



Austar Coal Mine Pty Ltd
A.B.N. 67 111 910 822

Mine Office
Middle Road,
Paxton, NSW.
Locked Bag 806,
Cessnock NSW 2325,
Australia.
PHONE: +61 2 4993 7200
FAX: +61 2 4993 7302

9 March 2012

The Director-General
Department of Planning & Infrastructure
GPO Box 39
SYDNEY NSW 2001

Attention: Howard Reed,

Response to Submissions - Modification to Longwall A5a Varied Commencing End

1 INTRODUCTION

Five submissions were made during the comment period of the Modification Application for the Austar Coal Mine Proposed Longwall A5a Varied Commencing End (DA29/95 MOD 5). The issues raised in each submission are summarised below.

2 AGENCY SUBMISSIONS

2.1 Department of Resources and Energy Submission (William Hughes, A/Director Minerals Operation)

1. *"NSW Trade & Investment, Regional Infrastructure & Services, Division of Resources & Energy (DRE) has no objections to the Environmental Assessment for the proposed modification to the development consent as outlined in the supporting documents provided by the proponent."*

Response

No further response required.

2.2 Environment Protection Authority Submission (Karen Marler, Head Regional Operations Unit – Hunter)

1. *"The EPA notes that new geological information with regards to dykes in the proposed footprint of Longwall Panel A5a has led to a change in the mine plan, and as a consequence an application to modify the existing consent. The presence of geological structures, such as dykes, can lead to non-conventional subsidence impacts to those predicted by modelling (Halla, 1987). In this case the significance of these dykes, as associated faults on any likely resulting mine subsidence for this proposal is not stated in the EA, and the EPA notes that none of the plans or cross-sections in the EA show any geological structures that may identify areas on the surface where non-conventional subsidence events could occur."*

Response

The location of dykes in relation to the proposed A5a varied commencing end is shown in **Figure 1**. Due to the western dyke being relatively small in nature and not associated with any major faulting no zones of increased subsidence risk have been identified.

2. *"The EPA recommends that if this application is approved, that approval conditions require the proponent to measure and monitor subsidence caused by the proposed additional development, and to measure and monitor the health of threatened biodiversity and its habitat above the development footprint, such as Riverflat Eucalypt Forest on the Coastal Floodplains Endangered Ecological Community (EEC) that occurs along the section of Cony Creek that will be undermined if this proposal is approved. In the event that the proposed development results in harm any threatened biodiversity, particularly through mine subsidence, then adaptive mine management must implemented to stop any further harm from occurring and that any harm to threatened biodiversity, or its habitats must be offset in accordance with EPA offsetting principles."*

Response

The Subsidence Monitoring Program which forms part of the Subsidence Management Plan (SMP) approved for Longwall A5a will be extended to the additional area of the Longwall A5a varied commencing end (pending landholder approval) by variation to the existing SMP.

The *Ecological Monitoring Program for Stage 2 Longwall Mining, Austar Coal Mine, Quorrobolong* prepared by Umwelt (Australia) Pty Ltd has been designed to particularly monitor effects on the Riverflat Eucalypt Forest on the Coastal Floodplains Endangered Ecological Community (EEC) from subsidence impacts, including from Longwall A5a.

There have been three longwall panels extracted in the Stage 2 area with no subsidence related negative effects identified by ecological monitoring. The monitoring program will be continued during the extraction of Longwall A5a.

Austar accepts OEH comments in relation to offsetting principals, however would comment that the recommendation that "adaptive mine management" be implemented in the event that the proposed development results in harm to any threatened biodiversity, to stop further harm from occurring will have practical difficulties and uncertainties in implementation which could render it problematic and would pose a great deal of risk to the Austar development.

3. *"The EPA recommends that the monitoring program should also include regular monitoring for myrtle rust and development of associated mitigation, management, hygiene and reporting measures, should myrtle rust be detected."*

Response

The *Ecological Monitoring Program for Stage 2 Longwall Mining, Austar Coal Mine, Quorrobolong* already notes introduced weed species within it's scope, and can include monitoring for Myrtle Rust in the Stage 2 area if required. Landowners where Exotic Rust Fungi is identified will be notified of it's presence, and of the availability DTIRIS information regarding hygiene practices. In the instance that Austar is the landowner, Austar will meet it's obligations to report and manage in consultation with DTIRIS / OEH.

4. *"ATTACHMENT A- EPA Recommended conditions of approval- Austar Coal Mine modification to longwall panel A5a."*

Response

The majority of recommended conditions of approval appear reasonable, subject to gaining access to private landholdings for monitoring. The exception is a recommended condition regarding "adaptive mine management" which may have practical difficulties & uncertainties in implementation that could render it problematic and would pose a great deal of risk to the Austar development. Whilst Austar does not accept this condition in it's current form, Austar recognises the underlying principles it is expressing. Austar is concerned that this could become a general condition of consent to all projects without consideration of impact assessment.

2.3 Department of Primary Industries – Office of Water Submission (Mark Mignanelli, Manager Major Projects, Mines and Assessment)

1. *“Yancoal Austar is obliged to avoid, as far as practicable, inducing erosion or degradation on Quorrobolong or Cony Creeks, which form part of the Upper Wollombi Brook Water Source. This requires verification of the subsidence impacts upon Cony and Quorrobolong Creeks, using a monitoring and management process outlined in the Office of Water's previous correspondence.”*

Response

Austar undertakes monitoring of subsidence, ecology and stream condition in accordance with established approved monitoring programs in the Stage 2 area (Subsidence Monitoring Program per the SMP, Stage 2 Ecology Monitoring Program (including bank stability observations), Site Water Management Plan (surface water quality monitoring, creek photo point monitoring, alluvial and sandstone groundwater monitoring).

2. The NSW Office of Water outlined monitoring and management recommendations which are recommended for inclusion in Austar's project approval relating to surface water and groundwater. The recommendations for monitoring and management of Quorrobolong and Cony Creeks – Longwalls A3 to A5a were included as Attachment A.

Response

Austar prepared an integrated surface and ground water monitoring program for mining in the Stage 2 area as a part of its update to the Austar Coal Mine Site Water Management Plan prior to the commencement in the Stage 2 area. This plan was submitted to the DoP, the Department of Environment and Climate Change (now the Office of Environment and Heritage) and the Department of Water and Energy (DWE, now a part of the Department of Primary Industries and known as the Office of Water) in March 2009. This plan has been implemented in the creeks in the Stage 2 area, including ahead of the approved LWA5a, and will continue to be implemented.

In addition, stream bank stability monitoring is undertaken in conjunction with ecological monitoring in the riparian zone of the Cony / Quorrobolong Creek areas for Stage 2 area which has not shown any change to creek stability in the mining area.

In consultation with NOW ahead of the Longwall A5a modification approval in 2010, Austar discussed an extension to the alluvial groundwater monitoring program with locations to allow monitoring and analysis of lateral alluvial movements in the Stage 2 area. These alluvial monitoring bores were installed and licenced with NOW in July 2011. Results of monitoring and trend analysis from these and existing bores will be provided to NOW in subsequent Annual Environmental Management Reports. The location of the additional alluvial groundwater bores are shown in **Figure 2**.

3 LANDOWNER SUBMISSIONS

3.1 F.J & N Muxlow (388 Quorrobolong Road, Quorrobolong)

1. Mr and Mrs Muxlow remain concerned with issues raised in previous submissions for DA29/95 and various modifications from time to time. The issues being, the undermining of the property by Austar, and loss in property value as a result of mining.

Response

Concern that mining will impact on property values is a common reaction to any proposed development, including mining. These concerns are based on a perception that mining in Stages 2 and 3 will have an adverse impact on the land and water resources and hence will result in reduced property value. Detailed assessment set out in the Longwall A5a EA and as previously set out in the Stage 3 EA has indicated that the approved development will not have a significant impact on the land or water resources and therefore will not reduce the value of properties. Subsidence

assessment and flooding assessment of the proposed extension of the Longwall A5a will not result in change to previous impact assessments.

There is no research or evidence to suggest that property values are depressed by the existence or otherwise of mining and in many instances it can be demonstrated that land values surrounding new mining developments have increased.

Property values are impacted by a wide range of factors including:

- the state of economy;
- availability of credit;
- location to employment and services; and
- aesthetic features such as rural amenity.

Approval of mining under properties will not affect rural amenity and locational attributes of properties within the development area.

As has been noted previously in response to community concerns regarding property value, protection for improvements on land is given via a process under the *Mine Subsidence Compensation Act 1961* whereby property owners may be eligible for compensation from the Mines Subsidence Board (MSB) in the event of impact to improvements from subsidence. It is noted that mining of LWA5a, the LWA5a extension (the subject of this application), and the proposed Stage 3 modification project is not expected to cause noticeable impact to the structures on the Muxlow property. These protections underpin property values.

In addition, Austar Coal has offered property owners with coal resources under their properties that are proposed to be mined an opportunity to participate in its 'Sharing the Benefits' policy. This policy allows landholders to opt-in to an agreement for a fixed \$ per tonne payment for each and every tonne of coal mined beneath their landholding. This initiative is voluntary and provides for a commercial return that underpins and can potentially add to the property value.

The voluntary opt-in agreement does not remove the existing protections for property owners for compensation under the *Mine Subsidence Compensation Act* concerning impact to improvements from subsidence.

As discussed at a community meeting during late 2009 and again in 2011, Austar personnel are available to discuss proposed mining and the Sharing the Benefits policy with potential buyers of properties within the Stage 2 and Stage 3 mining areas, or real estate agents acting on their behalf. Austar has directly consulted with leading Real Estate Agents in the Cessnock area to provide information regarding the location of mining and potential impacts to open a line of communication for potential buyers through these real estate agent. Austar welcomes and encourages any opportunities to meet with interested or concerned parties to ensure that the details of the impact assessments undertaken within the Stage 2 and Stage 3 mining areas and the Sharing the Benefits policy are clearly explained.

2. *"The value of the property as a poultry farm has all but gone....This extra new area proposed in (DA29/95 MOD5) to be mined under our property will certainly stop even the slightest chance of ever a poultry farmer entertaining the idea of purchasing the property. Even selling for hobby farming uses at greatly reduced value will certainly be a very hard proposition."*

Response

The Muxlow dwelling and poultry sheds are outside the predicted 20mm subsidence contour for the approved Stage 2 mine plan, the proposed Longwall A5a varied commencing end mine plan, and the

proposed Stage 3 modification mine plan (refer **Figure 1**). The mining operation therefore has not affected the operation of the poultry sheds to date, and also predicted subsidence from underground mining should not affect operation of the sheds in future (should the Stage 3 modification be approved).

As indicated in the Muxlow submission, Austar has consulted with prospective purchasers of the property as a poultry farm to provide information on mining operations and predicted impacts, and also details of the Sharing the Benefits policy. Austar continues to be available to provide detail of the mining operation to prospective purchasers.

3.2 Mark Newton & Carmel Bradstreet (282 Quorrobolong Road, Quorrobolong)

1. Concern was raised regarding the confidence in predictions relating to subsidence

Response

Subsidence monitoring in the Stage 1 and Stage 2 areas have confirmed that maximum prediction conventional subsidence is an appropriate prediction with which to assess impacts, with monitoring results being less than maximum predicted subsidence.

2. *Is it likely that this new proposal will have any impact on the amount or degree of flow of water in Cony and Quorrobolong Creeks?*

Response

Monitoring of subsidence, surface water, and alluvial groundwater for sections of Quorrobolong/Cony Creek already subject to underground mining in the Stage 2 area has indicated no impact from underground mining on surface or ground water systems. The point of extraction of Newton-Bradstreet is upstream and beyond the predicted 20mm subsidence contour. The predictions of the original Stage 2 A5a flood assessment, and the additional flood assessment undertaken for the A5a extension (refer **Attachment**) show no alternate flow paths that would alter flow regimes in the creek, and no significant change to surface water ponding after the subsided landform, compared to the pre mining landform. Consequently, there should be no significant impact on the amount or degree flow of water in either Cony or Quorrobolong Creeks.

3. *What compensation will be provided if there is any variation to the existing flow/amount of water*

Response

In the absence of the execution of a Sharing the Benefits Access and Compensation Agreement, the compensable loss provisions of the Mining Act 1992 will apply.

CLOSURE

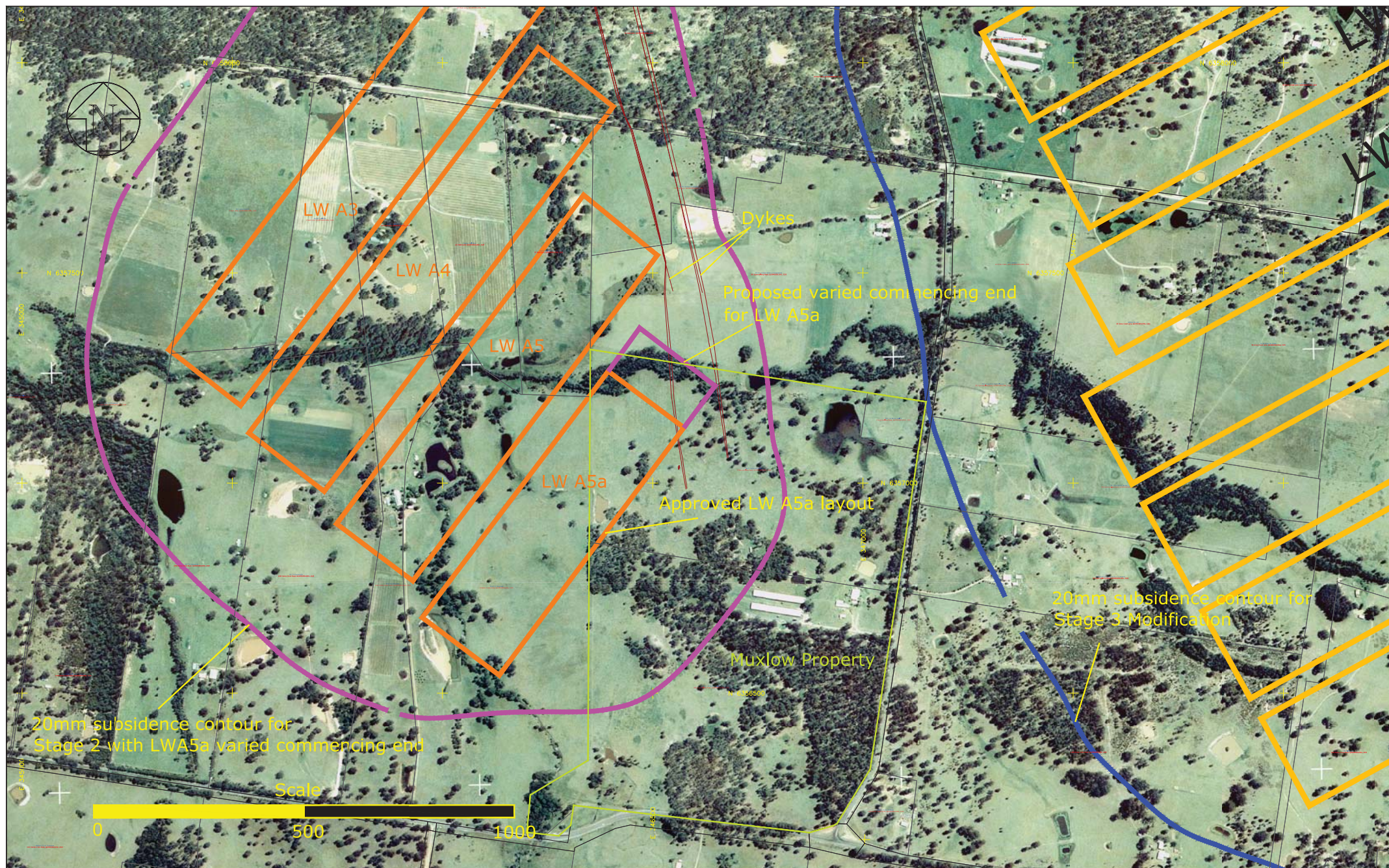
I trust the information provided is suitable to progress our modification application. If you require any further information in regard to this matter, please do not hesitate to contact me on 02 4993 7334.

Yours faithfully,

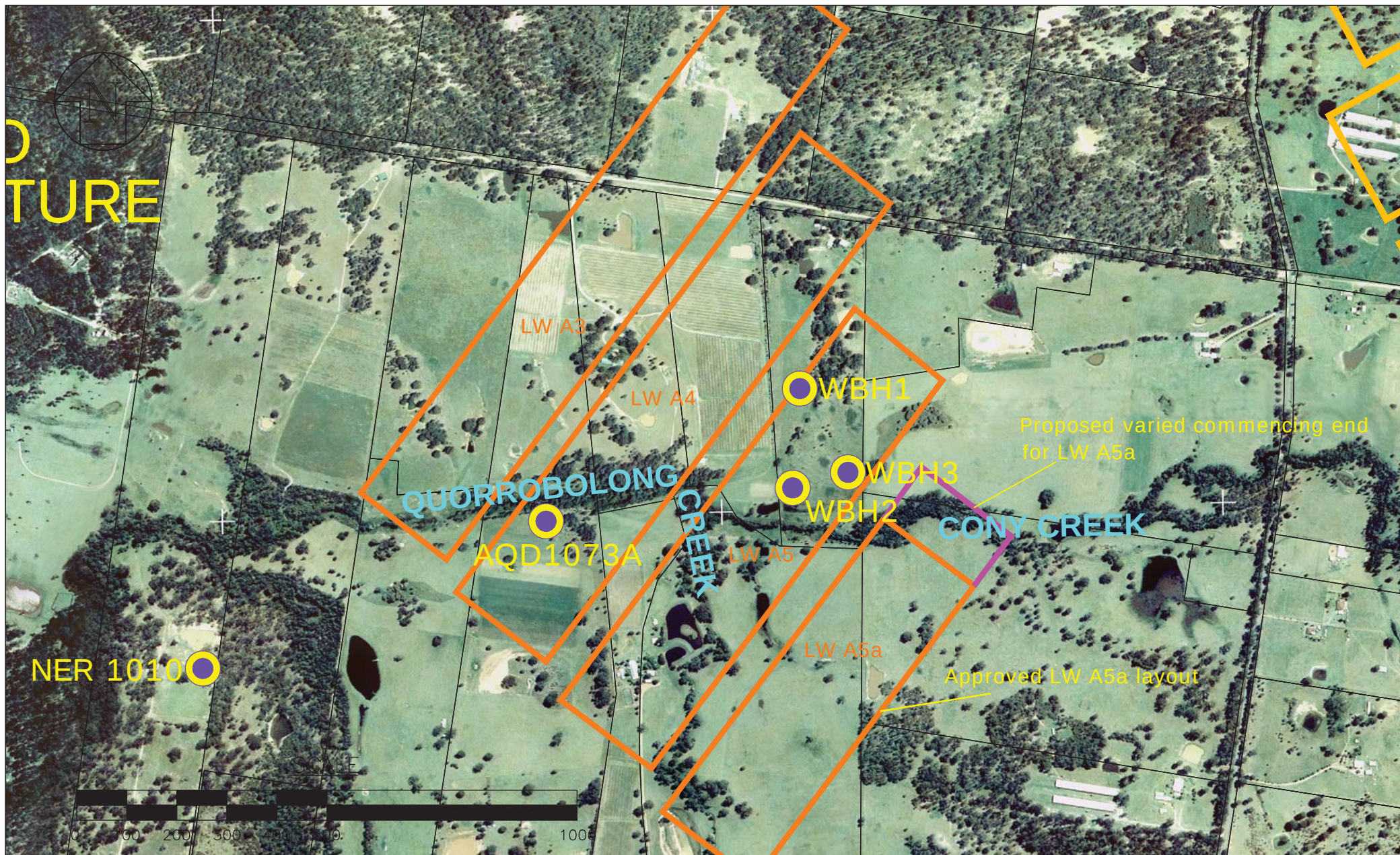


Gary Mulhearn
Environment & Community Manager
Austar Coal Mine

Encl Figure 1: Extent of Stage 2 Mod 5 and Stage 3 Modification Subsidence and Muxlow Property
 Figure 2: Groundwater monitoring bores including new alluvial monitoring bores (WBH1 to WBH3)
 Attachment: Longwall A5a Extension - Flood and Drainage Assessment (Umwelt, 2012)



DRAWN G. MULHEARN		AUSTAR COAL MINE		YANCOAL AUSTRALIA PTY LTD	
REVISION DATE: 5/3/2012		TITLE FIGURE 1: EXTENT OF STAGE 2 MOD 5 and STAGE 3 MODIFICATION SUBSIDENCE AND MUXLOW PROPERTY			
CHECKED					
APPROVED		SCALE Refer Scale Bar	DRAWING No. Stage2Mod5_RTSubmissionsFig1		 AUSTAR COALMINE



NER 10100 Groundwater Monitor

DRAWN

G. Mulhearn

DATE

5/3/2012

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APPROVED

TITLE

FIGURE 2: GROUNDWATER MONITORING BORES INCLUDING NEW ALLUVIAL MONITORING BORES (WBH1 TO WBH3)

SCALE

Refer to Scale Bar

DRAWING No.

Stage2Mod5_RTSubmissionsFig2

A3

AUSTAR COAL MINE



Austar Coal Mine Pty Ltd

Longwall A5a Extension Flood and Drainage Assessment

March 2012



Longwall A5a Extension Flood and Drainage Assessment

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Austar Coal Mine Pty Ltd

Project Director:	Catherine Pepper		
Project Manager:	Dr Adam Wyatt		
Report No.	2274/R80/Final	Date:	March 2012



2/20 The Boulevard
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

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1.0 Introduction

1.1 Background

Austar Coal Mine Pty Ltd (Austar) operates the Austar Coal Mine, an underground mine located approximately 10 kilometres south of Cessnock in the lower Hunter Valley of NSW. The mine is an aggregate of the former Ellalong, Pelton, Cessnock No. 1 and Bellbird South Collieries and is located in the South Maitland Coalfields (refer to **Figure 1.1**). Austar has approval to carry out underground mining in three stages. Mining of Stage 1 is complete. Stage 2 was approved in June 2008 to allow Longwall Top Coal Caving (LTCC) mining methods to be adopted. An extension to Stage 2 was approved in December 2010 to include an additional longwall, known as Longwall A5a.

Austar now proposes to modify the Stage 2 mine plan by increasing the length of Longwall A5a (refer to **Figure 1.2**) by approximately 125 metres.

The Longwall A5a extension is located within the catchment area of Cony Creek, which form part of the Quorrobolong Creek, Congewai Creek and Wollombi Brook drainage systems. The location of the Stage 2 mining area, including the modification area, within the Quorrobolong Creek and Cony Creek catchments is shown on **Figure 1.2**.

1.2 Scope of Assessment

The primary aims of this flood and drainage assessment are to determine how the flooding and surface drainage regimes might change with the underground mining of the proposed Longwall A5a extension, in comparison to the previously approved impacts for underground mining of the Stage 2 including the original Longwall A5a extent.

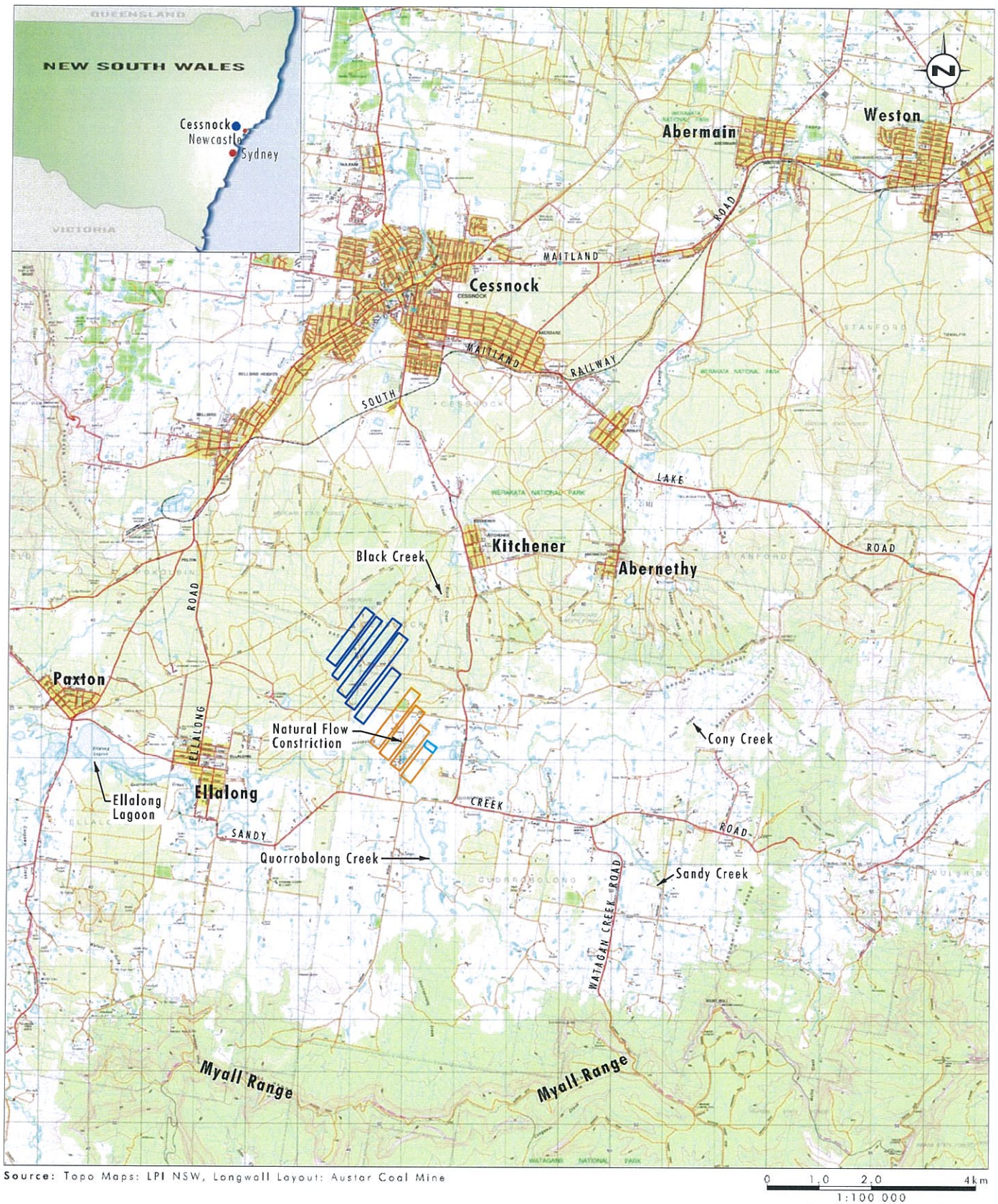
This report has been prepared to support a Statement of Environmental Effects (SEE) that assesses the potential environmental impacts of the proposed Longwall A5a extension, and also to support a variation application to the approved Subsidence Management Plan for Longwall A5a.

1.3 Modelling Approach

The two-dimensional (2D) hydrodynamic model previously developed to describe the flooding behaviour of the study area was used to assess the potential impacts of underground mining of the Longwall A5a extension. The development of this model is detailed fully in previous reports, being *Flooding Assessment: Longwalls A3, A4 and A5* (Umwelt 2007) and *Flood and Drainage Assessment: Stage 3* (Umwelt 2008).

The previously developed flood model was modified to reflect the predicted changes to the landform due to mine subsidence and was used to assess the flood impacts associated with the proposed Longwall A5a extension.

The inflows, boundary conditions, roughness characteristics and mesh structure used for the previous studies (Umwelt 2007; Umwelt 2008; Umwelt 2010; Umwelt 2011) for the 100 year Average Recurrence Interval (ARI) and 1 year ARI storm events were used in the flood modelling for this flood and drainage assessment.



Legend

- ▬ Layout for Stage 1 Longwall Panels
- ▬ Layout for Stage 2 Longwall Panels
- ▬ Proposed Modification

FIGURE 1.1

Locality Plan



Source: Longwall Layout: Austar Coal Mine, Aerial Photography: AAM Hatch 2006
Note: Dwellings only shown for Flood model extent

Legend
 Layout for Stage 2 Longwall Panels
 Proposed Modification
 Building
 Dwelling
 Catchment Boundary

A01a Dwelling Reference Number

FIGURE 1.2
Catchment Context

Results from the previous assessment work for the approved Stage 2 mining operations (Umwelt 2010) for the modelled maximum flood depths and velocities for the 100 year ARI storm event are shown on **Figures 1.3 and 1.4** respectively.

A series of models were run to generate flood characteristics for the predicted subsidence scenarios for the 100 year and 1 year ARI storm events with the proposed Longwall A5a extension.

In this report the different mine stages are referred to as follows:

- Stage 2 approved (approved mine plan (December 2010) consisting of Longwalls A3 to A5a); and
- Longwall A5a extension (approved mine Stage 2 plan with proposed extension of Longwall A5a).

After running the flood models the output data from the models was loaded into a database. From this database the peak flood depths, elevations and velocities were extracted and flood hazard categories generated according to Appendix G of the *Floodplain Development Manual* (NSW Government, 2005).

Based on the modelling outcomes the following potential impacts of the proposed Longwall A5a extension were assessed (refer to **Section 3.0**):

- freeboard at dwellings;
- flood hazard categories for dwellings and private property access routes; and
- flood regimes, including impacts on flood prone land, creek channels, flow paths and remnant ponding.

2.0 Subsidence Predictions

To assess the potential impact of mine subsidence on the flooding response, subsidence predictions prepared by MSEC (2011) for the proposed Longwall A5a extension underground mining operations were used. The subsidence predictions included the predicted subsidence for the mining operations for the proposed Longwall A5a extension. The subsidence predictions provided by MSEC (2011) were used to modify the existing land surface model used within the 2D hydrodynamic flood model.

3.0 Model Outcomes

The potential impacts of underground mining of the proposed Longwall A5a extension were determined and the outcomes of the assessment are summarised in **Sections 3.1.1 and 3.1.2**.

Figures 3.1 and 3.2 describe the modelled maximum flood depths and velocities for the 100 year ARI storm event with the predicted subsidence for the proposed Longwall A5a extension. **Figure 3.3** shows a comparison of flow hydrographs derived for the 100 year storm event downstream of the Stage 2 approved mining area and the Longwall A5a extension. **Figure 3.4** shows the potential changes to remnant ponding as a result of the proposed Longwall A5a extension compared to the Stage 2 approved mine plan.

Legend

 Range [0.300 - 1.100]

 Range [1.100 - 1.300]

 Range [1.300 - 1.500]

 Range [1.500 - 1.700]

 Range [1.700 - 1.900]

 Range [1.900 - 2.100]

 Range [2.100 - 2.300]

 Range [2.300 - 2.500]

 Range [2.500 - 2.700]

 Range [2.700 - 2.900]

 Range [2.900 - 3.100]

 Range [3.100 - 3.300]

 Range [3.300 - 3.500]

 Range [3.500 - 3.700]

 Range [3.700 - 3.900]

 Range [3.900 - 4.100]

 Range [4.100 - 4.300]

 Range [4.300 - 4.500]

 Range [4.500 - 4.700]

 Range [4.700 - 4.900]

 Range [4.900 - 5.100]

 Range [5.100 - 5.300]

 Range [5.300 - 5.500]

 Range [5.500 - 5.700]

 Range [5.700 - 5.900]

 Range [5.900 - 6.100]

 Range [6.100 - 6.300]

 Range [6.300 - 6.500]

 Range [6.500 - 6.700]

 Range [6.700 - 6.900]

 Range [6.900 - 7.100]

 Range [7.100 - 7.300]

 Range [7.300 - 7.500]

 Range [7.500 - 7.700]

 Range [7.700 - 7.900]

 Range [7.900 - 8.100]

 Range [8.100 - 8.300]

 Range [8.300 - 8.500]

 Range [8.500 - 8.700]

 Range [8.700 - 8.900]

 Range [8.900 - 9.100]

 Range [9.100 - 9.300]

 Range [9.300 - 9.500]

 Range [9.500 - 9.700]

 Range [9.700 - 9.900]

 Range [9.900 - 10.100]

 Range [10.100 - 10.300]

 Range [10.300 - 10.500]

 Range [10.500 - 10.700]

 Range [10.700 - 10.900]

 Range [10.900 - 11.100]

 Range [11.100 - 11.300]

 Range [11.300 - 11.500]

 Range [11.500 - 11.700]

 Range [11.700 - 11.900]

 Range [11.900 - 12.100]

 Range [12.100 - 12.300]

 Range [12.300 - 12.500]

 Range [12.500 - 12.700]

 Range [12.700 - 12.900]

 Range [12.900 - 13.100]

 Range [13.100 - 13.300]

 Range [13.300 - 13.500]

 Range [13.500 - 13.700]

 Range [13.700 - 13.900]

 Range [13.900 - 14.100]

 Range [14.100 - 14.300]

 Range [14.300 - 14.500]

 Range [14.500 - 14.700]

 Range [14.700 - 14.900]

 Range [14.900 - 15.100]

 Range [15.100 - 15.300]

 Range [15.300 - 15.500]

 Range [15.500 - 15.700]

 Range [15.700 - 15.900]

 Range [15.900 - 16.100]

 Range [16.100 - 16.300]

 Range [16.300 - 16.500]

 Range [16.500 - 16.700]

 Range [16.700 - 16.900]

 Range [16.900 - 17.100]

 Range [17.100 - 17.300]

 Range [17.300 - 17.500]

 Range [17.500 - 17.700]

 Range [17.700 - 1

FIGURE 1.3
100 year ARI Storm:
Maximum Modelled Water Depths for
Predicted Subsidence (Stage 2 Approved)



Base Source: AAM, Hertz, 2006
Source: Longwall Layout: Auster Coal Mine
Note: Dwellings only shown for flood model extent

Legend

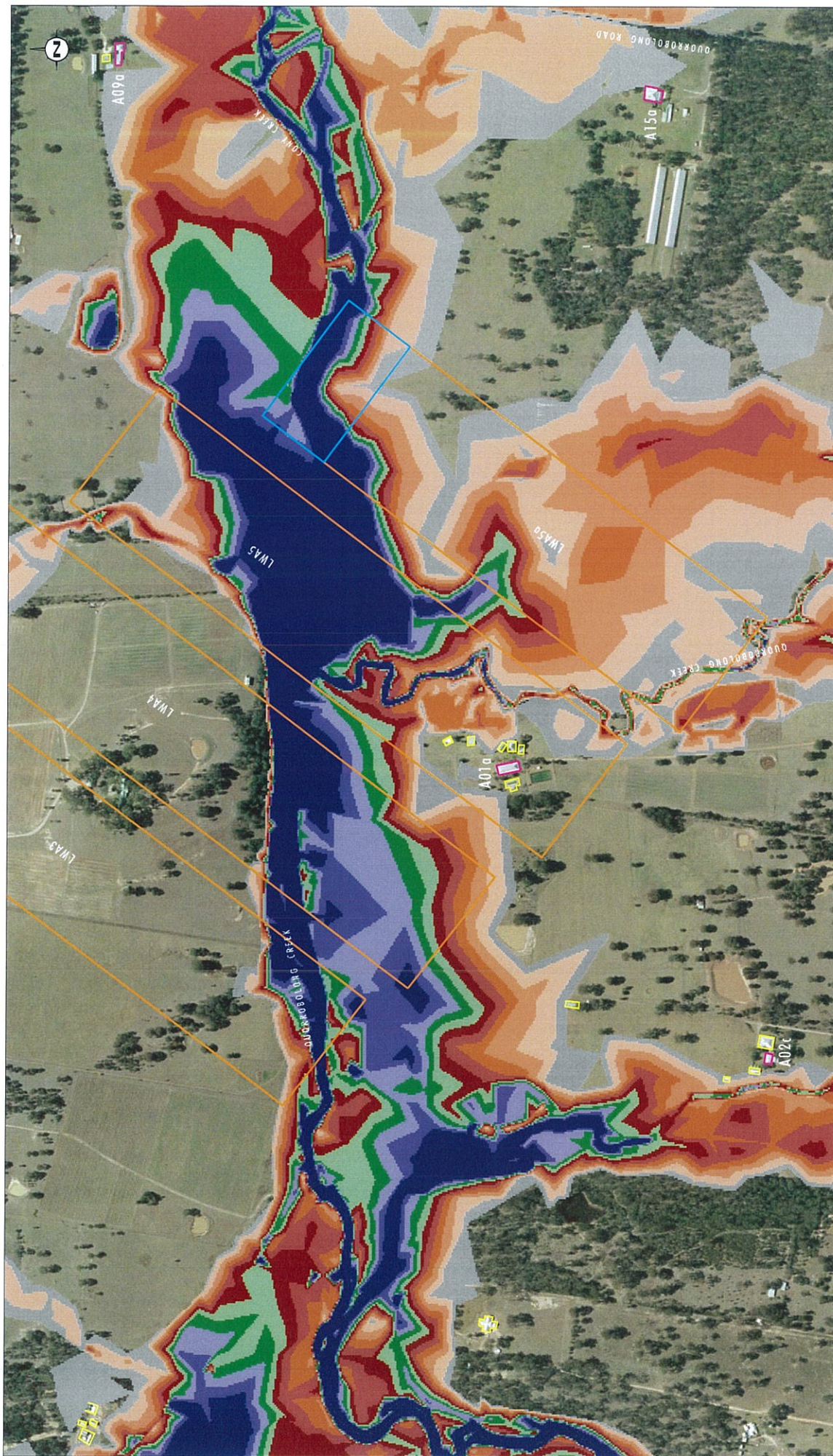
- Layout for Stage 2 Longwall Panels
- Proposed Modification
- Building
- Dwelling
- A01a Dwelling Reference Number

Velocity (m/s)

- Range [0.100 : 0.250]
- Range [0.250 : 0.500]
- Range [0.500 : 0.750]
- Range [0.750 : 1.000]
- Range [1.000 : 1.250]
- Range [1.250 : 1.500]
- Range [1.500 : 1.750]
- Range [1.750 : 2.000]
- Range [2.000 : 2.250]
- Range [2.250 : 3.500]

FIGURE 1.4

100 year ARI Storm:
Maximum Modelled Water Velocities for
Predicted Subsidence (Stage 2 Approved)



Base Source: AAM Harch, 2006
Source: Longwall Layout: Auster Coal Mine
Note: Dwellings only shown for flood model extent

Legend

- Layout for Stage 2 Longwall Panels
- Proposed Modification
- Building
- Dwelling
- A01a Dwelling Reference Number

Water Depth (m)

- Range [0.001 : 0.100]
- Range [0.100 : 0.300]
- Range [0.300 : 0.500]
- Range [0.500 : 0.700]
- Range [0.700 : 0.900]

- Range [0.900 : 1.100]
- Range [1.100 : 1.300]
- Range [1.300 : 1.500]
- Range [1.500 : 1.700]
- Range [1.700 : 1.900]
- Range [1.900 : 2.100]

FIGURE 3.1

100 year ARI Storm:
Maximum Modelled Water Depths for
Predicted Subsidence (Longwall A5a Extension)

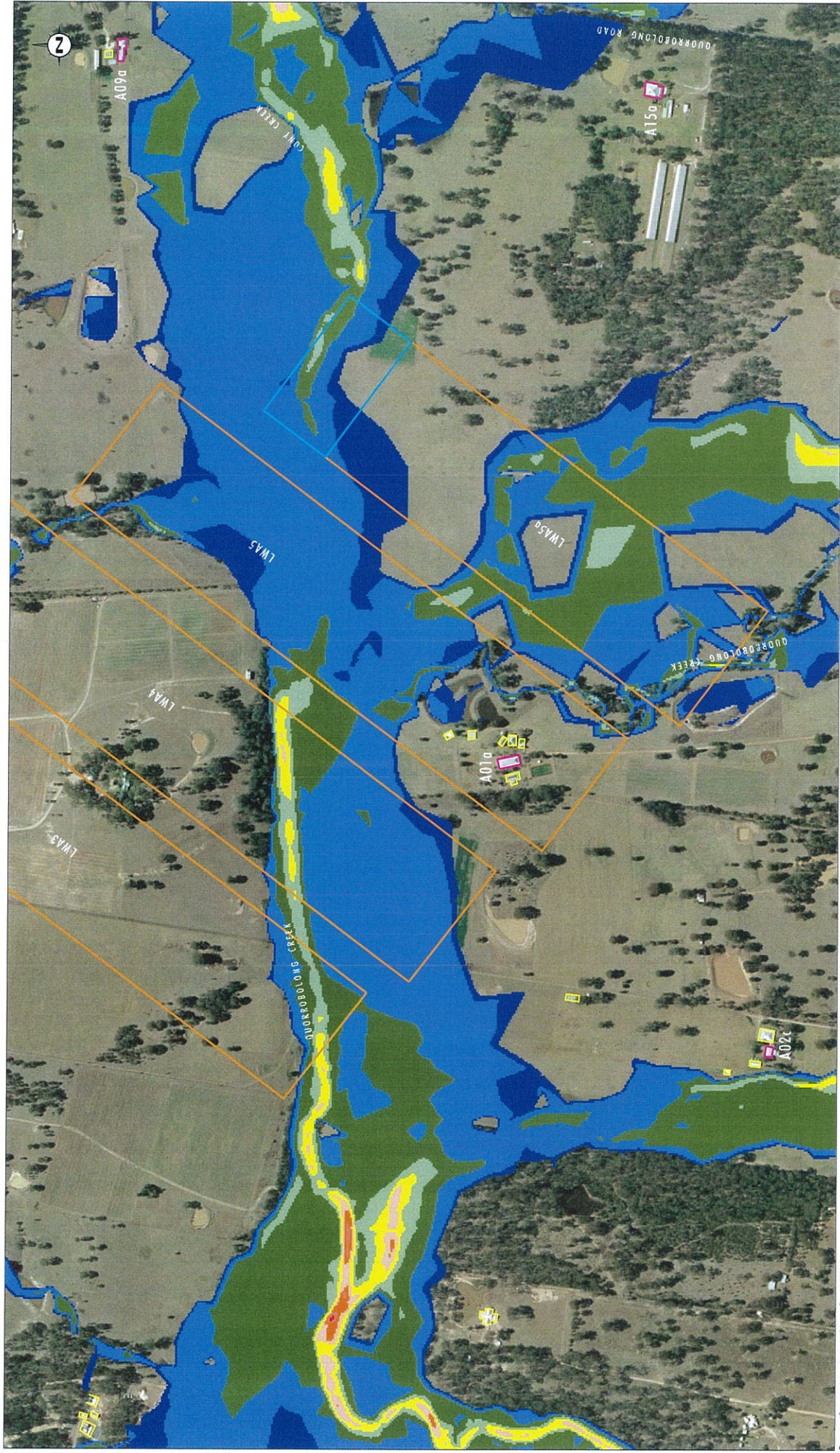


FIGURE 3.2
 100 year ARI Storm:
 Maximum Modelled Water Velocities for
 Predicted Subsidence (Longwalls A5a Extension)

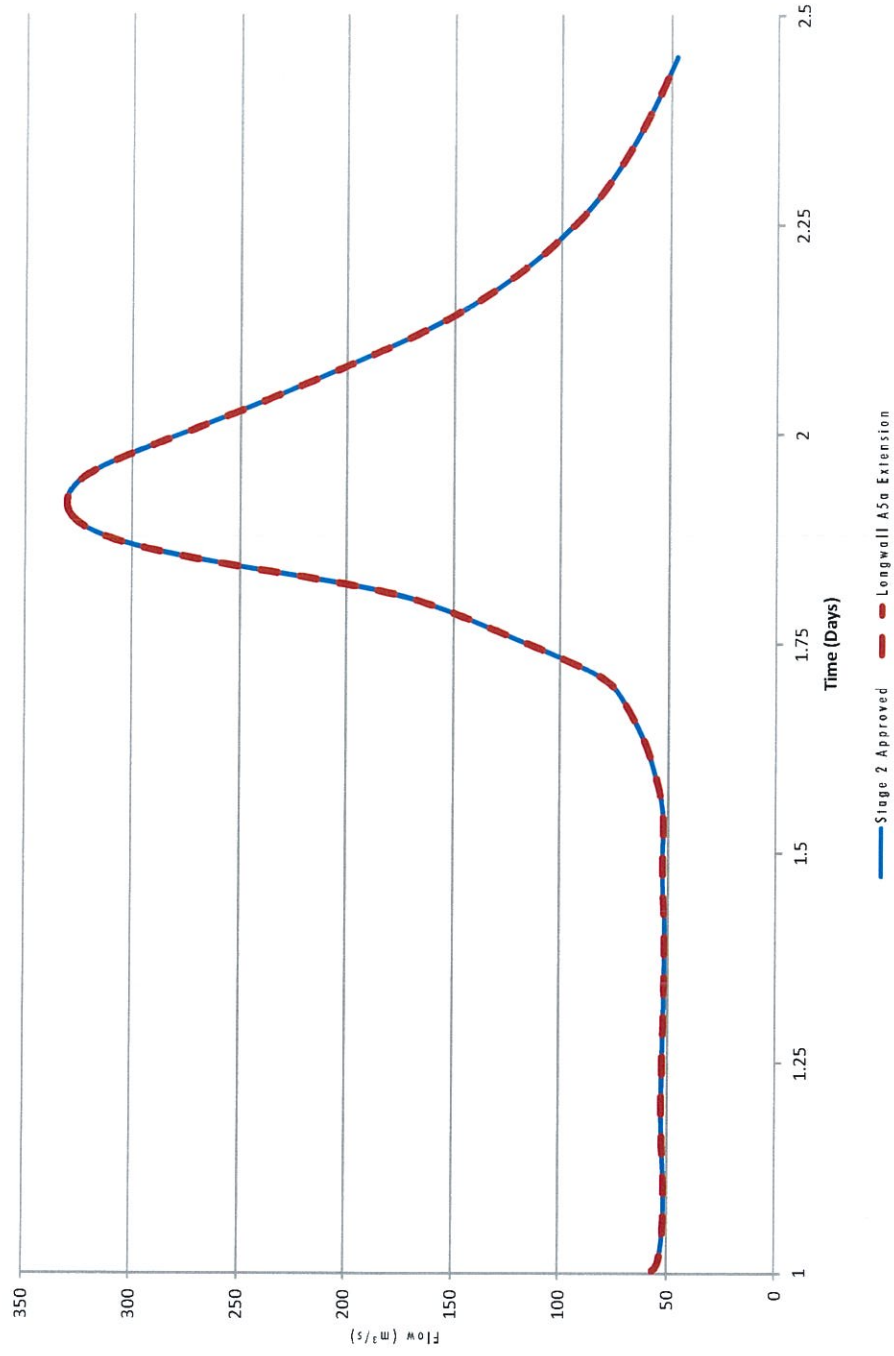


FIGURE 3.3

Modelled 100 year Flow Hydrographs
Downstream of Stage 2



Legend

- Layout for Stage 2 Longwall Panels
- Proposed Modification
- Building
- Dwelling
- A01a Dwelling Reference Number

Remnant Ponding

- Predicted Subsidence Stage 2 Approved
- Predicted Subsidence Longwall A5a Extension

FIGURE 3.4

Remnant Ponding

3.1 Predicted Impacts of Longwall A5a Extension

3.1.1 Flood Depths

The modelled maximum flood depths in the area surrounding Stage 2 as a consequence of the proposed Longwall A5a extension is shown in **Figure 3.1**. Comparing the results in **Figure 3.1** with the previously approved Stage 2 results (refer to **Figure 1.3**), it can be seen that there is little change in the modelled flooding response as a consequence of the proposed Longwall A5a extension outside of the immediate Stage 2 area. The modelling indicated that for the 100 year ARI event, the largest difference in maximum flood depths is an approximately 300 millimetre increase in flood depth within Cony Creek, upstream of the Cony Creek and Quorrobolong Creek confluence, over a section of Longwall A5 and Longwall A5a. The modelling indicated no increase in inundated area or impacts to flood levels at dwellings or access roads are expected during the 100 year storm event as a result of the proposed Longwall A5a extension.

The modelling indicates that the predicted subsidence associated with the Longwall A5a extension will not increase flood depths during the 100 year ARI storm event at dwellings within the Quorrobolong Valley compared to the previously modelled impacts for the approved Stage 2 (refer to **Figure 1.3**).

3.1.2 Flow Velocities

The modelled maximum flow velocities associated with the Longwall A5a extension are shown in **Figure 3.2**. A comparison of the results for the Longwall A5a extension in **Figure 3.2** to the previously approved Stage 2 maximum flow velocities (refer to **Figure 1.4**) indicates generally minimal changes in flow velocities in the vicinity of Stage 2. The modelling indicates a slight reduction in maximum flow velocities in Quorrobolong Creek, especially in the vicinity of the chain pillar between Longwalls A5 and A5a. Downstream of Stage 2, there appears to be no discernable change in the modelled maximum flow velocities between the previously approved Stage 2 and proposed Longwall A5a extension mine plans.

Analysis of the modelling results for Cony Creek and Quorrobolong Creek indicate that maximum velocities will remain within non-scouring levels for both the 100 year and 1 year ARI storm events following the Longwall A5a extension and as a result no significant changes due to velocity induced scouring or erosion are predicted.

3.1.3 Flood Hazard Categories

In order to assess the potential flood hazards associated with underground mining of the Stage 2 modification changes to the flood hazard categories outlined in Appendix G of the *Floodplain Development Manual* (2005) were utilised. The four flood hazard categories, in order of increasing hazard, are:

- unclassified;
- vehicles unstable;
- wading unsafe (and vehicles unstable); and
- damage to light structures.

Modelling indicated that negligible changes to the maximum flood hazard categories along access routes to dwellings would occur with the predicted subsidence for the proposed Longwall A5a extension compared to the predicted subsidence for the approved Stage 2.

Modelling also indicated that no changes to the maximum flood hazard categories at dwellings would occur with the predicted subsidence for the proposed Longwall A5a extension compared to the predicted subsidence for the approved Stage 2.

3.1.4 Duration of Flooding and Remnant Ponding

Flood model hydrographs immediately downstream of the Stage 2 mine area (refer to **Figure 3.3**) as a result of the proposed Longwall A5a extension are not discernibly different to the flood hydrographs derived previously with the predicted subsidence for the approved Stage 2 mine plan. The negligible change to the hydrographs indicate that the proposed Longwall A5a extension will have negligible effect on flood duration downstream of the approved Stage 2 mining area during the 100 year ARI storm event.

The analysis indicates that the predicted subsidence as a result of the proposed Longwall A5a extension resulted in minor changes to the remnant surface ponding (refer to **Figure 3.4**). From **Figure 3.4**, it can be seen that most of the small increases in predicted ponded areas are limited to an area within the vicinity of Longwall A5, north of Cony Creek. The increased remnant ponding areas are unlikely to result in significant changes to property access in the area compared to the previously approved Stage 2 impacts.

3.1.5 Stream Flow and Channel Stability

The flood modelling analysis indicates that the proposed Longwall A5a extension will not have a significant impact on the flow regime of the Cony Creek and Quorrobolong Creek systems, with no discernable changes predicted in runoff regimes and peak discharges when compared to the approved Stage 2 impacts.

Based on the subsidence predictions (refer to **Section 2.0**), the predicted subsidence associated with the proposed Longwall A5a extension will result in maximum changes in grade of Cony Creek of 0.2 per cent in the vicinity of the upstream edge of the proposed Longwall A5a extension, with no discernable changes in the grade of Quorrobolong Creek when compared to the approved Stage 2 impacts.

As the predicted changes in in-channel grade are small and are considered to lie within the natural variations in the grade of the creek lines of the Quorrobolong Valley, it is considered that the proposed Longwall A5a extension will not significantly alter the flow capacity or stream velocities within the existing channels when compared to the approved Stage 2 impacts. It is also considered that there is minimal potential for channel realignment to occur as a result of the proposed Longwall A5a extension.

The potential to increase erosion on the landform is also expected to be minimal due to the relatively small predicted changes in landform grades combined with the high level of groundcover limiting the amount of exposed soils that exist in the area.

4.0 Summary and Conclusions

Analysis of the predicted subsidence associated with the proposed Longwall A5a extension indicates that the extension of Longwall A5a would have only minor impacts on the flood response downstream of the Stage 2 mining area, compared to the approved Stage 2 impacts. The main area of influence of the proposed Longwall A5a extension on the flood response was predicted to be within the immediate vicinity of Longwall A5a, with increases in flood depth modelled for the sections of Cony Creek upstream of the confluence with Quorrobolong Creek, relative to the previous modelled results for the approved Stage 2. Whilst the modelling indicated an increase in flood depth in the vicinity of the proposed

Longwall A5a extension, the predicted increase is due to the subsided landform within the area of Coney Creek and not a result of an increase in the predicted maximum flood elevation in the area (i.e. the depth of the flood water has increased however the elevation of the flood water within the landscape is relatively unchanged). The minimal changes to the modelled maximum flood elevation is reflected in the predicted flood extents, which differ little between the approved and proposed Longwall A5a extension.

The modelling indicated no increase in inundated area or impacts to flood levels at dwellings or access roads are expected during the 100 year storm event as a result of the proposed Longwall A5a extension.

The modelled changes to flood hazard categories and flood extents as a result of the proposed underground mining of the proposed Longwall A5a extension were negligible. No access routes to private properties were found to be affected by the predicted subsidence associated with the proposed underground mining of the proposed Longwall A5a extension.

The predicted subsidence associated with the proposed Longwall A5a extension was predicted to result in very minor localised changes to the remnant ponding in the immediate area to be undermined. Areas of additional remnant ponding were predicted to be limited to a section of Coney Creek overlying Longwall A5. The additional predicted remnant ponding was limited to existing flow paths.

5.0 References

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**Umwelt (Australia) Pty Limited
2/20 The Boulevard
PO Box 838
Toronto NSW 2283**

**Ph. 02 4950 5322
Fax 02 4950 5737**