UG1 LONGWALLS 101 TO 103 BUILT FEATURES MANAGEMENT PLAN ESSENTIAL ENERGY

<table>
<thead>
<tr>
<th>Version</th>
<th>Issue Date</th>
<th>Approval Date</th>
<th>Description</th>
<th>Author(s)</th>
<th>Review Team</th>
</tr>
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<tr>
<td>1</td>
<td>September 2017</td>
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<td>Approved</td>
<td>MCO and MSEC</td>
<td>Environmental Department</td>
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Approved: [Signature]  
Date: 21/9/2017
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Attachment 2  UG1 Longwalls 101 to 103 Built Features Management Plan – Essential Energy Trigger Action Response Plan
Attachment 3  UG1 Longwalls 101 to 103 Built Features Management Plan – Essential Energy Subsidence Impact Register
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 (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.

The UG1 Underground Mine is a component of the approved Moolarben Coal Complex (Figure 2). The UG1 Underground Mine commenced first workings in April 2016 and is scheduled to commence secondary workings (longwall extraction) in October 2017 by longwall mining methods from the Ulan Seam within Mining Lease (ML) 1605, ML 1606, ML 1628, ML 1691 and ML 1715 (Figure 3).

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

This UG1 Longwalls 101 to 103 Built Features Management Plan – Essential Energy (LW101-103 BFMP-EE) forms a part of the Extraction Plan being developed for Longwalls 101 to 103 (herein referred to as Longwalls 101-103) of the approved UG1 Underground Mine.

1.1 PURPOSE AND SCOPE

Purpose: This LW101-103 BFMP-EE outlines the management of potential subsidence impacts of the proposed secondary workings described in the Extraction Plan on the existing 66 kilovolt (kV)/22 kV dual circuit powerline and future substation.

Scope: This LW101-103 BFMP-EE covers the future substation and the 66 kV/22 kV dual circuit powerline in the vicinity of the Study Area\(^1\), which relates to the extent of subsidence effects resulting from the secondary extraction of Longwalls 101-103 (Figure 4). This LW101-103 BFMP-EE will be reviewed and updated, prior to the secondary extraction of Longwalls 104 and 105.

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\(^1\) Longwalls 101-103 and 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

Source: NSW Land & Property Information (2015); NSW Department of Industry (2016); Office of Environment and Heritage NSW (2016)
Source: MCO (June 2016); NSW Dept of Industry (2016)

LEGEND

- Exploration Licence Boundary
- Mining Lease Boundary
- Haul Road
- Approved Road Realignment
  (not yet constructed)
- Existing/Approved Development
- Open Cut Mining Area
- Surface Infrastructure Area
- Underground Longwall Layout
- Direction of Longwall Mining
- Longwalls 101 to 103 Study Area

Moolarben Coal Complex Layout

Figure 2
Figure 3

Moolarben Coal Complex

Underground Mine 1
Longwalls 101 to 103 Layout

Source: MCO (June 2016); NSW Dept of Industry (2016)

LEGEND

- Exploration Licence Boundary
- Mining Lease Boundary
- Haul Road
- Existing/Approved Development
- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Underground Longwall Layout
- Longwalls 101 to 103 Study Area

Goulburn River National Park
Munghorn Gap Nature Reserve

Source: MCO (June 2016); NSW Dept of Industry (2016)
While the proposed Essential Energy Substation (to be located at the Remote Services Facilities) is outside of the Study Area (Figure 4), the potential for far-field effects is also discussed in this LW101-103 BFMP-EE.

1.2 SUITABLY QUALIFIED AND EXPERIENCED PERSONS

In accordance with Condition 5(a), Schedule 4 of Project Approval (08_0135), the suitably qualified and experienced persons that have prepared this LW101-103 BFMP-EE, namely representatives from Mine Subsidence Engineering Consultants (MSEC) and MCO, were endorsed by the Secretary of the Department of Planning and Environment (DP&E).

This LW101-103 BFMP-EE has been prepared in consultation with Essential Energy (Section 4.4).

A list of the key responsibilities of MCO personnel in relation to this LW101-103 BFMP-EE, and a list of key contacts, is provided in Section 11.

1.3 STRUCTURE OF THE LONGWALLS 101-103 BFMP-EE

The remainder of the LW101-103 BFMP-EE is structured as follows:

Section 2: Describes the review and update of the LW101-103 BFMP-EE.

Section 3: Outlines the statutory requirements applicable to the LW101-103 BFMP-EE.

Section 4: Provides baseline data, extraction schedule, revised assessment of the potential subsidence impacts and environmental consequences for Longwalls 101-103, as well as the outcomes of the risk assessment.

Section 5: Details the performance measures relevant to Essential Energy 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 program to collect sufficient baseline data for future Extraction Plans.
Section 13: Describes the Annual Review, audits, regular reporting and improvement of environmental performance.

Section 14: Outlines the management and reporting of incidents.

Section 15: Outlines the management and reporting of complaints.

Section 16: Outlines the management and reporting of non-compliances with statutory requirements.

Section 17: Lists the references cited in this LW101-103 BFMP-EE.
2.0 **LONGWALLS 101 TO 103 BFMP-EE REVIEW AND UPDATE**

In accordance with Condition 5, Schedule 6 of Project Approval (08_0135), this LW101-103 BFMP-EE will be reviewed within three months of the submission of:

- an Annual Review under Condition 4, Schedule 6;
- an incident report under Condition 7, Schedule 6;
- an audit under Condition 9, Schedule 6; or
- any modification to the conditions of Project Approval (08_0135) or Project Approval (05_0117) (unless the conditions require otherwise); and

if necessary, revised to the satisfaction of the Secretary of the DP&E, to ensure the plan is updated on a regular basis and to incorporate any recommended measures to improve environmental performance. Where this review leads to revisions to the LW101-103 BFMP-EE, then within four weeks of the review, the revised LW101-103 BFMP-EE will be submitted to the Secretary of the DP&E for approval.

2.1 **ACCESS TO INFORMATION**

In accordance with Condition 11, Schedule 6 ‘Access to Information’, MCO will make the approved LW101-103 BFMP-EE publicly available on the MCO website.
3.0 STATUTORY REQUIREMENTS

MCO’s statutory obligations are contained in:

- the conditions of the NSW Project Approval (05_0117) (as modified) and NSW Project Approval (08_0135) (as modified);
- the conditions of Commonwealth Approvals (EPBC 2007/3297, EPBC 2013/6926 and EPBC 2008/4444);
- relevant licences and permits, including conditions attached to the Environment Protection Licence (EPL) No. 12932 and MLs (i.e. ML 1605, ML 1606, ML 1628, ML 1691 and ML 1715); and
- other relevant legislation.

Obligations relevant to this LW101-103 BFMP-EE are described below.

3.1 EP&A ACT APPROVAL

Condition 5(g), Schedule 4 of Project Approval (08_0135) requires the preparation of a Built Features Management Plan as a component of the Extraction Plan. In addition, Conditions 3, 5(n), 5(p) and 6, Schedule 4 and Condition 3, Schedule 6 of Project Approval (08_0135) outline general management plan requirements that are applicable to the preparation of this LW101-103 BFMP-EE.

Table 1 presents these requirements and indicates where they are addressed within this LW101-103 BFMP-EE.
### Table 1: Management Plan Requirements

<table>
<thead>
<tr>
<th>Condition 3, Schedule 4</th>
<th>Condition 5(g), Schedule 4</th>
<th>Condition 5(n), Schedule 4</th>
<th>Condition 5(p), Schedule 4</th>
<th>Condition 6, Schedule 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes:</td>
<td>(g) include a Built Features Management Plan, which has been prepared in consultation with DRE and the owners of affected public infrastructure, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which:</td>
<td>(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:</td>
<td>(p) include a program to collect sufficient baseline data for future Extraction Plans.</td>
<td>6. The Proponent shall ensure that the management plans required under conditions 5(g)-(l) above include:</td>
</tr>
<tr>
<td>...</td>
<td>• addresses in appropriate detail all items of key public infrastructure and other public infrastructure and all classes of other built features;</td>
<td></td>
<td></td>
<td>(a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval; and</td>
</tr>
<tr>
<td>...</td>
<td>• has been prepared following appropriate consultation with the owner/s of potentially affected feature/s;</td>
<td></td>
<td></td>
<td>(b) a detailed description of the measures that would be implemented to remediate predicted impacts.</td>
</tr>
<tr>
<td>...</td>
<td>• 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</td>
<td></td>
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<tr>
<td>...</td>
<td>• 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;</td>
<td></td>
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<tr>
<td>...</td>
<td>Section 4.1</td>
<td>Section 4.4</td>
<td>Section 9</td>
<td>Section 4 and 6.3</td>
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</tbody>
</table>

**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 5 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.
Table 1 (Continued): Management Plan Requirements

<table>
<thead>
<tr>
<th>Condition 3, Schedule 6</th>
<th>Project Approval (08_0135) Condition</th>
<th>LW101-103 BFMP-EE Section</th>
</tr>
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<tr>
<td>3. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:</td>
<td></td>
<td></td>
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<tr>
<td>(a) detailed baseline data;</td>
<td></td>
<td></td>
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<tr>
<td>(b) a description of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• the relevant statutory requirements (including any relevant approval, licence or lease conditions);</td>
<td></td>
<td></td>
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<tr>
<td>• the relevant limits or performance measures/criteria;</td>
<td></td>
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<tr>
<td>• 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;</td>
<td></td>
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</tr>
<tr>
<td>(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(d) a program to monitor and report on the:</td>
<td></td>
<td></td>
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<tr>
<td>• impacts and environmental performance of the project;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• effectiveness of any management measures (see c above);</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(e) a contingency plan to manage any unpredicted impacts and their consequences;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(f) a program to investigate and implement ways to improve the environmental performance of the project over time;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(g) a protocol for managing and reporting any:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• incidents;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• complaints;</td>
<td></td>
<td></td>
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<tr>
<td>• non-compliances with statutory requirements; and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• exceedances of the impact assessment criteria and/or performance criteria; and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(h) a protocol for periodic review of the plan.</td>
<td></td>
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</table>

3.2 OTHER LEGISLATION

MCO will operate the Moolarben Coal Complex consistent with Project Approval (08_0135) and any other legislation that is applicable to an approved Part 3A Project under the EP&A Act.

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

- Crown Lands Act, 1989;
- Fisheries Management Act, 1994;
- Heritage Act, 1977;
- Mine Subsidence Compensation Act, 1961;
• 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

Relevant licences or approvals required under these Acts will be obtained as required.
4.0 ESSENTIAL ENERGY 66 KV/22 KV DUAL CIRCUIT POWERLINE

4.1 BASELINE DATA

A 66 kV/22 kV dual circuit powerline owned by Essential Energy runs adjacent to Ulan-Wollar Road and the Sandy Hollow Gulgong Railway Line and is shown on Figure 4. The 66 kV/22 kV dual circuit powerline is supported on timber poles with guy wires at changes in the alignment of the powerline for additional lateral restraint.

The nearest sections of the 66 kV/22 kV dual circuit powerline are approximately 90 metres (m) from the northern (finishing) end of Longwall 103 (pole 70548) and 230 m from the finishing end of Longwall 101 (pole 70540). A proposed substation is located within the Remote Services Infrastructure Facilities to the north of Longwall 101.

4.2 LONGWALLS 101-103 EXTRACTION SCHEDULE

The 66 kV/22 kV dual circuit powerline and substation are located to the north and east of the Longwalls 101-103 Study Area (Figure 4) and may be subject to subsidence effects (i.e. far-field horizontal movements).

Longwalls 101-103 and the area of land within the furthest extent of the 26.5° angle of draw and 20 mm predicted subsidence contour (i.e. the Longwalls 101-103 Study Area) are shown on Figures 3 and 4. Longwall extraction will occur from the west to the east. The longwall layout includes approximately 311 m panel widths (void) with 20 m pillars (solid).

The provisional extraction schedule for Longwalls 101-103 is provided in Table 2.

Table 2: Provisional Extraction Schedule

<table>
<thead>
<tr>
<th>Longwall</th>
<th>Estimated Start Date</th>
<th>Estimated Duration</th>
<th>Estimated Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>October 2017</td>
<td>10 months</td>
<td>August 2018</td>
</tr>
<tr>
<td>102 (A+B)</td>
<td>October 2018</td>
<td>12 months</td>
<td>October 2019</td>
</tr>
<tr>
<td>103</td>
<td>November 2019</td>
<td>10 months</td>
<td>September 2020</td>
</tr>
</tbody>
</table>
Following approval of the UG1 Optimisation Modification in April 2016, MCO has delineated a geological feature in Longwall 102 that prevents economic mining of this section, and has subsequently revised the longwall layout to incorporate a barrier pillar around this feature. The barrier pillar separating Longwalls 102A and 102B is approximately 140 m in length. In addition, following further detailed design, Longwalls 101-103 have been shortened by approximately 70 m to provide safe operational conveyor distance between the end of the longwalls and main headings. With the exception of these changes, the longwall geometry is the same as that for the approved UG1 Optimisation Modification, and MSEC (2017a) concludes that the overall impact assessments for the natural and built features are unchanged or reduced.

4.3 REVISED SUBSIDENCE AND IMPACT PREDICTIONS

Subsidence and impact predictions for Longwalls 101-105 in relation to the Essential Energy assets was conducted by MSEC (2015) as part of the Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment (EA) and was summarised as follows:

*The depth of cover under the three poles of the 66kV powerline, which are located along the Ulan-Wollar Road and just within the UG1 Study Area, is 110 metres. The nearest pole is located within 30 metres of the finishing end of Longwall 103, and, as shown in the Fig. C.07 in Appendix C, this pole is predicted to experience low systematic subsidence movements of less than 20 mm and very low tilts and strains. The other poles are predicted to experience no systematic subsidence movements.*

*In addition to these low systematic subsidence and tilts the 66kV powerline may also experience some far field horizontal movements of up to 200 mm towards the mined panels. However, these movements usually occur with little differential horizontal movements, i.e. strains.*

Revised subsidence and impact predictions specifically for the extraction of Longwalls 101-103 on Essential Energy assets were conducted by MSEC and reported in MSEC (2017b) (Attachment 1). Subsequent to the preparation of MSEC (2017b), the longwall layout was revised to incorporate a reduced longwall length and shorter barrier pillar (Section 4.2). MSEC (2017a) includes updated subsidence predictions for the revised layout. As the asset is located further from Longwalls 101-103 (and is no longer within the extent of the area predicted to experience conventional subsidence impacts), a reduced impact is predicted by MSEC (2017a) compared to MSEC (2017b).

In relation to subsidence predictions MSEC (2017a; 2017b) make the following conclusions:

- The 66 kV/22 kV dual circuit powerline and proposed substation are located at least 90 m from the finishing ends of the longwalls.
- The powerline and substation will not be subjected to measurable conventional vertical mine subsidence ground movements (i.e. less than survey accuracy limits).
The first longwall (Longwall 101) is the furthest from the 66 kV powerline (i.e. 230 m) which allows for validation of the subsidence behaviour over the ends of the longwall panels which can be variable, however should generally be accurate to within 50 mm.

The power poles and substation may, however, experience some far field horizontal movements in the order of 90 mm to 155 mm towards the mined panels. Relative movement between poles is expected to be less than 50 mm and relative movement within the substation is expected to be negligible.

There is a low probability that significant strains could develop at the location of the powerline and substation due to non-conventional movements and, therefore, adverse impacts are considered unlikely.

Notwithstanding, to check for the potential development of irregular subsidence movements, monitoring and management measures have been developed (Sections 6 and 7, respectively).

It is expected that any subsidence impacts affecting the serviceability of the 66 kV/22 kV dual circuit powerline could be managed using typical mitigation and management techniques for powerlines (Section 7).

4.4 RISK ASSESSMENT MEETING

In accordance with the Guidelines for the Preparation of Extraction Plans (DP&E and DRE, 2015), potential risks and potential risk control measures and procedures have been considered at a risk assessment for the Essential Energy infrastructure in the vicinity of Longwalls 101-103, held on 22 March 2017. Attendees at the risk assessment meeting included representatives from MCO, Essential Energy, MSEC and a risk assessment facilitator (AXYS Consulting Pty Ltd [AXYS]).

The investigation and analysis methods used during the risk assessment included (AXYS, 2017):

- Confirmation of relevant Essential Energy assets.
- Review of the revised subsidence predictions and potential impacts on Essential Energy assets (including consideration of past experience in the Western Coalfield).
- Consideration and discussion of the proposed monitoring program, management measures and contingency measures.

The following potential risks were identified during the risk assessment (AXYS, 2017):

- Essential Energy substation becomes unserviceable due to mining of Longwalls 101-103 and customers are affected.
• 66 kV/22 kV dual circuit powerline becomes unserviceable due to mining of Longwalls 101-103 and customers are affected.

A number of risk control measures and procedures were identified prior to and during the risk assessment and are summarised as follows:

**Baseline Data / Validation**

1. Carry out a baseline audit of the 66 kV/22 kV dual circuit powerline in the Longwalls 101-103 Study Area, before mining of Longwalls 101-103 is within 400 m of the structures.

2. Design of substation is to include consideration of anticipated subsidence (in consultation with Essential Energy).

3. Installation of the subsidence monitoring program (tilt monitoring points on the power poles closest to Longwalls 101-103 and subsidence monitoring points around the substation).

**Management / Monitoring / Response Measures**

4. Establish a key contacts list between MCO and Essential Energy to provide updates on the status of mining activities, and for ongoing liaison.

5. Include in the LW101-103 BFMP-EE a schedule of times/frequency of communication with Essential Energy during mining of Longwalls 101-103.

6. Develop a TARP and include triggers for conditions that may need to be actioned by MCO and/or Essential Energy.

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

The proposed risk control measures and procedures have been incorporated where relevant in this LW101-103 BFMP-EE and the program for implementation is summarised in Table 3.
### Table 3: Program for Implementation of Proposed Risk Control Measures and Procedures

<table>
<thead>
<tr>
<th>Risk Control Measure / Procedure</th>
<th>LW101-103 BFMP-EE Section</th>
<th>Proposed Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline Data / Validation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Carry out a baseline audit of the 66 kV/22 kV dual circuit powerline in the Longwalls 101-103 Study Area.</td>
<td>Section 6.2</td>
<td>Prior to secondary extraction within 400 m of the structures</td>
</tr>
<tr>
<td>2 Design the substation to include consideration of anticipated subsidence (in consultation with Essential Energy).</td>
<td>Section 6.2</td>
<td>Prior to Longwall 101</td>
</tr>
<tr>
<td>3 Installation of the subsidence monitoring program.</td>
<td>Section 6</td>
<td>Prior to Longwall 101</td>
</tr>
<tr>
<td><strong>Management / Monitoring / Response Measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Establish key contacts list in the LW101-103 BFMP-EE.</td>
<td>Section 11.1</td>
<td>Complete</td>
</tr>
<tr>
<td>5 Include a schedule of times/frequency of communication with Essential Energy for the status of mining of Longwalls 101-103 in the LW101-103 BFMP-EE.</td>
<td>Section 7 and Table 6</td>
<td>Complete</td>
</tr>
<tr>
<td>6 Include in the TARP triggers for conditions that may need to be actioned by MCO and/or Essential Energy.</td>
<td>Section 10 and Attachment 2</td>
<td>Complete</td>
</tr>
</tbody>
</table>
5.0 PERFORMANCE MEASURES

The performance measures specified in Table 19, Schedule 4 of Project Approval (08_0135) relevant to the 66 kV/22 kV dual circuit powerline, as a built feature, are listed in Table 4.

Table 4: Built Features Subsidence Impact Performance Measures

<table>
<thead>
<tr>
<th>Feature</th>
<th>Subsidence Impact Performance Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key public infrastructure:</strong></td>
<td></td>
</tr>
<tr>
<td>Gulgong-Sandy Hollow Railway Line Ulan-Wollar Road</td>
<td>Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.</td>
</tr>
<tr>
<td><strong>Other infrastructure:</strong></td>
<td></td>
</tr>
<tr>
<td>Murragamba Road Low voltage electricity power line *</td>
<td>Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else fully replaced or fully compensated.</td>
</tr>
</tbody>
</table>

Source: Table 19 in Schedule 4 of Project Approval (08_0135).

* Low voltage electricity power line refers to the 66 kV/22 kV dual circuit powerline.

In accordance with Condition 3, Schedule 4 of Project Approval (08_0135), MCO must ensure that there is no exceedance of the performance measures listed in Table 19, to the satisfaction of the Secretary of the DP&E.

Section 6 outlines the monitoring that will be undertaken to assess the impact of Longwalls 101-103 against the performance measures in relation to the 66 kV/22 kV dual circuit powerline. Management measures for the 66 kV/22 kV dual circuit powerline 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 Longwalls 101-103 on the 66 kV/22 kV dual circuit powerline to identify unsafe conditions or loss of serviceability during or after mining. Key components of the monitoring program are summarised in Table 5.

Table 5: 66 kV/22 kV Dual Circuit Powerline and Substation Monitoring Program Overview

<table>
<thead>
<tr>
<th>Monitoring Component</th>
<th>Parameter</th>
<th>Timing/Frequency</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-mining</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>66 kV/22 kV dual circuit powerline – power poles within 300 m of the relevant longwall</td>
<td>Installation of tilt monitoring points in consultation with Essential Energy. Baseline structure survey – 2 x monitoring points at each timber pole.</td>
<td>Prior to commencement of Longwall 101 extraction.</td>
<td>Underground Technical Manager / Registered Mine Surveyor / Essential Energy</td>
</tr>
<tr>
<td>Essential Energy Substation – foundation design.</td>
<td>The substation foundation will be designed in consultation with Essential Energy.</td>
<td>Prior to commencement of Longwall 101 extraction.</td>
<td>Underground Technical Manager / Essential Energy</td>
</tr>
<tr>
<td>Maintenance inspections.</td>
<td>Condition of existing 66 kV/22 kV dual circuit powerline (e.g. land clearance, vegetation clearance, road clearance, pole foundations, integrity and function of support clamps or other items).</td>
<td>As per Essential Energy’s routine maintenance schedule.</td>
<td>Essential Energy</td>
</tr>
<tr>
<td><strong>During and After Mining</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>66 kV/22 kV dual circuit powerline - Visual inspection (including structural assessment).</td>
<td>Condition of existing 66 kV/22 kV dual circuit powerline (e.g. land clearance, vegetation clearance, road clearance, pole foundations, integrity and function of support clamps or other items). Photo points (including baseline photographic record).</td>
<td>Prior to secondary extraction within 400 m of the Longwall 101 take-off position.</td>
<td>Underground Technical Manager and representative of asset owner if required</td>
</tr>
<tr>
<td>66 kV/22 kV dual circuit powerline – power poles within 300 m of the relevant longwall</td>
<td>Structure survey – 2 x monitoring points at each timber pole.</td>
<td>Prior to secondary extraction within 400 m of the Longwall 101 take-off position (i.e. the existing longwall mining limits). At 100 m intervals when mining within 400 m of the longwall take-off position. [Inspection sheets provided to Essential Energy if/when movement detected]</td>
<td>Underground Technical Manager / Registered Mine Surveyor</td>
</tr>
</tbody>
</table>
### Table 5 (Continued): 66 kV/22 kV Dual Circuit Powerline Monitoring Program Overview

<table>
<thead>
<tr>
<th>Monitoring Component</th>
<th>Parameter</th>
<th>Timing/Frequency</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>During and After Mining (Continued)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Essential Energy Substation – Subsidence monitoring.</td>
<td>Subsidence monitoring at survey points installed around the substation. Parameters include:</td>
<td>Prior to secondary extraction within 400 m of the longwall take-off position (i.e. the existing longwall mining limits). At 100 m intervals when mining within 400 m of the longwall take-off position. <em>[Inspection sheets provided to Essential Energy if/when movement detected]</em></td>
<td>Underground Technical Manager / Registered Mine Surveyor</td>
</tr>
<tr>
<td></td>
<td>• vertical subsidence;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• tilt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• tensile strain; and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• compressive strain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66 kV/22 kV dual circuit powerline – Subsidence impact inspection.</td>
<td>Condition of existing 66 kV/22 kV dual circuit powerline (e.g. land clearance, vegetation clearance, road clearance, pole foundations, integrity and function of support clamps or other items). Photo points (including comparison to baseline photographic record).</td>
<td>In the event monitoring detects movements in excess of survey/design tolerances. Opportunistic visual observations during routine works by MCO and its contractors. At any time in case of fault or emergency and where requested by Essential Energy.</td>
<td>Underground Technical Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Essential Energy Substation – Subsidence impact inspection.</td>
<td>Subsidence impact inspections will target the identification of:</td>
<td>Following identification of ground movements (in excess of survey accuracy) at the substation monitoring points. Opportunistic visual observations during routine works by MCO and its contractors.</td>
<td>Underground Technical Manager</td>
</tr>
<tr>
<td></td>
<td>• surface cracking;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• surface humps; and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• tilting of foundations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Condition of substation (including photographic record for baseline comparison).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>As per Essential Energy inspections (e.g. fault / emergency patrol).</td>
<td>Routinely as per Essential Energy inspections.</td>
<td>Essential Energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Mining</td>
<td>Structure survey – 2 x monitoring points at each timber pole. Condition of 66 kV/22 kV dual circuit powerline post-mining (e.g. land clearance, vegetation clearance, road clearance, pole foundations, integrity and function of support clamps or other items).</td>
<td>Within three months of longwall completion (e.g. longwall has been relocated from the final end of block mining position).</td>
<td>Underground Technical Manager and representative of asset owner if required</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Document</th>
<th>Version</th>
<th>Issue</th>
<th>Effective</th>
<th>Review</th>
<th>Author</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCO_BFMP_EE</td>
<td>1</td>
<td>Sept 2017</td>
<td>Sept 2017</td>
<td>Sept 2018</td>
<td>MCO</td>
<td>S. Archinal</td>
</tr>
</tbody>
</table>
Table 5 (Continued): 66 kV/22 kV Dual Circuit Powerline Monitoring Program Overview

<table>
<thead>
<tr>
<th>Monitoring Component</th>
<th>Parameter</th>
<th>Timing/Frequency</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Post-Mining (Continued)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Essential Energy Substation – Subsidence impact inspection.</td>
<td>Subsidence monitoring at survey points installed around the substation. Parameters include: • vertical subsidence; • tilt; • tensile strain; and • compressive strain. Condition of substation (including photographic record for baseline comparison).</td>
<td>Within three months of longwall completion (e.g. longwall has been relocated from the final end of block mining position).</td>
<td>Underground Technical Manager and representative of asset owner if required</td>
</tr>
</tbody>
</table>

The frequency of monitoring will be reviewed either:

- in accordance with the Annual Review; or
- if triggered as a component of the Contingency Plan as outlined in Section 9 of this LW101-103 BFMP-EE.

6.1 SUBSIDENCE PARAMETERS

Subsidence parameters (i.e. subsidence, tilt, tensile strain, compressive strain and absolute horizontal translation) associated with mining will be measured in accordance with the UG1 Longwalls 101 to 103 Subsidence Monitoring Program (LW101-103 SMP).

In summary, surveys will be conducted to measure subsidence movements in three dimensions using a total station survey instrument. Subsidence movements (i.e. tilt) will be measured at multiple heights on the power poles closest to Longwalls 101-103. Monitoring of subsidence specific to the Essential Energy 66 kV/22 kV dual circuit powerline will be measured by survey of power poles.

Prior to mining of Longwall 101, and in consultation with Essential Energy, MCO will install targets on the power poles closest to Longwalls 101-103 and will undertake a baseline survey of the poles. MCO will also install subsidence monitoring points around the Essential Energy substation. Unless otherwise agreed with Essential Energy, inspection sheets detailing the outcome of the subsidence monitoring program will be provided to Essential Energy.
6.2 SUBSIDENCE IMPACTS

A visual inspection (including structural assessment) of the 66 kV/22 kV dual circuit powerline and a visual inspection of the Essential Energy substation will be conducted prior to secondary extraction within 400 m of the Longwall 101 take-off positions. Visual inspections will also be conducted by MCO at the 66 kV/22 kV dual circuit powerline and substation in the event monitoring detects movements in excess of survey/design tolerances. Additional opportunistic observations of subsidence impacts will be conducted during routine works by MCO and its contractors.

Where relevant, inspections of subsidence impacts will include photographic record of the impacts from nominated photo points for comparison with baseline photographic records.

It is understood that Essential Energy also conducts routine inspections (including fault and emergency patrols) which would be used for monitoring of the impacts of subsidence if conducted during the course of mining Longwalls 101-103.

Information will be recorded in the LW101-103 BFMP-EE Subsidence Impact Register (Attachment 3) and reported in accordance with Project Approval (08_0135) (Section 13).

6.3 ENVIRONMENTAL CONSEQUENCES

MCO and Essential Energy 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 the Moolarben Coal Complex exceed the performance measure or indicators, MCO and Essential Energy will assess the consequences of the exceedance in accordance with the Contingency Plan described in Section 9.
7.0 MANAGEMENT MEASURES

A number of potential management measures in relation to the 66 kV/22 kV dual circuit powerline and/or Essential Energy substation are considered to be applicable. These include:

- alteration of conductor tensions;
- modification to attachment points such as placement of stringing sheaves to earth wires and/or phase conductors; and
- strengthening of pole footings.

The substation foundation will be designed in consultation with Essential Energy including potential management measures.

In the event management measures are considered to be required, the appropriate action will be determined and implemented in consultation with Essential Energy.

A summary of management measures will be reported in the Annual Review.

Key management actions and timing is summarised in Table 6.

**Table 6: 66 kV/22 kV Dual Circuit Powerline and Substation Key Management Actions**

<table>
<thead>
<tr>
<th>Management Measure</th>
<th>Timing/Frequency</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-mining</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notification to Essential Energy prior to commencement of secondary extraction.</td>
<td>Prior to secondary extraction of Longwall 101.</td>
<td>Underground Technical Manager</td>
</tr>
<tr>
<td>Installation of tilt monitoring points in consultation with Essential Energy.</td>
<td>Prior to secondary extraction of Longwall 101.</td>
<td>Underground Technical Manager</td>
</tr>
<tr>
<td>Structural assessment of 66 kV/22 kV dual circuit powerline timber poles (to identify management measures potentially required pre-subsidence) and visual inspection of substation (to establish baseline condition).</td>
<td>Prior to secondary extraction within 400 m of the Longwall 101 take-off position.</td>
<td>Underground Technical Manager and representative of asset owner if required</td>
</tr>
</tbody>
</table>
### Table 6 (Continued): 66 kV/22 kV Dual Circuit Powerline and Substation Key Management Actions

<table>
<thead>
<tr>
<th>Management Measure</th>
<th>Timing/Frequency</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>During Mining</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notification to Essential Energy prior to subsidence effects on the 66 kV/22 kV dual circuit powerline or substation.</td>
<td>Prior to secondary extraction within 400 m of the Longwall 101 take-off position.</td>
<td>Underground Technical Manager</td>
</tr>
<tr>
<td>Provision of inspection sheets detailing the outcome of the subsidence impact monitoring program to Essential Energy (unless otherwise agreed with Essential Energy).</td>
<td>Following identification of movements in excess of survey/design tolerances at the 66 kV/22 kV dual circuit powerline poles or at the substation.</td>
<td>Underground Technical Manager</td>
</tr>
<tr>
<td>Ensure safe access to 66 kV/22 kV dual circuit powerline and substation is available such that routine inspections and maintenance and remediation works are able to be undertaken.</td>
<td>During Longwalls 101-103 extraction.</td>
<td>Underground Technical Manager</td>
</tr>
<tr>
<td>Implement TARP (Attachment 2).</td>
<td>During Longwalls 101-103 extraction.</td>
<td>Underground Technical Manager</td>
</tr>
</tbody>
</table>

| **Post-mining** |                  |                              |
| Structural assessment of 66 kV/22 kV dual circuit powerline timber poles and visual inspection of substation (to identify any post-mining remediation works required). | Within three months of longwall completion (e.g. longwall has been relocated from the final end of block mining position). | Underground Technical Manager |
| The 66 kV/22 kV dual circuit powerline will be straightened where affected by subsidence. Where straightening is impractical, stays may be installed. Roller sheathing will be removed where fitted. | Within three months of longwall completion (e.g. longwall has been relocated from the final end of block mining position). | Underground Technical Manager |
8.0 ASSESSMENT OF PERFORMANCE INDICATORS AND MEASURES

In accordance with Condition 5(d), Schedule 4 of Project Approval (08_0135), 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 are achieved include:

- the structural integrity of the 66 kV/22 kV dual circuit powerline (power poles and transmission lines) is maintained;
- the electrical clearance from land, vegetation and roads is maintained; and
- the serviceability of the access roads/tracks is maintained.

Monitoring conducted to inform the assessment of secondary extraction of Longwalls 101-103 against the performance indicators for the performance measures relevant to the 66 kV/22 kV dual circuit powerline as a built feature is outlined in Section 6.

If a performance measure is considered to have been exceeded, the Contingency Plan outlined in Section 9 of this LW101-103 BFMP-EE will be implemented.
9.0 CONTINGENCY PLAN

In the event the performance measures relevant to the 66 kV/22 kV dual circuit powerline 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 Manager or the Environmental and Community Manager within 24 hours.
- The observation will be recorded in the Subsidence Impact Register (Attachment 3).
- 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. DP&E, DRE and Essential Energy).
- 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, Essential Energy and DRE.
- This LW101-103 BFMP-EE and the performance indicators will be reviewed to adequately manage future potential impacts within the limits of Project Approval (08_0135).

MCO will comply with the NSW Mine Subsidence Compensation Act, 1961 in the event that property damages occur as a result of mining Longwalls 101-103.

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 for the 66 kV/22 kV dual circuit powerline is exceeded are summarised in Table 7.
### Table 7: Potential Contingency Measures

<table>
<thead>
<tr>
<th>Environmental Consequence</th>
<th>Potential Contingency Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measure</td>
</tr>
<tr>
<td>Impact on:</td>
<td></td>
</tr>
<tr>
<td>Transmission Wires</td>
<td>Stabilisation techniques</td>
</tr>
<tr>
<td></td>
<td>Rebuilding</td>
</tr>
<tr>
<td>Poles</td>
<td>Stabilisation techniques</td>
</tr>
<tr>
<td></td>
<td>Rebuilding</td>
</tr>
<tr>
<td>Substation</td>
<td>Subsidence remediation</td>
</tr>
</tbody>
</table>
10.0 TRIGGER ACTION RESPONSE PLAN – MANAGEMENT TOOL

The framework for the various components of this LW101-103 BFMP-EE 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 environmental performance and the implementation of management and/or contingency measures.
11.0 ROLES AND RESPONSIBILITIES

Key responsibilities of MCO personnel in relation to this LW101-103 BFMP-EE are summarised in Table 8. Responsibilities may be delegated as required.

Table 8: Longwalls 101 to 103 Built Features Management Plan – Essential Energy
Responsibility Summary

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Manager</td>
<td>• Ensure resources are available to MCO personnel to facilitate the completion of responsibilities under this LW101-103 BFMP-EE.</td>
</tr>
<tr>
<td>Underground Technical Manager</td>
<td>• Ensure the LW101-103 SMP is implemented.</td>
</tr>
<tr>
<td></td>
<td>• Ensure monitoring required under this LW101-103 BFMP-EE is carried out within specified timeframes, adequately checked and processed and</td>
</tr>
<tr>
<td></td>
<td>prepared to the required standard.</td>
</tr>
<tr>
<td></td>
<td>• Undertake relevant monitoring and implementation of management measures summarised in Tables 5 and 6 respectively.</td>
</tr>
<tr>
<td>Environmental and Community Manager</td>
<td>• Ensure the LW101-103 BFMP-EE is implemented.</td>
</tr>
<tr>
<td></td>
<td>• Liaise with relevant stakeholders regarding subsidence impact management and related environmental consequences.</td>
</tr>
<tr>
<td>Registered Mine Surveyor</td>
<td>• Undertake all subsidence monitoring to the required standard within the specified timeframes and ensure data are adequately checked, processed and recorded.</td>
</tr>
</tbody>
</table>

11.1 KEY CONTACTS

The details of key contacts and phone numbers in relation to this LW101-103 BFMP-EE are summarised in Table 9.

Table 9: Longwalls 101 to 103 Built Features Management Plan – Essential Energy
Key Personnel Contact Details

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Position</th>
<th>Contact Name</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCO</td>
<td>Underground Technical Manager</td>
<td>Mr Shane Pegg</td>
<td>02 6376 1656</td>
</tr>
<tr>
<td></td>
<td>Environmental and Community Manager</td>
<td>Mr Graham Chase</td>
<td>02 6376 1407</td>
</tr>
<tr>
<td></td>
<td>Moolarben Coal Hotline</td>
<td></td>
<td>1800 556 484</td>
</tr>
<tr>
<td>Essential Energy</td>
<td>Mains Design Manager</td>
<td>Mr Damien Lloyd</td>
<td>02 6589 8078</td>
</tr>
<tr>
<td></td>
<td>Essential Energy Fault Line</td>
<td></td>
<td>132 080</td>
</tr>
</tbody>
</table>
12.0 FUTURE EXTRACTION PLANS

In accordance with Condition 5(p), Schedule 4 of Project Approval (08_0135), MCO will collect baseline data for the future Extraction Plan (e.g. Longwalls 104-105). However, for the 66 kV/22 kV dual circuit powerline, the baseline (and post-mining) data collected for Longwalls 101-103 will be used as baseline for Longwalls 104-105 as longwall mining progressively moves further south of the Essential Energy assets.

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 LW101-103 BFMP-EE, will inform the appropriate type and frequency of monitoring of the assets relevant to the next Extraction Plan.
13.0 ANNUAL REVIEW, REGULAR REPORTING AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

In accordance with Condition 4, Schedule 6 of Project Approval (08_0135), MCO will conduct an Annual Review of the environmental performance of the Project by the end of March each year, or as otherwise agreed by the Secretary of the DP&E.

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 EA;
- identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the 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 6 of Project Approval (08_0135), the Annual Review will be made available on the MCO website.

As described in Section 2, this LW101-103 BFMP-EE will be reviewed within three months of the submission of an Annual Review, and revised where appropriate.

In accordance with Condition 8, Schedule 6 of Project Approval (08_0135), MCO will also provide regular reporting on the environmental performance of the Project on the MCO website.
13.1 AUDITS

In accordance with Condition 9, Schedule 6 of Project Approval (08_0135), an independent environmental audit was conducted by the end of December 2015, and will be undertaken every three years thereafter. A copy of the independent environmental audit will be provided to the Secretary of the DP&E and made available on the MCO website.

The independent environmental audit will be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary of the DP&E.

The independent environmental audit will assess the environmental performance of the Project and assess whether it is complying with the requirements of Project Approval (08_0135), and any other relevant approvals, and recommend measures or actions to improve the environmental performance of the Project.

Further to the above, external auditing for compliance with ISO 31000 – Risk Management (or alternative standard agreed with Essential Energy) will be undertaken annually to report compliance and effectiveness of risk management practices during the extraction of Longwalls 101-103.
14.0 INCIDENTS

An incident is defined in Project Approval (08_0135) 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 (08_0135).

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 6 of Project Approval (08_0135).

MCO will notify the Secretary of DP&E and any other relevant agencies of any incident associated with the UG1 Underground Mine immediately after MCO confirms that an incident has occurred. Within seven days of the date of the incident, MCO will provide the Secretary of DP&E 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.
15.0 COMPLAINTS

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

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

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

- the nature of 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 6 of Project Approval (08_0135), the complaints register will be updated monthly and made available on the MCO website.
16.0 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 Environmental 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 DP&E, and any other relevant agencies, of any incident associated with MCO immediately after MCO becomes aware of the incident. Within seven days of the date of the incident, MCO will provide the Secretary of the DP&E, and any relevant agencies, with a detailed report on the incident.

A review of MCO’s compliance with all conditions of Project Approval (08_0135), mining leases 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 MCO website.

As described in Section 13.1, an independent environmental audit was conducted by the end of December 2015, and will be undertaken every three years thereafter. A copy of the audit report will be submitted to the Secretary of the DP&E and made publicly available on the MCO website.
17.0 REFERENCES


ATTACHMENT 1

MSEC (2017b) MOOLARBEN COAL OPERATIONS – LONGWALLS 101 TO 103
- SUBSIDENCE PREDICTIONS AND IMPACT ASSESSMENTS
FOR THE ESSENTIAL ENERGY INFRASTRUCTURE
16 January 2017

Shane Pegg
Underground Technical Manager
Moolarben Coal Operations Pty Ltd
Locked Bag 2003
Mudgee NSW 2850

Ref: MSEC877-05

Dear Shane,

RE: Moolarben Coal Operations – Longwalls 101 to 103 - Subsidence Predictions and Impact Assessments for the Essential Energy Infrastructure

Moolarben Coal Operations is preparing an Extraction Plan to support the commencement of longwall mining operations in the 4th quarter of 2017, and this letter has been prepared to detail potential subsidence impacts on infrastructure owned and operated by Essential Energy.

This letter report summarises the predicted subsidence movements and the assessed subsidence impacts for the Essential Energy infrastructure resulting from the extraction of Longwalls 101 to 103 at the Moolarben Coal Complex. In doing so, this letter considers potential subsidence induced mechanisms of impact and concludes with a summary of the impact assessment. The potential subsidence impacts are consistent with those previously assessed and approved for the Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment.

The locations of the Essential Energy infrastructure and Longwalls 101 to 103 are shown in the attached Drawing No. MSEC877-05. The Essential Energy infrastructure in the vicinity of Longwalls 101 to 103 comprises a 66kV powerline supported on timber poles, along the general alignment of Ulan-Wollar Road and Sandy Hollow – Gulgong Railway. At changes in the alignment of the powerline, the timber poles have guy wires for additional lateral restraint. A substation is also proposed to the north of Longwall 101.

The nearest sections of the powerline to the proposed longwalls are approximately 30 m from the finishing (northern) end of Longwall 103 (pole 70548) and 160 m from Longwall 101 (pole 70540). The proposed substation is 100 m to the north of Longwall 101. At these locations the depths of cover range from 110 m to 130 m and at the minimum distance of 30 m the powerline is 0.3 times the depth of cover from the longwall. At 160 m from Longwall 101, the powerline is 1.2 times the depth of cover from the longwall.

Conventional Subsidence Parameters

At distances of 30 m or more from the longwalls, the powerline and substation are outside the predicted 20 mm subsidence contour. The predicted subsidence movements at the powerline and substation are therefore less than typical limits of measurable conventional mine subsidence ground movements (i.e. less than limits of survey accuracy); however, the powerline and substation may experience far-field horizontal movements which are discussed below.

There can be considerable variation in predicted subsidence movements at low magnitudes and near the edges of extracted longwalls. In these cases, predictions should generally be accurate to within 50 mm of subsidence. The first longwall (Longwall 101) is furthest from the 66kV powerline and this layout allows for validation of the subsidence behaviour over the ends of the longwalls prior to extraction at the closest point to the powerline, which occurs adjacent to Longwall 103.
Far-Field Movements

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.

In some cases, higher levels of far-field horizontal movements have been observed where steep slopes or surface incisions exist nearby, as these features influence both the magnitude and the direction of ground movement patterns. Similarly, increased horizontal movements are often observed around sudden changes in geology or where blocks of coal are left between longwalls or near other previously extracted series of longwalls. In these cases, the levels of observed vertical subsidence and horizontal movement can be slightly higher than normally predicted, but these increased movements are generally accompanied by very low levels of tilt and strain.

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 very low levels of far-field horizontal movements, however, there is a higher scatter in the orientation of the observed movements.

The observed incremental far-field horizontal movements, resulting from the extraction of each longwall within a series, are shown in Figure 1. The observed directions of these far-field horizontal movements were generally observed to be orientated towards the extracted longwall.

This plot of far-field horizontal movements includes some multi-seam mining cases and some sites where it is known that the plotted movements include components from valley closure effects. The confidence levels, based on fitted Generalised Pareto Distributions (GPDs), have also been shown in this figure to illustrate the spread of the data. The magnitude of these movements decrease with distance from the mined edges however, there have been cases where the observed far-field horizontal movements beyond the edges of the mined panels have approached 400 mm. The highest observed far-field horizontal movements are multi seam cases that are located close to large valleys.

This data includes some of the available observed far-field horizontal movements that have been measured at Ulan Coal Mine and other observed data from other regions where the depths of cover are also relatively shallow compared to the Southern Coalfield of NSW. The available far-field incremental horizontal movement data has therefore been replotted, as shown in Figure 2, against the distances from the nearest edge of the incremental panel divided by the depth of cover.
Figure 1  Observed Incremental Far-field Horizontal Movements (mm) from Many Regions in NSW Plotted Against the Distance to the Nearest Edge of the Mined Panel (m)

Figure 2  Observed Incremental Horizontal Movement versus Distance to Active Longwall divided by Depth of Cover

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)
Figure 2 replots the available far-field horizontal movement data that is shown in Figure 1 to allow for varying depths of cover and this plot is more appropriate for use at the Moolarben Coal Complex. This plot still includes those many cases where higher movements occurred because of multi-seam mining and valley closure effects.

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.

Figure 2 shows the upper limit of previously observed absolute far-field horizontal movements (ignoring multi seam cases) for the sites located 0.3 times the depths of cover from longwalls, was less than 310 mm. This value is governed by a small number of data points from a Hunter single seam case that was adjacent to an open cut pit and can be excluded for assessment of the horizontal movements to the north east of Longwalls 101 to 103. The resulting upper limit of previously observed absolute far-field horizontal movements is 200 mm. At 1.2 times the depths of cover from longwalls, the upper limit of previously observed absolute far-field horizontal movements was less than 150 mm. These limits include data from the H-Line case and the F-Line case where high valley closure movements were observed. Ignoring sites with high valley closure movements and the multi seam cases, Figure 2 shows the upper limit of previously observed absolute far-field horizontal movements for sites located 0.3 times and 1.2 times the depths of cover from longwalls, is less than 180 mm and 120 mm respectively.

The 66kV powerline and substation, therefore, are predicted to experience incremental far-field horizontal movements in the order of 120 mm to 180 mm due to the extraction of each of Longwalls 101 to 103. These horizontal movements are not expected to be associated with measurable tilts, curvatures or strains.

**Influence of Unconsolidated Tertiary Sediments on Horizontal Far-field Movements**

There are unconsolidated Tertiary sediments, with a maximum thickness of 40-50 m, to the north and east of the Longwalls 101 to 103 as shown in Drawing No. MSEC877-05. These unconsolidated sediments are remnants of inactive river or stream channels that have been later filled in or buried by younger sediment that can be stronger or weaker than the original strata.

At Moolarben Coal Complex the unconsolidated sediments to the north and east of Longwalls 101 to 103 were formed when Permian strata layers were replaced with infill sediments consisting of poorly-sorted semi-consolidated quartzose sands and gravels in a clayey matrix, i.e. including unsaturated alluvium and low permeability clays. The presence of these materials can modify the subsidence ground movements beyond the end of the longwalls, (depending on the depth of the channels, and its location with respect to the panel edges).

Since these unconsolidated sediments are located away from the edges of the longwalls, then, their presence should result in less subsidence and reduced far-field movements within these areas.

**Influence of the Existing Open Cut (OC1) on Horizontal Far-field Movements**

An open cut mining area (OC1) currently in operation is located to the north west of the longwalls as shown in Drawing No. MSEC877-05. Access to the longwalls will be via the OC1 pit. An open cut mining area is also located to the south east (OC4) and will be extracted as part of future operations.

The open cut pits extract the overburden material and the target coal seam i.e. down to the seam floor level of the longwalls. The effect of the removal of this material is to relieve or redistribute much of the in situ stress in the overburden strata adjacent to the pit. With the removal of the overburden material, the potential for far-field effects to develop in the vicinity of the pit are significantly reduced.

With rehabilitated open cut mine areas, the overburden material has been replaced, typically with other stripped material which is compacted by vehicle tracking during the emplacement process. Potential for far-field movements where the open cut pit has been fully rehabilitated between the longwalls and the outer natural overburden is expected to be significantly reduced, similar to the open cut pit, as the emplaced material is unlikely to support any significant stress redistribution.
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 localised 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 remain 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.

The range of potential strains associated with non-conventional movements has been assessed using monitoring data from previously extracted panels in the NSW Coalfields, for single-seam conditions, where the width-to-depth ratios and extraction heights were similar to those of Longwalls 101 to 103. 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. 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 within 200 m of the nearest longwall goaf edge.

The 95 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 3.3 mm/m tensile and 3.0 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 9.2 mm/m tensile and 14.4 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 were 0.9 mm/m tensile and 0.5 mm/m compressive. It is noted that these results comprise a component of survey tolerance and have also been affected by disturbed survey marks and survey errors.

Impact Assessments for Essential Energy Infrastructure

The predicted subsidence movements at the 66kV powerline and substation are expected to be less than typical measurable limits for conventional vertical subsidence, tilt, curvature or strain. However, the powerline and substation may experience far-field horizontal movements. The upper limit of previously observed absolute far-field horizontal movements for sites located 0.3 times to 1.2 times the depths of cover from longwalls, is in the order of 120 mm to 180 mm. The presence of unconsolidated sediments should result in reduced far-field movements at the powerline and substation.

The predicted far-field horizontal movements at the powerline are expected to be bodily movements that are directed across the general alignment of the powerline towards the extracted goaf area and should be accompanied by very low levels of strain that are in the order of survey tolerance. Relative movement between poles is expected to be less than 50 mm. Negligible relative movement is expected to develop within the substation. Adverse impact to the powerline and the substation resulting from these potential far-field horizontal movements are considered to be unlikely to occur.

There is the potential for measurable ground strains to occur resulting from non-conventional movements. The statistical analysis of observed strain data within 200 m of extracted longwalls shows a 25 % probability of exceedance of 0.8 mm/m tensile and 0.5 mm/m compressive, and a 5% probability of exceedance of 3.3 mm/m tensile and 3.0 mm/m compressive.
With the location of the 66kV powerline and substation outside the longwall footprint and the low probability of significant observed strains developing based on statistical analysis, the development of adverse impacts to the powerline and substation due to the extraction of Longwalls 101 to 103 is considered to be unlikely to occur.

The ground movements can be monitored using traditional survey lines and visual inspections. These monitoring methods can be used to identify the development of irregular ground movements.

It is recommended that monitoring and management strategies are developed, in consultation with Essential Energy, to manage the powerline and substation for potential irregular ground movements. It is expected that the powerline and substation can be maintained in a safe and serviceable condition with the implementation of the appropriate monitoring and management strategies.

**Recommendations**

In order to manage the predicted impacts on Essential Energy infrastructure, the following is recommended:

- Implement a program of monitoring for potential far-field horizontal movements and non-conventional movement.
- Develop and implement monitoring and management strategies for dealing with potential impacts on Essential Energy infrastructure.

**Summary**

The 66kV powerline and substation are located outside the footprint of Longwalls 101 to 103 and within 30 m to 160 m from the finishing (northern) ends of these longwalls. The powerline and substation are expected to experience low level conventional vertical subsidence movements of less than typical survey accuracy, resulting from the extraction of these longwalls. The upper limits of predicted far-field horizontal movements at the location of the powerline and substation are of the order of 120 mm to 180 mm. Relative movement between poles is expected to be less than 50 mm. Negligible relative movement is expected to develop within the substation.

There is a low probability that significant strains could develop at the location of the powerline and substation due to non-conventional movements and as a result, the development of adverse impacts to the powerline and substation due to the extraction of Longwalls 101 to 103 are considered to be unlikely to occur.

Ground monitoring and visual monitoring is recommended for the powerline and substation for each longwall to check for the potential development of irregular subsidence movements.

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

Yours sincerely

Peter DeBono

Attachments:

Drawing No. MSEC877-05 – Longwalls 101 to 103 – Essential Energy Infrastructure
ATTACHMENT 2

UG1 LONGWALLS 101 TO 103 BUILT FEATURES MANAGEMENT PLAN – ESSENTIAL ENERGY TRIGGER ACTION RESPONSE PLAN
<table>
<thead>
<tr>
<th>Condition</th>
<th>Baseline Conditions</th>
<th>Predicted Impacts</th>
<th>Implement Management Measures</th>
<th>Restoration/Contingency Phase</th>
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<td>Trigger</td>
<td>Essential Energy 66 kV/22 kV dual circuit powerline is safe, serviceable and repairable or as otherwise identified by pre-mining inspection. Substation foundation designed in consultation with Essential Energy.</td>
<td>Subsidence effects on the Essential Energy 66 kV/22 kV dual circuit powerline and substation are within predicted levels.</td>
<td>Monitoring identifies impacts that are greater than predicted, but the performance measure has not been exceeded and is not likely to be exceeded.</td>
<td>If the Performance Measure relevant to the Essential Energy 66 kV/22 kV dual circuit powerline has been exceeded, or is likely to be exceeded (i.e. loss of serviceability).</td>
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<tr>
<td>Action</td>
<td>Establish baseline data, including: Pre-mining inspection. Installation of tilt monitoring points on power poles closest to Longwalls 101 to 103, and substation survey as per the UG1 Longwalls 101 to 103 Subsidence Monitoring Program. Installation of subsidence monitoring points around the substation, and substation survey as per the UG1 Longwalls 101 to 103 Subsidence Monitoring Program.</td>
<td>Conduct monitoring as described in Section 6, including: Survey of power poles closest to Longwalls 101 to 103. Visual inspection of the condition of existing 66 kV/22 kV dual circuit powerline and substation. Subsidence impact inspections, targeting the identification of: surface cracking; surface humps; damage to poles, conductors and/or powerlines; reduced ground clearance; tilting of substation foundations; tilting of power poles; and bent cross-arms or insulators.</td>
<td>Management measures will be determined and implemented in consultation with Essential Energy (with regard to the specific circumstances of the subsidence impact [e.g. the nature and extent of the impact]). Potential management measures are described in Section 7. Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures. Notifications by exception (i.e. following identification of movement).</td>
<td>Contingency Plan implemented if performance measure (i.e. secondary trigger) is exceeded (with regard to the specific circumstances of the subsidence impact). In summary:</td>
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<tr>
<td>Frequency</td>
<td>Prior to commencement of extraction of Longwall 101.</td>
<td>Survey of power poles closest to Longwalls 101 to 103. Prior to secondary extraction within 400 m of the Longwall 101 take-off position (i.e. the existing longwall mining limits). At 100 m intervals when mining within 400 m of the longwall take-off position. Visual inspection: Prior to secondary extraction within 400 m of the Longwall 101 take-off position (i.e. the existing longwall mining limits). Subsidence impact inspection: In the event monitoring detects movements in excess of survey/design tolerances. Within three months of longwall completion (e.g. longwall has been relocated from the final end of block mining position). At any time in case of fault or emergency and where requested by Essential Energy.</td>
<td>To be implemented as required (i.e. if monitoring identifies impacts that are greater than predicted, but the performance measure has not been exceeded and is not likely to be exceeded).</td>
<td>To be implemented following identification of an exceedance of the performance measure, or if the performance measure is likely to be exceeded (i.e. unsafe or loss of serviceability).</td>
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### Note
- kV = kilovolt
ATTACHMENT 3

UG1 LONGWALLS 101 TO 103 BUILT FEATURES MANAGEMENT PLAN – ESSENTIAL ENERGY
SUBSIDENCE IMPACT REGISTER

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UG1 Longwalls 101 to 103 Built Features Management Plan – Essential Energy
Subsidence Impact Register

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