†	-	†	48[1]	†	-	†	48[1]	†	-	†

[1] Monitoring location dry at time of sampling
† Value will be calculated when sufficient data is available

3.4.3 Stream Health Quality

Stream health monitoring has been undertaken for the Environmental Assessment (EA) process and prior to construction activities commencing on site. Stream health monitoring has been undertaken in the Goulburn River, Bora Creek, Moolarben Creek, Ryan's Creek, Murragamba Creek, Wilpinjong Creek and Eastern Creek (Figure 4). Stream health monitoring locations and stream health status (up to the Spring 2018 monitoring period) are summarised in Table 15.

Table 15: Stream Health Monitoring Sites – Location and Status

Site ID	Location of Site	Aquatic Macro Invertebrate Diversity		Pollution Tolerance Site SIGNAL scores		Aquatic Habitat Condition (RCE)	Salinity Score	Ephemeroptera, Plecoptera and Trichoptera (EPT) Taxa
		Mean	SD	Mean	SD	Mean	Mean	Mean
SH01B	Bobadeen Creek reference site – near the bottom of Bobadeen Creek above the confluence with Goulburn River	24.6	4.3	3.9	0.3	75.7	5.4	6.2
SH02	Goulburn River reference site – downstream of Bobadeen Creek confluence	24.8	7.9	4.2	0.4	83.7	5.8	6.3
SH03	Bora Creek reference site – upstream of CHPP and rail loading facilities	14.0	5.0	2.9	0.5	ND	4.0	0.3
SH04	Bora Creek monitoring site – downstream of CHPP and rail loading facilities	16.3	4.4	3.4	0.5	67.8	4.4	2.2
SH05	Goulburn River reference site – downstream of Moolarben Creek and Sportsmans Hollow confluence	21.3	5.5	3.7	0.4	56.4	5.1	4.2
SH06	Moolarben Creek monitoring site – Moolarben Creek, at Ulan road bridge	19.4	4.3	3.6	0.4	54.9	5.2	3.8
SH08	Moolarben Creek – reference site	16.3	4.5	3.2	0.4	50.7	4.1	0.9
SH10	Moolarben Creek monitoring site- adjacent to Open Cut 2	15.4	5.0	3.3	0.4	59.9	4.0	1.5
SH12	Ryans Creek reference site –at Lagoons Rd crossing, upstream of confluence with Moolarben Creek	21.5	5.5	4.2	0.3	70.1	5.7	5.4

Site ID	Location of Site	Aquatic Macro Invertebrate Diversity		Pollution Tolerance Site SIGNAL scores		Aquatic Habitat Condition (RCE)	Salinity Score	Ephemeroptera, Plecoptera and Trichoptera (EPT) Taxa
		Mean	SD	Mean	SD	Mean	Mean	Mean
SH13	Goulburn River monitoring site – downstream of Bora Creek, the Goulburn River diversion and Ulan Creek	23.3	5.4	4.3	0.5	79.0	5.9	6.4
SH14	Murragamba Creek monitoring site – downstream of OC4 immediately before Wilpinjong Creek confluence	12.9	3.7	3.3	0.5	61.4	4.2	1.5
SH15	Wilpinjong Creek monitoring site – upstream of OC4	11.8	4.8	3.3	0.1	82.7	5.0	0.5
SH16	Eastern Creek monitoring site – downstream of OC4 immediately before Wilpinjong Creek confluence	14.4	2.7	3.4	0.3	73.3	4.8	0.6
SH17	Wilpinjong Creek monitoring site – downstream of OC4 and downstream of confluences with Murragamba Creek and Eastern Creek	12.8	4.4	3.6	0.5	58.2	3.9	1.1
SH18	Eastern Creek monitoring site – located upstream of OC4	13.5	2.9	3.1	0.1	42.3	3.9	0.5
SH19	Murragamba Creek monitoring site – located upstream of OC4	14.0	ND	3.2	ND	49.0	3.9	1.0

The key outcomes of past stream health monitoring at the Moolarben Coal Complex include:

- Ecology at the sites sampled is consistent with dry conditions and greater contribution by groundwater to streamflow.
- Changes observed during sampling are not caused by mining operations at the Moolarben Coal Complex, since changes are not restricted to MCO-influenced sites.
- Phragmites sp. and Typha sp. grow extensively at SH05, SH06, SH08 and SH10 (see Figure 4). If flow remains low, the decomposition of this organic matter may reduce the dissolved oxygen concentrations in the water.

3.4.4 Channel stability

Goulburn River, Bora Creek and Moolarben Creek

Baseline channel stability monitoring was undertaken in September 2009 on the Goulburn River, Bora Creek and Moolarben Creek to assess the condition of the watercourse pre-mining activities in Open Cut 1. Additional baseline monitoring was undertaken in October 2013 on Moolarben Creek to assess the condition of the watercourse pre-mining activities in Open Cut 2 and Open Cut 3. The monitoring involved an observational survey of a stream reach that included:

- Monitoring the reach of Bora Creek from the western culvert of the rail loop and its confluence with Goulburn River; and
- Monitoring the reach of Moolarben Creek between Moolarben Dam and its confluence with Ryan's Creek.

Murragamba Creek and Eastern Creek

Baseline channel stability monitoring of Murragamba Creek and Eastern Creek was undertaken in May 2014 to assess the condition of the watercourse pre-mining activities in Open Cut 4.

Wilpinjong Creek

Baseline channel stability monitoring of Wilpinjong Creek was undertaken in November 2014 to assess the condition of the watercourse pre-mining activities in Open Cut 4.

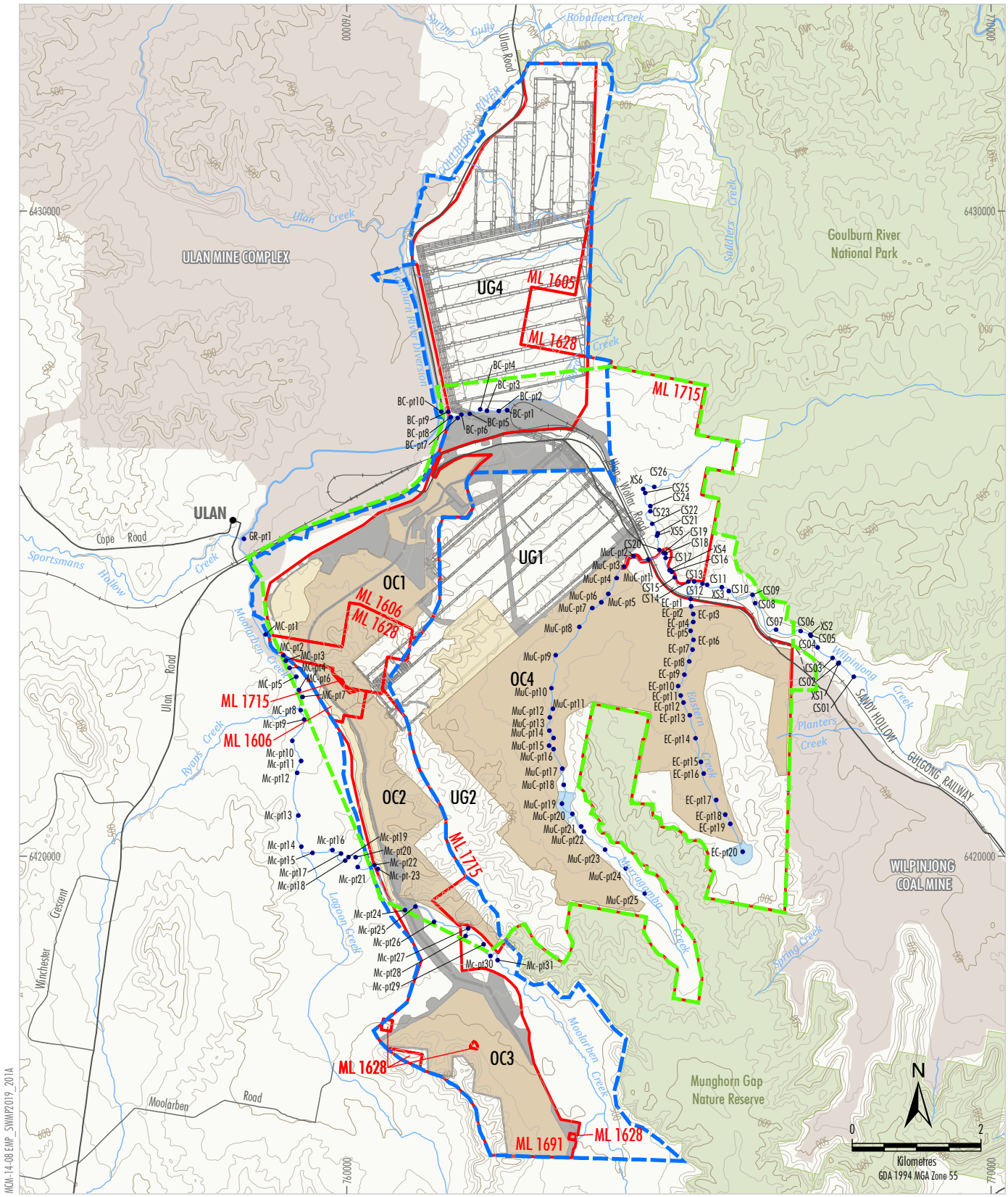
At each of these locations, the following was undertaken:

- Documenting locations and dimensions of significant erosive or depositional features so that any subsequent changes can be evaluated;
- Establishing photographic points at representative locations, so that photos can be taken of multiple inspections in a repeatable manner;
- Written descriptions of the stream at each of the photographic points, focussing on evidence of erosion and exposed soils; and
- Cross sections at strategic locations.

Photographic monitoring sites were established along Goulburn River at the Bora Creek confluence and Moolarben Creek confluence. They were also established at a number of points along the reaches of Murragamba Creek, Eastern Creek and Wilpinjong, as well as their confluences.

Plans showing the baseline channel stability monitoring sites at the respective waterways are shown on Figure 5.

The baseline monitoring program utilised the Commonwealth Scientific and Industrial Research Organisation (CSIRO) *Ephemeral Stream Assessment* to classify each monitoring location. Table 16 shows the classification of the drainage lines using the CSIRO system. Table 17 shows the baseline results at each of the locations selected for ongoing baseline monitoring.



LEGEND

- NSW National Parks and Wildlife Service
- Other Mining Operations
- Mining Lease Boundary

Existing/Approved Development

- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Clean Water Diversion Infrastructure
- Underground Longwall Layout
- Haul Road
- Road Realignment (not yet constructed)
- Approved Stage 1 Project Boundary
- Approved Stage 2 Project Boundary
- Channel Stability Monitoring Location

Source: MCO (June 2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

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Baseline Channel Stability Monitoring Locations

Figure 5

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Table 16: Classification of Different Drainage Line States (CSIRO)

Activity Rating (%)	Classification	Discussion of Classification
80 +	Very Stable	Drainage line is very stable and likely to be in original form. It is able to withstand all flow velocities that have previously occurred in this area and only minimal monitoring is required, predominantly after high flow events, to ensure condition does not deteriorate
70-80	Stable	Drainage line is stable. It is important to assess this zone in relation to the other classifications and define whether this zone is moving from potentially stabilising to a more stable form or if it is deteriorating from a very stable form. The nature of this relationship will identify the type of monitoring required.
60-69	Potentially Stabilising	Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
50-59	Active	Drainage line is actively eroding and remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.
< 50	Very Active	Drainage line is very actively eroding and immediate remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.

Table Source: CSIRO Ephemeral Stream Assessment (CSIRO, date unknown)

Table 17: Baseline Classification of Channel Stability Monitoring Sites

Site Number	Classification
Bora Creek	
BC-pt1	Very Stable
BC-pt2 (upstream)	Potentially Stabilising
BC-pt2 (downstream)	Stable
BC-pt3	Active/Potentially Stabilising
BC-pt4 (upstream)	Stable
BC-pt4 (downstream)	Active
BC-pt5	Active
BC-pt6	Active
BC-pt7	Active/Potentially Stabilising
BC-pt8	Active to Very Active
BC-pt9	Very Active
BC-pt10	Active
Moolarben Creek	
MC-pt1	As this site is a dam the CSIRO assessment could not be applied
MC-pt2	As this site is a dam the CSIRO assessment could not be applied
MC-pt3	As this site is a dam the CSIRO assessment could not be applied
MC-pt4	As this site is a dam the CSIRO assessment could not be applied

Site Number	Classification
MC-pt5	As this site is a dam the CSIRO assessment could not be applied
MC-pt6	Active
MC-pt7	Active
MC-pt8	Active
MC-pt9	Stable
MC-pt10	Very stable
MC-pt11	Potentially Stabilising
MC-pt12	Stable
MC-pt13	Stable
MC-pt14	Very Stable
MC-pt15	Potentially Stabilising
MC-pt16	Stable (at peg), Active (20m downstream of peg)
MC-pt17	Active
MC-pt18	Potentially Stabilising
MC-pt19	Potentially Stabilising
MC-pt20	Potentially Stabilising
MC-pt21	Potentially Stabilising
MC-pt22	Potentially Stabilising
MC-pt23	Stable
MC-pt24	Potentially Stabilising
MC-pt25	Stable
MC-pt26	Active
MC-pt27	Stable
MC-pt28	Stable
MC-pt29	Stable
MC-pt30	Potentially Stabilising
MC-pt31	Very Stable
Goulburn River	
GR-pt1	Very Stable
Murragamba Creek	
MuC-pt1	Active
MuC-pt2	Potentially Stabilising
MuC-pt18	Very Stable
MuC-pt19	Very Stable
MuC-pt20	Potentially Stabilising
MuC-pt21	Stable
MuC-pt22	Potentially Stabilising
MuC-pt23	Very Stable
MuC-pt24	Very Stable
MuC-pt25	Very Stable

Site Number	Classification
Eastern Creek	
EC-pt1	Active
EC-pt2	Very Stable
Wilpinjong Creek	
CS-pt1	Active
CS-pt2	Potentially Stabilising
CS-pt3	Active
CS-pt4	Very Active
CS-pt5	Very Active
CS-pt6	Stable
CS-pt7	Stable
CS-pt8	Stable
CS-pt9	Stable
CS-pt10	Active
CS-pt11	Potentially Stabilising
CS-pt12	Potentially Stabilising
CS-pt13	Stable
CS-pt14	Potentially Stabilising
CS-pt15	Active
CS-pt16	Active
CS-pt17	Active
CS-pt18	Very Active
CS-pt19	Very Active
CS-pt20	Very Active
CS-pt21	Active
CS-pt22	Active
CS-pt23	Potentially Stabilising
CS-pt24	Very Stable
CS-pt25	Stable
CS-pt25	Very Stable

Conclusions – Goulburn River, Bora Creek and Moolarben Creek

At the conclusion of the baseline Channel Stability Monitoring Program for Bora Creek, Moolarben Creek and the Goulburn River, large variability in terms of channel stability, vegetation composition and erosion potential was identified. Both Bora Creek and Moolarben Creek share similar characteristics associated through previous land practices, primarily tree clearing surrounding each creek line for agricultural pursuits, primarily grazing.

The survey identified some sections of Bora Creek and Moolarben Creek that were degraded and actively eroding due to natural influences, exacerbated by past land clearing, agricultural practices and animal activity, not associated with any MCO activities. The survey alternately recognised some sections of each creek displaying very stable environments, with respect to their low erosion potential.

The survey highlighted that the remaining remnant mature trees within these creeks are the primary mechanism for channel stability and therefore every effort to conserve these trees should be a priority for maintaining integrity of these waterways.

Conclusions – Murragamba Creek and Eastern Creek

The results of this baseline channel stability monitoring survey indicated that channel stability fluctuates along both Murragamba Creek and Eastern Creek. The survey identified that some sections of both creeks are currently experiencing and are vulnerable to erosion with areas of steep and exposed creek banks. Those areas are associated with exposed dispersive sub-soils, which hamper vegetation establishment by the development of a hard surface crust when the soil is dry, and the 'melting' nature of the soil when wet. Both creeks have been degraded by past land clearing and agricultural practices. The survey also recognised some sections of both creeks displayed very stable environments; generally in locations which have lower gradient creek banks and complete vegetation coverage.

Animal stock activity is causing stability issues in some sections of both Murragamba Creek and Eastern Creek along with wombat activity which is most dominant in the reaches with the presence of sandy-gravel alluvial soils within the creek banks.

Conclusions – Wilpinjong Creek

Evidence of varying erosional and depositional processes was recorded through point observations throughout the longitudinal survey and assessment. Morphological processes identified include:

- bank undercutting, slumping, caving, scour holes and erosion;
- gully and head-cut erosion, and knick points;
- areas of sediment deposition and debris accumulation;
- variation in channel width; and
- non-cascading pools.

The most active creek bed section occurred at CS5. This area was characterised by an incising bed, faceted lower bed benches, scour holes, steep banks, undercutting, and a decrease in channel width paralleling an increase in channel depth with a downstream aggradation of finer particles and floodplain alluvium. The high activity at this location is likely the result of natural influences, both historic large magnitude rainfall events and strong bedrock control, likely exacerbated by post-European agricultural activities and disturbance which has preconditioned rivers to erosion susceptibility.

Five areas along the creek were recorded as very active, and eight areas as active, and are therefore vulnerable to erosion during high rainfall events. These areas are generally associated with an incised, steeply banked channel between tree lines banks. The steep, vertical banks have exposed dispersive soil which is preventing vegetation establishment.

The Ephemeral Creek Assessment along Wilpinjong Creek identifies the creek as spatially variable, moving from areas of very high activity through to areas of high stability. The average classification for the creek is potentially stabilising. This is described by the CSIRO as 'the drainage line is potentially stabilising. Pooled water was recorded infrequently along the creek. There was no flowing water at the time of survey.

4.0 SURFACE WATER MANAGEMENT SYSTEM

4.1 OBJECTIVES

The key objectives of the surface water management system design for the Moolarben Coal Complex are to:

- preferentially segregate clean water runoff, sediment water runoff, mine water and brine generated from mining operations and rainfall events;
- minimise the volume of mine water generated by the Moolarben Coal Complex;
- preferentially reuse mine and brine water for dust suppression and coal washing;
- provide sufficient on-site storage to avoid unapproved discharges of water;
- capture sediment water from unrehabilitated overburden areas to settle coarse suspended solids;
- maximise diversion of clean water runoff where practicable;
- minimise surplus water through on site irrigation, evaporation and other miscellaneous uses;
- treatment of water to meet the water quality concentration limits of EPL 12932 and provide water for on-site use; and
- licensed discharge of treated water into the receiving environment in accordance with EPL 12932 to manage surplus water at the Moolarben Coal Complex.

The following definitions have been adopted for the water management system elements:

- **Clean water** is defined as runoff from catchments that are not disturbed by mining operations.
- **Sediment water** is defined as runoff from disturbed areas within the mine site and includes runoff from spoil dumps, haul roads and parts of the MIA (Mine Infrastructure Area). This water contains high levels of suspended solids.
- **Groundwater** is defined as groundwater from inflows to the mining void advanced dewatering of mine workings or production bores. This water may be mildly saline.
- **Mine water** is defined as runoff generated from coal stockpiles, the CHPP, parts of the MIA and the mining void, as well as groundwater inflows to the mining void/groundwater from advanced dewatering of mine workings from the northern borefield. This water may be mildly saline.
- **Erosion and sediment control** is defined as the suite of management and physical measures available to minimise the generation of soil erosion and to prevent soil and sediment entering the receiving water systems.
- **Effluent Water** is defined as treated water discharged from the Moolarben Coal Complex Sewage Treatment Plants (STP)**.**
- **Brine water** is defined as reverse osmosis by-product. This water is expected to be saline.

Sources of water supply to the Moolarben Coal Complex are summarised in decreasing order of priority:

- Groundwater inflows to open cut and underground mining operations;
- Runoff captured from the footprint of the mining disturbance area by the water management system;
- Advanced dewatering of mine workings;
- Mine water imported from the Ulan Mine Complex under agreement with UCML; and
- Groundwater extracted from production bores where not required for advanced dewatering of mine workings.

4.2 SURFACE WATER MANAGEMENT SYSTEM PLANS

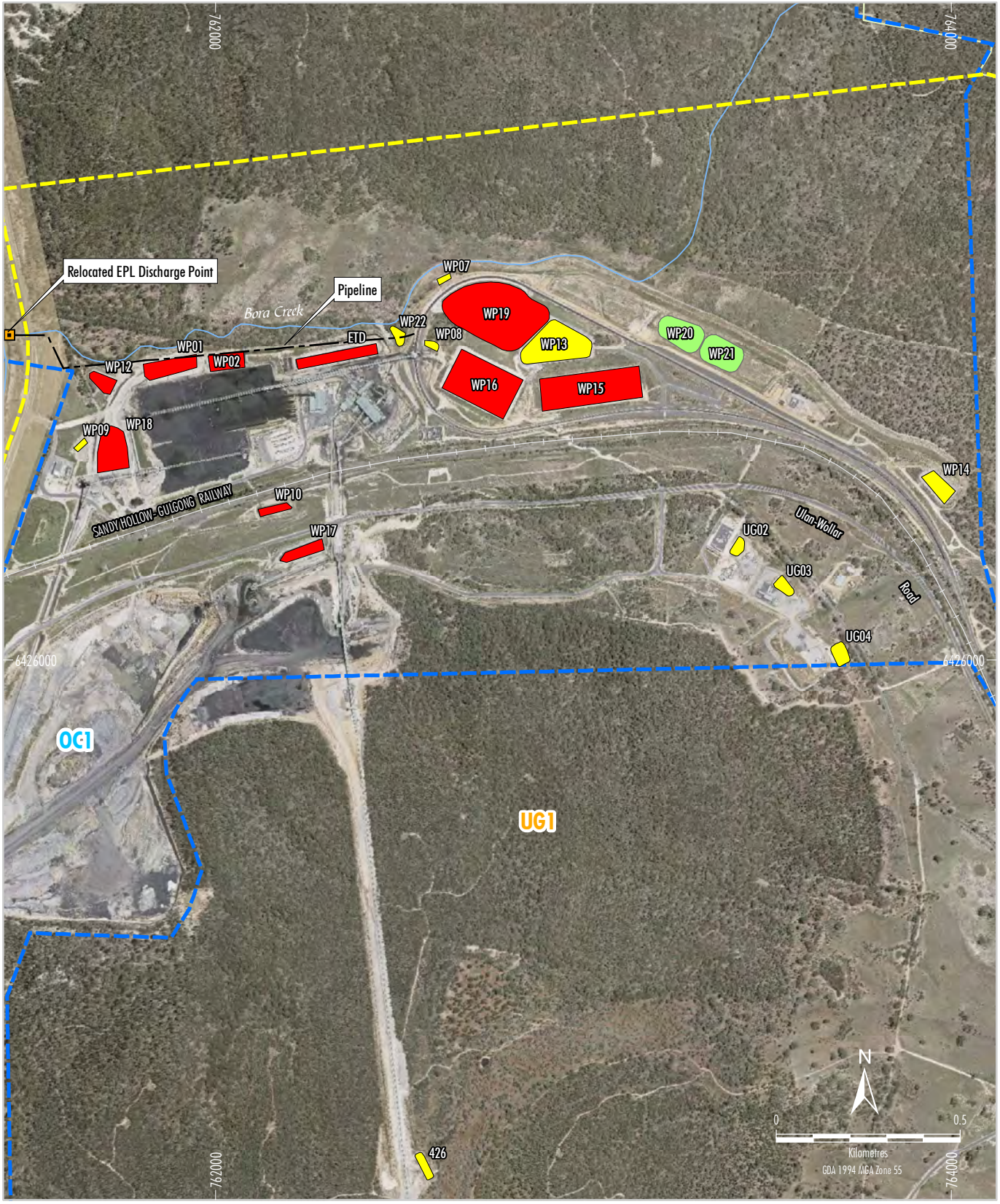
General descriptions of the various elements of the surface water management system are provided in this section and should be read in conjunction with the more detailed description provided in Section 4 of the SWB (MCO, 2020).

Water management system layout plans for existing and proposed WMS infrastructure are provided in Figure 6 to Figure 10. The locations of the operational and proposed dams at the CHPP and in OC1 and OC2 are shown on Figure 6, Figure 7 and Figure 8. The final dam locations for OC3 and OC4 will be determined and established progressively ahead of mining operations (indicative locations are shown on Figure 9 and Figure 10).

4.3 EROSION AND SEDIMENT CONTROL PLAN

Activities that have the potential to generate sediment and impact the surrounding catchment areas are:

- Vegetation clearing and topsoil stripping;
- Construction and use of linear infrastructure;
- Open cut mining operations;
- Operation of the CHPP infrastructure;
- Operation and construction of additional site infrastructure (including office and workshop areas);
- Construction of operational sediment control measures;
- Construction of creek crossings;
- Construction and operation of exploration sites;
- Construction of overburden and emplacement areas and haul routes; and
- Earthworks associated with mine site rehabilitation.



MCM-14-08 EMP_SWMP2019_202A

LEGEND

Approved Stage 1 Boundary

Approved Stage 2 Boundary

Surface Water Dams

Sediment Dam

Mine Dam

Brine Dam

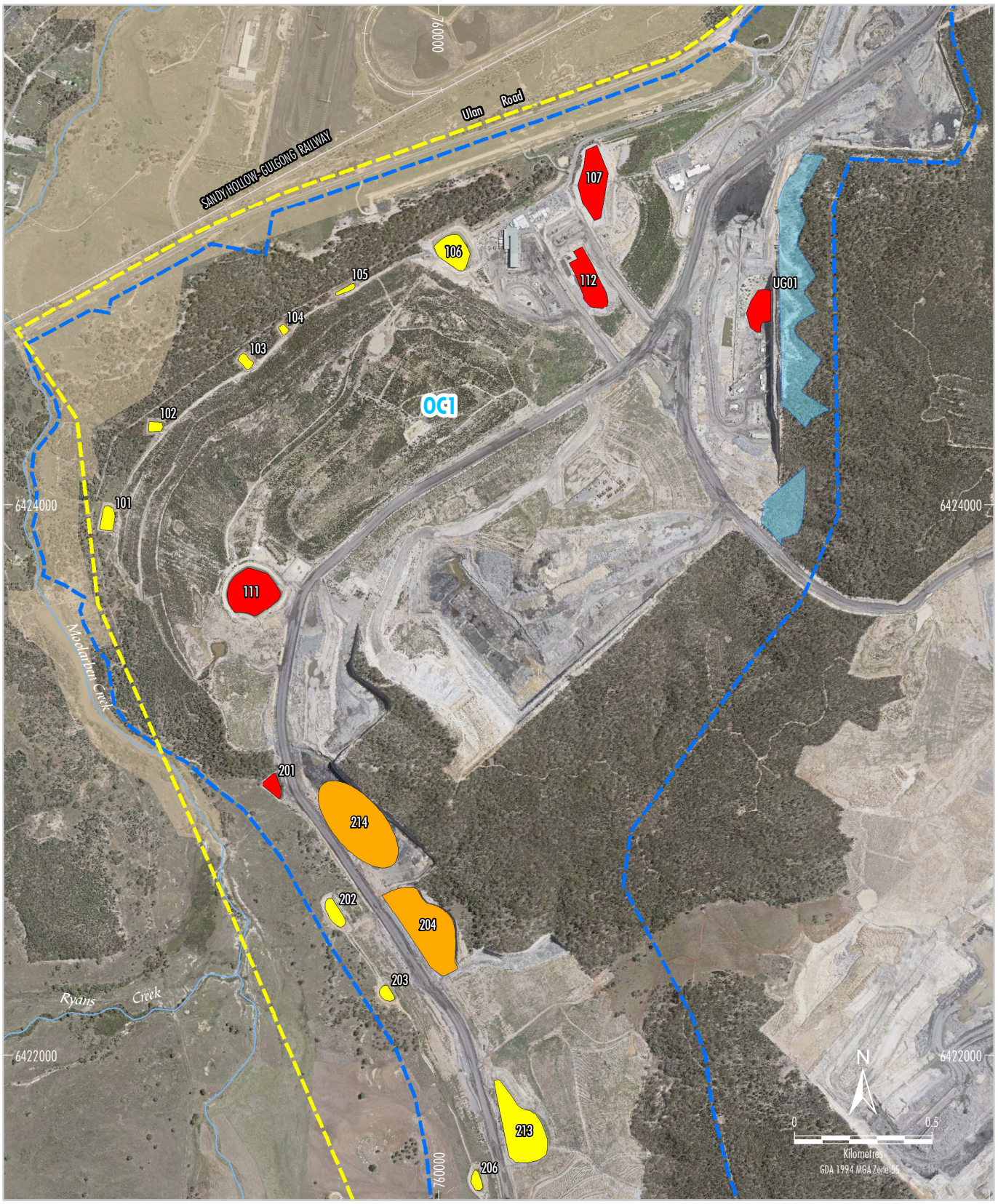
Source: MCO, 2019
Orthophoto: MCO (Jan 2019)

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Location of Water Storage and Sediment Dams in CHPP Area

Figure 6



MCM-14-08 EMP_SWMP2019_203B

LEGEND

- Approved Stage 1 Boundary
- Approved Stage 2 Boundary
- Stage 1, Clean Water Diversion Infrastructure

Surface Water Dams

- Brine Dam
- Sediment Dam
- Mine Dam

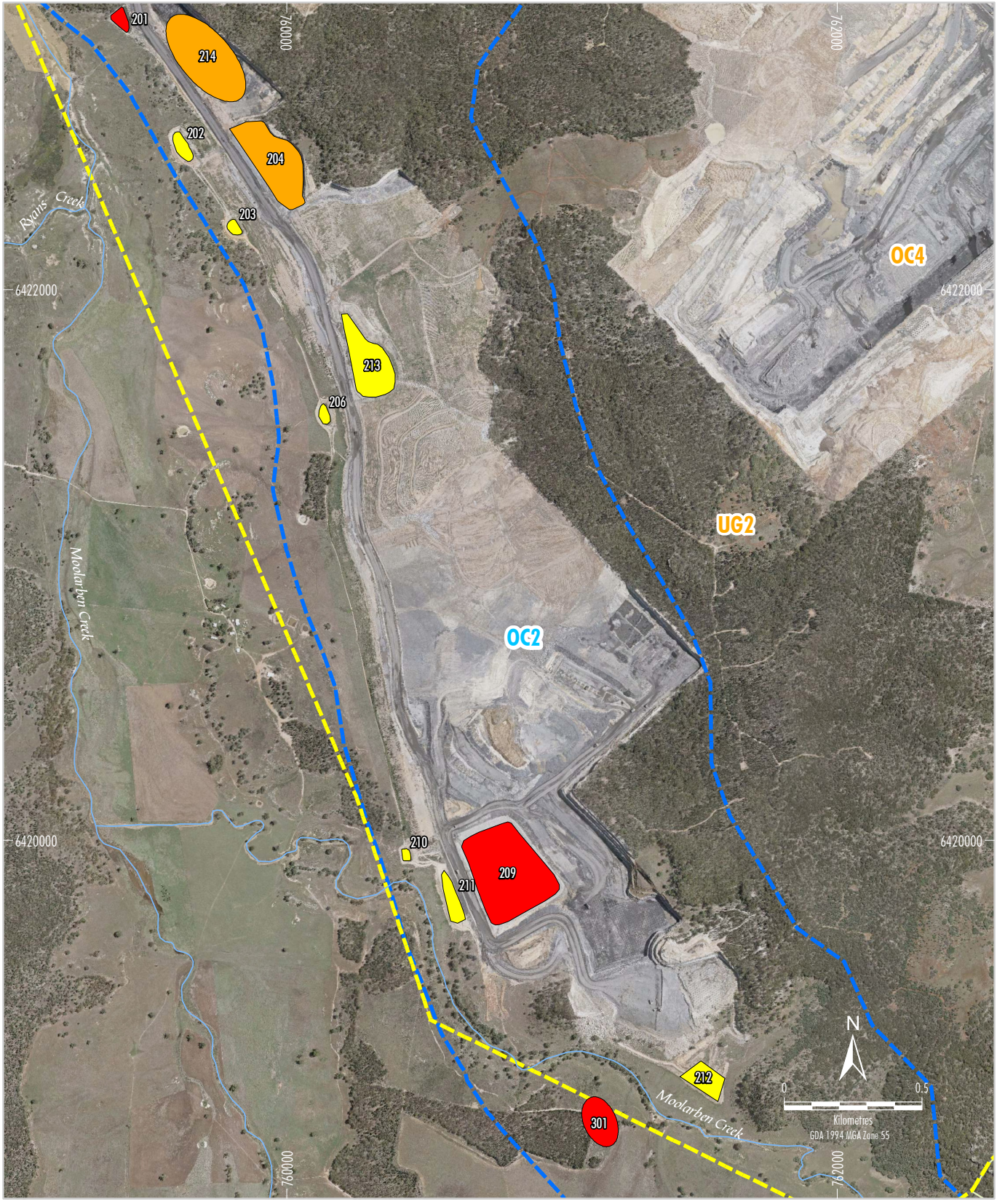
Source: MCO, 2019
Orthophoto: MCO (Jan 2019)

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Location of Water Storage and Sediment Dams in OC1

Figure 7



MCM-14-08 EMP_SWMP2019_204B

LEGEND

Approved Stage 1 Boundary

Approved Stage 2 Boundary

Surface Water Dams

Brine Dam

Sediment Dam

Mine Dam

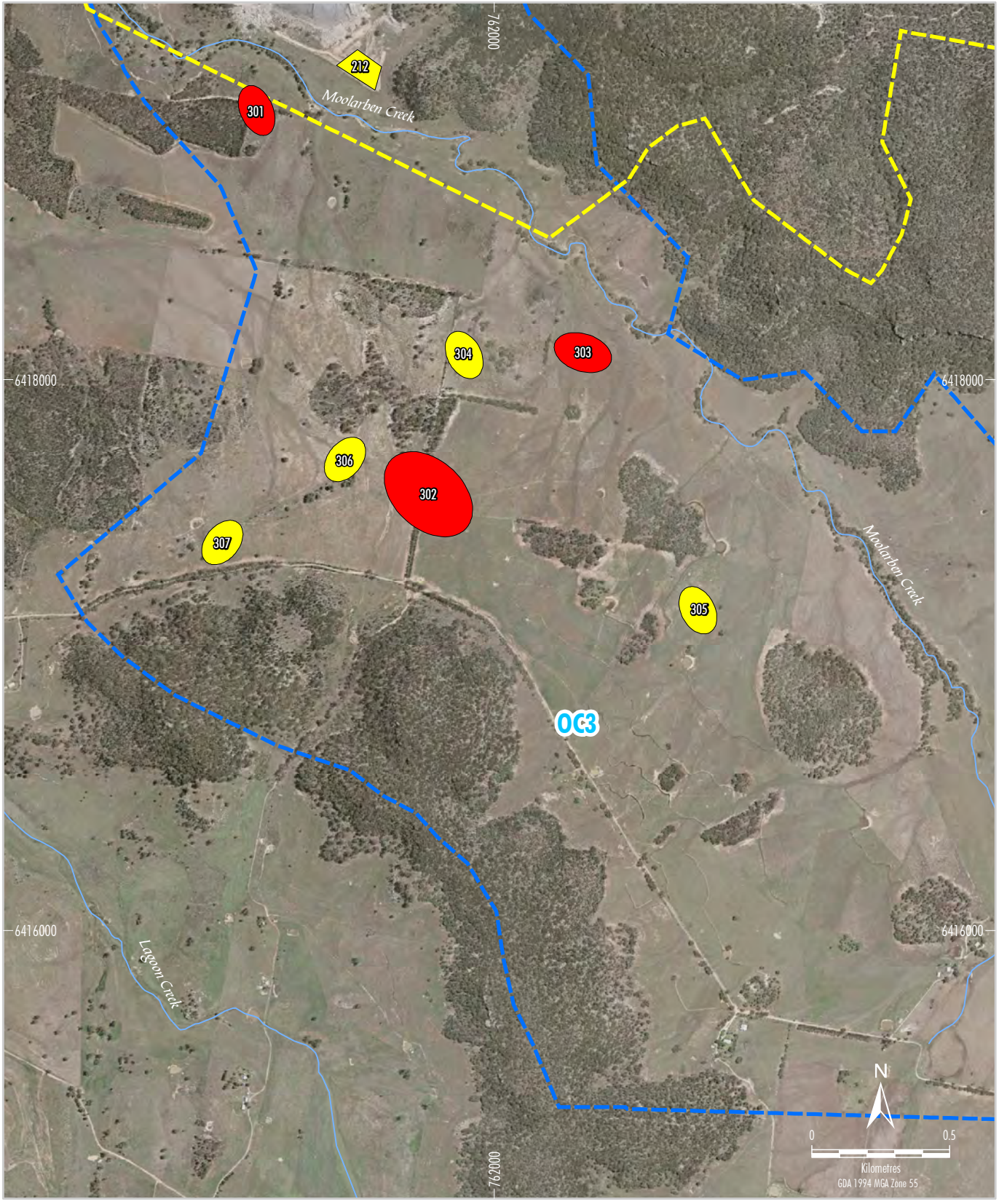
Source: MCO, 2019
Orthophoto: MCO (Jan 2019)

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Location of Water Storage and Sediment Dams in OC2

Figure 8



MCM-14-08 EMP_SWMP2019_205A

Source: MCO, 2019
Orthophoto: MCO (Jan 2019)

LEGEND

- Approved Stage 1 Boundary
- Approved Stage 2 Boundary

Surface Water Dams

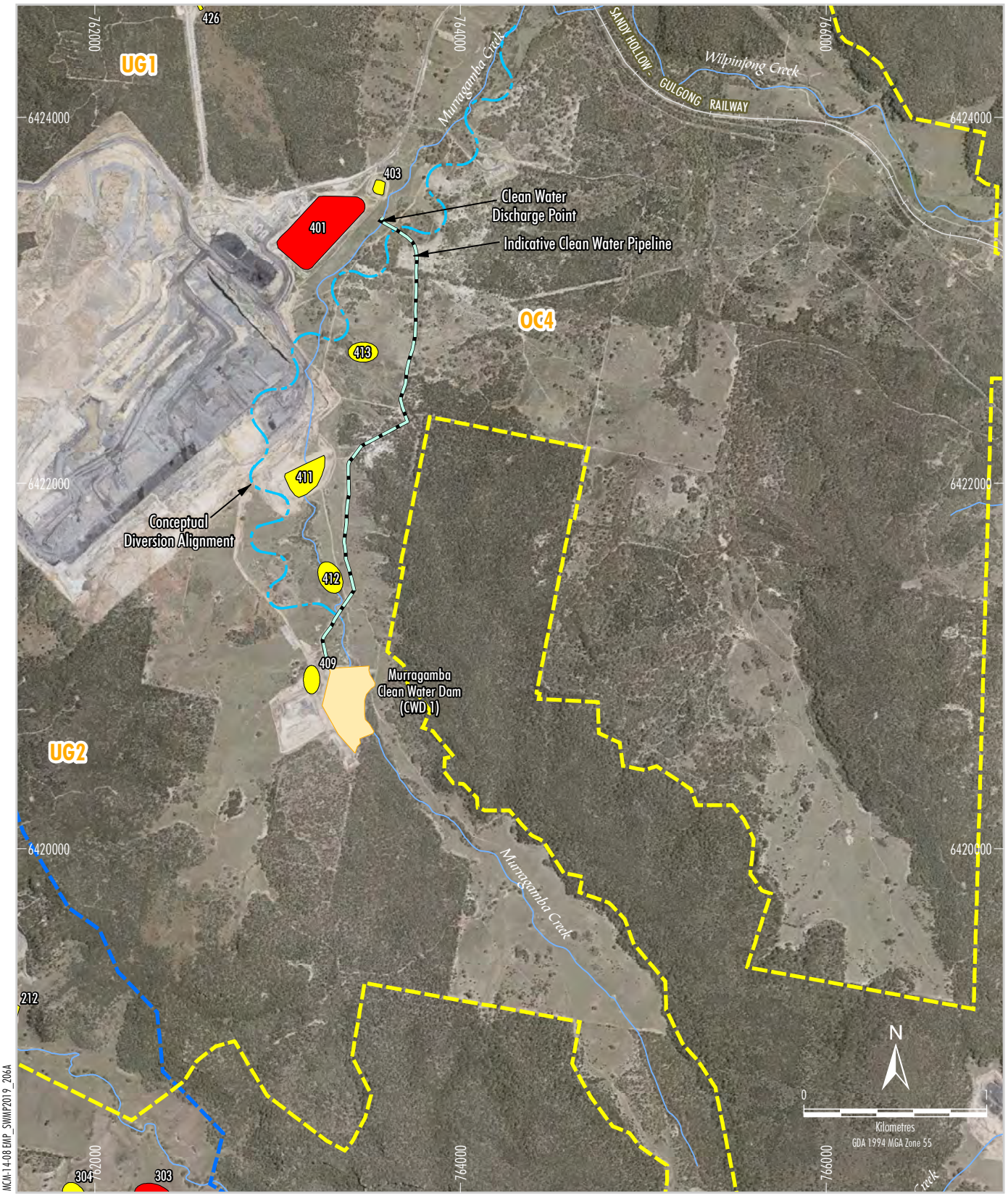
- Sediment Dam
- Mine Dam

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Location of Water Storage and Sediment Dams in OC3

Figure 9



LEGEND

- Approved Stage 1 Boundary
- Approved Stage 2 Boundary
- Clean Water Diversion Infrastructure

Surface Water Dams

- Sediment Dam
- Mine Dam

Source: MCO, 2019
Orthophoto: MCO (Jan 2019)

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Location of Water Storage and Sediment Dams in OC4

Figure 10

4.3.1 Erosion and Sediment Control Strategy

Typical erosion and sedimentation control strategies that will be implemented for construction, operation and rehabilitation activities at the Moolarben Coal Complex are described in the sections below.

The water management system captures runoff from the footprint of the mining disturbance and rehabilitation areas. An integrated surface water quality monitoring strategy has been developed and is described in the Surface Water Monitoring Program (Section 6.0).

All erosion and sediment control strategies and techniques will be designed and operated in accordance with the requirements of 'Managing Urban Stormwater: Soils and Construction including Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads' and 'Volume 2E Mine and quarries'. Where required the design and operation of erosion and sediment control strategies and techniques will be supplemented with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Document.

Erosion and sediment controls will be located as described in the strategies below and detailed in this section.

Prior to site disturbance a Ground Disturbance Permit (GDP) needs to be authorised by the Environment and Community Manager (ECM) or delegate. This GDP needs to include the erosion and sediment controls that must be established prior to disturbance. The GDP template is provided in Attachment 1.

Construction phase

The following measures are to be considered when preparing (and approving) the GDP for construction (note relevant mitigation measures need to be installed prior to commencement of disturbance):

- Clearly identifying and delineating areas (through use of flagging, fencing or bunds) required to be disturbed and limiting disturbance to those areas;
- Minimisation of all disturbed areas;
- Stabilisation by progressive rehabilitation as soon as practicable;
- Construction of diversion drains/bunds/coffer dams upslope of areas to be disturbed to direct clean runoff away from disturbed areas;
- Construction of catch drains and sediment dams to capture runoff from disturbed areas as required;
- Construction of other erosion and sediment controls works such as silt fences prior to construction works commencing within the catchment area;
- Construction of culverts, as required, under access roads, site services corridors and site haul roads;
- Construction of drainage controls such as table drains at roadsides and hardstand areas as required;
- Use of scour protection in temporary diversion drains;

- Construction of all temporary drains as earthen drains at typical grades no steeper than 5% (giving maximum peak velocities in the order of 1.5m/s) to minimise scouring, otherwise providing adequate scour protection;
- Use of stabilising vegetation, geotextile liners, rock check dams etc. (as appropriate) in drains as required to reduce water velocities and prevent scouring;
- Construction of graded banks over the majority of the reshaped overburden areas to minimise erosion and re-direct runoff to catch drains and water disposal areas;
- Locate stockpiled material away from concentrated water flows;
- Seeding of topsoil stockpiles if stored for longer than six months;
- Construction of road and earthworks cut and fill batters at appropriate slopes to maximise long term stability; and
- Regular inspection and maintenance of erosion and sediment controls.

Operational phase

Erosion and sediment control measures will be implemented for the life of the operation to minimise the potential impact on the surrounding environment. The development of operational phase control measures has been undertaken with reference to Section 3.3.3 of *Managing Urban Stormwater, Soils and Construction, Mines and Quarries* (DECC, 2008).

Measures to minimise erosion and the generation of sediment during operations include:

- Clearly identifying and delineating areas (through the use of flagging, fencing or bunds) required to be disturbed and limiting disturbance to those areas;
- Minimising areas to be disturbed and cleared and limiting machinery disturbance to these areas;
- Interception of runoff from disturbed catchment areas in pit or sediment dams;
- Preferential diversion of clean runoff away from disturbed areas;
- Reshaping, topsoiling and vegetating road cut and fill batters as soon as practical;
- Progressively stripping and direct emplacement or stockpiling topsoil for later use in rehabilitation;
- Clearing and topsoil stripping to be undertaken ahead of mining operations;
- Seeding of topsoil stockpiles stored for more than six months;
- Prompt revegetation of areas as soon as earthworks and mining are complete;
- Construction of sediment dams/controls to capture runoff from the office and workshop facilities and roadside table drains;
- Locate stockpile areas away from concentrated water flows;
- Monitoring and maintenance of clean water diversion systems including outlets;
- Regular inspection and maintenance of all erosion and sediment controls and rehabilitated areas; and

- Maintenance of design capacity of sedimentation dams by removing built-up sediment.

Rehabilitation phase

Rehabilitation will be undertaken in accordance with the Mining Operations Plan (MOP) and the Rehabilitation Management Plan (RMP) (MCO, 2019). Rehabilitation of the overburden emplacement areas and open cut pit will be conducted progressively over the life of the mine; forming an integral component of mining operations. Erosion and sediment controls to be implemented during the rehabilitation phase include:

- Progressive rehabilitation of disturbed land as soon as practicable in accordance with the MOP and the RMP;
- Construction of drainage controls to improve the stability of rehabilitated land;
- Reshaping, topsoiling and vegetating former areas used for earthworks, roads and batters as soon as practical upon completion of works;
- Application of gypsum, lime or other appropriate soil ameliorant at quantified rates to mitigate soil sodicity/dispersibility where exposed subsoils have been identified;
- Control of weeds through selective herbicide application and the reseeding of areas that fail to establish;
- Construction and installation of erosion and sediment controls such as silt fences, catch drains, grass swales, buffer strips and sediment dams down slope of rehabilitation areas;
- Regular inspections and maintenance of all erosion and sediment control works; and
- Restricting access to rehabilitated areas through the use of fencing and/or signposting.

4.3.2 Design of Erosion and Sediment Controls

Specific erosion and sediment controls to be implemented at the Moolarben Coal Complex are as follows:

- Clean water diversion drains and banks;
- Silt fences (or equivalent control);
- Vegetated buffer strips; and
- Sediment dams/basins.

Other *Blue Book* (Landcom, 2004) or *International Erosion Control Association Guideline* (IECA, 2008) erosion and sediment control measures may be implemented at the Moolarben Coal Complex as required.

Clean Water Diversion Drains and Banks

New clean water diversion drains are to be designed to cater for a 100 year ARI flood. Clean water runoff from undisturbed areas will be preferentially diverted around disturbed areas. Appropriate protection will be established at the down slope end of diversion drains, including level spreaders and other energy dissipation devices. Additional planting of grass, small shrubs and riparian species will be implemented as necessary to maintain channel stability.

Existing Moolarben Coal Complex clean water diversion and storage infrastructure have been designed and constructed to a 1 in 50 year ARI design event in accordance with the conditions of approval that applied at that time (i.e. prior to approval of the Moolarben Coal Project Stage 1 MOD 3 in January 2015).

Silt Fences

Where necessary, silt fences will be constructed immediately down slope of areas to be disturbed to minimise the potential for sediment transport into receiving catchments and waterways. Silt fences will be constructed along site contours where practicable. The catchment areas of silt fences are to be limited by constructing the fences with small returns at 20 metre intervals to create smaller contributing sub catchments (refer Figure SD 6-8 in Landcom 2004, page 6-36 or IECA, 2008 equivalent), unless otherwise approved in the GDP. The requirement for silt fences is assessed by the relevant project manager at a project/area specific level in consultation with the MCO Environment Department. Any silt fences will be described in the project/area Erosion and Sediment Control Plan, which is developed as part of the GDP process.

Silt fences are considered a temporary control measure and would only be utilised until no longer required or a more permanent control measure is installed.

Creek Crossings

A creek crossing will be constructed across Moolarben Creek to provide access to Open Cut 3. Erosion and sediment controls will be introduced during the construction phase and will be left in place to control sediment entering the waterway during and after the construction phase is complete and until the site has been stabilised. Erosion and sediment control measures, where necessary, will include silt fences, coffer dams and clean water diversion of intercepted upstream water around the creek crossing construction area.

Sediment Dams

Sediment dams would be installed as required in order to treat sediment laden runoff from disturbed areas to achieve the water quality required under EPL 12932 for release off-site. The use of flocculants or other ameliorants to treat water quality will be considered on a case by case basis.

Sediment dams will be designed with consideration given to topsoil and overburden characteristics and the contributing area of disturbance. The sediment dams will be sized in accordance with current recommended design standards in the following guidelines:

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

The sediment dam volumes will be designed to comply with Table 6.1 of *Managing Urban Stormwater, Soils and Construction, Mines and Quarries* (DECC, 2008) based on the following design standards and methodology:

- “Type D and F” sediment basins consistent with SD 6-4 (Landcom, 2004 page 6-19);

- embankment and spillway design standard will vary based on the duration of the disturbance of sediment dam catchment however it is anticipated that most sediment dam catchments will be disturbed for greater than three years (including time for rehabilitation to adequately establish);
- total sediment basin volume = settling zone volume + sediment storage volume. The sediment storage volume is the portion of the basin storage volume that progressively fills with sediment until the basin is de-silted. The settling zone is the minimum required free storage capacity that must be restored within 5 days after a runoff event;
- sediment basin settling zone volume based on 44mm rainfall in accordance with EPL 12932 conditions with an adopted volumetric event runoff coefficient for disturbed catchments of 0.64; and
- solids storage volume = 50% of settling zone volume.

The adopted design standard does not provide 100% containment for runoff from disturbed areas. Hence, it is possible that overflows will occur from sediment dams if rainfall exceeds the design standard.

Sediment dams will be constructed prior to substantial land disturbance activities occurring and will be maintained during the operation of the mine. The specific locations of the sediment dams for CHPP, OC1 and OC2 are illustrated in Figure 6, Figure 7 and Figure 8. The indicative sediment dam locations for OC3 and OC4 are shown in Figure 9 and Figure 10.

Sediment dams will be maintained in a drawn down state as far as practicable by transferring water to the water supply dams to be used for dust suppression or other mine related purposes (such as irrigation of rehabilitated areas). Sediment water may also be released in accordance with EPL 12932 which provides for a number of sediment dams to discharge when water quality is within the criteria specified in Condition L2.4 (refer Section 7.3) or following a 95th percentile 5 day rainfall event for the Central Tablelands.

Where required, level markers will be installed in sediment dams to identify the required storage volumes. Dams are dewatered as required and in some cases capacities may be increased to provide additional storage capacity.

Where practical, sediment dams will be designed to passively overflow to other sediment dams, to simplify operations and minimise the pumping requirements.

Resources will be provided to managed sediment dams and associated water transfers, including supervisors and pump crews on seven days a week.

Run-off from rehabilitated areas will be diverted to sediment dams for treatment until the water quality of surface runoff is suitable for release from the site, at which time the sediment dams will be decommissioned. Monitoring data from sediment dams will be compared with values of similarly sized control catchments with similar post-mine land use intensity outside the Moolarben Coal Complex area (e.g. pre-mine and post-mine [up-stream] monitoring points). It is anticipated that most sediment dams will be required for 2 or more years after rehabilitation of the disturbed catchment.

4.3.3 Monitoring and Reporting

The strategies outlined for the control of erosion and sedimentation will be inspected regularly. Inspections in active construction areas are to be completed weekly by the area supervisor. Monitoring and inspections of the site will include:

- Weekly inspections by a trained and competent person of water levels, silt build-up, scouring or erosion; and
- Revegetation progress of disturbed areas.

(Note unless defined by this plan, the inspection regime, including frequency and responsibility will be assigned as part of the ESCP prepared during the GDP approval process).

If the type and/or location of erosion and sediment control strategies are identified during inspections as being ineffective, the control structures will be modified. De-silting of erosion and sediment control structures will be carried out as necessary.

4.4 EFFLUENT MANAGEMENT AND DISPOSAL

Wastewater from the open cut and underground offices, workshop and bath houses is collected and treated on site in an effluent disposal system located near the open cut offices, CHPP Offices, Project Offices and underground Administration Offices.

In accordance with Condition O4 of EPL 12932, MCO will ensure:

- Effluent application will not occur in a manner that causes surface runoff.
- Spray from effluent application will not drift beyond the boundary of the premises.
- The quantity of effluent applied to the utilisation areas will not exceed the capacity of the utilisation areas to effectively utilise the effluent.

Monitoring of Biochemical Oxygen Demand, Nitrogen (total), Oil & Grease, pH, Phosphorus (total) and TSS is undertaken quarterly at each effluent discharge point with results presented in the Annual Reviews (refer Section 6.6).

4.5 MURRAGAMBA CREEK CLEAN WATER DIVERSION SYSTEM

The clean water diversion system for OC4 has been designed in accordance with the requirements of Condition 28 of Project Approval 08_0135. The Clean Water Diversion modelling, design and operation are detailed in the following sections. The Murragamba clean water diversion system is shown in Figure 10.

4.5.1 Design Approach

The Murragamba Clean Water system was sized based on XP-RAFTS hydrological modelling developed by WRM using the Australian Rainfall & Runoff (AR&R) 1987 rainfall intensities and temporal pattern for 1% AEP design storms of 1 hour to 72 hours to estimate the catchment inflows and required storage volume. The required storage volume was determined by evaluating a range of storm durations from 1 to 72 hours with sensitivity to pump arrangements and loss parameters completed.

4.5.2 Hydrologic Model

The XP-RAFTS model was prepared by WRM for the Murragamba Creek Dam catchment.

The adopted XP-RAFTS sub-catchment parameters were configured based on the available topographic data and aerial photographs:

- A percentage impervious of zero was adopted for all sub-catchments.
- Catchment slopes were determined based on the available topographic data.
- A sub-catchment storage coefficient multiplication factor 'Bx' of 1.0 was adopted for all events.
- A sub-catchment PERN 'n' value adopted was 0.03 was adopted.
- Channel routing in the XP-RAFTS model was configured based on specifying a 'K' and 'X' value for each routing link. An 'X' value of 0.2 was adopted for all routing links. The 'K' values represent estimated flow travel times (in hours) and were calculated based on assumed flow velocity of 2.5 m/s based on the slope of the flow path of 1.7% to 2%.

The sub catchment details used in the XP-RAFTS model are shown in Table 18. The model was calibrated for the total pre-mining catchment.

Table 18: Subcatchment Details and XP-RAFTS Model Inputs

Sub-catchment	Area (Ha)	Catchment Slope	Routing Flow Length (m)	Routing 'K' (Hr)
C1	256	4.7%		
C2	133	8.3%	1160	0.13
C3	129	10.0%	2200	0.24
C4	390	6.8%		

- The estimated RFFE 1% AEP design discharge for the total catchment is 91.9 m^3/s. The design discharge estimate was used to validate the XP-RAFTS model.
- The 1% AEP design storms from 1 hour to 72 hours durations using AR&R 1987 (IEAust, 2013) were used in the XP-RAFTS model. The initial loss (IL) and the continuing loss (CL) were then calibrated to the peak design discharge estimated by the RFFE. Adopted rainfall loss parameters were:
    - Initial Losses (minus pre-burst loss) (mm): 15.0
    - Continuing Losses (mm/h): 5.0

These loss values are consistent with AR&R Guideline 1987 recommended values for the Hunter River catchment range from 4.3 mm/hr (median) to 5.7 mm/hr (mean) for continuing loss, and 10 to 35 mm for initial loss and the *Concept Design for Proposed Diversions of Murragamba & Eastern Creeks* (Worley Parsons, May 2011).

Modelling indicated that a 500 ML storage and a two-stage pumping system meets the performance criteria. Pumped diversion of clean water would occur at 400 litres per second (lps) when storage volume was less than 200 ML, and at 800 lps when the dam volumes exceed 200 ML. The pump capacity would enable dewatering of the storage within 14 days.

4.5.3 Infrastructure & Operation

The Murragamba Clean Water Diversion system includes the

- Murragamba Clean Water Dam
    - 500 ML capacity.
    - Earthen dam.
    - Trapezoidal spillway designed to carry overflow reporting to the mining operations until creek diversion works are completed.
- Pumped Clean Water Diversion System
    - Conveys water via pump and pipe to Murragamba Creek down stream of current operations
    - Two stage dewatering pump system at 400/800 lps.
    - Clean water transfer pipeline sized to convey 800 lps.
    - Clean water release point including energy dissipation and scour protection.
    - The pumped clean-water diversion release location will be progressively advance with mine progression.

Modifications to the Clean Water Dam may be undertaken prior to mining adjacent to the facility and as the catchment reporting to the system reduces with mine progression.

The Murragamba Clean Water Dam is designed to be operated at a minimal storage volume, effectively functioning as a detention basin, with clean water reporting to the dam released during and following inflow events. The pumping system will generally operate at 400 lps where water volumes are less than 200 ML and at 800 lps where volume exceeds 200 ML.

Monitoring of the Murragamba Clean Water Diversion system is included in Section 6.5.

4.6 MOOLARBEN CREEK CROSSING

The Moolarben Creek crossing to OC3 has been designed in accordance with the requirements of Condition 32, Schedule 3 of Project Approval (05_0117) and in accordance with NSW Department of Primary Industries (DPI) (2013) *Policy and Guidelines for Fish Habitat Conservation and Management*. The clean water culvert sizing will be based on 20 year and 100 year ARI events using the HEC-RAS 1-dimensional hydraulic model.

Sediment controls along drainage lines will be introduced during the construction phase and will be left in place to control sediment entering the waterway during and after the construction phase is complete until the site has been stabilised.

The Moolarben Creek crossing works will be staged to allow the creek to preferentially flow around the works. Stage 1 will divert creek low flows around the works via a temporary upstream embankment during the installation of the initial culvert. Stage 2 works will include a temporary coffer dam to intercept low flow and direct it through the Stage 1 culvert during the installation of the remaining culverts. The temporary coffer dam will be removed at completion of the Stage 2 works.

4.7 WATER TREATMENT FACILITY

Water treatment facilities will be constructed to allow surplus water stored on-site to meet the water quality concentration limits of EPL 12932 and provide water for on-site use.

The water treatment process is subject to final engineering design and will involve pre-treatment followed by the secondary treatment of water via reverse osmosis (RO).

Additional water storages will be constructed as required to hold feed water, blend water and treated water, and to store by-products of the treatment process (Figure 6).

Water will be blended and transferred from the water treatment facility to the release point at the junction of Bora Creek and the Goulburn River Diversion via a pipeline (nominally poly pipe with a diameter of approximately 400 millimetres). The pipeline will run through culverts under Ulan Road adjacent to the existing water supply pipeline between the Moolarben Coal Complex and Ulan Mine Complex to the discharge point on the Goulburn River Diversion (Figure 6). The discharge point will include a spreader/diffuser to avoid scouring.

Water quality monitoring will be undertaken to enable the release water to meet the EPL criteria (Section 6.6).

A Brine Management Plan has been developed and approved in accordance with Condition 33A, Schedule 3 of Project Approval (05_0117) prior to operating and releasing water from the Water Treatment Facility. The Brine Management Plan describes the management of Brine.

5.0 SURFACE WATER MANAGEMENT MEASURES

MCO has developed a range of surface water management strategies to manage and mitigate surface water impacts. These include:

- Use and periodic update of the SWB (Appendix 1 of the WAMP) to forecast the mine water balance for the life of the mine;
- Implementation of a water hierarchy of use (Section 4.1);
- Minimisation of water use (Section 5.1);
- Utilising the existing UCML Water Sharing Agreement (Section 5.2);
- Operation of the site Water Management System (WMS) (Appendix 1 of the WAMP) which includes collection of runoff from areas of disturbance in mine water storages and preferential diversion of upslope runoff around operational areas;
- Design and construction of infrastructure to relevant standards and guidelines (Section 5.3);
- Use of surplus water for irrigation, evaporation, and other miscellaneous uses (4.0);
- treatment of water and release (4.7);
- Management of final voids (Section 5.4);
- Temporary storage of water in active mine voids;
- In-pit emplacement of tailings, acid forming and potentially acid forming materials (Section 5.5);
- Correct storage of chemical and hydrocarbon products (Section 5.6);
- Monitor relevant waterway channel stability (Section 5.7);
- Diversion of the Murragamba and Eastern Creeks (Section 5.8);
- Implementation of detailed Erosion and Sediment Control Plans (Section 4.3); and
- Implementation of a detailed Surface Water Monitoring Program (Section 6.0).

5.1 MINIMISATION OF WATER USE

Various strategies to reduce water usage on site and reliance on importing raw water were considered as part of the site water balance (refer Section 4.3 of the SWB). These include:

- Use of a belt filter press to reclaim water from rejects materials for reuse during the coal washing process. (Note; use of a belt filter press circumvents the need for disposal of tailings in dedicated tailings storage dams).
- Only washing run of mine (ROM) coal from open cut operations (i.e. underground ROM coal will primarily bypass the coal wash plant).
- Irrigation undertaken to minimise surplus water only.
- Use of surplus mine water from the adjacent Ulan Mine Complex as a primary supplementary water source (under the UWSA).

- Use of groundwater from advanced dewatering of underground mining areas as a primary supplementary water source. (Note: The northern borefield is designed to operate as an advanced dewatering/production borefield).
- Diversion of clean water where practicable around the operation, e.g. development and operation of the Murragamba Clean Water Diversion system.

Water reduction measures will be reviewed on an on-going basis and will be implemented as required.

5.2 WATER SHARING

Where practical, MCO seeks to maximise use of surplus mine water from neighbouring mines in preference to importing raw water from other sources for mining related purposes (such as process water and dust suppression) and has agreement with UCML for the supply of 1,000ML/year of surplus mine water from the Ulan Mine Complex. MCO and Wilpinjong Coal Mine have, and will continue to, liaise and implement reasonable and feasible opportunities for water sharing between the two sites. MCO may also work cooperatively with other operations to share surplus water.

5.3 INFRASTRUCTURE DESIGN

MCO will design, install and maintain any infrastructure within 40m of watercourses generally in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (DPI, 2007), or its latest version.

When required, MCO will design, install and maintain any new creek crossing necessary for mine progression or to maintain safety 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 their latest versions.

Stage 1 mine water storage dams will be designed to store a minimum 50 year ARI 72 hour storm event and Stage 2 mine water storage dams will be designed to store a minimum 100 year ARI 72 hour storm event (as required by Condition 32 of Schedule 3 of Project Approval 05_0117 and Condition 28 to Schedule 3 of Project Approval 08_0135, respectively). All on-site mine water storages (including emergency tailings dams, mine infrastructure dams, groundwater storage and treatment dams) are suitably lined to comply with a permeability standard that is the equivalent of $<1 \times 10^{-9}$ m/s.

Sediment dams will be designed, installed and maintained generally in accordance with the series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries, as described in Section 4.3.2.

Brine and feedwater dams associated with the water treatment facility will be constructed to store a 100 year ARI 72 hour storm event. Brine storages will be constructed to a permeability standard that is the equivalent of $<1 \times 10^{-9}$ m/s over 1000mm (as required by Condition 32, Schedule 3 of Project Approval [05_0117]). Where dams may be used for both brine and mine water, they will be constructed to a brine water standard.

New clean water diversion systems will be designed, installed and maintained to capture and convey the 100 year ARI flood.

5.4 REHABILITATION AND MANAGEMENT OF FINAL VOIDS

Three final pit voids will remain at the completion of the Moolarben Coal Complex – one in OC1 (where the portal to UG1 is located), one at the southern end of OC3 (when approved Stage 1 open cut mining ceases) and one at the far eastern extremity of OC4 (when approved Stage 2 open cut mining ceases). Groundwater levels are predicted to rise above the void floor levels in OC1 and OC4 voids, but the OC3 void is expected to be at or above final equilibrium groundwater level.

Additional detail regarding the rehabilitation and management of final voids is provided in the Rehabilitation Management Plan.

5.5 IN-PIT EMPLACEMENT OF REJECTS AND (POTENTIAL) ACID FORMING MATERIALS

MCO will dispose of rejects and potential acid forming (PAF) materials in a manner that prevents the migration of pollutants beyond the pit limits. All coarse and fine reject materials recovered during coal beneficiation will be disposed of by emplacement in the backfilled open cut pits generally according to one of the following three disposal alternatives:

- In dump co-disposal - disposal of rejects with active overburden in in-pit emplacement areas, thereby dispersing the rejects;
- Block tipping – bulk disposal of rejects within in-pit emplacement areas; or
- Cell dump – disposal of rejects in cells within in-pit emplacement areas.

To minimise impacts on water, rejects will be progressively disposed and capped with at least 5 m of inert overburden material. All identified PAF material will be blended and emplaced in deeper areas of the pit to avoid shallow emplacement in concentrated areas. Cells of PAF material will be located below the long-term water table.

Emplacement of overburden materials limiting tree root growth will also be avoided near the surface of the final landform where practical to minimise erosion potential or land slumping and to minimise potential for revegetation failure.

Additional information is available in Section 6.0 the Rehabilitation Management Plan.

5.6 CHEMICAL AND HYDROCARBON STORAGE

Chemical and hydrocarbon products will be stored in bunded areas in accordance with Australian Standard 1940:20017 (*The storage and handling of flammable and combustible liquids*) and AS/NZ 3833:1998 (*The safe storage and handling of mixed classes of dangerous goods, including segregation and compatibility guidelines*) to prevent the risk of contamination of the surrounding environment should a spill occur.

In addition, MCO will implement the following management measures, as required:

- Installation and maintenance of oil separators in the truck wash and refuelling areas; and
- Provide spill kits, including hydrocarbon booms in the vicinity of chemical and hydrocarbon storage areas.

5.7 MAINTAINING OR IMPROVING BASELINE CHANNEL STABILITY

MCO will maintain or improve channel stability on the sections of Moolarben Creek, Bora Creek, Murragamba Creek, Wilpinjong Creek and Eastern Creek that are within the Moolarben Coal Complex Project boundary. If work is required this may involve physical stabilisation works or vegetation planting.

The need for channel stability works would be informed by monitoring undertaken in accordance with Section 6.3 (e.g. evaluation of changes in locations and dimensions of significant erosive or depositional features). Works would be developed by MCO with input from suitably qualified experts based on the monitoring undertaken in Section 6.3.

5.8 DIVERSION OF MURRAGAMBA AND EASTERN CREEKS

To maximise extraction of the coal resource within OC4 it will be necessary to realign the channel and construct a new creek alignment for both Murragamba and Eastern Creeks. A concept design for the diversion of these two creeks was developed for the Stage 2 PPR (*Concept Design for Proposed Diversions of Murragamba and Eastern Creeks* [M&ECDCD report] [Worley Parsons, 2011]).

In accordance with Condition 29, Schedule 3 of Project Approval 08_0135 and Statement of Commitments, MCO will progress with a staged development of detailed creek diversion plans in consultation with technical experts and relevant government authorities. These plans will include design objectives and performance criteria and will be finalised prior to the commencement of Murragamba or Eastern Creek diversion works. Detailed design works for the permanent Murragamba Creek Diversion are anticipated to commence in 2019 following the review of the conceptual design. The SWMP will be reviewed and updated as necessary following finalisation of the detailed creek diversion plans.

Approximately 5 km of Murragamba Creek and 5 km of Eastern Creek will be relocated. This will require the temporary diversion of surface flows around the mine area and the reinstatement of the creeks in the post-mining landform. The temporary Murragamba Creek Clean Water Diversion system (Figure 10) has been constructed as detailed in Section 4.5. The design and timing of temporary and permanent creek diversions has been accommodated into the mining sequence. At mine closure, both creeks will comprise a mix of natural and reconstructed rehabilitated alignments.

MCO will develop operational criteria for the realigned sections of Murragamba and Eastern creeks in consultation with relevant regulators and install diversions around the realigned sections of creek until such time as they become operational. MCO is committed to realigning and reconstructing the mined sections of Murragamba and Eastern Creeks to meet geomorphological, hydraulic and ecological performance and completion criteria developed in consultation with relevant regulators.

The performance measures for the creek diversions are summarised as follows:

- Increase the overall length of the creek diversions and reduce the overall average bed slope compared to the existing creek alignments;
- Mimic the existing meandering plan form of the low flow channel;
- Include creek corridors which are designed to contain flood flows up to the 1 in 100 year ARI;
- Include low flow channels which are designed to contain a rainfall event of a 1 in 1 year ARI;

- Include riffle/drop structures that are designed for a 1 in 20 year ARI peak flow;
- Incorporate erosion control measures based on vegetation and engineering revetments;
- Incorporate persistent/permanent pools for aquatic habitat;
- Incorporate seepage control/flow loss measures through sections of the creek lines to be constructed over mine waste backfill; and
- Revegetate with suitable native species.

6.0 SURFACE WATER MONITORING PROGRAM

This program includes monitoring of the following elements of the Moolarben Coal Complex water management system and surrounding river and creeks (Figures 11 and 12):

- Surface water flows in Goulburn River, Bora Creek, Murragamba Creek, Eastern Creek and Wilpinjong Creek;
- Surface water quality in Goulburn River, Bora Creek, Moolarben Creek, Murragamba Creek, Wilpinjong Creek, Eastern Creek and Lagoon Creek;
- Channel stability in Goulburn River, Bora Creek, Moolarben Creek, Murragamba Creek, Eastern Creek and Wilpinjong Creek;
- Stream health conditions in Goulburn River, Bora Creek, Moolarben Creek, Murragamba Creek, Wilpinjong Creek and Eastern Creek;
- Water quality in mine site water management structures, including discharge, mine water and sedimentation dams, and effluent disposal system; and
- Monitoring of discharge water quality and quantity.

All monitoring is subject to agreement from the landowner to access their property. Where agreement cannot be reached the location may be removed from the monitoring program and an alternative location will be investigated.

Monitoring parameters and locations will be reviewed and may be altered or discontinued as a result of changes to operations. Any changes to the monitoring program will be approved by DP&E prior to implementation. Any revisions to the monitoring program will also be discussed in the Annual Review.

6.1 STANDARDS

Surface water monitoring at the Moolarben Coal Complex will be undertaken in accordance with relevant Australian Standards, legislation and the NSW EPA approved methods for sampling including (but not limited to):

- NSW DECCW, 2004*, Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales;*
- Australian Standard/New Zealand Standard (AS/NZS) 5667.1:1998, *Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques, and the Preservation and Handling of Samples;* and
- AS/NZS 5667.10:1998, *Water Quality – Sampling – Guidance on Sampling of Waste Waters.*

Sampling programs and procedures are documented within MCO's system and detailed in contractors work scopes.

MCO undertakes Quality Assurance (QA) and Quality Control (QC) as part of the sampling programs, including the following:

- Calibration of monitoring equipment;
- Laboratory to check analytical procedure by conducting duplicates for all batches of samples conducted for each analytical procedure. Laboratory duplicates provide information regarding method precision and sample heterogeneity;
- Laboratory to conduct method blank and spike recovery. The purpose of this QC parameter is to monitor potential laboratory contamination;
- Laboratory to conduct matrix spikes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries; and
- Sampling Contractor to carry a blank and conduct a duplicate sample in the field. The purpose is to gauge any contamination of samples in the sampling/transportation process by contamination of the blank and to gauge relative sample heterogeneity by conducting a duplicate.

6.2 SURFACE WATER QUALITY AND FLOWS

Surface water monitoring will be undertaken at the monitoring locations described in Table 19 and shown on Figure 11.

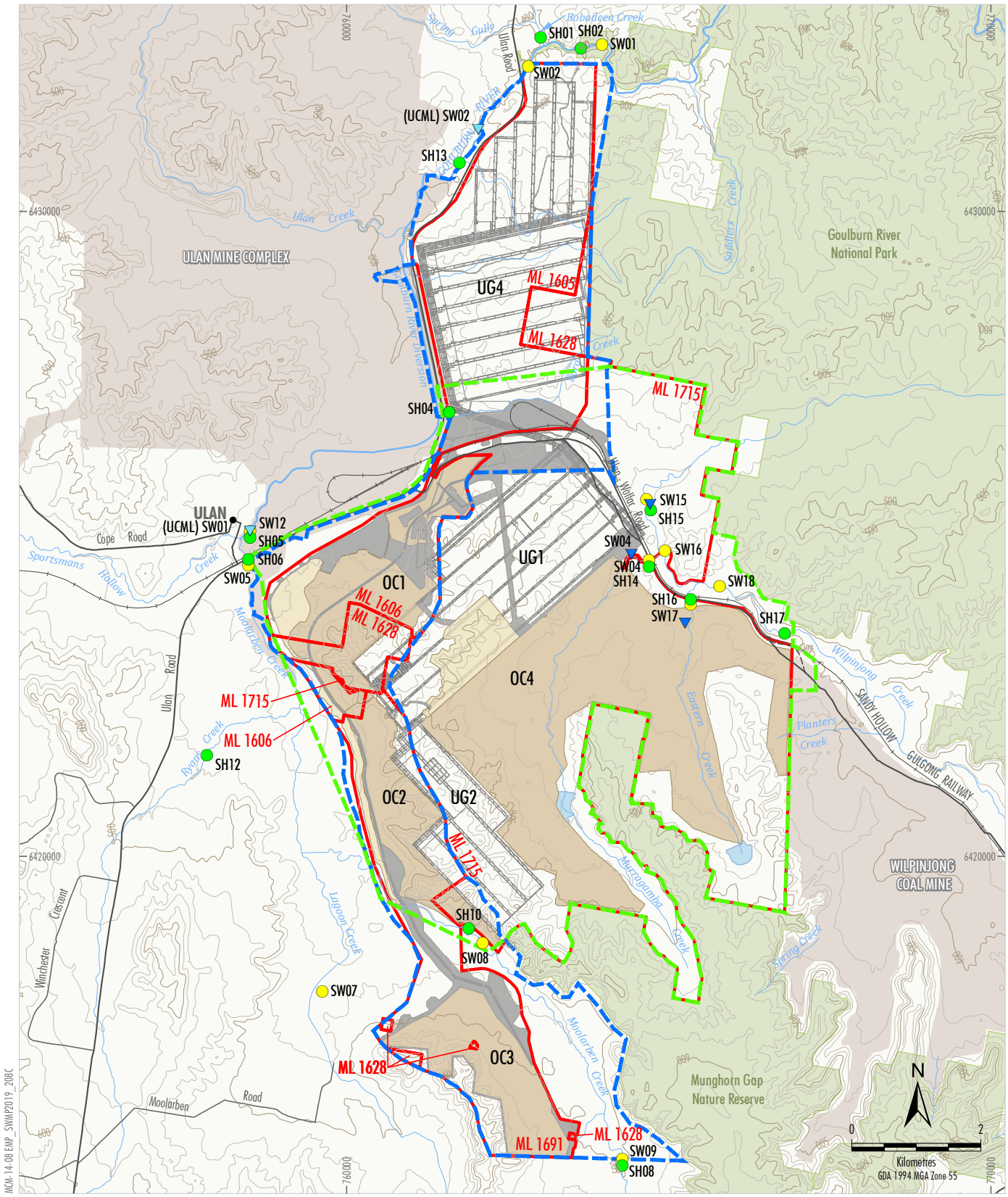
The monitoring schedule presented in Table 19 outlines the frequency and parameters for each water sampling location. A monthly review of water quality data will be undertaken; including consideration of relevant flow and rainfall data.

Table 19: Surface Water Monitoring Program

Site	Frequency	Parameters	Site Justification
SW01	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Located downstream of all operations
	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 adjacent to UG4 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	

Site	Frequency	Parameters	Site Justification
SW04	Monthly (if flowing)	Flow – Measured pH, EC, TSS, TDS, temperature, turbidity	Downstream of OC4 on Murragamba Creek Downstream of diversion on Murragamba Creek
	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, turbidity	
SW05	Monthly (if flowing)	Flow –Observation pH, EC, TSS, TDS, temperature, turbidity	Downstream of open cut operations on Moolarben Creek
	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, turbidity	
SW07	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Upstream of open cut operations on Lagoon Creek
	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, turbidity	
SW08	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Between OC2 and OC3 on Moolarben Creek
	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, turbidity	
SW09	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Upstream of open cut operations on Moolarben Creek
	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, turbidity	

Site	Frequency	Parameters	Site Justification
SW12	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Upstream of OC1, UG4 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, turbidity	
SW15	Monthly (if flowing)	Flow – Measured pH, EC, TSS, TDS, temperature, turbidity	Upstream of OC4 and the confluence of Murragamba Creek on Wilpinjong Creek
	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, turbidity	
SW16	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Downstream of the confluence of Murragamba Creek on Wilpinjong Creek
	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, turbidity	
SW17	Monthly (if flowing)	Flow – Measured pH, EC, TSS, TDS, temperature, turbidity	Downstream of diversion on Eastern Creek
	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, turbidity	
SW18	Monthly (if flowing)	Flow – Observation pH, EC, TSS, TDS, temperature, turbidity	Downstream of OC4 on Wilpinjong Creek
	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, turbidity	



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LEGEND

- NSW National Parks and Wildlife Service
- Other Mining Operations
- Mining Lease Boundary

Existing/Approved Development

- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Clean Water Diversion Infrastructure
- Underground Longwall Layout
- Haul Road
- Road Realignment (not yet constructed)
- Approved Stage 1 Project Boundary
- Approved Stage 2 Project Boundary

Surface Water Monitoring

- MCO Streamflow Gauge
- UCML Streamflow Gauge
- Stream Health Monitoring Site
- Surface Water Monitoring Site

Source: MCO (2019); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

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Surface Water Monitoring Programme

Figure 11

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.

Additional stream flow data will be obtained from and shared with UCML for UCML SW01 and UCML SW02, and Wilpinjong Coal Mine as required, in accordance with a data sharing agreement between the three mines.

Runoff and seepage from coal stockpiles and overburden emplacements will be monitored at the receiving dams every 6 months as part of Acid Mine Drainage (AMD) monitoring.

6.3 STREAM HEALTH

The actual and proposed long term stream health assessment sites are illustrated on Figure 11. The sampling model is based on a consideration of separating out possible mining impacts from other catchment-associated impacts.

The stream health monitoring program is based on the Australian Rivers Assessment System (AusRivAS) aquatic invertebrate monitoring protocol, as used for the baseline stream health study. AusRivAS is a rapid biological assessment protocol with twice yearly (spring and autumn) aquatic macro invertebrate sampling. Monitoring and analysis comprise:

- Aquatic Macro Invertebrate Diversity;
- Pollution Tolerance Site SIGNAL Scores;
- Aquatic Habitat Condition;
- Salinity Score; and
- EPT.

In addition to the aquatic macro invertebrate sampling, monitoring will also include:

- Fish observations;
- Site water quality;
- Stream condition;
- Aquatic and riparian edge plants; and
- Possible platypus and native water rat usage at site SH02.

The results of stream health monitoring will be interpreted in consideration of water quality, stream flow and rainfall data.

The outcomes of the annual stream health monitoring (i.e. two rounds of monitoring) are described in the Annual Review for the Moolarben Coal Complex.

6.4 CHANNEL STABILITY

Channel stability monitoring is undertaken annually on the Goulburn River, Bora Creek, Moolarben Creek, Murragamba Creek, Eastern Creek and Wilpinjong Creek to assess any impacts that may be attributed to mining at the Moolarben Coal Complex. Monitoring involves observational surveys including:

- Monitoring of locations on Bora Creek from the culvert of the rail loop and its confluence with Goulburn River;
- Monitoring of locations on Moolarben Creek upstream of Moolarben Dam;
- Monitoring of locations on Murragamba Creek upstream and downstream of OC4;
- Monitoring of locations on Eastern Creek downstream of OC4 (there are no upstream locations on Eastern Creek as there is no defined channel); and
- Monitoring of locations on Wilpinjong Creek upstream and downstream of OC4.

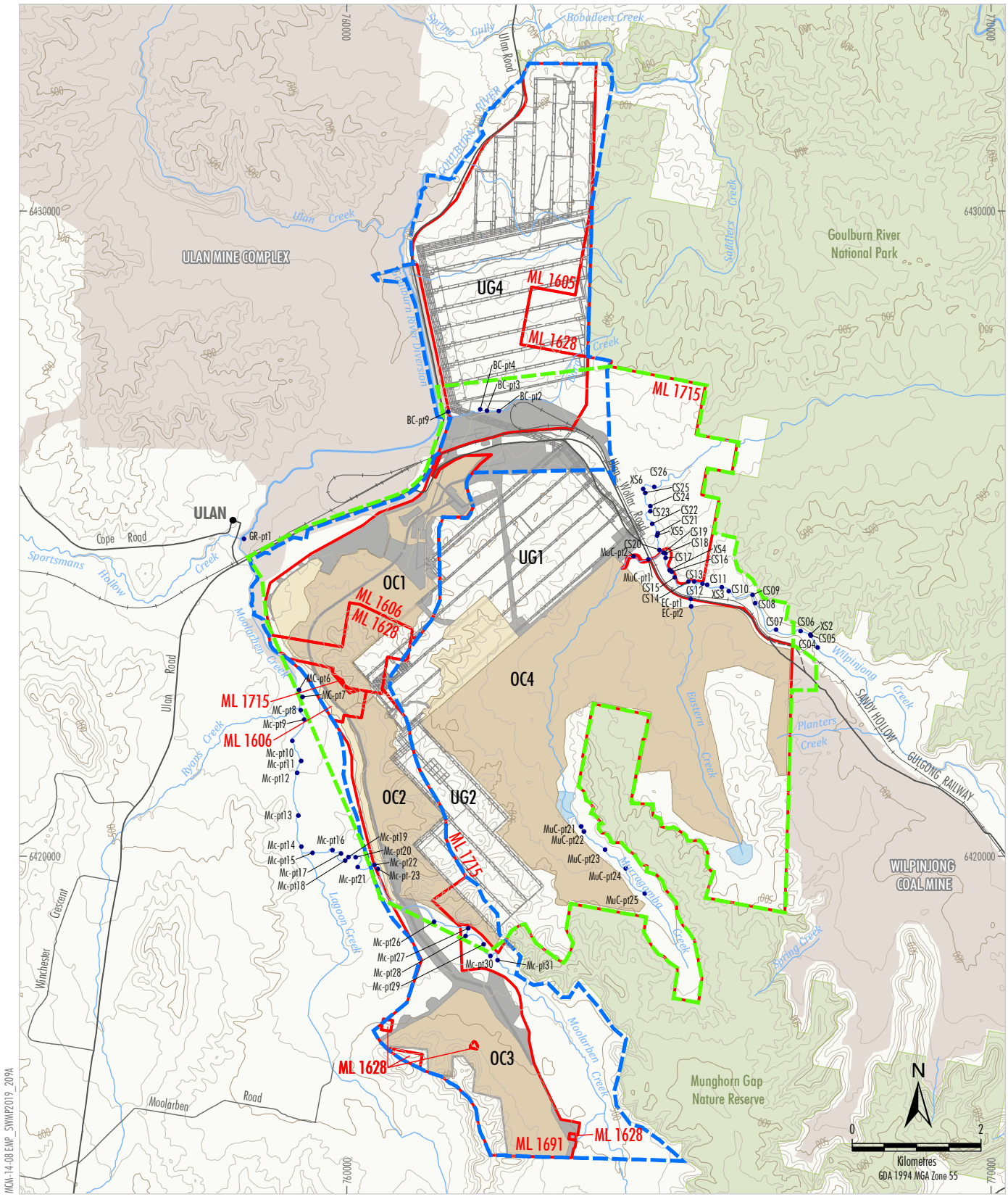
Ongoing channel stability monitoring locations are shown on Figure 12.

At each of the monitoring locations, the following will be undertaken on an annual basis or following significant flow (1:50 ARI) in the creek and may include:

- Documenting locations and dimensions of significant erosive or depositional features so that any subsequent changes can be evaluated;
- Establishing photographic points at representative locations, so that photos can be taken of multiple inspections in a repeatable manner;
- Written descriptions of the stream at each of the photographic points, focusing on evidence of erosion and exposed soils; and
- Cross sections at strategic locations.

Refer to Section 3.4.4 for details of the baseline channel stability monitoring.

The outcomes of the annual channel stability monitoring and implementation of any required actions are described in the Annual Review for the Moolarben Coal Complex.



LEGEND

- NSW National Parks and Wildlife Service
- Other Mining Operations
- Mining Lease Boundary

Existing/Approved Development

- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Clean Water Diversion Infrastructure
- Underground Longwall Layout
- Haul Road
- Road Realignment (not yet constructed)
- Approved Stage 1 Project Boundary
- Approved Stage 2 Project Boundary
- Channel Stability Monitoring Location

Source: MCO (June 2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

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Channel Stability Monitoring Locations

Figure 12

6.5 ON-SITE WATER MANAGEMENT

Water levels in the major surface water dams will be inspected weekly and recorded monthly and included in the site water balance. Major surface water dam structures will be visually inspected weekly by the area supervisor, and annually by a delegate of the Technical Services Manager to assess structural integrity and detect potential loss of seepage or leachate. Additional mitigation measures will be developed on a case by case basis where visual monitoring indicates that seepage losses from water and/or waste storages may be occurring.

Monitoring of the licensed discharge points (not including storm water discharge points or discharge from EPL Pt 1) will be undertaken monthly where used to assist in demonstrating the water quality complies with relevant EPL conditions prior to any discharge taking place. Monitoring of the major surface water storages will include the minimum parameters to be monitored shown in Table 20.

Table 20: Water Management Structures Monitoring Program

Site	Monitoring Frequency	Parameters
Licensed Discharge Points†	Monthly and prior to controlled discharge	pH, EC, TSS, O&G, TDS, Turbidity,
Other major water storages	Quarterly	pH, EC, TSS, TDS

† *Does not apply to storm water discharge points that are licensed to discharge when rainfall exceeds 44 mm over any consecutive five day period, or EPL Pt 1 from Water Treatment Facility.*

Leak detection is undertaken using flow meters at the inlet and outlet of the UCML water transfer pipelines. The differential flow is monitored through the CITECT system (monitored at the CHPP control room with alarms and SMS alerts to the CHPP Supervisor) and includes alarms and automatic pump shut-offs. The pipeline is inspected monthly. In the event that a leak or loss of flow is detected in the pipelines, pumping will cease and the cause will be investigated and remediated.

Field monitoring of sediment dams with EPL release limits (Discharge points 24, 26, 29, 31, 33, 35 and 51) as shown in Table 21 will be undertaken monthly if there is sufficient water to sample (note water quality criteria prescribed in EPL 12932 do not apply for sediment dams [i.e. storm water discharge points] that are licensed to discharge when rainfall exceeds 44 mm over any consecutive five day period).

Table 21: Discharge Monitoring Program

Pollutant†	Units of Measure	Frequency	Sampling Method
Discharge from EPL Licensed Discharge Point 1			
Conductivity (EC)	µS/cm	Continuous during discharge	Probe
Oil & Grease	mg/L	Weekly during any discharge	Grab Sample
pH	pH	Continuous during any discharge	Probe
TSS	mg/L	Weekly during any discharge	Grab Sample
Turbidity	NTU	Continuous during any discharge	Probe
Dissolved Al, Mn, Ni, Cu, Cd, As, Pb.	mg/L	Monthly during any discharge	Grab Sample
Discharge from EPL Licensed Discharge Points 2 and 28			
Conductivity (EC)	µS/cm	Continuous during discharge	Probe
Oil & Grease	mg/L	Weekly during any discharge	Grab Sample
pH	pH	Continuous during any discharge	Probe
TSS	mg/L	Weekly during any discharge	Grab Sample
Turbidity	NTU	Continuous during any discharge	Probe
Discharge from Effluent Discharge and Monitoring (EPL Points 5, 22, 23 and 48)			
Biochemical Oxygen Demand	mg/L	Quarterly	Grab Sample
Nitrogen (total)	mg/L	Quarterly	Grab Sample
Oil & Grease	mg/L	Quarterly	Grab Sample
pH	pH	Quarterly	Probe
Phosphorus (total)	mg/L	Quarterly	Grab Sample
TSS	mg/L	Quarterly	Grab Sample
Discharge from Licensed Discharge (EPL Points 24, 26, 29, 31, 33, 35 and 51)			
Oil & Grease	mg/L	Daily during any discharge	Grab Sample
pH	pH	Daily during any discharge	Grab Sample
TSS	mg/L	Daily during any discharge	Grab Sample
Turbidity	NTU	Daily during any discharge	Grab sample

† *Does not apply when the discharge occurs solely as a result of rainfall that exceeds 44 mm over any consecutive five day period.*

6.6 EPL MONITORING

MCO undertakes monitoring at a number of points in accordance with EPL 12932 (Figure 13). Table 21 summarises the parameters required to be monitored in accordance with EPL 12932.

Subject to any express provision to the contrary in the EPL, monitoring for the concentration of a pollutant discharged to waters or land must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

Condition M7.1 of EPL 12932 requires MCO to monitor discharge volumes continuously during discharge using a flow meter and continuous logger for Point 1. Continuous refers to the capture of relevant volume monitoring data for the duration of the frequency reporting period except during the following situations:

a) equipment breakdown;

b) power loss;

c) scheduled maintenance;

d) performance specification testing;

e) vandalism

MCO will notify the EPA when continuous monitoring equipment is unavailable for a period of time greater than 48 hours.

Monitoring as required by the EPL will be undertaken by the Environment and Community Coordinator or delegate.

MCM-14-08 EMP_SWMP2019_207A

Source: MCO, 2019
Orthophoto: MCO (Jan 2019)

LEGEND

Approved Stage 1 Boundary
Approved Stage 2 Boundary

EPA Monitoring Point

- EPA Monitoring No.1
- EPA Monitoring No.2
- EPA Monitoring No.5
- EPA Monitoring No.22
- EPA Monitoring No.23
- EPA Identification No.24
- EPA Identification No.26
- EPA Identification No.28
- EPA Identification No.29
- EPA Identification No.31
- EPA Identification No.33
- EPA Identification No.35
- EPA Identification No.48
- EPA Identification No.51

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EPA Indicative Monitoring Locations

Figure 13

6.7 SUBSIDENCE MONITORING

A Subsidence Monitoring Program was developed in consultation with DRG prior to the commencement of secondary workings in the underground areas (required as part of the development of an Extraction Plan). The monitoring of subsidence along ephemeral drainage lines forms part of this monitoring program. LW101-103 Extraction plan includes visual monitoring of Drainage Line 7 prior to and following extraction of LW103.

This SWMP will be reviewed and updated to incorporate subsidence monitoring requirements for surface water included in future extraction plans.

7.0 SURFACE WATER INVESTIGATION TRIGGER VALUES

Surface water investigation trigger values for surface water quality and stream health have been developed using statistical analysis of the baseline data (Section 3.4) and consideration of applicable post baseline data. Water quality and quantity criteria for discharges to receiving waters are set in the EPL.

Surface water, stream health and EPL discharge monitoring programs are discussed in Section 6.0, which includes a description of the monitoring site locations, the parameters monitored and the frequency of monitoring.

Trigger levels are designed as conservative measurements that identify the potential of a performance exceedance. The trigger level values allow for a timely response to the potential of a performance exceedance before an actual performance exceedance occurs. As the trigger levels are statistically derived from baseline data (e.g. based on an 80th percentile value from baseline data) it should be noted trigger exceedances will occur naturally; and hence an investigation is required following a trigger exceedance to determine whether or not a mine-derived impact has occurred.

Section 8.0 of this document provides a trigger action response plan including the trigger investigations, performance measure exceedance/incident notifications and responses.

Flow monitoring is discussed in Sections 3.3, 3.4.1, and 6, however trigger levels for flow are not required.

7.1 WATER QUALITY

The ANZECC & ARMCANZ (2000) guidelines recommend that wherever possible, site-specific data is used to define investigation trigger values for physical and chemical factors which can adversely impact the environment. Trigger values are not regarded as strict impact assessment criteria; rather they are proposed as indicators used to initiate investigations into the risk of potentially adverse effects from a change in surface water quality as reported by the monitoring program.

The approach recommended by ANZECC & ARMCANZ (2000) is to develop site-specific trigger values based on the 80th and 20th percentiles (where relevant) of site-specific monitoring data. The objective of this approach is to develop conservative, site-specific performance indicators for use as a means to improve water quality and ultimately enhanced aquatic ecosystems.

The default (low-risk) values defined by ANZECC (2000) for upland rivers in slightly to moderately disturbed ecosystems in south-east Australia are described in Table 22. These default trigger values will be implemented when: the 80th and 20th percentile trigger values lie within the ANZECC (2000) default trigger values.

Table 22: ANZECC (2000) Default Guideline Values for Key Water Quality Parameters

Water Quality Variable	Default Trigger Values
pH range	6.5 – 8.0
Electrical conductivity (µs/cm)	30 – 350
Turbidity (mg/L)	2 – 25

Comparison of the monitoring results to the ANZECC (2000) default trigger values contained in Table 22 indicates that the existing water quality in the creek systems surrounding the Moolarben Coal Complex have the potential to exceed the ANZECC (2000) default trigger values for pH, EC and turbidity for slightly to moderately disturbed upland river ecosystems.

The monitoring results also indicate that the ephemeral creeks record significantly higher EC levels than those recorded in flowing creeks. This can be attributed to salt accumulation following periods of no/low rainfall and run-off. These results demonstrate the variability of water quality in flow and non-flow conditions. The water quality data has been analysed to determine the trigger values for pH, EC and turbidity in the surrounding catchments at the Moolarben Coal Complex. The ANZECC (2000) guidelines recommend a percentile value equivalent to the 80th (or 20th) percentile of a reference data set, which should be calculated from a minimum of two (2) years of monthly data (i.e. 24 data points).

Trigger sites are located downstream of the Moolarben Coal Complex within the following three sub-catchment areas of the Moolarben Coal Complex:

- Moolarben Creek Catchment area, west of OC3, OC2 and OC1 – monitoring site SW05.
- Goulburn River Catchment area, north of UG4 – monitoring site SW01.
- Wilpinjong Creek Catchment area, east of OC4 and UG1 – monitoring site SW16.

Proposed trigger values for investigation of water quality at specific monitoring sites in Goulburn River, Moolarben Creek and Wilpinjong Creek have been based on the baseline water quality data and relevant release criteria for Ulan Coal Mine and MCO and are presented in Table 23. As the Goulburn River trigger monitoring site is downstream of the Ulan Coal Complex discharge, the proposed trigger value for investigation at the site is based on the Ulan Coal Mine EPL discharge criteria at the upstream Ulan Coal Mine EPL discharge location.

An investigation is triggered when a water quality indicator at a downstream receiving water monitoring location is above (or outside the range) of trigger investigation level for two consecutive monthly measurements.

Table 23: Surface Water Quality Investigation Trigger Levels

Monitoring Site	Waterway	pH		EC (µs/cm)		Turbidity (NTU)		Dissolved Metals (Al, As, Cd, Cu, Mn, Ni, Zn)
		20th/80th %ile Trigger Values	ANZECC Guideline	80th %ile Trigger Value	ANZECC Guideline	80th %ile Trigger Value	ANZECC Guideline	
SW01	Goulburn River	6.5 – 8.5	6.5 – 8.0	900*	350	11	25	As per Table 25b
SW05	Moolarben Creek	6.5 – 7.7**	6.5 – 8.0	1,000**	350	34	25	N/A
SW16	Wilpinjong Creek	6.5 – 7.4	6.5 – 8.0	714	350	ND	25	N/A

** EC trigger levels reflect approved discharge limits at the Ulan Mine Complex (Ulan's discharge points are located upstream of SW01)*
*** Based on a combination of field and lab data (time period: Feb 2003 – Aug 2016)*
Note: The shaded cells indicate the adopted water quality trigger level
ND = No data (i.e. less than 24 monitoring points)

In accordance with Condition 32A, Schedule 3 of Project Approval (05_0117), MCO will complete an Independent Water Quality Study by 1 December 2021 in accordance with the ANZECC Guidelines. The surface water quality trigger investigation levels will be reviewed, and if necessary revised, on the basis of the results of this study.

7.2 STREAM HEALTH

Trigger levels for site investigation for stream health have been developed using baseline data for indices. The trigger level for a specific stream health index score is one standard deviation below the mean baseline level index score (stream health index value above the mean index value is a sign of stream health improvement and is not considered a trigger for investigation). An investigation is triggered when a specific stream health score at a trigger site is more than one standard deviation below the baseline mean for two consecutive monitoring rounds. Further details on trigger action and response are described in Section 8.0. Stream health trigger values are provided in Table 24.

Trigger sites are located downstream of the Moolarben Coal Complex within the following three sub catchment areas of the Moolarben Coal Complex:

- Moolarben Creek Catchment area, west of OC3, OC2 and OC1 – monitoring site SH06.
- Goulburn River Catchment area, east of UG4 – monitoring site SH02.
- Wilpinjong Creek Catchment area, east of OC4 and UG1 – monitoring site SH17.

Table 24: Stream Health Monitoring Sites – Investigation Trigger levels

Site ID	Location of Site	Aquatic Macro Invertebrate Diversity Score	Pollution Tolerance Site SIGNAL scores
		Trigger Level	Trigger Level
SH02	Goulburn River reference site – located downstream of Bobadeen Creek confluence	16.9	3.8
SH06	Moolarben Creek monitoring site – located at bottom of Moolarben Creek, under road bridge	15.1	3.2
SH17	Wilpinjong Creek monitoring site – located downstream of OC4 and downstream of confluences with Murragamba Creek and Eastern Creek	8.4	3.1

7.3 LICENSED DISCHARGE AND DESIGN LIMITS

Condition L2.4 of EPL 12932 and Condition 32, Schedule 3 of Project Approval (05_0117) specify the licensed discharge limits for various water quality parameters. The discharge limits for the Moolarben Coal Complex are presented in Table 25a.

Note that for Discharge Points 24, 26, 29, 31, 33, 35 and 51 the TSS and NTU limits do not apply when the discharge occurs solely as a result of rainfall measured at the premises which exceeds a total of 44 mm of rainfall over any consecutive five day period. A 44 mm rainfall depth is defined by "*Managing Urban Stormwater: Soils and Construction*" (Landcom 2004) as the rainfall depth in millimetres for a 95th percentile five day rainfall event for the Central Tablelands consistent with the storage capacity (recommended minimum design criteria) for Type D sediment retention basins for mines and quarries (Vol 2E of Landcom 2004).

The EPA discharge points are shown on Figure 13. Note that in some cases a single EPL discharge point can relate to multiple dams. The EPL license, including discharge point locations, is revised from time to time with mine progression.

Table 25a: Discharge Limits

Pollutant	Units of Measure	100th %ile Concentration Limit
Discharge Point 1, 2 and 28		
Conductivity	µs/cm	685
Oil and grease	mg/L	10
pH	-	6.5 – 8.5
Total suspended solids	mg/L	50
Turbidity	NTU	25
Discharge Points 24, 26, 29, 31, 33, 35 and 51		
pH	-	6.5 – 8.5
Total suspended solids†	Mg/L	50
Turbidity†	NTU	25

†*Does not apply when the discharge occurs solely as a result of rainfall that exceeds 44 mm over any consecutive five day period.*

MCO is permitted under EPL 12932 to discharge water from licenced Discharge Point 1 to the Goulburn River catchment subject to meeting the EPL water quality criteria in Table 25a.

EPL 12932 and Project Approval (05_0117) permit a maximum discharge of 10ML/day from the Goulburn River Diversion discharge point (EPA ID 1), 15ML/day during mining operations in UG4, and the release of a combined volume greater than 15ML/day during prolonged wet periods following written approval from the EPA.

MCO is also permitted to allow stormwater discharge from additional locations under certain rainfall conditions or subject to meeting the EPL water criteria in Table 25a with no volumetric limits.

Monitoring undertaken in accordance with EPL 12932 is described in Section 6.6.

In addition to the above, MCO's design limits for dissolved metal concentrations (as identified by geochemistry test work) discharged via Discharge Point 1 are presented in Table 25b.

Table 25b: Discharge Point 1 Design Limits for Dissolved Metals

Pollutant	Unit of Measure	100th%ile Concentration Limit
Discharge Point 1		
Al	mg/L	0.14*
Mn	mg/L	1.9**
Ni	mg/L	0.011**
Cd	mg/L	0.0002**
Cu	mg/L	0.0014**
As	mg/L	0.013**
Pb	mg/L	0.0034**

** 80th percentile value from UMC SW01 used as it exceeds the default ANZECC Guideline value as per recommendations in the Environmental Assessment – Open Cut Optimisation Modification response to submissions dated May 2018.*
*** ANZECC Guideline default trigger values for freshwater (slightly to moderate disturbed ecosystems), 95% species protection.*

8.0 SURFACE WATER TRIGGER ACTION AND RESPONSE PLAN

The water management strategy for the Moolarben Coal Complex includes a protocol to respond to trigger events that, if unaddressed, could eventually lead to a non-compliance with the Project Approval or EPL requirements.

When a trigger level exceedance occurs the specific trigger exceedance response plan is initiated. Trigger action response plans for Water Quality, Stream Health and Discharge and Releases are detailed in Tables 26, 27 and 28 respectively.

Table 26: Surface Water Quality Trigger Action Response Plan

Performance Criteria	Trigger	Action – Trigger Exceedance	Response
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 (**Table 23**) at trigger monitoring location (**Table 23**). It is noted trigger levels are based on baseline data (e.g. 80th %ile) and as such baseline levels naturally exceed the triggers for a portion of the time.	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 and water quality is achieving the limits in Tables 25a and 25b. Consider discharge from Ulan[1]. 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 DPIE and other relevant agencies immediately. b. If not, notify DPIE and other relevant agencies as soon as practicable. 5. Notify DPIE and other relevant agencies if performance measures are exceeded as soon as practicable. 6. Complete Preliminary investigation report and provide to DPIE 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. Measures may include: • Temporarily cease discharges if contributing to trigger exceedances. • Review and if necessary, revise Monitoring Program. • Review and repair/replace water management infrastructure if required. • Review and revise if necessary SWMP and re-submit to DPIE.

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

[1] SW01 is downstream of Ulan Mine's discharge point and trigger exceedance events at SW01 can occur as a result of a discharge from Ulan.

Table 27: Stream Health Trigger Action Response Plan

Performance Criteria	Trigger	Action – Trigger Exceedance	Response
No significant adverse mining-related effects to downstream stream health (when compared to baseline and/or ANZECC limits).	Two consecutive Stream Health monitoring results below investigation trigger (**Table 24**) at trigger monitoring location (**Table 24).** It is noted trigger levels are based on baseline data (e.g. 80th %ile) and as such baseline levels naturally exceed the triggers for a portion of the time.	1. Check and validate data. 2. Notify ECM or delegate. 3. Aquatic ecologist to undertake investigation to confirm if investigation trigger exceedance is mining-related: a. Review stream health data relative to upstream stream health. b. Confirm if discharge has occurred in the previous 2 months prior to trigger. Consider discharge from Ulan[1]. c. Consider other relevant recent conditions, including climate, flow, water releases, land-use activities. d. Consider other relevant monitoring data, e.g. surface water quality and releases. e. If the aquatic ecologist 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 DPIE and other relevant agencies immediately. b. If not, notify DPIE and other relevant agencies as soon as practicable. 5. Notify DPIE and other relevant agencies if performance measures are exceeded as soon as practicable. 6. Complete Preliminary investigation report and provide to DPIE and relevant agencies within 7 days of identifying the incident.	Where mining related impacts are greater than approved, develop contingency and remedial measures based on investigation. Measures may include: • Suspend discharges if contributing to trigger exceedances. • Review and if necessary, revise Monitoring Program. • Review and repair/replace water management infrastructure if required. • Review and revise if necessary SWMP and re-submit to DPIE.

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

[1] SH02 is downstream of Ulan Mine's discharge point and trigger exceedance events at SW01 can occur as a result of a discharge from Ulan.

Table 28: Discharge and Other Releases Trigger Action Response Plan

Performance Criteria	Trigger	Action – Trigger Exceedance	Response
Authorised Releases			
Discharge in accordance with EPL release limits and design limits (quality and quantity).	Discharge of water outside EPL criteria (Quality [Table 25a] or Quantity) and design limits (Table 25b).	1. Suspend discharge as soon as possible and notify ECM or delegate. 2. Check and validate instrument calibration. 3. Notify DPIE, EPA and other relevant agencies immediately of becoming aware a water discharge outside EPL criteria. 4. Complete preliminary investigation report and provide to DPIE, EPA and relevant agencies within 7 days of identifying the discharge.	Develop contingency and remedial measures based on investigation. Measures may include: • Review and if necessary, revise Monitoring Program. • Review and if necessary, revise discharge procedures. • Review and repair/replace water management infrastructure if required. • Review and revise if necessary SWMP and re-submit to DPIE. • Implement reasonable and feasible remedial measures.
Other Releases			
Water storages operate as designed (design storage capacity).	Unauthorised water release.	1. Cease release as soon as possible and make safe. 2. Notify ECM or delegate. 3. If necessary, engage suitably qualified person. 4. If deemed necessary undertake a water quality monitoring program including, pH, EC and TSS upstream and downstream of release location. 5. Notify DPIE, EPA and other relevant agencies immediately of becoming aware if the release has caused or threatens to cause material harm to the environment. 6. Notify DPIE and other relevant agencies if performance measure is exceeded as soon as practicable. 7. Complete preliminary investigation report and provide to DPIE, EPA and relevant agencies within 7 days of identifying the release	Develop contingency and remedial measures based on investigation. Measures may include: • Review and if necessary, revise Monitoring Program. • Review and if necessary, revise water management system. • Review and repair/replace water management infrastructure if required. • Review and revise if necessary SWMP and re-submit to DPIE. • Implement reasonable and feasible remedial measures.

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

9.0 ANNUAL REVIEW AND PERFORMANCE IMPROVEMENT

Annual Review reporting, triggers for Water and Surface Water Management Plan review, and if necessary, revision, and other SWMP revision and development are described in Section 4 of the WAMP.

10.0 REPORTING SYSTEMS

Reporting, of incidents, complaints and non-compliances are described in Section 5.0 of the WAMP. Details of performance criteria exceedances for Water Quality, Stream Health and Discharge and Other Releases are detailed in Section 8.

11.0 REFERENCES

ANZECC (1994), *National Water Quality Management Strategy*, Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand.

ANZECC (2000), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand.

Department of Primary Industries (2013) *Policy and guidelines for fish habitat conservation and management*.

EMM (2013), Moolarben Coal Project Stage 1 Optimisation Modification Environmental Assessment, May 2013.

Hansen Bailey, HB (2012), *Moolarben Coal Project Stage 2 – Preferred Project Report*, January 2012.

Landcom (2004*), Managing Urban Stormwater – Soils and Construction – Fourth Edition*, March 2004, NSW Government

Moolarben Coal Operations Pty Ltd (2020) *Site Water Balance*.

Moolarben Coal Operations Pty Ltd (2019) *Rehabilitation Management Plan*.

NOW (2009), Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009.

NSW (2004). *Approved Methods for the Sampling and Analysis of Water Pollutant in NSW*. Department of Environment and Conservation and Environmental Protection Agency. ISBN 1-74137-051-5. Document reference DEC 2004/35. March 2004.

NSW Department of Environment and Climate Change, DECC (2008), *Managing Urban Stormwater – Soils and Construction – Volume 2E Mines and Quarries*, June 2008.

Worley Parsons (2011), *Concept Design for Proposed Diversions of Murragamba and Eastern Creeks*, May 2011.

Worley Parsons (2011), *Supplementary Surface Water Investigations including Water Balance Modelling, Moolarben Coal Project – Stage 2 Preferred Project*, August 2011.

Attachment 1: Ground Disturbance Permit

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ENV GDP.	-
Version No.	

Ground Disturbance Permit

This Permit applies to all ground disturbing works of vegetated areas undertaken by, or on behalf of MCO.
A separate Excavation Permit is required for approval to disturb UG services/power/communication lines etc.
This GDP must be completed & approved by the Environment & Community Delegate prior to any disturbance works taking place.

Section 1- Project Description *(Project Manager to complete)*

Project Manager: (Name and Role)		**Phone #**	
Brief description of works required and location (the Project):			
Estimated Project Dates	Start:	End:	

Has the Project Manager been trained in the GDP Procedure?	Yes	No	
Have the below been provided to E&C Dep't?			
Area of proposed disturbance (dxf, shp, tab, KML, GPX file)	Yes	No	Na
Progressive Works Schedule (sequence and extent of disturbance)	Yes	No	Na
Proposed location for storage of topsoil and cleared vegetation	Yes	No	Na
Erosion and Sediment Control Plan	Yes	No	Na
Has the area been clearly delineated (fenced, pegged or marked with tape)? *Work cannot commence until the approved area has been clearly delineated*	Yes	No	Na
Details (Name/Date)			

Section 2 - Assessments (Attach Reports if required) *(E&C to complete)*

Has a Preclearance Survey been carried out?	Yes	No	Na
Name/Date/Report			
Has an archaeological survey in accordance with section 5.8.2 of the HMP been carried out?	Yes	No	Na
Name/Date/Report			

Section 3 - Supporting Information (Attach Plans if required) *(E&C to complete)*

	Checked?	Date	Initial
Area of proposed disturbance			
Project Approval/ Disturbance Limit/MOP/ML/EL/BOA/Land Ownership boundaries			
Current land ownership (MCO, private, Crown, Easements, National Parks etc.)			
Location of any endangered species & protected vegetation communities (EEC)			
Location of heritage sites and management status (Archaeological & European)			
Location of any creeks or water bodies			

Section 4 - Approval Checklist *(E&C to complete)*

Are the proposed works within land owned or managed by MCO? *If No, attach Landowner Access Agreement*	Yes	No	
Does any agency or member of the public need to be considered or contacted?	Yes	No	N/A
Are the works within the Project Approval, EPL12932, ML, Approved MOP or EL boundary or Biodiversity Offset Area? *Circle each as relevant*	Yes	No	N/A
Approval Name/Date:			

Section 4 - Approval Checklist (Cont'd) *(E&C to complete)*

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Are the proposed works to be undertaken in accordance with an additional regulatory approval? *E.g. ESF4, Construction, Water Licence, MWRC approval*	Yes	No	
Approval Name/Date:			
Has a site inspection been completed by the E&C Department?	Yes	No	N/A
Name:	Date:		
Findings:			
Will the proposed works impact any of the following?: *(If yes, attach approval or management controls)*			
• Threatened species, endangered populations or an EEC	Yes	No	
• A regulated exclusion or buffer zone? E.g. National Park, Crown Land, infrastructure easements, rural licence etc.	Yes	No	
• Aboriginal Archaeological sites	Yes	No	
• European Heritage sites	Yes	No	
• Creeks or water bodies	Yes	No	
• MCO Biodiversity Offset or Conservation areas.	Yes	No	
• Potentially Contaminated Sites	Yes	No	
• Environmental monitoring sites	Yes	No	
• Rehabilitation	Yes	No	
• Other	Yes	No	
Comments:			

Section 5 - Disturbance Control Requirements *(E&C to complete)*

Erosion and Sediment Controls to be installed prior to disturbance?	Yes	No	N/A
Vegetation clearing to be undertaken in accordance with VCLMP/BioMP?	Yes	No	N/A
Works to be cleared progressively. Disturbance area to be minimised where possible?	Yes	No	N/A
Is removal of habitat trees and presence of a fauna-catcher required?	Yes	No	N/A
Tree hollows, woody debris and rock to be retained where possible?	Yes	No	N/A
Topsoil to be removed?	Yes	No	N/A
Topsoil Type 1: _____, Depth to remove: _____ mm, Stockpile Location: _____ Topsoil Type 2: _____, Depth to remove: _____ mm, Stockpile Location: _____			
Buffers required (E.g. heritage sites fenced)?	Yes	No	N/A
Rehabilitation works required? *(Detail type and timing below)*	Yes	No	N/A
Proposed Rehabilitation Completion Date:	__/__/____		N/A
Other Controls:			
NOTE 1: No heritage sites are to be disturbed. If Archaeological site(s) are discovered (Aboriginal or European) stop all works **immediately** and notify the Environment and Community Manager.			
NOTE 2: If injured Fauna is discovered stop all works **immediately** and notify the E&C Coordinator.			

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Section 6 - Approval *(Environment & Community Manager or Delegate to complete)*				
Version:	**Position:**	**Name:**	**Signature:**	**Date:**
1				
Section 7- Acceptance *(Project Manager to complete)*				
Version:	**Position:**	**Name:**	**Signature:**	**Date:**
1	**Project Manager**			

By signing the Acceptance, you will implement all conditions outlined in this GDP. Works outside the scope of this GDP require approval from the E&C delegate. The original GDP should be provided to the E&C Department on signing.

Section 8 - Variation Approval *(Environment & Community Manager or Delegate to complete)*				
Version:	**Variation Description:**	**Approved By:**	**Signature:**	**Date:**
2				
3				
4				
Section 9 - Variation Acceptance *(Project Manager to complete)*				
Version:	**Position:**	**Name:**	**Signature:**	**Date:**
2	**Project Manager**			
3				
4				

A copy of this GDP must be available on the job site at all times. All personnel involved in the job must be familiar with the GDP and attachments. An electronic, signed copy of the GDP is held on the Common Drive (U:).

Section 10 - Closure *(Project Manager to complete)*					
Version:	**GDP Inspection?**	**E&C Delegate:**	**Date:**	**Project Manager:**	**Date:**
ALL					