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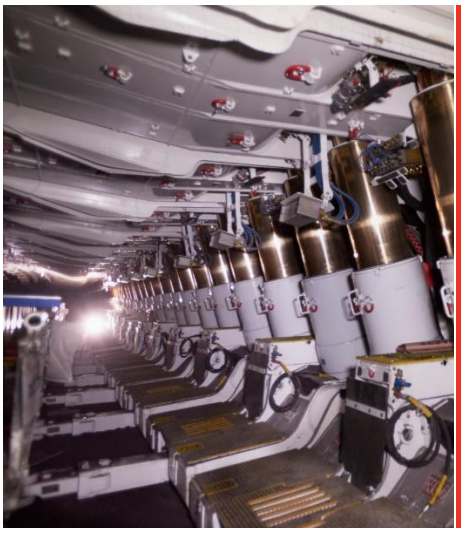

UG4 LONGWALLS 409 TO 414 BUILT FEATURES MANAGEMENT PLAN MID-WESTERN REGIONAL COUNCIL

Version	Issue Date *(Month/YYYY)*	Revision Detail *(Include the main areas reviewed, trigger / why the change)*	Author *(Name/s)*	Review Team *(Name/s)*
1	October 2024	Original BFMP for Mid-Western Regional Council Assets for the UG4 Longwalls 409-414 Extraction Plan	MCO	MCO
2	January 2025	Updated to Address Agency Consultation	MCO	MCO
3	April 2026	Updated to Address Agency Consultation	MCO	MCO

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1.0 INTRODUCTION

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

Moolarben Coal Operations Pty Ltd (MCO) is the operator of the Moolarben Coal Complex on behalf of the Moolarben Joint Venture. MCO is a wholly owned subsidiary of Yancoal Australia Limited.

The UG4 Underground Mine (UG4) is a component of the approved Moolarben Coal Complex (**Figure 2**). First workings for UG4 commenced in October 2020 (**Figure 3**). Secondary extraction in UG4 of the first Longwall (LW) 401 commenced in July 2022. LW401 to 407 were completed in January 2026. The extraction of LW409 to LW414 (hereafter referred to as LW409-414) within UG4 is scheduled to commence in September 2026.

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

1.1 PURPOSE AND SCOPE

This UG4 Longwalls 409 to 414 Built Features Management Plan – Mid-Western Regional Council (LW409-414 BFMP-MWRC) has been prepared to satisfy the requirements of Condition 77(g), Schedule 3 of Project Approval (05_0117) for the management of potential impacts to the Mid-Western Regional Council (MWRC) Infrastructure due to secondary extraction of LW409-414.

This LW409-414 BFMP-MWRC forms a part of the Extraction Plan developed for LW409-414 of the approved UG4. This LW409-414 BFMP-MWRC has been prepared by MCO, with input from Mine Subsidence Engineering Consultants (MSEC), to satisfy the requirements of Project Approval (05_0117) (as modified) and the *Extraction Plan Guideline* (NSW Department of Planning and Environment [DPE], 2022). The appointment of the team of suitably qualified and experienced persons (which includes representatives of MCO and MSEC) was endorsed by the Secretary of the Department of Planning, Housing and Infrastructure (DPHI) on 9 May 2024 (Attachment 2 of the Extraction Plan).

Purpose: This LW409-414 BFMP-MWRC outlines the management of potential subsidence impacts on the MWRC Infrastructure resulting from the extraction of LW409-414.

Scope: This LW409-414 BFMP-MWRC covers the section of Ulan Road within and in the vicinity of the LW409-414 Study Area[1] (**Figure 4**).

Saddlers Creek Road (which is managed by MWRC) is an unsealed dirt road that is undermined by the northern ends of LW412-414 (**Figure 4**). Impacts, predictions and management of the subsidence impacts on Saddlers Creek Road are discussed in a separate document (Appendix E2 of the Extraction Plan).

[1] The LW409-414 Study Area is defined as the area of land within the furthest extent of the 26.5 degree (°) angle of draw and 20 millimetres (mm) predicted subsidence contour.

Figure 1: Regional Location

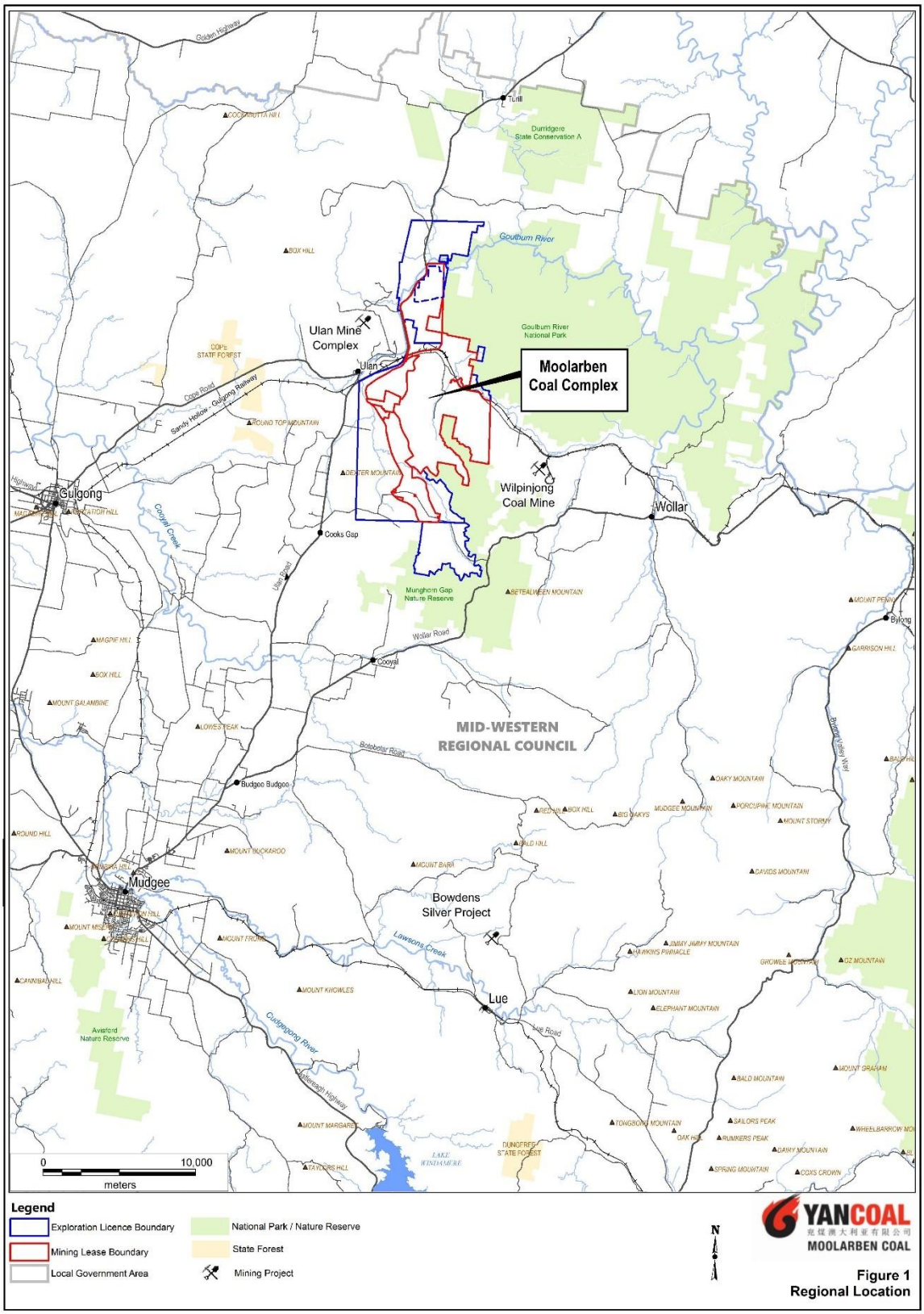

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Figure 2: Moolarben Coal Complex Layout

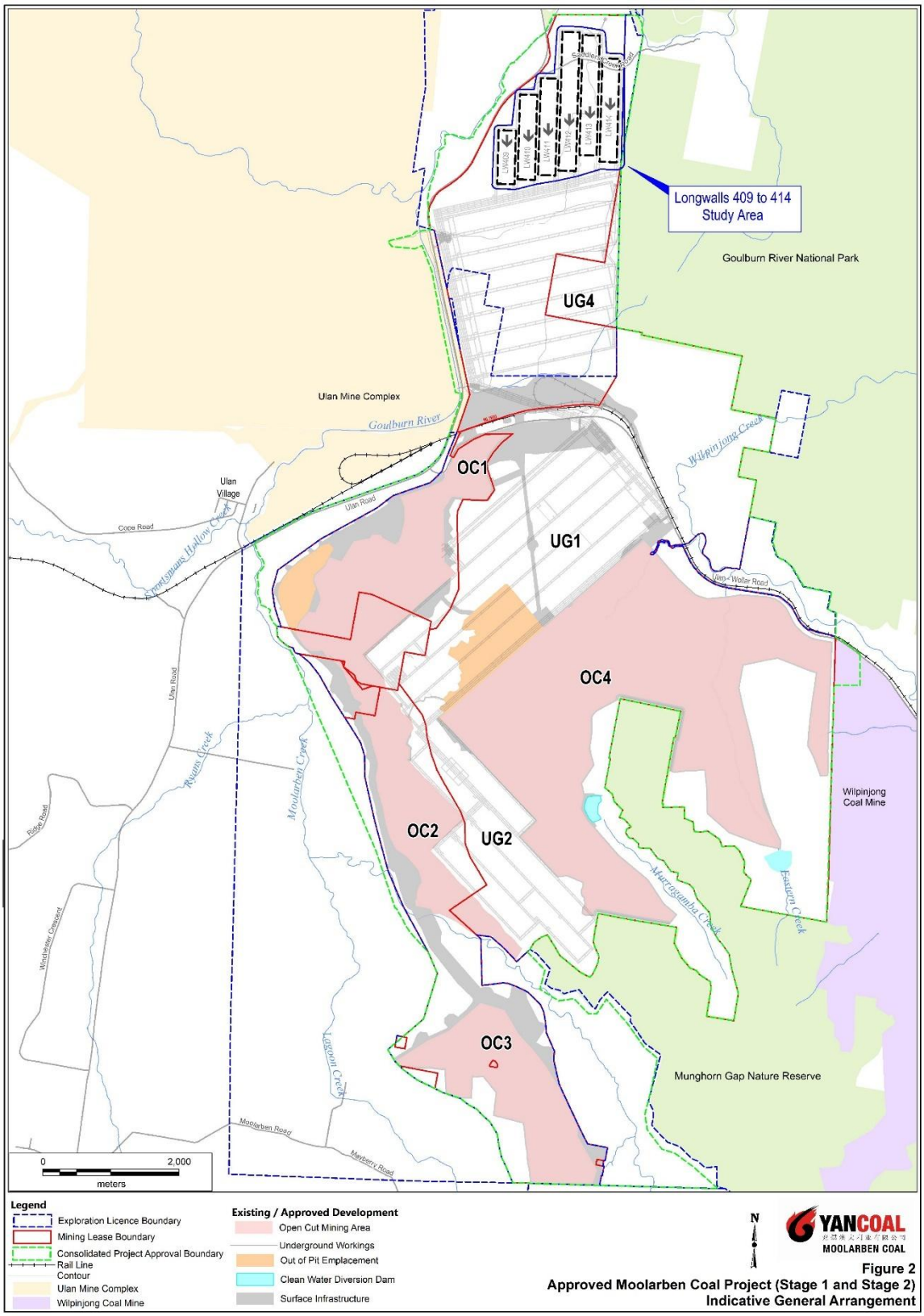


Figure 3: UG4 Longwalls 409 to 414 Layout

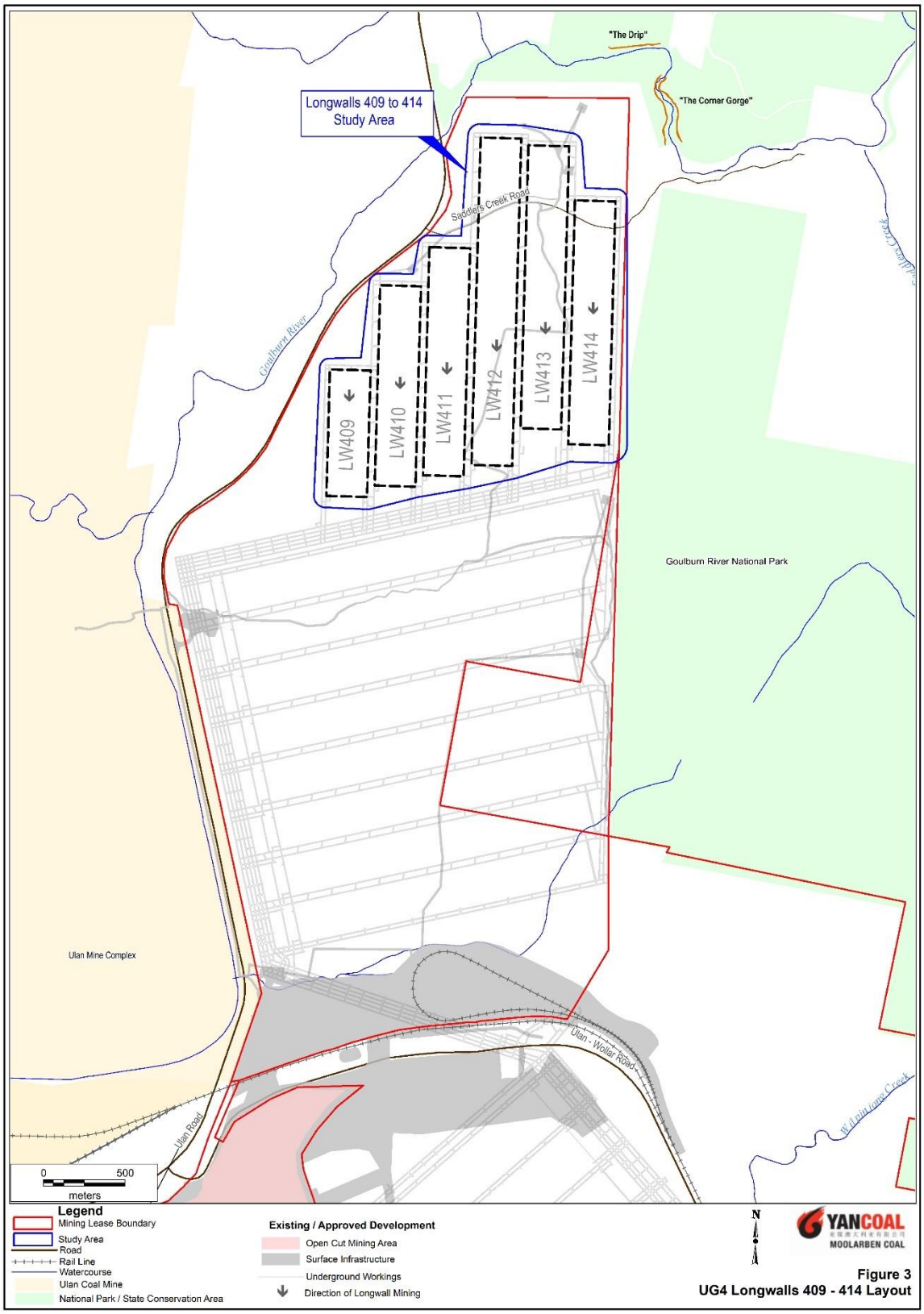
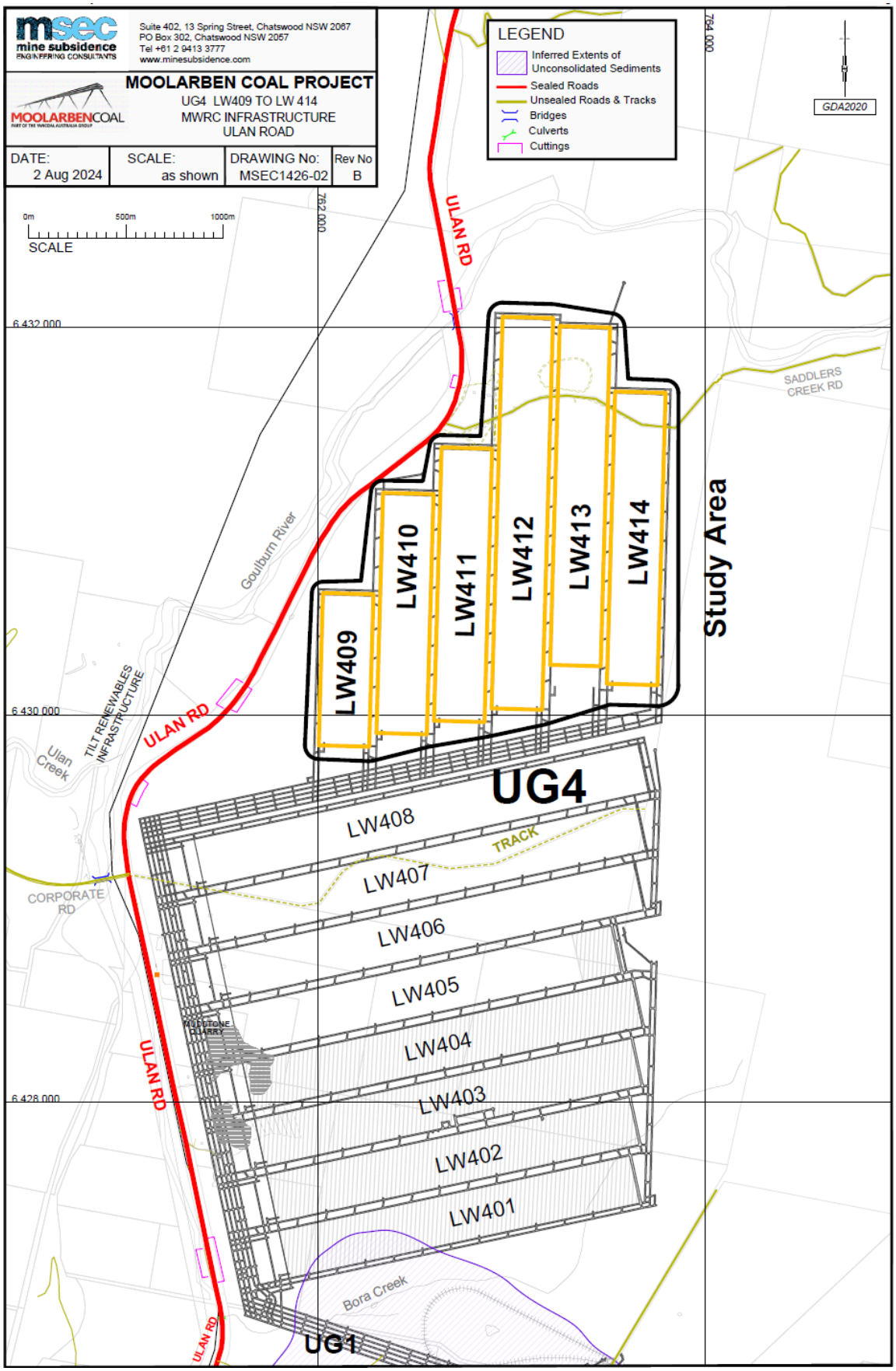


Figure 4: MWRC Assets



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1.2 STRUCTURE OF THE LONGWALLS 409 TO 414 BUILT FEATURES MANAGEMENT PLAN – MID-WESTERN REGIONAL COUNCIL

The remainder of the LW409-414 BFMP-MWRC is structured as follows:

Section 2: Describes the review and update of the LW409-414 BFMP-MWRC.

Section 3: Outlines the statutory requirements applicable to the LW409-414 BFMP-MWRC.

Section 4: Provides baseline data, extraction schedule, revised assessment of the potential subsidence impacts and environmental consequences for LW409-414, as well as the outcomes of the risk assessment.

Section 5: Details the performance measures relevant to MWRC assets.

Section 6: Describes the monitoring program.

Section 7: Describes the management measures that will be implemented.

Section 8: Details the performance indicators that will be used to assess against the performance measures.

Section 9: Provides a contingency plan to manage any unpredicted impacts and their consequences.

Section 10: Describes the Trigger Action Response Plan (TARP) management tool.

Section 11: Describes the roles and responsibilities for MCO personnel and key contacts.

Section 12: Describes the Annual Review, audits, regular reporting, improvement of environmental performance and the program to collect sufficient baseline data for future Extraction Plans.

Section 13: Outlines the management and reporting of incidents.

Section 14: Outlines the management and reporting of complaints.

Section 15: Outlines the management and reporting of non-compliances with statutory requirements.

Section 16: Lists the references cited in this LW409-414 BFMP-MWRC.

2.0 LONGWALLS 409 TO 414 BUILT FEATURES MANAGEMENT PLAN – MID-WESTERN REGIONAL COUCIL REVIEW AND UPDATE

In accordance with Condition 5, Schedule 5 of Project Approval (05_0117), this LW409-414 BFMP-MWRC will be reviewed as follows:

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

2.1 ACCESS TO INFORMATION

In accordance with Condition 11, Schedule 5 of Project Approval (05_0117), MCO will make the approved LW409-414 BFMP-MWRC publicly available on the Yancoal's website.

3.0 STATUTORY REQUIREMENTS

MCO's statutory obligations are contained in:

- the conditions of the Project Approval (05_0117) (as modified);
- the conditions of Commonwealth Approvals (EPBC 2007/3297, EPBC 2013/6926, EPBC 2008/4444 and EPBC 2017/7974);
- relevant licences and permits, including conditions attached to the Environment Protection Licence No. 12932 and mining leases (MLs) (i.e. ML 1605, ML 1606, ML 1628, ML 1691 and ML 1715); and
- other relevant legislation.

Obligations relevant to this LW409-414 BFMP-MWRC are described below.

3.1 ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979 PROJECT APPROVAL

Condition 77(g), Schedule 3 of Project Approval (05_0117), requires the preparation of a Built Features Management Plan as a component of the Extraction Plan. In addition, Conditions 75, 77(n), 77(p) and 78, Schedule 3 and Condition 3, Schedule 5 of Project Approval (05_0117) outline general management plan requirements that are applicable to the preparation of this LW409-414 BFMP-MWRC.

Table 1 presents these requirements and indicates where they are addressed within this LW409-414 BFMP-MWRC.

Table 1: Management Plan Requirements

Project Approval (05_0117) Condition	LW409-414 BFMP-MWRC Section
Condition 75, Schedule 3	
Notes: ... • *The Proponent will be required to define more detailed performance indicators for each of these performance measures in Built Features Management Plans or Public Safety Management Plan (see condition 74 below).* • *Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.* ... • *Requirements under this condition may be met by measures undertaken in accordance with the Mine Subsidence Compensation Act 1961.* ...	**Section 8** **Section 6** **Section 9**
Condition 77(g), Schedule 3	
(g) include a Built Features Management Plan, which has been prepared in consultation with Resources Regulator and the owners of affected public infrastructure, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which: • *addresses in appropriate detail all items of key public infrastructure and other public infrastructure and all classes of other built features;* • *has been prepared following appropriate consultation with the owner/s of potentially affected feature/s;* • *recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and* • *in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO 31000 (or alternative standard agreed with the infrastructure owner) and provides for annual auditing of compliance and effectiveness during extraction of longwalls which may impact the infrastructure;*	**Section 4.1** **Section 1.2** **Sections 7 & 9** **Section 12.1**
Condition 77(n), Schedule 3	
(n) include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 18 and 19, or where any such exceedance appears likely;.	**Section 9**
Condition 77(p), Schedule 3	
(p) include a program to collect sufficient baseline data for future Extraction Plans.	**Section 12.3**
Condition 78, Schedule 3	
78. The Proponent shall ensure that the management plans required under conditions 77(g)-(l) above include: *a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval; and* *b) a detailed description of the measures that would be implemented to remediate predicted impacts.*	**Section 4** **Section 7**

Table 1 (Continued): Management Plan Requirements

Project Approval (05_0117) Condition	LW409-414 BFMP-MWRC Section
Condition 3, Schedule 5	
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 4.1**
b) a description of:	
• *the relevant statutory requirements (including any relevant approval, licence or lease conditions);*	**Section 3**
• *the 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 8**
c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	**Sections 7 & 9**
d) a program to monitor and report on the:	**Sections 6, 8 & 12**
• *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 9**
f) a program to investigate and implement ways to improve the environmental performance of the project over time;	**Sections 6 & 12**
g) a protocol for managing and reporting any:	
• *incidents;*	**Section 13**
• *complaints;*	**Section 14**
• *non-compliances with statutory requirements; and*	**Section 15**
• *exceedances of the impact assessment criteria and/or performance criteria; and*	**Section 9**
h) a protocol for periodic review of the plan.	**Section 2**

3.2 OTHER LEGISLATION

MCO operates the Moolarben Coal Complex consistent with Project Approval (05_0117) (as modified) and Project Approval (08_0135) (as modified) and any other legislation that is applicable under the *Environmental Planning and Assessment Act 1979*.

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

- *Crown Land Management Act 2016;*
- *Fisheries Management Act 1994;*
- *Heritage Act 1977;*
- *Coal Mine Subsidence Compensation Act 2017;*
- *Mining Act 1992;*
- *National Parks and Wildlife Act 1974;*
- *Biodiversity Conservation Act 2016;*
- *Protection of the Environment Operations Act 1997;*
- *Roads Act 1993;*
- *Water Act 1912;*
- *Water Management Act 2000;*
- *Work Health and Safety Act 2011;* and
- *Work Health and Safety (Mines and Petroleum Sites) Act 2013.*

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

4.0 MID-WESTERN REGIONAL COUNCIL INFRASTRUCTURE

4.1 BASELINE DATA

Roads and other assets owned and/or maintained by MWRC in the vicinity of LW409-414 includes (**Figure 4**):

- Saddlers Creek Road (which is managed by MWRC); and
- Ulan Road, including the Ulan Road Bridge (over the Goulburn River).

The MWRC also owns infrastructure associated with these roads, such as the road pavement, embankments, tunnels and culverts.

Ulan Road is a sealed bitumen pavement with no kerb and gutter. The road passes along the north western side of LW409-412 and is 65 metres (m) from the commencing end of LW410 at its nearest point, which equates to approximately 0.5 times the depth of cover at this location. The road is wholly outside the Study Area. Features along the road include three cuttings in sandstone with approximate heights up to 3 m at 400 m west of LW409, 2 m at 175 m west of LW412, and 5 m at 250 m north west of LW412. Culverts beneath Ulan Road are typically 400 mm to 800 mm diameter concrete pipes.

The Ulan Road Bridge (over the Goulburn River) is 210 m from LW412 at its nearest point. The Ulan Road Bridge (over the Goulburn River) comprises a two span structure on concrete abutments, with a central headstock supported on three cast piers. The Ulan Road Bridge (over the Goulburn River) is approximately 33 m long, 10 m wide and the pavement surface is approximately 7 m above the bed of the Goulburn River.

Impacts, predictions and management of the subsidence impacts on Saddlers Creek Road are discussed in a separate document (Appendix E2 of the Extraction Plan).

4.2 LONGWALLS 409 TO 414 EXTRACTION SCHEDULE

LW409-414 and the area of land within the Study Area are shown on **Figure 3**. Longwall extraction will occur from the north to the south for each panel. The longwall layout includes approximately 260 m panel widths (void) with 35 m width pillars (solid). The provisional extraction schedule for LW409-414 is provided in **Table 2**.

Table 2: Provisional Extraction Schedule

Longwall	Estimated Start Date	Estimated Duration (months)	Estimated Completion Date
LW409	September 2026	3	November 2026
LW410	December 2026	3	March 2027
LW411	April 2027	3	July 2027
LW412	August 2027	4	December 2027
LW413	January 2028	4	May 2028
LW414	June 2028	4	September 2028

Note: In June 2026, the extraction timing was administratively updated to ensure consistency with the approved June versions of the LW409-414 Water Management Plan and LW409-414 Subsidence Monitoring Program. This update does not otherwise amend the approved April version of this Plan.

4.3 REVISED SUBSIDENCE AND IMPACT PREDICTIONS

Revised Subsidence predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings have been prepared by MSEC (2024), incorporating any relevant information obtained since approval (e.g. additional data from underground mining in UG1 and LW401-408 to date), in accordance with Condition 77(e), Schedule 3 of Project Approval (05_0117).

The LW409-414 BFMP-MWRC has incorporated the subsidence predictions and impacts as described below, in **Attachment 1** and **Technical Report 1** of the Extraction Plan.

A summary of the subsidence impacts and predictions (MSEC, 2024) is provided below:

- The minimum distances to Ulan Road occur at the north west corners of LW409 (130 m), LW410 (65 m), and LW411 (75 m) due to the staggered location of these longwalls. The majority of the road is greater than 200 m from LW409-414. There is the potential for measurable ground strains to occur along the sections of Ulan Road nearest to the LWs, particularly those sections within 100 m of the extracted LWs, however the risk of adverse impacts to the road and culverts is considered to be low.
- The Ulan Road Bridge (over the Goulburn River) is located 210 m from LW412. The maximum expected horizontal movements at this distance is 75 mm.
- Minor movements within the bridge structure are expected at this distance however the potential for significant differential movement within the bridge structure elements is considered to be low. Based on a ground strain of 0.6 mm/m and span lengths of approximately 15 m, it is recommended that potential differential movement (longitudinal and transverse) of 10 mm between span supports is adopted.
- The Ulan Road cuttings are located 175 m or more from the nearest longwall. The cuttings south of the Ulan Road Bridge (over the Goulburn River) are formed as gentle batters in weathered sandstone, away from the road pavement and show significant erosion. The cuttings immediately to the north of the Ulan Road Bridge (over the Goulburn River) are steeper and closer to the road pavement. The maximum expected horizontal movements at this distance is 75 mm. The 95 % confidence levels for the maximum total strains observed at UG4 LW409-414 at 175 m from extracted goaf are 0.6 mm/m tensile and 0.3 mm/m compressive. At these magnitudes of horizontal movement and strain, adverse impacts to the cuttings are considered unlikely to occur.

It is expected that potential impacts on the MWRC infrastructure can be managed with the implementation of suitable monitoring and management strategies. (**Sections 6** and **7**).

4.4 RISK ASSESSMENT

In accordance with the *Extraction Plan Guideline* (DPE, 2022), potential risks and potential risk control measures and procedures have been considered for the MWRC infrastructure in the vicinity of LW409-414. The risk assessment for MWRC assets was completed on 1 May 2024.

Attendees at the risk assessment meeting included representatives from MCO (including the Underground Technical Services Manager and Environment and Community Manager), MSEC and a risk assessment facilitator (AXYS Consulting Pty Ltd).

The proposed risk control measures and procedures have been incorporated where relevant in this LW409-414 BFMP-MWRC and the program for implementation is summarised in **Table 3**.

MCO considers all risk control measures and procedures to be feasible to manage all identified risks.

Table 3: Program for Implementation of Proposed Risk Control Measures and Procedures

	Risk Control Measure / Procedure	LW409-414 BFMP-MWRC Section	Proposed Timing
Baseline Data / Validation			
1	Carry out a baseline visual inspection of the Ulan Road surface, culverts, bridge and cuttings within 400 m of LW409-414.	**Section 6.2**	Prior to commencement of secondary extraction of LW409
2	Provide MWRC with a copy of the visual inspection of the Ulan Road cuttings and culverts once carried out.	**Section 6.2**	Prior to commencement of secondary extraction of LW409
3	In consultation with MWRC review the design of the new Ulan Road Bridge (over the Goulburn River) against the LW409-414 subsidence predictions.	**Section 6.1**	Prior to commencement of secondary extraction of LW409
4	Installation of UG4 subsidence effect monitoring line and commencement of the subsidence monitoring program for LW409-414	**Section 6.1**	Prior to commencement of secondary extraction of LW409
Management / Monitoring / Response Measures			
5	Include in the TARP triggers for conditions that may need to be actioned by MCO and/or MWRC.	**Section 10** and **Attachment 1**	Complete
6	Undertake a visual assessment of Ulan Road surface, culverts, bridge and cuttings within 400 m of LW409-414 and compare to the baseline condition.	**Section 7**	Within 1 month of first 300 m of secondary extraction of each LW409-412.

5.0 PERFORMANCE MEASURES

The performance measures specified in Table 15, Schedule 3 of Project Approval (05_0117) relevant to Ulan Road, as a built feature, are listed in **Table 4**.

Table 4: Built Features Subsidence Impact Performance Measures

Feature	Subsidence Impact Performance Measure
Other infrastructure:	
Roads	Safe, serviceable and repairable unless the owner agrees otherwise in writing.

Note: Requirements regarding safety or serviceability do not prevent preventative or mitigatory actions being taken prior to or during mining in order to achieve or maintain these outcomes.

Source: Table 15 in Schedule 3 of Project Approval (05_0117).

In accordance with Condition 75, Schedule 3 of Project Approval (05_0117), MCO must ensure that there is no exceedance of the performance measures listed in Table 15, Schedule 3 of Project Approval (05_0117), to the satisfaction of the Secretary of the DPHI.

Section 6 outlines the monitoring that will be undertaken to assess the impact of LW409-414 against the performance measures in relation to the Ulan Road. Management measures for the Ulan Road are outlined in **Section 7** and performance indicators for the performance measures are summarised in **Section 8**.

6.0 MONITORING

A monitoring program will be developed in order to monitor the impacts of the extraction of LW409-414 on Ulan Road to identify unsafe conditions or loss of serviceability during or after mining. Key components of the monitoring program are summarised in **Table 5**.

The frequency of monitoring will be reviewed either:

- in accordance with the Annual Review; or
- if monitoring determines there has been no impact to MWRC Infrastructure and/or no exceedance of the performance measures listed in **Table 5**, MCO in consultation with MWRC will review the frequency of this monitoring component; or
- if triggered as a component of the Contingency Plan as outlined in **Section 9** of this LW409-414 BFMP-MWRC.

6.1 SUBSIDENCE PARAMETERS

Subsidence parameters measured by a survey line ('U Line') (i.e. Easting, Northing, vertical subsidence, tilt, tensile strain, compressive strain and compressive strain) associated with mining will be measured in accordance with the UG4 Longwalls 409 to 414 Subsidence Monitoring Program (LW409-414 SMP).

In summary, surveys will be conducted to measure subsidence movements in three dimensions using a total station survey instrument. Subsidence movements (i.e. Easting, Northing, vertical subsidence, tilt, tensile strain, compressive strain and compressive strain) will be measured along subsidence lines that have been positioned across the general landscape.

Monitoring of subsidence parameters specific to Ulan Road will be measured by a single survey line ('U Line'). Surveys along the 'U Line' will be undertaken prior to extraction of LW409 and within 1 month of the first 300 m of secondary extraction of each of LW409-412.

Unless otherwise agreed with MWRC, inspection sheets detailing the outcome of the subsidence impact monitoring program will be provided to MWRC following confirmation of the results.

6.2 SUBSIDENCE IMPACTS

A baseline visual inspection of Ulan Road will be conducted prior to commencement of LW409 to establish the condition of the section roadway cuttings and pipes/culverts within 400 m of LW409-414.

The visual inspection will be conducted by MCO and include recording the condition of existing cuttings and pipes/culverts.

A copy of the visual inspection report will be provided to MWRC.

In the event monitoring identifies ground movement greater than the predicted subsidence monitoring parameters for LW409-414 and those predictions described in **Section 4.3,** MCO will undertake an inspection of the road for any potential impacts caused by subsidence movements. Opportunistic observations of subsidence impacts will be conducted during routine works by MCO (and its contractors) and MWRC's routine road condition inspections.

Table 5: Ulan Road Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Pre-mining			
Ulan Road – Visual inspection within 400 m of LW409-414.	Condition of road surface, culverts, bridge and cuttings.	Prior to secondary extraction of LW409.	Underground Technical Services Manager.
UG4 subsidence monitoring lines, as described in the LW409-414 SMP.	Installation of survey monitoring program and initial ground survey ('U Line'). Monitoring parameters include: • Easting; • Northing; • Vertical Subsidence; • Tilt; • Tensile Strain; and • Compressive Strain.	Prior to secondary extraction of LW409.	Underground Technical Services Manager.
UG4 subsidence monitoring points on the Ulan Road Bridge (over the Goulburn River), as described in the LW409-414 SMP.	Installation of survey monitoring points and initial ground survey on the Ulan Road Bridge (over the Goulburn River). Monitoring parameters include: • Easting; • Northing; • Vertical Subsidence; • Tilt; • Tensile Strain; and • Compressive Strain.	Prior to secondary extraction of LW409.	Underground Technical Services Manager.
Review of the Ulan Road Bridge (over the Goulburn River) baseline condition by a structural engineer in consultation with MWRC.	Condition of bridge structure, abutments, and road surface.	Prior to secondary extraction of LW409.	Underground Technical Services Manager.

Table 5 (Continued): Ulan Road Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
During and After Mining			
Ulan Road – Visual inspection within 400 m of LW409-414	Condition of road surface, culverts, bridge and cuttings to compare against the baseline condition.	Within 1 month of the first 300 m of secondary extraction of each of LW409-412.	Underground Technical Services Manager.
UG4 subsidence monitoring lines, as described in the LW409-414 SMP.	Survey monitoring program for subsidence parameters measured along the 'U Line', including: • Easting; • Northing; • vertical Subsidence; • Tilt; • Tensile Strain; and • Compressive Strain.	Within 1 month of the first 300 m of secondary extraction of each of LW409-412. Provide a copy of the results of the subsidence parameters measured along the 'U Line' to MWRC upon request or exceedance of subsidence predictions *(unless otherwise agreed to by MWRC).*	Underground Technical Services Manager.
UG4 subsidence monitoring points, as described in the LW409-414 SMP.	Survey monitoring program for subsidence parameters measured on the Ulan Road Bridge (over the Goulburn River), including: • Easting; • Northing; • Vertical Subsidence; • Tilt; • Tensile Strain; and • Compressive Strain.	Within 1 month of the first 300 m of secondary extraction of LW412. Provide a copy of the results of the subsidence parameters measured along the Ulan Road Bridge (over the Goulburn River) *(unless otherwise agreed to by MWRC).*	Underground Technical Services Manager.

Table 5 (Continued): Ulan Road Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Ulan Road – Subsidence impact inspection within 400 m of LW409-414.	Subsidence impact inspections will target the identification of: • impacts to the surface including cracks, buckling and stepping; • impacts to the visible surfaces of pipes/culverts including cracking, buckling, shearing, and collapse; • impacts to the bridge including cracking, buckling, shearing and collapse. • impacts to road cuttings including slope failure, rock falls and pavement impacts; and • visible impacts to furniture.	If ground surveys identify an exceedance of the predicted subsidence monitoring parameters measured along the 'U Line' or at Ulan Road Bridge. Opportunistic visual observations during routine works by MCO (and its contractors). At any time in case of an emergency and requested by MWRC.	Underground Technical Services Manager.
		Routinely as per MWRC inspections.	MWRC.
Review of the Ulan Road Bridge (over the Goulburn River) by a structural engineer in consultation with MWRC.	Condition of bridge structure, abutments, and road surface.	At the completion of LW412. If ground surveys identify an exceedance of the predicted subsidence monitoring parameters measured along the Ulan Road Bridge monitoring points. At any time in case of an emergency and requested by MWRC.	Underground Technical Services Manager.

Note: Copies of results of the visual inspections and survey monitoring program will be provided to MWRC (unless otherwise agreed to by MWRC).

MCO and MWRC will compare the results of the subsidence impact monitoring against the built features performance measure and indicators (**Sections 5** and **8**). In the event the observed subsidence impacts from LW409-414 exceed the performance measure or indicators, MCO and MWRC will assess the consequences of the exceedance in accordance with the Contingency Plan described in **Section 9**.

7.0 MANAGEMENT MEASURES

The potential management measures in relation to the Ulan Road pavement include:

- mill and/or replace pavement layers; and
- crack sealing/repair.

In the event that repairs are required, traffic control measures such as contra-flow of traffic or partial carriageway closures may be used to divert traffic off one carriageway, lane or shoulder. Repairs would be carried out as soon as practicable in consultation with the MWRC.

The potential management measures in relation to drainage structures (pipes/culverts) and cuttings include:

- point repairs;
- replace sections of pipe/culvert;
- grouting/sealing of cracks; and
- stabilise road cuttings and complete necessary repairs.

The potential management measures in relation to guard rails, marker posts and signage include repairs and/or replacement of furniture. Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.

Any required management measures for the Ulan Road Bridge (over the Goulburn River) will be determined in consultation with a structural engineer.

A summary of management measures (if required) will be reported in the Annual Review. Key management actions and timing is summarised in **Table 6**.

Table 6: Ulan Road Key Management Actions

Management Measure	Timing/Frequency	Responsibility
Pre-mining		
Notification to MWRC prior to commencement of secondary extraction.	Prior to secondary extraction of LW409.	Underground Technical Services Manager.
Visual inspection and record (baseline) of Ulan Road surface, culverts, bridge and cuttings.	Prior to secondary extraction of LW409.	Underground Technical Services Manager
Implement recommended management measures from structural engineer review of baseline condition of Ulan Road Bridge (over the Goulburn River).	Prior to secondary extraction of LW412.	Underground Technical Services Manager.
During Mining		
Visual inspection and record of Ulan Road surface, culverts, bridge and cuttings.	If ground surveys identify an exceedance of the predicted subsidence monitoring parameters measured along the 'U Line' or at the Ulan Road Bridge monitoring points.	Underground Technical Services Manager
Notification to MWRC during longwall mining of LW409-414.	If ground surveys identify an exceedance of the predicted subsidence monitoring parameters measured along the 'U Line' or at the Ulan Road Bridge monitoring points. If visual monitoring detects subsidence related impacts.	Underground Technical Services Manager.
Provision of **inspection sheets** detailing the outcome of the subsidence impact monitoring program to MWRC (unless otherwise agreed with MWRC).	Following exceedance of the predicted subsidence monitoring parameters and/or subsidence related impact inspections.	Underground Technical Services Manager.
Implement TARP (**Attachment 2**).	During LW409-414 extraction.	Underground Technical Services Manager.
Post-mining		
Notification to MWRC to inform longwall mining of LW409-414 is completed.	Following completion of secondary extraction LW414.	Underground Technical Services Manager.

8.0 ASSESSMENT OF PERFORMANCE INDICATORS AND MEASURES

In accordance with Condition 77(d), Schedule 3 of Project Approval (05_0117), performance indicators have been developed for the performance measures listed in **Table 4** (**Section 5**).

The performance indicators proposed to ensure that the performance measures for Ulan Road and the Ulan Road Bridge (over the Goulburn River) in relation to subsidence induced far-field movements are achieved include:

- Ulan Road: Maintain Ulan Road and cuttings in a safe and serviceable manner.
- Ulan Road drainage structures: No joint displacement or cracking or other defects of the drainage structure (e.g. pipes/culverts) in excess of 5 mm (when compared against baseline condition) due to LW409-414 mining.
- Ulan Road Bridge (over the Goulburn River): No potential differential movements between span supports in excess of 10 mm (when compared against baseline condition) due to LW409-414 mining.

Monitoring conducted to inform the assessment of secondary extraction of LW409-414 against the performance indicators (for the performance measures relevant to the Ulan Road and Ulan Road Bridge [over the Goulburn River] as a built feature) is outlined in **Section 6**.

Assessment of monitoring results against the performance indicators and performance measure would include comparison against the baseline visual inspection to confirm any changes were not present prior to the commencement of mining at LW409-414, and review of 'U Line' and Ulan Road Bridge (over the Goulburn River) monitoring data to confirm if ground movements in excess of survey accuracy have occurred.

If a performance measure is considered to have been exceeded, the Contingency Plan outlined in **Section 9** of this LW409-414 BFMP-MWRC will be implemented.

9.0 CONTINGENCY PLAN

In the event the performance measures relevant to the Ulan Road as a built feature, summarised in **Table 4**, are considered to have been exceeded or are likely to be exceeded, MCO will implement the following Contingency Plan:

- The observation will be reported to the Underground Technical Services Manager or the Environment and Community Manager within 24 hours.
- The likely exceedance will be reported in an Incident Report (refer to the Extraction Plan).
- MCO will provide the Incident Report to relevant stakeholders (i.e. DPHI, the Resources Regulator and MWRC).
- MCO will conduct an investigation to identify and evaluate contributing factors to the exceedance, including re-survey of the relevant subsidence monitoring lines, analysis of predicted versus observed subsidence parameters and a review of the subsidence monitoring program with updates to the program where appropriate.
- An appropriate course of action will be developed in consultation with relevant stakeholders and government agencies including proposed contingency measures (**Section 9.1**), and a program to review the effectiveness of the contingency measures.
- The course of action will be approved by, and implemented to the satisfaction of DPHI, MWRC and the Resources Regulator.
- This LW409-414 BFMP-MWRC and the performance indicators will be reviewed to adequately manage future potential impacts within the limits of Project Approval (05_0117).

MCO will comply with the *Coal Mine Subsidence Compensation Act 2017* (formerly *Mine Subsidence Compensation Act 1961)* in the event that property damages occur as a result of mining LW409-414.

9.1 CONTINGENCY MEASURES

Contingency measures will be developed in consideration of the specific circumstances of the feature (e.g. the location, nature and extent of the impact, and the assessment of environmental consequences). Potential contingency measures that could be considered in the event the performance measure is exceeded are summarised in **Table 7**. Temporary road closure procedures (if required) would be developed and carried out in consultation with the MWRC.

Table 7: Potential Contingency Measures

Environmental Consequence	Potential Contingency Measures	
	Measure	Description
Impact on:		
Pavement	Repair road.	Temporary closure of the road and repair of pavement.
Cuttings	Stabilise slope.	Temporary closure of the road and repair of road cutting.
Pipes/Culverts	Repair or replace pipe. Repair or rebuild culvert.	Construction of temporary drainage pipe/culvert (if required) and repair or replacement of original pipe/culvert.
Other Furniture (Guard Rail, Marker Posts, Signage)	Repair or replace furniture.	Repair/replace section of guard rail, marker post or signage.
Ulan Road Bridge over the Goulburn River	Repair bridge.	Temporary closure of Ulan Road Bridge over the Goulburn River and repair of bridge.

10.0 TRIGGER ACTION RESPONSE PLAN – MANAGEMENT TOOL

The framework for the various components of this LW409-414 BFMP-MWRC are summarised in the TARP shown in **Attachment 2**. The TARP illustrates how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements, and the framework for management and contingency actions.

The TARP comprises:

- baseline conditions;
- predicted subsidence impacts;
- trigger levels from monitoring to assess performance; and
- triggers that flag implementation of contingency measures.

The TARP system provides a simple and transparent snapshot of the monitoring of performance and the implementation of management and/or contingency measures.

11.0 ROLES AND RESPONSIBILITIES

Key responsibilities of MCO personnel in relation to this LW409-414 BFMP-MWRC are summarised in **Table 8**. Responsibilities may be delegated as required.

Table 8: Responsibility Summary

Responsibility	Task
General Manager	• Ensure resources are available to MCO personnel to facilitate the completion of responsibilities under this LW409-414 BFMP-MWRC.
Underground Technical Services Manager	• Ensure the LW409-414 SMP is implemented. • Ensure monitoring required under this LW409-414 BFMP-MWRC is carried out within specified timeframes, adequately checked and processed and prepared to the required standard. • Undertake relevant monitoring and implementation of management measures summarised in **Tables 5** and **6** respectively.
Environment and Community Manager	• Liaise with relevant stakeholders regarding subsidence impact management and related environmental consequences.
Registered Mine Surveyor	• Undertake all subsidence monitoring to the required standard within the specified timeframes and ensure data are adequately checked, processed and recorded.

11.1 KEY CONTACTS

The details of key contacts and phone numbers in relation to this LW409-414 BFMP-MWRC are summarised in **Table 9.**

Table 9: Key Personnel Contact Details

Organisation	Position	Phone Number
MCO	Underground Technical Services Manager	02 6376 1500
	Environment and Community Manager	02 6376 1500
	Moolarben Coal Hotline	1800 556 484
MWRC	General Manager	02 6378 2850
	Manager Works	02 6378 2920 or 0428 725 802

12.0 ANNUAL REVIEW, REGULAR REPORTING AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

12.1 ANNUAL REVIEW

In accordance with Condition 4, Schedule 5 of Project Approval (05_0117), (as modified), MCO will conduct an Annual Review of operations conducted at the Moolarben Coal Complex (including the performance of the LW409-414 BFMP-MWRC) prior to 31 March for the preceding calendar year, or as otherwise agreed by the Secretary of the DPHI.

The Annual Review will:

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

In accordance with Condition 11, Schedule 5 of Project Approval (05_0117), the Annual Review will be made available on the Yancoal's website. As described in **Section 2**, this LW409-414 BFMP-MWRC will be reviewed within three months of the submission of an Annual Review, and, if necessary, revised to ensure the plan is updated on a regular basis and to incorporate any recommended measures to improve environmental performance.

12.2 AUDITS

In accordance with Condition 9, Schedule 5 of Project Approval (05_0117), the most recent independent environmental audit of the Moolarben Coal Complex was conducted in July 2024, and will continue to be conducted every three years. A copy of the independent environmental audit will be provided to the Secretary of the DPHI and made available on the Yancoal's website.

The independent environmental audit will be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary of the DPHI. The independent environmental audit will assess the environmental performance of the Project and assess whether it is complying with the requirements of Project Approval (05_0117), and any other relevant approvals, and recommend measures or actions to improve the environmental performance of the Project.

12.3 FUTURE EXTRACTION PLANS

In accordance with Condition 77(p), Schedule 3 of Project Approval (05_0117), MCO will collect baseline data for future Extraction Plans (e.g. for the next underground mining domain.). In addition to the baseline data collection, consideration of the environmental performance and management measures, in accordance with the review(s) conducted as part of this LW409-414 BFMP-MWRC, will inform the appropriate type and frequency of monitoring of the assets relevant to any future Extraction Plan at the Moolarben Coal Complex.

13.0 INCIDENTS

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

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

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

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

MCO will notify the Secretary of DPHI and any other relevant agencies of any incident associated with the LW409-414 which causes or threatens to cause material harm to the environment immediately after MCO confirms that an incident has occurred. For any other incident associated with the LW409-414, MCO will notify the Secretary of DPHI and any other relevant agencies as soon as practicable after becoming aware of the incident. Within seven days of the date of the incident, MCO will provide the Secretary of DPHI and any relevant agencies with a detailed report on the incident. The report will:

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

14.0 COMPLAINTS

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

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

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

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

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

15.0 NON-COMPLIANCES WITH STATUTORY REQUIREMENTS

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

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

The Environment and Community Manager (or delegate) will undertake regular inspections, internal audits and initiate directions identifying any remediation/rectification work required, and areas of actual or potential non-compliance.

As described in **Section 14**, MCO will notify the Secretary of the DPHI, and any other relevant agencies, of any incident associated with LW409-414 as soon as practicable after MCO becomes aware of the incident. Within seven days of the date of the incident, MCO will provide the Secretary of the DPHI, and any relevant agencies, with a detailed report on the incident.

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

As described in **Section 13.1**, the most recent independent environmental audit was conducted in July 2024, and will be conducted every three years thereafter. A copy of the independent environmental audit will be provided to the Secretary of the DPHI and made available on the Yancoal's website.

16.0 REFERENCES

Department of Planning and Environment (2022) *Extraction Plan Guideline.*

Mine Subsidence Engineering Consultants (2024) *Moolarben Project Stage 1 – Longwalls 409 to 414 – Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Extraction Plan.*

ATTACHMENT 1

MOOLARBEN COAL OPERATIONS – LONGWALLS 409 TO 414 SUBSIDENCE PREDICTIONS AND IMPACT ASSESSMENT FOR THE MID-WESTERN REGIONAL COUNCIL INFRASTRUCTURE ULAN ROAD

Document	Version	Issue Date	Status	Author
MCO_BFMP_MWRC	3	April 2026	Approved	MCO

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2nd August 2024

Liam Mildon
Underground Technical Services Manager
Moolarben Coal Operations Pty Ltd
Locked Bag 2003
Mudgee NSW 2850

Ref: MSEC1426-02

Dear Liam,

RE: Moolarben Coal Operations – Longwalls 409 to 414 - Subsidence predictions and impact assessments for the Mid-Western Regional Council Infrastructure Ulan Road

1. Background

Moolarben Coal Operations Pty Limited (MCO) operates the Moolarben Coal Complex (MCC), which is located approximately 40 kilometres north east of Mudgee in New South Wales (NSW). MCO has been granted approval to develop Stages 1 and 2 of the Moolarben Coal Project (MCP) under the *Environmental Planning and Assessment Act 1979*. Approval for Stage 1 of the MCP (05_0117) was granted by the Minister for Planning on 6 September 2007. Approval for Stage 2 of the MCP (08_0135) was granted on 30 January 2015.

The MCC includes four approved open cut mines, (known as Open Cut 1 mine (OC1), Open Cut 2 mine (OC2), Open Cut 3 mine (OC3) and Open Cut 4 mine (OC4)), and three approved underground mines, (known as Underground Area 1 (UG1), Underground Area 2 (UG2) and Underground Area 4 (UG4)) and the associated infrastructure.

Underground longwall mining operations in UG4 commenced in July 2022 and MCO is currently extracting Longwall 405. The layout of Longwalls 409 to 414, is referred to as the *Extraction Plan Layout* in this report.

Ulan Road is owned and managed by Mid-Western Regional Council (MWRC). The road is located to the west of the Longwall 409 to 414 mining area as shown in attached Drawing No. MSEC1426-02. MWRC also own infrastructure associated with these roads, including the road pavement, embankments, culverts and a road bridge over the Goulburn River.

Ulan Road is a sealed bitumen pavement with no kerb and gutter. The road passes along the north western side of Longwalls 409 to 412 and is 65 m from the commencing end of Longwall 410 at its nearest point, which equates to approximately 0.5 times the depth of cover at this location. The road is wholly outside the Study Area Boundary but is close to the boundary at the commencing ends of Longwalls 409 to 411. Features along the road include three cuttings in sandstone with approximate heights up to 3m at 400 m west of Longwall 409, 2 m at 175 m west of Longwall 412, and 5 m at 250 m north west of Longwall 412. Culverts beneath Ulan Road are typically 400 mm to 800 mm diameter concrete pipes.

The Ulan Road bridge over the Goulburn River, is 210 m or 1.5 times the depth of cover from Longwall 412. This bridge is a two span simply supported structure on concrete abutments and a central headstock supported on three cast piers. The bridge dimensions are approximately 26 m to 30 m long, 7 m wide and the pavement surface is approximately 4 m above the bed of the Goulburn River. Photographs of Ulan Road and the bridge over the Goulburn River are shown in Figure 1.

This letter report summarises the predicted subsidence movements and the assessed subsidence impacts for Ulan Road and associated features based on the Extraction Plan Layout. In doing so this letter considers potential subsidence induced mechanisms of impact and concludes with a summary of the impact assessment.

Figure 1 Ulan Road and Bridge over Goulburn River

2. Study Area

A Study Area is defined around the longwall layout as the surface area that is likely to be affected by the proposed mining of Longwalls 409 to 414. The extent of the Study Area is calculated by the further extent a 26.5° angle of draw line and the predicted vertical limit of subsidence, taken as the 20 mm subsidence contour. The Study Area boundary is shown in MSEC1426-01.

3. Predicted Subsidence Parameters

Ulan Road, the cuttings and Goulburn River bridge are all located outside the Study Area Boundary and will not be subjected to measurable conventional subsidence, tilts, and curvatures; however, the road, cuttings and bridge may experience far-field horizontal movements which are discussed below.

The measured horizontal movements at survey marks which are located beyond the longwall goaf edges and over solid unmined coal areas are often greater than the observed vertical movements at those marks. These movements are often referred to as *far-field horizontal movements*.

Far-field horizontal movements tend to be bodily movements towards the extracted goaf area and are accompanied by very low levels of strain. These movements generally do not result in impacts on natural or built features, except where they are experienced by large structures which are very sensitive to differential horizontal movements.

An empirical database of observed incremental far-field horizontal movements has been compiled using available monitoring data from the NSW and Queensland Coalfields, but this database predominately comprises measurements from the Southern Coalfield. The far-field horizontal movements are generally observed to be orientated towards the extracted longwall. At low levels of far-field horizontal movements, however, there is a higher scatter in the orientation of the observed movements.

This database includes available observed far-field horizontal movements that have been measured at Ulan Coal Mine, Moolarben Mine and observed data from other regions where the depths of cover are also relatively shallow compared to the Southern Coalfield of NSW. The observed far-field horizontal movements in the database represent large variations in depth of cover from less than 50 m to greater than 600 m. In order to utilise the observed far-field horizontal data at the Moolarben Coal Complex where depth of cover is relatively shallow, the data has been plotted, as shown in Figure 2, against the distances from the nearest edge of the incremental panel divided by the depth of cover. This plot excludes those cases where higher movements occurred because of multi-seam mining and valley closure effects as these are not applicable to the extraction of Longwalls 409 to 414.

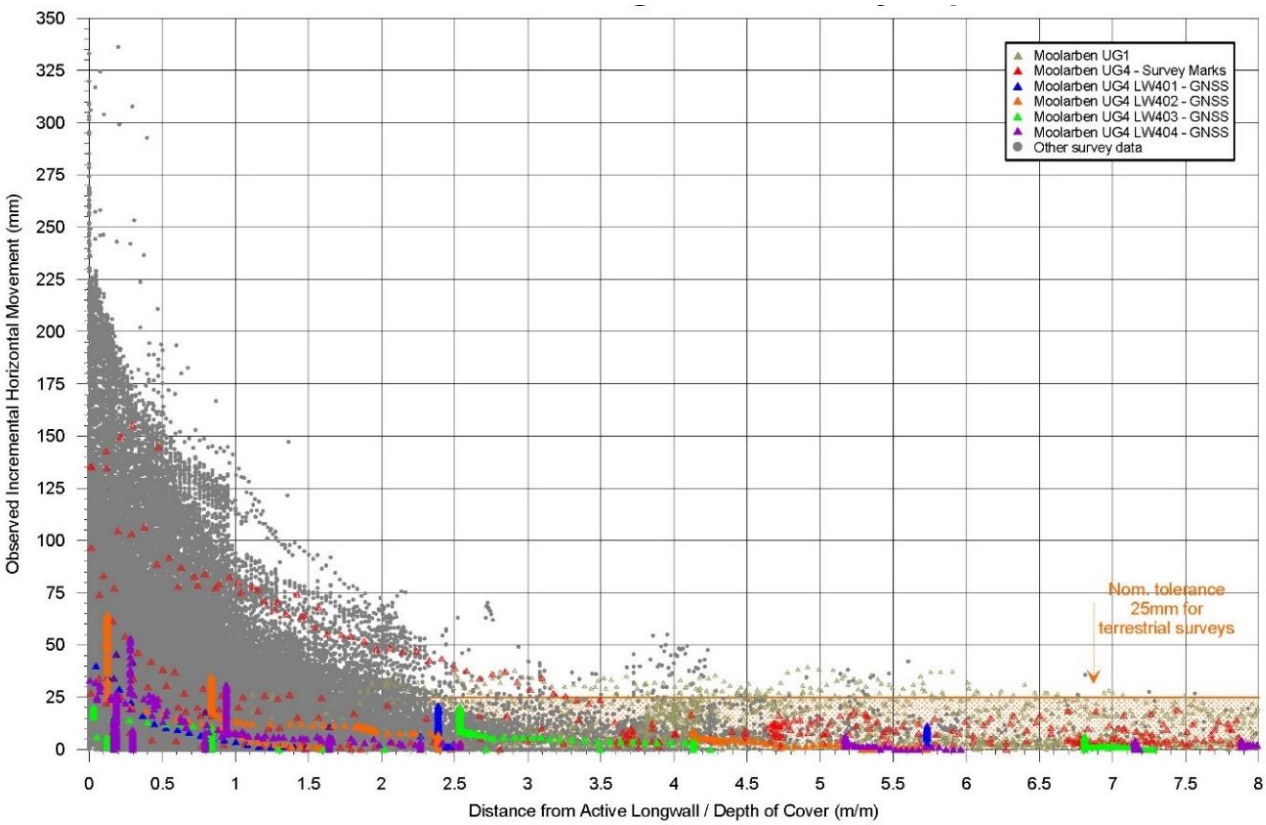

Figure 2 Observed incremental far-field horizontal movements (mm) from many regions in NSW versus the distance to the nearest edge of the mined panel divided by the depth of cover (m/m)

As successive longwalls within a series of longwall panels are mined, the magnitudes of the incremental far-field horizontal movements decrease. This is possibly due to the fact that once the in situ stresses in the strata within the collapsed zones above the first few extracted longwalls has been redistributed, the potential for further movement is reduced. The total far-field horizontal movement is not, therefore, the sum of the incremental far-field horizontal movements for the individual longwalls.

The maximum observed horizontal movements based on MCO monitoring data in Figure 2 for Ulan Road, the road cuttings and Goulburn River bridge are summarised in Table 1.

Table 1 Maximum horizontal movements at Ulan Road features resulting from the extraction of longwalls 409 to 414

Feature	Minimum distance to longwalls (m)	Distance on Depth of Cover (m/m)	Maximum horizontal movement (mm)
Ulan Road	65	0.5	150
Ulan Road Cuttings	175	1.2	75
Goulburn River Bridge	210	1.5	75

Ulan Road, the road cuttings and the bridge of the Goulburn River therefore, are predicted to experience maximum potential far-field horizontal movements as summarised in Table 1 due to the extraction of Longwalls 409 to 414.

Predicted Strains

The prediction of strain is more difficult than the predictions of subsidence, tilt and curvature. The reason for this is that strain is affected by many factors, including ground curvature and horizontal movement, as well as local variations in the near surface geology, the locations of pre-existing natural joints at bedrock, and the depth of bedrock. Survey tolerance can also represent a substantial portion of the measured strain, in cases where the

strains are of a low order of magnitude. The profiles of observed strain, therefore, can be irregular even when the profiles of observed subsidence, tilt and curvature are relatively smooth.

For this reason, the predicted strains have been based on statistical analyses of strains measured in the NSW Coalfields to account for this variability.

The range of potential strains has been assessed using monitoring data from previously extracted panels in the Hunter, Newcastle and Western Coalfields, for single-seam conditions, where the longwall width-to-depth ratios and extraction heights were similar to those of the Extraction Plan layout.

The data used in the analysis of observed strains included those resulting from both conventional and non-conventional anomalous movements, but did not include those resulting from valley related movements. The strains resulting from damaged or disturbed survey marks have also been excluded.

For the surface features located outside the extracted longwalls, above solid coal, the survey database has been analysed to extract the maximum tensile and compressive strains that have been measured at any time during mining for survey bays that were located beyond the goaf edges of the mined panels and positioned on unmined areas of coal, i.e. outside the longwall panels, but within 200 m of the nearest longwall goaf edge.

The histogram of the maximum observed tensile and compressive strains measured in survey bays above solid coal is provided in Figure 3. The probability distribution functions, based on the fitted Generalised Pareto Distribution (GPD), have also been shown in this figure.

The 95 % confidence levels for the maximum total strains that the individual survey bays *above solid coal* experienced within 200m of the extracted longwalls at any time during mining are 3.3 mm/m tensile and 3.0 mm/m compressive.

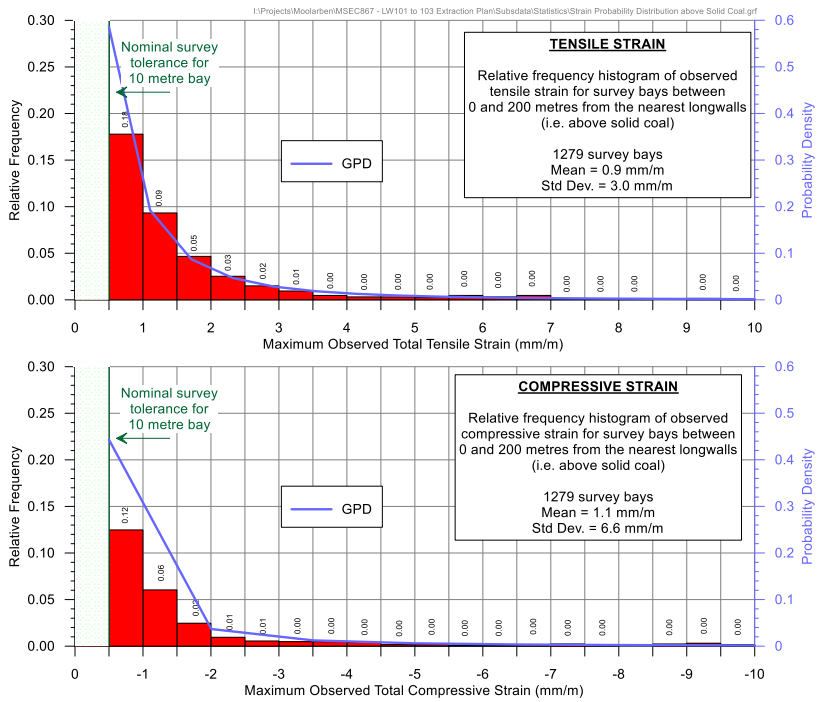

Figure 3 Distributions of the Measured Maximum Tensile and Compressive Strains in the Hunter, Newcastle and Western Coalfields for Survey Bays located above Solid Coal within 200 m of the nearest longwall

For features located beyond 200m from the nearest longwall the survey database has been analysed to extract the maximum tensile and compressive strains between 200 m and 600 m of the nearest longwall goaf edge. The 95 % confidence levels for the maximum total strains that the individual survey bays above solid coal between 200 m and 600 m from extracted goaf experienced at any time during mining are 1.6 mm/m tensile and 1.5 mm/m compressive. The 75 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining over this distance are 0.5 mm/m both tensile and compressive, which is the

typical limit of accuracy of strain measurement by conventional survey methods. It is noted that these results comprise a component of survey tolerance and have also been affected by disturbed survey marks and survey errors.

Further assessment of observed strain data was carried out using monitoring data from the extraction of Longwalls 401 to 403 in UG4. Survey marks along monitoring lines within UG4 are nominally spaced at approximately 15 m. A plot of the observed tensile and compressive strains from UG4 monitoring lines versus distance from the extracted longwalls is shown in Figure 4. It can be seen from Figure 4 that observed tensile and compressive strains are predominantly less than 0.5 mm/m.

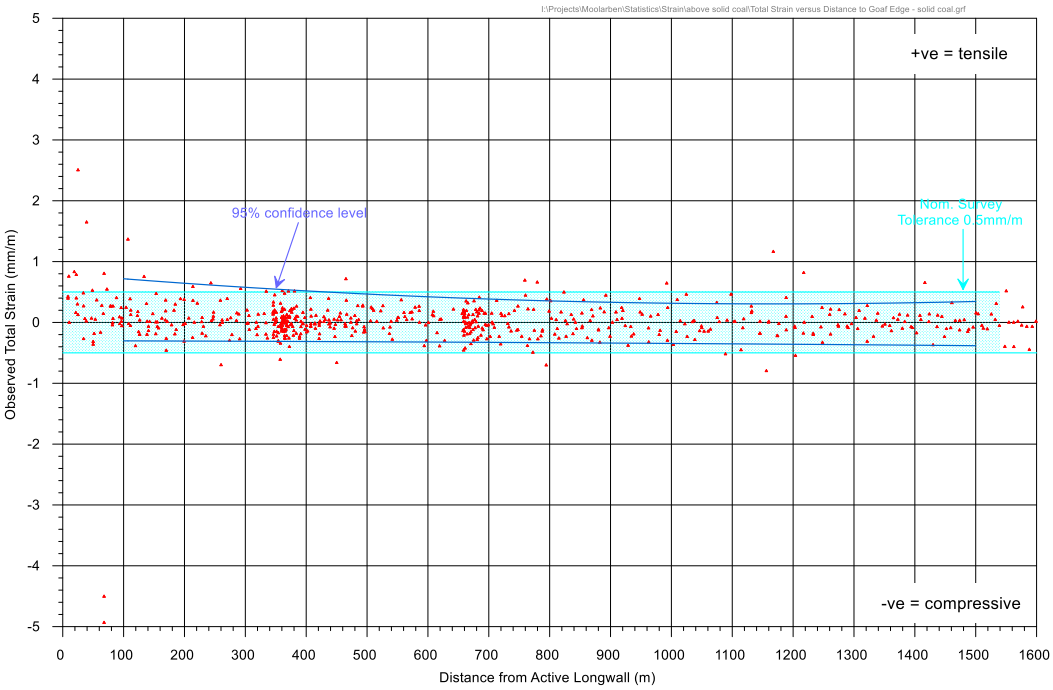

Figure 4 Observed Total Strain Versus the Distance to the Nearest Edge of the Mined Panel for UG4

Based on Figure 4, the 95 % confidence levels for the maximum total strains that the individual survey bays *above solid coal* experienced within 200m of the extracted longwalls at any time during mining are 0.8 mm/m tensile and 0.3 mm/m compressive. The 95 % confidence levels for the maximum total strains that the individual survey bays above solid coal between 200 m and 600 m from extracted goaf experienced at any time during mining are 0.5 mm/m tensile and 0.3 mm/m compressive.

The minimum distances to Ulan Road occur at the north west corners of Longwalls 409 (130 m), 410 (65 m), and 411 (75 m) due to the staggered location of these longwalls. The majority of the road is greater than 200 m from the Extraction Plan layout. There is the potential for measurable ground strains to occur along the sections of Ulan Road nearest to the longwalls, particularly those sections within 100 m of the extracted longwalls. Based on the above observed strains, the predicted ground strains for Ulan Road are 3.3 mm/m tensile and 3.0 mm/m compressive for sections of the road within 100 m of the extracted longwalls and 0.5 mm/m tensile and 0.3 mm/m compressive for the remainder of the road (to within approximately 1km of the Study Area).

Potential for Non-Conventional Movements

It is believed that most non-conventional ground movements are the result of the reaction of near surface strata to increased horizontal compressive stresses due to mining operations. Some of the geological conditions that are believed to influence these irregular subsidence movements are the blocky nature of near surface sedimentary strata layers and the possible presence of unknown faults, dykes or other geological structures, cross bedded strata, thin and brittle near surface strata layers and pre-existing natural joints. The presence of these geological features near the surface can result in a bump in an otherwise smooth subsidence profile and these bumps are usually accompanied by locally increased tilts and strains.

Even though it may be possible to attribute a reason behind most observed non-conventional ground movements, there remains some observed irregular ground movements that still cannot be explained with the available geological information. The term “anomaly” is therefore reserved for those non-conventional ground movement cases that were not expected to occur and cannot be explained by any of the above possible causes.

It is not possible to predict the locations and magnitudes of non-conventional anomalous movements. In some cases, approximate predictions for the non-conventional ground movements can be made where the underlying geological or topographic conditions are known in advance.

The likelihood of non-conventional anomalous movements reduces with increasing distance away from the longwall panels. Monitoring undertaken at UG1 and UG4 to date has not identified non-conventional subsidence movements outside the longwall layouts. The likelihood of non-conventional subsidence movements is therefore considered to be very low.

4. Impact Assessment

Ulan Road

Ulan Road is located to the west of the Extraction Plan Layout. The minimum distances to Ulan Road occur at the north west corners of Longwalls 409, 410, and 411 due to the staggered location of these longwalls. The majority of the road is greater than 200 m from the Extraction Plan layout and impacts to the road due to far-field horizontal movements are considered unlikely to occur. There is the potential for measurable ground strains to occur along the sections of Ulan Road nearest to the longwalls, however the risk of adverse impacts to the road and culverts outside the Study Area boundary is considered to be low.

Ground monitoring and visual monitoring is recommended for Ulan Road during the extraction of Longwalls 409 to 412 to check for the potential development of strain or irregular subsidence movements.

It is expected that the potential impacts on the MWRC infrastructure can be managed with the implementation of the necessary monitoring and management strategies. It is recommended that monitoring and management strategies developed for UG4 Longwalls 401 to 408 are updated for the extraction of Longwalls 409 to 412.

Bridge over Goulburn River

The bridge over the Goulburn River is located 210 m from the nearest longwall. The maximum expected horizontal movements at this distance based on Figure 2 is 75 mm. From Figure 4, the 95 % confidence levels for the maximum total strains observed at UG4 at 200 m from extracted goaf are 0.6 mm/m tensile and 0.3 mm/m compressive.

The height of the banks of the Goulburn River at the location of the bridge are about 3 m to 4 m and average valley height within approximately 75m of the bridge (based on 0.5 times depth of cover) is approximately 7 m. At a distance of over 200 m from the nearest longwall and a small valley height, the development of valley related movement due to the extraction of the longwalls is not expected.

Minor movements within the bridge structure are expected at this distance however the potential for significant differential movement within the bridge structure elements is considered to be low. Based on a ground strain of 0.6 mm/m and span lengths of approximately 15 m, it is recommended that potential differential movement (longitudinal and transverse) of 10 mm between span supports is adopted.

It is expected that the potential impacts on the bridge can be managed with the implementation of the necessary monitoring and management strategies. It is recommended that an assessment of the bridge is carried out by a bridge engineer to identify movement tolerances within the bridge elements and abutments. Development of a monitoring program for key structural elements is recommended to monitor movement of the bridge during the extraction of at least Longwalls 411 to 413. It is recommended to monitor absolute horizontal movements at or near the location of the bridge and differential movement between bridge abutments. Monitoring of key structural elements within the bridge structure should be carried out in consultation with the bridge engineer.

Cuttings

The Ulan Road cuttings are located 175 m or more from the nearest longwall. The cuttings south of the bridge over Goulburn River are formed as gentle batters in weathered sandstone, away from the road pavement and show

significant erosion. The cuttings immediately to the north of the bridge over Goulburn River are steeper and closer to the road pavement. The maximum expected horizontal movements at this distance based on Figure 2 is 75 mm. Based on Figure 4, the 95 % confidence levels for the maximum total strains observed at UG4 at 175 m from extracted goaf are 0.6 mm/m tensile and 0.3 mm/m compressive. At these magnitudes of horizontal movement and strain, adverse impacts to the cuttings are considered unlikely to occur.

Baseline monitoring and visual monitoring is recommended for the cuttings during the extraction of Longwalls 409 to 412 to check for the potential development of irregular subsidence movements and impacts.

It is expected that the potential impacts on the cuttings can be managed with the implementation of the necessary monitoring and management strategies. It is recommended that monitoring and management strategies developed for UG4 Longwalls 401 to 408 are updated for the extraction of Longwalls 409 to 412.

5. Recommendations

Ground monitoring and visual monitoring is recommended for Ulan Road and the cuttings adjacent to Longwalls 409 to 412 to check for the potential development of subsidence impacts or irregular subsidence movements. An assessment of the bridge over Goulburn River by a bridge engineer is recommended.

It is expected that the potential impacts on the MWRC infrastructure can be managed with the implementation of the necessary monitoring and management strategies. It is recommended that similar monitoring and management strategies developed for UG4 Longwalls 401 to 408 are adopted for UG4 in consultation with MWRC. These strategies could include visual inspections, surveys, communications protocols and trigger action response plans.

6. Summary

Ulan Road is located to the west of the Extraction Plan Layout. The minimum distances to Ulan road occur at the north west corners of Longwalls 409 (130 m), 410 (65 m), and 411 (75 m). There is the potential for measurable ground strains to occur along the sections of Ulan Road nearest to the longwalls, particularly those sections within 100 m of the extracted longwalls, however the risk of adverse impacts to the road and culverts is considered to be low. Cuttings along Ulan Road are located 175 m or more from the proposed longwalls. At these distances, adverse impacts to the cuttings are not expected.

The Ulan Road bridge over Goulburn River is located 210 m from Longwall 412. Minor movements within the bridge structure are expected at this distance however the potential for significant differential movement within the bridge structure elements is considered to be low.

Ground monitoring and visual monitoring is recommended for the roads and cuttings for each longwall to check for the potential development of subsidence movements. It is recommended that an assessment of the bridge is carried out by a bridge engineer to identify movement tolerances within the bridge elements and abutments.

It is expected that potential impacts on the MWRC infrastructure can be managed with the implementation of suitable monitoring and management strategies.

Yours sincerely

Peter DeBono

Attachments:
Drawing No. MSEC1426-02 – Longwalls 409 to 414 – MWRC Infrastructure – Ulan Road

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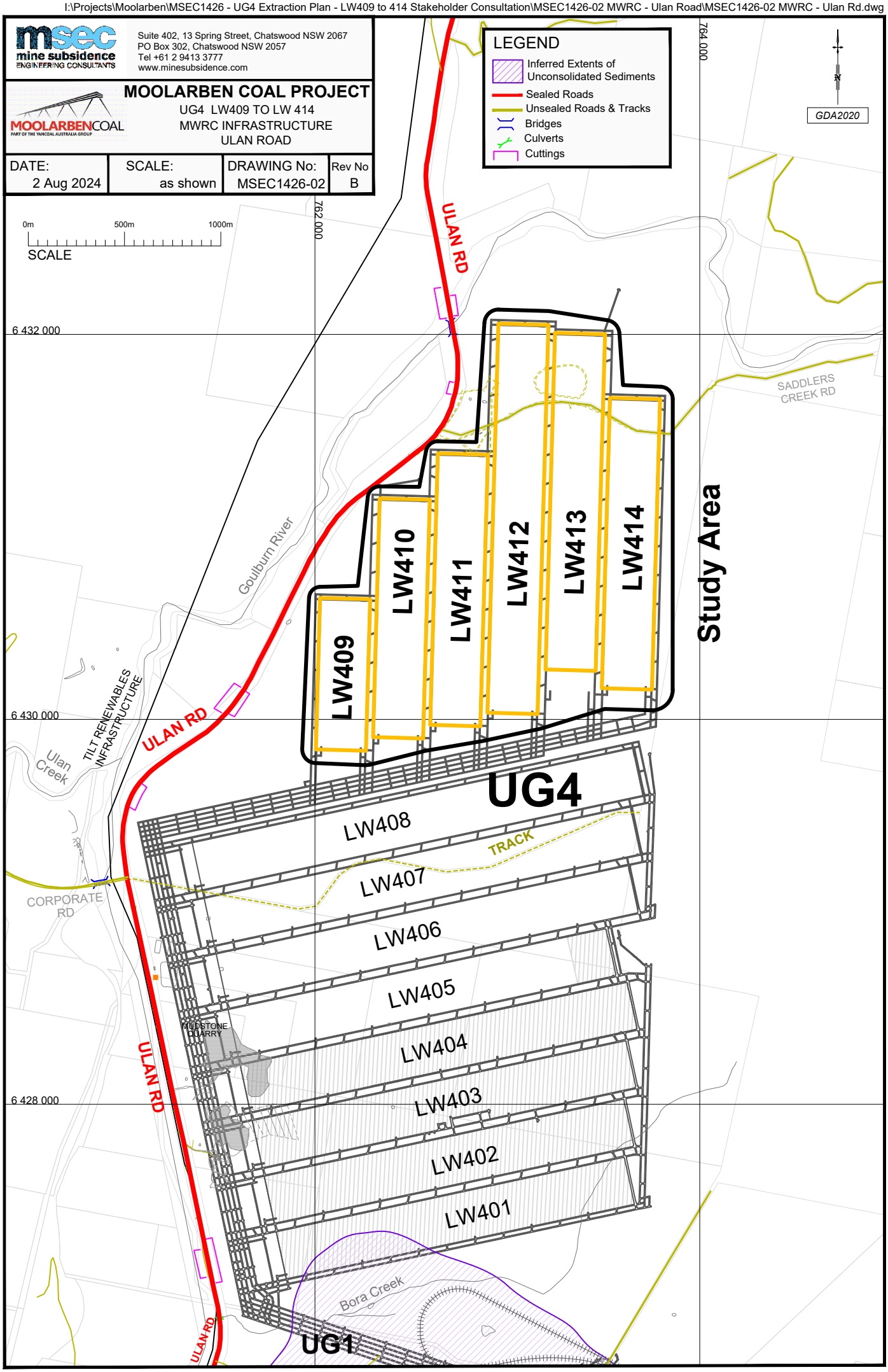
MOOLARBEN COAL

MOOLARBEN COAL PROJECT

UG4 LW409 TO LW 414
MWRC INFRASTRUCTURE
ULAN ROAD

DATE:	SCALE:	DRAWING No:	Rev No
2 Aug 2024	as shown	MSEC1426-02	B



ATTACHMENT 2

UG4 LONGWALLS 409 TO 414
BUILT FEATURES MANAGEMENT PLAN – MID-WESTERN REGIONAL COUNCIL
TRIGGER ACTION RESPONSE PLAN

Document	Version	Issue Date	Status	Author
MCO_BFMP_MWRC	3	April 2026	Approved	MCO

Condition	Normal		Level 1	Level 2
	Baseline Conditions	**Predicted Impacts**	**Implement Management Measures**	**Restoration/Contingency Phase**
Trigger	Ulan Road, Ulan Road Bridge (over the Goulburn River) and associated infrastructure is safe, serviceable and repairable or as otherwise identified by pre-mining inspection.	Subsidence effects on Ulan Road and Ulan Road Bridge (over the Goulburn River). (i.e. far-field horizontal movements up to the predicted values)	Monitoring identifies impacts that are greater than predicted, but the performance indicator has not been exceeded and is not likely to be exceeded.	If the performance indicator relevant to Ulan Road and Ulan Road Bridge has been exceeded, or is likely to be exceeded (i.e. unsafe or loss of serviceability).
Action	Establish baseline data, including: • Pre-mining visual inspection. • Pre-extraction subsidence survey as per the UG4 Longwalls 409 to 414 Subsidence Monitoring Program. • Review of the Ulan Road Bridge (over the Goulburn River) baseline condition by a structural engineer in consultation with the Mid-Western Regional Council (MWRC).	Conduct monitoring as described in **Section 6**, including: • Ground survey of the subsidence effects monitoring line 'U Line' and Ulan Road Bridge monitoring points. • Subsidence impact inspections, targeting the identification of: – impacts to the surface including cracks, buckling and stepping; – impacts to the visible surfaces of pipes/culverts including cracking, buckling, shearing and collapse; – impacts to the bridge including cracking, buckling, shearing and collapse; – impacts to road cuttings including slope failure, rock falls and pavement impacts; and – visible impacts to furniture. • Visual inspection of the condition of culverts, bridge and cuttings.	Management measures implemented as described in **Section 7** (with regard to the specific circumstances of the subsidence impact [e.g. the nature and extent of the impact]). Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.	Contingency Plan implemented (with regard to the specific circumstances of the subsidence impact). In summary: • The observation will be reported to the Underground Technical Services Manager or the Environment and Community Manager within 24 hours. • The likely exceedance will be reported in an Incident Report (refer to the Extraction Plan). • MCO will provide the Incident Report to relevant stakeholders (i.e. DPHI, the Resources Regulator and MWRC). • MCO will conduct an investigation to identify and evaluate contributing factors to the exceedance, including re-survey of the relevant subsidence monitoring lines, analysis of predicted versus observed subsidence parameters and a review of the subsidence monitoring program with updates to the program where appropriate. • An appropriate course of action will be developed in consultation with relevant stakeholders and government agencies including proposed contingency measures (**Section 9.1**), and a program to review the effectiveness of the contingency measures. • The course of action will be approved by, and implemented to the satisfaction of DPHI, MWRC and the Resources Regulator. • The LW409-414 BFMP-MWRC and the performance indicators will be reviewed to adequately manage future potential impacts within the limits of Project Approval (05_0117).
Frequency	Prior to secondary extraction of LW409.	• Ground survey of the subsidence effects monitoring line 'U Line': – Within 1 month of the first 300 m of secondary extraction of each of LW409-412. • Ground survey of the Ulan Road Bridge monitoring points: – Within 1 month of the first 300 m of secondary extraction of LW412. • Subsidence impact inspection: – If ground movement exceeds the predicted subsidence monitoring parameters for LW409-414 during monitoring of the 'U Line' or at the Ulan Road Bridge monitoring points. – Opportunistic visual observations during routine works by MCO (and its contractors). – At any time in case of an emergency and requested by MWRC. – Routinely as per MWRC inspections. • Visual inspection: – Within 1 month of the first 300 m of secondary extraction of each of LW409-412. • Review of the Ulan Road Bridge (over the Goulburn River): – At the completion of LW412. – If ground surveys identify an exceedance of the predicted subsidence monitoring parameters measured along the Ulan Road Bridge monitoring points. – At any time in case of an emergency and requested by MWRC.	To be implemented as required (i.e. if monitoring identifies impacts that are greater than predicted, but the performance indicator has not been exceeded and is not likely to be exceeded).	To be implemented following identification of an exceedance of the performance indicator, or if the performance measure is likely to be exceeded (i.e. unsafe or loss of serviceability).
Position of Decision Making	• Underground Technical Services Manager.	• Underground Technical Services Manager.	• Underground Technical Services Manager.	• Underground Technical Services Manager. • MWRC – General Manager (or delegate).