Submission to the

NSW Department of Planning and Environment

KEPCO - Bylong Coal Project

November 2015

Bylong Valley Protection Alliance Inc

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BYLONG NSW 2849

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Thank you for the opportunity to make this submission in relation to KEPCO's proposed Bylong Coal Project.

The Bylong Valley Protection Alliance Inc objects to the proposal.

Prefatory Comments Regarding KEPCO's Character And Approach

KEPCO locally has form in playing loose with the truth (misrepresenting levels of engagement with stakeholders, for example) and in withholding important information from - and failing to consult genuinely and openly with – various individuals and groups affected by their proposed development. At the same time, KEPCO is currently under investigation for knowingly providing false and misleading information to government as part of an exploration application and has, at various times, shown itself unaware of obligations under legislation. KEPCO's behaviour during exploration has also raised questions as to their willingness to take shortcuts or proceed less than carefully at times. Note that these claims are not just empty assertions: each of them can be substantiated by evidence (and the BVPA is more than happy to provide this evidence to the Department of Planning on request).

Given such form, it's hardly surprising that the EIS contains multiple claims that are at best disingenuous in nature and multiple instances where the detail that would be necessary for proper scrutiny and critical review is lacking. (Many of these are highlighted at various points in the consultants' reports attached as appendices to this submission.)

Relatedly, our consultants have identified a number of instances where the EIS fails to adequately address various issues raised by the Gateway Panel and others, suggesting either a certain lack of attention to detail on KEPCO's behalf or, alternatively, a propensity to test limits with respect to what it might be able to "get away with" – neither of which is desirable in the context of a large greenfield proposal. (It also invites a question as to why the EIS was ever deemed by the Department to be "adequate" to go on public exhibition in its current state.)

Holding KEPCO To Account And 'Raising The Bar'

KEPCO's proposal promises a great deal with very little by way of a guarantee in terms of delivery. Without strong conditions and equally strong monitoring and enforcement of compliance, KEPCO's undertakings amount to little more than "vapourware", regardless of the apparent amount of detail they contain. More can and should be done to carefully scrutinise KEPCO's plans, to ensure KEPCO is held to account in relation to all its undertakings and to 'raise the bar' when it comes to the standards it is expected to meet with respect to planning and execution.

Key Areas Of Concern

Our submission will make comment on the following key areas of concern:

1. Water
2. Ecology
3. Economics
4. Noise
5. Social Impacts
6. Soils
7. European Heritage
8. Aboriginal Heritage
9. Agricultural impacts
10. Air Quality

Most – but not all – of these areas benefit from a level of commentary provided by various experts engaged by the BVPA. This commentary has been included in each case as an appendix to this submission.

Some of the experts used (specifically those in the areas of water, economics and noise) have been engaged on the BVPA's behalf via the Environmental Defenders Office, while others have been engaged directly by the BVPA. Some of those engaged directly have wished to remain anonymous and we have respected that wish in this submission. All available expert reports have been included with this document.

Supplementary Information

Supplementary information (by way of a summarisation of key themes/issues within each key area of interest) will be provided separately and by no later than Friday, 20th November 2015.

Key Submission Areas

1. **Water**

   See consultants' reports included as Appendices 1a (Pells Consulting) and 1b (Anonymous).

2. **Ecology**

   See consultant report included as Appendix 2 (Ethical Ecology Australia)

3. **Economics**

   See consultant report included as Appendix 3 (The Australia Institute)

4. **Noise**

   See consultant report included as Appendix 4 (Day Design)

5. **Social Impacts**

   See consultant commentary included as Appendix 5 (Anonymous)

6. **Soils, Land Capability and Equine CIC**

   See consultant commentary included as Appendix 6 (Anonymous)

7. **European Heritage**

   See consultant commentary included as Appendix 7 (Hickson)

8. **Aboriginal Heritage**

   Some brief additional remarks, compiled from the input of several associates with experience in Indigenous Heritage, are included as commentary included as Appendix 8 (Anonymous)

9. **Agricultural Impacts**

   Note that there is some information pertaining to agricultural impacts insofar as they relate to soils included in Appendix 6.

   Further comments regarding Air Quality will be provided with the supplementary information we have said we will lodge by 20/11/15.

10. **Air Quality**

    Comments regarding Air Quality will be provided with the supplementary information we have said we will lodge by 20/11/15.

Key Recommendations (Provisional)

1. KEPCO should not be allowed to develop a greenfield mine project in Bylong because of unacceptable impacts on water, BSAL and Equine CIC land, on the environment more generally and on the community of Bylong and surrounds. The economic benefits – of somewhat dubious reliability as they are – do not outweigh the environmental and social impacts of the project.

2. If a mine project is to proceed, it should be underground only, since the greatest impacts (social and environmental, including on water and Strategic Ag Land) are associated with the short life-span open cut elements of the project. Even so, plans for the underground operation would require modification so as to avoid subsidence damage to the Bylong Valley Way and to rein in the worst of the remaining impacts. There would also obviously need to be a revised plan for handling mine waste.

3. If open cut mining is found to be absolutely necessary then it should not be approved until critical concerns regarding water availability (via the borefield) are settled. Plans should also be modified so as to avoid open cut mining of verified BSAL.

4. If mining is to proceed, proper provision needs to be made by the government for adequate compliance monitoring and enforcement. Key performance criteria must be monitored and decisive action taken in the event of failure to deliver key outcomes as promised. Such monitoring should be continuous. The community and remaining landholders should be empowered through appropriate, independent monitoring of water, noise, air quality, traffic and so on, so as to help keep KEPCO 'honest' with regard to its operations.

We will submit a revised/final list of Key Recommendations with the supplementary information we have said we will lodge by 20/11/15.

APPENDICES

WATER

Appendix 1a

KEPCO, BYLONG COAL PROJECT, SOME RESPONSES TO THE ENVIRONMENTAL IMPACT STATEMENT OF SEPTEMBER 2015

(Pells Consulting)

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Our Ref: S006.R1

4 November 2015

Ms Rana Koroglu
EDO NSW
Level 5, 263 Clarence Street
SYDNEY NSW 2000

Dear Madam

KEPCO, BYLONG COAL PROJECT, SOME RESPONSES TO THE ENVIRONMENTAL IMPACT STATEMENT OF SEPTEMBER 2015

We enclose our report in response to the brief from EDO NSW dated 26 October 2015.

Please contact the undersigned if you have questions in regard to this report.

Yours sincerely

PHILIP PELLS
FTSE BSc(ENG) MSc DSc(Eng) DIC FIEAust MASCE

CONTENTS

1. INTRODUCTION

This report is in response to a brief from EDO NSW dated 26 October 2015 (**the Brief**). We have read the Expert Witness Code of Conduct (Division 2, Part 31 *Uniform Civil Procedure Rules 2005*) for the Land and Environment Court, and have prepared this report in accordance with those rules.

This report has been prepared by Dr Philip Pells and Mr Steven Pells. Our curricula vitae can be found on www.pellsconsulting.com.au.

In accordance with the Brief we understand that the primary purpose of this report is "to assist the decision maker for the Project" in respect to matters within our expertise. These cover the following facets canvassed in the EIS:

- mine induced subsidence,
- the impacts of subsidence movements on the natural and built environment,
- impacts of mining on groundwater and surface water systems, and
- water resources and water balance.

Section 2 of this report presents and discusses a central issue germane to the EIS for the Bylong Coal Project which we consider impacts on the whole evaluation of the EIS, and should be addressed by the 'decision maker for the Project'. Section 3 sets out the bases for our assessments, and Section 4, and sub-sections, address the 15 questions set out in the Brief.

2. GENERAL CONSIDERATIONS

The EIS for the Bylong open pit and underground coal project generates a legal-technical issue that we have not encountered previously.

In essence this issue is that Kepco Bylong Australia (KEPCO), which is a subsidiary of Korea Energy Power Corporation, has bought much of the land, beneath which open pit and underground longwall mining is proposed[1] (see Figures 1). This land includes some iconic properties, such a Tarwyn Park[2] (see Figure 2).

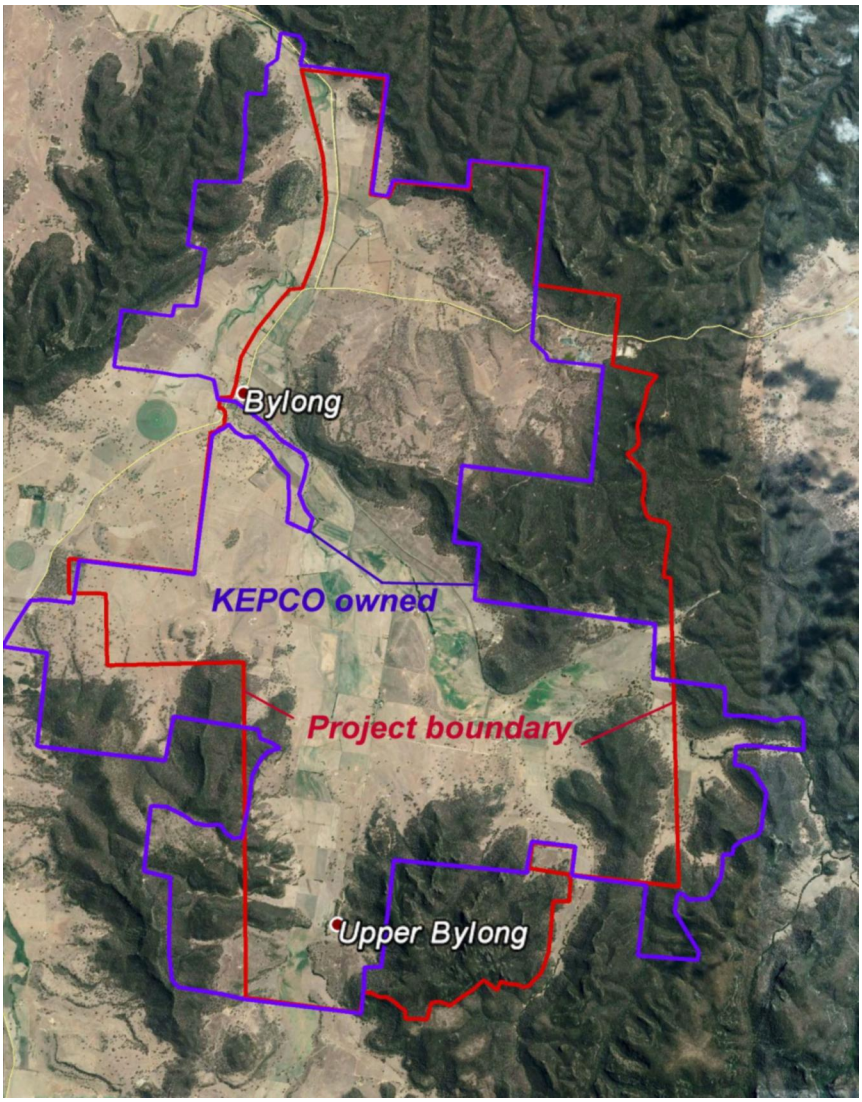

Figure 2.1: Land owned by KEPCO shown in blue; project outline shown by red dashed line.

[1] WorleyParsons is responsible for the delivery of the Bylong Coal Project's exploration activities, mine feasibility planning, environmental approvals and ongoing environmental monitoring. Subject to the project obtaining all necessary approvals, Worley Parsons will also manage construction activities.(http://www.bylongproject.com.au/index.cfm/about-us/)

[2] See Peter Andrews. *Natural Sequence Farming* (http://tarwynpark.com/)

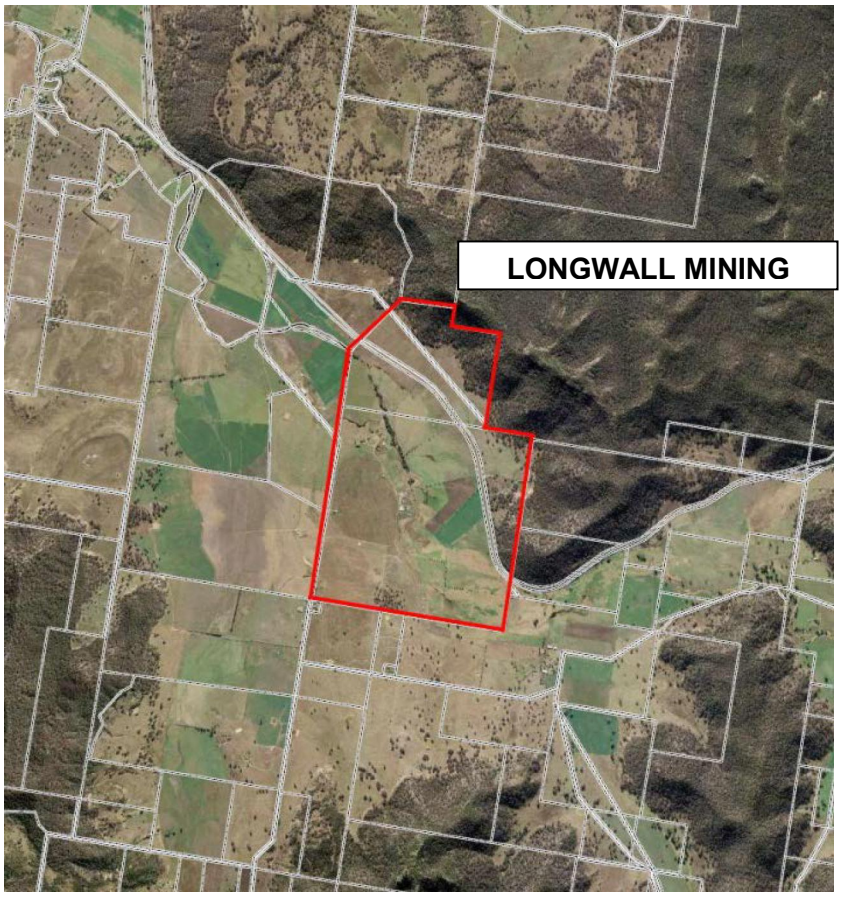

Figure 2.2: Tarwyn Park.

The issue is best explained as set out below:

Typically coal mining, or CSG extraction, occurs beneath land that is owned by private citizens, or is crown land. Therefore typically the impacts of mining are of concern to those owners and are examined and, argued against, in order to protect the land owners interests in respect to farming activities, or water resources, or groundwater bores, or farm dams or buildings etc. Such an example is currently the situation in the Sutton Forest area where another Korean company, POSCO, proposes underground mining.

However in the Bylong Project almost all the land under which mining is occurring is owned by KEPCO. A small portion is crown land. The land owned by KEPCO measures about 14kms North-South and up to about 8kms West-East (about 75 square kilometres). This is piece of land equivalent to the Sydney area from the Airport through to the Harbour Bridge and extending from Leichhardt through to Woollahra.

The land ownership is not the issue, the issue is that the EIS states, or implies, in many places that because KEPCO are not concerned about impacts of their land those impacts don't matter.

This is a contradictory if not bizarre situation. What it is saying is that impacts of mining, on the natural or built environment, depend on who owns the land and whether that owner is concerned or not concerned about the impacts.

We are not expert to address the legal connotation of this matter but from the technical viewpoint we consider the situation to be untenable. Because technically the impacts from subsidence, and on groundwater and surface water systems, are matters of fact and can only be assessed against objective criteria. Assessing such matters of fact against owner-subjective criteria, in effect makes the EIS process a nonsense.

We illustrate the issue by specific statements in the EIS for the Bylong Project.

Firstly, on page 209 of the EIS it states:

> *There are no bores on privately owned land where the drawdown is predicted by the groundwater model to be greater than 0.1m at any time throughout the life of the Project. A number of bores located on KEPCO owned land are present within the zone of drawdown around the mining area.*

In similar vein, on page 144 is the statement:

> *There are no privately owned bores within the Subsidence Study Area. Three groundwater monitoring bores (owned by KEPCO) are located within the Subsidence Study Area. These bores may experience impacts such as lowering of the piezometric surface, blockage of the bore due to differential horizontal displacements at different horizons within the strata, changes to groundwater quality, and horizontal shearing of the bores.*

The above quotes contain a matter that is clearly nonsense, in that it is implied that KEPCO bores are not privately owned. KEPCO is a Korean-owned company and is effectively privately owned – it is certainly not owned by any Australian State or Federal entity. It is certainly not public land. However, of greater importance is the implication that drawdown of the bores owned by KEPCO is of no concern because, being the mining company, KEPCO doesn't care about the impact on their bores.

We turn to the question of subsidence, noting that subsidence of the order of 3m is expected above most of the longwall mines. The EIS addresses farm dams within the Subsidence Study Area. It is noted that there are 11 dams owned by KEPCO within the area, with the largest one having a surface area of 21,000m^2. The EIS states,

> *The maximum subsidence effects at the locations of farm dams are predicted to be:*
> - *Maximum subsidence of 3,150mm;*
> - *Maximum tilt of 70mm/m (7%);*
> - *Maximum tensile strain of 35mm/m; and*
> - *Maximum compressive strain of 20mm/m.*

The EIS notes that these surface movements and strains will have substantial impacts on the farm dams.

Based on our experience in other areas of New South Wales we know that such movements would be unacceptable to the owners of such dams, and would have a high probability of creating unsafe dams.. Yet because the dams are owned by KEPCO, the proponent of the mining, these subsidence impacts are of no particular concern to the Proponent.

Likewise it is noted on page 137 of the EIS, that subsidence will cause permanent surface cracking - with cracks typically between 25mm and 50mm wide but sometimes up to 100mm wide. These cracks are expected to extend for horizontal distances of several hundred metres and to depths of 20 to 30m. Our experience with proposed underground mining in the vicinity of Kelstral Colliery in Queensland and above the Appin Colliery and Tahmoor collieries in southern New South Wales is that such cracking would be unacceptable to private land owners as it substantially damages their land.

In respect to the impact of the longwall mining on the groundwater system, the calculations in the EIS indicate that significant drawdown will only occur within the KEPCO owned property, again with the implication that such drawdown is of no concern because it is of no concern to KEPCO. In our opinion, this is contrary to the intent of the NSW Aquifer Interference Policy which defines aquifer interference in objective terms and not in relation to the owner of the land beneath which the groundwater system exists. It is stated on page 201 of the EIS in respect to the Aquifer Interference Policy requirements:

> *For both highly and less productive groundwater sources, changes in pressures and water tables due to the Project should not induce a decline of more than 2m at any water supply work (i.e. a privately owned bore or well).*
>
> *KEPCO has secured a large landholding surrounding the mine and substantial volume of water entitlements for the Bylong River water source. This creates an extensive buffer around the Project, meaning that impacts on private users are unlikely. There are no bores on privately owned land where the drawdown is predicted by the numerical model to be greater than 0.1m at any time throughout the life of the Project.*

As with the statements cited further above in respect to private bores, this statement generalises the concept to the point that by owning the land KEPCO has created a zone within which significant groundwater impacts can and will occur, but which are of no concern because KEPCO owns the land.

The above issue has created for us a significant dilemma in addressing the EIS for the Bylong Project. We are of the view that the impacts should be addressed as if all the land was owned by concerned private land owners without interests in the Proponent and the project, or the crown: and that all environmental impacts should be addressed on objective criteria, not the subjective criteria partly used in the EIS (see Pells, Young and Turner 2015[3]).

[3] *"On the establishment of Acceptability Criteria for Subsidence Impacts on the Natural Environment"*, PJN Pells, A Young and P Turner, 9th Triennial Conference Proceedings, Mine Subsidence: Risk Management In Action, Volume 1

3. BASES OF ASSESSMENTS IN THIS REPORT

Within the time and budget constraints for this report we have not undertaken independent groundwater modelling, and independent calculations of subsidence. We have relied upon the calculations of ground level subsidence induced movements made by MSEC on behalf of the proponent. We have no cause to question the reasonableness of the computations within the general framework of uncertainties in subsidence predictions[4].

We have examined the groundwater modelling studies given in Appendix M of the EIS. We consider the work to be of a high professional standard. However, we have determined what we consider to be significant errors in the formulation of some parameters used in the groundwater model. These errors impact on the rate at which depressurisation can be expected to propagate from the depressurised areas of coal seam extraction – not on the quantities of computed seepage.

Therefore our assessments are based primarily on computations given in Appendices I, L, M, and N of the EIS, together with studies we have undertaken and published in respect to longwall mining subsidence and groundwater impacts of longwall mining. Our publications are listed in our curricula vitae (*loc cit*).

4. ANSWERS TO QUESTIONS IN THE BRIEF

4.1 Q(1) In your opinion, does the EIS on surface water, groundwater and subsidence adequately assess the potential environmental impacts from the Project?

We consider that the computations given within the EIS provide predictions of settlements, strains and tilts arising out of longwall extraction that are at the level of accuracy that can be expected given the state of this branch of engineering science, and current experience in coalfield of the Ulan-Bylong area. However, for reasons set out in our detailed answers to Question 2, below, we consider that the EIS is substantially inadequate in properly evaluating the mine-life and permanent impacts on the built and natural environment of the project and surrounding areas.

We consider that the computations given in the EIS in respect to impacts from mining activities (open pit and underground) on the groundwater system of the project and surrounding areas are consistent with current best practice. However, we have concerns in relations to specific parameters used in the groundwater modelling which impact on the rate at which groundwater system changes will occur.

For reasons set out in our detailed answers to Questions 2,4,5,6,8,12 and 13 we consider that the EIS is in places misleading in respect impacts on groundwater and surface water systems.

[4]Seedsman, R and Pells, P J N (2014). *On the deception in requiring and providing singular accurate predictions of surface subsidence, tilt and strain.* 9th Triennial Mine SubsidenceTerchnological Society Conference, 2014

4.2 Q(2) In your opinion what, if any, are the surface water, groundwater and subsidence impacts arising from the Project as proposed?

4.2.1 Subsidence Impacts

Magnitudes of surface settlements, and surface strains and tilts have been computed by MSEC. We consider their computations to provide reasonable estimates of these quantities. The following extracts from the main text of the EIS summarise key dimensions and subsidence predictions:

1. *The depth of cover above the proposed longwall panels varies from 105m to 310m. Based on a 26.5° angle of draw, the Subsidence Study Area extends horizontally at distances of between 53m and 155m from the edge of longwall extraction* (see Figure 4.1A).

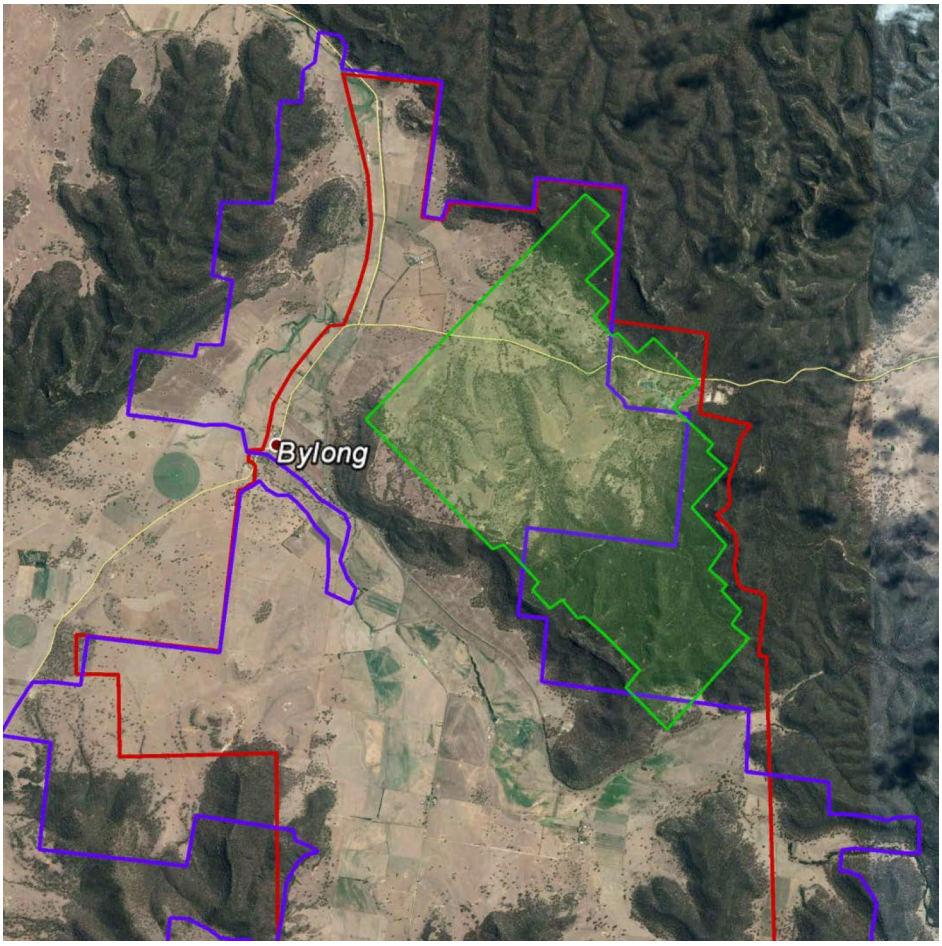

Figure 4.1A: Area of longwall mining

2. *The maximum total subsidence, after the completion of the proposed longwalls, is predicted to be 3,300mm, which represents approximately 68% of the extraction height. The maximum predicted total conventional tilt is 75mm/m (i.e. 75%), which represents a change in grade of approximately 1 in 13.*

3. *…the maximum conventional strains for the Project are predicted to be 35mm/m of tensile strain and 25mm/m of compressive strain. It is*

noted however that localised and elevated strains greater than the predicted conventional strains can occur as a result of non-conventional subsidence movements.

4. *The extraction of the proposed longwall panels may also generate far-field horizontal movements. Far-field horizontal movements refer to movements outside of the area directly overlying the longwall panels. These are small bodily movements towards the extracted longwall panels.*

Figure 4.1B shows that mine subsidence is expected to cause connective cracking through to the surface within much of the catchment area of Dry Creek.

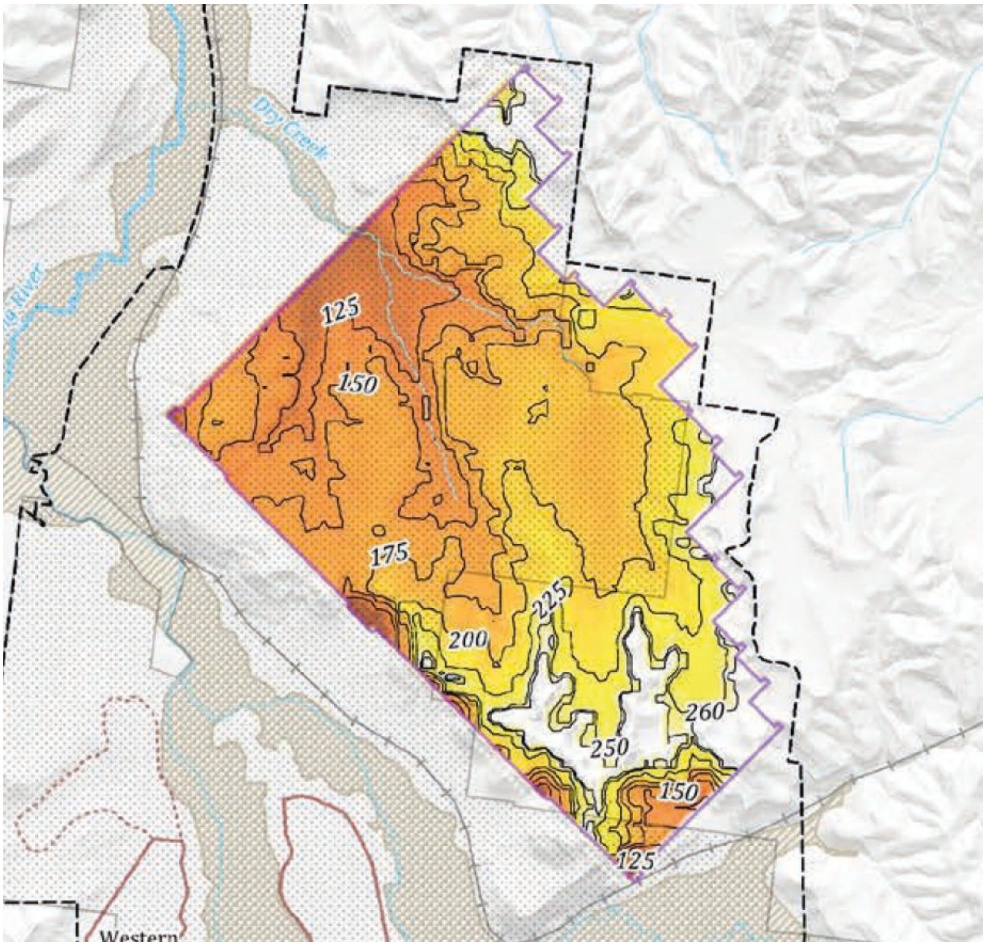

Figure 4.1B: Connective fracturing reaching the surface (from Appendix M)

It must be understood that the predicted subsidence movements (settlements, strains and tilts) are very large in relation to those generated by most longwall mines in NSW. The maximum subsidence induced settlements at some other current mines are listed below:

- Clarence Colliery	<50mm (partial extraction mining)
- Springvale Colliery ~	1m to 1.8m
- Tahmoor Colliery	~1m
- Bellambi (SW of Cataract Reservoir)	~0.15m to 0.3m
- Metropolitan	~0.9m
- Appin Area 7	~0.8m

The EIS concludes as follows in respect to subsidence induced surface cracking.

a) *Subsidence has the potential to result in cracking or deformation of the ground surface. Transient tensile cracking may occur during extraction of a longwall panel. Permanent surface cracking will generally occur in the tensile zone, which generally extends a horizontal distance of up to 0.4 times the depth of cover from the longwall panels. Most surface cracks will occur within a distance of 0.1 times the depth of cover from the longwall panels.*

b) *Surface cracks in the flatter areas are generally expected to vary in width from 25mm to 50mm, although isolated cracks of up to 100mm width may occur. In steeper areas, surface cracks widths are generally expected to be in the order of 50mm to 100mm, with possible isolated examples of cracking wider than 200mm.*

c) *There is a potential for connective cracking to occur between the mined coal seam and the surface in areas where the depth of cover is shallower.*

Based on, published information[5], and our experience in respect to subsidence impacts at Central Colliery, Queensland, and Appin, Tahmoor, Springvale, Baal Bone, Wambo, West Wallsend, Lithgow Valley and Metropolitan collieries in NSW, we are of the opinion that the cracking described above will have substantial degradation effects on the land. If the land subjected to the cracking described above were in private hands, other than the mining company itself, the cracking would be deemed to have unacceptable impacts in respect to crops, and livestock operations.

The longwall mining will extend under Dry Creek (see Figure 4.2). The predicted impacts stated in the EIS include the following:

i. *The only named drainage line within the Subsidence Study Area is Dry Creek.*

ii. *Areas of ponding are expected to be between 50m to 100m in length.*

[5] See the Proceedings of the 7th, 8th and 9th Triennial Conferences of the Mine Subsidence Technological Society of Engineers Australia, 2007, 2011 and 2014

iii. *Conversely, increased scouring of the stream beds may occur along Dry Creek. However, the lower stream reaches with shallower grades are more susceptible to localised changes in alignment.*

iv. *The maximum strains along Dry Creek are predicted to be 34mm/m tensile and 25mm/m compressive. Tensile strains have the potential to result in fracturing of the bedrock. Previous experience at mine sites has indicated that fracturing may occur when tensile strain is greater than 0.5mm/m.*

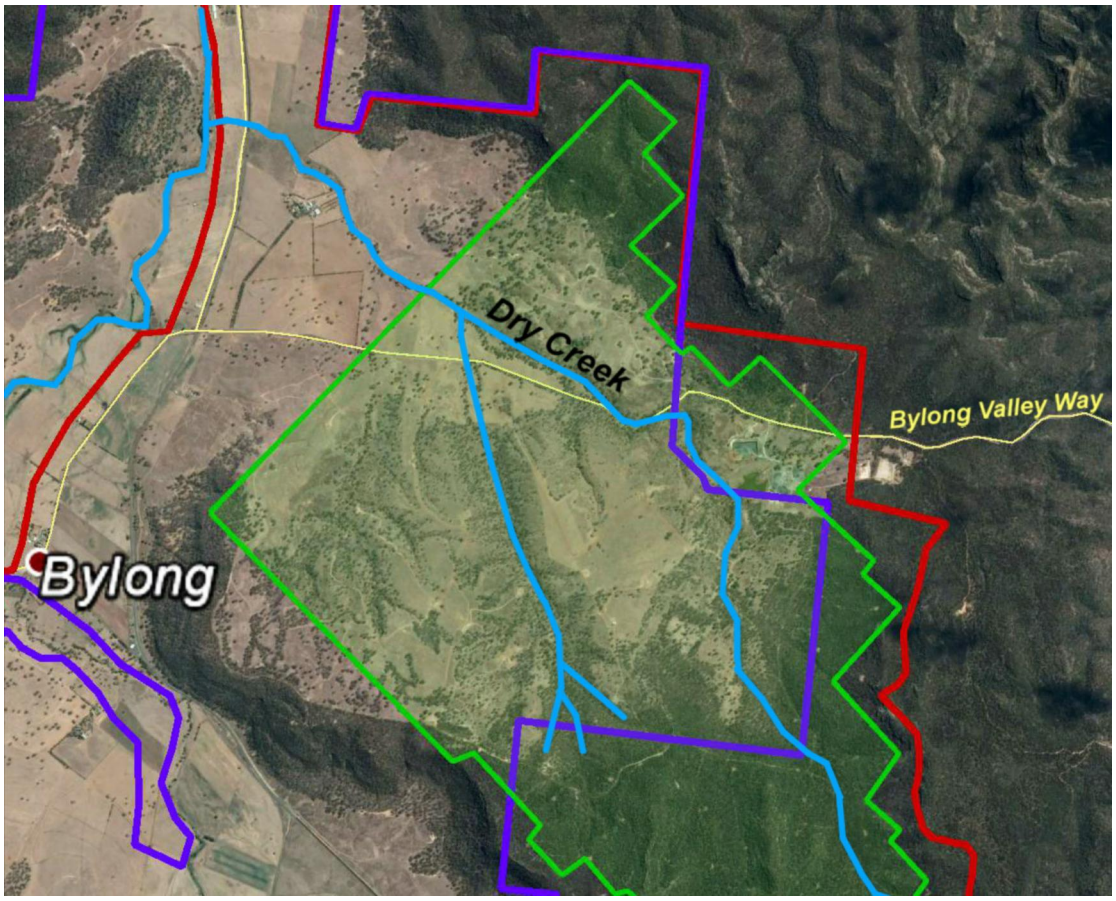

Figure 4.2: Location of Dry Creek

While the name may be convenient as indicating a creek of little value, the truth is that Dry Creek is an ephemeral stream, of 3rd order in its lower reaches, with a catchment of about 14 sq km.

Based on experience with cracking of stream and river beds in the Bargo River, Woronora Rivulet and Cataract River it is very highly likely that the predicted, very high, tensile strains of 34mm/m will cause substantial cracking of the steam bed, and substantial loss of water during flow periods. As the EIS notes, the predicted strains are about 70 times higher than strains known to have caused river bed cracking in the Southern Coalfields.

Once again, if the properties containing Dry Creek were owned privately by persons other than KEPCO, it is highly probable that there would be substantial objection to such damage to a natural creek system that feeds the Bylong River and hence to the Goulburn River. Based on our experience with

mining beneath creek systems in the Southern Coalfields in the Appin, Picton, Thirlmere and Tahmoor areas, damage of the kind expected world be environmentally untenable.

Damage to this catchment will potentially remove significant quantities of flow that would otherwise report to the Bylong River.

The EIS predicts that subsidence will cause collapse of parts of the cliff lines above the area of longwall extraction (see Figures 4.3, 4.4A and 4.4B). It is stated (p139 of main text) that the mine plan was altered to "minimise significant impact" (whatever this may mean quantitatively) to protect Cliffs C1, C3 and C4, shown in Figure 4.3.

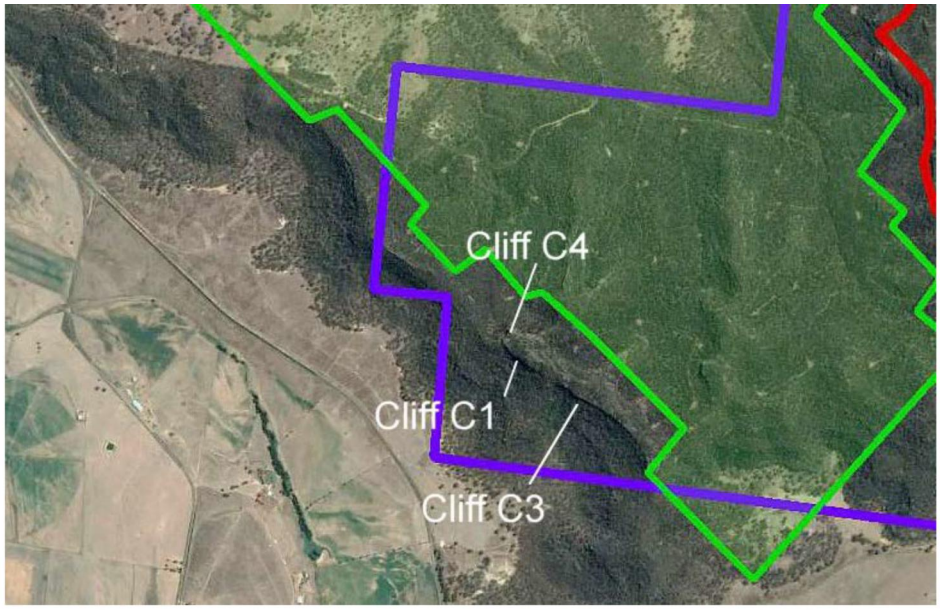

Figure 4.3: Cliffs C1, C3 and C4 (there are 41 cliffs >10m high; >20m in plan length)

Figure 4.4A: Perspective view of cliff line – note that there are cliff faces both side of the ridge line.

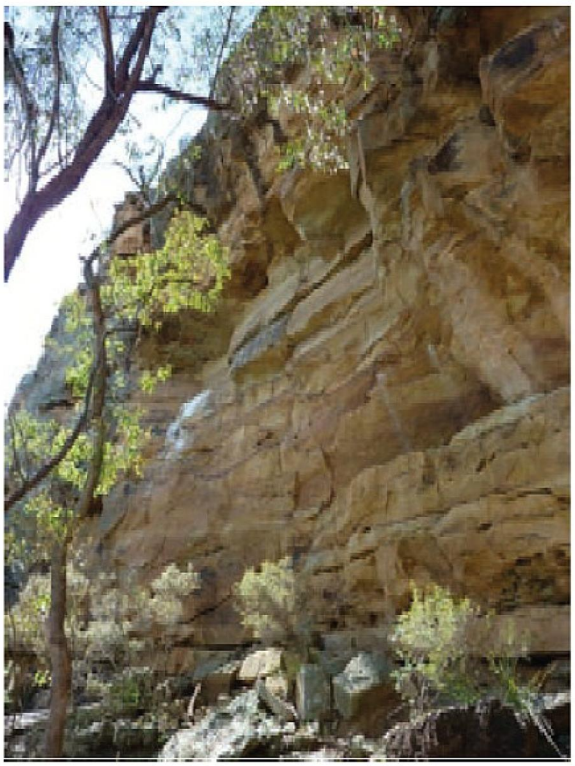

Fig. 5.11 Cliff 24128 adjacent to Longwall 206

Figure 4.4B: Typical cliff with significant probability (1 in 5) of partial or total collapse

The layout of the longwalls makes it less likely that there will be collapses on the southern side of the cliff line shown in Figure 4.3, where such damage would be clearly visible from the vicinity of Bylong. The damage predicted in the EIS, as discussed below, will be concentrated on the northern side of the ridge line, and far less visible to the public.

No calculations are given of likely strains that would be generated by the rapid topographic changes associated with cliff lines and which would impact cliff stability, calculations of the kind that are currently required of, and produced by, Clarence, Springvale and Airly collieries that mine near sensitive cliff lines[6]. We are not persuaded by the information given in the EIS that Cliffs 1, 3 and 7 are protected.

The information given in the EIS shows there will be widespread damage to other cliff lines and scree slopes, as per the following quotes.

1) *MSEC has identified 41 cliffs within the Subsidence Study Area, including 30 cliffs directly overlying the proposed longwall panels. Most of these cliffs are located within the Bylong State Forest, and occur above Longwalls 105 to 107 and Longwall 109.*

[6] Pells, P J N (1991). A note on Escarpment Instability Associated with Mining Subsidence. 2nd Triennial Conference, Mine Subsidence Technological Society, Maitland

2) *The cliffs within the Subsidence Study Area are predicted to experience more substantial movements. As such, the likelihood of cliff instability is difficult to predict.*

3) *Monitoring undertaken at Ulan Mine of more than 8km of cliff length (which has been directly undermined) has confirmed that rock falls have occurred over approximately 20% of the length of the cliffs with visible mining subsidence movements occurring in approximately 50% to 70% of the sandstone formations greater than 3m high…..The maximum measured subsidence at Ulan Mine is less than predicted for the Project on account of a lower extraction height.*

4) *Therefore, rock falls are likely to be experienced from approximately 20% of the length of the cliffs within the Underground Extraction Area. Further, visible mining subsidence movements within the Underground Extraction Area are expected to occur in approximately 50% to 70% of this subset of cliffs.*

5) *It is expected that cliffs with greater height and continuous length will be more susceptible to impacts. Subsequently, two cliffs (C5 and C6) located directly above the longwalls with heights between 30m and 40m and one of these (C5) with a length of between 250m and 300m are at risk of greater visible mining subsidence movements and rock falls.*

In respect to steep slopes [gradient steeper than 1(h) :3(v)] the EIS states that: *There is a potential for tension cracking to occur at upper or side slopes and for compressive ridges to form on the lower slopes.* It then says that these consequences can be *remediated by infilling cracks or re-grading the surface*. Our experience at Mount Sugarloaf, above West Wallsend Colliery, in 2013, is that such remediation is not feasible or meaningful (see Figures 4.5A and 4.5B).

Figure 4.5A: Cracking in steep slope above West Wallsend Colliery

Figure 4.5B: Attempted infilling of scarp/crack in steep slope above West Wallsend Colliery, 2013

It is our opinion that the envisaged damage to cliff lines is not consistent with current environmental requirements in NSW (see Pells, Young and Turner, 2014 *loc cit*).

In respect to damage to public roads the EIS states:

> *Sections of the Bylong Valley Way are predicted to experience maximum strains of 30mm/m tensile and 25mm/m compressive. These strains are expected to result in cracking, heaving and stepping of the road surfaces. The widths of tensile cracks are generally expected to be in the order of 50mm to 100mm. Heaving resulting from compressive strains is predicted to be in the order of 25mm high.*

We consider that the EIS grossly understates the impact on Bylong Valley Way. We cite the work reported by Kay et al (2011)[7] in respect to mine subsidence impacts on the Hume Highway near Picton, NSW. Dr Philip Pells was a member of the Technical Committee that developed the management measures and it is a matter of fact that the then RTA, now RMS, concluded that ground movements that could create steps in the road pavement of greater than about 20mm created dangerous road user conditions that would not be countenanced; and that such movements could occur at compressive ground strains of about 5mm/m. This is 5 times lower than the predicted ground strains for Bylong Valley Way. On this basis, and on the basis of experience of deformations along Appin Road above Westcliff Colliery, we consider that the expected subsidence movements beneath Bylong Valley Way cannot be countenanced, and that at the very least the mine plan should be changed to safeguard the public using this infrastructure.

The EIS notes that;

A. *There are 11 farm dams (owned by KEPCO) within the Subsidence Study Area.*

B. *The maximum subsidence effects at the locations of farm dams are predicted to be: Maximum subsidence of 3,150mm; Maximum tilt of 70mm/m (7%); Maximum tensile strain of 35mm/m; and Maximum compressive strain of 20mm/m.*

C. *The predicted tensile and compressive strains may result in cracking, heaving or stepping of the dam bases or walls, which may lead to leakage of stored water. If leakage from farm dams is observed, remediation will be undertaken to re-instate the dam base and walls.*

We mentioned this information in Section 2, and there stated:

Based on our experience in other areas of New South Wales we know that such movements would be unacceptable to the owners of such dams, and would have a high probability of creating unsafe dams. Yet because the dams are owned by KEPCO, the proponent of the mining, these subsidence impacts are of no particular concern to the Proponent.

[7] Kay, Buys, Donald, Howard and Pells. *Management of the Hume Highway Pavement for Subsidence Impacts from Longwall Mining.* 8th Triennial Conference, Mine Subsidence Technological Society.

4.2.2 Surface Water

An overview of the surface water features is shown in Figure 4.6. Existing registered bores, and the location of river gauging station “Bylong River at Bylong 2” are shown in Figure 4.7. The registered bores draw water primarily from the alluvium.

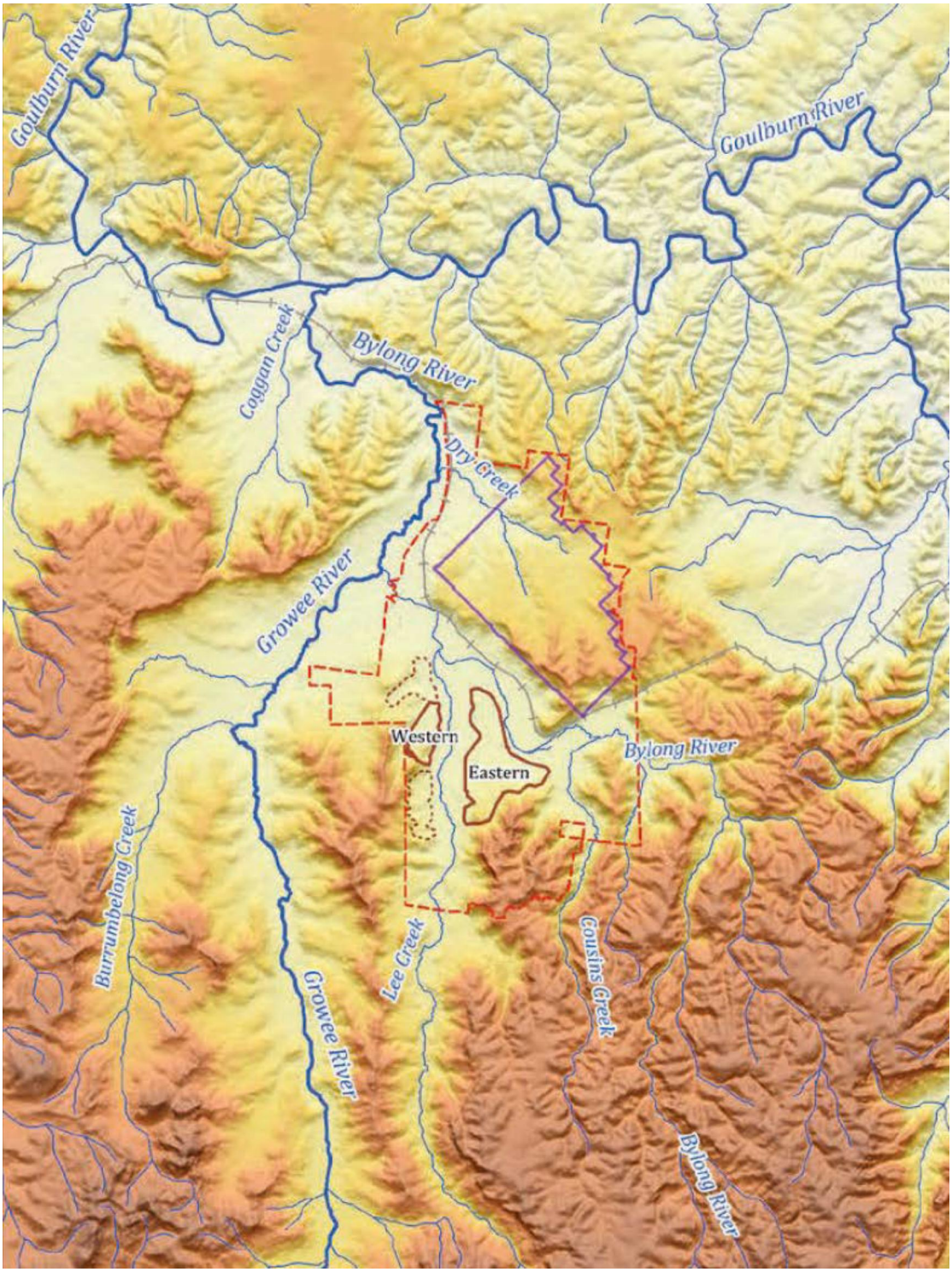

Figure 4.6: Surface water features

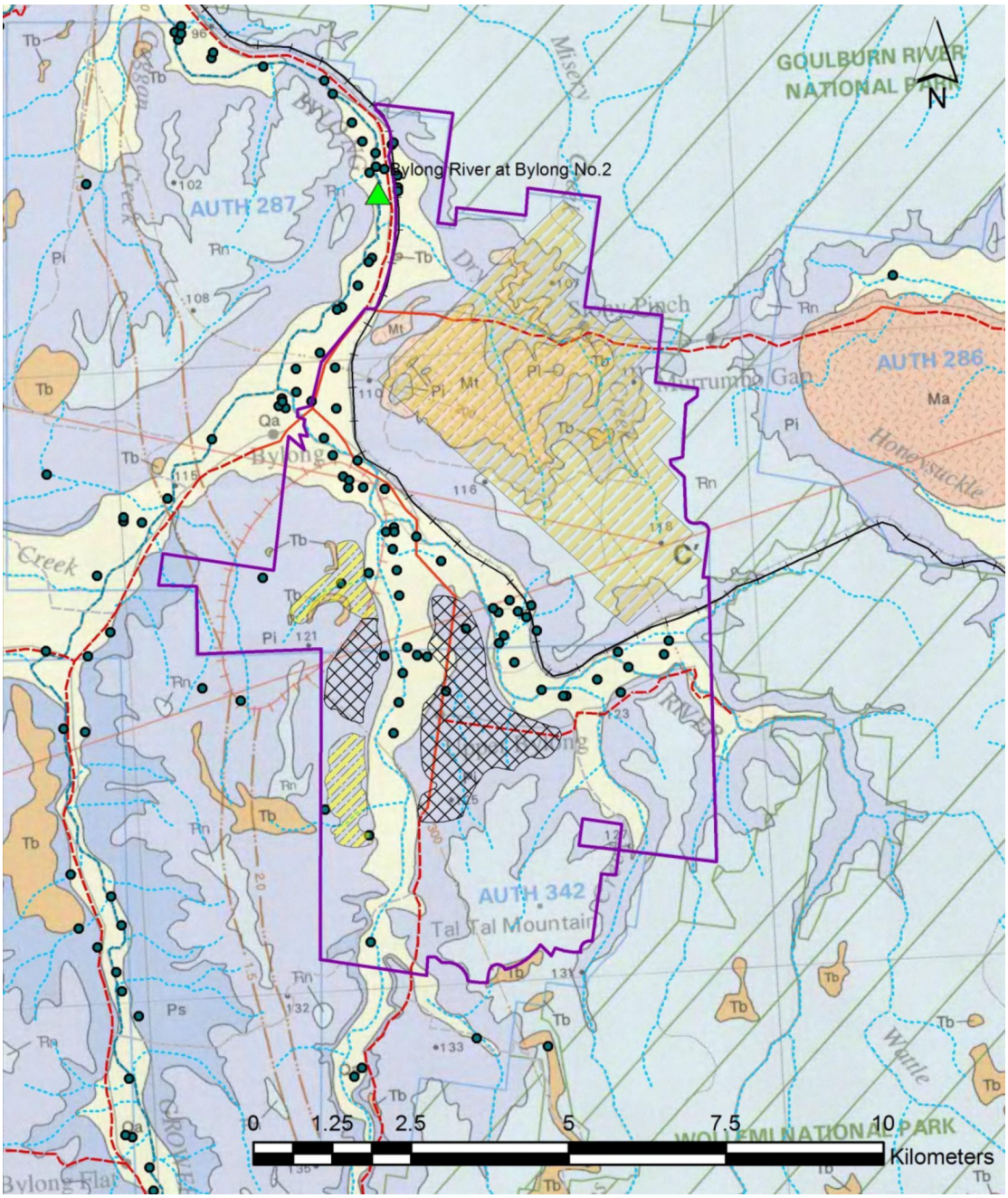

Figure 4.7: Registered bores and gauging location of gauging station ”Bylong River at Bylong 2”

The mine plan is structured around the creek systems, and avoids excavation of the alluvium associated with the creek systems, as shown in Figure 4.6. It is also further than 200 m from creek alignments, in accordance with the requirements of the Aquifer Interference Policy. It is understood that there is no plan for re-alignment of the river channels.

Modelling of flood hydraulics in the EIS shows that the impacts to scour / sediment transport are small and changes to morphology are unlikely to arise from altered flood conditions.

The impacts to surface water resources are summarised in EIS Appendix L as:

> The potential impacts of the Project on surface water resources include:
>
> - impacts on regional water availability due to the need to extract bore water to meet the operational water requirements of mining operations;
> - adverse impacts on the quality of surface runoff draining from the disturbance areas to the various receiving waters surrounding the Project, during both construction and operation of the Project;
> - loss of catchment area draining to local drainage paths due to capture of runoff within onsite storages and the open cut pit;
> - potential impacts on flood levels and flood velocities in the Bylong River and its tributaries, including Dry Creek.

Box 1

In addition to these impacts, we also expect, for the case of Dry Creek, cracking of the stream bed and its catchment due to subsidence, significantly increasing depression storage losses throughout the catchment and loss of streamflow from the stream bed. The main text of the EIS (pg 138) states the following:

> The uppermost bedrock lies directly beneath the surface soils hosting Dry Creek and its tributaries. Any fractures that form in this bedrock material as a result of subsidence are expected to gradually infill with surface soils during flow events. To mitigate the losses of stream flow into the mine workings, remediation of the fractured bedrock material within the stream alignments can be proactively undertaken in the circumstance where the infilling of these fractures does not occur naturally.

Box 2

It seems implausible that suitable remediation of fractured bedrock could be achieved.

Points 1 and 3 in Box 1., and impacts to Dry Creek, relate to streamflow's in creeks. Clearly, the quantities of water planned to be drawn from the alluvial aquifer, and changes to the watershed shape and character, have the potential to impact on streamflow significantly (see Figure 4.8).

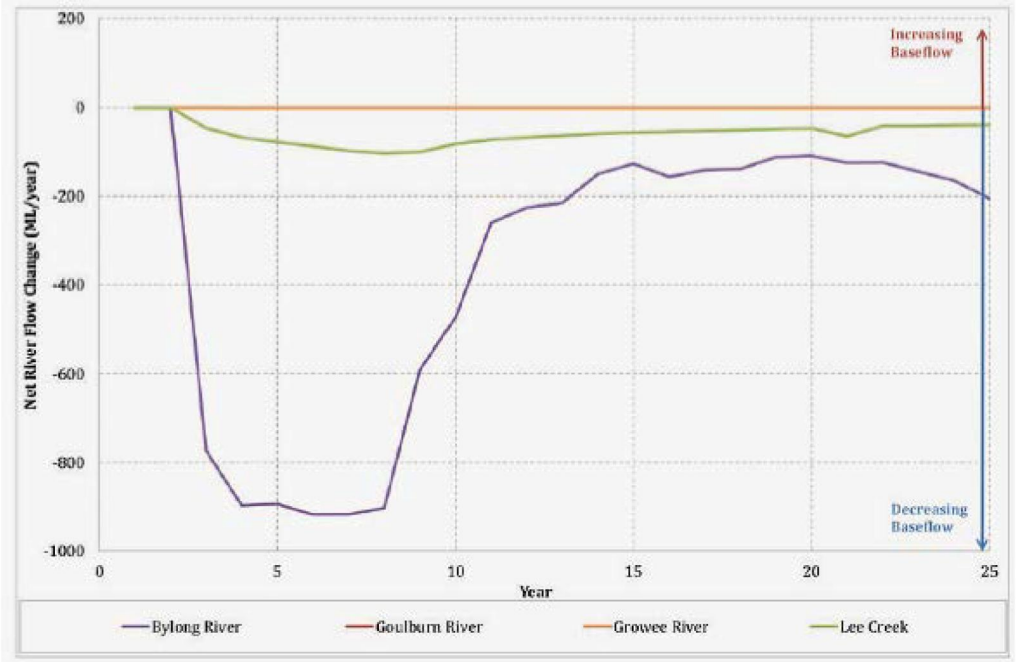

Figure 10-24 River change during mining

Figure 4.8: Computed net changes in river flows

As shown by Figure 4.9, the 'net' flow change is significant, but this figure gives no quantification of the impacts on flow frequency. Impacts to streamflow is considered in the EIS in terms of "water availability" – and the impacts therefore appear to be addressed by management of water licencing.

The item missing in this logic-equation is establishment of appropriate environmental flow criteria for the creeks systems. The frequency of river flows, including flow persistence, but also the frequency, duration and magnitude of peak events, are critical to river and ecological health. As stated in Appendix J of the EIS:

> *'Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands'* is recognised as a major factor contributing to the loss of biological diversity and ecological function in aquatic ecosystems, including floodplains (NSW Scientific Committee, 2002a). Potential impacts identified within the determination of this KTP that are relevant to the Project include:

Box 3

The modelling tools and methodology in the EIS are appropriate, and are calibrated to available data. These tools are used to estimate groundwater usage, and impacts to flood extents and velocity. However, at no point are these tools applied to examine the changes in flow frequency which will arise from the cumulative effects of groundwater extraction and watershed changes.

River health and ecological impacts (presented in Appendix J of the EIS) have thus been assessed in the absence of such analysis. The conclusions from Appendix J regarding impacts to creek systems from changes to flow regime are simply, and only, what is expressed in the following excerpt:

> Modelling has indicated that, for a short period of time, mining will reduce the baseflow in Lee Creek and the Bylong River but will not impact on baseflows in the Growee River or Goulburn River (AGE, 2015). A reduction in baseflow in Lee Creek and Bylong River may lead to a loss of aquatic habitat. However, because of the ephemeral nature of the waterways there are few permanent aquatic habitats along Lee Creek and Bylong River and, as discussed in **Chapter 5**, these aquatic habitats are of low quality, with severely or significantly impaired macro-invertebrate communities and exotic fish species. Therefore, there is unlikely to be a significant impact as a result of water extraction on aquatic habitats and the communities within them within the Study Area.

BOX 4 (from Appendix J 6.65)

Simply stating that the reductions in baseflow "may lead to loss of aquatic habitat", without reference to flow frequency or the nature of such losses, is inadequate.

We recommend very strongly that the proponent applies their detailed catchment and mine water management model to simulate the flow frequency, at the old the Bylong River gauge site and in the Bylong River, just upstream of the confluence with Growee River. This should be done to simulate flow frequency before, during and after mining. Assessment to impacts on river health and ecology should then be made with reference to these flow-frequency analyses.

Based on this, appropriate environmental flow requirements for the streams should be set, which may set limits on mine water operations.

4.2.3 Groundwater

The groundwater modelling predicts drawdowns of up to 10 metres in the alluvium, and complete depressurization of the geological stratum above the longwalls. The predicted regional extent of drawdown above the longwalls, after 25 years, extends a small distance into the adjacent Wollemi National Park. As discussed in relation to Question 4 (Section 4.4 below), the extent of drawdown reflects the choice of hydrogeological modelling parameters made in the EIS. We conclude by fundamental analysis that there are major inconsistencies (errors) in some of the adopted parameters and note that the extent of drawdown in sensitive to these parameters. More extensive regions of drawdown may be expected.

4.3 Q(3) Has the EIS complied with the Secretary's Requirements relating to water and subsidence issues including, in particular, those set out in the Gateway Certificate?

For reasons set out in Section 4.4 we consider that the transient 3D groundwater model does not properly address the Gateway Certificate Recommendations 17H4(a)(iv) Items 1 and 2.

In Section 4.5 we point out that the production from the proposed borefield is critical to the real water supply in the 1st decade of operation of the project.(as opposed to theoretical water quantities in licences). We also note that the computed yields from the borefield are primarily theoretical and that there is low confidence in the validity of the computations because of absence of substantive field testing[8]. These matters are, in effect, confirmed in Section 7.6.4 of the main text of the EIS where it states:

> The proposed borefield requires high volumes of water to be extracted from a relatively thin aquifer system. The groundwater model assumes a component of this water is derived from a consistent surface water influx. Sensitivity analysis of the possible climatic scenarios concluded that the proposed borefield will not be able to meet the Project requirements if extraordinarily dry periods coincide with high water volume requirements. In such an event it would be necessary to either seek approval to expand the borefield or modify mining operations to reduce water demand.
>
> A testing program is proposed prior to the construction of the borefield to determine an optimal design for the borefield that will minimise impacts on the aquifers and streams. This will likely include test pumping bores and modelling to optimise the bore locations.

Box4A

We are of the opinion that the quote in Box4A understates the uncertainty in respect to borefield where it implies that insufficient water may only transpire in 'extraordinarily dry periods'. The factual information in respect to the reliability of the water source from the borefield does not support this assertion. The assumption of "consistent surface water influx" appears to be inconsistent with the claimed ephemeral nature of the streams. It is also understood that the grid resolution of the groundwater model, in this region, is 50 metres – this is an inadequate basis to assess drawdown impacts on the alluvial aquifers. Therefore we consider that the reliance placed on licence allocations is false; it is real water in times of low rainfall that matters, not bureaucratic allocated 'units of water', and the following statement, also from Section 7.6.4 is substantially meaningless in respect to the operation of the

[8] Involving multiple long term pumping tests.

mine in the 1st decade until such time that yield from the borefield is substantiated by field testing.

> KEPCO holds entitlements to account for its groundwater take from the Bylong River Water Source even if the available water determination (AWD) reduces to less than 80%.

Box4B

For the reasons set out above we consider that Item 5 of 17H(a)(iv) of the Gateway Certificate Recommendations is not satisfied.

4.4 Q(4) Has there been an adequate description of all units and associated groundwater, including the role of Triassics?

4.4.1 Stratigraphy

The hydrogeological conceptual model is shown in Figure 4.9.

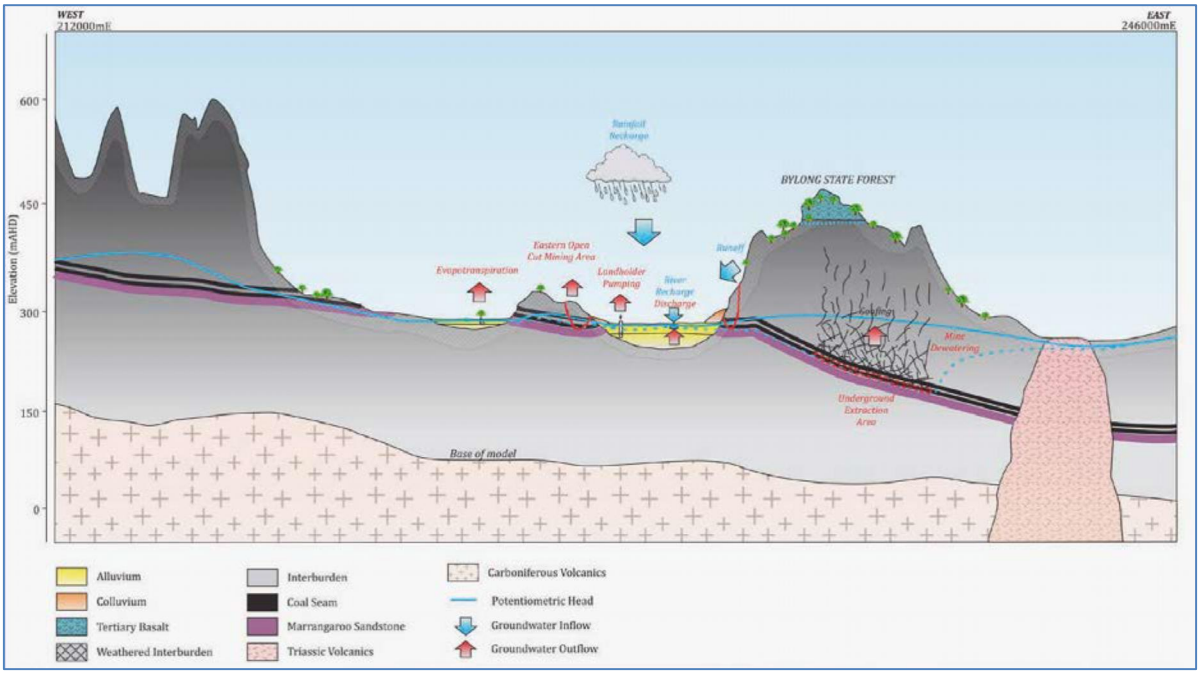

Figure 4.9: Conceptual hydrogeological model from the EIS

We have been unable to find, within the main text of the EIS, or Appendices H (Subsidence), L (Surface Water) and M (Groundwater), a reasonable representation of the stratigraphic profile above the longwall panels. Appendix H provides the following 'cartoon' stratigraphic column (see Figure 4.10) – but it does not allow understanding of the distribution on the Triassic strata above the longwall panels.

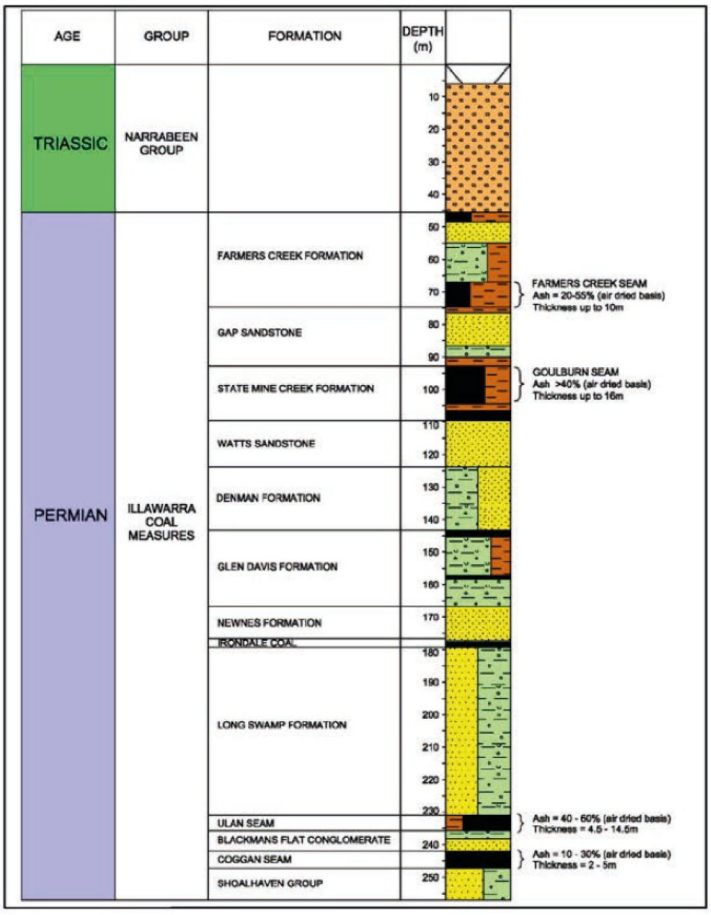

Figure 4.10: Stratigraphic column (note that the Coggan Seam is to be mined, and the cover is shown to be up to 300m (Drg MSEC708-06), so the Triassic rocks may be up to 110m thick

The point is that the upper part of the sequence above the longwalls includes Triassic rocks, dominantly sandstones, of the Narrabeen Formation. These Triassic rocks have substantially different hydrogeological parameters compared with the Permian strata that include the various coal seams. The hydrogeological report in Appendix M is silent on this matter. The model is represented as per Figure 4.11, and, within the numerical analysis, comprises the layers given in Box 5:

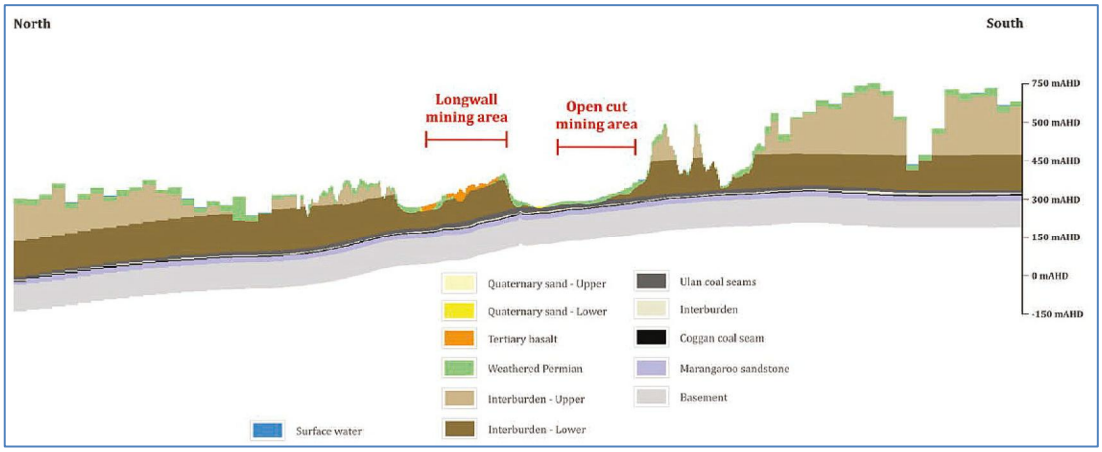

Figure 4.11: Modflow groundwater model

The model represented the main hydrostratigraphic units as ten layers, as follows:

	avg. thickness
• Layer 1 – Quaternary upper alluvium, colluvium, regolith	4 m
• Layer 2 – Quaternary lower alluvium, colluvium, regolith	6 m
• Layer 3 – Weathered interburden	20 m
• Layer 4 – Farmers Creek Seam, State Mine Creek interburden	50 m
• Layer 5 – Interburden	115 m
• Layer 6 – Ulan Seams & interburden	20 m
• Layer 7 – Interburden	4 m
• Layer 8 – Coggan Seam	5 m
• Layer 9 – Marrangaroo Sandstone	20 m
• Layer 10 – Underburden	100 m+

Box5

We cannot determine, from the information given, the thickness of the Narrabeen Formation above the longwall workings, what parameters have been ascribed to this Formation, and whether it is properly included in the groundwater model.

There is further confusing discussion with the EIS in respect to Triassic rocks, where there is a mix-up between the Tertiary Basalts and the Narrabeen Formation.

Within Appendix M it is stated:

Igneous bodies – Basalt flows

An extensive basalt flow caps the plateau area where longwall mining is proposed. The basalt cover is typically overlain by a thin layer of soil or alluvium. The thickness of the basalt varies from 10 m to 40 m and it can be blocky and highly fractured (Figure 5-21). Calcite commonly infills fractures, whilst open joints are pervasively oxidised, both indicating water flow.

Box 6

and (p64)

Data indicates a perched groundwater system is present in elevated areas with aquitards separating the shallow Permian overburden from the lower Permian sequence. The Tertiary basalt cap in this area is expected to enhance recharge resulting in perching of water on the less permeable Permian sequence. The shallow VW1 in BY0011 also recorded a gradually rising trend suggesting a long lag time for recharge.

Box 7

This is also consistent with the following cross-sections from Appendix H (Figure 4.12) which show the Tertiary Basalts.

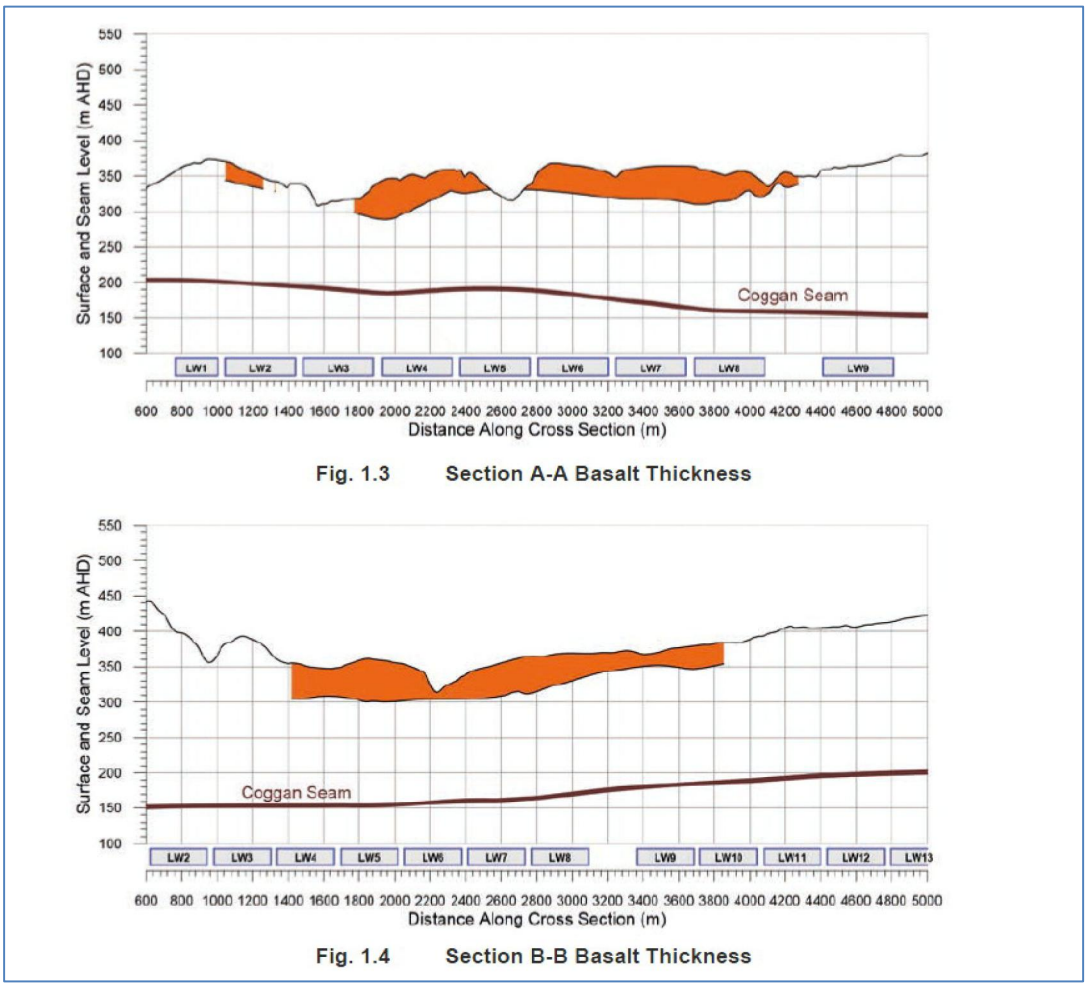

Figure 4.12: Tertiary basalt capping

Elevated groundwater levels in the Tertiary basalt region are interpreted in the EIS to be "perched" due to increased recharge through the basalt. This elevated water level may be the case, but the inference of this groundwater as being "disconnected" from the rest of the geological sequence, as is stated in the Main text of the EIS, is without basis. Rather, the elevated level indicates increased vertical potential for movement vertically through the whole sequence.

Where matters become very confused in the EIS is that the main text contains the following statement:

> *The groundwater impact assessment has identified a minor perched Triassic aquifer and Permian bedrock aquifers within the Subsidence Study Area. The perched Triassic aquifer has been identified as a localised aquifer and does not form part of the regional groundwater system*

Box 8 (EIS Main document, pg 138)

We think that the use of 'Triassic' in the above quote is an error, and that the EIS may mean the Tertiary Basalts. However, the net result is that the EIS is unsatisfactory in assessing the groundwater systems in the Triassic strata, and also the Tertiary Basalts. These units are crucial to baseflows to creeks over the whole catchment of Dry Creek, which in turn feeds into the Bylong River, The flows may be

relatively small but are not inconsequential to the environment, even though that environment is within properly currently owned by KEPCO, and appear to be of no concern to KEPCO.

Given all the above information we conclude that the groundwater assessment does not properly, or adequately, address the groundwater system within the Triassic Narrabeen Formation.

4.4.2 Hydrogeological Parameters

It is a matter of fact that the results of the groundwater model directly reflect the values chosen, by the modeller, for the parameters **hydraulic conductivity** and **specific storage**. In simple terms, the hydraulic conductivity is related to how easily water flows through the ground, and the specific storage is related to how water is stored in the ground.

As per Table 1, the results from field testing indicated a very large range of hydraulic conductivity values, leaving the modeller with a large scope of possible outcomes from the model.

Table 1

	Packer Testing			
	m/day		m/sec	
	min	max	min	max
Alluvium	0.04	14	4.6E-07	1.6E-04
Tertiary volcanics	4.50E-05	0.2	5.2E-10	2.3E-06
Permian interburden	1.90E-05	8.3	2.2E-10	9.6E-05
Ulan Coal sea,	3.90E-04	6.00E-01	4.5E-09	6.9E-06
Coggan Coal Seam	5.50E-04	2.1	6.4E-09	2.4E-05
Marrangaroo Sandstone	2.30E-04	7.10E-01	2.7E-09	8.2E-06

Typically in groundwater engineering, hydraulic conductivity is not known to a high degree of confidence, and it is up to the practitioner to choose and justify an appropriate range of possible parameters based on test data and geological knowledge. This range may typically be in the order of 5 to 20 times (ie plus minus 500% to 2000%), although the range given in the EIS as per Table 1 is somewhat higher.

We now need to delve into some basic mathematics, as by so doing a significant problem is revealed.

The **specific storage** is defined as:

S_s = specific storage $= \rho_w g \left[\frac{(1+\nu)(1-2\nu)}{E(1-\nu)} + \phi\beta\right]$ (1)

where

ρ_w = density of water (~1000kg/m^3)
g = acceleration due to gravity (9.81 m/s^2)
v =Poisson's Ratio
E =Young's Modulus (Pa)
ϕ = porosity
β = compressibility of water (~5 x 10^{-10} Pa^{-1})

The hydraulic diffusivity is defined as

D = diffusivity $= \frac{K}{S_s}$ (2)

where

K = hydraulic conductivity (m/s)

Most experienced geotechnical engineers can estimate *in situ* Young's Modulus values to an accuracy of about +/-12%. Also it is known that Poisson's Ratio ranges between 0.15 and 0.3. Therefore, for jointed rock masses, the compressibility parameter (in Equation 1) is typically known to an accuracy of about plus or minus 25%. Volumetric water content can be estimated to a similar accuracy.

The aquifer parameters used in the EIS model are summarised in Table 2. Also shown in Table 2 are the hydraulic diffusivity, and the inferred bulk modulus[9] values determined by the choice of values used for hydraulic conductivity, porosity and specific storage (i.e. calculated from Equations 1 and 2).

The resulting bulk modulus values are inconsistent with known (or possible) properties of the geology. Much higher values would actually be applicable.

Appropriate values of bulk modulus indicate diffusivity[10] values of 2 to 3 orders of magnitude larger. The diffusivity is directly related to the rate at which depressurisation of the geology occurs, due to mining. <u>As such, the extent of impacts at various time-frames, computed by the EIS groundwater model, are significantly under-predicted.</u>

[9] Bulk modulus is simply a measure of the stiffness of the rock mass

[10] A numerical model predicts movement of groundwater underground in direct proportion to the 'diffusivity' parameter where diffusivity = the hydraulic conductivity divided by the specific storage. A high diffusivity is correlated with more rapid propagation of groundwater effect (ie such as mining). A low diffusivity is correlated with slower propagation of effects.

Table 2

Formation	Values Selected by AGE Consultants					**Values explicitly inferred by the applied mathematics**	
	Kh m/s	Kv m/s	Kv/Kh	Porosity	SS 1/m	**Diffusivity m2/s**	**Inferred Horizontal Modulus MPa**
Alluvium upper	$3.1x10^{-5}$	$1.2x10^{-5}$	0.4	0.1	0.005	**0.0063**	**2**
Alluvium lower	$5.5x10^{-5}$	$1.9x10^{-5}$	0.35	0.09	0.001	**0.0546**	**10**
Colluvium	$5.3x10^{-6}$	$1.0x10^{-8}$	0.002	0.08	0.00002	**0.266**	**499**
Weathered Permian	$2.8x10^{-6}$	$1.4x10^{-6}$	0.5	0.1	0.0002	**0.014**	**49**
Tertiary basalts	$1.3x10^{-5}$	$2.2x10^{-7}$	0.02	0.05	$1.52x10^{-5}$	**0.838**	**655**
Interburden	$1.7x10^{-8}$	$1.7x10^{-9}$	0.1	0.02	$1.63x10^{-5}$	**0.00107**	**605**
Interburden	$4.2x10^{-9}$	$5.0x10^{-12}$	0.001	0.03	$2.31x10^{-6}$	**0.00182**	**4511**
Ulan Coal Seam	$1.2x10^{-10}$	$1.2x10^{-11}$	0.1	0.02	$2.28x10^{-5}$	**$5.08x10^{-6}$**	**432**
Interburden	$1.7x10^{-8}$	$1.7x10^{-9}$	0.1	0.01	0.000076	**0.00023**	**129**
Coggan Coal Seam	1.2x10-^{10}	$1.2x10^{-11}$	0.1	0.02	0.0002	**$5.79x10^{-7}$**	**49**
Marangaroo Sandstone	$1.9x10^{-8}$	$3.6x10^{-11}$	0.002	0.01	1.31x105	**0.00144**	**751**
Basement	$2.2x10^{-9}$	$2.2x10^{-10}$	0.1	0.01	7.06x106	**0.00031**	**1398**
Triassic Intrusions	$1.7x10^{-8}$	$8.6x10^{-9}$	0.5	0.01	1.57x105	**0.0011**	**627**

The model should be recalibrated using physically possible diffusivity values, and model results, and drawdown extents should be re-produced based on these revised models.

Technical sensitivity analyses of the modelling parameters were undertaken in the EIS, presented in Appendix F to the Groundwater Impact Assessment. In Figure 4.13, the effects of sensitivity of some hydraulic parameters in the predicted extents of drawdown are shown. It is clear from our calculations presented above that much larger drawdown extents will be incurred with more appropriate diffusivity values.

We note also that groundwater impacts (and drawdown mapping) asserted within the main text of the EIS are declared on a single model output alone. This is inappropriate, and does not adequately communicate the uncertainty in predicted impacts.

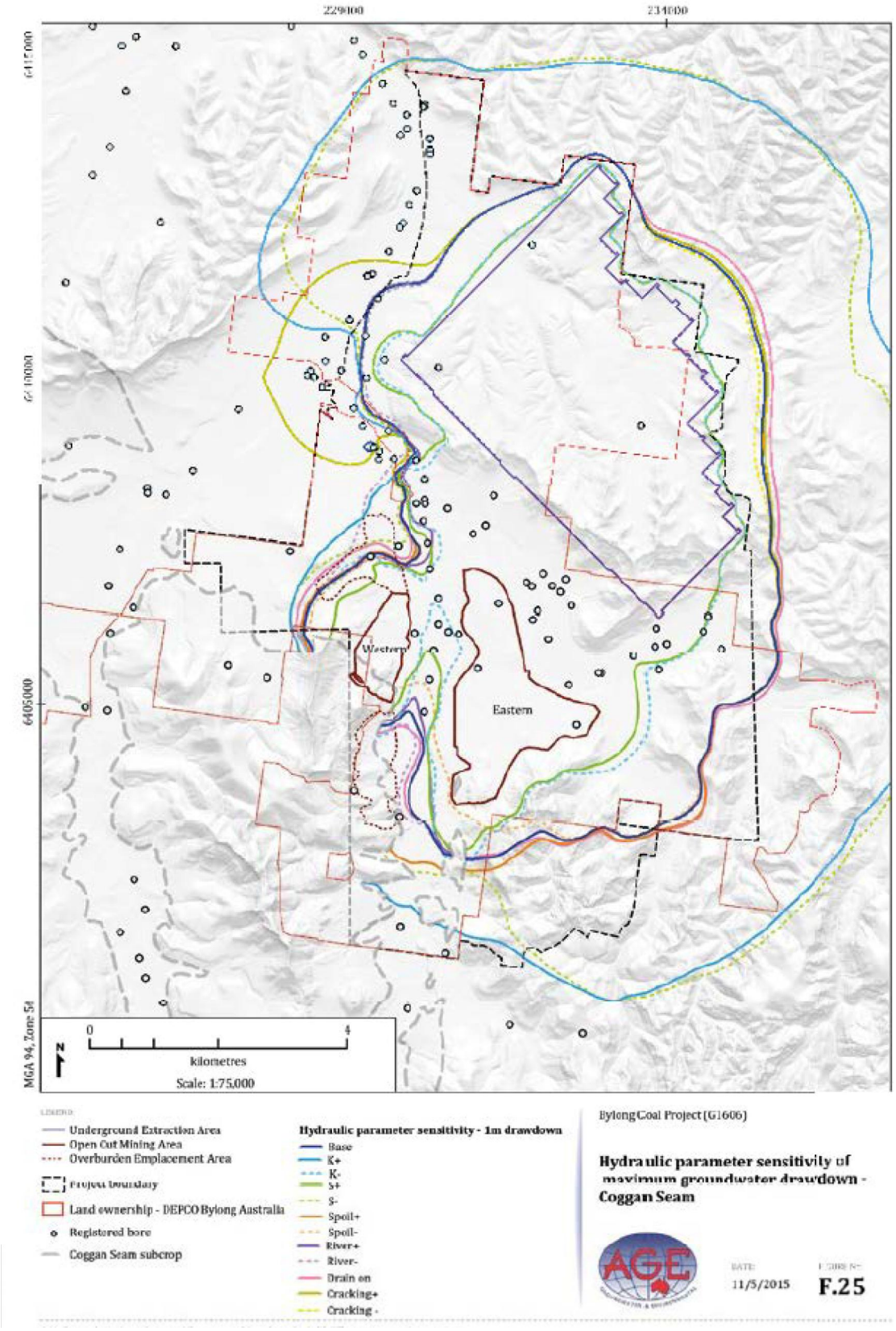

Figure 4.13: Sensitivity analyses given in Appendix H

4.5 Q(5) Has there been an adequate assessment of the sustainability of aquifers? In times of drought, is it possible for the Proponent to source the water they need, notwithstanding the fact they may have the requisite licences?

Relevant extracts from the main text of the EIS in respect to the overall water requirements are:

i. *The Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009 (Hunter Unregulated WSP) applies to the surface water and alluvial water sources in the locality of the Project.*

ii. *The Project is located within the Goulburn Extraction Management Unit within the Bylong River management zone.*

iii. *This water source has an area of 697.5km^2, with approximately 63% of this area being forested. These water sources include all surface water and any groundwater contained in alluvial sediments.*

iv. *KEPCO will therefore require WALs to account for the capture of surface runoff and any groundwater extraction from alluvial aquifers.*

v. *A WAL does not need to be obtained for water captured in water diversion drains or sediment dams, provided that these are located on a minor stream.*

vi. *The harvestable rights order for the Eastern and Central Division allows a landholder to capture 10% of the average regional rainfall runoff on the land.*

vii. *As at July 2015, KEPCO had a total landholding of 5,425 ha within the Project Boundary. In consideration of this landholding area, KEPCO's maximum harvestable right dam capacity has consequently been determined to be 355 ML/Year.*

viii. *A borefield within the Bylong River and Lee Creek alluvial aquifers is proposed to be utilised throughout the life of the Project to supplement the other site water supplies.*

ix. *KEPCO currently holds eight WALs with a total allocation of 2,535 ML/Year.*

The mine water balance was simulated using appropriate analytical tools and calibration to the available data. Nonetheless, it is a very complex arrangement, incorporating: borefield abstraction; surface water runoff and capture; mine-pit inflows, and; mine water usage (see Figure 4.14) for various possible climatic conditions.

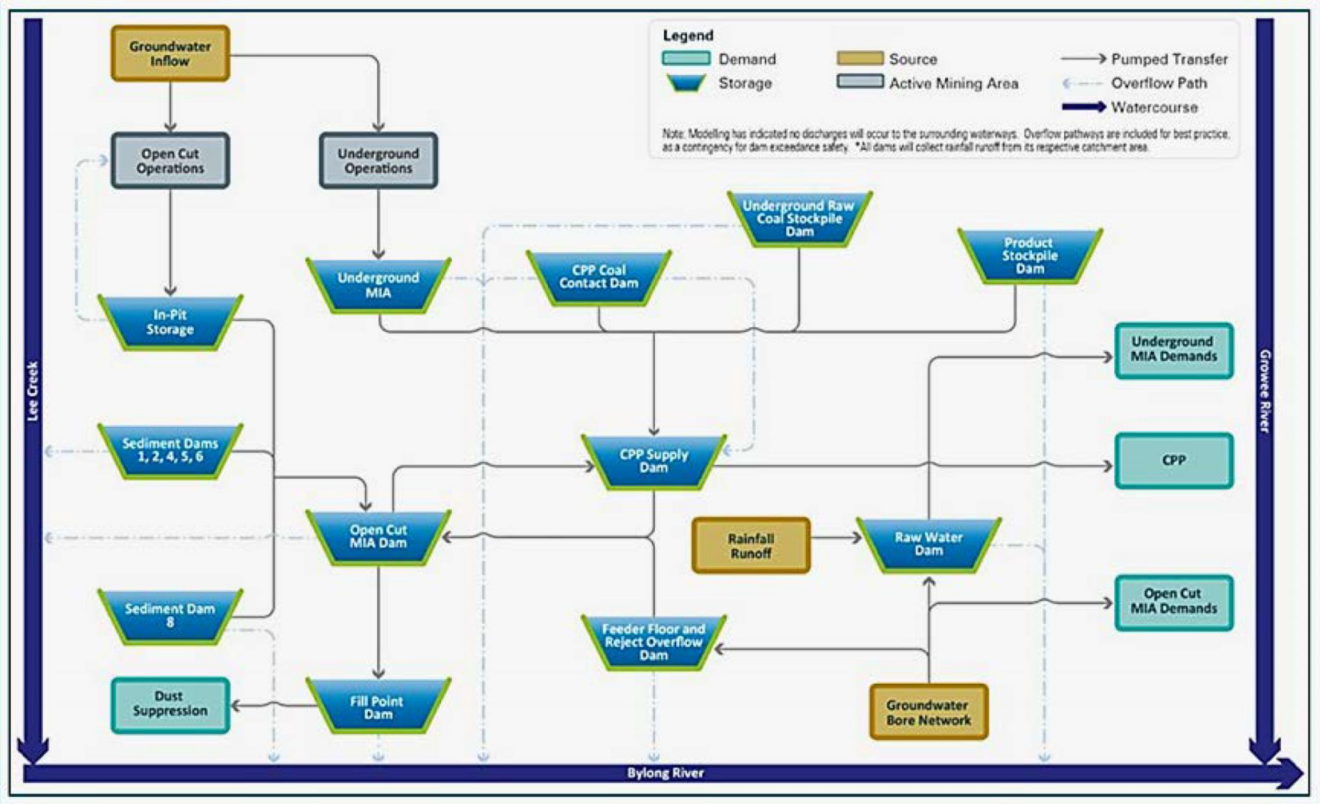

Figure 4.14: Water balance model

It is clear from the results of the analyses, as summarised in the following Table and in Figure 4.15, that production from the proposed borefield is critical to operation of the mine for the first decade.

Project Water Licensing Requirements
(re-typed from the EIS)

Water Type	***Predicted Annual Take (ML/Year)***		***Water Available in Water Source***
	Avg	***Max***	
Alluvial Groundwater	*153*	*295*	
Alluvial Groundwater (Borefield)	*338*	*1,172*	
Surface Water (loss of Baseflow)	*111*	*230*	
Surface Water (loss of catchment runoff)	*-*	*149*[1]	
Total from Bylong River Water Source for licensing	***491***	***1,149***	***5,843ML/Year***

The predicted amount of water needed to be abstracted from the borefield for various climate conditions is shown Figure 4.15.

Table 6.2 - Summary of bore water requirements

Operational period	Bore Water Supply		
	1% chance of requiring	10% chance of requiring	50% chance of requiring
Open cut only operations (PY3 to PY6)	985 to 1170 ML/a	940 to 1,140 ML/a	560 to 990 ML/a
Combined mining operations (PY7 to PY10)	380 to 1,005 ML/a	195 to 895 ML/a	0 to 500 ML/a
Underground only operations (PY11 to PY25)	55 to 150 ML/a	0 to 60 ML/a	0 ML/a

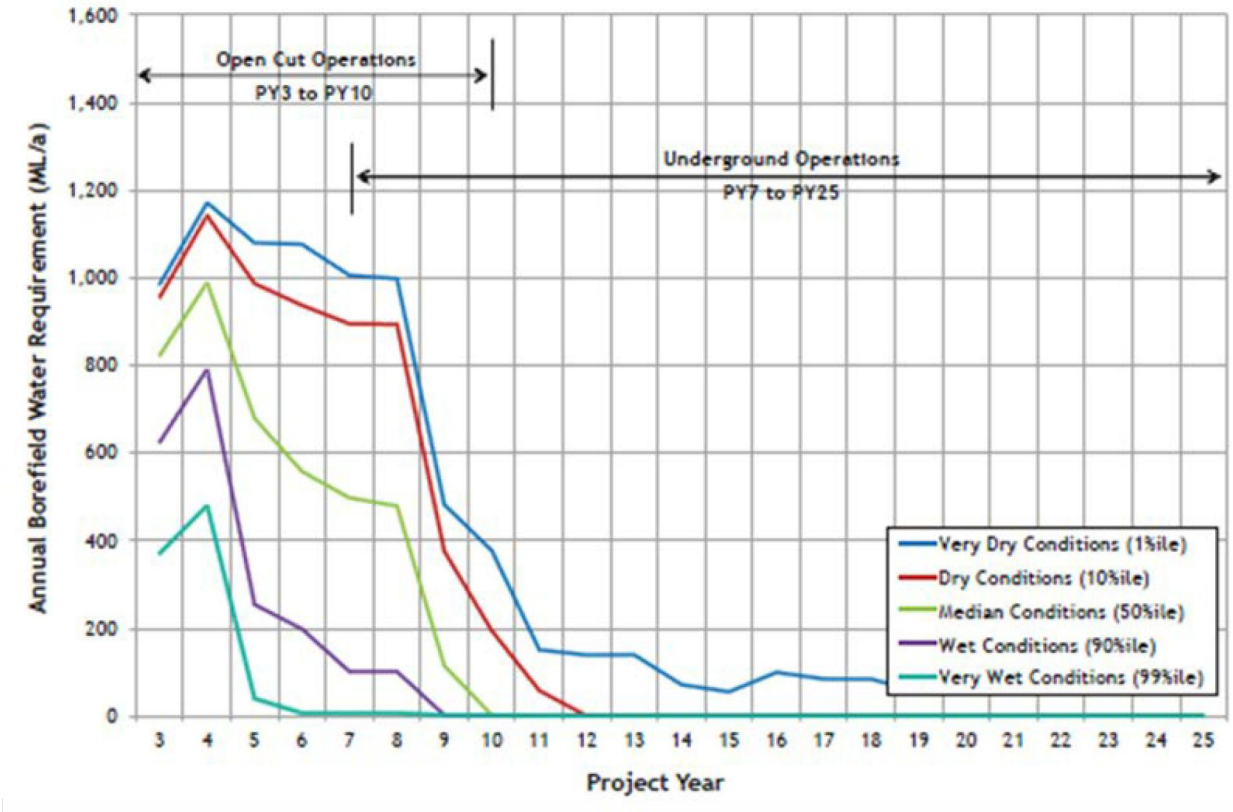

Figure 4.15: Annual bore-field water requirements

The information given in the EIS in respect to yield testing of the alluvium in the area of the proposed borefield (see Figure 4.16) indicates to us that very low confidence can be placed on the validity of the results given in Figure 4.15.

A substantial pumping test program would be necessary to demonstrate that the borefield can in fact provide the critically required water for the 1st decade of the mine life.

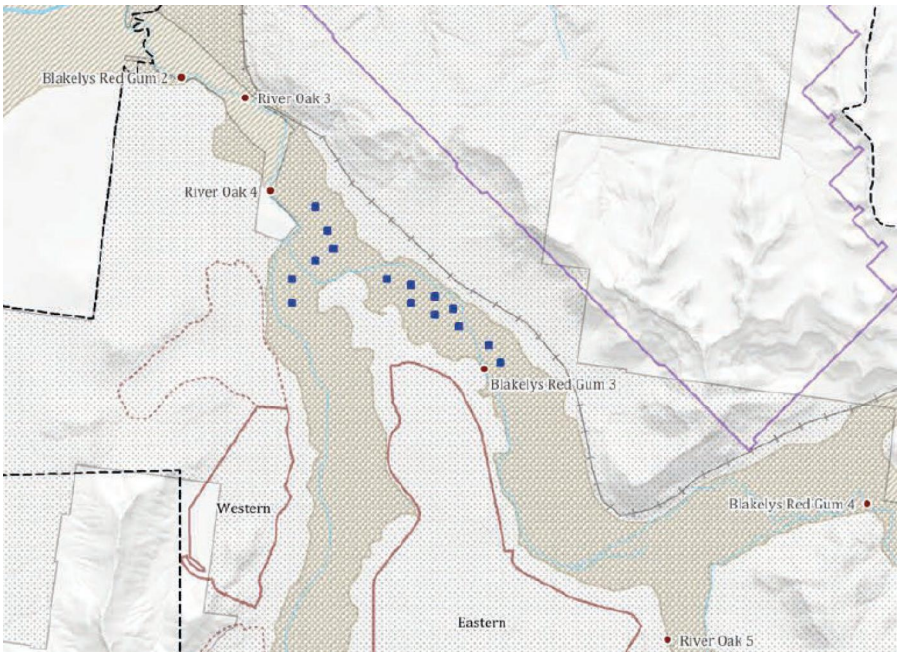

Figure 4.16: Proposed borefield

4.6 Q(6) If there are groundwater impacts, do they terminate at the Proponent's property boundaries?

The predicted depressurisation at seam level is shown in Figure 4.17. The extents are predicted from the modelling supplied in the EIS to be largely contained within the lease boundary.

However, this extent is subject to the aquifer parameters adopted. As stated in Question 6, presentation of drawdown extents from alternative scenarios that use more realistic values of hydraulic diffusivity are essential, and are likely to shown greater drawdown extents.

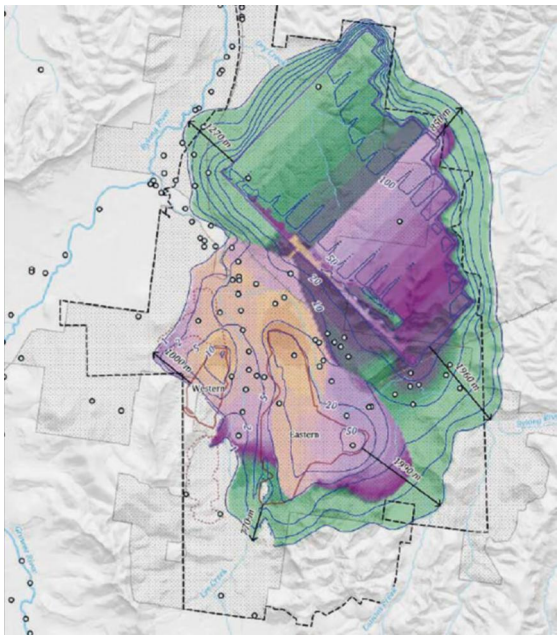

Figure 4.17: Predicted drawdown at the level of the Coggan Seam

We note that Figure 4.17 is for drawdown at the level of the mined seam. As discussed in Section 4.4, we have been unable to find within the EIS a proper analysis of the depressurisation of the rock strata above the Coggan Seam. The one piece of information we can glean is from the cross-sections reproduced in Figure 4.18.

These cross-sections show no groundwater within upper >200m of strata in the profile prior to mining. Based on our experience at other collieries in the NSW mountain areas (Clarence, Baal Bone, Springvale, Lithgow Valley) we cannot accept this assumption without justification from sufficient field measurements.

We think that when the model is re-run with appropriate rock mass stiffness values, and proper representation of the Triassic strata, it will be found that depressursation impacts will extend well beyond the Proponents property boundaries. However, as discussed in Section 2 of this report we think that that it is illogical for unacceptable environmental impacts within the Proponents property to make those impacts acceptable to society.

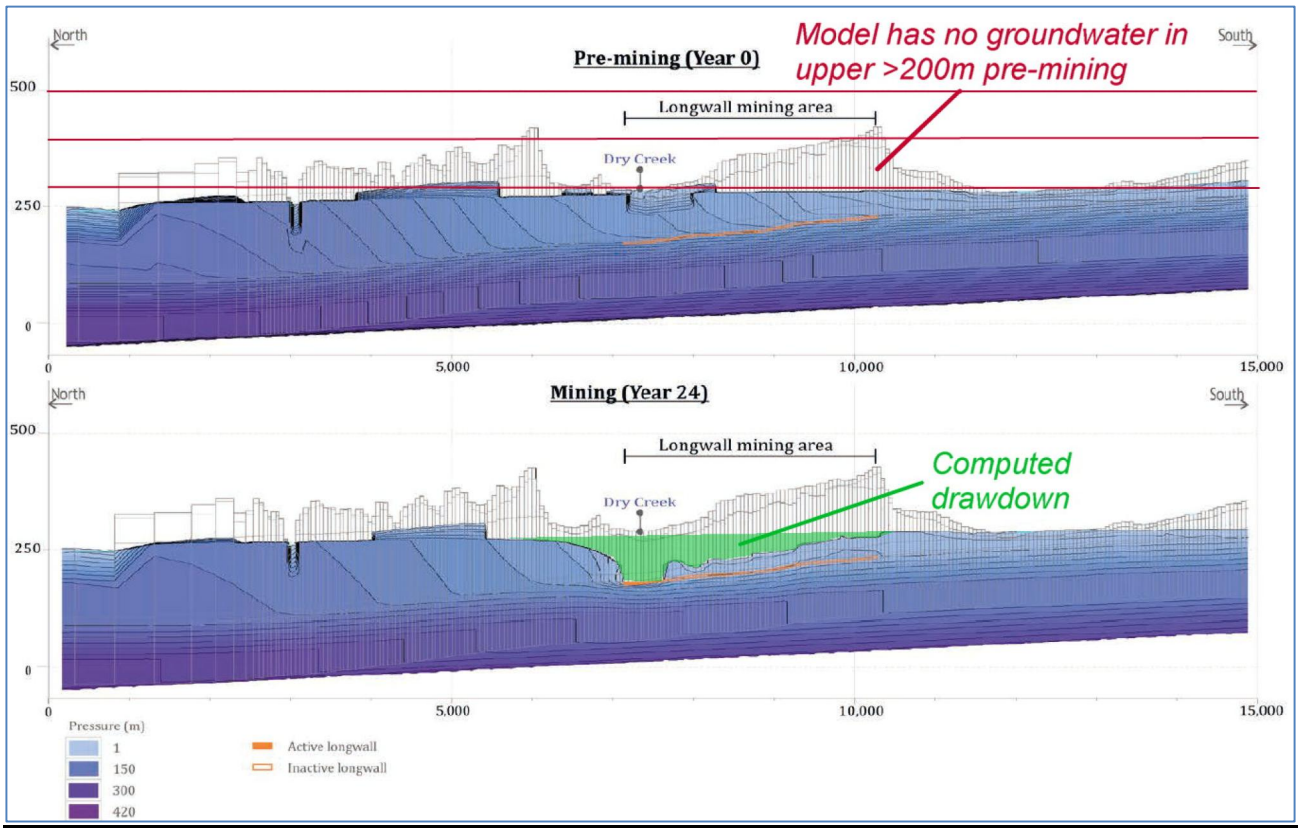

Figure 4.18 Computed pre-mining and post-mining groundwater regimes.

4.7 Q(7) Have the impacts on water quality been adequately assessed?

Having considered this matter carefully in light of material given in the EIS we consider that this question is outside our areas of expertise

4.8 Q(8) Has the horizontal extent of the drawdown footprint been adequately assessed?

See Answer to Question 4

4.9 Q(9) Are there any landholders (apart from the Proponent) who may be affected by the drawdown?

See answer to Question 4

4.10 Q(10) Are there any impacts above the longwall (which is proposed as an offset)?

We have discussed the substantial impacts above the longwall panes in Section 4.

We are not expert to answer questions in relation to the matters of 'offsets'.

4.11 Q(11) Are there any impacts relating to the proposed storage of mine waste water in the unlined Eastern Pit?

A detailed study would be required to answer this question with substantial scientific confidence. However, based on our experiences with storage of coal mine waters in completed open cuts both in the Hunter valley and in Queensland we think this should not be an issue of significant concern.

4.12 Q(12) Is there a baseflow reduction to the Bylong River or Goulburn River? If so, what are the impacts, including at time of critical low flow?

The EIS states:

> The model predicts the reduced pressure in the bedrock will reduce the rate of flow of groundwater from the bedrock, into the overlying alluvium. This effectively reduces the rate of recharge to the alluvium. The model predicts the rate of groundwater flow from the bedrock into the overlying alluvial formations will reduce by an average of 153 ML/year over the life of the Project with a peak of 295 ML/year. Groundwater may also need to be pumped directly from the alluvial aquifer by a bore field designed to obtain 'make up' water to cover a potential shortfall required for the washing of the coal product. The model contained 15 wells to supply the make-up water which peaks at 1172 ML/year during year 4, then reducing as inflows to the underground mine increase over time. KEPCO Bylong Australia Pty Ltd has secured 2,535 units of water allocation from the Bylong Water Source under the Hunter Unregulated Water Sharing Plan and therefore hold holds entitlements to account for its groundwater take even if the available water determination (AWD) reduces to less than 80%.

Box 9

Given that we consider that greater impacts will be found when the model is re-run with the corrected rock mass stiffness values, we expect the impacts on baseflow to the Bylong River to be greater than described above.

4.13 Q(13) If there are impacts on groundwater or alluvial aquifers, what is the outlook for aquifer recovery?

The EIS states as follows:

> When mining is completed within the open cut mining areas, the remaining void within the Eastern Open Cut is divided into two compartments for storage of coarse/fine rejects and mine water. One of the voids will be gradually filled with coarse and fine reject material from the processing of underground ROM coal for the remainder of the mine life.
>
> The modelling indicates the void space within the backfilled overburden in the Eastern Open Cut Mining Area is slow to fill with groundwater, and there is a gradual drainage of groundwater from the alluvium into the backfilled pit. Despite the slow recovery of groundwater levels within the backfilled open cut mining area, the adjacent alluvium still recovers due to the recharge rate on the flood plain, and subsurface flow from upstream exceeding the rate of drainage of groundwater into the backfilled pit. The coarse and fine reject disposal area has a relatively small footprint and therefore does not have a significant influence of recovery of groundwater levels within the alluvium.
>
> The underground mining operation depressurises the overlying strata, inducing steeper hydraulic gradients between the alluvium and Permian. This results in groundwater drawdown within the alluvium to the northwest of the underground mining area by year 22.

Box 10

Given that we consider that greater impacts will be found when the model is re-run with the corrected rock mass stiffness values we expect the impacts on the alluvium to be greater than described above. Obviously the greatest impact on the alluvium will be from the proposed borefield.

4.14 Q(14) Are there any impacts on the properties of Tarwyn Park and/or Iron Tank? If so, what constraints on subsidence and groundwater should be imposed to avoid those impacts?

The locations of the two properties are shown in Figures 4.19 and 4.20.

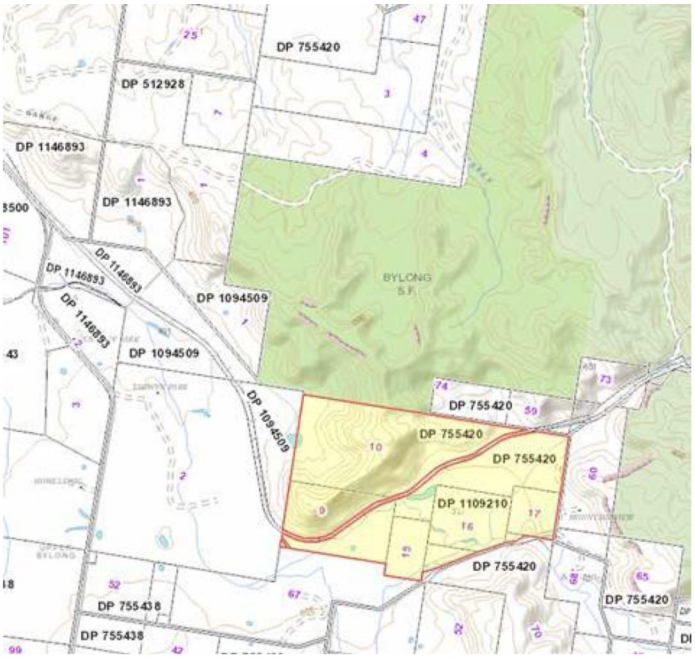

Figure 4.19: location of Iron Tank

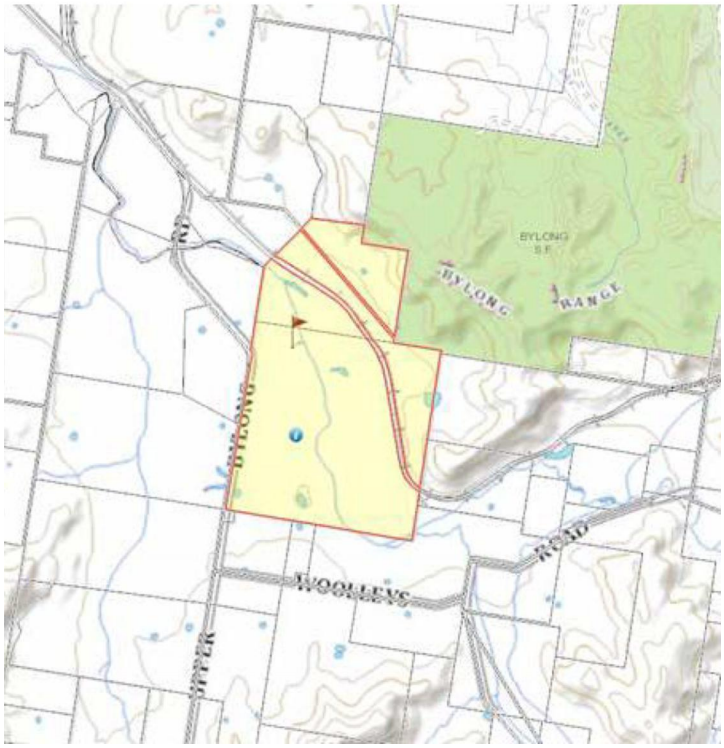

Figure 4.20: Location of Tarwyn Park

The EIS shows that there will be significant depressurisation of the groundwater regimes beneath Iron Tank, and the northern part of Tarwyn Park. The EIS also shows that both will be impacted by mine subsidence movements; Iron tank to a greater extent than Tarwyn Park as only the northern part of the latter would be impacted.

4.15 Q(15) Provide any further observations or opinions which you consider to be relevant.

None at this time.

……

Yours faithfully

PHILIP PELLS

STEVEN PELLS

WATER

Appendix 1b

SUBMISSION IN RELATION TO GROUNDWATER IMPACT ASSESSMENT PREPARED BY AUSTRALIAN GROUND WATER AND ENVIRONMENTAL CONSULTANTS

(Anonymous)

This submission predominately relates to the Bylong Coal (the proponent) Groundwater *Impact Assessment* (the Assessment), prepared by Australian Groundwater and Environmental Consultants Pty Ltd (AGE) (June 2015). This submission is not confidential.

Water supply for mine operations

The proponent proposes to construct a bore field comprising 15 shallow wells extracting up to 295 ML/year from the Bylong River alluvial aquifer, however in dry periods this could increased to 31 bores. There is a lack of certainty regarding sustainable water supply and drought security options. There are also no proposed contingency plans for water supply if sufficient water from the proposed bore field is not possible. Contingency plans are a requirement from the NSW Office of Water, as stated in the Appendix A of the Assessment.

The proponent notes that the existing bores targeting the alluvial aquifer cannot take their full entitlement (page 148 of the Assessment). Other mines in the Mid West, including Moolarban, Wilpinjong and Ulan mines, do not rely on the alluvial groundwater as a source of water. In addition the proposed reduction of upwards, vertical flow associated with the proposed mine will further reduce available water from the alluvial source (page 153 of the Assessment).

The confirmation of long term, sustainable groundwater supply has not been tested or verified with any site specific field testing in the form of constant rate pumping tests. The Department of Primary Industries, NSW Office of Water (2014) and Midwest Regional Council recommend aquifer testing be undertaken for this project (Assessment Appendix A), as do the Assessment authors. AGE recommend that the true sustainability of the bore field be tested via long term pumping tests at varying times of the year (page 158 of the Assessment).

Aquifer testing in the form of constant rate pumping tests, are recommended to determine the site specific hydraulic characteristics of an aquifer (notably aquifer storage) and aquifer connectivity. Hydraulic measurements have been predicted using the numerical model, and/or referenced from other locations. Any aquifer testing for the project has focused principally on the Permian Illawarra Coal Measures and has not verified the potential of the proposed water supply from the alluvial aquifer.

Water security for the mine operation

Hunter Unregulated Alluvial Water Sharing Plan is due for extensions/replacement in 2020. The proponent has not investigated the implications for possible reduced available water determinations or the introduction of the 'cease to pump' rules. This was a requirement from the Gateway Panel (Assessment Appendix A).

Being entitled to take from a source that has not been scientifically verified as sustainable is against precautionary principle and would be considered a significant impact, as per the Commonwealth Department of the Environment *Matters of National Environmental Significant* (2013). This guideline states that where there is a lack of scientific certainty about the potential impacts of an action this does not justify that the action is unlikely to have a significant impact on the environment.

Mine water disposal

It is proposed that excess water is stored in the unlined Eastern Open Cut mine pit totalling up to 2,542 ML at the end of mining. Some reinjection of waste water to the underground mine workings has been proposed, the volume is not reported. Reinjection has been included in the numerical model, at a constant rate of 7 ML/day to the Coggan Seam for a one year period. There has been no field investigation to support sustainable reinjection volumes and explore water quality impacts. The reinjection of mine waste water will require approval from the Department of Primary Industries, Water. No such evidence of the approvals is included in the Assessment. In addition it is unclear what will happen to the remainder of the waste water not reinjected. Overall the provisions for mine water management are unclear and not supported by field assessments.

Monitoring network

The NSW Office of Water requests construction details of the proposed abstraction bores be included in the Assessment, while the Gateway Panel requests plans to monitor actual water take (Assessment Appendix A). Construction details and monitoring plans are not included in the EIS. In addition a groundwater monitoring and modelling plan is a standard condition of licence for exploration required under the Mining Act 1992, there is no reference to such plan(s).

Flows to Goulburn River

While drawdown impacts are not predicted to extend to the Goulburn River there is a reduction in baseflow to the Bylong River by 918 ML/year, which will see a subsequent reduction in flow to the Goulburn River. Surface water runoff and rainwater capture to supply site water demands will reduce surface water flows (the maximum reduction in catchment area is 5.8% (of the Lee Creek catchment)). While the reported loss of flow in the Goulburn River catchment would be *immeasurably small (*as per the Surface Water Impact) no exact measurement is provided, and there does not appear to be any consideration of potential reductions from both reduced baseflow and loss of catchment area.

Aquifer disruption

The Independent Expert Scientific Committee (IESC) signalled the potential impacts to the alluvial systems porosity and permeability, and consequential implications for long term flow and storage resulting from the predicted alluvial drawdown (Appendix A, page 6). The proponent has confirmed this has not been addressed. Again this should trigger the application of the precautionary principle.

In addition a requirement of the IESC guidelines (2014) is to provide information on the time for post development drawdown equilibrium to be reached. This has not been provided for the alluvial aquifer, rather it is stated that recovery rates of groundwater levels will depend on rainfall (page 139). Some range of the recovery period should be provided based on numerical modelling and site rainfall patterns. Alternatively it should be clearly stated that groundwater level recovery will not occur.

Geology

The overview of local geology (page 24) lacks sufficient detail, such as grain texture, grain size and cementing. There is no mention of the Marrangaroo Sandstone or the interburden/overburden units, which comprise a large part of the subsurface environment. A detailed and comprehensive description of geology is a requirement of the IESC Guidelines (2014).

In addition the stratagraphic table, Figure 5.14, is not site specific and is not consistent with the units used in Figure 7.21. The cross section in Figure 7.21 is also not consistent with the surface outcrop shown in Figure 5.16, notably the Triassic units are absent.

Figures 5.16 and 5.17 showing folding within the coal measures are unclear, and do not include a reference plan figure showing the location of the cross section lines. Further discussion is required to support these figures. An information request from IESC (2014) and the Gateway Panel (Assessment Appendix A) is a description of the influence of geological structures on groundwater, in particular groundwater flow, discharge and recharge. Such a description is lacking in the Assessment.

Water quality

There are no reported water quality results from the overburden. The six Permian bores assessed for water quality intersect the target coal measures and minor interburden. This does not comply with the NSW Office of Water request to describe groundwater quality for all units (Assessment Appendix A). Without suitable assessment of baseline water quality from all groundwater units the extent of impact on hydrogeological interactions between water resources cannot be explored. This is a requirement of the IESC Guidelines (2014).

Considering the proposed mixing of groundwaters associated with mine dewatering and wastewater storage, and the reported difference in chemical composition between groundwater from coal measures and alluvium, a comprehensive and technically robust assessment of water quality and hydrogeochemistry is expected.

The IESC have requested an assessment of the hydrogeochemistry of spoil and rejects (Appendix A), the Assessment focuses on salinity only with no mention of potential acidity, fouling and metal leachate impacts. These latter impacts can have devastating impacts on environmental health.

It is noted that dissolved iron from alluvium and coal groundwaters exceeds the ANZECC (2000) trigger values for the protection of 95% of species. However this is not disucssed in the main text, rather the reader has to search through the results tables to find this out.

Pit discharge and geochemistry

It is proposed to co-dispose of overburden and coal rejects in the open cut pit. The Assessment reports that the impact on salinity from the rejects material on Bylong River and Lee Creek alluvium depends on the dilution effects within the flow path towards the aquifers, and it is likely the mean alluvium salinity will increase (page 145 of the Assessment). No measures are proposed to further investigate or mitigate salinity impacts, rather the potential influence of rainfall has been used to avoid making a commitment to detailed salinity investigations. This is exactly the type of high level technical assessment that should be undertaken.

The Geochemistry Assessment highlighted the presence of potentially acid forming material and the subsequent generation of acid metalliferous drainage. The acidification of receiving environments can have devastating negative impacts. RGS, authors of the Geochemistry Assessment, have proposed a number of measures to further investigate acid generation potential or mitigate for such impacts. Not all of these mitigation and management recommendations have been adopted by Bylong Coal. Specifically, the completion of scale up of leaching tests for potentially acid forming material and alkaline amendment tests as part of operational planning, and a commitment to encapsulate coal reject material when no storage capacity is available have been ignored.

Best practice observed at Hume Coal Mine

Other mines in NSW are adopting measures to minimise impacts and prioritise environmental protection. The Hume Coal mine, also targeting the Illawarra Coal Measures located in the southern Sydney Basin, is proposing to construct an innovative mine that avoids and reduces environmental impacts wherever possible mining (The Australian Mining Review 2015).

The Hume Coal mine is specifically designed to minimise any impact on the aquifers above the coal seam and the local groundwater systems, while the proposed re-emplacement of reject paste in the underground workings will eliminate subsidence, and other water and atmospheric impacts from reject stockpiling. Subsidence studies for the Bylong Project predict cracking generated by longwall mining could extend 260 meters to the surface over the majority of the mine footprint. The connective fracturing potential reaches land surface at the headwaters of dry creek.

Hume Coal acknowledges that the methods adopted to protect water and subsurface structure are more expensive, however they accept this is now a requirement of modern mining (The Australian Mining Review 2015).

Miscellaneous

- Figure 10.8 showing predicted alluvial groundwater drawdown is unclear, this should be separated into alluvium and regolith to remove the influence of topographic gradient.
- Figure 10.9 showing groundwater levels in the Coggan Seam does not include the contours at the mine footprint.
- Figure 10.10 does not show the location of the proposed bore field. The supporting text on page 117 states that drawdown from the extraction bore field extends 5-9 m, this is not clear on Figure 10.10.
- No justification or reasoning for the groundwater monitoring network is provided.
- No remedial measures or contingency plans are proposed for potential impacts (a requirement from the NSW Office of Water, Appendix A). There is a commitment to 'further investigation' however this is not considered a remedial measure or contingency.
- Text confirming that there will be enough overburden to fill the open cut voids or whether mounding will be observed is absent.
- The classification system used to determine the groundwater salinity type on page 67 (ie fresh, brackish) has not been reported.

Conclusion

The water investigations commissioned by Bylong Coal are not considered to be scientifically robust or best practice. This has produced a weak site conceptual model that lacking sufficient details and is often contradictory. There is significant reliance on numerical modelling with minimal focus on a robust, detailed site conceptual model.

There is a lack of water specific management measures, and rather commitments to monitor water resources and adopt management measures only if actual impacts precede the predicted impacts. In some instances the water management approach ignores the fundamental precautionary principle. Other mines in NSW have adopted best practice principles to minimise the environmental impacts of mining, and pride themselves on having as little impact as practically possible.

References

Department of Primary Industries, Office of Water, 2014. Groundwater Monitoring and Modelling Plans, information for prospective mining and petroleum exploration activities.

Department of the Environment 2013. *Matters of National Environmental Significance.*

Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) 2014. *Information guidelines for independent expert scientific committee advice on coal seam gas and large coal mining development proposals*.

Miningoilgas, The Australian Mining Review October 2015. *Australia's first low impact coal mine*.

ECOLOGY

Appendix 2

ADEQUACY OF ASSESSMENT OF ECOLOGICAL ISSUES IN THE EIS FOR THE BYLONG VALLEY MINE PROJECT

(Ethical Ecology Australia)

Adequacy of assessment of ecological issues for the Bylong Valley Mine Project EIS

Brush-tailed Rock Wallaby

David Paull (M. Res. Sc., Dip. Hum., UNE)

Ethical ecology AUSTRALIA

ABN: 57227012954

Adequacy of assessment of ecological issues in the EIS for the Bylong Valley Mine Project

To undertake this task, I reviewed the following documents:

- Bylong Coal Project EIS, Executive Summary (Hansen Bailey/Worley Parsons)
- Bylong Coal Project EIS, Appendix H: Subsidence Ground Movement Predictions and Impact Assessment (MSEC)
- Bylong Coal Project EIS, Appendix J: Ecological Impact Assessment (Cumberland Ecology)
- Bylong Coal Project EIS, Appendix K: Biodiversity Offset Strategy (Cumberland Ecology)
- Bylong Coal Project EIS, Appendix L: Surface Water Impact Assessment (WRM water and Environment)
- Bylong Coal Project EIS, Appendix M: Groundwater Impact Assessment (AGE)

1. Summary

While there was considerable effort undertaken to gather baseline data on biodiversity and habitats in the project study area, the assessment of ecological impacts has been hampered by a several major deficiencies, namely;

1. Lack of consideration to key threatened species matters occurring in the locality, particularly in relation to the Regent Honeyeater, Bruch-tailed Rock-wallaby, Large-eared Pied Bat, Eastern Bentwing Bat and Red-crowned Toadlet;
2. Very poor assessment of the impacts on GDEs;
3. Very poor assessment of potential impacts of cracking on rock formations and habitats;
4. Strong deficiencies in the offset proposal should mean it requires revision or rejection,
5. Failure to provide assessment in the form as stipulated in the Framework For Biodiversity Assessment; and
6. Lack of consideration for impacts on the adjacent Wollemi National Park.

2. Expected extent of direct and indirect impacts

The expected impacts of the open cut and underground mining companies have been described in the EIS as being;

Direct Impacts (habitat removal)

- 783 ha of native vegetation and habitats, including over 3000 hollow bearing trees
- 59 ha of Box Gum Woodland TEC and 189 ha of derived native grassland matching the definition of the TEC
- Portions of the Bylong and Lees Creeks

Indirect impacts (only subsidence and drawdown impacts considered here):

- 1,698 ha of native vegetation and habitats
- 546 ha of Box Gum Woodland TEC and 321 ha of derived native grassland matching the definition of the TEC
- The subsidence area underlies the Dry Creek Catchment – a 1st and 2nd order stream flowing out of the Bylong State Forest

Subsidence and associated hydrological impacts include:

a. Lowering of groundwater within alluvial aquifer, and usage of the borefield result in significant loss of baseflow to Bylong River. This impact will be seen as a maximum 10 m reduction in groundwater levels in the alluvium, with impacts extending up to 1 km from the open cut area and 2.3 km from the underground area.
b. Significant change to flow frequency of Bylong River (4th order stream)
c. Cracking from subsidence causing drainage of shallow, perched basalt aquifers and enhanced drainage from surface water systems into the alluvium.
d. Precipitous drop in groundwater levels in the Permian Sandstones above longwalls. This impact will be seen as a maximum 20 m drawdown (or reduction in groundwater level) just outside the mine footprint, and a 1 m drawdown up to 2.4 km away from the mine.
e. Cracking / subsidence along Dry Creek may significantly change its flow and ponding regime. Cracking is also likely to cause damage to rock formations and rock outcrop habitats.

3. Issues concerning GDE/water body distribution and impact.

Poor assessment of GDEs

The ecological assessment identifies two GDEs in the study area supporting terrestrial vegetation, both associated with alluvial plain riparian and river terrace areas associated with Bylong River and Lee's Creek, River Oak/Redgum Riparian woodland (Unit 3) and Blakely's Redgum/Apple Riparian Forest (Unit 4). No GDEs are identified in the subsidence area, despite this being mapped in the Australian GDE Atlas as having a 'moderate potential' for sub-surface ground water interraction (Figure 2).

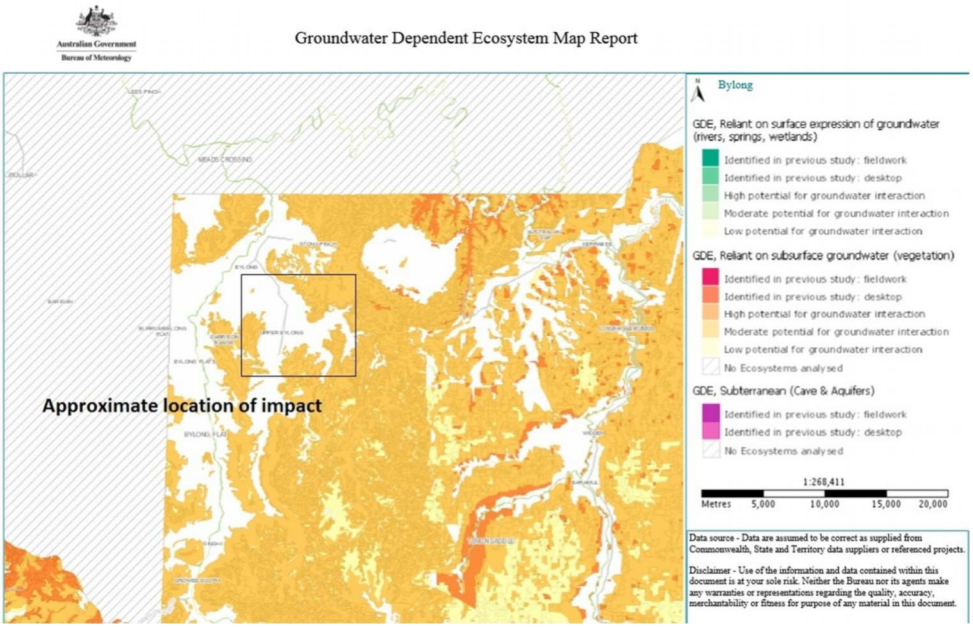

Figure 1. Results of Australian GDE Atlas search for Bylong area

The GDE Atlas shows the Bylong River and Lees Flat systems have a 'moderate potential' for groundwater interaction (surface expressions of groundwater), while the Bylong Stater Forest area and Dry Creek also has a 'moderate potential' for groundwater interraction (sub-surface). Despite this, the ecological assessment has not identified any GDEs in the subsidence area.

This is not surprising given the difficulty the consultant (CE) seems to have in interpreting and identifying what a GDE is and what it may look like in the field.

The consultant first states that, "*Eastcoast Flora Survey observed no obvious evidence of GDEs apart from one 'soak' at Tal Tal Mountain …*" However GDEs do not necessarily require standing water to substantiate their identity, particularly sub-surface GDEs. Yet the assessment goes on to say that, "*temporary pools are present within the network of drainage lines in the Study Area with some aquatic vegetation present in pools where water persist for longer durations*." (p.4.1). Importantly, the location of these water bodies, like the dams, are not indicated in the assessment, nor is their presence thought to be indicative of groundwater influences.

There are two groundwater systems in the study area, the one on the lowland alluvium which supports a base-flow river GDE and the sandstone groundwater in the state forest which supports GDEs with a much lower productivity. Despite this the drainages of the Dry Creek system have narrow areas of alluvium associated with them according to the assessment. Both systems are sustained by water table levels and their interaction with inflows. Both may display surface expression of groundwater like springs and seepages, though the more productive Bylong/Lee Creek system is more likely to sustain surface flow.

The assessment also states that the drainage lines in the study area, "*are typically ephemeral and historically have been degraded…"* and that they have, *"… a moderate reliance not a complete reliance (on groundwater)*". These points are quickly dealt with below:

- As alluded to above, being 'ephemeral' does not preclude a system from being a GDE, in fact is typical condition for a lot of GDEs most of the time.
- Having been degraded (presumably by agricultural uses) in the past, does not preclude a proper assessment of the cumulative impact the Project will have on groundwater levels in the area.
- Not having a complete reliance does not mean the GDE should not be considered, as a moderate chance of groundwater interaction generally is indicative of systems which are mostly sustained by rainfall and surface water, though require groundwater during times of dryness or drought. Lowering water tables for these systems may see increased rates of dying vegetation during dry times.

Sub-surface groundwater GDEs in subsidence area

The riparian zones associated with Dry Creek are typically dominated by a distinctive community according to the ecological assessment, 'Blakely's Red Gum/Paperbark Forest' (Unit 5). Another type 'Grey Myrtle Dry Rainforest' (Unit 2) is also found in sheltered, moist gully areas and may also be a GDE. Red Gums generally grow where there is alluvial soil and the presence of Paperbark suggest a level of water retention in these environments and should be regarded as a GDE.

It could be strongly argued that not all the vegetation types in the Bylong State Forest are GDEs that are worth considering in an impact assessment. Levels of groundwater reliance varies considerably across a complex landscape such as Bylong State Forest, though that argument would be hard to sustain for drainage zones in areas with moderate levels of groundwater interaction. For these reasons I would identify this restricted communities (Units 2 and 5) as the most important GDE in the subsidence area and should require an impact assessment of the subsistence/ water loss impacts. An interesting feature of this community was the discovery of a potentially new species of plant *Sannatha sp. aff. cunninghammi.*

A key deficiency in the EIS however is that no impact assessment of drawdown or subsidence was undertaken for the GDEs that were identified by the consultants. This could have been easily done by taking into consideration extent of depressurisation over the study area (and beyond), the depth of the water tables and the expected drops in the aquifers and cracking that are modelled to occur. Reasonable statements then could be made about the relative risk to the different GDEs. A similar process should have been undertaken for the sub-surface GDE along Dry Creek.

Further, as the zone of depressurization encompasses the neighbouring Wollembi National Park, this impact should have been considered in the Ecological Assessment. In relation to subsidence, the predicted angle of draw outlined in the Subsidence Assessment shows that subsidence is expected right up to the boundary of the National Park itself leaving no room for error and no adherence to the

precautionary principle. It is recommended that a buffer zone be established, so that physical impacts on the NP can be more likely avoided.

Lack of detail on man-made dams

There are 11 dams occurring in the study area according to the Subsidence Assessment. They are described as being of poor quality for wildlife to others supporting native vegetation. Their location and an accurate habitat assessment of each one has not been undertaken. They should really be described as a separate vegetation category. Dams containing native vegetation could provide habitat and drinking sources for a wide range of locally occurring fauna.

4. Assessment of Impacts on rock outcrops

There are a number of rock-dependent fauna that occur in the study area, in particular, the Brush-tailed Rock Wallaby, Large-eared Pied Bat, Eastern Bent-wing Bat, Broad-headed Snake and Rosenberg's Goanna. While the reptiles were not observed during the field surveys, a Rock Wallaby was observed, indicating the possibility of a local population in the area. Both species of cave bat were detected during field surveys undertaken by the consultant.

Assessments are made in the EIS in relation to subsidence impacts on surface features such as rock formations and creek beds. The Ecological Assessment gives the maximum vertical displacement at 3.3m, while cracking of hard surfaces ranges will cover approximately 10% of the subsistence area and crack widths range up to 200 mm wide on the steeper slopes. These are major impacts upon rocky areas which the consultant dismisses by stating that rocky cliffs are "*dynamic areas*" where rock falls are, "…*not uncommon for significant periods of time*", and that subsidence may in fact provide additional habitat for rock species or they are adapted to such conditions and can carry on as usual.

Both assertions fail the test of credibility. The Project will in fact compress the time in which rock falls will occur from hundreds of years into a few years. This is not a normal geological process. As for providing additional habitat, this is a desperate assertion as it would be more likely that habitats will be damaged by cracking and rock falls. Animals just do not occupy any crack which happens to form. They live in stable, thermo-regulatory environments that have formed as much from geological erosion as well as rock falls. For an animal like a snake or a bat, cracking of their refuge areas could make this unsuitable due to changes in the temperature, heat and light regime of the fallen or cracked refugia. This is just as important for cave-roosting bats which require very cool roost sites.

There seems to be some inconsistency between what the subsidence study and what Cumberland Ecology states are the expected impacts of subsidence on terrestrial habitat in the subsidence area. MSEC (2015) identified 45 cliff locations in the study area, of which 22 lie above or bordering the subsidence area. However, in the Offset Strategy document, it is stated that surface cracking will only

affect 1% of the subsidence area. This is misleading because this figure represents areas most susceptible to cracking, rock surfaces, which may not cover more than 1% of the subsidence area.

Potential damage to approximately half the cliff-line area could have a significant impact on any species dependent on this type of habitat. However these impacts are not adequately considered in the significance of impact assessments as the extent of rocky habitat within the indirect disturbance area is not indicated in the Ecological Assessment nor what proportion this represents of the total extent of this type of habitat in the study area. It is stated that the impact on habitat in the direct disturbance area is 125 ha, though in the Offset Strategy document, this is given as <1 ha. What do these figures represent?

In relation to the direct impacts on fauna and flora generally, the Ecological Assessment states:

"It is anticipated that the types (sic) of fauna and flora species utilizing the habitat within the Project Disturbance Boundary will continue to persist within other areas of the Study Area where suitable habitat is present."

This assessment does not take into account the anticipated impacts that may arise as a result of subsidence in the area of indirect impact. This is particularly relevant for rocky habitats.

In relation to indirect impacts on threatened fauna and flora, the Ecological Assessment states that:

"The majority of threatened species known, or with the potential to occur within the Study Area are highly mobile and are considered likely to utilize habitat resources throughout the locality and within adjacent reserves. However removal of habitat within the disturbance boundary is considered significant for the Regent Honeyeater."

As the assessment of significance of impact needs to address the impact on the local population, pursuant to Section 5A of the EP&A Act, that is the area as defined by the Study Area boundary. While a significant impact was thought likely for the Regent Honeyeater due to removal of woodland habitat in the Disturbance Boundary, the impact on rocky and groundwater dependent matters does not appear to have been undertaken adequately as they do not take into account expected impacts within the Subsidence Zone. Particular matters are addressed below.

5. Threatened Species Impact Assessment

The ecological assessment for this project was undertaken prior to the adoption of the Framework for Biodiversity Assessment, though was submitted after the adoption of this framework and therefore should have informed the ecological assessment in the form a Biodiversity Assessment Report (BAR). Of relevance are the factors which guide a determination as a matter for "further consideration".

Further consideration by the consent authority required for landscape features:

> (a) impacts on landscape features, being: (i) impacts that will reduce the width of vegetation in the riparian buffer zone bordering significant streams and rivers, important wetlands or estuarine areas, or (ii) impacts that will prevent species movement along corridors that have been identified as providing significant biodiversity linkages across the state, and
> (b) impacts on native vegetation that are likely to cause the extinction of an EEC/CEEC from an IBRA subregion or significantly reduce its viability, and
> (c) impacts on critical habitat or on threatened species or populations that are likely to cause the extinction of a species or population from an IBRA subregion or significantly reduce its viability.

Bylong River (4th Order Stream) is arguably a 'significant stream' and would trigger 'further consideration'.

For threatened species and populations:

> (a) on any critically endangered species, unless the critically endangered species is specifically excluded in the SEARs;
> (b) on a threatened species or population that is specifically nominated in the SEARS as a species or population that is likely to become extinct or have its viability significantly reduced in the IBRA subregion if it is impacted on by the development, or
> (c) where the survey or expert report undertaken in Section 6.6 confirms that a threatened species is present on the proposed development site, and the threatened species has not previously been recorded in the IBRA subregion according to records in the NSW Wildlife Atlas

The Regent Honeyeater is a 'critically endangered' species, making the Project one that should be a matter for further consideration by the Minister.

The FBA sets out that offsets for impacts requiring further consideration will not be able to be finalised in the biodiversity offset strategy prior to submitting the development application, as the consent authority will need to consider these impacts in their decision-making process.

As the assessment has used the older approach of determining significant and residual impacts, the approach used by the consultants has been addressed here. The Ecological Assessment provides the figures for the extent of impact upon the White Box – Yellow Box – Blakely's Red Gum Woodland Threatened Ecological Community (TEC).

Structure	Direct Impact	Subsidence Area	Study Area
Woodland	63	519	951
Derived Native Grassland	198	318	1,261
Total	261	837	2,212

Figures show that the extent of impact (by both direct and indirect means) is approximately 50 % of the total extent of this community in the Study Area. This is a large proportion of the extent of this community in the Study Area and should be regarded as a significant impact pursuant to s. 5A of the EP&A Act. The Ecological Assessment considers only the areas of direct impact within the Disturbance

Boundary. While the extent of impact from subsidence is uncertain, a precautionary approach should identify acknowledge the extent of potential impact on this community.

Red-crowned Toadlet

The use of the concept of the 'locality' to identify which matters need to be considered in the EIS is consistent with accepted practice and is consistent with the OEH's Assessment of Significance Guidelines (DEC 2009), the ecological impact assessment does not identify one species known from the locality as results from the BioNet Database search indicate (Figure 1). This is not a record which has appeared in the last few years, but was present in the database for the last 12 years.

The assessment guidelines for this species (NPWS 2001) states that it is often found "*…just below benched rock platforms. Red-crowned Toadlets usually live in the vicinity of permanently moist soaks or areas of dense ground vegetation or leaf litter along or near head-water stream beds. They prefer the first or second order ephemeral drainage lines commonly called 'feeder creeks' which drain the ridges, benches, cliffs and tallus slopes. These watercourses are often dry or reduced to ponded areas for much of the year and only sustain flow for short periods. Under natural conditions these feeder creeks have flows of high water quality and low nutrient loads*."

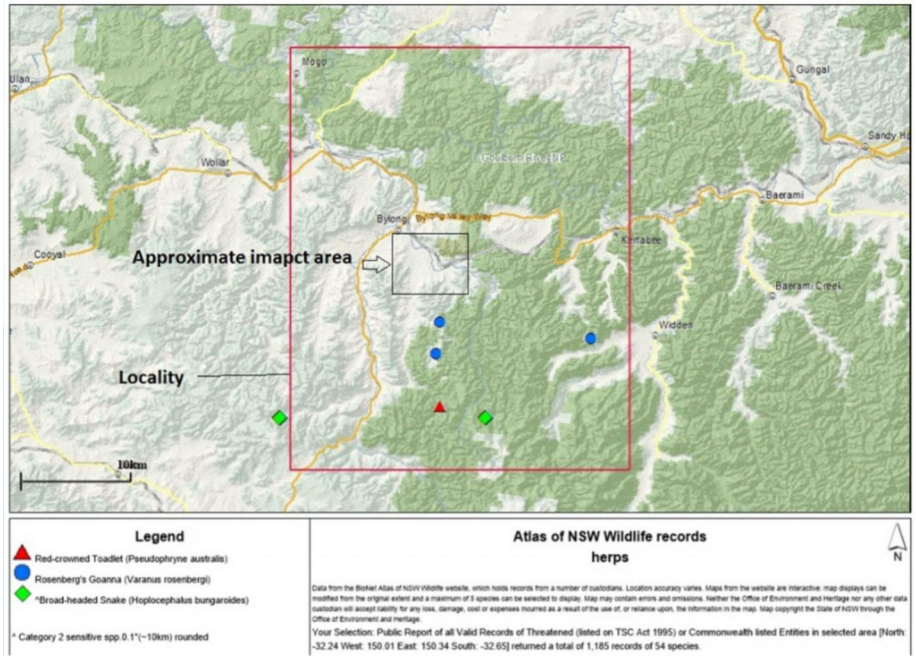

Figure 2. BioNet search results for amphibians and reptiles (September 2015)

As a result of this habitat selection, this species leads a precarious breeding existence, with failures common:

"*..when faced with the desiccation of their ephemeral ponds, the tadpoles of Pseudophryne australis, a semi-endotrophic myobatrachid frog, do not accelerate metamorphosis, and total reproductive losses are a frequent event*". (Thumm and Mahony 2006)

The habitat for this rare frog may be suitable in the study area and its presence in the locality should have been identified prior to field work so that targeted surveys could be undertaken. Judging by the survey effort for frogs (7.5 hours of reptile and frog surveys at 15 locations) this has clearly not been done.

Red-crowned Toadlets are a localised species in the breeding season appear to be largely restricted to the immediate vicinity of suitable breeding habitat where they are found as small colonies scattered along ridges coinciding with the positions of suitable refuges near breeding sites. Due to this tendency for discrete populations to concentrate at particular sites, a relatively small localised disturbance may have a significant impact on a local population if it occurs on a favoured breeding or refuge site.

Due to the likely impacts on the Dry Creek Catchment from subsidence and water table drawdown, impacts on any locally occurring population of this species may be significant.

Regent Honeyeater

A critically endangered Regent Honeyeater was observed in Blakely's Red Gum /Apple riparian Forest during field investigations for the Ecological Assessment. This is consistent with habitat types selected by this species (http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10841) which often utilize riparian zones for breeding and foraging. Despite groundwater/depressurization matters not being addressed, and the fact that this species may be considered to be 'highly mobile', the impact on this species by the Project is thought to be significant. This is an accurate assessment because:

- A large amount of habitat will be removed and degraded in relation to its extent within the study area.
- Recent verified usage of the Study Area

Brush-tailed Rock-wallaby

An individual Brush-tailed Rock-wallaby was observed during field investigations within the Study Area indicating the possible presence of a local population. NSW Atlas records indicate this species has a known historic presence in the Wollemi National Park, though its continued presence is uncertain, due to sparsity of records and was not detected during most recent surveys in the western side of the park. This is an endangered species in NSW and so any records of its continued presence are significant for the conservation of this species.

The Ecological Assessment did not find a significance of impact on this species. The extent of impact in the Disturbance Area is given at 125 ha while the extent of habitat in the subsidence area and

within the Study Area is given in Appendix J as 795 ha and 3,943 ha respectively. However a question mark has to be raised as what type of habitat is being assigned as preferred for this species.

Table 6.7 identifies habitat for this species as being Rainforest, Riparian Forest and Grassy Woodland. While the Rainforest and some of the Riparian Forest areas are associated with steeper country where rocky refugia occur, the Grassy Woodlands, while containing foraging habitat for this species, does not match expected habitats that this species typically requires for refugia as they do not occur in areas associated with rocky terrain. Brush-tailed Rock-wallabies require rocky refugia to survive and cannot persist in Grassy Woodland areas where this habitat does not exist. The individual that was observed was found in Slatey Gum Woodland. The assessment of impact on this species suffers from a lack of identification of the extent of rocky terrain in the study area and the figures provided are not a reliable indication. The survey of cliff faces (MSEC) suggest that approximately 50% of optimal refugia habitat for this species occurs within the Subsidence Area.

Notwithstanding the limitations of the assessment, there may be a significant impact and residual impact on this species because:

- A large amount of critical habitat will be removed and /or degraded in relation to its likely extent within the Study Area, and
- Verified recent usage of the Study Area

Though data to inform a more precise assessment has not been provided.

Cave dwelling Bats

Both the Large-eared Pied Bat *Chalinobolus dwyeri* and the Eastern Cave Bat *Miniopterus schreibersii* were recorded within the Study Area during field investigations. The Large-eared Pied Bat is not thought to be a 'highly mobile' species, maintaining discrete territories centered around roost sites (Pennay 2006). It is clear from an examination of Table 6.7 that the habitats assigned to this species covers most of the forested vegetation in the study area (5,207 ha). While this species may be recorded foraging across the study area, this assessment suffers from a lack of consideration of the extent of potential breeding or roosting sites, ie. caves and rock crevices. Notwithstanding this limitation, there may be a significant and residual impact on this species because:

- A large amount of breeding habitat will be removed and degraded in relation to its extent within the study area, and
- Recent verified usage of the Study Area

Though data to inform a more precise assessment has not been provided. In relation to this Eastern bent-wing Bat, it is known to be a more highly mobile species, though a significant impact may result if roost sites are damaged.

6. Adequacy of offset strategy

Offset Security

As stated in the Ecological Assessment, at the time that the SEARs for the Project were issued, the current Biodiversity Offset Policy for Major Projects (OEH 2014) had not been ratified as policy, though had become policy by the time the assessment was submitted. This is not consistent with the Transitional Arrangements for the new Policy for Major Projects where the new Policy still applies for any project submitted during this period,

"During the transitional implementation of this policy, biobanking agreements must be used to secure offsets if any of the following conditions are met:

- *there are appropriate credits available on the market for purchase (noting that 'reasonable steps' to locate offsets includes a requirement that an expression of interest be put on the biobanking credit register for a minimum of six months)*
- *the fund has been established, or*
- *a service agreement for establishment of biobanking agreements has been put in place by OEH."*

Given suitable amounts of offsets are available, a Biobanking Agreement should be mandatory for the Bylong Valley Coal Project.

Despite identifying five offset areas which are owned partially by KEPCO (except that lying within Bylong State Forest) the Offset Strategy does not identify any mechanism by which offsets could be secured. Five possibilities are suggested, a BioBanking Agreement, a Conservation Agreement under the NPW Act, Conservation Covenants under Section 88 of the *Conveyencing Act*, and a proposed re-zoning application. This is despite the fact that under the current Offset Policy for Major Projects, an in perpetuity BioBanking Agreement or a transfer to the NPW estate, should be mandatory for any offset strategy in NSW. Surprisingly the latter is not discussed in the Offset Strategy.

The offset package provided for this Project contains five distinct areas, most close to the mine impact area. However Offset Area 5 is marked by being above the Subsidence Area and partially incorporating Bylong State Forest.

Is Offset Area 5 suitable for a BioBanking Agreement - Subsidence

This is an entirely inappropriate offset for use in the package for a number of reasons.

Given the subsidence and drawdown impacts that are predicted, some which may not be able to be rehabilitated, it is more likely the site will diminish in value over the life of the mine. This is not consistent with the general criterion for offsetting as being able to generate an improvement in biodiversity value. Increases in biodiversity over time cannot be calculated if the area has vast uncertainty about ongoing health of ecological systems.

In addition, the SEARs for the project state that the EIS must address,

" a comprehensive offset strategy to ensure the development maintains or improves the terrestrial and aquatic biodiversity of the region in the medium to long term."

This has not been addressed in the EIS in relation to expected impacts of subsidence.

Areas subject to subsidence cannot be made a National Park either due to potential costs and uncertainty in relation to maintenance of the area and because of risk to the public. In particular, Section 30E(c) of the NPW Act states that the management goal of National Parks is for, "*the protection of the ecological integrity of one or more ecosystems for present and future generations*."

Can State Forest be used as an offset?

This offset lies on a public forest used for exploitation of resources - creating an offset over a state forest is a new precedent and raises questions of appropriate tenures and whether this is consistent with Offsetting rules in NSW.

Of course the elimination of this offset could mean that residual impacts on listed matters are not retired.

Supplementary Measures

No supplementary measures have been proposed as it is stated that the direct offsetting is sufficient to retire all credits generated by the project.

Adequacy of biodiversity credit retirement

Cumberland Ecology have used a concept of 'minimum area thresholds' to assess adequacy of the offset package. This is not consistent with the Offset Policy for Major Projects, which uses the system of biodiversity credit retirement to assess adequacy.

The Offset Strategy seeks to provide a 'discount' on the biodiversity value of Offset Area 5 to reflect diminished values as a result of subsidence by reducing the area affected by subsidence by 10%. Again this is not consistent with the Offset Policy, being an area discount rather than a biodiversity credit discount. The only discounts allowed under the Policy are in relation to management actions above and beyond existing management actions being undertaken on crown lands,

"A discount of 5-7.5% is applied to overall credits for each management action already legally required on the land."

The ecosystem credits generated and retired are presented in Table 5.7 of the Offset Strategy. Given the combination of proposed offset areas, it shows that for all ecosystems except Fuzzy Box Woodland, Coastal Grey Box Woodland and Shrubby Regrowth, there is adequate credit retirement. The shortfalls are justified by inclusion within other similar habitat types, an approach that would be largely consistent with variation rules in the Offset Policy.

With respect to White Box – Yellow Box – Blakely's Red Gum Woodland, the generated credits are large in surplus though depend entirely upon the acceptability of Offset 5 within the package for adequacy.

The species credit generated and retired are presented in Table 5.9 of the Offset Strategy. These have been calculated for the Regent Honeyeater, Brush-tailed Rock Wallaby, Large-eared Pied Bat and Eastern Bent-wing Bat.

For the Regent Honeyeater, there is a total surplus of credits (based on extent of preferred habitat) of 150 credits of the 13,031 that require retirement. The greatest amount is within Offset Area 5 with 5,486 credits generated. Even if this offset can be accepted within the package, this is precisely where a reduction of credits is justified given the subsidence impacts expected. Either way a shortfall in retired credits is likely for this species, even if the habitat nominated can be judged to be adequately offsetting this species.

However, as this species is listed as being 'critically endangered' in NSW, retirement of the species credit requirements for this species must be done according to the BBAM. That would mean the identification of other offset areas where this species occurs. This has not been undertaken in the Ecological Assessment.

For the Brush-tailed Rock-wallaby, the credit figures appear to have been manipulated to reduce credit requirement. The credits generated due to impact on this species have been calculated over <1 ha to give 12 credits. This is despite an earlier figure of 125 ha given as the extent of impact. What this <1 ha figure represents is not clear. The credits generated by the offset sites has been given at 2,035, but what this means in terms of habitat for the wallaby is not clear. The assessment of adequacy should have focused on the offset of impact on critical refugia (ie. Rock surfaces, cliffs and caves) though this information is not provided in the work undertaken by Cumberland Ecology.

Similarly for the breeding habitat of the two cave dwelling bats, the credits required for retirement is given at 1,300 credits with 6,183 credits generated in the offset sites. Breeding habitat should refer to rocky features though it is clear that in no way do these figures represent the actual extent of such habitat in the Study Area.

IN CONCLUSION, the adequacy of the offset package is dependent upon the inclusion of Offset 5 within the package. The contention here is that it should not be included for reasons relating to uncertainty regarding subsidence impacts and suitability for a Biobanking Agreement or transferal to the reserve system. This is particularly significant for the White Box – Yellow Box – Blakely's Red Gum Woodland and the Regent Honeyeater. Retirement of species credit requirements for the Regent Honeyeater has not been undertaken according to the BBAM.

The credit requirements for the Brush-tailed Rock Wallaby and the cave bats do not appear to reflect the actual impact and extent of essential breeding and shelter habitat and so are an inaccurate representation of the degree of credit retirement for these species.

How well the offset strategy meets the requirements of the NSW Offset Policy for Major Projects (2014) is considered below:

Principle 1: Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.	Some attention has been paid to movement of disturbance boundaries
Principle 2: Offset requirements should be based on a reliable and transparent assessment of losses and gains.	Assessment not transparent (has not followed FBA), impact assessment and species credit requirements not reliable
Principle 3: Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.	More or less consistent with principle
Principle 4: Offsets must be additional to other legal requirements.	Overlap with State Forest area and existing management actions not taken into account
Principle 5: Offsets must be enduring, enforceable and auditable.	Not clarified, Offset 5 unsuitable for Biobanking Agreement
Principle 6: Supplementary measures can be used in lieu of offsets.	Not provided

How well the offset strategy meets the requirements of the EPBC Act Biodiversity Offset Policy (2012) is considered below:

Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	Question marks remain whether offsets will improve or maintain
be built around direct offsets but may include other compensatory measures	Direct offsets only
be in proportion to the level of statutory protection that applies to the protected matter	Deficiencies in level of protection of critically endangered matters (Regent Honeyeater and Box Gum Woodland)
be of a size and scale proportionate to the residual impacts on the protected matter	Question marks remain as to whether residual matters have been sufficiently addressed
effectively account for and manage the risks of the offset not succeeding	Subsidence raises serious questions about sustainability offset
be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	Questions remain as to whether management actions in State Forest area has been taken into account
be efficient, effective, timely, transparent, scientifically robust and reasonable	Questions remain as to conservation mechanism to be used
have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	Not as yet clarified

In assessing the suitability of an offset, government decision-making will be: informed by scientifically robust information and incorporate the precautionary principle in the absence of scientific certainty	Serious deficiencies in account of species; ecology and expected impacts. Does not seem to follow precautionary principle
Be conducted in a consistent and transparent manner.	As above

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ECONOMICS

Appendix 3

BYLONG COAL PROJECT: SUBMISSION ON ENVIRONMENTAL IMPACT STATEMENT, APPENDIX AE ECONOMIC ASSESSMENT

(The Australia Institute)

The Australia Institute
Research that matters.

Bylong Coal Project

Submission on Environmental Impact Statement, Appendix AE Economic Assessment

Submission

Rod Campbell
November 2015

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Summary

The economic assessment of the Bylong Coal Project is not suitable for decision making purposes. It lacks transparency, is based on flawed methodologies and contains serious errors.

The economic assessment is based on a coal price of approximately $AUD100 per tonne. This is much higher than the current coal price and the Federal Treasury's long term forecast, both of which are around $AUD80 per tonne.

The assessment does not disclose this coal price assumption, but it can be calculated from data in the assessment. No justification is presented for this lack of transparency.

The sensitivity analysis estimates considerable net benefit for the project even at lower coal prices. This is incorrect. The value of the project's coal is lower than its costs at current coal prices. This is evident from basic consideration of the revenue estimate in the economic assessment and confirmed by more detailed analysis.

Estimates of environmental and social impacts assume that all mitigation and offset measures work to entirely offset the project's impacts. This is an unrealistic assumption and serves to overstate the value of the project.

The economic impact assessment is based on methodology described as "biased" by the Australian Bureau of Statistics, "abused" by the Productivity Commission and "deficient" by the NSW Land and Environment Court. These results heavily overstate the impacts of the project on employment and other measures of economic activity.

If approved, in our opinion, the project is unlikely to be developed and risks becoming a stranded asset. This has the potential to impose significant uncertainty and costs on the local community. Exactly this situation has occurred with the Cobbora Coal Project. To avoid this same result the Bylong project should be rejected.

Project viability

The key flaw in the economic assessment of the Bylong Coal Project is that it is based on a coal price of over $AUD100 per tonne. This is far higher than the current $AUD coal price of $81 per tonne.[1] Commonwealth Treasury is using a long term coal price forecast of $AUD80.[2]

The economic assessment does not disclose what coal price it uses. No explanation is presented as to why this most important assumption is not included in the assessment. The coal price used in the assessment can be derived, however, from the production schedule in Table 2.1 (p12) and the present value of coal in Table 4.3 (p42).[3]

This is discussed in the BDA Economics peer review:

> *Gillespie Economics has used a US/AUD exchange rate higher than is currently the case. In addition, the thermal coal prices are stated to be higher than those currently prevailing, although the exact prices assumed are not stated. Given inevitable uncertainty over future exchange rates and prices, this begs the question of what impact would continuation of the current exchange rate and coal price have on the estimated net project benefits.*
>
> *This question is not specifically explored.... (p3)*

This is the most fundamental question currently being asked by the global coal industry. In the last month major banks have published assessment showing that new coal mines are not likely to be viable. Goldman Sachs concludes:

> *The [coal] industry does not require new investment given the ability of existing assets to satisfy flat demand, so prices will remain under pressure as the deflationary cycle continues.*[4]

Another global investment bank, UBS, has stated:

> *No new coal mines [are] needed on 5+ year view.*[5]

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[1] Based on September 2015 average price of USD$58 and exchange rate of 0.71, sourced from xe.com and indexmundi.com 5 November 2015

[2] (Bullen, Kouparitsas, & Krolikowski, 2014)

[3] See Table 1, full working available on request. Our final price estimate from this derivation is $102.60/t. As some product coal is reported as being high ash, which is presumably modelled at a lower price, the low-ash assumed price is over $102.6/t.

[4] Quoted in http://www.businessspectator.com.au/article/2015/9/24/resources/one-goldman-sachs-chart-shows-india-wont-save-coal-industry

These latest reports follow two years of similar warnings from market analysts such as Bloomberg and Morningstar.[6] This analysis is not predicated on optimistic assumptions about climate action, but on the energy market outlook.

Sensitivity analysis is reported in the economic assessment, including an estimate of the net present value of the project at a 20 percent lower coal price. This value is estimated at $304 million to Australia, or $240 million to NSW at a 7 percent discount rate in Tables 4.5 and 4.6. The economic assessment and the peer review use these estimates to claim that the project is viable even at lower coal prices. Tellingly, the peer review made:

> *No attempt…to check the data used, or to review the computational accuracy of the spreadsheet based model. (p2)*

The Australia Institute has conducted this review. The results of the sensitivity analysis in the economic analysis are incorrect. Present value revenue estimates at coal prices of $AUD80 and $AUD102.6, the price assumed in the economic assessment, are presented in Table 1 below:

[5] http://ieefa.org/wp-content/uploads/2015/09/UBS-report-Japan-et-al.pdf

[6] See for example (Bloomberg Energy Finance, 2014; MorningStar, 2014)

Table 1: Revenue sensitivity analysis – present values at 7% discount rate

Year	Product coal	PV Revenue at price…	PV Revenue at price…
		$102.60	$80
0		$ -	$ -
1		$ -	$ -
2		$ -	$ -
3	2.200	$ 184	$ 144
4	3.250	$ 254	$ 198
5	**4.300**	$ 315	$ 245
6	4.400	$ 301	$ 235
7	4.500	$ 288	$ 224
8	4.300	$ 257	$ 200
9	4.100	$ 229	$ 178
10	4.233	$ 221	$ 172
11	4.367	$ 213	$ 166
12	4.500	$ 205	$ 160
13	4.600	$ 196	$ 153
14	4.700	$ 187	$ 146
15	4.800	$ 178	$ 139
16	4.900	$ 170	$ 133
17	4.250	$ 138	$ 108
18	3.600	$ 109	$ 85
19	3.467	$ 98	$ 77
20	3.333	$ 88	$ 69
21	3.200	$ 79	$ 62
22	3.425	$ 79	$ 62
23	3.650	$ 79	$ 62
24	3.875	$ 78	$ 61
25	4.100	$ 78	$ 60
Total	**92.05**	**$ 4,025**	**$ 3,138**

The production schedule in Table 1 has been derived from the economic assessment *Table 2.1 - Indicative Production Schedule*. It assumes straight line changes between the years reported in the economic assessment, which are shaded in Table 1 above. This may cause some minor deviation from the full production schedule, however, the total product coal estimate of 92 million is close to the 90 million figure claimed on p33 of the economic assessment. At a coal price of $AUD102.6 this production results in

the present value of revenue reported in the economic assessment Table 4.3 of $4,025 million.

As we have been able to closely recreate the production schedule in the economic assessment, we can calculate the present value estimates of revenue at higher and lower coal prices as claimed in the sensitivity analysis of the economic assessment. At $AUD80 per tonne, the present value of the revenue from this production schedule is $3,138 million.

Comparing these results to present value cost estimates in the economic assessment, we find that the estimates in the sensitivity analysis are incorrect. In Table 2 below, we compare the revenue estimates above to the costs presented in the economic assessment. All are present values at 7 percent discount rate:

Table 2 – Revenue sensitivity analysis and costs

Coal price (AUD/t)	$102.60	$80
Present value revenue	$4,025	$ 3,138
Present value costs	$3,226	$3,226
Producer surplus	$799	-$88
Royalties	$290	$220
Producer surplus less royalties	$509	-$ 307

Table 2 shows that at current coal prices, around $AUD80/t, the value of the coal is less than the costs of the project. The net present value of just these financial costs and benefits is negative $88 million. Royalties would still be owed to the NSW Government, however. Based on these estimates, the project is unviable and would represent a $307 million dollar present value loss to the proponent.[7]

It is not clear how the sensitivity analysis calculations were conducted. Putting aside the detailed present value calculations in Table 1, reducing Value of Coal in the economic assessment Table 4.3 by 20 percent takes it from $4,025 million to $3,220 million, less than the $3,226 of costs before royalties. Clearly, the estimate of $304 million present value benefit is not credible.

The economic assessment claims:

[7] Royalties in our $80/t sensitivity column are calculated at 7%. This understates royalties from the open cut part of the project which are calculated at 8.2%. It is unclear from the economic assessment how much product coal would be levied at each rate.

> *[The] financial viability of projects is a risk assumed by the mine owners. Nevertheless, it should be noted that KEPCO is willing to invest $1.3BM in the Project. It is highly unlikely that a $1.3B investment would take place and then operations would cease…(p47)*

The author misrepresents the situation. KEPCO will only be "willing" to invest large amounts of money in the project if it is profitable. At this point the company is simply seeking approval, not spending the money. If approval is granted the company may decide to invest in the project, or it may not. It may try to sell the project, or keep it in case coal prices increase, or the project may become a worthless stranded asset.

Arguments that KEPCO will develop the mine regardless of its viability as it could sell the coal to itself do not make sense from an economic or financial perspective. A firm will buy from the market rather than use their own supply when it is cheaper to do so. No rational firm would pursue a more expensive supply option unless there was a compelling argument around security of supply. Given the abundant supply available in world markets, there is no reason why KEPCO would do this.

If the project did proceed and KEPCO was selling Bylong Coal to its other entities in South Korea, company tax payments could be heavily influenced by marketing arrangements. The use of marketing hubs and related party sales to reduce tax payments has been highlighted in recent Senate hearings on tax avoidance. There is no discussion around the uncertainty of tax receipts in the economic assessment, as noted by the peer review.

If the project is approved but does not proceed, it can still impose costs on the community. Uncertainty about the future of the mine can impact the local economy and reduce landholders' willingness to invest in their land.

An example of this is the nearby Cobbora Coal Project. This project was assessed as having a $2 billion net economic benefit by the same consultant, Gillespie Economics. Despite NSW Treasury finding the project was not financially viable, it was approved by the Planning Assessment Commission. As forecast by Treasury, the project has never proceeded as it is not financially viable. It has imposed considerable costs on the community of Dunedoo and NSW taxpayers through the Cobbora Transition Fund.[8]

The Bylong Coal Project should be rejected as it is not viable and has the potential to impose significant costs on the local community.

[8] http://www.abc.net.au/local/stories/2013/09/03/3839873.htm, http://www.infrastructure.nsw.gov.au/restart-nsw/cobbora-transition-fund.aspx

External costs

The economic assessment assumes that all mitigation and offset measures work perfectly to reduce the external costs of the project to zero. This is highly unlikely. In the case of biodiversity offsets, most ecologists doubt the efficacy of such offsets.[9]

Parts of the assessment include a value for non-market values of employment. The studies this estimate is based on have been rejected by the NSW Land and Environment Court and the NSW Court of Appeal. They are based on flawed methodology which results in overstatement of any possible non-market value of employment, the existence of which the peer review charitably describes as "contestable".

[9] See for example, (Bekessy et al., 2010)

Impact analysis

The impact analysis is based on multiplier methodology described as “biased” by the Australian Bureau of Statistics (ABS), “abused” by the Productivity Commission and “deficient” by the NSW Land and Environment Court.[10] These multipliers are mathematically certain to overstate the employment impacts of the project. As the ABS puts it:

> *While I–O multipliers may be useful as summary statistics to assist in understanding the degree to which an industry is integrated into the economy, their inherent shortcomings make them inappropriate for economic impact analysis. These shortcomings mean that I–O multipliers are likely to significantly over–state the impacts of projects or events.*

All results from the impact analysis part of the economic assessment should be read with the knowledge that they are heavily overstated. The use of this methodology should be discouraged from future assessments due to this inaccuracy.

[10] (ABS, 2011; Gretton, 2013; Preston CJ, 2013)

Conclusion

The Bylong Coal Project should be rejected. At a time when the world is grappling with the problems of how to reduce carbon emissions as well as facing low coal prices, new coal projects like this one are undesirable and financially unviable. The project also has the potential to impose significant costs on the local community, as has occurred with the nearby Cobbora Coal Project.

The economic assessment presented in the environmental impact statement is flawed and unreliable. Its estimates of the project's net present value are skewed by optimistic coal prices and incorrect sensitivity analysis. The use of discredited multiplier analysis to estimate economic impacts is inappropriate and serves to further overstate the case for the project.

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NOISE

Appendix 4

BYLONG COAL PROJECT: ACOUSTIC REVIEW OF NOISE AND BLASTING IMPACT ASSESSMENT

(Day Design)

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6 November 2015
Our ref: 5824-1.1L.DOCX

Attention: Ms Megan Kessler
Ph: (02) 9262 6989 Email: megan.kessler@edonsw.org.au

Dear Madam,

Bylong Coal Project
Acoustic Review of Noise and Blasting Impact Assessment

Day Design Pty Ltd was engaged by EDO NSW, on behalf of Bylong Valley Protection Alliance, to review the Noise and Vibration Impact Assessment prepared by Pacific Environment Limited dated 10 July 2015 (the "Report") and report on any potentially adverse acoustic issues associated with the assessment.

A 2 page Peer Review was also prepared by Bridges Acoustics dated 18 June 2015, which found that the Report reliably indicated the acoustic impacts likely to occur from the Bylong Coal Project.

Our review found that there were minor deviations from the assessment method required by the Industrial Noise Policy, including the low frequency assessment method and the application of reasonable and feasible mitigation methods.

While there were no major deviations from the INP, due to the very low background noise level in the Bylong area (<19 dBA), the impact of noise from the proposal is likely to be significant. This arises because the INP methodology allows measured background noise levels below 30 dBA to be considered as 30 dBA for the purpose of assessment. In this case, that leads to a prediction of project noise levels of 15-20 dB above the background noise level, instead of the normally accepted 5 dB emergence. This is a serious shortcoming of the INP which only affects rural communities.

Measured Rating Background Levels

The measured Rating Background Levels (RBL) found in Appendix B of the Report were measured over a number of weeks in each season of the year at five different locations. This data provides a good representation of the ambient noise levels, which is useful for determining the noise impact.

At all five locations, the average RBL was found to be less than 25 dBA, with the minimum RBL at each location 19 dBA with the exception of location BG02 (within Bylong Village) which was 22 dBA.

The RBL's are highly likely to be lower still as the noise floor of the instrumentation is 15-20 dBA and the measured data clearly shows the data 'bottoming out' at 19 dBA. It would not be unreasonable to expect a 'real' RBL of less than 19 dBA at most locations.

In accordance with the Industrial Noise Policy (INP), where the RBL is measured to be less than 30 dBA, the RBL is increased to be 30 dBA. The effect of this artificial increase in the RBL is that it will increase the audibility of the expected mine noise and most likely the annoyance for residents.

This effect should be taken into account when assessing the extent of 'non-compliance' of the proposal. All predicted exceedances above the Project Specific Noise Level (PSNL) should be considered significant.

A 1-2 dB exceedance above the PSNL is normally 5-6 dB above the background noise level. In this case, 1-2 dB above the PSNL will often be 16-18 dB above the measured background noise level and will be clearly audible, and most likely annoying. In my opinion, this level of noise would be considered offensive as defined by the POEO Act 1997. That is, "it would interfere unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted".

Reasonable and Feasible Mitigation

If the predicted noise level from a proposal exceeds the PSNL, the INP requires proponents to implement mitigation measures that are reasonable and feasible.

In the Report, Table 5-1, the Noise Mitigation Process followed is shown. The Report states that mitigation modelling was carried out to investigate the effect of best available noise control technology, noise berms, barriers, moving operations and reduced plant numbers.

The Report states that controls at receivers were not investigated.

In Section 5.4.1 of the Report there is a discussion on mitigation measures considered to reduce operational noise. Table 5-2 contains information relating to a table of mitigation measures for each source considered, reduction and sound power levels. It is not uncommon for a wide range of noise controls to be necessary to achieve a very small overall reduction. This is due to the large number of noise sources affecting the predicted noise level at any location.

A 10 dB reduction for one source will not result in a 10 dB overall reduction. However a barrier that provides 10 dB reduction may provide a benefit from a number of noise sources.

In Table 5-3, the proponent has rejected all bund walls considered as they are 'Not reasonable'. I do not have enough information at hand to agree or disagree with the rejection of bund walls as a mitigation measure. Due to the large volume of earth being moved to create the proposal, the creation of earth berms would appear to be a reasonable method of noise control.

The Table includes a heading labeled "No of Receivers Significantly Impacted in Year 3". The definition of 'Significantly affected' is 5 dB above the PSNL. The table excludes receivers that are predicted to receive 1-4 dB above the PSNL.

In my opinion, all receivers that are affected should be included in the table, not just those +5dB above the PSNL. In my opinion, due to the low background noise level in the area, all 'Affected Receivers' will be significantly affected.

Low Frequency Noise

The INP requires 5 dB to be added to the predicted noise levels if the difference between the predicted dBC value exceeds the predicted dBA value by 15 dB or more (C-A >15).

The Report predicts a difference of 15 dB or more at several locations (Sections D1 and D2), however does not apply the 5 dB penalty.

Section 4.1.3 of the Report applies the Broner criterion that allows predicted noise levels below 60 dBC without any penalty.

The Report finds that the predicted noise levels are well below 60 dBC and therefore no penalty is applied.

The Broner method is often relied on but has not been adopted by the EPA. In the proposed amendment to the INP, currently on public exhibition, the Broner method is not included.

It is not acceptable to rely on a low frequency noise criterion that essentially ignores the INP LFN correction.

If the receivers where the LFN should be applied in accordance with the INP, were duly corrected, the outcome of the Report would be vastly different and many more receivers would be significantly affected.

Voluntary Land Acquisition and Mitigation Policy

Table 4-3 of the Report contains a summary of the impacts and potential treatment for receivers who are calculated to be above the PSNL.

For receivers in the 0-2 dB above the PSNL category, impacts are said to be negligible. In most instances I would agree. However, for very low noise areas where the actual

background noise level is very low (say 20-25 dBA), the impacts are much greater.

In my opinion the Table 4-3 misrepresents the impacts of the expected mine noise on residential receivers in areas with very low background noise levels.

Peer Review

It is unusual that the date of the Peer Review is 18 June 2015, whereas the date of the Report is 10 July 2015. It is apparent that the Final Report has not been peer reviewed.

I trust that this summary assists your client's consideration of the EIS documents.

Kind regards

Stephen Gauld, MEngSc (Noise & Vibration), MIEAust, MAAS
Principal Acoustical Engineer
For and on behalf of Day Design

The undersigned hereby certifies that this Report has been checked and approved in accordance with our Quality Management System.

Date: 6/11/15

SOCIAL IMPACTS

Appendix 5

BYLONG COAL PROJECT: SOCIAL IMPACT ASSESSMENT – REVIEW

(Anonymous)

Bylong Coal Project: Social Impact Assessment – Review

General comment

The Social Impact Assessment (SIA) of the Bylong Coal Project, prepared by Hansen Bailey, identifies a number of negative social and economic impacts and benefits for the Regional Study Area and the Project Area. The assessment of these impacts and benefits is, however, incomplete and inadequate. There are a number of methodological and analytical shortcomings in the SIA, and the entire impact analysis section lacks evidence of social research and is devoid of actual, structured assessment. There is limited cross-analysis of the data and a significant lack of consideration of cumulative, long-term impacts. The assessment consequently treats benefits and impacts unequally, speaking of negative impacts only as perceived impacts and positive impacts (benefits) as actualities. This creates a biased picture of the social impacts that, subsequently, produces inadequate mitigation and management procedures. The assessment does not include a 'no development' scenario, which is standard for any impact assessment and important for understanding change.

The concerns that we have with the SIA can be grouped into two overall categories: process and analysis of data.

Process

- **Lack of evidence of social research and actual, structured assessment of impact:** the entire impact analysis section lacks evidence of social research and is devoid of actual, structured assessment of impacts, a requirement not only of the Secretary (NSW Department of Planning and Environment) but also typical of common SIA practice for major projects. There is neither in-depth thematic quantitative analysis of identified social impacts nor qualitative analysis (with a lack of stakeholder quotations to illustrate research findings)
- **Social impacts have only been assessed as positive or negative:** in any standard risk or impact assessment framework risks and impacts (see Queensland Guidelines, T4 SIA, also lots of standard risk assessment tools) need to be assessed for key characteristics such as duration, significance (perceived and technical), likelihood etc. Just assessing an impact as positive or negative is meaningless - e.g. a positive impact could be temporary, a negative impact could be permanent and critical in impact - this detail is completely lost in the assessment
- **No ranking and prioritisation of social impacts** based on risk/significance of impact: due to the lack of assessment described above, the impacts have not been ranked and prioritised for management. This means that the impacts and their management strategies are portrayed as equal in importance, duration etc. It is considered common practice of any impact assessment to include ratings of impacts and opportunities, and there are many available and widely used standard rating scales (see QLD Government SIA Guidelines 2013). At no point is an assessment matrix provided to assess the relative extent of each impact or opportunity.
- **No sense of an overall assessment of impacts and opportunities**: how many stakeholders identified positive versus negative impacts? Where do these stakeholders reside? What are their experiential accounts of these impacts and opportunities?
- **No sense of stakeholder feedback**: there is no information about if and how stakeholders were provided with opportunity to comment and provide feedback on impacts/opportunities and their ratings.
- **Lack of benchmarks, standards, best practice evidence**: there is no sense of whether an impact is significant based on evidence/benchmarks. Burdge (2004) states that a population change of greater than 5% will have significant social impacts; this has not been taken into consideration. Moreover, there is no consideration of the impacts of temporary accommodation facilities besides some off-hand comments about how the community has dealt with temporary accommodation facilities in the past. There is a lot of existing research on this topic, which should have been referenced and used for analysis.

- **Insufficient description of the proponent:** the proponent has not been described in any detail and this is important for understanding social impacts of the proposed operation - what are it's operational policies? financial statements/plans? history of mining operations/developments? ownership of existing land not mapped or described? OHS/workplace policies?
- **Insufficient consideration and presentation of visual impacts:** considering the importance of amenity impacts and the scale of open-cut operations, there is a lack of any maps or visual presentation of the evidence - i.e. maps of the project area do not give a sense of residential locations, numbers of residences, ownership of residences etc and are only included in the appendices; and no photos of the area. It is important to include maps and photos in the SIA and also provide project maps that show the 'social context' - i.e. residential locations, topography of area, adjoining industries etc.
- **The 'no development' scenario is not assessed:** standard part of any impact assessment and important for understanding social change.
- **Management strategies are vague and do not align with significance of impact:** although it is proposed that the proponent would consider undertaking a Social Impact Management Plan, the details of management strategies provided in the SIA are insufficient and do not consider the significance of the impacts as part of the design of the management strategies. Terms such as 'support', 'encourage' and 'assist' do not provide a sense of 'how' these actions will happen, when etc.
- **The consideration of specific impacts lacks social research and analysis**, i.e. there is limited quantitative and hardly any qualitative data and analysis provided, very few stakeholder quotations, and no supporting literature or research.
- **Limited stakeholder engagement program**: the stakeholder engagement program appears very limited. More information is required regarding the methodology and sampling underpinning the research for the SIA. The interview schedule and survey used for the SIA are not included, subsequently restricting transparency about how the conclusions presented in the SIA have been reached. There is little evidence provided in the SIA for comprehensive stakeholder engagement and very little detail on the participants.
- **Health impact assessment is required:** due to the nature of the project (open-cut, greenfield), extent of existing operations, and emerging evidence on coal mining and health impacts, we would push for the urgency of conducting a health impact assessment.

Analysis of data

Our main concern with the SIA in relation to its analysis of the data relates to the Secretary's first Social and Economic Requirement, namely: 'the assessment of the likely social impacts of the development (including perceived impacts), paying particular attention to any impacts on the Bylong village' (Secretary's Environmental Assessment Requirements SSD 14_6367, 2014: 3). The methodological shortcomings identified above impart significant limitations on the analysis of the data and the assessment of identified (perceived) social impacts. Whereas the SIA gives particular attention to the social impacts on the Project Area (the Bylong Valley), the analysis of these impacts is shallow and lacks references to the primary data and existing research. The impacts are not adequately analysed in relation to one another; each identified impact (positive and negative) are treated in isolation, though these are intertwined and together they create a much more complex picture than what the SIA presents.[1]

1. Introduction

[1] For example, on page 42 it is stated that the consultation identified the concerns of 'changes in natural landscape…and the perceived corresponding change in rural character'. It is also emphasised on page 40 that one of the key assets of the area is its 'remoteness and peacefulness'. On page 42, it is stated that one of the opportunities associated with the project is population growth. The assessment identifies potential increase in social capital and increased population in the Project Area (temporary). The opportunity identified is, however, not analysed in relation to how it will impact on the key assets of the area. Only some off-handed comments are made about how the workforce will be working long shifts and, as such, have limited opportunity to contribute to the area. Moreover, no consideration is made as to whether this in fact will be in the interest of the workers. No analysis is made about how the remoteness and peacefulness may be impacted by the presence of the WAF and the increased traffic of workers coming along the new (proposed) Wollar road from Mudgee.

- This section provides an introduction to the SIA and the Project. It describes the background and context of the Project. This section is meant to introduce the proponent, however there is only one sentence included about KEPCO. **The insufficient description of the proponent** is a significant shortcoming of the SIA and has implications for the subsequent assessment. More information about the proponent's operational policies, financial statements and plans, history and past experience of mining operations and developments, ownership of land and workplace policies is required.
- The background to the project describes **the parallel/dual construction phase**. This is not dealt with adequately in later sections of the SIA. The social impact of dual construction and operation of mining activity needs to be properly assessed; both in terms of their independent impacts and their cumulative impacts. **The SIA does not address existing literature on cumulative impact**.
- Considering the emphasis in the data on 'diverse economies' the lack of understanding, analysis and management strategies of cumulative impacts is a significant shortcoming of the SIA. Indeed, as argued in the recent CSRM report on cumulative impacts, '[t]he impacts of individually minor, but collectively significant activities taking place over time, when considered together, than compound or increase their effect. These cumulative impacts present greater management challenges than individual activity impacts' (CSRM 2015: 5).

2. Project setting

- In section 2.2.1, it is noted that whilst coal mining is new to the Bylong Valley, coal exploration has been occurring for more than 15 years. **The pre-existing impact of mining activities in the Project Area is not adequately addressed in the SIA**. The SIA presents the Project as a novel activity within the area and does not analyse if/how the proponent and its predecessors' activities in the area have had social impacts such as depopulation, closing of the school, and loss of services. Whereas these issues are noted in the later chapters of the SIA, it is not sufficiently analysed in the context of the proponent's past and current activities in the area.
- When presenting the Central West Regional Action Plan's planning priorities for the region (p.13), these are listed as if they are in hierarchical order. More information is required here. Moreover, the discussion of the Plan only considers how the mining sector positively contributes to the planning priorities and no information is included about how the Plan considers expanding mining sectors in relation to competing land uses and diverse economic strategies.

3. Methodology

- More information is required in relation to the stakeholder consultation program.
- There is hardly any information about sampling
- There is limited information about the research protocol (survey and interview schedule should be included as appendices)
- There is no information about how the interviews were conducted
- There is no information about how the research team identified perceived versus technical impacts.
- There is no information about how the data was analysed.

4. Project Socio-economic characteristics

- Section four outlines a number of important issues, including the question **of workforce recruitment and workforce roster assumptions**. Key issues in this section are **the lack of attention to the cumulative impacts of construction and operation,** and the implications of dual construction and operation. This section outlines operational factors that have significant implications for social impacts discussed later in the SIA; however, these are treated in isolation and there is no in-depth analysis of the relationship between the project's socio-economic characteristics and other social impacts. For example, in relation to the workforce roster assumption; the seven day rotating roster for the duration of the construction phase suggest that there will be an influx of people to the area who will have limited, if any, engagement with the local community. It will increase traffic and

noise, which will deter the quality of life for local residents. It states that the roster will 'be sensitive to Mudgee community values' (p.33), but it does not adequately explain what 'Mudgee community values' are, nor does it explain how it will be 'sensitive' to these values. Moreover, it does not consider how this will be aligned with 'Bylong community values'

- In the discussion about the **Worker Accommodation Facility** (WAF) it is stated that 'the WAF has been designed to address social amenity considerations and blend in with the Bylong village'. No information is provided as to how this is facilitated, and it is unclear how the WAF, which can hold 650 people, will 'blend in' with the local community. This is a typical example of the limitations of the analysis of the SIA.
- **Assumptions of Workforce Residential Locations** – the SIA suggests that the Operation Phase will encourage NLHs to reside permanently within the Local Area. How will this be done? What does 'permanent' mean? It is significant that the SIA speaks about residence as 'permanent' when it is referring to a temporary project that will endure a gradual reduction in workforce.

5. Community issues, values and aspirations

- A key issue with this section is how **each of the values identified are treated in isolation**. The themes (variables) identified are interconnected and it requires a holistic perspective to fully understand the impact (positive and negative) of the Project. The data that is presented in this section is open for misinterpretation; a fact that is further increased due to the lack of transparency about the questions that have been asked. The discussion about the values and the 'existing issues' and 'issues and opportunities' is treated separate but should be cross-analysed.
- This section does not consider the **health impacts** that may arise from the project related issues identified (e.g. changes to natural landscape, loss of rural character, air quality changes etc.).
- The SIA suggests that with population growth, the Project will attract new residents to the Bylong Valley, and that this may secure **long-term viability of the local school**. This is unsubstantiated. No analysis about the location of the school within the Project Boundary Area and how this may impact on the viability of the local school is made. This lack of information is misleading.
- The SIA presents an **unsupported and unrealistic assumption about relocation of families to the Bylong Valley.** In what other areas adjacent to major coal operations have families relocated? The SIA fails to justify this claim that approximately 20 employees with families could move to the area. Pure speculation used to disguise significant population impacts.

6. Population and demographics

- The SIA identifies a **significant loss of population** from the Project. The SIA notes 14% population loss from Bylong Valley due to the Project. It does, however, not include additional loss of population due to the social impacts of the Project. The figure presented is nonetheless significant; as mentioned above, Burdge (2004) states that a population change of greater than 5% will have significant social impacts. Considering the small scale of Bylong Valley, a 14% population loss further enhances its significance. If this was loss was equated to loss to the broader Mudgee area, it would result in the loss of approximately 1400+ people.
- **Population changes associated with property acquisition** (p.67). This section of the SIA considers the 'perceived' cumulative impact on population decline due to property acquisition associated with coal exploration in the Bylong Valley. This section is a typical example of how the SIA uses 'perceived' to describe negative impacts of the Project or associated with the activities of the Proponent. The population changes in the Valley as a consequence of coal activity are not 'perceived'; these can be analysed and tested as they are backward looking. The discussion in this section and the calculation of changes in population are also typical of the limitations to the analysis and the lack of cross-analysis of data and holistic exploration of the issues at stake. In this section, the net calculation of population loss is calculated to ten people (10% of 2014 population). There is no discussion of the significance of this number and the social impacts that this

significant change pose on the area; as stated above, any change greater than 5% is believed to have significant social impact. Why is there no further discussion of the social impacts? Why is there not assessment of how this change has impacted the local community and its members? Why is there no modeling based on these experiences in relation to the forecasting of property acquisition?

- In relation to **future property acquisition**, the SIA states that '[w]hilst the percentage change in population from Project related property acquisition appears significant, it must be considered in the context of the gradual decline in Bylong Valley population' (p.68). This statement is not supported by any analysis of how the existing population decline relates to the presence of coal mining activity and the Proponent's acquisition of property in the area.
- In the same paragraph it is stated that '[i]t is realistic to plan for the **return of land affected by open cut mining to productive non mining land uses and for the associated arrival of new landholders to manage land**' (p.68). This statement is not supported and it is unclear how this will happen. Moreover, it is a complex argument to suggest that future population can 'replace' existing populations with long-term history. It also does not account for the stress and uprooting that the current population will go through as a consequence of the mining activity. The analysis presented in the SIA suggests that you can simply pause a community for a period of time; there is a significant body of work that shows that this is not the case**. The lack of acknowledgement of social research in this area is problematic.**
- The use of the term '**permanent resident population** predicted for the Bylong Valley' (e.g. pg. 73) is problematic as there is no qualification or discussion of what 'permanent' means, nor the potential long-term social impacts (negative and positive) of such population change.

7. Economic Vitality

- This section does **not account** for Bylong Valley.
- On page 88, the SIA states that 'the Project will not reduce the availability of land for agricultural purposes or affect the productivity of existing agricultural land outside the Project Disturbance Boundary and Biodiversity Offset Ares within the locality'. **This needs to be substantiated and supported by further analysis**.
- On page 88 it is also stated that 'KEPCO is committed to **returning appropriate areas** within the Project Disturbance Boundary to agricultural land use practices as soon as possible following achievement of rehabilitation'. There is, however, **not outline of how KEPCO is planning to do so**.

8. Labour market dynamics

- This section does **not adequately address** what will happen in Bylong.
- **Local employment benefits** are assumed to automatically flow to local residents but there is no evidence of a local recruitment/procurement strategy associated with the project. The SIA also assumes the 'generation of employment opportunities for existing residents of the Bylong Valley', again without any commitment to local recruitment or training. It should also be noted that the analysis of local employment benefits does not consider how the employment opportunities that may potentially arise from the project are aligned with people's motivations and aspirations. Whereas the local employment benefits – if sufficiently addressed through procurement and recruitment opportunities – may presents opportunities for local residents, it may also be a negative impact as the new employment may replace traditional work (e.g. move from employment in agriculture to extractive industry).

9. Housing and accommodation

- **Property market analysis**: the impact on the property market is based on unsubstantiated assumptions that do not draw on precedents at other sites. The figure of 9% relocation of NLHs is included without support or justification, and relocation projections are based on peak workforce. Any modelling of population and property market impacts must be modelled on average annual workforce.

10. Community liveability

- This section describes the SIA study area in terms of community liveability and presents the potential impacts of the project on community liveability, and a description of the management of these impacts.
- This section is a key section in exploring, analysing and assessing the intangible aspects that will be affected by the Project, as well as the **interconnections** of the various changes identified in the social composition of the local community, the environmental (physical) changes, and the changes to livelihood, economy and social cohesion. It is, however, **treated largely in isolation from the other sections**. **It is not possible to adequately assess liveability without considering it in relation to the economic, social and environmental factors that have been identified in the previous sections of the SIA**.
- There is no explanation of what is meant by or definition of 'community liveability'
- There is a **gap in understanding and knowledge about the meaning and role of 'place'**
- An extensive body of research exist about the connections between people's home, identity, community and belonging, yet there is no references made to this research or to other areas that have endured similar changes as to what Bylong is exposed to.
- The SIA points to the **character and amenity** of the Bylong Valley (p.152), to the concept of community cohesion (p.153), and to the question of residency stability (p.153). Yet, **no analysis is presented by which these values are assessed against the social impacts identified in the earlier sections** (e.g. housing, employment, population change).
- Section 10.2.5 (pg.157) outlines issues related **community health and wellbeing**. The lack of analysis and assessment of health impacts and their relationship to both environmental and social changes is one of the most significant shortcomings of the SIA. The SIA only mentions stress and tension, noise and air quality (one paragraph) despite this being an identified as an 'evident finding' in the material. Considering the extensive research that exist in relation to the health impacts due to environmental and social change in relation to large scale mining activities, it is highly problematic that there is no real analysis and assessment of community health and wellbeing.
- Section 10.3.3 (pg.167) looks at **'loss of connection to land'**; this is another issue that has been identified in existing research as a significant health and wellbeing issue. The analysis that is presented here is problematic, not least because of ambiguous use of quotes and unclear reference to stakeholders as 'participants' – who is it that is represented here? Whose voices is it that is quoted? What does it mean when someone says that the can 'move to any place where there was similar land' – where does the person who said this live? Who are 'the participants in SIA consultation' that are cited in this section? The lack of evidence of social research displayed in this section is not unique and is characteristic for the whole SIA; this section can be used as an example of the shortcoming in evidence of social research.

Conclusion

Page 228: The summary of the 'positive impacts of the Project on the Bylong Valley' is highly contentious and exemplifies the problems with the SIA. It uncritically forwards population growth as a benefit for community capital, infrastructure and availability of volunteer work; it uncritically forwards the potential for improved local social capital, skills and capabilities, it suggest improved local infrastructure and services, and an opportunity for strategic approach to land management and land improvement due to a significant proportion of the land being held by a single entity.

These benefits are contradicted by the negative impacts, summarised on page 229, which includes loss of rural character, adverse changes in rural amenity, changes in local and regional perceptions of community identity etc.

The conclusion is a clear illustration of the shortcomings of the SIA and its limited analysis. It presents contradictory data and insufficient analysis. For example, on the one hand it says that the Project holds the potential to improve local social capital; on the other hand, it says that the loss of long-term landholders will result in negative impacts on social

capital. These two findings needs to be assessed in relation to the baseline; it is not sufficient and meaningless simply to classify these as positive and negative. A much more thorough analysis that looks at the range of data, adopting a system analytical approach is required not only to understand the social impacts of the Project but also to develop mitigation and management strategies that are in the interest of those affected.

SOILS, LAND CAPABILITY AND EQUINE CIC

Appendix 6

BYLONG COAL PROJECT – SOILS, LAND CAPABILITY AND EQUINE CIC

(Anonymous)

BYLONG COAL PROJECT – SOILS, LAND CAPABILITY AND EQUINE CIC

NSW GATEWAY PANEL ASSESSMENT

We note that the KEPCO Bylong Coal Project failed 11 of the 12 Gateway criteria relating to Biophysical Strategic Agricultural Land (BSAL) and Government verified Equine Critical Industry Cluster (CIC) Land.

This clearly demonstrates that if the Gateway Panel had the ability to refuse to issue certificates, this Project should have been refused given the unacceptable the risks of to agricultural productivity, BSAL, equine CIC, ground and surface water.

In its assessment, dated 15 April 2014, the Independent Gateway Panel found that (p3):

- The Project ***would have direct and significant impacts on agricultural productivity of verified BSAL within the Project Boundary area***;
- Indirect impacts on verified BSAL within the Project Boundary area ***have not been assessed and are potentially significant***;
- Indirect impacts on potential BSAL adjacent to the Project Boundary area ***have not been assessed and are potentially significant***. (Emphasis added)

The Gateway Panel rejected KEPCO's assertions that the Gateway requirements regarding the Equine CIC and concluded that KEPCO is non-compliant with respect to its equine CIC assessment and lacks proper assessment of the potential impacts. (p3)

We concur with the Gateway Panel's opinion that (p3):

- There is 1,933ha of verified Equine CIC land within the Project Boundary area;
- The Applicant has already directly impacted the Equine CIC through its acquisition of land, e.g. Bylong Park Thoroughbreds, and implemented land use change;
- The Project proposes a disturbance footprint of 2,667ha for open-cut and underground coal mining;
- The Project proposes open-cut and underground coal mining that directly impacts lands within this CIC; and
- The Applicant has misconstrued the Gateway process and failed to put forward a compliant or considered assessment of its potential impacts on the Equine CIC.

BIOPHYSICAL STRATEGIC AGRICULTURAL LAND

In its assessment the NSW Gateway Panel found that the "Project will directly impact about 401ha of verified BSAL and has the potential to indirectly impact some of the remaining 1,965 ha of verified BSAL within the Project Boundary and BSAL external to this boundary." (p29)

Preliminary analysis of the Project's impacts on soil and land capability conducted for the Bylong Valley Protection Alliance reveals that:

- The study area contains **at least** 2366 ha of verified BSAL;
- There are discrepancies within the Proponent's assessment of the BSAL to be impacted by the Project Disturbance area (401ha and 441 ha are quoted by SLR (the latter at page 81 of SLR 2015);
- At least 194 ha (or nearly 50%) of BSAL is at high risk of being directly and permanently impacted as it occurs within the mine void;

- Another 20 ha will be impacted by mine infrastructure – including haul roads and buildings. This disturbance severity will make recovery of BSAL extremely problematic;
- The remaining 187 ha (or 47%) of BSAL will be impacted from underground operations – including mine subsidence.
    - As BSAL land is by definition low slope, it is highly likely that the subsidence will also create issues with drainage and consequent water logging;
- The **BSAL areas impacted by this Project may be underestimated** – including the Growee Soil Landscape Unit soils which are at or above the Australian average for Cation Exchange Capacity (CAC);
- Criterion 7 for BSAL includes soils with 'moderately high' fertility to be included in BSAL provided the slope is >5% to <10%. The SLR report dated March 24, 2015 does not discuss the proportion of the Growee Soil Landscape Unit that is <5%;
- This is important because soils with less than 5% slope need to be only 'moderately' fertile to meet BSAL criteria, while soils on slopes of 5 to 10% need to have 'moderately high fertility';
- This **lack of separation between 5 and 10% grade is a significant deficiency** in the report, especially as the report argues that the soils are only 'moderately' not 'moderately to highly' fertile;
    - We noted that the CEC can be varied with management, especially via soil organic carbon accumulation and liming. That is, a soil that may not meet the BSAL criteria for fertility can be improved to meet this criterion.
- It is concerning that the Proponent (page 54) argues for a major reduction in BSAL to 358.3 ha;
- Underground mining covers some 1717ha of the land. Longwall mining has the potential to cause significant subsidence. We disagree with the Proponent's assessment of this impact as "low";
- Open cut mines typically have a high impact on soil properties of the site;
- Long term rehabilitation and restoration of the landscape and soil properties of the site is made more difficult by the presence of large, unconsolidated spoil heaps containing sodic and even saline subsoil (Tongway and Ludwig, 2011, *Restoring Landscapes after Open-Cut Coal Mining, Chapter 8*);
- Typically the construction phase will involve complete removal to topsoil together with minor to severe compaction of the subsoil. The construction phase by removing the topsoil will expose the subsoil of soils such as G15 a Subnatric Brown Sodosol which in the north eastern area of Open Cut Mining Area, OEA and Mine Infrastructure area .G15 is sodic, saline and dispersible;
- It is difficult to successfully separate topsoil from subsoil without mixing;
    - This is especially true if the 'A' horizon is shallow, the micro-topography is rough, and drag lines are used to scalp the area;
- Some of the soils in the area of high risk have unstable subsoils. These subsoils will be exposed during disturbance required to excavate, process and transport coal. **This issue has not been addressed.**

The Proponent suggests that it intends to "recreate" "relocate" some 194.4ha of BSAL that will be permanently affected by open cut mining.

This is an unusual concept and neither Proponent nor the Proponent's consultants (SLR or Barnett) proffer:

- a possible suitable location for the permanent relocation of verified BSAL; nor more importantly
- any scientific insights on how this can be achieved or any evidence of whether it has ever been achieved; or
- the technical and economic costs and risks associated with moving up to 1.5 million cubic metres of soil.

It is clear from our analysis and the Gateway Panel's assessment that the impacts of this Project will cause a reduction in BSAL and will significantly reduce the agricultural productivity of verified BSAL which, rather than being destroyed, should be protected.

EQUINE CIC

The Secretary's Environmental Assessment Requirements (SEARS) specifically require the Proponent to assess the impacts of this Project on Land – including:

- "*an assessment of the likely impacts of the development on the soils and land capability of the site and surrounds, paying particular attention to any biophysical strategic agricultural land (BSAL), having regards to the Mining & Petroleum Gateway Panel's and Department of Primary Industries' requirements (see Attachments 2 & 3);*

- *an assessment of the likely agricultural impacts of the development,* ***paying particular attention to the mapped equine critical industry cluster in the area****." (emphasis added)*

The Proponent has **fundamentally failed to assess the impact of this Project on the equine critical industry cluster**.

The Bylong Valley along with the Widden Valley form an important and integral part of the Upper Hunter's critical equine industry cluster.

This cluster was assessed, mapped, verified and legislated over a three year period culminating in 2014 with the inclusion of the mapped CICs, their protection under the Gateway process and protection from mining (including new coal seam gas which is prohibited in CIC mapped areas).

The intention of the mapping of these clusters, as articulated by the NSW Government in the Strategic Regional Land Use Plan - Upper Hunter, was **to afford them the highest levels of protection** in recognition of their national and international significance. In the words of the former Premier:

" *More than two million hectares of our State's most valuable agricultural land as well as the critical water sources that supply it are now subject to protections never before seen in NSW. Much of that land is located in the Upper Hunter.*

The national and international significance of the Upper Hunter's wine and thoroughbred industries has also been recognised, with large areas of the region

also identified for heightened protection." (Premier's Foreword, Strategic Regional Land Use Policy – Upper Hunter)

Bylong Valley – Integral part of Equine CIC and Should be Protected

The Bylong Valley has a long, proud history and is an integral part of the equine CIC – a fact that has been acknowledged, mapped and legislated and protected by the NSW Government.

It is acknowledged by the Proponent that **Tarwyn Park**, whose owners were forced to sell to KEPCO earlier this year, is a historically important thoroughbred stud home to historically important horses including:

- **Heroic** – trained by Hall of Fame inductee Jack Holt
    - champion racehorse – who won 21 races including the Cox Plate, Caulfield Stakes, Australian Derby and AJC Breeders Plate; and
    - leading Australian sire 1933 – 1939: during his season at stud her sired 29 stakes winners that had 110 stakes wine between them
    - sire of 1933 Melbourne Cup winner Hall Mark; and
- **Rain Lover** – dual Melbourne Cup winner (1968 and 1969)
    - Champion racehorse – in addition to two Melbourne Cups, major wins included the Adelaide Cup (1968); Mackinnon Stakes (1968) CB Fisher Plate (1968), VRC Queen Elizabeth Stakes (1969), VRC Queens Plate (1970) and AJC Autumn Stakes (1970);
    - Australian Horse of the Year (1969);
    - Inducted into the Australian Racing Hall of Fame (2014);
    - SAJC Rain Lover Plate at Morphettville Racecourse named in honour of Rain Lover;
    - Retired to stud at Tarwyn Park and is buried on the property.

Tinka Tong, also located within the Study Area, is the home of stock horses registered by the Australian Stock Horse Association.

Walling's Aggregation – has a number of equine related operations (Helvetia complex, Torrie Lodge and Sunnyside) including stables, stable complexes, associated facilities and produces fodder cropping and conservation (including Lucerne and oats).

The Proponent acknowledges the equine history and equine related operations conducted on the above properties - including lucerne production (to be sold to the equine industry), horse breeding and husbandry and horse sales.

There is no doubt that activities which contribute to horse breeding, husbandry, horse sales and forage production were the reasons why these operations were mapped and included in the equine CIC.

Impacts on Equine CIC Not Assessed

1,933 ha of Equine CIC land is located within the Project Boundary.

Despite the legislated protections in place with respect to equine CIC lands, the Proponent has arbitrarily decided not to assess the impacts of this Project on the equine CIC.

This is completely unacceptable and contrary to Government policy – a fact acknowledged by the Gateway Panel in its report.

It is incorrect, misleading and contrary to established NSW regulations, to claim that the Bylong Valley is an "isolated pocket" of the equine CIC. The Bylong Valley has historically been, and continues to be, an integral part of the Upper Hunter CIC.

Proximity from Scone is not the key determinant of what constitutes the equine CIC. In addition to the abovementioned activities, equine CIC concentrations were defined by the Department of Planning and Environment as:

"*concentrations of highly productive industries within a region that are related to each other, contribute to the identity of that region and provide significant employment opportunities*."

(Department of Planning and Environment, Critical Industry Clusters in the Upper Hunter http://www.planning.nsw.gov.au/Policy-and-Legislation/Mining-and-Resources/Critical-Industry-Clusters-in-the-Upper-Hunter)

There is no doubt that the previous and current operations at Tarwyn Park, Tinka Tong and Walling's Aggregation are related to the equine industry, contribute richly to the history of NSW's equine industry and are an integral part of the region's identity and contribute to the industry's significant employment generation in the regionally and more broadly.

DESTRUCTION OF BSAL AND EQUINE CIC LAND CONTRARY TO GOVERNMENT POLICY

The equine CIC mapping recognised the critical mass of equine operations in the Upper Hunter which together constitute what is recognised as one of three Thoroughbred Breeding Centres of Excellence in the world.

This concentration of operations was identified and legislated for heightened protection.

It is difficult for local communities to witness and combat big multi-national mining companies and a devastating experience for regional communities whose identity, agricultural productivity, environment and future is at risk.

It is unacceptable that mining multinationals can ignore the law and disregard the State rules that govern the assessment and protection of strategic agricultural lands and critical industry clusters.

In its report the Gateway Panel has correctly concluded that KEPCO has:

- failed to submit a compliant or considered assessment of the potential impacts of this Project on the equine CIC; and that
- already directly impacted the Equine CIC through its acquisition of land, Bylong Park Thoroughbreds, and implemented land use change.

The question now for this process is how can this be rectified? KEPCO must:

1. fully assess the impacts of this Project to the entire equine CIC; and

2. amend its mine plan to ensure that all CIC and BSAL areas, intended for protection under NSW legislation, remain undisturbed and are fully protected.

NATURAL SEQUENCE FARMING

It is important to note that Tarwyn Park is the first property in Australia, and possibly the world, to establish and successfully implement the revolutionary concept of Natural Sequence Farming. For over 30 years Peter Andrews set about testing theories and developing a sustainable agricultural system on the Tarwyn Park property.

The model that Mr Andrew's successfully implemented at Tarwyn Park is not only world leading but is based on the principles of reintroducing natural landscape patterns and process to reintroduce natural hydrological and fertility cycles to the landscape and, through a managed succession of vegetation, improve the natural fluvial patterns so that nutrients and biomass harvested on the floodplain can be redistributed throughout the property and through the stock.

To test his theories of improved animal health, Mr Andrews measure the growth and performance of thoroughbred horses.

As Ms Barbara Hickson, Mudgee based heritage advisor and architect, has noted:

"Tarwyn Park is a place both rare and endangered by present pressure from mining, especially open cut coal mining that can easily change the whole nature of water reticulation systems, the fertile fields that have been developed and the wider visual environmental curtilage."

It would be a travesty of national proportions to allow this open cut and underground mining project to destroy the decades of world leading research, development and application of sustainable agricultural farming practices pioneered by Mr Andrews. Every effort should be made to protect this valuable strategic agricultural land and Mr Andrew's sustainable agricultural legacy.

EUROPEAN HERITAGE

Appendix 7

BYLONG EIS + HERITAGE ASSESSMENT - REVIEW OF THE SOHI

(Barbara Hickson)

Note that this document was originally prepared as part of a presentation to Mid-Western Regional Council regarding potential impacts of the Bylong Project and concerns regarding heritage preservation. It has been included 'as is'.

BYLONG EIS + Heritage Assessment Review of the SoHI and Proposed Interim Heritage Order

Figure 1 View of the Bylong Valley. BJ Hickson

Items of Heritage Significance in the Bylong Valley

No meaningful assessment of the cultural significance of the Bylong Valley has been undertaken by the local listing authority, the Mid-western Regional Council, and formerly the Rylstone Shire Council, nor by the writers of the SoHI for the Bylong valley. There are many items of significance in the Valley, but this report will concentrate on just two : Tarwyn Park and the associated cultural landscape.

There is only one statutory listing in the Bylong Valley. The Anglican Church of St. Stephens.
There are a number of reasons for the very limited listings.

1. **The Mid western Regional Council was a council formed through amalgamation. The council adopted the earlier Rylstone Council LEP listings, adding them to their own.**
2. **The former Rylstone Council had only a very limited number of listing of heritage items, based on a minimal field study. For example the town of Rylstone contains only 14 statutory listed items, and virtually of them are x--government buildings such as Police Station, Post Office or church buildings. No privately owned buildings are listed .**
3. **This limited heritage list reflects the time when heritage listing was 'unpopular' with owners and councils, and so Council's took the line of least resistance and listed only those items that would not protest.**
4. **In the Bylong valley there is one listing- The Anglican Church, on the Bylong Valley way. The listing description is less than minimal and does not include a statement of significance, a physical description, or details about the associated cemetery. These items would normally be considered the minimum requirement for listing.**

Figure 2 Anglican Church and graveyard, Bylong. Bj Hickson

The poor quality of heritage data is not unusual for many small shires of the day. But this list in no way represents the significance of the valley.

It is not because there are no items of local, or greatest significance in the area - but rather one of timing and poor governance. When the majority of community based heritage studies were undertaken in NSW, the Shire of Rylstone did not undervalue its heritage, but it was politic to only a few built items that would present 'least resistance'. This was true of the whole shire.

For example the historically significant Pastoral properties such as Richard Fitzgerald's (1771-1840) Dabee Station, and Edward Cox's Rawdon Station are not listed. These are grand houses, part of the main settlement story of the region and could not be missed in any genuine list of potential heritage items for the Shire.

Rawden and Dabee were assessed as being highly significant in the heritage Study: Christo Aitken, heritage adviser and convener for the Rylstone heritage study said:

> *"Dabee" is probably the most significant property in the Rylstone area. It is situated east of Rylstone long the Narrango Road on the southern bank of the Cudgegong River. The property is flanked by several other historic pastoral properties including Rawdon and Fernside. Dabee was taken up by Richard Fitzgerald, an emancipist public servant and pastoralist possibly as early as 1819. The property has had continuous ownership of the Fitzgerald – Evans family from that time until 2000.'*

Yet no pastoral properties were listed by the shire. So it is not surprising that the only listing in the Bylong Valley was a church, and even that was not described or given a 'statement of significance' which is considered an absolute minimum for LEP listings.

Tarwyn Park

The Tarwyn property itself, under closer inspection, should be locally listed at the very least for its exceptional stone Federation homestead by **architect Harold Hardwick**[1]. Harold was born in Rylstone and was the most important architect in the district, and a number of his buildings are well

[1] Harold Robert Hardwick (A.I.A.) was born 6 November 1866 at Rylstone, sixth child and fifth son of John William Hardwick and Rebecca, nee White. Little is known of Harold Hardwick's early life. After qualifying as an architect, he practised in Sydney until 1898, when he moved to Mudgee and established his successful architectural practice in Davidson's chambers in Market Street East. In 1898 he married Adele Florence Wells. Many of Harold Hardwick's architectural briefs in the district are well-known.

known in the neighbouring town of Mudgee. Yet this item, an excellent example of the work, in his local Federation style and in face stonework, with generous verandahs, decorative gables and asymmetrical balance, is not listed. It stands with its collection of outbuildings, some of which are also in stone, forming a complete setting for listing as a group.

Further to the inadequate initial heritage listing process, there has been no effective review of heritage listings. When Peter Andrew's property '**Tarwyn Park'** jumped to fame as the experimental farming practices of its enterprising farmer became known, Tarwyn Park should have been visited or revisited, and then recommended for listing. The place become known nationally as the place where Peter Andrew's ground breaking work on water systems for farming fertility was developed, known as *Natural Sequence Farming*. Through this development the whole area of Tarwyn Park and the associated property Iron Tank deserves investigation as a potential item of State Significance.

Peter Andrews' 'Natural Sequence Farming' is a landscape system. Its functioning relies heavily on working flood plains and high water table. Based on the current proposal for the mine's open cut pits and the ensuing modelled drawdown across the Tarwyn Park and Iron Tank properties, the operation of this system is at significant risk, even though there are no plans to mine directly on, or under the areas where Peter and his son have done most of their world-renowned work.

Figure 3 Homestead of Tarwyn Park. Image Barbara Hickson

Tarwyn Park and the associated stone stables are noted as an item of local significance in the Bylong Valley EIS report by Hansen Bailey. In their description it states: *'The complex consists of the homestead constructed in 1926, stables, various farm buildings, rubbish mound containing antique bottles and racehorse burial sites (Rain Lover and Eloisa). The area is also the location where the Natural Sequence Farming (NSF) was first developed and practiced.'*

This document does not go far enough. For example

- The document does not sight the provenance of the architect Harold Hardwick, or his work elsewhere.

- It make no attempt to define the curtilage of the place, nor to recommend an appropriate setting – which would probably encompass the whole of the Andrew's Farm including the property Iron Tank, and their water catchment. It does not explore the significance to the nation of this work at a time when Climate Change is occurring.

- There should also be further study of Tarwyn Park's association with race horse breeding and the significance of Rain lover and Eloisa.

Figure 4 Stables at Tarwyn Park where Rain lover spent many days. Image by Barbara Hickson

Rural Cultural Landscapes

Tarwyn Park leads up to a larger area of cultural interest. That of 'Cultural Landscapes'. The NSW historic theme is the 'Environment - cultural landscape - Activities associated with the interactions between humans, human societies and the shaping of their physical surroundings'. There are few listings in this theme in the Heritage Data Base but it is an area of growing interest, and Tarwyn Park and its environs is an excellent example.

Rural landscapes are all but missing from most LEP Heritage Schedules in the western districts of NSW. This valley particularly encapsulates a culturally significant space where settlement began in an area that promised good reliable water, deep soils for crops, with surrounding hills that ameliorated the climate and protected the development there. The hills also provided alpine retreat for grazing animals – so that there was a complete system of farming here. These attributes attracted Peter Andrews in his search for a distinct and promising valley to develop his ideas on natural valley health through farming management practices.

The whole landscape, and particularly that associated with Tarwyn Park are underappreciated and unlisted and should be included in any future listing to encapsulate the history of Andrew's top end farming and horse breeding practices which are totally unrepresented in listings today.
The words of the National Trust in their assessment of the cultural landscape in August 2013 are paraphrased here:

> *By 1976 Peter Andrews set up on Tarwyn Park as an example of a sustainable agricultural system reintroducing natural landscape patterns and processes as they would have existed in Australia prior to European settlement with natural valley flow pattern, and a managed succession of the vegetation so that nutrients and biomass harvested on the flood plain are redistributed throughout the property and the stock. The approach is called Natural Sequence Farming.*

Figure 5 Looking across the Valley. Image by Barbara Hickson

Figure 6 Looking towards Rylstone . Image by Barbara Hickson

Proposed Interim Heritage Order

Tarwyn Park and its associated property Iron Tank, should be placed under an Interim Heritage Order.

The recommendations is that Tarwyn Park Homestead and stables, and its associated property Tarwyn Park and Iron Tank should be locally listed on the Mid Western Regional LEP immediately and that an Interim Heritage Order should be placed on the property so that detailed heritage assessment can be made to determine if the place is of State significance.

The purpose of an interim heritage order is to provide a "breathing space" of no more than 12 months during which a full heritage assessment can be completed. The majority of interim heritage orders are made in response to community representations or concerns raised by local government. There are currently 11 places under an Interim Heritage Order[2]. They can be made by the Minister as recommended by the Heritage Council, or by local government under delegation. In this case it is clear that Tarwyn Park and its associated Cultural Landscape have been greatly undervalued in terms of listing and represents a place of potential State Significance, able to demonstrate a place of an integrated farming and landscape environment with scientific and cultural values.

[2]State significant Items subject to an interim heritage order made by the Minister. This process is known as Integrated Development Assessment (IDA) under the Environmental Planning and Assessment Act 1979 . The local council is the consent authority under the Act for items covered by interim heritage orders made by the council itself under delegated authority.

The Significance of a place should be developed through a study examining the seven (7) criteria the Heritage Branch of the Department of Planning sets out, and this statement of significance would provide the principal basis for future management and planning. To make this assessment it is important to examine the ways the place is of value to the community. The criteria, and brief examples are given below in relation to Bylong Valley and in particular in relation to Tarwyn Park :

Criterion (a) – a place is important in the course, or pattern, of NSW's cultural or natural history.

The Bylong Valley is historically significant for its role in early settlement in this area as it provided good water and promised fertile soils for crops. The first sighting by a European was explorer William Lawson during a survey of the Upper Goulburn River in 1822. Early settlers followed including John Tindale and William Lee.

Criterion (b) - an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history.

The Bylong Valley and especially Tarwyn Park and Iron Tank are associated with Peter Andrews (OAM), author and exceptional farmer, who has significantly contributing to our knowledge of appropriate farming practices through natural sequence methods in a global warming environment.

Criterion (c) - an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).

The Bylong Valley is part of the Capertee Valley Way and has great aesthetic scenic values as an encapsulated and peaceful farming valley. The spectacular drive from Rylstone through the Valley is included in special tourist drives and includes a stunning drive down into the valley through 300 m of sandstone rock layers, a drive never forgotten.

The Technical achievements of the practices of Peter Andrews and his son Stuart Andrews are of great significance and their work and contribution to farming practices has been recognised through the granting of an OAM to Peter.
Tarwyn Park homestead and associated buildings are an excellent example of the Federation design work of architect Harold Hardwick, who was Rylstone born and practiced in the region most of his life.

Criterion (d) - an item has strong or special association with a particular community or cultural group in NSW for social, cultural or spiritual reasons.

The Bylong Valley is of particular social and cultural significance to the farming community and their heirs and descendants, including the William Lee Family descendants whilst also being a place of significance to the towns that have serviced them such as Rylstone and Mudgee.
The valley has aboriginal heritage sites likely to be of cultural significance to aboriginal groups.

Criterion (e) - an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history.

The valley has the potential to reveal more about Aboriginal inhabitants of the area prior to and subsequent to colonial settlement.

Criterion (f) - an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history.

The Tarwyn Park Natural Sequence Farming practices are an example of specialist experimental farming that is rare and endangered by present pressure for mining, especially pit mining that can easily change the whole nature of the water systems and the fertile fields that have been developed through the practice.

Criterion (g) - an item is important in demonstrating the principal characteristics of a class of NSW's.

The Tarwyn Park farming lands demonstrate the principal characteristics of NSW Theme: cultural landscape - Activities associated with the interactions between humans, and the shaping of their physical surroundings.

Statement of Significance

The Bylong Valley is historically significant for its role in early settlements of the land by William Lee, John Tindale and their descendants. The area offered settlers clean water and fertile soils and was first sighted by William Lawson c. 1822. The Bylong Valley, a place of great scenic value and interest. Tarwyn Park Homestead and associated stables building were designed by architect Harold Hardwick in 1920. An excellent example of the Federation design work of Harold Hardwick, who was Rylstone born and practiced in the region most of his life.

Tarwyn Park has historical and cultural significance. This property and the associated Iron Tank property are important pastoral properties within the Bylong Valley, demonstrating a cultural landscape that illustrates significant interactions and technical achievements of Peter Andrews OAM and his family. His work on the farming environment at this place significantly contributes to our knowledge of appropriate farming practices through natural sequence methods in a global warming environment. Tarwyn Park buildings and the natural sequence farming practice area, are both rare and endangered by present pressure for mining, especially open cut coal mining that can easily change the whole nature of the water reticulation systems, the fertile fields that have been developed and the wider environmental curtilage.

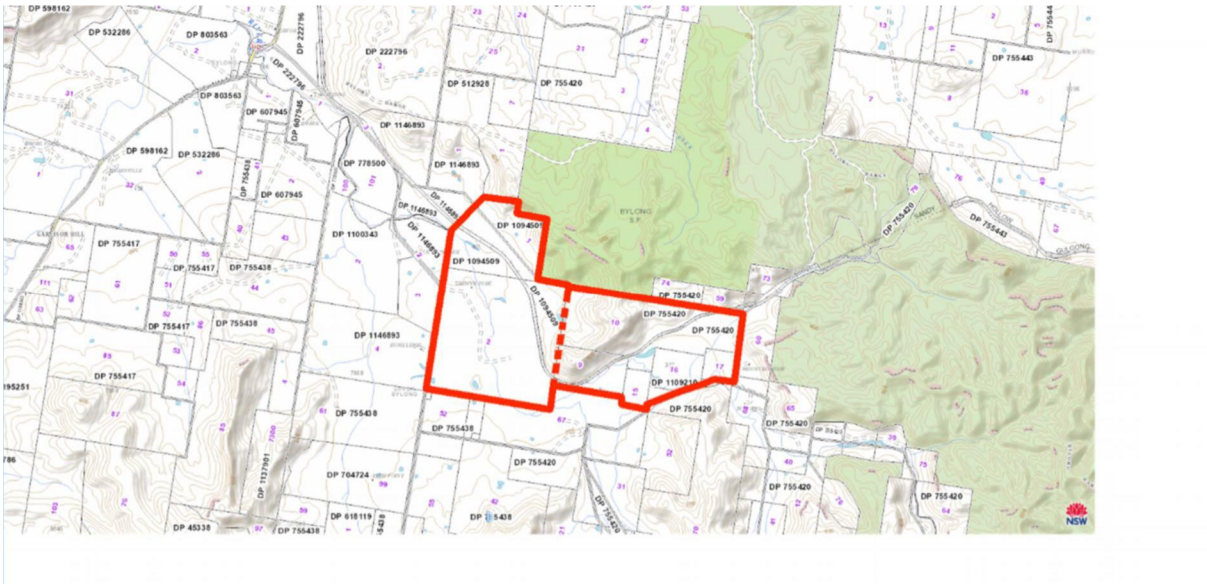


Figure 7 Topographic showing the properties of Tarwyn Park and Iron Tank

Review of other matters contained in the EIS report by AECOM

AECOM Australia Pty Ltd (AECOM) were the authors of the Historic Heritage Impact Assessment (HHIA) for the Bylong Coal Project (the Project).

That assessment forms part of an Environmental Impact Statement (EIS) for the open cut and underground coal mining operation in Bylong. The document also claims sequential reinstatement/rehabilitation of the agricultural land but not the built environment of heritage items.

The report states that there are 'no heritage items or sites within the Project Boundary' meaning there are no currently statutory listed items within that site, but as noted above there are many reasons for there being 'no items'. If the Heritage study was carried out today this would be a different story. One listed item, St Stephen's Anglican Church and Cemetery (registered 2003), is located in close proximity the Project Boundary. (200M)

The report makes note of two National Trust listed items

- Bylong Landscape Conservation Area (registered 2013) which encompasses Tarwyn Park
- the Our Lady of the Sacred Heart Catholic Church and Cemetery (registered 2003).

However he Rylstone Shire Community Heritage Study Report (2003), field surveys and oral histories undertaken for the Project has identified a further 15 heritage items and areas of archaeological deposits within or directly adjacent to the Project Boundary and some of these may well be of sufficient value to warrant at local heritage listing.

The impact assessment of these items includes strategies to '**mitigate and manage'** these places. However 'mitigation' mean very little in this case when the whole sale demolition of an item occurs and only the photographs are left to record its existence.

Overall the mitigation strategies are quite ineffective and do not provide suitable outcomes.

Of the seven items of local significance, that will be completely demolished, those that should be either retained or relocated and then repositioned are:

- the former **Our Lady of the Sacred Heart Catholic Church**, which opened in 1915, comprises a church building and four marked graves. The church building is a simple Carpenter Gothic style representative of vernacular timber rural churches in Australia.
- **Bylong Upper Public School**, particularly the section dating from 1912.
- Former **Upper Bylong Post Office** and Store, first established on the Chapman property in 1915.
- Bylong Upper Hall. built in the 1920s and important as a function centre for the valley.

Each of these must first be more thoroughly investigated with succinct statements of significance developed reflecting the cultural heritage values of the places. Also to this list should be added the landscapes, as they will be so impacted upon as to be visually destroyed. They are:

- The Bylong Valley Cultural Landscape
- National Trust Registered Bylong Landscape Conservation Area

The **'mitigation'** process is supposed to 'retain heritage information about the role and contribution of these items to the history and development of the local area'. However the processes recommended here generally only record what exists for future removal.

Beside those items that will be totally affected through demolition there are other heritage places that will be severely impacted. In particular those places that will suffer the effects of vibration, dust and the wholesale loss of the supporting landscape and cultural environment are:

- Homestation (visual impact), in very poor condition this sandstone brick structure of the colonial or early Victorian era and was the first stone building built in Bylong in 1848.
- Bylong Station Farm Complex (direct and visual impact), known historically, as was its owner John Lee, as a producer of some of the best cattle and thoroughbred horses in Australia throughout the mid to late nineteenth century and early twentieth century.
- St Stephens Anglican Church and Cemetery (visual impact), a simple sandstone and brick building of Early English Gothic Revival style church and its cemetery. The cemetery contains at least 44 graves and churchyard monuments. (Note: Often grave markers have disappeared over the years such as timber Stele that burn in a grass fire.)
- Harley Hill Farm Complex (visual and potential vibration impacts),
- Bylong Hall (visual impact),
- Tarwyn Park Farm Complex (direct, visual and potential vibration impacts). Tarwyn Park homestead (1920) and associated buildings are an excellent example of the Federation design work of architect Harold Hardwick, and the site of natural sequence farming practices, developed by an important and significant achievement of recent owner Peter Andrews OAM. The site also of important race horse breeding and burial sites (Rain Lover and Eloisa)
- The Bylong Valley Cultural Landscape and the National Trust Registered Bylong Landscape Conservation Area (direct and visual). reflecting the physical and cultural character of its use by both Aboriginal and European people. The valley, comprising a number of natural elements, and has distinctive aesthetic values.

The other effects are the effect of dust and noise, the effects of loss of amenity, the loss of views to and from the items and the loss of their overall setting- the Bylong Valley floor.

Mine rehabilitation strategy

The Mine Rehabilitation Strategy is required to consider 'the cultural values of these items and landscapes, including views and vistas'. However this MRS aims only to restore 'a landscape' which cannot be construed as being anything like 'restoring the landscape with its cultural views and vistas! It may have land use capabilities' but they will be minus their diversification and cultural items, once mining is complete.

Conservation Management Plans

Another recommendation of the EIS is that 'Conservation Management Plans (CMP) will be included as appendices to the Historic Heritage Management Plan in accordance with the principles of Kerr's Conservation Plan (2013) and the Burra Charter for Tarwyn Park Farm Complex, Bylong Station Farm Complex and Homestation. If these CMPs are to be prepared in good faith then the buildings need occupation and conservation as an ongoing policy to maintain the buildings that are habitable now, through the whole mining process and many years. It is unlikely that built items can be unoccupied and untendered and expect them to survive years of neglect.

Homestation requires more urgent work.

Cemetery

As noted in the EIS, the former 'Catholic Church and Cemetery is located within the Project Disturbance Boundary. Burial sites within the Cemetery will need to be exhumed and relocated following consultation with various stakeholders and the receipt of the necessary approvals.'

This will need considerable thought as to the appropriate location. If possible these burials should also be reinstated to their original site as part of the Mine rehabilitation strategy.

Also it should be noted that the remaining headstones are unlikely to represent all the burials.

Blasting Impacts

The EIS notes that ground vibrations and overpressure associated with blasting have the potential to indirectly impact the structural integrity of the identified historic heritage sites. Most older buildings and in particular masonry buildings will be impacted. Cracks and deterioration through water penetration are likely consequences. In particular those places affected include a detrimental effect on the highly significant stone built Tarwyn Park group. The blasting impacts are noted as follows:

- Tarwyn Park Homestead (31.7 mm/s); and its Stables (79.5 mm/s);

Visual Impacts

The general destruction of the environment will modify all of the existing visual environment and potentially the visual aesthetics of the surrounding heritage sites.

The EIS contains a 'Visual Impact Assessment' undertaken by JVP Visual Planning and Design describes the likely visual impacts associated with the Project on sensitive receivers in the surrounding area. A list of visually impacted or potentially visually impacted heritage items and landscape areas is provided in the Table 69.

While a landscape of 'high visual diversity' is promised as an long term outcome it is very difficult to appreciate that this will resemble the existing cultural landscape. As the historic built items will be removed or altered, and the farming practices that create the environment will be long gone, the diverse landscape will be denuded.

Views to and from the demolished items, and for the retained items will be largely modified. The valleys heritage environment will no longer exist.

Dust impacts

The EIS does not address dust impacts. The worst effects are probably against persons and living animals which will of course relocate. These include elevated levels of fine particle exposure which cause coughing, sneezing, wheezing and increased breathlessness.

Also there will be visual effects on the built environment as elevated levels of fine particle dust levels include short-term reduction in visibility occurs (e.g. bushfires, dust storms).

There would also be a the low end the annoyance of coal dust cause discolouration on windows and the more damaging long term effects of coal dust being ingrained on buildings where those building consist of light sandstone structures such as Tarwyn Park and its stables. The dust contains sulphur compounds, which can corrode structures and combine with rain, falling or rising damp, and do further damage. These effects are not easily managed. Wall blasting with water, powder or sand blasting will cause loss of building fabric. Coal dust should be constantly monitored and removed regularly to avoid long term staining.

Coal dust is also known to be highly explosive and both accelerates and spreads smaller ignitions underground. It has been linked to several coal mining explosions

Mitigation recommendations

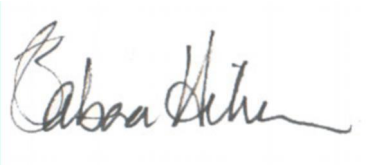
The mitigation recommendations given in the EIS document are generally quite insufficient to ameliorate the effects this open cut mine will have on the built heritage.

The EIS states that the 'Project will result in direct impacts to seven historic sites within the Project Disturbance Boundary. These sites will need to be removed prior to disturbance' That is they will be **demolished.** Removal to a safer temporary place does not seem to be an option considered.

The 'mitigation' measures for the built environment involve documentation and photographic recording. This is not actually mitigation in any sense that mitigation is 'the effort to reduce loss by lessening the impact by taking action now—before the disaster—to reduce consequence'

The proposed mitigation measures with respect to the built environment do not 'mitigate' – they simply records. **Mitigation should involve no mining in the vicinity of the item, protective barriers, separation of building foundations from vibrations , protected of view corridors to and from items, barriers against dust penetration and recorded details of the setting in terms of the landscape and its plants.**

Report prepared by



Barbara Hickson

Heritage adviser and architect 13 October 2015

Barbara Hickson
Brief CURRICULUM VITAE

EDUCATION

Bach. of Architecture (1st class hons.) Sydney University 1973

Architects Board Registration exam. 1974

Masters of Materials Conservation with Honours: (UWS) 1999.

PROFESSIONAL DEVELOPMENT

- Chartered & Registered Architect (3845).
- Licensed Builder (for 10 years to 2000).
- Heritage Planning in Practice, Heritage Short Course 1997
- Member: NSW Heritage Advisor's Network
- Convener of the Central West Heritage Network 2005-7
- Member if the Heritage Branch of the Dept. of Planning- Technical Advisory Group (TAG) 2012-13

AREAS OF SPECIALISATION

- Architecture
- Heritage Advice
- Project administration
- Community consultation

AWARDS

- 2007 Energy Australia NSW National Trust Cathy Donnelly Memorial Award granted to an architect for contribution to heritage management.
- 2007 Energy Australia NSW National Trust for cultural heritage study: Tracking the dragon through the central west.
- 2003 Energy Australia National Trust of Australia Award for Cultural Heritage – '100 lives of Bourke: A cemetery interpretation book'.
- 2002 NSW Government Heritage Volunteers' Award.
- 2001 Sydney Harbour Foreshore Authority 2001 Heritage Award: Highly Commended - 'Conservation and Repair of Victoria and Colonial Brickwork'.Architecture

ABORIGINAL HERITAGE

Appendix 8

COMMENTS ON ABORIGINAL CULTURAL HERITAGE ASSESSMENT

(Anonymous)

BYLONG PROJECT – COMMENTS IN RELATION TO ABORIGINAL CULTURAL HERITAGE ASSESSMENT

- The DGRs are very brief in regards to ACHA requirements, at least compared to others.

- The number of impacted sites seems unusually high.

- Quarries are significant and their significance might be somewhat understated in the ACHA. They may have also understated the significance of the scarred trees, which is unfortunately normal in ACHAs.

- Other concerns with the document:

    - 1.4.1: What are the credentials of the authors of the ACHA? What does being a 'Cultural Heritage Consultant' require? A failure to employ the services of an anthropologist is common (and not a requirement of any guidelines), however it can sometimes lead to a failure of an appropriate ethno-historiographical assessment of the area, including the cultural significance of sites identified, being properly undertaken. Thus the 'ethnography' detailed in section 5.1 is simply a brief recitation of selected texts and does not appear to add to the values and impact assessment undertaken. Compare, for example, the more detailed examination of the previous heritage assessments undertaken at section 5.4.

    - 3.1.2: Dispute that holding one planning meeting and site visit prior to the site survey is 'robust and inclusive consultation strategy'. Adequate for the purposes of the consultation guidelines, but is it really adequate to properly inform the RAPs and garner their input? What measures were in place to ensure that, in a cross-cultural context, the RAPs understood and were comfortable providing input into the process?

    - 3.1.2: Neither here nor elsewhere do RPS undertake any process to identify who the traditional owners were with the appropriate level of cultural knowledge of the area, who would be key to a proper assessment of cultural value of the survey area and elements therein.

    - 5.4.2: The second para is confusing. The first sentence seems to downplay the significance of sites of cultural significance – if they are not connected to songlines, oral history and/or ceremonial activities, the implication is that they are considered of secondary significance. Shouldn't it be for the person with cultural significance to make conclusions about the relative cultural significance? Contrastingly, the last sentence suggests they are nevertheless linked to 'cultural activities and practices'. Also what does 'generally do not conform predictive models..' part of the last sentence means, or the relevance of it to the values assessment. Later at section 6.3.2 it is stated that the cultural values discussion sessions were used to reach a consensus on the values of the features, but was this coloured by a preconception as stated within section 5.4.2?

    - 7.1: Although cultural value is addressed at section 7.1, it is given far less consideration (only 1 ½ pages) compared with the many pages devoted to archaeological/scientific criteria. Does this suggest it was considered of a lesser importance in the overall values assessment? Also, does the consideration of criteria broken into cultural and archaeological significance properly address the 4-pronged values assessment of the Burra Charter and OEH Guidelines, as summarised in section 7.0? There is more detail on cultural significance of each site in Appendix 4, but why is this not included in the main text? There is also a weird process of separating 'archaeological sites' from 'cultural sites', which suggests that the former do not have cultural values and vice versa, which is incorrect and flawed. For example there did not appear to be a detailed examination of the cultural value of the quarry site, other than table 18 saying it has 'high' cultural significance, with no discussion of why.

    - 7.3.2: The assessment of the high archaeological value sites seems sound, although it is surprising the ochre quarry does not rate as a site of high State significance. This is particularly notable since it is 'probable' that it will be impacted by subsidence and rockfall

(section 8.2.1). Also consider whether a second review of the scarred trees significance assessment might be in order – if many scarred trees have been removed elsewhere in NSW they are becoming significant by their relative scarcity, noting that a scarred tree, if removed, loses its cultural context (the wording in table 37 they will be 'conserved by controlled removal' is extremely disingenuous).

- 8.1: Is it good that the cultural impacts of subsidence-impacted sites are listed in table 24 to be considered alongside archaeological significance in table 23, but this is not replicated in terms of artefacts within the project boundary (table 26) and the overall impact table (table 29). Does this suggest that cultural value impacts are not considered as important as archaeological value impacts?

- 8.7: Unsure about cumulative assessment, to make a call whether this methodology is valid. Not sure if there is any guidance from OEH to assist.

- 9.1.2: In relation to the quarry (and some other sites) it says that 'it is recommended that "all reasonable and practical steps" be taken to avoid/minimise impacts to this site; this may involve modification to mine plan. If impacts cannot be avoided then engineering/mine design solutions to precent rockfall and cracking are to be explored, for instance shoring and artificial stabilisation' (also see 10.3). A few points on this:

    - It is a disingenuous statement. There is not a point where 'impacts cannot be avoided' – they can always be avoided by not carrying out the mining causing the impact. What they really mean is 'cannot be avoided without causing impacts on the viability of coal extraction', and they should say that, otherwise they are giving false hope.

    - Conditions should be suggested to say that the quarry and other sites of high significance should not be impacted.

    - The solutions should be designed and approved in advance of the approval being granted. This is particularly so noting that at 8.1. it is considered that the impacts are probable, and the subsidence assessment undertaken should be robust enough to base design principles upon. As well as obscuring the fact of this high probability of impact, it means that the decision-makers are not able to make an informed decision on what the impacts will be to the quarry and other significant sites of the project they are being asked to approve.

- 9.3: For artefacts collection, removal of scarred trees etc. it should be specified that person with relevant cultural knowledge/responsibility be present at these processes, and have input into how they are carried out.

- Table 3 of Appendix 2 details some of the data on the coverage of the surveys, but there is no mapping of the transect lines, which one would expect to be included. This would enable some verification of the data in Table 3. The representative who attended the survey should be asked if they considered that the coverage was sufficient. Not aware of OEH guidelines on what is sufficient coverage.