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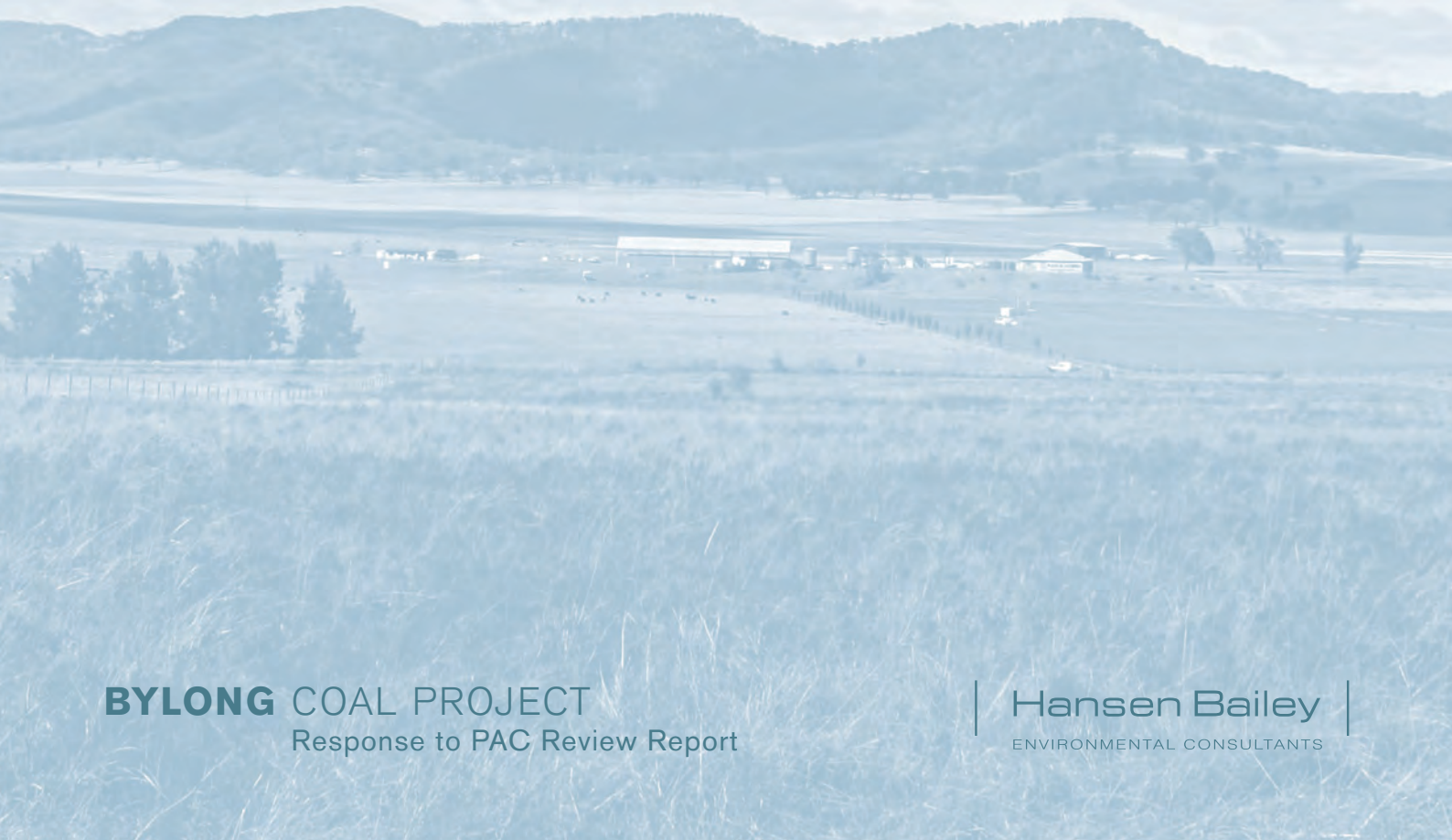
MWRC Briefing on Bylong Valley Way Subsidence Management



BYLONG COAL PROJECT
Response to PAC Review Report

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

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Phone: 02 8904 9508 Fax: 02 8904 9588

22 December 2017

Mr Brad Cam
General Manager
Mid-Western Regional Council
PO Box 156
Mudgee NSW 2850

Dear Mr Cam

Bylong Coal Project – Subsidence Management Bylong Valley Way

I refer to the meeting held on 18 October 2017 at MWRC offices regarding the management of subsidence on Bylong Valley Way above the longwall panels should the Bylong Coal Project (the Project) be approved. The meeting was attended by:

- Gary Hemsworth – MWRC;
- Julie Robertson – MWRC;
- Sally Mullinger – MWRC;
- Bill Vatovec – KEPCO;
- Thomas Frankham – WorleyParsons;
- Nathan Cooper – Hansen Bailey; and
- Peter DeBono – Mine Subsidence Engineering Consultants (MSEC)

The purpose of the meeting was to address issues raised by the Planning Assessment Commission (PAC) in its Review Report of 25 July 2017.

A comprehensive presentation was provided to the Council officers at the meeting setting out the layout of the longwall mining panels, subsidence predictions and the potential impacts on Bylong Valley Way and the proposed management measures and process for mitigating the impacts.

Please now find attached a letter report (including the presentation) from MSEC which provides a record of what was discussed and agreed at the meeting.

We seek from MWRC acknowledgement of the letter report as representing the outcomes of the meeting and that Council believes that what has been proposed for the management of any subsidence on Bylong Valley Way can be managed as represented.

Should you require any clarification on the detail of this letter, please do not hesitate to contact me on (02) 8904 9508.

Yours faithfully,

William (Bill) Vatovec
Chief Operating Officer
KEPCO Australia Pty Ltd

Attachment: MSEC Letter Report

27th November 2017

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Level 12, 141 Walker Street
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NSW 2060

For the attention of Mr. Rory Gordon

Dear Rory,

RE: Bylong Project – Mid-Western Regional Council briefing on Bylong Valley Way Subsidence Management

WorleyParsons Project No. 201015-00276
Agreement No. 201015-00276-PS-CNT-0013

Background

KEPCO Bylong Australia Pty Ltd plan to develop a new thermal coal mine currently known as the Bylong Coal Project (the Project), which is to consist of both open cut and underground operations. The EIS was submitted to the Department of Planning and Environment (DP&E) on 22 July 2015. The NSW Government Planning Assessment Commission subsequently issued a Review Report for the Bylong Coal Project; Report Ref. SSD 6367, dated 25 July 2017.

The Review Report raised concern about the ongoing management of subsidence impacts to the Bylong Valley Way from a public safety perspective. This document has been prepared to address the issues raised in the report and provide further detail on the measures proposed to mitigate the perceived risks to public safety.

In order to understand and address the concerns raised in the Review Report, a meeting (the Meeting) was held on Wednesday 18th October 2017 with Mid-Western Regional Council (MWRC), who are the owner and have responsibility for the management of the Bylong Valley Way. The Meeting was attended by the following persons:

- Gary Hemsworth – MWRC;
- Sally Mullinger – MWRC;
- Julie Robertson – MWRC;
- Nathan Cooper – Hansen Bailey;
- Bill Vatovec – KEPCO;
- Thomas Frankham – WorleyParsons; and
- Peter DeBono – Mine Subsidence Engineering Consultants (MSEC).

A copy of the presentation delivered by Hansen Bailey and MSEC to MWRC during the Meeting is provided in Appendix A and is summarised below.

The Meeting concluded the following:

- Potential subsidence impacts can be effectively managed, as has been demonstrated with numerous previous case studies;
- KEPCO has a firm commitment to manage and repair subsidence related impacts to the Bylong Valley Way, to ensure public safety is maintained at all times;
- Extraction Plans, including detailed management plans and risk assessments, will be prepared prior to commencement of longwall mining beneath Bylong Valley Way; and

- Recommendation to form a steering committee and technical committee consisting of representatives from MWRC, Kepco, related professions (e.g. subsidence, geotechnical, pavement design) and other stakeholders to successfully manage surface infrastructure that may experience impacts resulting from underground mining operations (an approach previously successfully relied upon by RMS).

MWRC were satisfied with the proposed approach and processes to manage and mitigate potential subsidence impacts to the Bylong Valley Way. Additional meetings and discussions will be held with MWRC to further develop the approach to managing potential risks and impacts prior to the occurrence of active subsidence of the Bylong Valley Way.

A summary of information presented during the Meeting is provide below. Further information relevant to subsidence predictions, impacts and management on Bylong Valley Way can be found in the following documents:

- MSEC, (2015). *Bylong Coal Project - Subsidence Ground Movement Predictions and Subsidence Impact Assessments for all Natural Features and Surface Infrastructure in support of the Environmental Impact Statement*, Mine Subsidence Engineering Consultants, May 2015 (Appendix H of Hansen Bailey (2015) *Bylong Coal Project Environmental Impact Statement*.)
- O'Brien, D. (2004). *Beltana Mine - A case study on a proactive approach to managing and monitoring the impacts of mine subsidence*. Proceedings of the MSTS Mine Subsidence Technological Society 6th Triennial Conference on Mine Subsidence, Maitland, 31 Oct to 2 Nov 2004, pp 137-150.
- RTS, (2016). *Bylong Coal Project – Environmental Impact Statement – Response to Submissions*, *Main Report*, 23 March 2016, Section 5.4.10, pp 264-275.
- Planning Assessment Commission (2017). *Bylong Coal Project, SSD 6367, Review Report*, 25 July 2017.
- Umwelt, (2008). *Bulga Coal Complex Annual Environmental Management Report 2007*, Umwelt (Australia) on behalf of Bulga Coal Management, April 2008.
- Umwelt, (2009). *Bulga Coal Complex Annual Environmental Management Report 2008*, Umwelt (Australia) on behalf of Bulga Coal Management, April 2009.

Bylong Valley Way

Bylong Valley Way is a two lane sealed asphalt road that connects the townships of Bylong and Sandy Hollow. The road has a posted speed limit of 100 km/h generally, with reduced speed limits at level crossings and outside and within the township of Bylong. A photograph of Bylong Valley Way above the proposed longwalls is shown in **Plate 1**.

Plate 1 Bylong Valley Way

Annual Average Daily Traffic on Bylong Valley Way based on October 2011 traffic counts was 418 vehicles, of which 13% were heavy vehicles, between Bylong and Sandy Hollow (PB, 2015). For the length of Bylong Valley Way that overlies the longwall mining area, various culverts facilitate drainage, with pipe diameters varying from 375 mm to 1200 mm diameter. Land either side of this length of road is owned by KEPCO, Bylong Quarry and Crown Land.

Underground Operations

The sequencing of underground mining is shown in Figure 1. Development of the underground mains is scheduled to commence in Year 6 of the Project. Bylong Valley Way will be mined beneath by Longwall 101, then by Longwalls 201 to 206. Longwall mining is scheduled to commence with Longwall 101 in Year 9 of the Project, with extraction of Longwall 201 to 23 in Years 16 to 20 and Longwalls 204 to 206 in Years 21 to 25.

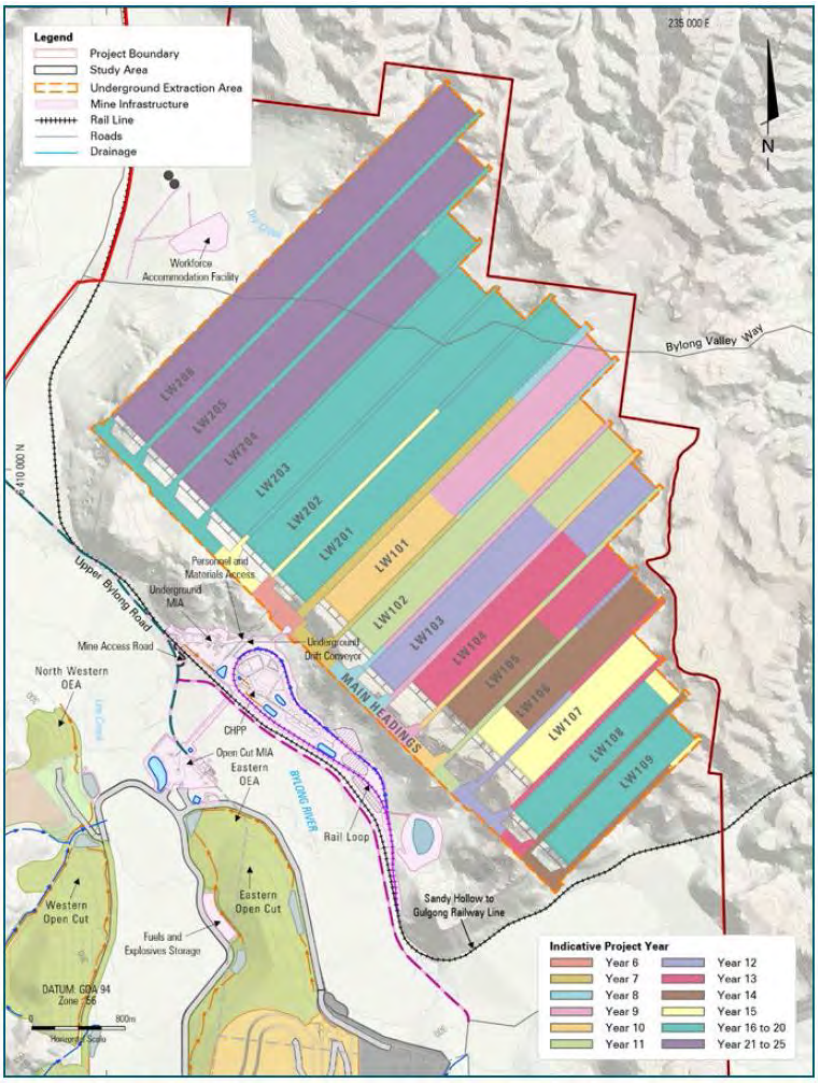

Figure 1 Bylong Valley Way

Subsidence Parameters and Subsidence Predictions

During the Meeting with MWRC, MSEC provided an overview of subsidence parameters, and the subsidence predictions for the Project and specifically for Bylong Valley Way.

Potential Impacts to Bylong Valley Way

A summary of expected impacts to Bylong Valley Way include:

- Subsidence impacts occur following the progression of longwall panel extraction – monitoring and management can therefore be well planned;
- Bylong Valley Way is located above the corner of LW101, therefor minor subsidence impacts are expected from LW101 due to low level of subsidence (<450mm);
- Increasing magnitudes of subsidence and associated impacts are expected for extraction of LW201 to LW206 from project year 16. Refined modelling will be carried out at the extraction plan stage of the Project;
- There is the potential for subsidence to result in cracks, heaving, and stepping of the road surface; and
- Ponding and flow redirection are also expected to result from subsidence.

Duration

Further clarification was provided during the Meeting with MWRC on expected duration of subsidence with the extraction of each longwall panel. The following summary was provided:

- Subsidence events occur along a section of Bylong Valley Way with the extraction of each longwall panel.
- The length of the affected section of pavement for each subsidence event is expected to range from about 250 m to 800 m. Most of the sections of pavement are about 400 m, with the longer 800 m section located above Longwall 202.
- The duration of each subsidence event is expected to range from about 4 weeks to 8 weeks.
- With extraction of the 200 series longwall panels, the expected duration between subsidence events is to range from about 6 months to 8 months.
- The duration of the subsidence events and the time between subsidence events is dependent on the rate of extraction of the longwall panels.
- Estimates are currently based on an extraction rate of 100 m per week using current modern mining methods.

Case Studies

Examples of successful management of impacts for similar roads with similar mining conditions provides an important precedent for the successful management of Bylong Valley Way. Previous submissions cited mining beneath the Hume Highway as an example. It was noted during the Meeting with MWRC that the Hume Highway subsidence and management case study was not considered to be suitable as a comparative case study since the setting in the NSW Southern Coalfield has much deeper cover above the longwall panels, much higher traffic volumes, and a different type of pavement, which results in different subsidence impacts.

The extraction of longwall panels and management of Charlton Road is considered to provide a suitable comparison for the future extraction of longwalls beneath Bylong Valley Way. Features of the Charlton Road case study are as follows:

- Shallow mining conditions, shallower than those for Bylong Valley Way.
- Similar predicted differential movements, i.e. tilt and curvature.
- Traffic volumes similar but slightly greater than Bylong Valley Way.
- Similar type of pavement.

The successful methods of subsidence management that were employed along Charlton Road can also be applied to Bylong Valley Way, as described within RTS, (2016).

Longwall mining beneath Appin Road in the NSW Southern Coalfield was also discussed as a case study and while some conditions differ from the proposed mining beneath Bylong Valley Way, the magnitudes of subsidence parameters are similar to those for the initial extraction of Longwall 101, and could therefore provide some guidance as to expected impacts at the commencement of Longwall 101.

Extraction Plans and Requirements Prior to Mining

Mine subsidence is tightly regulated in NSW with the NSW government enforcing strict contemporary standards that must be met before approval is granted for secondary extraction. Namely, Development Consents are subject to conditions that require the preparation and approval of an Extraction Plan prior to carrying out any second workings. Extraction Plans are only approved if the government accepts that the proposed management measures will reduce potential impacts to acceptable levels.

In accordance with Condition 6 of Schedule 3 of the draft Development Consent for the Project, an Extraction Plan will be prepared for the relevant workings to the satisfaction of the Secretary. As relevant to the Bylong Valley Way, each Extraction Plan will:

(a) Be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Secretary;

(b) Include detailed plans of existing and proposed first and second workings and overlying surface features, such as the Bylong Valley Way roadway and associated infrastructure, including any applicable adaptive management measures;

(c) Provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed mining covered by the Extraction Plan;

(d) Describe in detail the performance indicators and measures that would be implemented to ensure compliance with the performance measures listed in Tables 1 and 2, which includes ensuring the Bylong Valley Way is:

- Always safe and serviceable; and
- Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.

(e) Include a:

(i) Subsidence Monitoring Program which has been prepared in consultation with Office of Environment and Heritage (OEH) and Forests NSW, to:

- monitor the subsidence effects and subsidence impacts of the development;
- develop effective remote monitoring techniques for the development;
- provide data to assist with the management of risks associated with subsidence;
- validate the subsidence predictions;
- analyse the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and
- inform the contingency plan and adaptive management process;

(ii) Built Features Management Plan which has been prepared in consultation with DRE, to manage the potential subsidence impacts of the proposed underground workings on built features, and which:

- has been prepared in consultation with the owner/s of potentially affected feature/s;
- addresses in appropriate detail all items of key public infrastructure and other public infrastructure and all classes of other built features;
- recommends appropriate pre-mining mitigation measures to reduce subsidence impacts; and
- recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate predicted impacts on potentially affected built features in a timely manner;

(iii) Bylong Valley Way Management Plan which has been prepared in consultation with Council and the Subsidence Advisory, to manage the potential subsidence impacts of the proposed underground workings on Bylong Valley Way, and which includes provisions for:

- Pre-mining mitigation measures to reduce subsidence impacts;
- Pre-mining inspections of the road condition;
- Review of subsidence movements prior to mining near the road to validate subsidence predictions;
- Notification to the public and emergency services of the timing and lotion of mining operations beneath the road;
- 24-hour monitoring of the road during critical periods of active subsidence, with repair crews on hand to repair and maintain the integrity of the road;
- Undertaking of temporary repairs of surface cracks as soon as possible; and
- Post-mining inspections to review the temporary repair work and determine the extent of permanent repairs required;

The Extraction Plans also include a number of other Management Plans and programs such as:

(iv) Water Management Plan to provide for management of potential impacts of the proposed underground workings on watercourses and aquifers;

(v) Biodiversity Management Plan, which provides for the management and monitoring of potential impacts of the proposed first and second workings on aquatic and terrestrial flora and fauna,

(vi) Land Management Plan to manage the potential impacts and/or environmental consequences of the proposed underground workings on land in general, with a specific focus on cliffs and steep slopes;

(vii) Heritage Management Plans to manage the potential environmental consequences of the proposed workings on Aboriginal and historic heritage;

(viii) Public Safety Management Plan which has been prepared in consultation with DRE and Forest NSW to ensure public safety and manage access on the site;

(ix) Property Subsidence Management Plan for the Bylong State Forest and each privately-owned property affected by the proposed second workings, prepared in consultation with the landowner.

(x) include Trigger Action Response Plans, or equivalent, to prevent greater than predicted subsidence impacts and environmental consequences that may result from mining subsidence;

(xi) 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 1 and 2, or where any such exceedance appears likely;

(xii) proposes appropriate revisions to the Rehabilitation Management Plan required under condition 63 of Schedule 4; and

(xiii) includes a program to collect sufficient baseline data for future Extraction Plans.

It was noted during the Meeting that further assessments would be prepared prior to mining beneath Bylong Valley Way, including consultation and risk assessments. The key documents relating to the management of Bylong Valley Way for mine subsidence impacts includes, but is not limited to, the following:

- Extraction plan for selected longwall panels, to meet development consent conditions, as detailed above;
- Built Features Management Plan for MWRC;
- Public Safety Management Plan;
- Report on subsidence predictions and impact assessments for MWRC infrastructure; and
- Other management plans may be prepared for equipment and materials used for management of impacts along Bylong Valley Way.

Proposed Management Measures

The extraction of Longwall 101 is the commencement of underground longwall operations, therefore there would be no monitoring data or observational data for the project prior to extraction of this longwall. The predicted subsidence parameters for Bylong Valley Way due to the extraction of Longwall 101 are however low in magnitude in comparison to the extraction of subsequent longwalls. The following management measures are considered suitable for the extraction of Longwall 101 beneath Bylong Valley Way:

- Weekly survey and monitoring;
- Regular visual monitoring during active subsidence;
- Repair crew available if required; and
- TARP would be available, including contingency measures.

It is noted that the management of Bylong Valley Way for the extraction of Longwall 101 will be subject to the details set out in the final conditions of consent.

The extraction of Longwalls 201 to 206 will have the benefit of up to approximately 7 years of monitoring and observational data from the extraction of Longwalls 101 to 109. The following management measures are considered suitable for the extraction of Longwall Panels 201 to 206 beneath Bylong Valley Way:

- Pre-mining inspections of road conditions;
- Notifications to public and emergency services, including MWRC;
- 24hr monitoring during critical periods of active subsidence;
- Repair crew on standby;
- Actively carry out repair, as required;
- Post mining inspection of temporary repair; and
- Assessment of permanent repair.

Discussion

The outcomes from the Meeting with MRWC were considered to be very productive and gave all involved confidence that, as has previously been the case on other public roads, the subsidence of the Bylong Valley Way can be readily managed to ensure the safe and serviceable utilisation of the road way both during and post mining.

Yours sincerely

Peter DeBono
Mine Subsidence Engineering Consultants

APPENDIX A. PRESENTATION

Bylong Coal Project

Bylong Valley Way
Subsidence Management

For Mid Western Regional Council

18 October 2017

WorleyParsons
resources & energy

KEPCO
KOREA ELECTRIC POWER CORPORATION
BYLONG AUSTRALIA

Hansen Bailey

Bylong Valley Way

- Regional rural type road – identified as a tourist route
- Two lane bitumen sealed road
- Speed limit of 100 km/hr
- AADT of 418 vehicles per day between Wollar Road and Sandy Hollow (based on counts undertaken in 2011)
- Various culverts to facilitate drainage from the more elevated areas of Bylong State Forest
- Land either side of road is generally owned by KEPCO, Bylong Quarry and Crown Land

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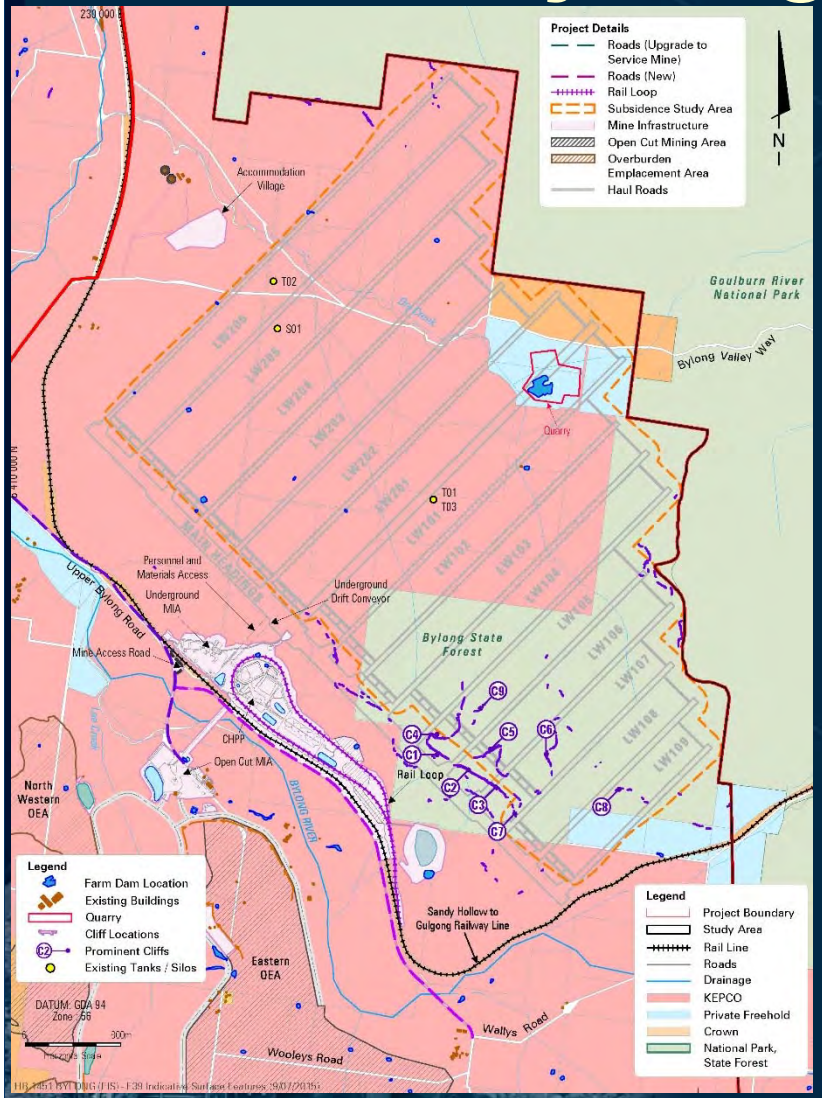
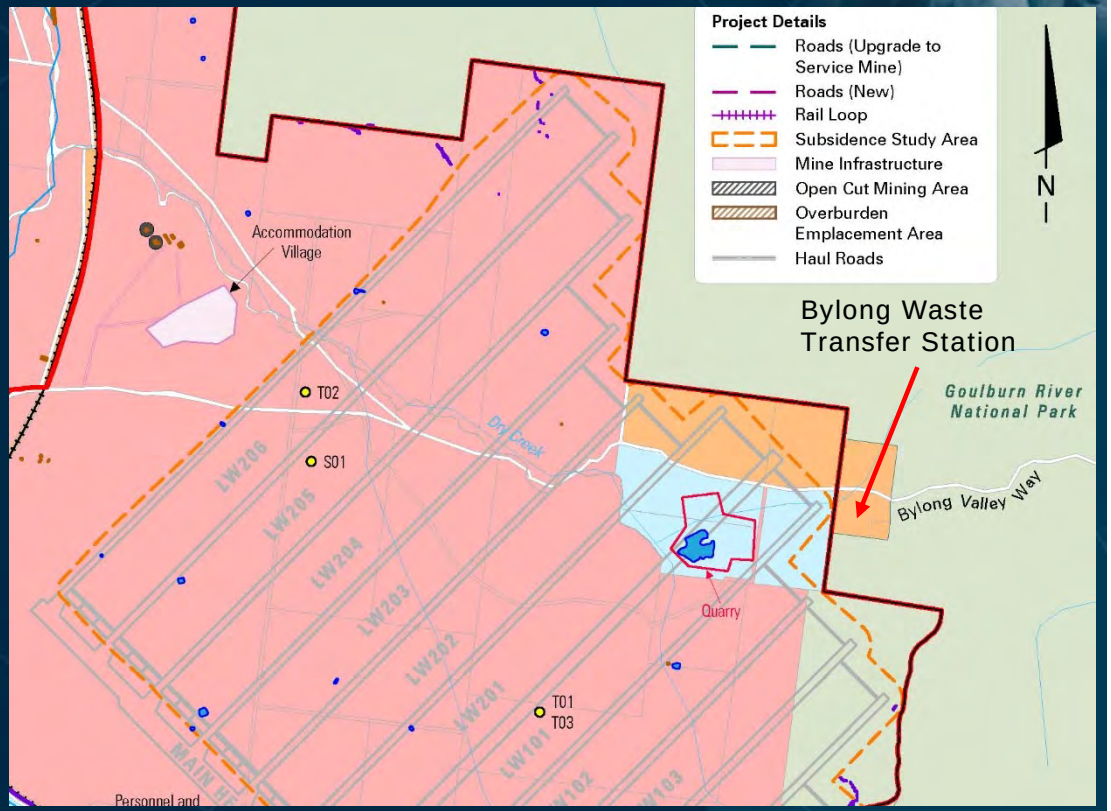
Bylong Valley Way





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Bylong Valley Way

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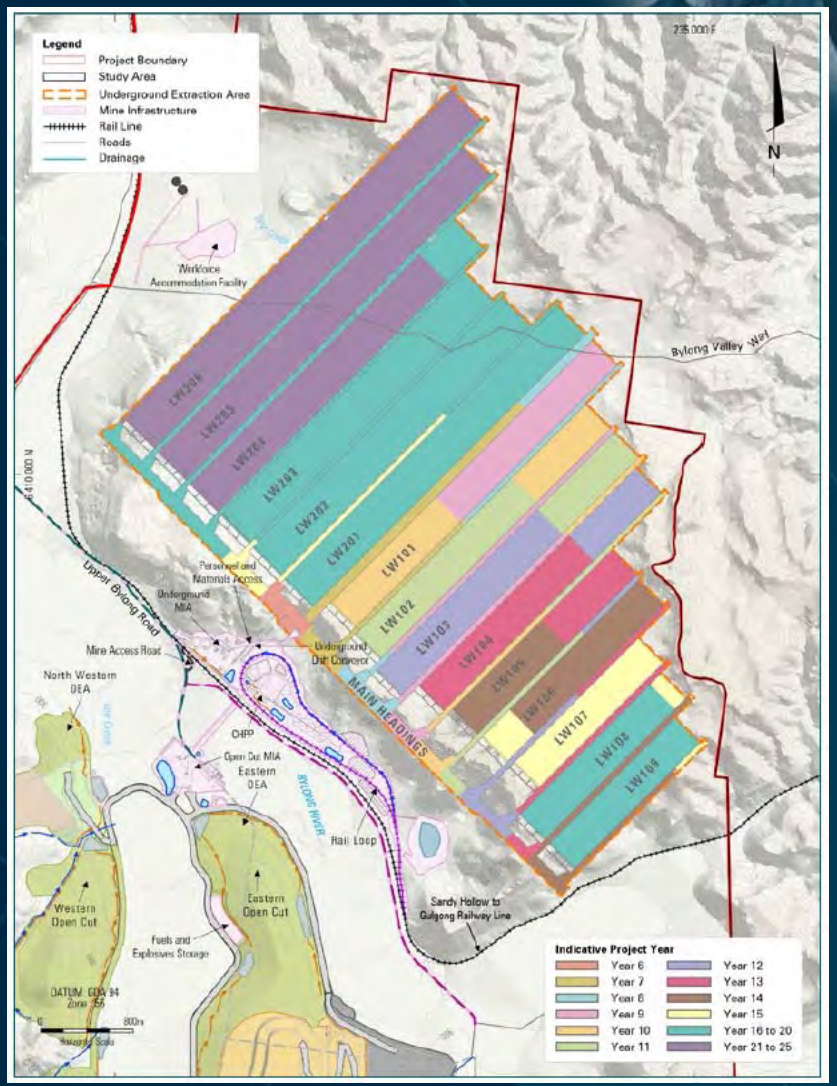
Underground Operations

- Initial mains development – Project Year 6
- Longwall 101 – Project Year 9 (start of underground longwall mining)
- Longwalls 201 to 203 – Project Years 16 to 20
- Longwalls 204 to 206 – Project Years 21 to 25



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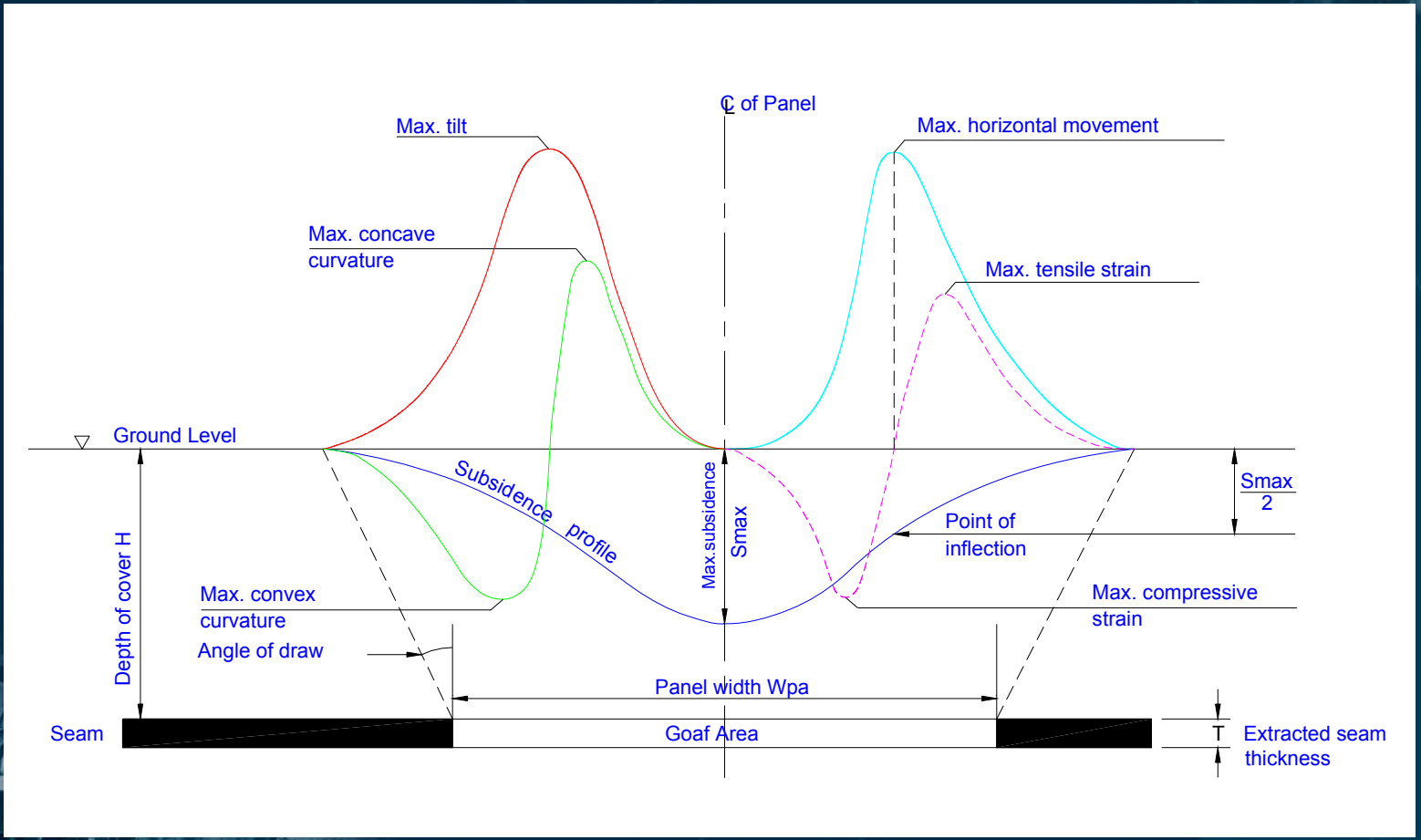
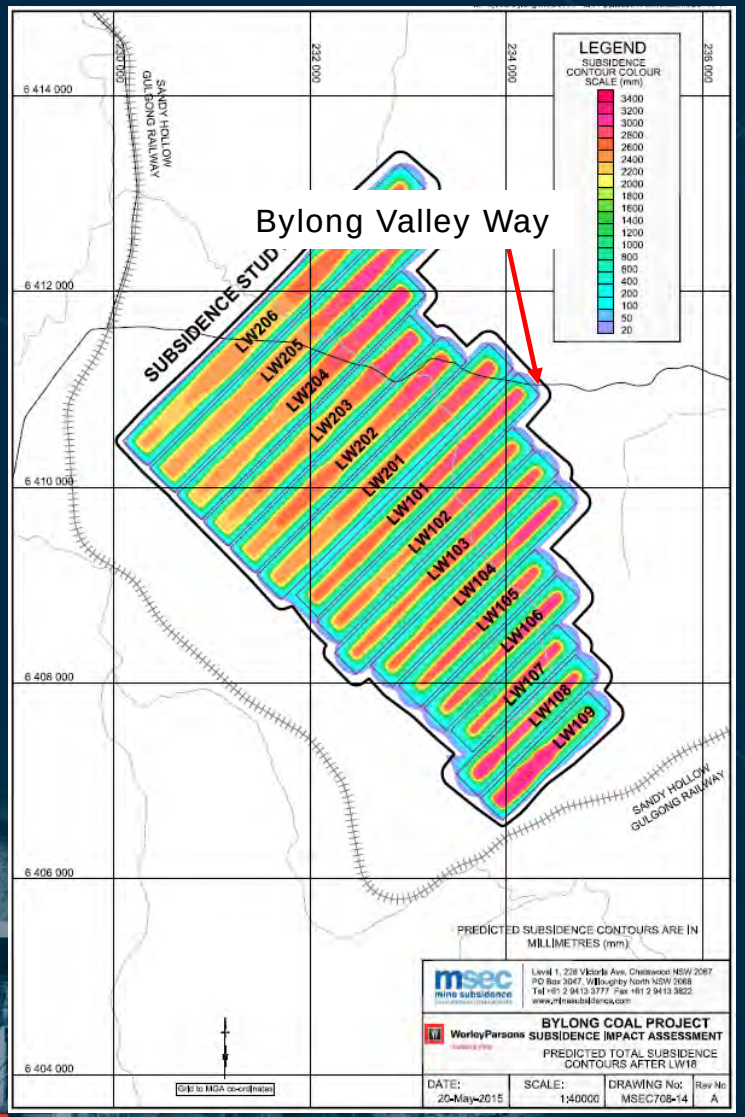
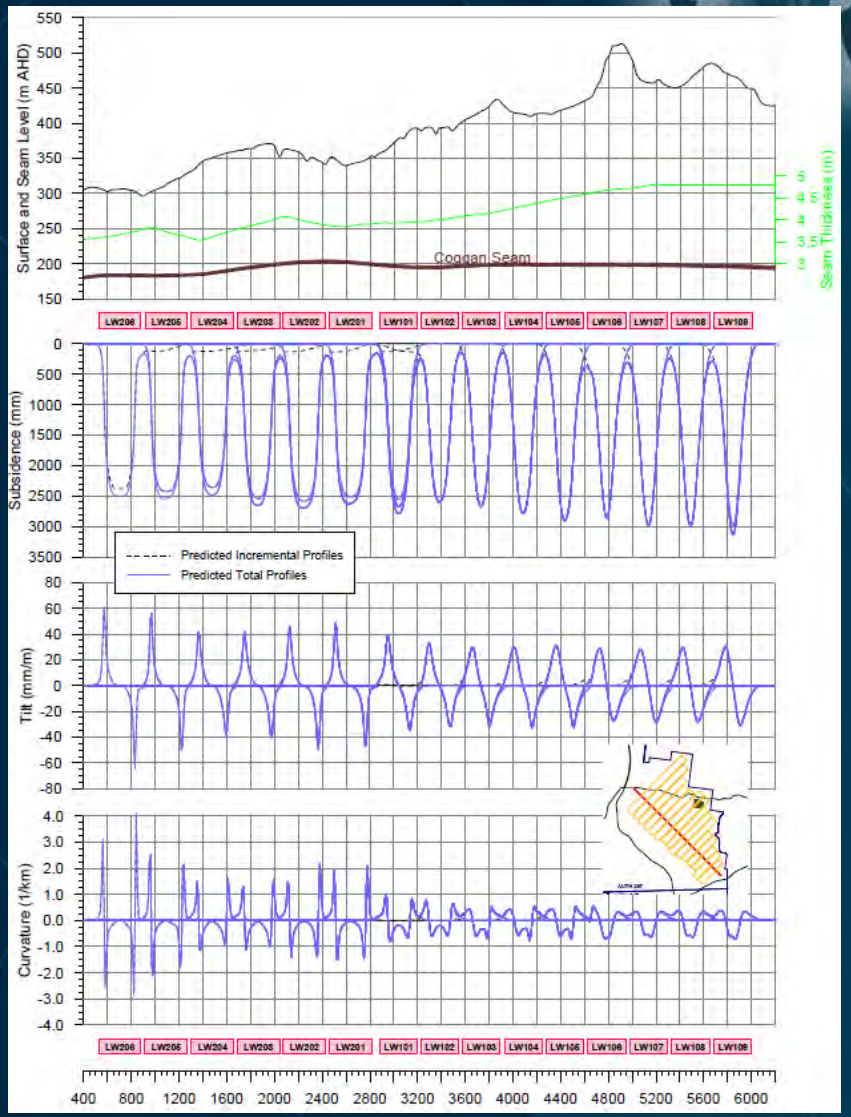
Subsidence Parameters



Subsidence Predictions





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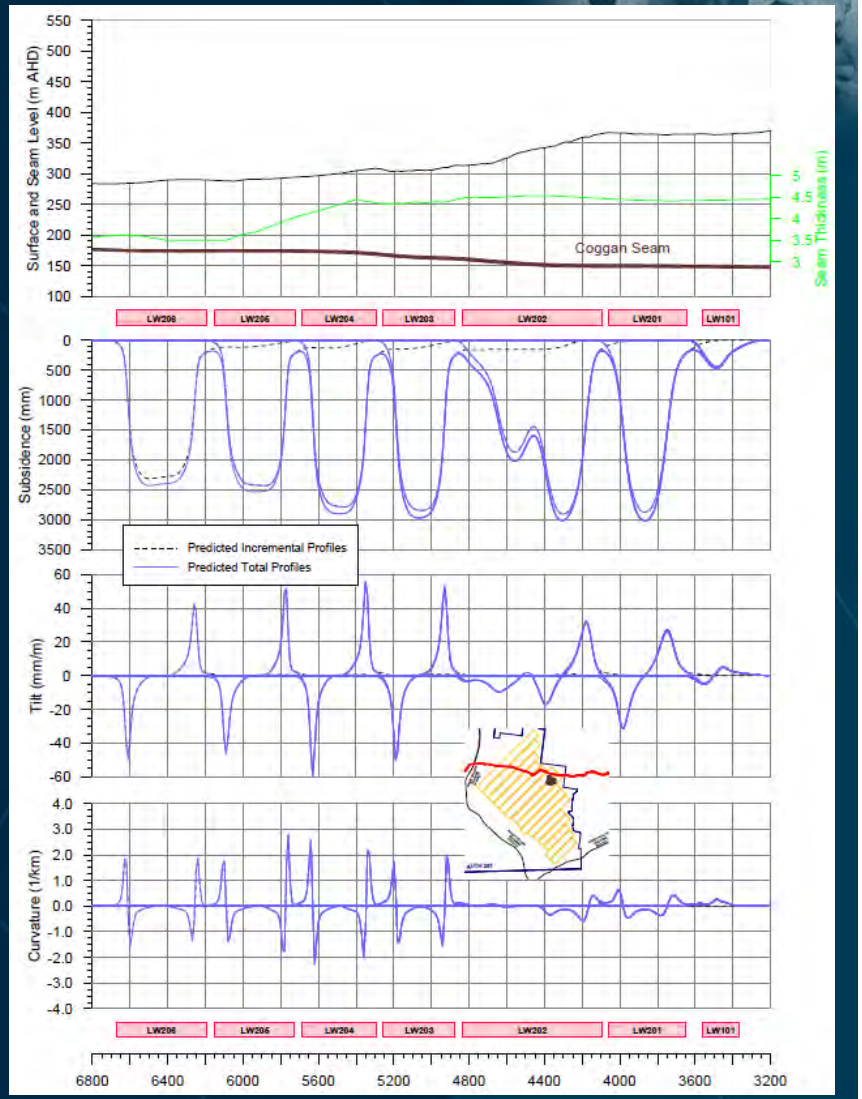
Subsidence Predictions

TABLE 28 Predicted Subsidence Effects Along Bylong Valley Way

Longwall	Maximum Subsidence (mm)	Maximum Tilt Along Alignment (mm/m)	Maximum Hogging Curvature (km^{-1})	Maximum Sagging Curvature (km^{-1})
LW101	450	5	0.3	<0.01
LW201	2,900	30	0.6	0.5
LW202	3,000	30	0.6	0.6
LW203	3,000	50	2.0	1.5
LW204	3,000	60	2.5	2.5
LW205	3,000	60	3.0	2.5
LW206	3,000	60	3.0	2.5

- Proposed mining heights between 3.5 m and 4.5 m
- Longwall widths 315 m and 355 m
- Depth of Cover 105 m to 215 m



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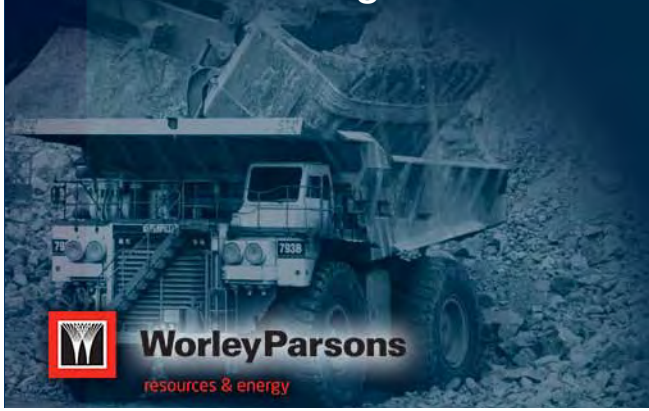
Potential Impacts to Bylong Valley Way

- Subsidence impacts are short lived and occur following the progression of longwall panel extraction – monitoring and management can therefore be well planned
- Minor impacts expected from LW101 due to low level of subsidence (<450 mm) – corner of longwall panel to be extracted
- Increasing subsidence levels and associated impacts for LW201 to LW206 – from Project Year 16 – use refined model for extraction plan
- Potential for subsidence to result in cracks, heaving, stepping of road surface
- Ponding, flow redirection – further predictions for extraction plan



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Duration

- Subsidence event each longwall
- Length of affected pavement 250 m to 800 m
- Duration of subsidence events ~4 to 8 weeks each
- ~6 to 8 months between subsidence events within the 200 series longwall panels
- Depends on extraction rate
- Assumed 100 m per week based on modern LW mining methods

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Case Studies

- Hume Highway not useful as a case study
  - Deep cover
  - High traffic volume
  - Different pavement

- Appin Road – useful for impacts from LW101
- Charlton Road – similar and one of the best case study's for Project
  - Shallower depth of cover
  - Similar predicted differential movements
  - Traffic volumes more than, but similar to Bylong Valley Way
  - Similar type of pavement

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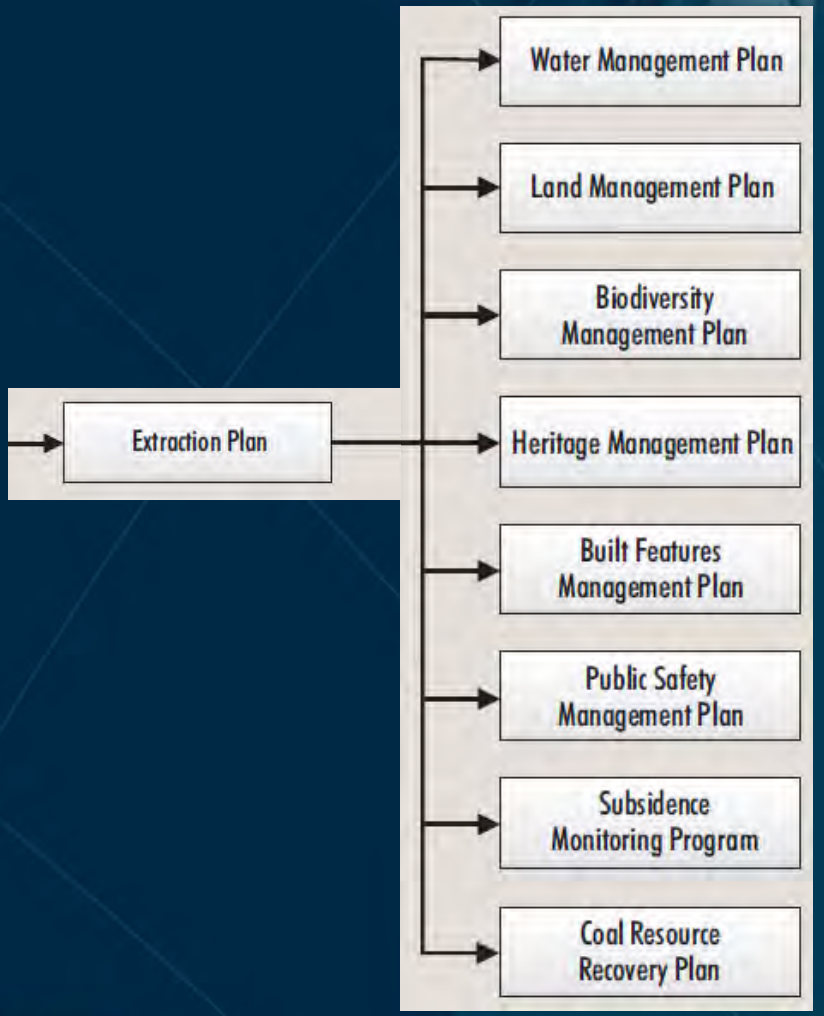
Extraction Plans and Requirements Prior to Mining

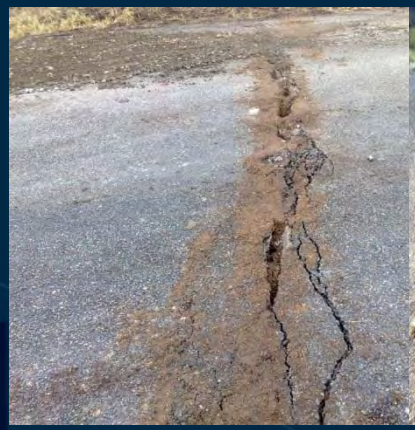
- Several management plans to be prepared
- Consultation process
  - Risk assessment
- Key documents include:
  - Extraction Plan for selected longwalls
  - Built Features Management Plan – Mid Western Regional Council
  - Public Safety Management Plan
  - Subsidence predictions and impact assessments for MWRC Infrastructure
  - Others relevant for equipment and materials used for management of impacts



Proposed Management Measures

- Longwall 101
  - First longwall, no monitoring data
  - Predicted subsidence parameters low in magnitude
  - Weekly survey and monitoring
  - Repair crew available, if needed
  - TARP - Contingency
- Longwalls 201 to 206
  - 10 years of monitoring data and observed impacts (access roads and others)
  - Pre-mining inspections of road conditions
  - Notifications to public and emergency services, including MWRC
  - 24hr monitoring during critical periods of active subsidence
  - Repair crew on standby
  - Actively carry out repair, as required
  - Post mining inspection of temporary repair
  - Assessment of permanent repair

Management



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Discussions

- Impacts can be effectively managed
- Commitment by KEPCO to manage and repair subsidence related impacts to the Bylong Valley Way
- Extraction Plans
  - Management Plans
  - Risk Assessments
- Steering Committee (RMS)
- Technical Committee (RMS)

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Discussion

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APPENDIX B.
MID-WESTERN REGIONAL COUNCIL CORRESPONDENCE