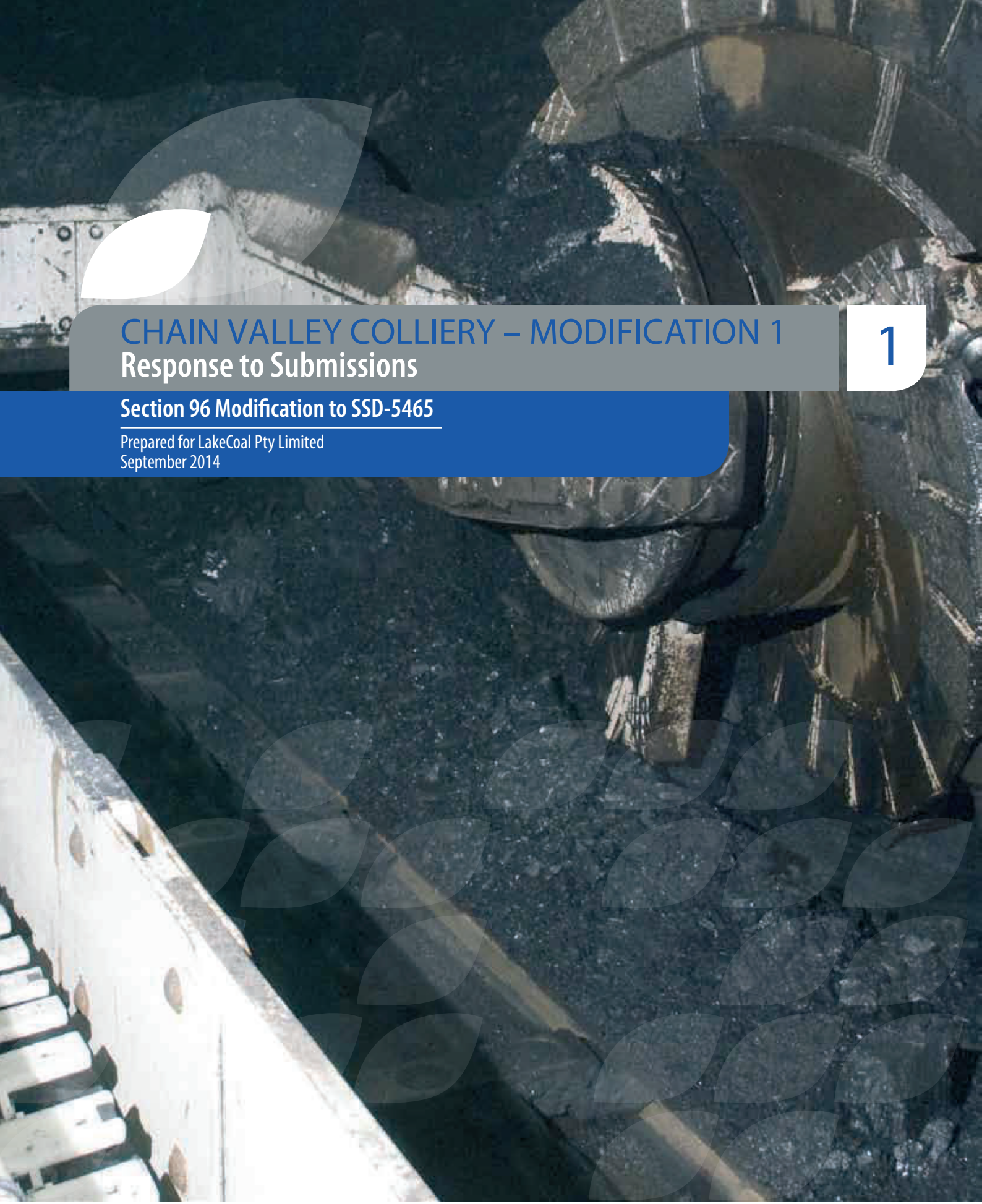


CHAIN VALLEY COLLIERY – MODIFICATION 1

Response to Submissions

1

Section 96 Modification to SSD-5465

Prepared for LakeCoal Pty Limited
September 2014

LakeCoal

EMM
EMGA Mitchell McLennan

Chain Valley Colliery Modification 1 to SSD 5465

Response to Submissions

Prepared for LakeCoal Pty Ltd | 15 September 2014

Ground Floor, Suite 01, 20 Chandos Street
St Leonards, NSW, 2065

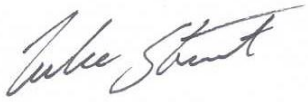
T +61 2 9493 9500
F +61 2 9493 9599
E info@emgamm.com

emgamm.com

Chain Valley Colliery Modification 1 to SSD 5465

Final

Report J13117RP1 | Prepared for LakeCoal Pty Ltd | 15 September 2014

Prepared and approved by	**Luke Stewart**
Position	Director
Signature	
Date	15 September 2014

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

Document Control

Version	Date	Prepared by	Client review
1	2 September 2014	Luke Stewart	Chris Ellis / Bob Corbett
2	15 September 2014	Luke Stewart	Chris Ellis / Bob Corbett

EMM
EMGA Mitchell McLennan

T +61 (0)2 9493 9500 | F +61 (0)2 9493 9599

Ground Floor | Suite 01 | 20 Chandos Street | St Leonards | New South Wales | 2065 | Australia

emgamm.com

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Appendices

Tables

1 Background

We refer to a proposal by the applicant, LakeCoal Pty Limited (LakeCoal), dated April 2014, for the modification to Development Consent SSD 5465 under Section 96(2) of the NSW *Environment Planning and Assessment Act 1979* (EP&A Act).

The proposed modification comprises the construction of an underground linkage between the Chain Valley Colliery (CVC) and the Mannering Colliery (MC) within the Fassifern Seam workings and the ability to use the existing MC infrastructure to transport coal from the CVC underground workings to the Vales Point Power Station at a rate not greater than currently approved.

All other components of CVC, as approved under Development Consent SSD 5465, will remain unchanged.

The *Chain Valley Colliery Modification 1 Statement of Environmental Effects* (SEE) (EMM, 2014) accompanying the development application was publically exhibited from 22 May to 10 June 2014.

Following public exhibition of the SEE a total of 15 submissions were received: eight from government and special interest groups and seven from community members.

Of significance, all submissions received from the community were in support of the proposal: there were no community objectors.

It is important to note that following advice received from the Department of Planning and Environment on 1 July 2014, the proposed amendment to the development consent boundary as described in the EMM (2014) SEE has been revised to extend the full length of the proposed underground linkage to the boundary with the existing MC project approval (MP06_0311) boundary.

This area of the underground linkage previously formed part of a separate application lodged at the same time as the proposed CVC modification which sought to modify MC's project approval to allow for the receipt and handling of coal from CVC and construction of the underground linkage.

The amendment to the CVC development consent boundary is shown in Figure 1, attached as Appendix A.

Several of the matters raised in agency submissions on the MC modification related to the underground linkage beneath terrestrial areas. Given this area now forms part of the CVC modification, the response to submissions for the MC modification, which addresses these matters, is attached as Appendix B.

The description of the proposed modification and environmental impact assessments remain as presented in the EMM (2014) SEE for the proposed modification to CVC. The statement of commitments, however, has been updated to capture additional subsidence related management and monitoring measures for the underground linkage beneath terrestrial areas. The revised statement of commitments is presented in Appendix C. These additional commitments were formerly presented in the EMM (2014) *Mannering Colliery – Modification 2 Environmental Assessment* which accompanied a separate application to modify Mannering Colliery's project approval MP06_0311.

2 Community submissions

Seven submissions were received from community members. All submissions were in support of the proposed modification. There were no community objections.

Reasons for support of the proposed modification were:

- *Job security*. A number of submissions stated that the proposed modification would enhance the economic viability of the mine and, hence, job security.

- *Flow-on effects*. A number of submissions referenced adverse flow-on effects to local businesses utilised by CVC and its employees, and the community more generally, if the proposed modification was not approved and there were job losses. It was noted that job losses may result in relocation to find alternative employment, retraining or unemployment.

- *Improved efficiencies*. It was noted that the underground linkage was a logical connection of the two mines and that it would enable an improved method of coal delivery from the CVC to Vales Point Power Station (by use of existing conveyor infrastructure instead of truck haulage on internal haul roads). It was also noted that underground driveage was short and that the proposed modification would not require any new surface disturbance.

- *Improved environmental outcomes*. The noise and dust benefits from replacing road haulage with conveyor haulage of product coal were noted.

3 Government and special interest group submissions

Eight submissions were prepared by councils, government agencies and special interest groups. These comprised submissions from:

- Construction Forestry Mining and Energy Union (Mining and Energy Division) Northern District Branch;
- NSW Office of Environment and Heritage (OEH);
- NSW Department of Primary Industries (NSW Office of Water, Agriculture NSW and Fisheries NSW);
- NSW Environment Protection Authority (EPA);
- NSW Department of Trade & Investment, Regional Infrastructure & Services – Division of Resources & Energy;
- Wyong Shire Council (WSC);
- Lake Macquarie City Council (LMCC); and
- TransGrid.

A summary of the submissions and responses are provided in Table 1 below.

As described in Section 4.3 of the SEE, due to the potential subsidence impacts on surface features, greater consultation effort was undertaken with TransGrid and Delta Electricity during the preparation of the SEE. A meeting between LakeCoal and Delta Electricity to discuss the proposed modification was held on 22 January 2014. Delta raised no major concerns in relation to the proposed modification and did not provide a submission.

TransGrid was contacted on several occasions during the preparation of the SEE, with detailed correspondence on the proposed modification provided 14 January 2014 and subsequent provision of the full subsidence assessment on the 26 February 2014. TransGrid confirmed receipt of the correspondence; however, no further comments on the proposed modification were received.

A submission from TransGrid on the proposed modification was provided to the DP&E on 14 August 2014, over two months after the public exhibition period closed. Subsequent to receipt of this submission a meeting was held on 21 August with representatives of LakeCoal and Transgrid along with the appointed independent peer reviewer of the subsidence assessment, Dr Russell Frith. The response to the TransGrid submission referencing the outcomes of the meeting is given in Table 1.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
Construction Forestry Mining and Energy Union (Mining and Energy Division) Northern District Branch	The CFMEU review of the proposal concludes: "The modification is a minor alteration to the approved CVC operations which will result in improved amenity outcomes (noise, dust and greenhouse gas emissions) in the local area due to changes in CVC operations and operational cost savings that can be achieved with little to no adverse environmental impact and is aligned with the principles of ecologically sustainable development".	Noted.
OEH	OEH supports the requirements for a heritage management plan to be developed and recommends that ongoing and continuous consultation with the relevant Aboriginal community and that any management plans be developed in consultation. OEH acknowledges that subsidence above the proposed underground linkage will range from 5 mm to 20 mm. Nonetheless, OEH is of the opinion that the EA does not adequately assess the impacts of subsidence on benthic micro and macro communities in Lake Macquarie and has concerns about the location of the highest predicted levels of subsidence and therefore cumulative subsidence corresponding with the shoreline and the seagrass protection barrier.	In accordance with Schedule 3 Condition 21 of Development Consent SSD 5465, a heritage management plan was prepared in consultation with relevant Aboriginal stakeholders. The management plan includes mechanisms for ongoing Aboriginal stakeholder consultation. Both the benthic communities of the mud basin and seagrass zone around the shoreline of Lake Macquarie may be affected by mine subsidence. Accordingly, both a high water mark subsidence barrier (HWMSB) and seagrass protection barrier (SPB) have been established to actively protect benthic communities and the seagrasses within the foreshore zone. As described in Section 3.1.2 of the SEE, the mining parameters at CVC have been specifically designed to ensure protection of: • the Lake Macquarie foreshore – by the use of the HWMSB, consistent with the requirements of the relevant mining leases; and • seagrass communities – by the use of a SPB consistent with requirements established in the seagrass management plan and benthic communities management plan. LakeCoal has committed to undertaking only first workings within the HWMSB and SPB. Subsidence associated with first workings is generally less than 20 mm. Subsidence less than 20 mm is commonly referred to as 'zero' subsidence as subsidence of less than 20 mm is widely adopted as being imperceptible for all practical purposes because the magnitude of natural, seasonal variations in ground level is commonly greater than 20 mm.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
		The application of the HWMSB is required as a condition of the relevant mining tenements and has been developed to protect foreshore areas and the boundary of water bodies from mining induced subsidence. The width of the HWMSB is determined by a 35^{o} angle of draw lakewards from the High Water Mark and from the point 2.44m AHD above the High Water Mark landward to the depth of the workings. The SPB was adopted by LakeCoal to protect the seagrass beds of Lake Macquarie from any potential impacts from underground mining at the CVC. The width of the SPB is determined by a 26.5^{o} angle of draw from the surveyed boundary of the seagrass beds to the depth of the workings. The proposed modification has been designed to limit subsidence and prevent impacts on the natural and built environment. This ensures compliance with its HWMSB and SPB commitments and the proposed modification does not risk adverse impacts on benthic communities, seagrass zone or the shoreline. Further, as reported in Section 5.2.3 of the SEE, the subsidence study completed for the proposed modification predicted vertical subsidence of only 5 mm where overlying first workings exist and by ~ 20 mm where the proposed workings pass underneath existing second workings. It should also be noted that the mine design was cognisant of this and the location of the proposed linkage sought, wherever possible, to avoid undermining existing second workings, both in the vicinity of the foreshore and elsewhere. As reported in Section 5.2.2 of the SEE, subsidence from historic mining within the Great Northern Seam in the 1970s has occurred. Subsidence from historic first workings beneath the shoreline and SPB are predicted to have ranged from 20 mm to <30 mm. This subsidence occurred approximately 20 years ago and, therefore, there is no potential for adverse cumulative impacts on the shoreline and SPB from the proposed modification. As stated in Table 5.2 of the SEE the benthic communities management plan and seagrass management plan will continue to be implemented under the proposed modification, with the seagrass management plan having already been updated to include a new monitoring location (L1) above the proposed workings.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
		The proposed modification has been designed to ensure adverse impacts from the proposed modification on benthic communities, seagrass zone and shoreline are negligible. The level of assessment presented in the SEE is commensurate with this level of risk.
	OEH states that further data is required to ensure the potential impacts of the proposed activities on existing seagrass populations and foreshore vegetation in addition to the predicted threatened species can be assessed irrespective of subsidence rates.	This matter has been addressed in a response letter prepared by J.H. & E.S. Laxton - Environmental Consultants P/L (Laxton) which is attached as Appendix E. Seagrass surveys referred to in Table 5.2 of the SEE were conducted by Laxton in 2007. The initial survey identified an absence of seagrasses in the application area. As described in the Laxton letter, the area was re-surveyed on 28 June 2014 and 8 July 2014. The seagrass *Zostera capricorni* was now found to be present. Seagrass cover was variable but in most of this region the plants were healthy with only light fouling of the leaves by algae. Laxton notes that in the near future, a healthy seagrass meadow will likely develop in this part of Chain Valley Bay and, concludes, that subsidence of 20 mm is considered highly unlikely to harm this developing seagrass meadow. It is noted that subsidence study predicts 5 mm of subsidence in this area. In addition to this, the existing annual seagrass surveys have shown that natural changes in seagrass bed levels of up to 240 mm (increase in bed height) and 200 mm (decrease in bed height) occurred simultaneously while seagrass cover increased in both scenarios. Subsidence less than 20 mm is widely accepted as 'zero' subsidence as subsidence of less than 20 mm is imperceptible for all practical purposes because, as stated in Section 3.1.2 of the SEE, the magnitude of natural, seasonal variations in ground level is commonly greater than 20 mm. The underground linkage was designed to minimise the potential for subsidence. As described in Section 5.4 of the SEE, the level of assessment completed for the SEE was commensurate with the level of risk as determined a through risk assessment completed with the input of technical specialists, including subsidence engineers and ecologists. The risk assessment, which is presented as Appendix B to the SEE, assigned the lowest possible risk rating to impacts on aquatic and foreshore vegetation.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
		The proposed modification has been designed to limit subsidence in this area to less than 20 mm to prevent impacts to the natural environment: subsidence in this area is predicted to be less than 5 mm. Given the negligible potential for adverse impact, it is considered that data provided in the SEE is appropriate and sufficient to determine the potential impacts on seagrass populations and foreshore vegetation.
DPI (NSW Office of Water, Agriculture NSW and Fisheries NSW)	NOW states that: • The SEE adequately addressed the potential impacts on water resources; and • The proponent holds licences with sufficient entitlement to account for the water take. The NOW submission also lists water licence requirements under the *Water Act 1912* and *Water Management Act 2000*. Agriculture NSW and Fisheries NSW advise no issues.	NOW's comments are noted. LakeCoal confirms that the appropriate water licences are held for the CVC under the *Water Act 1912* and the *Water Management Act 2000*.
EPA	The EPA notes that, should development consent be granted, it would be able to vary LakeCoal's Environment Protection Licence under section 58 of the *Protection of the Environment Operations Act 1997* to facilitate the modification and enable the transfer of coal to Mannering Colliery, subject to conditions. The licence variation would be required in order for the premises description to be amended in relation to the border with Mannering Colliery in the underground workings.	Noted.
	The EPA notes that LakeCoal was required to develop and implement a Water Management Plan as a condition of the development consent SSD-5465 issued on 23 December 2013 within six months of the date that consent. The EPA has initiated a number of Pollution Reduction Programs (PRP) regarding surface water management following a recent site inspection.	LakeCoal is committed to the process of continual improvement and more specifically, implementing the required Pollution Reduction Programs that the EPA sets under the Environment Protection Licence (EPL). LakeCoal received an extension to the timeframe for completion of the Water Management Plan to enable the plan to reflect a number of changes currently proposed to the EPL.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
	The EPA advises that the provision of an underground road and receival and coal handling at Mannering Colliery will alleviate some of the tracking of coal offsite, reduce coal truck movements on the local service road and would most likely reduce noise and dust generation from the premises.	Noted.
	The EPA notes that it would maintain the current volumetric discharge limit from the CVC at 12,161 kilolitres per day from licensed discharge/monitoring point number 1.	As identified by the EPA, a number of Pollution Reduction Programs regarding surface water management are proposed for the CVC EPL. In addition, a detailed review of surface water management will be undertaken as part of the water management plan requirement, with specific focus on meeting EPL discharge limits and proposing appropriate changes to the water management system. Notwithstanding the above, LakeCoal is committed to complying with both the volumetric discharge limits and all other regulatory limits that are applicable to the site.
	DRE notes that the SEE has identified general rehabilitation strategies and objectives and that the SEE adequately describes the potential impact of the project along with monitoring and mitigation measures to be implemented.	Noted.
	DRE advised that additional trigger action response planning will be required to be incorporated into the Mining Operations Plan.	LakeCoal understands that the Mining Operations Plan (MOP) will need to be updated prior to commencement of mining operations, as modified. As the MOP is required to be accepted by DRE, any changes will need to be consistent with MOP Guidelines, September 2013 (ESG3) and to the satisfaction of DRE.
	DRE notes that the site is characterised by the presence of: critical electrical transmissions infrastructure; multi-seam workings; and complex geotechnical conditions. In consideration of this, DRE suggest that the proposed mining be independently reviewed by an expert(s) based on the site specific conditions.	An independent peer review of the subsidence assessment has been completed by Mine Advice Pty Ltd director, Dr Russell Frith, and is attached in full as Appendix D. The review states that the subsidence assessment is a comprehensive study whereby the various mechanisms that could conceivably result in significant levels of surface subsidence occurring have been identified and evaluated in detail. The various sources of conservatism used in the calculations were also noted.
	It is noted that clarification was provided by DP&E, following consultation with DRE on the above which culminated in the requirement for peer review of the subsidence assessment to be completed and provided as part of the response to submissions (letter from DP&E dated 29 July 14).	Regarding predicted impacts, the review concluded that the vertical subsidence predictions provided by the subsidence assessment are at the absolute low end of what can be considered as “meaningful predictions” in that any lower values would almost certainly lead to a conclusion of “zero” subsidence. It is considered that the various predictions as they relate to TransGrid infrastructure can be classified as “imperceptible” levels of increased surface subsidence as it is likely that they will result in no obvious visible changes to surface conditions and may not even be detectable using survey methods (dependent upon local near-surface strata conditions).

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
		Comment on Transgrid's submission is provided below.
	Revised conditions were provided in relation to: • Rehabilitation objectives and commitments; • Progressive rehabilitation; and • Rehabilitation plan.	Noted.
	DRE recommends approval with the inclusion of the conditional requirements for a Mining Operations Plan and an Annual Environmental Management Report.	Noted. LakeCoal has, and would continue to, ensure that a valid MOP is in place, and that Annual Environmental Management Reports are completed for CVC. However, as both these items are requirements under the *Mining Act 1992*, it is considered that they need not be included as conditional requirements within the modified development consent.
	WSC states that it has reviewed the submitted information and considers that the existing conditions of MP06_0311 and SSD-5465 are adequate to mitigate the impacts of the proposal as they affect the Wyong Local Government Area.	Noted.
	WSC states that it is unclear whether or not the proposed works would comply with existing conditions relating to subsidence in Development Consent SSD 5465.	It is confirmed that the proposed modification complies with all existing conditions relating to subsidence in Development Consent SSD 5465. This includes Schedule 4 Condition 1 which states that "The Proponent shall ensure that vertical subsidence within the High Water Mark Subsidence Barrier and within seagrass beds is limited to a maximum of 20 mm". Subsidence in the High Water Mark Subsidence Barrier and within seagrass beds from the proposed modification is predicted to be less than 5 mm.
	WSC notes that there is a Council sewer rising main within the project area. To ensure WSC's infrastructure is protected it requests that a monitoring and management plan be included for the MP01 sewer rising main as part of the approval conditions for the Mannering Colliery.	LakeCoal would ensure that a monitoring and management plan for the MP01 sewer rising main is in place prior to commencement of mining that may impact Council's infrastructure. The statement of commitments (Appendix C) has been updated to incorporate this commitment.
LMCC	LMCC contend that surface subsidence predicted in the environmental assessments could exacerbate the effects of increased flooding and permanent inundation caused by rising lake levels.	This matter has been addressed in a response letter prepared by J.H. & E.S. Laxton - Environmental Consultants P/L (Laxton) which is attached as Appendix E.
	It is stated that although the maximum predicted subsidence effect is 20 mm, even this small change would alter the distribution of foreshore plant species sensitive to tidal inundation and groundwater such as mangroves, salt marsh and swamp mahogany.	In summary, studies have shown the actual water depth above a lake bed of a coastal lagoon with an entrance open to coastal waters, such as Lake Macquarie, varies substantially due to combinations of naturally occurring factors such as tidal influence, atmospheric pressure, large swells, and rainfall. The Laxton letter notes a variation of 0 to 1.3m above AHD over a single year.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
		LMCC's submission suggests that Lake Macquarie is a static system and that 20 mm of subsidence will allow saltwater from the lake to penetrate further inland to affect sensitive vegetation. As referenced above, naturally occurring factors can raise the water level significantly above AHD allowing saltwater to penetrate far inland in low lying areas of the foreshore. On a monthly basis, changing atmospheric pressure alone means that the water level of Lake Macquarie can cycle between 0 and 0.7m above AHD. On lee shores wind wave set up can raise the water level of the lake to even higher levels for short periods. Furthermore, high wind waves can deposit a thick band of vegetable detritus and sand that acts as a dam along the shoreline that prevents accumulated saltwater from draining out of wetlands for several days. It is also noted that humans have occupied much of the shoreline of Lake Macquarie. Native vegetation has been stripped from the lake perimeter, seawalls built and in many places lawn mowers can operate to the water's edge. The land controlled by CVC and Vales Point Power Station, and the subject of this application, still contains several hundred metres of low lying natural vegetation in good condition. The Laxton letter concludes that a subsidence of 20 mm is highly unlikely to have any measurable effect on this remaining vegetation. It is noted that up to 5 mm of subsidence is predicted in this area from the proposed modification.
	LMCC states that it is desirable to reduce subsidence in the vicinity of the lake foreshore as much as possible and contends that there is little or no discussion in the assessment provided of the need or justification for the additional northern roadways. It notes that the direct and cumulative effect of subsidence could be reduced by withholding approval for the additional roadways, particularly as the cumulative impacts are biased towards the northern side of the development as a result of the existing workings.	The mine design, which is limited solely to first workings, is cognisant of the importance of limiting subsidence in the vicinity of the foreshore. Accordingly, the subsidence assessment specifically modelled subsidence from mine workings in the Great Northern Seam, associated with the former Wyee State Mine, to ensure worst case impacts were able to be assessed, despite this earlier subsidence occurring approximately 20 years prior. As identified in Section 3.2.1 of the SEE, the two northern roadways, while not planned to be developed initially, would permit a significant improvement in ventilation flows between the Collieries. The additional roadways would also provide flexibility in ventilation management and redundancy in the event of equipment failure, extended maintenance or in an emergency situation. Although the additional roadways have no specific commencement date, by identifying and assessing the impacts for the four roadways in the current application, not two, significant efficiencies will be realised for LakeCoal, regulators and other stakeholders in the longer term, while also being transparent about potential longer term first workings in the area.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
		Regarding the cumulative impacts being biased to the northern side of the development, the cumulative subsidence in this area is largely a result of the previous secondary extraction that was undertaken in the 1970s in the Great Northern Seam. Subsidence resulting from the proposed modification (i.e. the development of all four roadways) would generally be less than 20 mm or 'zero'. As per Table 6.1 of the SEE, LakeCoal was committed to "Complete representative borehole core drilling and sampling of the Fassifern Seam floor at the start and finishing ends of the underground linkage and where the headings pass beneath the SPB. Development below the foreshore will be limited to two headings only until floor conditions can be confirmed." This commitment is reiterated in the revised statement of commitments (Appendix C). It is considered that there is no reason for withholding approval of the additional roadways.
TransGrid	TransGrid's Vales Point 330kV substation and four 330kV transmissions lines (No. 22, No. 23, No. 24 and No. 92) are located above the proposed modification. The modification must not put at risk the safe, reliable and efficient continued operation and maintenance of TransGrid's electricity network.	Transgrid's infrastructure was identified as a significant built feature during the planning phase for the proposed modification and, accordingly, was an important consideration in the design of the underground linkage. The subsidence assessment completed a detailed assessment of potential impacts on this infrastructure. The independent peer review, Appendix D, also provided a focus on the potential impacts of the proposed modification on this infrastructure. LakeCoal fully appreciates the importance of this infrastructure. As described above, the infrastructure was considered during the detailed design process, subsidence assessment presented in the SEE and independent peer review. The subsidence assessment concludes the proposed first workings are unlikely to impact on the transmission towers and switchyard. The peer review concludes that the proposed mining does not cause a credible threat to the future stability and serviceability of the TransGrid assets.

Table 3.1 Summary of submissions and responses

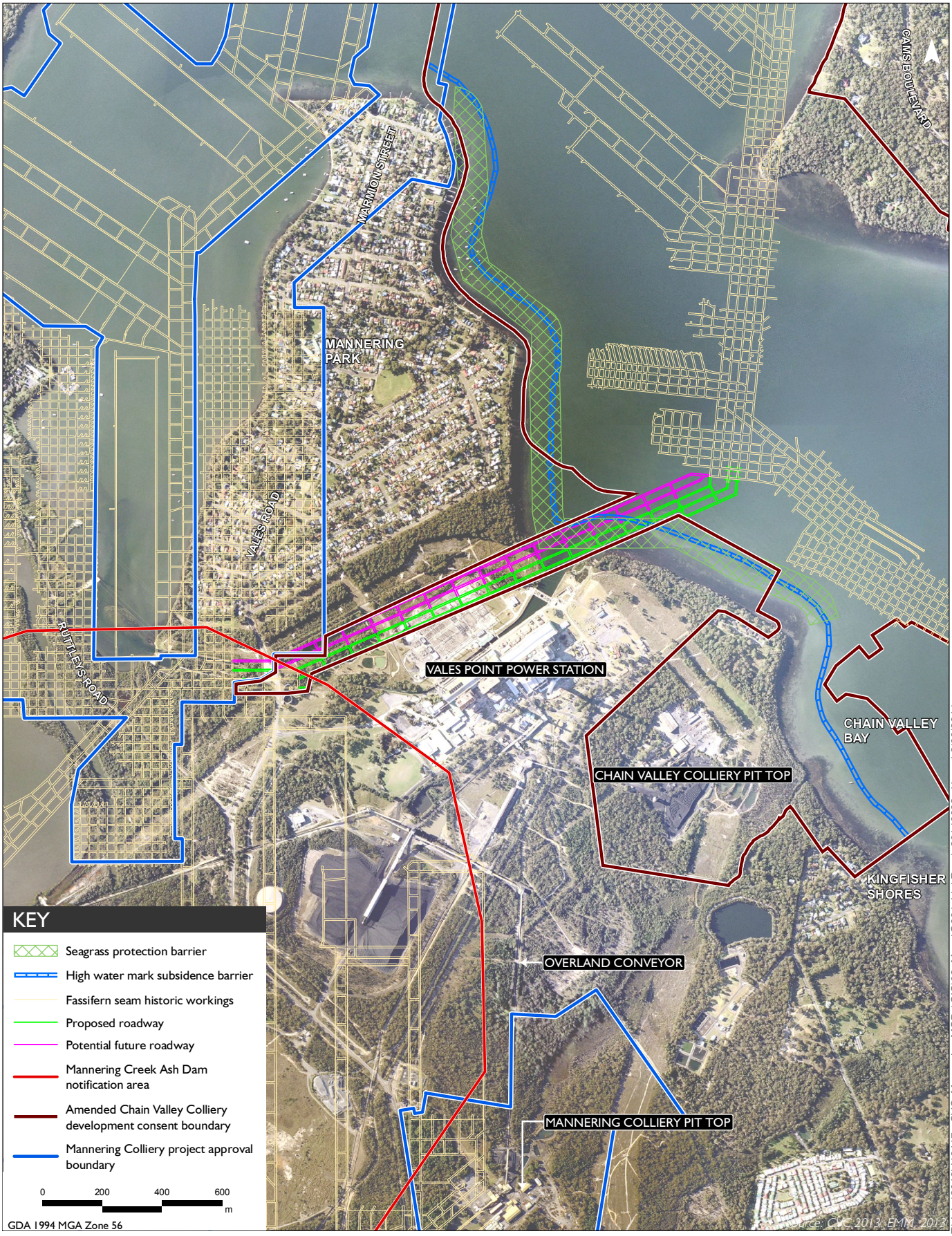
Submission by	Comment summary	Response
	The existing transmission towers and the Vales Point substation have not been designed or constructed to allow for any tolerance from subsidence impacts. Exposure to these impacts would result in potential long term damage to TransGrid's Vales Point substation and transmissions towers. This is likely to affect the safe operation of those assets and result in potential failure and outages of the high-voltage electricity network (i.e. blackouts).	As described above, subsidence from the proposed modification does not cause a credible threat to the future stability and serviceability of the TransGrid assets. As stated in the independent peer review: In their submission dated 14th August 2014 TransGrid note that "*the existing transmission towers and the Vales Point sub-station have not been designed or constructed to allow for any tolerance from subsidence impacts*". Whilst this is taken as factual, it is inevitably the case that those structures have been designed to include levels of design conservatism consistent with their critical importance to the electricity supply network that they support. Therefore it must surely also be the case that they are able to accommodate some level of disturbance due to mining subsidence without inevitably resulting in "*long-term damage to TransGrid's Vales Point sub-station and approximately 21 transmission towers*". As a final comment, in any cases whereby underground coal mining was to include substantial secondary extraction in close proximity to such electricity network infrastructure, the author would inevitably conclude that the infrastructure not having been designed to accommodate mining subsidence impacts was a fatal flaw and that consequently such mining would indeed represent a major threat to its continued stability and serviceability. However in this particular instance whereby the type of mining being contemplated is limited to highly stable first workings only, the author is compelled to conclude that the infrastructure not being designed for mining subsidence impacts does not in any way automatically result in a credible threat to its future stability and serviceability.
	It is unprecedented that any sub-surface development has been permitted to adjoin or encroach on any of TransGrid's substation infrastructure.	Mining beneath the Vales Point substation previously occurred in the Great Northern Seam as identified in the subsidence assessment. Mining was undertaken by Powercoal, a wholly owned subsidiary of Pacific Power, a State Owned Corporation established under the Electricity (Pacific Power) Act 1950 (NSW).

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
	TransGrid considers that the proposed modification would place unacceptable risk on the safe, reliable and efficient continued operation and maintenance of TransGrid's high voltage electricity network and requests that the alignment of the proposed workings be reconsidered to avoid undermining the Vales Point substation and minimising the number of transmission towers undermined.	As described above, the proposed modification does not cause a credible threat to the future stability and serviceability of the TransGrid assets. Therefore, it is not considered appropriate to reconsider the alignment of the proposed underground linkage.
	TransGrid requests a copy of the peer review of the subsidence assessment and would appreciate ongoing consultation about the project.	A copy of the independent peer review is attached as Appendix D and was provided to Transgrid on 29 August 2014. No formal comment from TransGrid subsequent to receipt of the independent peer review has been received.

Appendix A

Revised CVC modification figure



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EMGA Mitchell McLennan

Proposed underground linkage

Chain Valley Colliery – Modification 1

Figure 3.1

Appendix B

Mannering Colliery RtS

MANNERING COLLIERY – MODIFICATION 2
Response to Submissions

2

Section 75W Modification to MP06_0311

Prepared for LakeCoal Pty Limited
September 2014

LakeCoal

EMM
EMGA Mitchell McLennan

Mannering Colliery Modification 2 to MP06_0311

Response to Submissions

Prepared for LakeCoal Pty Ltd | 16 September 2014

Ground Floor, Suite 01, 20 Chandos Street
St Leonards, NSW, 2065

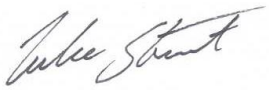
T +61 2 9493 9500
F +61 2 9493 9599
E info@emgamm.com

emgamm.com

Mannering Colliery Modification 2 to MP06_0311

Final

Report J13117RP1 | Prepared for LakeCoal Pty Ltd | 16 September 2014

Prepared and approved by	**Luke Stewart**
Position	Director
Signature	
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EMM
EMGA Mitchell McLennan

T +61 (0)2 9493 9500 | F +61 (0)2 9493 9599

Ground Floor | Suite 01 | 20 Chandos Street | St Leonards | New South Wales | 2065 | Australia

emgamm.com

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Annexures

Tables

1 Background

We refer to a proposal by the applicant, LakeCoal Pty Limited (LakeCoal), dated April 2014, for the modification to Project Approval MP06_0311 under Section 75W of the NSW *Environment Planning and Assessment Act 1979* (EP&A Act).

The proposed modification would enable the receipt and handling of coal from Chain Valley Colliery (CVC) and construction of an underground linkage between the Mannering Colliery (MC) and CVC within the Fassifern Seam workings.

All other components of MC, as approved under Project Approval MP06_0311, would remain unchanged.

The *Mannering Colliery Modification 2 Environmental Assessment* (EA) (EMM, 2014) accompanying the development application was publically exhibited from 22 May to 10 June 2014.

Following public exhibition of the EA a total of 14 submissions were received: seven from government and special interest groups and seven from community members.

Of significance, all submissions received from the community were in support of the proposal: there were no community objections.

It is important to note that following advice received from the Department of Planning and Environment on 1 July 2014, the proposed amendments to the development consent boundary as described in the EMM (2014) EA will no longer form part of the application. The CVC development consent boundary will now be extended to accommodate the full length of the proposed underground linkage to the boundary with the existing MC project approval boundary.

The amendment to the CVC development consent boundary is shown in Figure 1, attached as Annexure A. Again, it is noted that the existing MC project approval boundary will no longer be modified.

Several of the matters raised in agency submissions on the MC modification related to the underground linkage beneath terrestrial areas. For completeness these are addressed to in this response to submissions. It is also noted, however, that given this area now forms part of the CVC modification, the response to submissions for the MC modification, which addresses these matters, has also been attached to the CVC response to submissions.

Commitments made for the MC modification in addition those identified in Project Approval MP06_0311 related exclusively to management and monitoring measures associated with the underground linkage. As a consequence of the amendment to the CVC development consent boundary, these commitments no longer apply to the MC modification and now form commitments under the CVC modification. The revised statement of commitments provided as Appendix C to the CVC response to submissions report captures these commitments.

2 Community submissions

Seven submissions were received from community members. All submissions were in support of the proposed modification. There were no community objections.

Reasons for support of the proposed modification were:

- *Job security*. A number of submissions stated that the proposed modification would enhance the economic viability of MC (and CVC) and, hence, job security. It was also noted that proposed would support the re-establishment of workforce at MC.

- *Flow-on effects*. A number of submissions referenced adverse flow-on effects to local businesses utilised by CVC and its employees, and the community more generally, if the proposed modification was not approved and there were job losses. It was noted that job losses may result in relocation to find alternative employment, retraining or unemployment.

- *Improved efficiencies*. It was noted that the underground linkage was a logical connection of the two mines and that it would enable an improved method of coal delivery from the CVC to Vales Point Power Station (by use of existing conveyor infrastructure instead of truck haulage on internal haul roads).

- *Improved environmental outcomes*. The noise and dust benefits from replacing road haulage with conveyor haulage of product coal were noted.

- *Synergies*. It was noted that MC (and CVC) was initially established to provide coal to the Vales Point Power Station. Continuing in this capacity reduces the likelihood of coal being sourced by Vales Point Power Station from much further afield.

3 Government and special interest group submissions

Seven submissions were prepared by councils and government agencies and special interest groups. These comprised submissions from:

- Wyong Shire Council (WSC);
- Lake Macquarie City Council (LMCC);
- Construction Forestry Mining and Energy Union (Mining and Energy Division) Northern District Branch;
- NSW Office of Environment and Heritage (OEH);
- NSW Department of Trade & Investment, Regional Infrastructure & Services – Division of Resources & Energy;
- NSW Department of Primary Industries (NSW Office of Water, Agriculture NSW and Fisheries NSW); and
- NSW Environment Protection Authority (EPA).

A summary of the submissions and responses are provided in Table 1 below.

It is noted that TransGrid made a submission on the CVC modification. The submission raised matters on predicted subsidence below TransGrid assets. These assets, however, are confined to areas above the MC modification area as lodged (see Section 1 above). Accordingly, while not identified in the list of submissions received on the MC modification, Table 3.1 also includes comments and responses to the TransGrid submission for completeness.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
WSC	WSC states that it has reviewed the submitted information and considers that the existing conditions of MP06_0311 are adequate to mitigate the impacts of the proposal as they affect the Wyong Local Government Area. It is necessary that all works recommended in Table 4.1 of the road safety audit for the Ruttleys Road/Access Road Intersection be implemented and reviewed for adequacy prior to any recommencement of operations at the Colliery. WSC disagree that recommendations of the road audit have been successfully completed. In particular, Item 7, which requires the reconstruction/repair of the shoulders on the approaches and departures to the intersection of Ruttleys Road/ Access Road to allow vehicles to pass the intersection within the carriageway.	Noted. The majority of the works which were recommended by the road safety audit have been implemented as part of the road works recently undertaken for Ruttleys Road, south of Mannering Park, by WSC. In February 2014, EMM undertook a review of the completion status of the eight items of the roadworks which were listed in Table 4.1 of the Road Safety Audit (from November 2008). The EMM review indicated two of the eight items of the roadworks potentially required further work. These were: • The painting of an extra Stop line 'hold line' on the access road which is now provided (this was done by the MC in June 2014); and • An additional section of guardrail (safety barrier) should be provided on the eastern side of Ruttleys Road, between the Mannering Colliery access road (where there are angled masonry walls located alongside the access road either side of the intersection) and the other existing sections of guardrail further to the north (where there are power poles located close to the road edge). It is understood that WSC do not propose to construct any additional sections of guardrail on the eastern side of Ruttleys Road near the MC access road as the location of the masonry wall to the north of the intersection does not compromise the clear zone travel safety requirements for the 85 percentile travel speed for this section of Ruttleys Road. A further clarification by EMM of the current completion status of Item 7 of the Stage 5 Road Safety Audit is provided in Annexure B. The clarification states that works completed by WSC meet the requirement for two normal vehicles (passenger cars) to pass each other, albeit at a reduced speed but without significant delay to either vehicle, within one direction of the road carriageway at this intersection.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
		Further, in the case of the two northbound trucks passing, the vehicle passing manoeuvre will need to be undertaken at a relatively slow speed but will still be able to be undertaken without the passing vehicle having to stop. The clarification also states that had the November 2008 road safety audit recommendations envisaged a more extensive road shoulder widening treatment being undertaken for the northbound traffic on Ruttleys Road at the Mannering Colliery Access Intersection, it would have specifically recommended an Austroads Type BAR intersection treatment be constructed at this location, generally described by the Austroads design guide summary extract which is provided within Annexure B. The November 2008 road safety audit did not specifically recommend that an Austroads Type BAR intersection should be constructed at this location. The clarification concludes that the road lane and shoulder widening works which have been completed by the Wyong Shire Council do meet the requirements of item 7 of the road safety audit. Further confirmation measurements of the 'as constructed' sealed road and shoulder width on Ruttleys Road, at four locations at and immediately north and the south of the access intersection, were commissioned by EMM in July 2014. These road width measurements have confirmed the current sealed width at the intersection is now a minimum of 5.5 m in each direction (a minimum total sealed width of 11 m). This width is sufficient to allow two passenger cars, or two trucks (up to 2.5m wide), to pass each other while travelling in the same direction without leaving the road carriageway.
	WSC states that it is unclear whether or not the proposed works would comply with existing conditions relating to subsidence in the approval (specifically Schedule 3, Condition 4 of MP 06_0311).	The condition referred to from the existing Mannering Colliery project approval states; "The Proponent shall limit its coal extraction methods on the site to first workings only, and shall not undertake second workings." As the modification relates only to the development of first workings, and no second workings, the modification would comply with the existing subsidence condition.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
	WSC notes that there is a Council sewer rising main within the project area. To ensure WSC's infrastructure is protected it requests that a monitoring and management plan be included for the MP01 sewer rising main as part of the approval conditions for the Mannering Colliery.	LakeCoal would ensure that a monitoring and management plan for the MP01 sewer rising main is in place prior to commencement of mining that may impact Council's infrastructure. The statement of commitments of the CVC response to submissions (Appendix C) has been updated to incorporate this commitment.
LMCC	The LMCC submission raises matters related to the Lake foreshore and subsidence, part of the area the subject of the CVC modification.	Matters relate to the part of the area the subject of the CVC modification and, accordingly, are addressed in the CVC modification response to submissions report.
Construction Forestry Mining and Energy Union (Mining and Energy Division) Northern District Branch	The CFMEU review of the proposal concludes: "The modification is a minor alteration to the approved MC operations which will result in improved amenity outcomes, operational cost savings and additional employment that can be achieved with little to no adverse environmental impact and, as substantiated in this chapter, is aligned with the principles of ESD".	Noted.
NSW Office of Environment and Heritage	OEH supports the requirements for a Heritage Management Plan to be developed and recommends that ongoing and continuous consultation with the relevant Aboriginal community and that any management plans be developed in consultation. OEH states that is unable to assess potential impacts on terrestrial ecology due to inadequate information provided in the EA.	In accordance with Schedule 3 Condition 18 of Project Approval MP06_0311, a Heritage Management Plan was prepared in consultation with the relevant Aboriginal stakeholders. The management plan includes mechanisms for ongoing Aboriginal stakeholder consultation. Subsidence less than 20 mm is widely accepted as 'zero' subsidence as subsidence of less than 20 mm is imperceptible for all practical purposes because the magnitude of natural, seasonal variations in ground level is commonly greater than 20 mm. The underground linkage was designed to ensure subsidence of less than 20 mm. As reported in Section 5.2.2 of the EA, subsidence from historic mining within the Great Northern Seam in the 1970s has occurred. Historical vertical subsidence is predicted to have ranged between 20 mm and 33 mm; and 88 mm to 106 mm above the first and second workings panels, respectively. The majority of linkage occurs in areas of historic first workings. This subsidence was fully developed approximately 20 years ago and, therefore, there is no potential for adverse cumulative impacts on terrestrial ecology from the proposed modification.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
		As described in Section 5.4 of the EA, the level of assessment completed for the EA was commensurate with the level of risk as determined through risk assessment completed with the input of technical specialists, including subsidence engineers and ecologists. The risk assessment, which is presented as Appendix B to the EA, assigned the lowest possible risk rating to impacts on terrestrial ecology. The proposed modification has been designed to limit subsidence to less than 20 mm to prevent impacts to the natural and built environment. Given the negligible potential for adverse impact, it is considered that data provided in the EA is appropriate and sufficient to determine the potential impacts on terrestrial ecology.
	DRE advised that additional trigger action response planning will be required to be incorporated into the Mining Operations Plan.	LakeCoal understands that the Mining Operations Plan (MOP) will need to be updated prior to commencement of mining operations, as modified. As the MOP is required to be accepted by DRE, any changes will need to be consistent with MOP Guidelines, September 2013 (ESG3) and to the satisfaction of DRE.
	DRE notes that the site is characterised by the presence of: critical electrical transmissions infrastructure; multi-seam workings; and complex geotechnical conditions. In consideration of this, DRE suggest that the proposed mining be independently reviewed by an expert(s) based on the site specific conditions. It is noted that clarification was provided by DP&E, following consultation with DRE on the above which culminated in the requirement to peer review the subsidence assessment and provide as part of the response to submissions document (letter from DP&E dated 29 July 14).	An independent expert review of the proposed modification has been completed by Mine Advice Pty Ltd director, Russell Frith, and is attached in full as Annexure C. The review states that the subsidence study is a comprehensive study whereby the various mechanisms that could conceivably result in significant levels of surface subsidence occurring have been identified and evaluated in detail. The various sources of conservatism used in the calculations were also noted. Regarding predicted impacts, the review concluded that the vertical subsidence predictions provided by subsidence study are at the absolute low end of what can be considered as “meaningful predictions” in that any lower values would almost certainly lead to a conclusion of “zero” subsidence. It is considered that the various predictions as they relate to TransGrid infrastructure can be classified as “imperceptible” levels of increased surface subsidence as it is likely that they will result in no obvious visible changes to surface conditions and may not even be detectable using survey methods (dependent upon local near-surface strata conditions). Comment on Transgrid’s submission is provided below.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
	Revised conditions were provided in relation to; • Rehabilitation objectives and commitments; • Progressive rehabilitation; and • Rehabilitation plan.	Noted.
	DRE recommends approval with the inclusion of the conditional requirements for a Mining Operations Plan and an Annual Environmental Management Report.	Noted. LakeCoal has, and would continue to, ensure that a valid MOP is in place, and that Annual Environmental Management Reports are completed for the Colliery. However, as both these items are requirements under the Mining Act, it is considered that they need not be included as conditional requirements within the modified project approval.
DPI (NSW Office of Water, Agriculture NSW and Fisheries NSW)	NOW states that: • The EA adequately addressed the potential impacts on water resources; and • The proponent holds licences with sufficient entitlement to account for the water take. The NOW submission also lists water licence requirements under the *Water Act 1912* and *Water Management Act 2000*. Agriculture NSW and Fisheries NSW advise no issues.	NOW's comments are noted. LakeCoal confirms that the appropriate water licences are held for the MC under the *Water Act 1912* and the *Water Management Act 2000*.
EPA	The EPA notes that, should development consent be granted, it would be able to vary LakeCoal's Environment Protection Licence under section 58 of the *Protection of the Environment Operations Act 1997* to facilitate the modification and enable the transfer of coal to Mannering Colliery, subject to conditions. The licence variation would be required to amend the premises description and conditions. The EPA notes that the Colliery will receive or handle coal at a rate not greater than limit (1.1 Mtpa) approved under Mannering's current project approval.	Noted.
	The EPA notes that the EA identifies that the current rate of groundwater inflow will increase from 1.1 ML/day to 1.8 ML/day and that there was no discussion about whether this would necessitate a greater need to dewater and discharge more wastewater from the premises.	The EA referenced increased groundwater inflows which were previously identified in the groundwater assessment completed by GHD in 2011. This groundwater assessment was completed in association with Modification 1 of MP 06_0311, which was subsequently approved in October 2012. No material increase in groundwater inflow was predicted as a consequence of the current modification.

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
	The EPA note that the Colliery is under care and maintenance. However, EPA consider that LakeCoal would need to continue to meet the wastewater volumetric and concentration of pollutant limits imposed by the current EPL.	No changes to existing EPL limits were considered necessary as a result of the current proposal. LakeCoal remains committed to meeting the existing wastewater volumetric and concentration of pollutant limits imposed by the current EPL.
	The EPA notes that LakeCoal must continue to meet the daily volumetric limit for discharge currently established at 4,000 kilolitres per day for wastewater from the site. The EPA would not grant an increase without assessment undertaken commensurate with section 45 of the *Protection of the Environment Operations Act 1997.*	LakeCoal is committed to complying with the current daily volumetric limit as specified in the Mannering Colliery EPL (EPL 191).
TransGrid	TransGrid's Vales Point 330kV substation and four 330kV transmissions lines (No. 22, No. 23, No. 24 and No. 92) are located above the proposed modification.	Transgrid's infrastructure was identified as a significant built feature during the planning phase for the proposed modification and, accordingly, was an important consideration in the design of the underground linkage. The subsidence study completed a detailed assessment of potential impacts on this infrastructure. The independent peer review, Annexure C, also provided a focus on the potential impacts of the proposed modification on this infrastructure.
	The modification must not put at risk the safe, reliable and efficient continued operation and maintenance of TransGrid's electricity network.	LakeCoal fully appreciates the importance of this infrastructure. As described above, the infrastructure was considered during the detailed design process, subsidence study presented in the SEE and independent peer review. The subsidence study concludes the proposed first workings are unlikely to impact on the transmission towers and switchyard. The peer review concludes that the proposed mining does not cause a credible threat to the future stability and serviceability of the TransGrid assets.

Table 3.1 Summary of submissions and responses

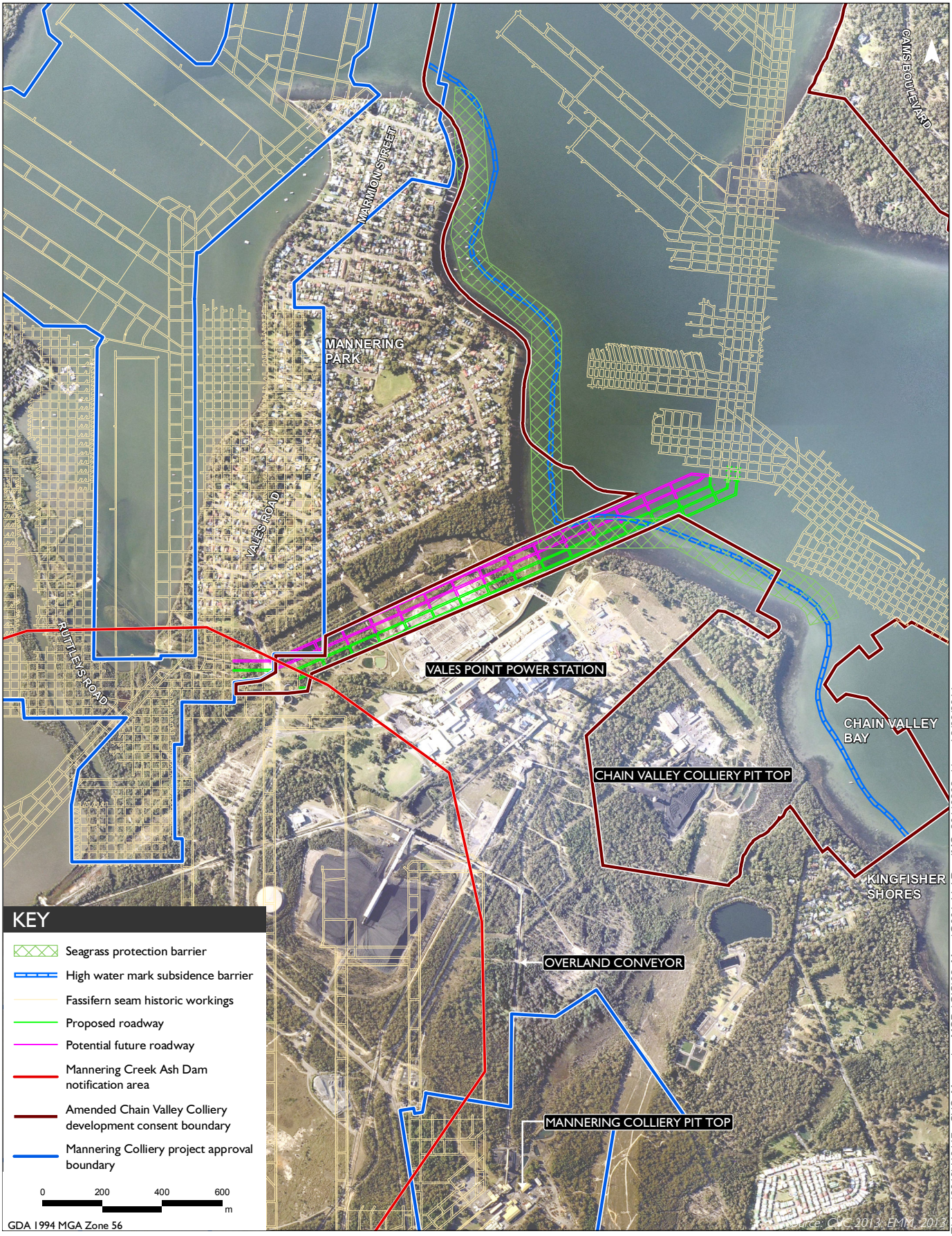
Submission by	Comment summary	Response
	The existing transmission towers and the Vales Point substation have not been designed or constructed to allow for any tolerance from subsidence impacts. Exposure to these impacts would result in potential long term damage to TransGrid's Vales Point substation and transmissions towers. This is likely to affect the safe operation of those assets and result in potential failure and outages of the high-voltage electricity network (i.e. blackouts).	As described above, subsidence from the proposed modification does not cause a credible threat to the future stability and serviceability of the TransGrid assets. As stated in the independent peer review: In their submission dated 14th August 2014 TransGrid note that "*the existing transmission towers and the Vales Point sub-station have not been designed or constructed to allow for any tolerance from subsidence impacts*". Whilst this is taken as factual, it is inevitably the case that those structures have been designed to include levels of design conservatism consistent with their critical importance to the electricity supply network that they support. Therefore it must surely also be the case that they are able to accommodate some level of disturbance due to mining subsidence without inevitably resulting in "*long-term damage to TransGrid's Vales Point sub-station and approximately 21 transmission towers*". As a final comment, in any cases whereby underground coal mining was to include substantial secondary extraction in close proximity to such electricity network infrastructure, the author would inevitably conclude that the infrastructure not having been designed to accommodate mining subsidence impacts was a fatal flaw and that consequently such mining would indeed represent a major threat to its continued stability and serviceability. However in this particular instance whereby the type of mining being contemplated is limited to highly stable first workings only, the author is compelled to conclude that the infrastructure not being designed for mining subsidence impacts does not in any way automatically result in a credible threat to its future stability and serviceability.
	It is unprecedented that any sub-surface development has been permitted to adjoin or encroach on any of TransGrid's substation infrastructure.	Mining beneath the Vales Point substation previously occurred in the Great Northern Seam as identified in the subsidence study. Mining was undertaken by Powercoal, a wholly owned subsidiary of Pacific Power, a State Owned Corporation established under the Electricity (Pacific Power) Act 1950 (NSW).

Table 3.1 Summary of submissions and responses

Submission by	Comment summary	Response
	TransGrid considers that the proposed modification would place unacceptable risk on the safe, reliable and efficient continued operation and maintenance of TransGrid's high voltage electricity network and requests that the alignment of the proposed workings be reconsidered to avoid undermining the Vales Point substation and minimising the number of transmission towers undermined.	As described above, the proposed modification does not cause a credible threat to the future stability and serviceability of the TransGrid assets. Therefore, it is not considered appropriate to reconsider the alignment of the proposed underground linkage.
	TransGrid requests a copy of the peer review of the subsidence assessment and would appreciate ongoing consultation about the project.	A copy of the independent peer review is attached as Annexure C and was provided to TransGrid on 29 August 2014. No formal comment from TransGrid subsequent to receipt of the independent peer review has been received.

Annexure A

Revised MC modification figure



EMM
EMGA Mitchell McLennan

Proposed underground linkage

Mannering Colliery – Modification 2

Figure 3.1

Annexure B

Clarification of completion of Item 7

EMGA Mitchell McLennan

Ground Floor, Suite 01, 20 Chandos Street
St Leonards, NSW, 2065
PO Box 21
St Leonards, NSW, 1590

T +61 2 9493 9500
F +61 2 9493 9599
E info@emgamm.com

www.emgamm.com

8 July 2014

Chris Ellis
Environmental Officer
LDO Group
16 Spitfire Place
Rutherford, NSW, 2320

Re:	Clarification of Completion of Item 7 of the Stage 5 Road Safety Audit. Intersection of Ruttleys Road and Mannering Colliery Access Road

Dear Chris,

This letter summarises our latest review of Item 7 of the November 2008 Parsons Brinkerhoff road safety audit recommendations for this intersection, which were previously reviewed by EMM in our letter of 18 February 2014.

In that letter EMM provided a summary description of each item (1-8) of the road safety audit, together with a description of how the recent road and shoulder widening and resurfacing of the road which was undertaken by the Wyong Shire Council, meets the requirements of the road safety audit.

The 18 February EMM letter included a summary description, in a table, of each item of the road safety audit recommendations. The full description of Item 7 of the Road Safety Audit report is actually two remedial measures which are as follows:

- Reconstruct/repair the damaged road shoulders; and
- Reconstruct/repair the shoulders on the approaches and departures to the intersection to allow vehicles passing the intersection 'within carriageway'.

The Wyong Shire Council has now completed the road traffic lanes and shoulder reconstruction of Ruttleys Road between the Pacific Highway and Mannering Park, which now generally provides minimum 3.5 metre wide travel lanes and 2.0 metre wide sealed shoulder in each direction (11 metres sealed road width in total) along this section of Ruttleys Road.

At and in the vicinity of the Mannering Colliery access intersection, the new road lane and shoulder widths have been confirmed by recent ROAR DATA check survey measurements on 4 July 2014 which are included as an attachment to this letter. These measurements show the northbound road travel lane and sealed shoulder widths for traffic passing through the intersection are consistently 3.6 metres and 1.9 metres respectively. This provides a combined trafficable sealed width for the road of 5.5 metres in the northbound direction. The same combined minimum trafficable sealed width is also generally provided for the traffic passing through the intersection in a southbound direction.

The combined minimum trafficable sealed width of 5.5 metres essentially meets the requirement for two standard vehicles (either passenger cars which are up to 1.9 metres wide, or trucks which are up to 2.5 metres wide) to pass each other while travelling in the same direction, either in the northbound or the southbound directions on the road carriageway at this intersection.

The typical minimum clearances between two vehicles passing and to the outer edges of the road trafficable width in the direction of travel, will be as follows:

- For two northbound passenger cars, there will be typical clearances of 0.85 metres between the two vehicles and 0.425 metres between the outside of each vehicle and the edges of the either the road shoulder or the centre line of the road;

- For one northbound passenger car and one truck there will be typical clearances of 0.55 metres between the two vehicles and 0.275 metres between the outside of each vehicle and the edges of the either the road shoulder or the centre line of the road, and.

- For two northbound trucks, there will be typical clearances of 0.25 metres between the two vehicles and 0.125 metres between the outside of each vehicle and the edges of the either the road shoulder or the centre line of the road.

With the exception of the case of the two northbound trucks passing, these typical clearances will be sufficient for the two vehicles to pass at reduced speed in comparison to the posted speed limit of the road, but without significant delay to either vehicle. In the case of the two northbound trucks passing, the vehicle passing manoeuvre will need to be undertaken at a relatively slow speed but will still be able to be undertaken without the passing vehicle having to stop.

If the November 2008 road safety audit recommendations had envisaged a more extensive road shoulder widening treatment being undertaken for the northbound traffic on Ruttleys Road at the Mannering Colliery Access Intersection, it would have specifically recommended an Austroads Type BAR intersection treatment be constructed at this location, generally described by the Austroads design guide summary extract which is provided as an attachment to this letter.

The November 2008 road safety audit did not specifically recommend an Austroads Type BAR intrersection should be constructed at this location. Therefore the road lane and shoulder widening works which have been undertaken by The Wyong Shire Council do meet the requirements of item 7 of the road safety audit.

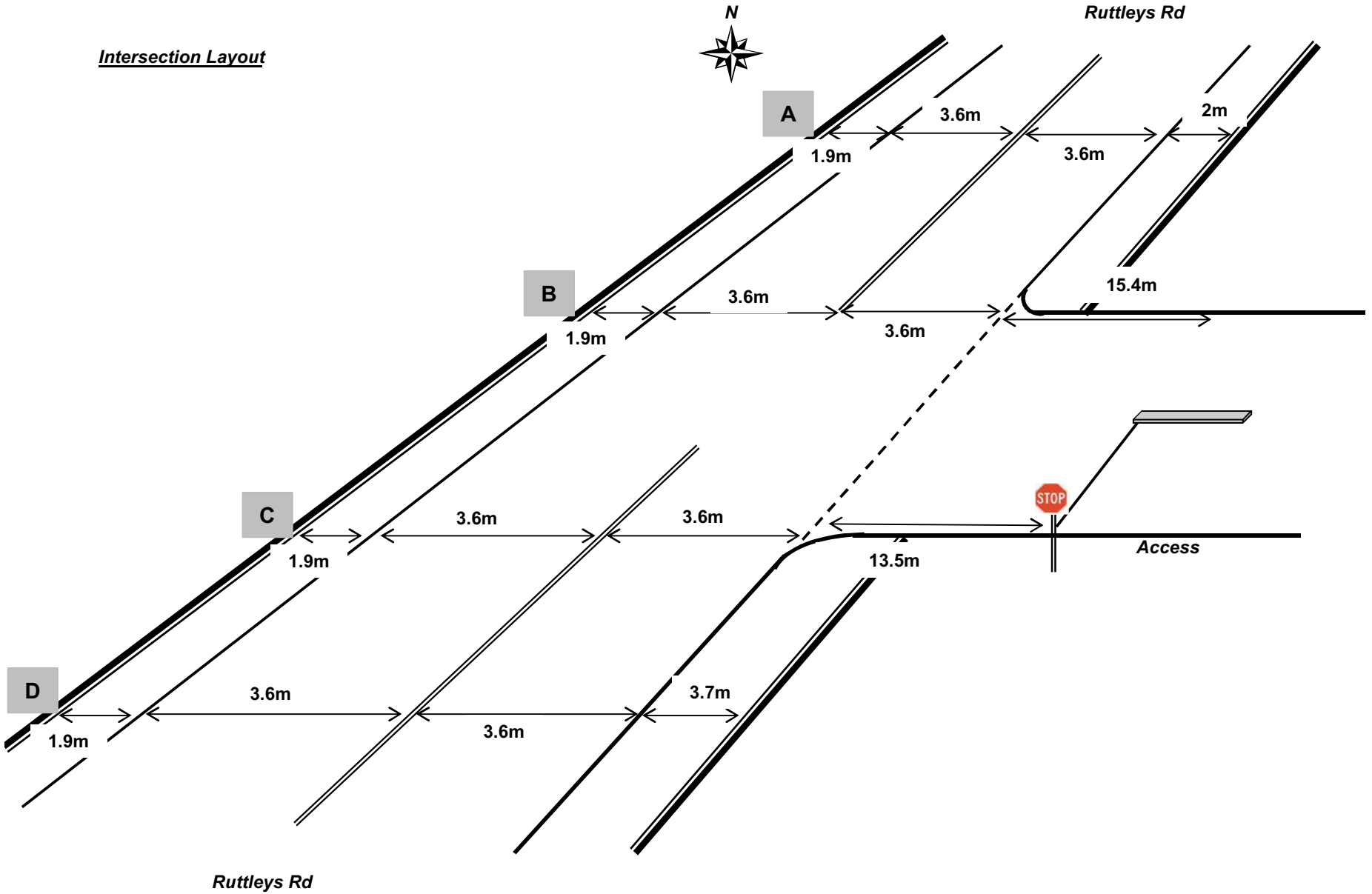
Yours sincerely

Tim Brooker
Senior Transport Planner
tbrooker@emgamm.com

R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob.0418-239019

Client : EMGA
Job No/Name :MANNERING COLLIERY INTERSECTION Road Widths
Day/Date : Friday / 4th July 2014

Intersection Layout



7.3 Right-turn Bans at Signalised Intersections

Consideration should be given to banning a right turn where:

- a right-turn lane cannot be provided and the right-turning traffic would cause a safety and/or a capacity problem
- sight distance is poor and cannot be corrected, and other options such as erecting advance signs are not satisfactory.

If the right-turn can be banned, several options may be considered as described in Section 2.2.3 of the *Guide to Traffic Management – Part 6: Intersections, Interchanges and Crossings* (Austroads 2007) and illustrated in Section 4.14 of this guide.

7.4 Right-turn Lanes for Cyclists

Right-turn lanes for cyclists are rarely used and should generally not be provided for cyclists at right-turn treatments on arterial roads or busy traffic routes because of the difficulty and crash risk for cyclists moving from the left of an intersection to the centre of the road in order to utilise such treatments. Conditions for the use of cyclist right-turn lanes and illustrations of their use at an intersection are provided in Section 10.6.4 of this guide.

7.5 Rural Right-turn Treatments – Undivided Roads

All the turn treatments described in this section are applicable to two-lane two-way rural roads. They can also be applied to multi-lane rural roads (divided and, less commonly, undivided), except for the BAR turn treatment.

7.5.1 Rural Basic Right-turn Treatment (BAR)

The basic right-turn treatment (BAR) shown in Figure 7.5 is the minimum treatment for right-turn movements from a through road to side roads and local access points. This treatment provides sufficient trafficable width for the design through vehicle to pass on the left of a stationary turning vehicle. This is achieved by widening the shoulder to provide a minimum width sufficient to allow the vehicles to pass. Substantial speed reduction (potentially half of the design speed) is a feature of this layout.

Other aspects of the design are:

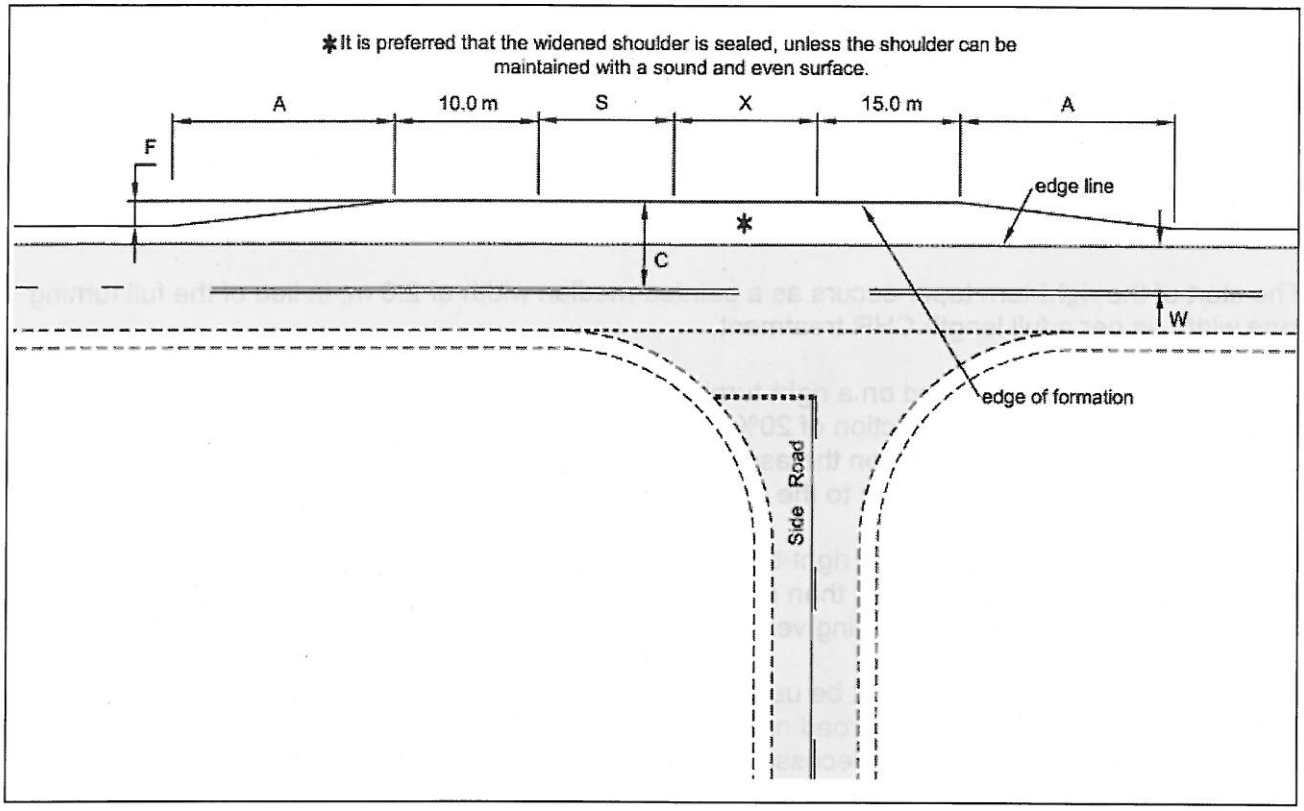
- on a terminating intersection leg no special provision is usually made for right-hand turns when a BAR is used
- this layout can be used on both sealed and unsealed roads
- it is preferred that the widened shoulder at BAR turn treatments is sealed, unless the shoulder can be maintained with a sound and even surface
- this layout should not be used where there is reduced visibility to the turn treatment. Right turning drivers on the major road need to perceive the location of the side road and stop if necessary in the through lane before the intersection.

Where adequate through sight distance exists, BAR turn treatments will generally be marked with a broken centreline to allow overtaking on the major road through the intersection. This will not restrict overtaking opportunities, thereby minimising delays. However, there may be instances where a BAR turn treatment on a section of road with good overtaking opportunities will yield a high likelihood of crashes resulting from inappropriate overtaking through the intersection. In such cases, a barrier line should be used. Examples of such instances include the following:

- The turn treatment is located after a significant length of roadway that has no overtaking opportunities. This geometry would result in drivers often overtaking through the intersection because of the large amount of time spent following other vehicles prior to the intersection. The increased exposure of overtaking may result in an excessively high overtaking-intersection vehicle crash rate.
- There are reasonably high right-turning volumes.
- The warrants dictate that a higher-level turn treatment is appropriate.

It is suggested that BAR treatments should generally have a barrier line on the major road approaches to reduce the likelihood of overtaking vehicles colliding with vehicles entering from the side road. Consideration should only be given to the use of a broken centreline in situations where overtaking opportunities are limited and the volume on the side road is very low.

The BAR turn treatment on a two-lane rural road as shown in Figure 7.5 has limited applications. It is mainly applicable at the junction of side roads and rural arterial roads with lower traffic volumes. Such turn treatments can record high crash rates, especially in high-speed areas. A more desirable treatment at such sites is a CHR(S) turn treatment discussed in Section 7.5.2.



Notes:

1. This treatment applies to the right turn from a major road to a minor road.
2. The dimensions of the treatment are defined thus:

W = **Nominal through lane width (m) (including widening for curves). Width to be continuous through the intersection.**

C = **On straights – 6.5 m minimum**

7.0 m minimum for Type 1 & Type 2 road trains

On curves – widths as above + curve widening (based on widening for the design turning vehicle plus widening for the design through vehicle).

A = $\frac{0.5VF}{3.6}$

Increase length A on tighter curves (e.g. those with a side friction demand greater than the maximum desirable). Where the design through vehicle is larger than or equal to a 19 m semi-trailer the minimum speed used to calculate A is 80 km/h.

V = **Design speed of major road approach (km/h).**

F = **Formation/carriageway widening (m).**

S = **Storage length to cater for one design turning vehicle (m) (minimum length 12.5 m).**

X = **Distance based on design vehicle turning path, typically 10–15 m.**

Source: QDMR (2006).

Figure 7.5: Basic right (BAR) turn treatment on a two-lane rural road

7.5.2 Rural Channelised T-junction – Short Lane Type CHR(S)

The CHR(S) turn treatment shown in Figure 7.6 is a more desirable treatment than the BAR treatment because it provides greater protection for vehicles waiting to turn right from the centre of the road. This treatment is suitable where there are low to moderate through and turning volumes. For higher volume sites, a full-length CHR turn treatment (Figure 7.7) is preferred.

Annexure C

Subsidence study independent review

MINE ADVICE Pty Ltd
A.B.N.15 152 928 222

27th August 2014

Dr. M. Callan
Technical Services Manager
Chain Valley Colliery
LakeCoal

Report No. CHAINVALLEY04/01

Dear Mick,

SUBJECT: Independent Peer Review of Subsidence and Impact Assessment Undertaken by Ditton Geotechnical Services Pty Ltd: Chain Valley to Mannering Colliery Connection Roadways

This letter report provides details of the various outcomes from an independent review by the signatory of a detailed subsidence and impact assessment (Ditton Geotechnical Services [DGS] 2014) relating to the proposed drivage of up to four connection roadways between Chain Valley and Mannering Collieries (see Figure 1). These roadways are required to allow coal resources at Mannering (owned by Centennial Coal) to be exploited by Chain Valley (owned by LakeCoal) and also to provide a coal conveying route out through Mannering to supplement the existing coal clearance system at Chain Valley.

There is little doubt that the economic case for the proposed connection roadways is substantial. However this has been given no weight by this review which has focused solely on the prediction of any associated subsidence impacts upon overlying surface features, the report being compiled under the general principles of the expert witness code of conduct for Local, District and Supreme Court matters as set out in Schedule 7 to the *Uniform Civil Procedure Rules 2005* (NSW), this being to ensure the impartiality of the review outcomes.

It is understood that the proposed connection headings are sufficiently close to a number of surface features to warrant a subsidence impact assessment, including the Mannering Creek Ash Dam, a section of Lake Macquarie foreshore, a sewer line, a buried optic-fibre cable, a number of concrete treatment ponds and various transmission towers/sub-station infrastructure that is operated by TransGrid.

1. Completeness of the Subsidence Impact Assessment Study and Report (DGS 2014)

Overall, the DGS subsidence impact assessment is judged to be a comprehensive study whereby the various mechanisms that could conceivably result in significant levels of surface subsidence occurring have been identified and evaluated in detail.

739 Hunter Street
Newcastle West
NSW 2302
PO Box 1556
DANGAR
NSW 2309

Phone: 02 49 405222
Fax: 02 49 405223
e-mail: enquiries@mineadvice.com.au

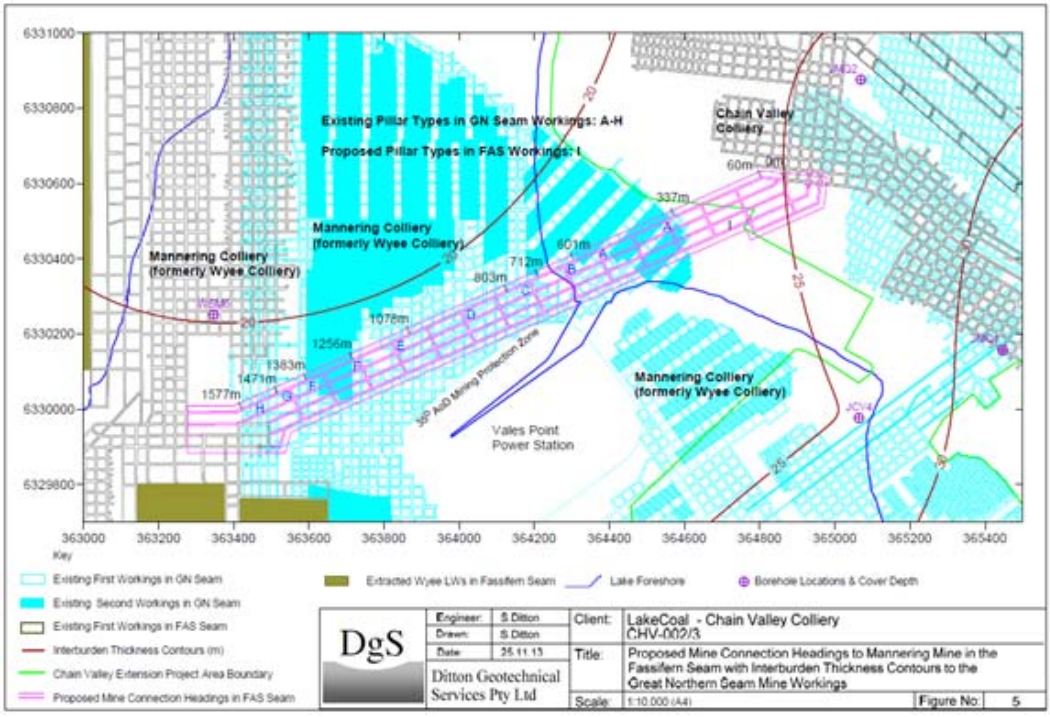


FIGURE 1. General Arrangement of Proposed Connection Headings and Overlying Mine Workings (Reproduced Figure 5 from DGS 2014)

In specific terms, the DGS impact assessment addresses the following material considerations:

(i) The likely stability of the proposed coal pillars between the connection headings in the Fassifern Seam

(ii) The likely stability of the pre-existing standing coal pillars within both first and second workings areas in the overlying Great Northern Seam

(iii) The potential for vertical ground movements, including up to surface, as a direct result of the presence of soft strata unit(s) in the immediate floor of the connection headings in the Fassifern Seam

(iv) The presence or absence of thick and massive strata units within the overburden that have the potential ability to (a) span across mining panels thus limiting the upward progression of vertical strata movements due to mining and/or (b) truncate the upwards progression of any localised roof falls that may occur within the connection headings either during or after mining is complete.

(v) The potential for direct stress interaction between the existing Great Northern Seam workings and proposed connection headings in the Fassifern Seam that will be located in the order of 22 m below the Great Northern Seam, the threat being the potential inadvertent de-stabilisation of what are otherwise currently stable workings in the GN Seam.

Figure 2 contains a general cross-section (to an approximate scale) from the Fassifern Seam up to surface so that both the vertical proximity of mine workings in different coal seams and the relative scale in terms of the coal removal to be required as part of the proposed connection headings can be visualised.

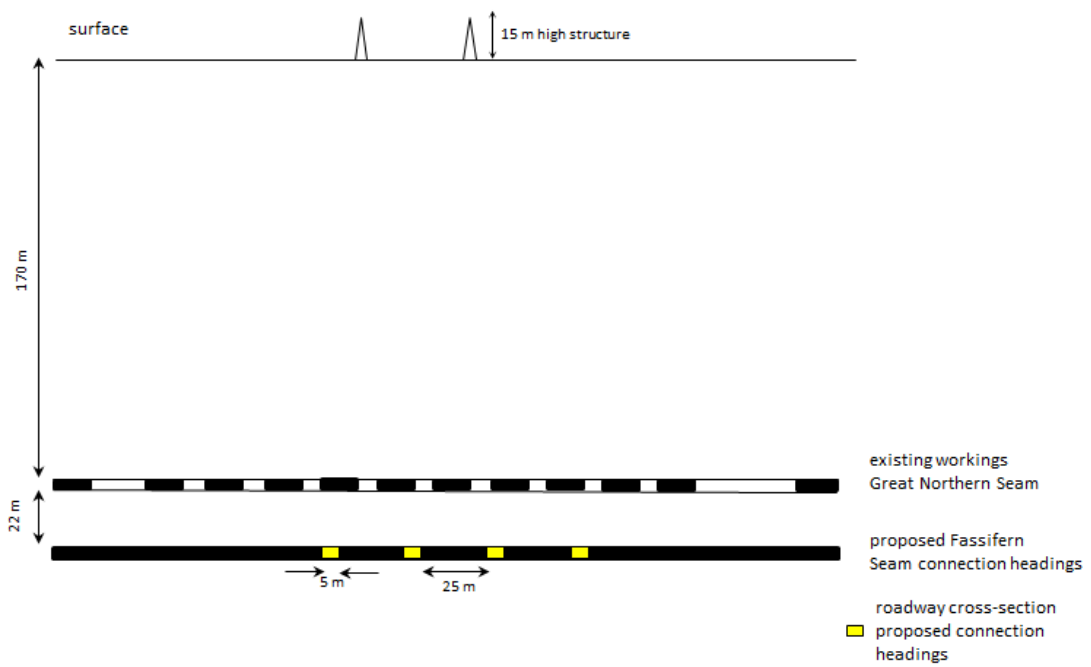


FIGURE 2. Approximate Scale Cross-Section from Surface to Fassifern Seam in Area of Proposed Connection Headings

In terms of the evaluation process used by DGS, the following comments are made:

(i) The geological and geotechnical characterisation is assessed to be comprehensive in its content in that it addresses the necessary parameters associated with the various behavioural mechanisms that could result in significant surface subsidence. The three exploration boreholes upon which the characterisation is based "triangulate" around the proposed connection headings, however none directly intersect the actual area of the headings. This in itself does not negate the characterisation presented as uncertainty in geological and geotechnical conditions between surface boreholes is always present in pre-mining geotechnical design. In this case it simply means that prudence demands that confirmatory geotechnical information be collected during the drivage of the connection headings, particularly as it relates to the thickness and nature of soft material in the immediate floor of the Fassifern Seam headings.

(ii) Coal pillar stability has been evaluated using the UNSW Pillar Design Procedure (UNSW PDP) which is fully appropriate and best practice for the type of mine workings involved.

(iii) A significant effort has been made to provide rational and logical explanation for previous unexpected surface subsidence "events" in the general vicinity, these relating to the time-dependent behaviour of soft floor measures directly beneath Great Northern Seam workings. Offering a credible explanation for measured time-dependent subsidence behaviour (see Figure 3 as an example) that when it was occurring resulted in significant cause for concern as to long-term outcomes, is a significant contribution to the DGS impact assessment, particularly as it has been linked to a well-established

aspect of claystone stability under vertical loading, namely the exceedance of pre-consolidation pressures resulting in primary and secondary consolidation over time.

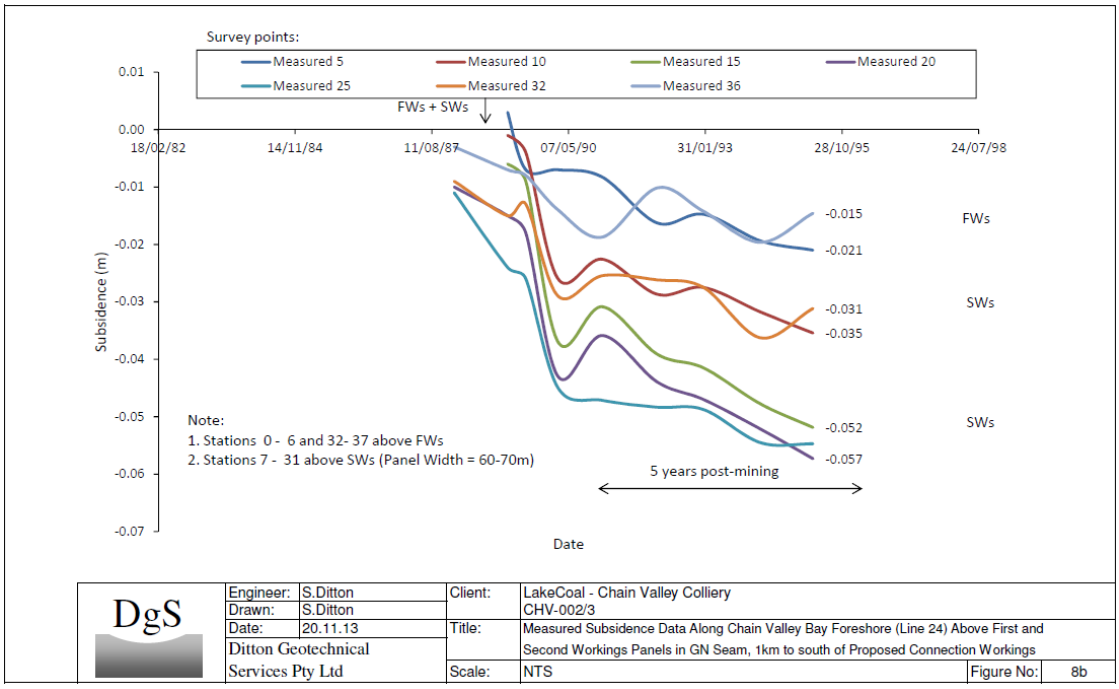


FIGURE 3. Measured Time Dependent Subsidence Behaviour above Comparable GN Seam Workings (Reproduced Figure 8b from DGS 2014)

(iv) The influence of multi-seam stress interactions between the proposed connection headings in the Fassifern Seam and overlying GN Seam workings has been evaluated using both a recognised numerical model that is commonly used in such situations (i.e. LaModel) in conjunction with an analytical treatment using the well-known Boussinesq method of evaluating stress changes below (and above) loaded footings (including a coal pillar). A combination of analytical and numerical evaluation is judged to represent a relatively robust approach to evaluating this key issue.

(v) In terms of the stabilising or subsidence-limiting effect of thick and massive strata units in the overburden, even though their presence is detailed in the geological and geotechnical characterisation, they are only used as a mitigating factor as the predictions of subsidence levels following heading development in the Fassifern Seam effectively ignore their presence. This also introduces further robustness into the study outcomes as the impact assessment is conducted on what is then a conservative basis with the likely outcomes in practice then being less than the predicted levels.

Overall, the author fully agrees with the process that has been adopted by DGS in their analyses and assesses it to be fit for purpose in this instance.

2. Comments on Subsidence Predictions and Associated Impact Assessment

The two most fundamental issues relating to the prediction of surface subsidence effects due to the drivage of the proposed connection headings are:

(a) the stability of the resultant mine workings in the Fassifern Seam, and then as a direct consequence,

(b) any impact upon the future stability of the already existing GN Seam workings.

These two key issues will now be individually commented upon.

2.1 Stability of Proposed Mine Workings in the Fassifern Seam

On the understanding that no secondary extraction will ever occur in the vicinity of the proposed connection headings, their future stability can be evaluated simply based on first workings.

With coal pillar Factor of Safety (FoS) values in excess of 3 under Full Tributary Area Loading (which is a conservative assumption for a 4 heading development panel at the depths involved) plus an allowance for multi-seam interaction, it is concluded that structural instability of the proposed coal pillars in the Fassifern Seam headings is not a credible possibility.

In terms of vertical strata movements due to any associated compression of claystone units in the floor of the Fassifern Seam, the analysis undertaken has demonstrated that the pre-consolidation pressures of such material will not be exceeded. Therefore the type of post-mining subsidence movements that have previously been associated with old GN Seam workings (see Figure 3 again) should not occur. This is not a surprising outcome given the limited proposed coal removal in the Fassifern Seam (see Figure 2) and the associated relatively minor changes in vertical stress acting through the coal and into the floor measures.

The author concurs with the stability assessment for the proposed connection headings in the Fassifern Seam, namely that there is no obvious source of substantial strata failure that could result in significant surface subsidence effects being generated.

2.2 Impact on the Overlying GN Seam Workings

There is little doubt that should the formation of the connection headings in the Fassifern Seam significantly de-stabilise the overlying GN Seam workings, substantial additional subsidence effects would occur at surface.

The overall finding in Section 2.1 is relevant as the Fassifern Seam is close enough to the GN Seam (vertical separation of just greater than 20 m) to be considered as part of the “foundations” for the GN Seam workings. Obviously if the foundation of any structure such as a bridge or building undergoes a substantial change in state, it may jeopardise the stability of the structures it is designed to support and the same is true of the foundations for mine workings.

If the formation of the connection headings and associated coal pillars caused (as an example) the floor of the GN Seam workings to decouple from the coal pillars in the GN Seam, it would have the obvious potential to de-stabilise the GN Seam workings in their entirety as a direct result. However for this to occur, the floor of the GN Seam would need to lower sufficiently to overcome or unload the vertical stresses acting in the coal

pillars and the floor itself. This would require substantially more lowering of the GN Seam floor than that associated with long-term stable workings in the Fassifern Seam.

The analysis presented in DGS 2014 is judged to be sufficient to confirm that the formation of the proposed connection headings and associated coal pillars poses no credible threat to the future on-going stability of the overlying GN Seam workings.

3. Comments on Predicted Additional Subsidence due to Drivage of the Connection Headings and Associated Impacts

Having reliably established that the formation of the proposed connection headings in the Fassifern Seam poses no credible threat to the on-going stability of the pre-existing GN Seam workings, the prediction of associated surface movements can be undertaken using cumulative compression in the various strata units that will undergo changes in vertical stress as a result of heading formation.

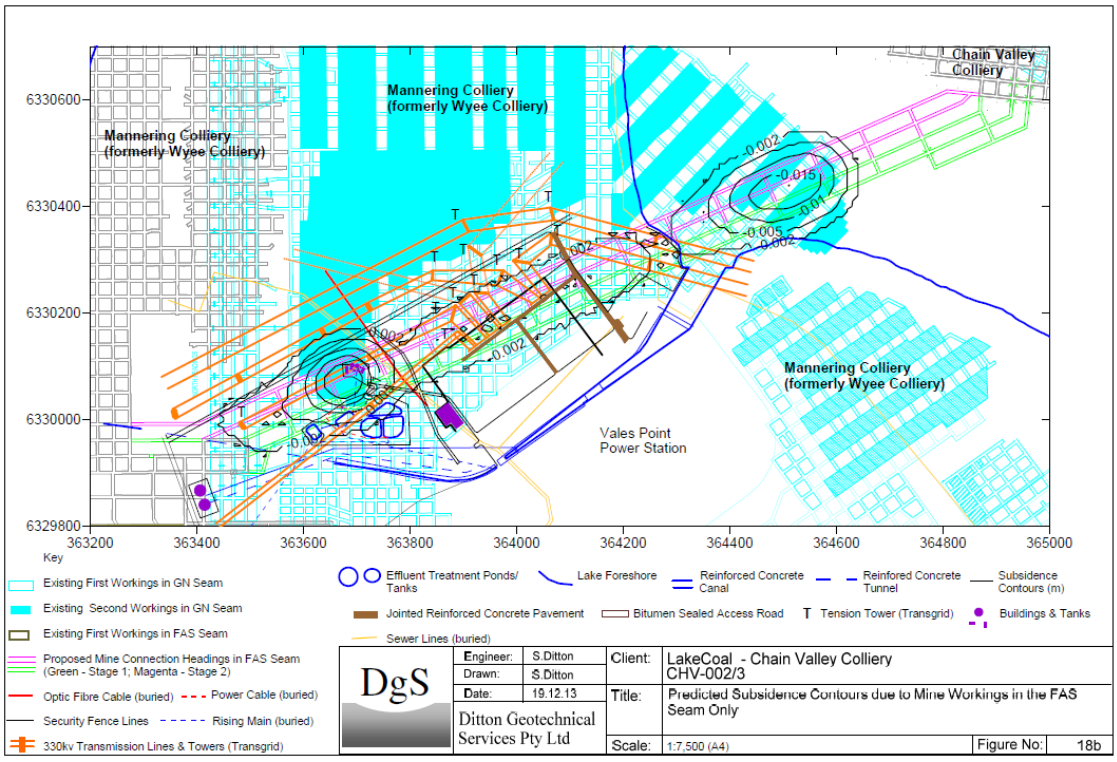


FIGURE 4. Predicted Subsidence Isopachs Due to the Formation of the Connection Headings in the Fassifern Seam and Surface Features (Reproduced Figure 18b from DGS 2014)

The analyses undertaken and presented in DGS 2104 are judged to be suitably detailed to return credible values for surface lowering (S_{max}) and any associated parameters such as curvature, tilt and strain that are directly linked to the magnitude of S_{max} (i.e. they increase in line with increasing S_{max}) and are primary damage drivers for surface features. The various sources of conservatism used in these calculations is also noted, particularly the assumption of Full Tributary Area Loading for the proposed Fassifern Seam pillars and the

non-inclusion of thick massive strata units that may tend to mitigate against the development of the full predicted additional subsidence levels.

Figure 4 shows isopachs of the increase in surface subsidence as a direct result of forming the proposed connection headings along with the various surface features that are of relevance. This figure along with those detailing tilts, curvatures and strain provide a credible basis for assessing the likely impact on the various defined surface features due to the formation of the Fassifern Seam connection headings.

The areas of pre-existing second workings in the Great Northern Seam are logically where the highest level of additional surface subsidence has been predicted due to the formation of the connection headings. Up to 25 mm of additional vertical lowering is predicted in these areas, albeit that the lake foreshore is limited to in the order of 2 mm of additional lowering due to the Great Northern Seam workings having been restricted to first workings directly under the foreshore.

The TransGrid infrastructure of the Vales Point sub-station and nearby transmission towers (some of which are known to be tension towers) is situated above first workings in the Great Northern Seam such that the predicted increase in vertical subsidence as a result of forming up the proposed connection headings in the Fassifern Seam is 6 mm and less, again noting the conservative assumptions used by DGS when calculating these values. The associated maximum values of curvature, tilt and strain are < 0.03 km^{-1}, < 0.2 mm/m and < 0.3 mm/m respectively. Figure 4 also indicates that the majority of the TransGrid tension towers are located outside the 2 mm additional surface lowering isopachs so will be influenced by < 2 mm of vertical lowering due to the proposed mining.

Overall, it is judged that the vertical subsidence predictions provided by DGS 2014 are at the absolute low end of what can be considered as "meaningful predictions" in that any lower values would almost certainly lead to a conclusion of "zero" subsidence. It is considered that the various predictions as they relate to TransGrid infrastructure can be classified as "imperceptible" levels of increased surface subsidence as it is likely that they will result in no obvious visible changes to surface conditions and may not even be detectable using survey methods (dependent upon local near-surface strata conditions).

In their submission dated 14th August 2014 TransGrid note that "*the existing transmission towers and the Vales Point sub-station have not been designed or constructed to allow for any tolerance from subsidence impacts*". Whilst this is taken as factual, it is inevitably the case that those structures have been designed to include levels of design conservatism consistent with their critical importance to the electricity supply network that they support. Therefore it must surely also be the case that they are able to accommodate some level of disturbance due to mining subsidence without inevitably resulting in "*long-term damage to TransGrid's Vales Point sub-station and approximately 21 transmission towers*".

As a final comment, in any cases whereby underground coal mining was to include substantial secondary extraction in close proximity to such electricity network infrastructure, the author would inevitably conclude that the infrastructure not having been designed to accommodate mining subsidence impacts was a fatal flaw and that consequently such mining would indeed represent a major threat to its continued stability and serviceability. However in this particular instance whereby the type of mining being contemplated is limited to highly stable first workings only, the author is compelled to conclude that the infrastructure not being designed

for mining subsidence impacts does not in any way automatically result in a credible threat to its future stability and serviceability.

Please do not hesitate to contact the undersigned should you have any further questions.

Regards,

Dr. Russell Frith
Principal Geotechnical Engineer

REFERENCES

Ditton Geotechnical Services (2014). Subsidence Assessment for the Proposed Underground Headings Between Chain Valley Colliery and Mannering Colliery. Commercial consulting report # CHV-002/3 dated 27th January 2014.

EMM
EMGA Mitchell McLennan

www.emgamm.com

SYDNEY
Ground Floor, Suite 1, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500 F 02 9493 9599

NEWCASTLE
Level 5, 21 Bolton Street
Newcastle NSW 2300
T 02 4927 0506 F 02 4926 1312

BRISBANE
Suite 1, Level 4, 87 Wickham Terrace
Spring Hill Queensland 4000
T 07 3839 1800 F 07 3839 1866

Lake Coal

Appendix C

Revised Statement of Commitments

Revised statement of commitments

Environmental management under the proposed modification will continue in accordance with the processes and procedures outlined in Section 3.1.4 of the SEE. Table 1 provides commitments specific to aspects of the proposed modification relevant to CVC and are additional to those identified in SSD-5465.

Table 1 Commitments

Aspect	Commitment
Subsidence	Install a new foreshore survey line above the first and second workings panels where the underground linkage passes beneath them and possibly extending from the foreshore to the point of connection with the MC workings.
	Inspect existing conditions in the Fassifern Seam and undertake geotechnical and geological mapping in the roadways proximate to the proposed linkage in both CVC and MC workings.
	Complete representative borehole core drilling and sampling of the Fassifern Seam floor at the start and finishing ends of the underground linkage and where the headings pass beneath the SPB. Development below the foreshore will be limited to two headings only until floor conditions can be confirmed.
	Develop infrastructure monitoring and management plans in consultation with infrastructure owners and other relevant stakeholders.
	Re-establish and re-survey Survey Line 24.
	Install a suitable survey line at the starting end above Great Northern Seam first workings to provide early warning monitoring data for the tension towers and switchyard structures.
	Monitor tension and suspension towers and switchyard conductor suspension frames directly above the panels, foreshore and adjacent inlet canal wall.
	Ensure that a monitoring and management plan for the MP01 sewer rising main is in place prior to commencement of mining that may impact Council's infrastructure.

Appendix D

Subsidence assessment independent review

MINE ADVICE Pty Ltd
A.B.N.15 152 928 222

27th August 2014

Dr. M. Callan
Technical Services Manager
Chain Valley Colliery
LakeCoal

Report No. CHAINVALLEY04/01

Dear Mick,

SUBJECT: Independent Peer Review of Subsidence and Impact Assessment Undertaken by Ditton Geotechnical Services Pty Ltd: Chain Valley to Mannering Colliery Connection Roadways

This letter report provides details of the various outcomes from an independent review by the signatory of a detailed subsidence and impact assessment (Ditton Geotechnical Services [DGS] 2014) relating to the proposed drivage of up to four connection roadways between Chain Valley and Mannering Collieries (see Figure 1). These roadways are required to allow coal resources at Mannering (owned by Centennial Coal) to be exploited by Chain Valley (owned by LakeCoal) and also to provide a coal conveying route out through Mannering to supplement the existing coal clearance system at Chain Valley.

There is little doubt that the economic case for the proposed connection roadways is substantial. However this has been given no weight by this review which has focused solely on the prediction of any associated subsidence impacts upon overlying surface features, the report being compiled under the general principles of the expert witness code of conduct for Local, District and Supreme Court matters as set out in Schedule 7 to the *Uniform Civil Procedure Rules 2005* (NSW), this being to ensure the impartiality of the review outcomes.

It is understood that the proposed connection headings are sufficiently close to a number of surface features to warrant a subsidence impact assessment, including the Mannering Creek Ash Dam, a section of Lake Macquarie foreshore, a sewer line, a buried optic-fibre cable, a number of concrete treatment ponds and various transmission towers/sub-station infrastructure that is operated by TransGrid.

1. Completeness of the Subsidence Impact Assessment Study and Report (DGS 2014)

Overall, the DGS subsidence impact assessment is judged to be a comprehensive study whereby the various mechanisms that could conceivably result in significant levels of surface subsidence occurring have been identified and evaluated in detail.

739 Hunter Street
Newcastle West
NSW 2302
PO Box 1556
DANGAR
NSW 2309

Phone: 02 49 405222
Fax: 02 49 405223
e-mail: enquiries@mineadvice.com.au

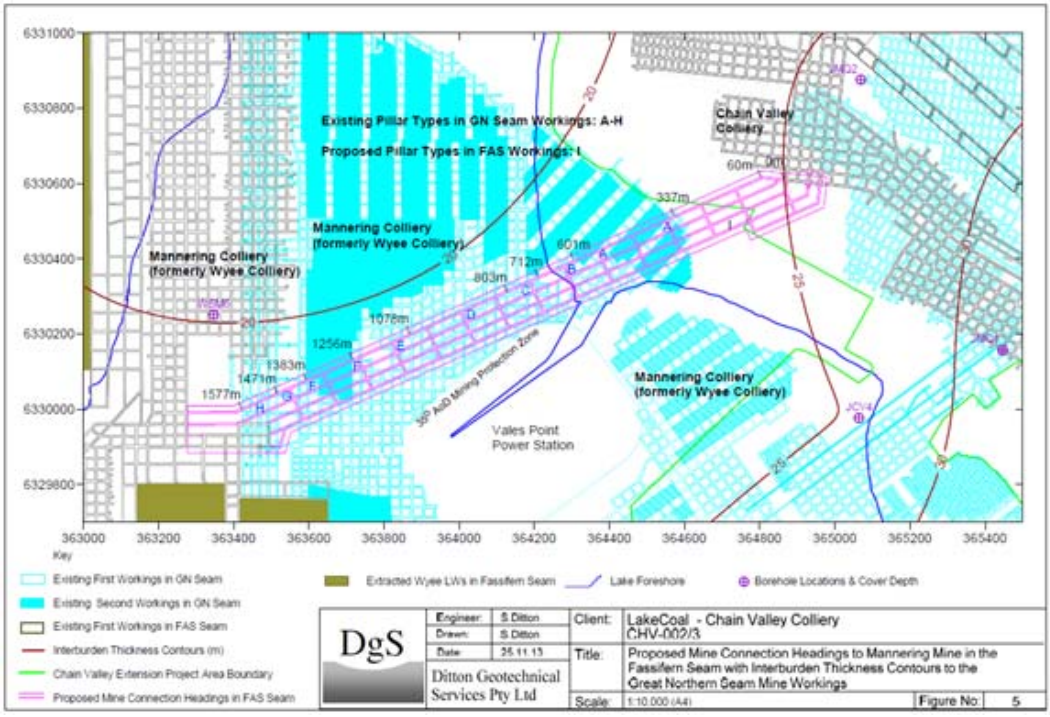


FIGURE 1. General Arrangement of Proposed Connection Headings and Overlying Mine Workings (Reproduced Figure 5 from DGS 2014)

In specific terms, the DGS impact assessment addresses the following material considerations:

(i) The likely stability of the proposed coal pillars between the connection headings in the Fassifern Seam

(ii) The likely stability of the pre-existing standing coal pillars within both first and second workings areas in the overlying Great Northern Seam

(iii) The potential for vertical ground movements, including up to surface, as a direct result of the presence of soft strata unit(s) in the immediate floor of the connection headings in the Fassifern Seam

(iv) The presence or absence of thick and massive strata units within the overburden that have the potential ability to (a) span across mining panels thus limiting the upward progression of vertical strata movements due to mining and/or (b) truncate the upwards progression of any localised roof falls that may occur within the connection headings either during or after mining is complete.

(v) The potential for direct stress interaction between the existing Great Northern Seam workings and proposed connection headings in the Fassifern Seam that will be located in the order of 22 m below the Great Northern Seam, the threat being the potential inadvertent de-stabilisation of what are otherwise currently stable workings in the GN Seam.

Figure 2 contains a general cross-section (to an approximate scale) from the Fassifern Seam up to surface so that both the vertical proximity of mine workings in different coal seams and the relative scale in terms of the coal removal to be required as part of the proposed connection headings can be visualised.

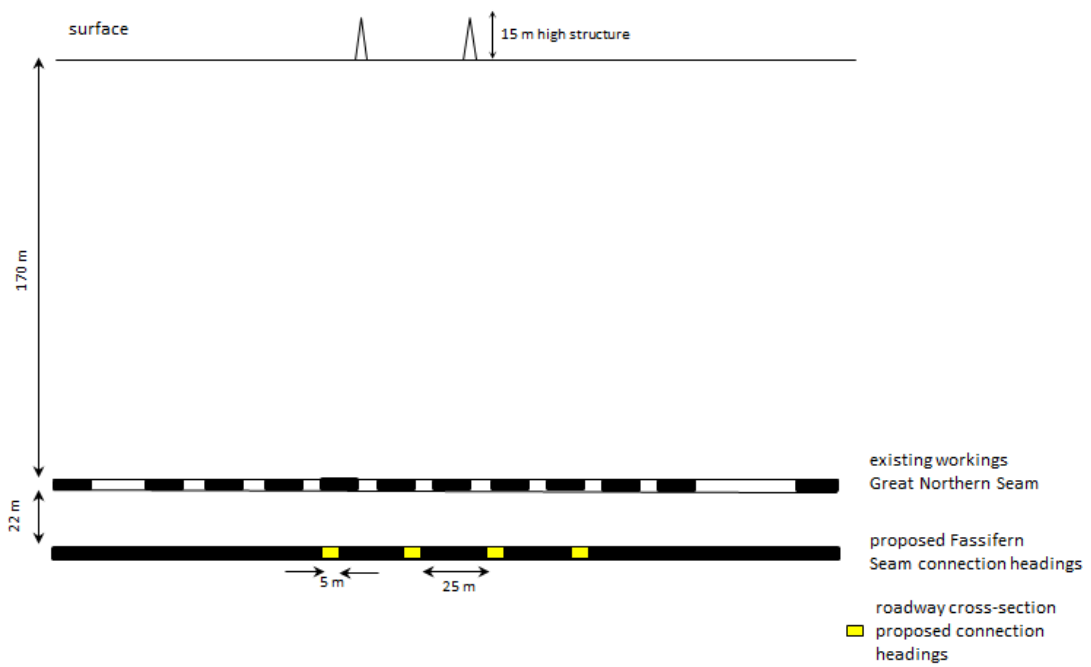


FIGURE 2. Approximate Scale Cross-Section from Surface to Fassifern Seam in Area of Proposed Connection Headings

In terms of the evaluation process used by DGS, the following comments are made:

(i) The geological and geotechnical characterisation is assessed to be comprehensive in its content in that it addresses the necessary parameters associated with the various behavioural mechanisms that could result in significant surface subsidence. The three exploration boreholes upon which the characterisation is based "triangulate" around the proposed connection headings, however none directly intersect the actual area of the headings. This in itself does not negate the characterisation presented as uncertainty in geological and geotechnical conditions between surface boreholes is always present in pre-mining geotechnical design. In this case it simply means that prudence demands that confirmatory geotechnical information be collected during the drivage of the connection headings, particularly as it relates to the thickness and nature of soft material in the immediate floor of the Fassifern Seam headings.

(ii) Coal pillar stability has been evaluated using the UNSW Pillar Design Procedure (UNSW PDP) which is fully appropriate and best practice for the type of mine workings involved.

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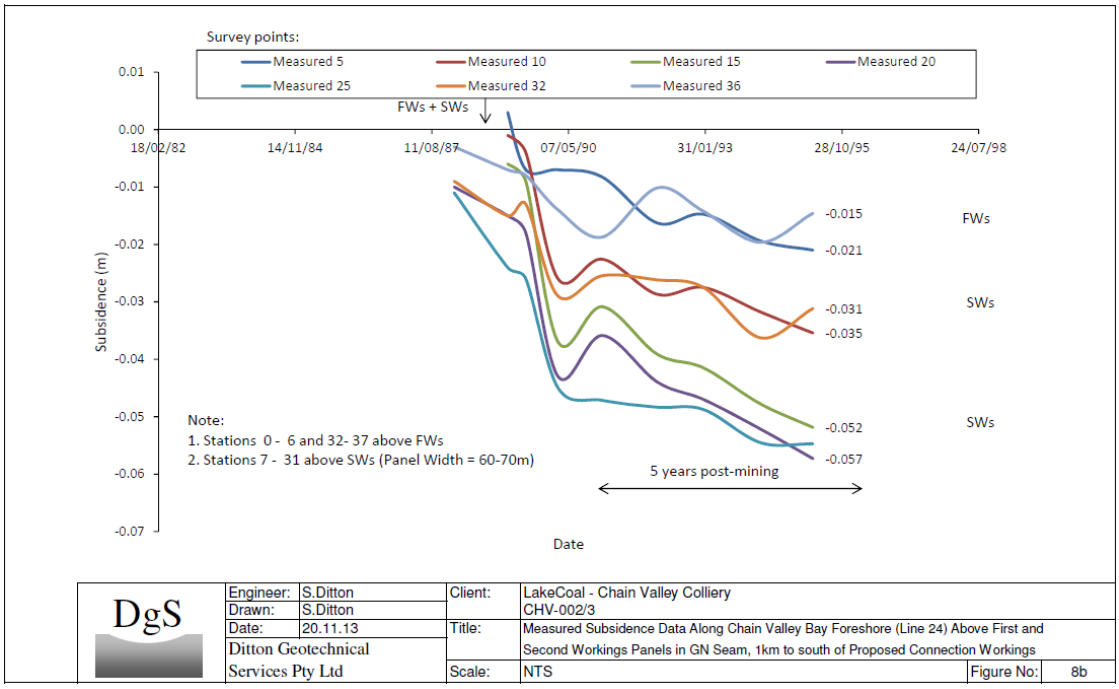

FIGURE 3. Measured Time Dependent Subsidence Behaviour above Comparable GN Seam Workings (Reproduced Figure 8b from DGS 2014)

(iv) The influence of multi-seam stress interactions between the proposed connection headings in the Fassifern Seam and overlying GN Seam workings has been evaluated using both a recognised numerical model that is commonly used in such situations (i.e. LaModel) in conjunction with an analytical treatment using the well-known Boussinesq method of evaluating stress changes below (and above) loaded footings (including a coal pillar). A combination of analytical and numerical evaluation is judged to represent a relatively robust approach to evaluating this key issue.

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Overall, the author fully agrees with the process that has been adopted by DGS in their analyses and assesses it to be fit for purpose in this instance.

2. Comments on Subsidence Predictions and Associated Impact Assessment

The two most fundamental issues relating to the prediction of surface subsidence effects due to the drivage of the proposed connection headings are:

(a) the stability of the resultant mine workings in the Fassifern Seam, and then as a direct consequence,

(b) any impact upon the future stability of the already existing GN Seam workings.

These two key issues will now be individually commented upon.

2.1 Stability of Proposed Mine Workings in the Fassifern Seam

On the understanding that no secondary extraction will ever occur in the vicinity of the proposed connection headings, their future stability can be evaluated simply based on first workings.

With coal pillar Factor of Safety (FoS) values in excess of 3 under Full Tributary Area Loading (which is a conservative assumption for a 4 heading development panel at the depths involved) plus an allowance for multi-seam interaction, it is concluded that structural instability of the proposed coal pillars in the Fassifern Seam headings is not a credible possibility.

In terms of vertical strata movements due to any associated compression of claystone units in the floor of the Fassifern Seam, the analysis undertaken has demonstrated that the pre-consolidation pressures of such material will not be exceeded. Therefore the type of post-mining subsidence movements that have previously been associated with old GN Seam workings (see Figure 3 again) should not occur. This is not a surprising outcome given the limited proposed coal removal in the Fassifern Seam (see Figure 2) and the associated relatively minor changes in vertical stress acting through the coal and into the floor measures.

The author concurs with the stability assessment for the proposed connection headings in the Fassifern Seam, namely that there is no obvious source of substantial strata failure that could result in significant surface subsidence effects being generated.

2.2 Impact on the Overlying GN Seam Workings

There is little doubt that should the formation of the connection headings in the Fassifern Seam significantly de-stabilise the overlying GN Seam workings, substantial additional subsidence effects would occur at surface.

The overall finding in Section 2.1 is relevant as the Fassifern Seam is close enough to the GN Seam (vertical separation of just greater than 20 m) to be considered as part of the “foundations” for the GN Seam workings. Obviously if the foundation of any structure such as a bridge or building undergoes a substantial change in state, it may jeopardise the stability of the structures it is designed to support and the same is true of the foundations for mine workings.

If the formation of the connection headings and associated coal pillars caused (as an example) the floor of the GN Seam workings to decouple from the coal pillars in the GN Seam, it would have the obvious potential to de-stabilise the GN Seam workings in their entirety as a direct result. However for this to occur, the floor of the GN Seam would need to lower sufficiently to overcome or unload the vertical stresses acting in the coal

pillars and the floor itself. This would require substantially more lowering of the GN Seam floor than that associated with long-term stable workings in the Fassifern Seam.

The analysis presented in DGS 2014 is judged to be sufficient to confirm that the formation of the proposed connection headings and associated coal pillars poses no credible threat to the future on-going stability of the overlying GN Seam workings.

3. Comments on Predicted Additional Subsidence due to Drivage of the Connection Headings and Associated Impacts

Having reliably established that the formation of the proposed connection headings in the Fassifern Seam poses no credible threat to the on-going stability of the pre-existing GN Seam workings, the prediction of associated surface movements can be undertaken using cumulative compression in the various strata units that will undergo changes in vertical stress as a result of heading formation.

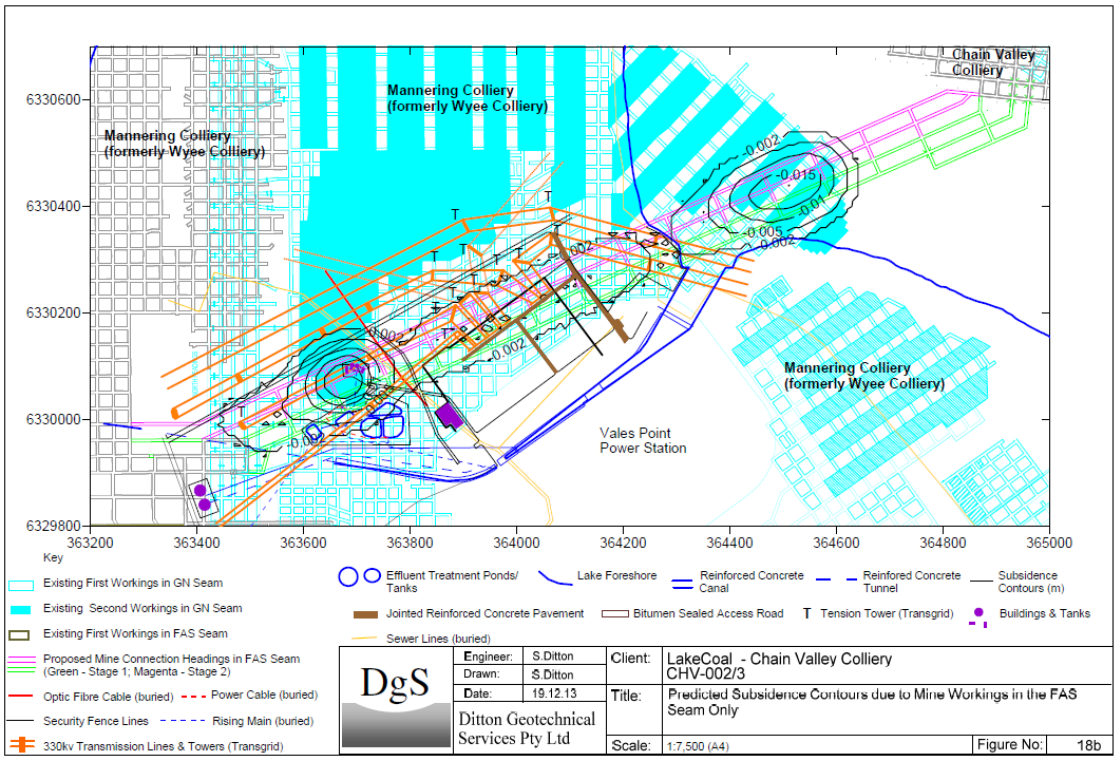

FIGURE 4. Predicted Subsidence Isopachs Due to the Formation of the Connection Headings in the Fassifern Seam and Surface Features (Reproduced Figure 18b from DGS 2014)

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non-inclusion of thick massive strata units that may tend to mitigate against the development of the full predicted additional subsidence levels.

Figure 4 shows isopachs of the increase in surface subsidence as a direct result of forming the proposed connection headings along with the various surface features that are of relevance. This figure along with those detailing tilts, curvatures and strain provide a credible basis for assessing the likely impact on the various defined surface features due to the formation of the Fassifern Seam connection headings.

The areas of pre-existing second workings in the Great Northern Seam are logically where the highest level of additional surface subsidence has been predicted due to the formation of the connection headings. Up to 25 mm of additional vertical lowering is predicted in these areas, albeit that the lake foreshore is limited to in the order of 2 mm of additional lowering due to the Great Northern Seam workings having been restricted to first workings directly under the foreshore.

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Overall, it is judged that the vertical subsidence predictions provided by DGS 2014 are at the absolute low end of what can be considered as "meaningful predictions" in that any lower values would almost certainly lead to a conclusion of "zero" subsidence. It is considered that the various predictions as they relate to TransGrid infrastructure can be classified as "imperceptible" levels of increased surface subsidence as it is likely that they will result in no obvious visible changes to surface conditions and may not even be detectable using survey methods (dependent upon local near-surface strata conditions).

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As a final comment, in any cases whereby underground coal mining was to include substantial secondary extraction in close proximity to such electricity network infrastructure, the author would inevitably conclude that the infrastructure not having been designed to accommodate mining subsidence impacts was a fatal flaw and that consequently such mining would indeed represent a major threat to its continued stability and serviceability. However in this particular instance whereby the type of mining being contemplated is limited to highly stable first workings only, the author is compelled to conclude that the infrastructure not being designed

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Please do not hesitate to contact the undersigned should you have any further questions.

Regards,

Dr. Russell Frith
Principal Geotechnical Engineer

REFERENCES

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Appendix E

Additional marine ecology information

J.H. & E.S. Laxton Environmental Consultants P/L

A.C.N. 002 862 160

170 Warrimoo Ave, St Ives, NSW 2075
Ph: (02) 9449-7846 Fax: (02) 9983-0736

22nd July 2014

Mr Chris Ellis
LDO Chain Valley Colliery.

Dear Chris,

Answers to Questions relating to Mine Subsidence at Chain Valley Bay, Lake Macquarie

Background

Three distinct marine ecological communities inhabit Lake Macquarie. They are:

- The pelagic community that inhabits the water column, incorporating dissolved nutrients, phytoplankton, zooplankton and fish.
- The benthic community of the mud basin of Lake Macquarie that derives its energy from suspended and settled organic matter from the water column. Deposit and filter feeders in this community are preyed upon by carnivorous benthos and fish.
- The benthic community of the perimeter of the lake that obtains energy directly from sun-light. Marine angiosperms (seagrasses) and benthic algae (macro- and micro-algae) photosynthesise in the shallow water of the lake perimeter. These plants support a rich community of deposit and filter feeders, herbivores and carnivores. They also provide shelter for fish and feeding grounds for birds.

Both the benthic communities of the mud basin and seagrass zone around the shoreline of Lake Macquarie may be affected by mine subsidence. As described in Section 3.1.2 of the EMM (2014) Chain Valley Colliery Modification 1 Statement of Environmental Effects, the mining parameters at Chain Valley Colliery (CVC) have been specifically designed to ensure protection of:

- the Lake Macquarie foreshore – by the use of the high water mark subsidence barrier (HWMSB), consistent with the requirements of the relevant mining leases; and
- seagrass communities – by the use of a seagrass protection barrier (SPB) consistent with Conditions 19 and 20 of the existing Subsidence Management Plan approval.

Lake Coal has committed to undertaking only first workings within the HWMSB and SPB. Subsidence associated with first workings is generally less than 20mm. Subsidence less than 20mm is commonly referred to as ‘zero’ subsidence as subsidence of less than 20 mm is widely adopted as being imperceptible for all practical purposes because the magnitude of natural, seasonal variations in ground level is commonly greater than 20mm.

The application of the HWMSB is required as a condition of the relevant mining tenements and has been developed to protect foreshore areas and the boundary of water bodies from mining induced subsidence. The width of the HWMSB is determined by a 35 degree angle of draw lakewards from the High Water Mark and from the point 2.44m AHD above the High Water Mark landward to the depth of the workings.

The SPB was adopted by Lake Coal to protect the seagrass beds of Lake Macquarie from any potential impacts from underground mining at the CVC. The width of the SPB is determined by a 26.5 degree angle of draw from the surveyed boundary of the seagrass beds to the depth of the workings.

In 2007, CVC management, in concert with NSW Government Departments commenced a programme to monitor subsidence and its ecological effects on Lake Macquarie. J.H. & E.S. Laxton - Environmental Consultants P/L and Pearson and Associates P/L Consulting Surveyors were engaged to carry out these studies.

J.H & E.S. Laxton - Environmental Consultants P/L had completed an 18 year water quality study of Lake Macquarie for Hunter Water Corporation (Laxton 2005). The 2007 study involved a bathymetric survey of Chain Valley Bay, a soft bottom benthic survey and a seagrass survey.

Chain Valley Bay was found to have an average depth of slightly less than 6m below AHD and had a rocky mound 3.5m below the surface. The benthos of the mud basin of Chain Valley Bay comprised polychaete worms, bivalves, gastropods, ophuroids, amphipods, sponges and coelenterates (Laxton and Laxton 2007).

The seagrass study in 2007 involved mapping their distribution and cover of the substratum, their condition (degree of fouling by algae) and the maximum depth that seagrasses grew. Only one species of seagrass was found in the study area in 2007. It was *Zostera capricorni*. Later studies found a small amount of *Halophila ovalis*. The maximum depths reached by seagrass in Chain Valley Bay ranged from -0.89m to -2.12m below AHD. In 2007, seagrasses in Chain Valley Bay were moderately to heavily fouled by epiphytic algae.

In 2007, seagrasses formed an almost continuous band along the shoreline of Chain Valley Bay except for a region adjacent to the inlet canal of Vales Point Power Station (Figure 1).

In 2008, 10 permanent experimental transects were established in Chain Valley Bay and a further 4 control transects were established in Crangan Bay (Laxton and Laxton 2008).

In 2009, a further 8 permanent seagrass monitoring transects were established along Summerland Point (Laxton and Laxton 2009). Additional benthic studies of the mud basin were also carried out at this time. The maximum depth that seagrasses grew along Summerland Point ranged from -1.29 to -2.12m below AHD.

In 2010 all the permanent seagrass monitoring transects (18 experimental transects and 4 control transects) were resurveyed.

In 2011, a further 6 permanent seagrass transects was established along the eastern shore of Chain Valley Bay (Laxton and Laxton 2011), increasing the number of experimental transects to 24.

In 2012 and 2013, the 24 permanent experimental seagrass transects were resurveyed along with the 4 control stations (Laxton and Laxton 2012 and 2013).

In 2014, a further 6 permanent seagrass monitoring transects were established in Bardens Bay increasing the number of experimental stations to 30 (Laxton and Laxton 2014).

On each occasion that the annual seagrass monitoring was carried out, the elevation of the lake bed at the inner and outer ends of each transect was determined by Pearson and Associates. These measurements were compared with the original values obtained in 2008 (and later as new transects were added). In this way any subsidence could be determined and quantified.

On 28th June 2014, the area of shoreline lying between Experimental Transects E4 and E5 was resurveyed for the presence of seagrasses (Figure 2).

On 8th July 2014, the area lying between Transects E4 and E5 was resurveyed using the video camera mounted on a floating platform (Figure 3). The results of this survey were reported in a supplementary report (Laxton and Laxton 2014b).

Figure 1. Area of Chain Valley Bay foreshore where no seagrass was found in 2007.

Figure 2. Area of Chain Valley Bay foreshore resurveyed on 28th June 2014. Red letters denote points of interest as follows:

A Almost continuous bed of short leaved seagrass with some algal fouling of leaves.

B Seagrass cover becoming more patchy towards the shore and sparse towards the outer edge.

C Patches of seagrass and exposed mud along shore line and out to the drop-off.

D Long leaved seagrass in shallow areas and short leaved seagrass forming broken cover.

E Rock armour of the inlet canal with some seagrass growing among the rocks.

F Patches of short leaved seagrass with what appears to be new fine leaved seagrass plants.

G Almost complete seagrass cover.

Results of 8th July 2014 seagrass survey

The area of the lake bed between Transects E4 and E5 was resurveyed on 8th July 2014 to provide current data to support the proposal to construct an underground linkage between CVC and Mannering Colliery. The seagrass survey was conducted using a video camera in an underwater housing mounted on a floating platform. This rig was towed slowly behind a boat along the track shown in Figure 3. A new permanent station L1 was established in the area where the 20mm predicted subsidence was predicted.

Figure 3. Track surveyed by floating video camera between Transects E4 and E5 on 8th July 20014.

The results of the 8th July 2014 survey of the lake bed between Transects E4 and E5 are shown in Table 1. Table 2 shows changes in seagrass cover along Transects E4 and E5 between 2007 and 2014.

Table 1 (2014)	E4	E4 to L1	L1	L1 to E5	E5
% area SG	96.66	89.30	81.54	81.46	96.32
% no SG	3.34	10.70	18.46	18.54	3.68
% area long SG	8.60	0.00	34.63	13.67	23.90
% area long SG (1)	8.60	0.00	34.63	11.17	23.90
% area long SG (2)	0.00	0.00	0.00	2.50	0.00
% area long SG (3)	0.00	0.00	0.00	0.00	0.00
% area short SG	88.06	89.30	46.91	67.79	72.43
% area short SG (1)	85.22	89.30	39.56	67.79	72.43
% area short SG (2)	1.40	0.00	7.35	0.00	0.00
% area short SG (3)	0.00	0.00	0.00	0.00	0.00
% Cystophyllum	0.00	0.02	0.00	0.00	0.00
% filamentous algae	0.10	4.48	0.00	0.92	0.00
No. *Pinna*	0	1	1	1	2
% Bare ground	3.24	6.21	18.46	17.63	3.68

Table 2.	**2008**	**2010**	**2011**	**2012**	**2013**	**2014a**	**2014b**
Transect E4							
% seagrass	80.16	98.54	95.74	100.00	97.50	98.06	96.66
% no seagrass	19.84	1.46	4.26	0.00	2.50	1.94	3.34
Transect E5							
% seagrass	95.88	94.93	95.19	100.00	98.82	97.01	96.32
% no seagrass	4.12	5.07	4.81	0.00	1.18	2.99	3.68

Between 2008 and 2014, the percentage cover of seagrass along Transect E4 ranged from 80.16 to 100%. At Transect E5, seagrass cover ranged from 94.93 to 100% over the same period. At Transect L1 the cover of seagrass was 81.54% in July 2014. The space between Transects E4 and L1 had seagrass cover of 89.30%. The space between Transects L1 and E5 had seagrass cover of 81.46%

Fouling of seagrass leaves by algae was low to moderate in July 2014.

Although quantitative evidence is not available, it would appear that seagrasses are increasing in abundance in the shallow inshore zone between Transects E4 and E5. In 2007 seagrasses in this region were sparse. In the 7 years following, seagrasses have grown to occupy between 81 and 89% of the substratum.

Two other factors had a bearing seagrass distribution and lake bed ecology in Lake Macquarie. They were:

- Changes in water level, such as those experienced in saline lagoons with a permanent entrances to coastal waters.
- Light attenuation with depth

These two factors are discussed in the following sections.

Changes in water level of Saline Lagoons with Permanent Entrances to Coastal Waters

Figure 4 shows water level changes in a NSW coastal lagoon with an entrance open to coastal waters.

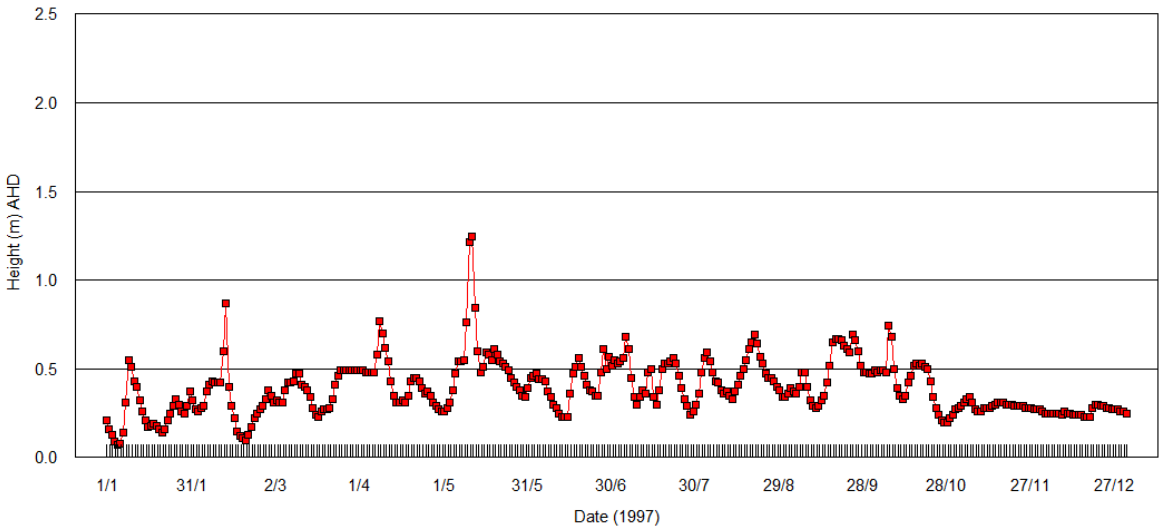


Figure 4. Water level changes in a coastal lagoon with an entrance open to coastal waters.

The actual water depth above the lagoon bed varied between 0 and 1.3m above AHD over a year. Water depths in coastal saline lakes with an open entrance to coastal waters varied due to combinations of the following factors:

- Tidal influences. The body of a coastal lagoon was subject to tidal influence. The height of the tidal prism at the ocean end of the entrance channel may reach almost 2m (during spring tides) but by the time the body of the lagoon was reached, the tidal prism was reduced to 0.05m.
- Atmospheric pressure. The heights of coastal waters and coastal lakes were influenced by changes in atmospheric pressure. The Tasman Sea responded to atmospheric pressure changes like a huge barometer. When the atmospheric pressure was high the sea surface was depressed. This caused water to drain from the lagoon causing the depth of water in the body of the lagoon to decrease. When the atmospheric pressure over the Tasman Sea was low, the surface of the sea bulged upwards. This raising of sea level caused water to flow into the lagoon, increasing the water depth.
- Large swells. Low pressure systems in the Tasman Sea almost always generated strong winds and coastal rainfall. The strong winds caused large swells to form that impact the coast. Wave setup at the entrance to the lagoon caused the water level in the lagoon to rise as large volumes of seawater entered the system.
- Rainfall. Rainfall during a period of low atmospheric pressure caused runoff into catchment rivers and streams to increase. When this extra water reached the body of the lagoon, the water level rose in proportion to the runoff volume. This water was prevented from exiting the lagoon by wave setup at the entrance and the state of the tide. Under these circumstances, the level of the lagoon rose to heights of a meter or more above AHD (Figure 4).

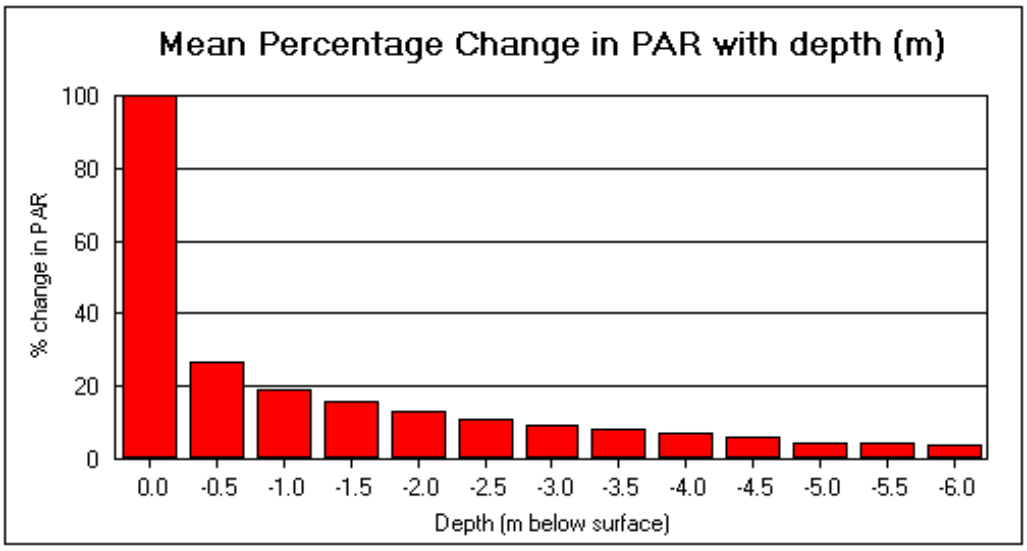
Light attenuation with depth in Lake Macquarie

Observations made over many years (Laxton and Laxton 2007) show that photosynthetic benthic organisms (seagrasses and algae) are confined to the shallow water areas around the perimeter of

Lake Macquarie. In Chain Valley Bay and off Summerland Point, seagrasses and benthic algae grow between -0.5 and -2.12m AHD.

The water quality study of Lake Macquarie, carried out between 1983 and 1997 (Laxton 2005), measured Photosynthetically Active Radiation (PAR) changes with depth monthly at twelve stations throughout the lake during the years 1983 to 1985. Data for Station 1 off Wyee Point are presented in Figure 5.

Whichever way the results are presented, only 14% of the light present at the surface reaches a depth of 2.0m below the surface. By 6m below the surface only between 2 and 4% of PAR remains. Seagrasses and algae just manage to survive at 14% of the surface radiation but have no chance of survival at 6m below the surface. The mud basin of Lake Macquarie is devoid of macroscopic benthic algae and seagrasses.



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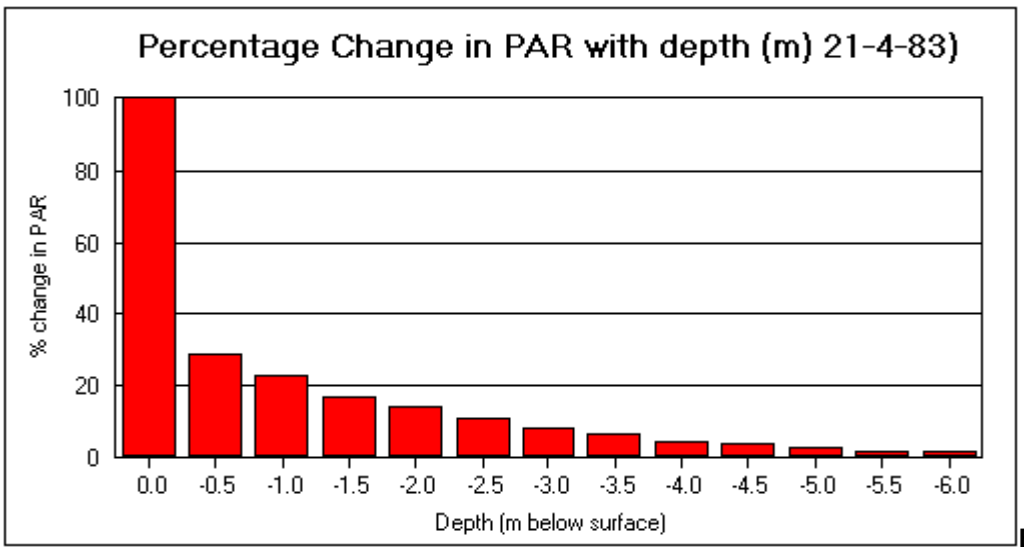

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Figure 5A. Mean percentage changes in PAR with depth at Station 1 - Wyee Point over 12 months. **Figure 5B.** Actual percentage changes in PAR at Station 1 - Wyee Point on the morning of 21-4-83.

Response to matters raised

In response to submissions from Lake Macquarie City Council (LMCC) and the NSW Office of Environment and Heritage (OEH) on the linkage applications from CVC, further information and clarification was requested.

Lake Macquarie City Council

Matter raised

The maximum predicted effect of subsidence is 20mm, but even this small change can alter the distribution of foreshore plants of species sensitive to tidal inundation and groundwater such as mangroves, salt marsh and swamp mahogany.

Response

This statement suggests that Lake Macquarie is a static system and that 20mm of subsidence will allow saltwater from the lake to penetrate further inland to affect sensitive vegetation. As shown in Figure 4, extreme events can raise the water level of Lake Macquarie to around 1.3m above AHD allowing saltwater to penetrate far inland in low lying areas of the foreshore. On a monthly basis, changing atmospheric pressure means that the water level of Lake Macquarie can cycle between 0 and 0.7m above AHD. On lee shores wind wave set up can raise the water level of the lake to even higher levels for short periods. Furthermore, high wind waves can deposit a thick band of vegetable detritus and sand that acts as a dam along the shoreline that prevents accumulated saltwater from draining out of wetlands for several days. It is also noted that humans have occupied much of the shoreline of Lake Macquarie. Native vegetation has been stripped from the lake perimeter, seawalls built and in many places lawn mowers can operate to the water's edge. The land controlled by CVC and Vales Point Power Station, and the subject of this application, still contains several hundred metres of low lying natural vegetation in good condition. A subsidence of 20mm or 'zero subsidence, is highly unlikely to have any measurable effect on this remaining vegetation as the elevation of the land rises behind the shoreline.

OEH

The NSW Office of Environment and Heritage raised several matters.

1. The EA states that surveys conducted for this area showed an absence of seagrasses but no details of the survey were provided.
2. OEH acknowledges that predicted subsidence from the proposed underground linkage will range from 5mm to 20mm where first and secondary working occurs, respectively. None the less OEH is of the opinion that the that the EA does not adequately assess the impacts of subsidence on the benthic micro and macro communities in Lake Macquarie and has concerns about the location of the highest predicted levels of subsidence and therefore cumulative subsidence corresponding with the shoreline and the Seagrass Protection Barrier.
3. OEH has concerns about any changes in depth in the lake due to mine subsidence that may reduce light levels reaching the sediment surface and thereby affect benthic microalgal primary production. Subtle changes in depths influencing critical light levels reaching the sediment surface can have strong effects on benthic productivity and this can have flow on effects to important ecological processes such as oxygen production and sediment-water nutrient cycling.

Response to Question 1

The initial seagrass survey of Chain Valley Bay for CVC was carried out in 2007 by J.H. & E.S. Laxton - Environmental Consultants P/L (Laxton and Laxton 2007). This initial survey found no significant beds of *Zostera capricorni* in the embayment of Chain Valley near the inlet canal of Vales Point Power Station shown in Figure 1. South of this region very small patches of *Zostera capricorni* were present. This was the reason for the long gap between permanent seagrass monitoring transects E4 and E5 established in 2008 (Laxton and Laxton 2008).

When this area of foreshore between Experimental Transects E4 and E5 was resurveyed on 28th June 2014 and quantitatively on 8th July 2014, the seagrass *Zostera capricorni* was found to be present (Figure 2 and Table 1). Seagrass cover was variable but in most of this region the plants were healthy with only light fouling of the leaves by algae. It is possible, that in the near future, a healthy and continuous seagrass meadow will develop in this part of Chain Valley Bay. It should also be noted that, as identified in the Subsidence Assessment by Ditton Geotechnical Services (2014), a significant portion of the area between Experimental Transects E4 and E5 was previously subsided prior to the mid 1990s, with subsidence modeling indicating that up to 106mm would have occurred in this area. This region of the foreshore and out to the drop-off is now covered by a rich seagrass meadow which shows that moderate subsidence has little effect on the vigor of seagrass beds in the inshore zone but still may affect those plants living on the underwater slope down to the mud basin.

Response to Question 2

As stated in the answer to Question 1, a seagrass meadow appears to be developing in the area between Experimental Transects E4 and E5. Where there was no seagrass in 2007, there are now large areas of healthy short and some long leaved seagrass. With the amplitude of water level changes in the lake described earlier and shown in Figure 4, a subsidence of 20mm is considered highly unlikely to harm this developing seagrass meadow.

Response to Question 3

The seagrass beds in the area monitored for CVC ranged in depth of 0.5 to 2.12m below AHD. Only 14% of the surface light reaches the sea bed at 2.0m below AHD (Figure 5). Extending to slightly deeper depths are patches of filamentous algae. Seagrass beds in Chain Valley Bay and off Summerland Point may extend between 16.3 and 152.7m off shore as a continuous meadow (Laxton and Laxton 2014). At the offshore edge of the seagrass beds, the lake bed drops quickly to 6m below AHD. This is the location of the mud basin which occupies most of Lake Macquarie. At this depth only between 2 and 4% of the surface light penetrates to the lake bed. The surface of the mud basin was very fine silt, but buried in mud were vast quantities of intact bivalve and gastropod shells (Laxton and Laxton 2014a).

The surface of the mud has no macroscopic algae but microscopic phytoplankton settle on the surface but are unlikely to be able to photosynthesize in such low light conditions. Instead they are consumed by deposit feeders.

The huge quantity of intact shells in the sediment are evidence of mass extinction events that coincide with prolonged periods of zero dissolved oxygen concentration in the bottom water of Lake Macquarie. Several periods of zero dissolved oxygen concentration in the bottom water that lasted for months were recorded during the 18 year water quality study of Lake Macquarie (Laxton 2005).

Dissolved oxygen depletion of the bottom water of Lake Macquarie occurred in the following manner. Heavy rain in the catchment of the lake caused the discharge of turbid flood water. This almost fresh turbid water flows over the surface of the lake cutting off light from the lower saline bottom water. Because of the pronounced density stratification of the water column at this time, no vertical mixing of the water column can take place. Over a period of time there was complete deoxygenation of the bottom water which may last for months. This lack of dissolved oxygen in the bottom water caused the death of benthic animals.

At times of deoxygenation of the bottom water large amounts of ammonia and orthophosphate were released from the bottom sediments into the water column by bacterial action. In zero dissolved oxygen conditions, the bacteria obtain oxygen by stripping nitrate ions and phosphorus containing compounds of oxygen atoms. This reaction produced ammonia and orthophosphate. When the vertical stratification of the water column eventually broke down, these nutrients became available to phytoplankton in the upper levels of the water column.

Most of the organisms in the seagrass zone occupy a depth range of 0 to -2m AHD. Tiny bed level changes of 20mm are insignificant. In the mud basin of Lake Macquarie in the study areas of Chain Valley Bay, Summerland Point and Bardens Bay water depths ranged from -4.5 to -6.5m AHD. Within this region of the lake, past mining had caused subsidence in some areas of around 1m. The benthic fauna of this whole area consisted of the same suite of organisms. That is, their distribution and abundance was unrelated to the depth of water.

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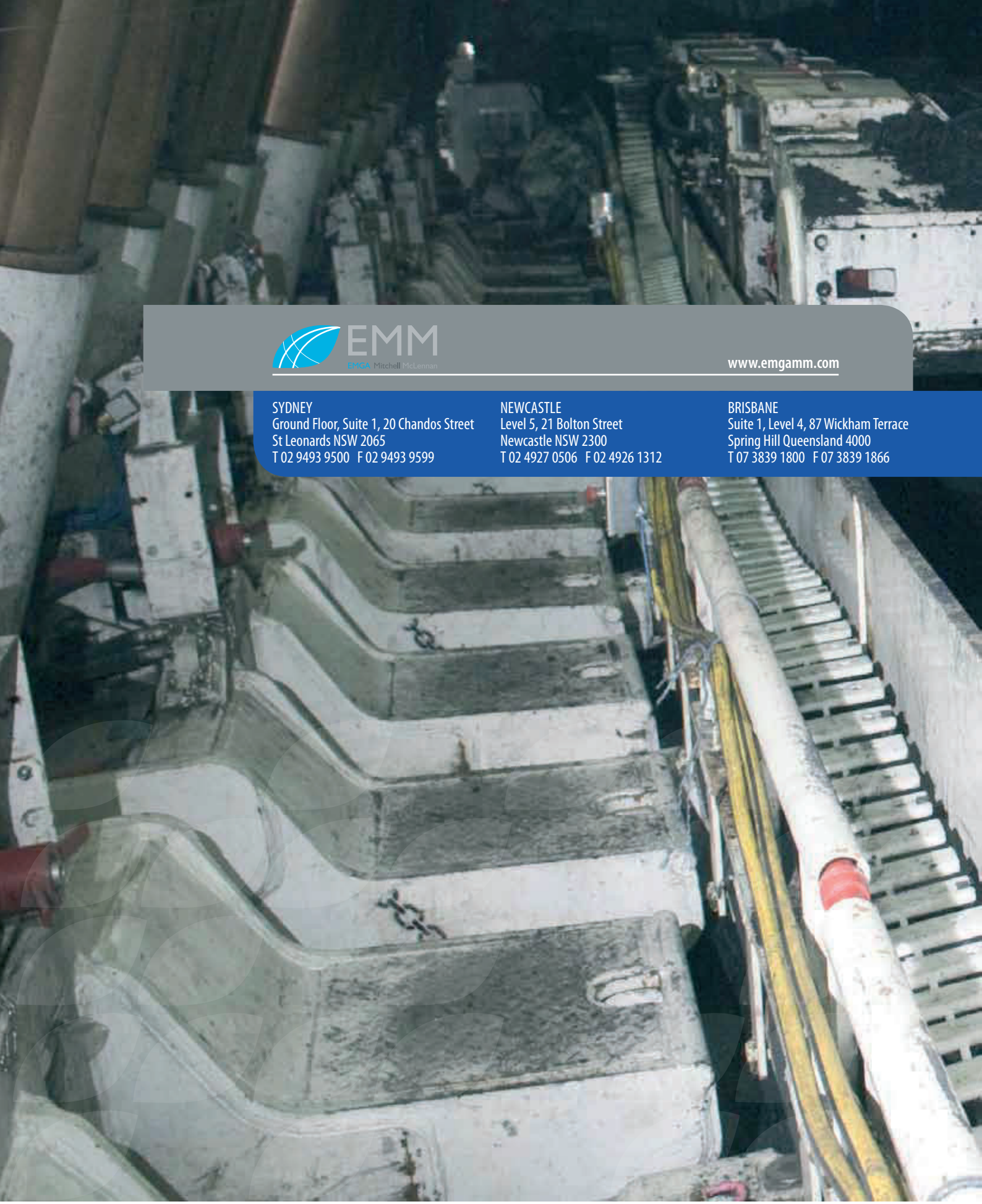

EMM
EMGA Mitchell McLennan

www.emgamm.com

SYDNEY
Ground Floor, Suite 1, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500 F 02 9493 9599

NEWCASTLE
Level 5, 21 Bolton Street
Newcastle NSW 2300
T 02 4927 0506 F 02 4926 1312

BRISBANE
Suite 1, Level 4, 87 Wickham Terrace
Spring Hill Queensland 4000
T 07 3839 1800 F 07 3839 1866

LakeCoal