Austar Coal Mine Pty Limited

REPORT

on

THE EFFECTS OF THE PROPOSED MODIFICATIONS TO LONGWALLS A4 AND A5 IN STAGE 2 AT AUSTAR MINE ON THE SUBSIDENCE PREDICTIONS AND IMPACT ASSESSMENTS

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Background reports available at *www.minesubsidence.com:-*

Introduction to Longwall Mining and Subsidence (Revision A)
General Discussion of Mine Subsidence Ground Movements (Revision A)
Mine Subsidence Damage to Building Structures (Revision A)

EXECUTIVE SUMMARY

Austar Coal Mine (Austar) is proposing to extract Longwalls A3 to A5 using Longwall Top Coal Caving mining techniques. The predictions and impact assessments for the proposed Longwalls A3 to A5 were provided in Report No. MSEC275 (Revision C), which was issued on the 2nd February 2007 and supported the SMP Application for these longwalls.

Austar now proposes to modify Longwalls A4 and A5, from those which were indicated in the SMP Application, by increasing the longwall void widths by 10 metres and by increasing the width of the chain pillar between these longwalls by 15 metres. Austar also proposes to shorten the overall length of Longwall A5 by 25 metres. The relative locations of Longwalls A4 and A5, based on the layout indicated in the SMP Application and based on the proposed modified layout, are shown in Drawing No. MSEC391-01 in Appendix A.

The predicted total systematic subsidence contours resulting from the extraction of Longwalls A3 to A5, based on the layout indicated in the SMP Application, are shown in Drawing No. MSEC391-05. The predicted total systematic subsidence contours resulting from the extraction of Longwalls A3 to A5, based on the proposed modified layout, are shown in Drawing No. MSEC391-06.

The maximum predicted total systematic subsidence parameters resulting from the extraction of Longwalls A3 to A5, based on the proposed modified layout, are similar to or slightly less than those based on the layout indicated in Report No. MSEC275 and the SMP Application. That is, the additional subsidence resulting from the proposed increases in void widths of Longwalls A4 and A5 is compensated by the proposed increase in the chain pillar width between these longwalls.

The maximum predicted cumulative systematic subsidence parameters after the extraction of Longwall A4, based on the proposed modified layout, are similar to or up to 5 % greater than those based on the layout indicated in Report No. MSEC275 and the SMP Application. It is noted, however, that the predicted systematic subsidence parameters based on the proposed modified layout also include the effects of the proposed extension to the commencing (north-eastern) end of Longwall A4, which was subjected to a separate modification application.

There are a number of natural features and items of surface infrastructure in the vicinity of Longwalls A4 and A5, including Quorrobolong and Cony Creeks, Nash Lane, 11 kV powerlines, copper telecommunications cables, building structures, farm dams and survey control marks.

The predicted maximum systematic subsidence and valley related movements at these features, based on the proposed modified layout, are similar to those based on the layout indicated in Report No. MSEC275 and the SMP Application. There are some features where the predicted systematic subsidence parameters increase slightly, as the result of the proposed modifications, however, the differences in the predicted movements are in the order of accuracy of the methods of prediction.

The impact assessments and proposed management strategies for the natural features and items of surface infrastructure, based on the proposed modified layout, are the same as those previously provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant changes in the levels of impact on the natural features and items of surface infrastructure resulting from the proposed modifications to Longwalls A4 and A5.

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CHAPTER 1. INTRODUCTION

1.1. Background

Mine Subsidence Engineering Consultants (MSEC) was previously commissioned by Austar Coal Mine (Austar) to undertake subsidence predictions and impact assessments for Longwalls A3 to A5, in support of the SMP Application. Report No. MSEC275 (Revision C) was issued on the 2nd February 2007 on completion of that work. The Department of Primary Industries (DPI) gave Austar first workings approval for Longwall A3 on the 3rd March 2008 and gave Austar approval to mine Longwall A3 on the 3rd February 2009.

Austar previously proposed to modify the length of Longwall A4 by extending the commencing (north-eastern) end by 20 metres. A letter report was issued by MSEC on the 13th October 2008 to support the proposed modification of Longwall A4. The DPI gave Austar first workings approval for Longwall A4 on the 12th November 2008.

Austar now proposes to modify Longwalls A4 and A5, from those which were indicated in the SMP Application and from those approved for first workings on the 12th November 2008, by increasing the longwall void widths, by increasing the chain pillar width between these longwalls and by slightly shortening the overall length of Longwall A5. The relative locations of Longwalls A4 and A5, based on the layout indicated in the SMP Application and based on the proposed modified layout, are shown in Drawing No. MSEC391-01 in Appendix A.

MSEC has now been commissioned by Austar to report on the effects of the proposed modifications to Longwalls A4 and A5 on the predictions and impact assessments previously provided in Report No. MSEC275 and the SMP Application. This report is to support a variation to the SMP Application to be issued by Austar to the DPI.

1.2. Proposed Modifications to Longwalls A4 and A5

Austar is proposing to modify Longwalls A4 and A5 by increasing the longwall void widths by 10 metres and by increasing the width of the chain pillar between these longwalls by 15 metres. Austar is also proposing to shorten the commencing (north-eastern) end and the finishing (south-western) end of Longwall A5 by 10 metres and 15 metres, respectively.

The longwall layout indicated in Report No. MSEC275 and the SMP Application will be referred to as the *SMP Layout* in the remainder of this report. The longwall layout with the proposed modifications to Longwalls A4 and A5, as well as the previous modification to the commencing (north-eastern) end of Longwall A4, will be referred to as the *Modified Layout* in the remainder of this report.

The locations of Longwalls A4 and A5, based on the SMP Layout and based on the proposed Modified Layout, are overlaid in Drawing No. MSEC391-01 in Appendix A. A summary of the dimensions of these longwalls for each of these layouts is provided in Table 1.1.

Table 1.1 Dimensions of Longwalls A4 and A5 Based on the SMP and Modified Layouts

Layout	Longwall	Overall Void Length Including Installation Heading (m)	Overall Void Width Including First Workings (m)	Tailgate Chain Pillar Width (m)
SMP Layout Adopted in Report No. MSEC275	LWA4	1135	225	45
	LWA5	980	225	45
Proposed Modified Layout	LWA4	1155	235	45
	LWA5	955	235	60

The depth of cover to the Greta Seam directly above Longwalls A3 to A5 varies between a minimum of 485 metres, above the finishing (south-western) end of Longwall A3, and a maximum of 530 metres, above the middle of Longwall A4. The seam floor within the proposed mining area generally dips from the north-west to the south-east.

The seam thickness within the proposed mining area of Longwalls A3 to A5 varies between a minimum of 4.8 metres, at the finishing (south-western) end of Longwall A4, and a maximum of 6.8 metres, at the commencing (north-eastern) end of Longwall A3. It is proposed that the Longwall Top Coal Caving (LTCC) equipment will be used to extract the bottom 3 metres of the seam and recover approximately 85 % of the remaining top coal.

CHAPTER 2. THE EFFECTS OF THE PROPOSED MODIFICATIONS TO LONGWALS A4 AND A5 ON THE MAXIMUM PREDICTED SYSTEMATIC SUSBISDENCE PARAMETERS

2.1. Maximum Predicted Systematic Subsidence Parameters

The Incremental Profile Method was previously used to predict the systematic subsidence parameters resulting from the extraction of Longwalls A3 to A5, based on the SMP Layout, which were provided in Report No. MSEC275. The Incremental Profile Method was calibrated for the local geology using monitoring data from previous extracted longwalls at the Colliery and was also adjusted for the LTCC mining techniques. Discussions on the calibration of the Incremental Profile Method were provided in Sections 3.4 and 3.5 of Report No. MSEC275.

The calibrated Incremental Profile Method has now been used to predict the systematic subsidence parameters that are likely to result from the extraction of Longwalls A3 to A5, based on the proposed Modified Layout. The surface level contours, seam floor contours and seam thickness contours, which were provided by Austar, were used to predict the systematic subsidence parameters.

Predictions were made at points on a regular grid orientated north-south and east-west across the mining area. A grid spacing of 10 metres in each direction was adopted, which provides sufficient resolution for the generation of subsidence, tilt and strain contours. Further details on the Incremental Profile Method are provided in the background report entitled *General Discussion on Mine Subsidence Ground Movements* which can be obtained from *www.minesubsidence.com*.

The width-to-depth ratios of the proposed longwalls vary between 0.4 and 0.5 and, therefore, the overburden is thick enough to bridge over the extracted longwall goafs. It is also highlighted, that the main sequence overlying the proposed longwalls is the Branxton Formation, which comprises thickly bedded and massive sandstones. As a consequence, the subsidence resulting from the extraction of the proposed longwalls is governed by pillar compression rather than by sag subsidence. In this case, the additional subsidence resulting from the proposed increases in void widths of Longwalls A4 and A5 from 225 to 235 metres is compensated by the proposed increase in the chain pillar width between these longwalls from 45 to 60 metres.

This is illustrated in Fig. A.01, which shows the predicted profiles of systematic subsidence, tilt and strain along Prediction Line A, which is a transverse cross-section through Longwalls A3 to A5, the location of which is shown in Drawing No. MSEC391-01. It can be seen from this figure, that the maximum predicted systematic subsidence parameters along this prediction line, based on the Modified Layout, are similar to or less than those based on the SMP Layout. The predicted systematic subsidence above the maingate of Longwall A5, based on the Modified Layout is, however, slightly greater than that based on the SMP Layout, which is primarily the result of the longwall maingate moving 35 metres towards the south-east.

The calibrated Incremental Profile Method has been used to determine the predicted systematic subsidence contours over the proposed longwalls, based on the SMP and Modified Layouts. The predicted total systematic subsidence contours resulting from the extraction of Longwalls A3 to A5, based on the SMP Layout, are shown in Drawing No. MSEC391-05. The predicted total systematic subsidence contours resulting from the extraction of Longwalls A3 to A5, based on the Modified Layout, are shown in Drawing No. MSEC391-06.

A summary of the maximum predicted values of cumulative systematic subsidence, tilt and strain resulting from the extraction of Longwalls A3 to A5, based on the SMP Layout, is provided in Table 2.1. A summary of the maximum predicted values of cumulative systematic subsidence, tilt and strain resulting from the extraction of Longwalls A3 to A5, based on the Modified Layout, is provided in Table 2.2.

Table 2.1 Maximum Predicted Cumulative Systematic Subsidence, Tilt and Strain Resulting from the Extraction of Longwalls A3 to A5 Based on the SMP Layout

Longwalls	Maximum Predicted Cumulative Systematic Subsidence (mm)	Maximum Predicted Cumulative Systematic Tilt (mm/m)	Maximum Predicted Cumulative Systematic Tensile Strain (mm/m)	Maximum Predicted Cumulative Systematic Comp. Strain (mm/m)
LWA3 & LWA4	1130	5.1	0.7	1.7
LWA3 to LWA5	1390	5.8	0.7	1.9

Table 2.2 Maximum Predicted Cumulative Systematic Subsidence, Tilt and Strain Resulting from the Extraction of Longwalls A3 to A5 Based on the Modified Layout

Longwalls	Maximum Predicted Cumulative Systematic Subsidence (mm)	Maximum Predicted Cumulative Systematic Tilt (mm/m)	Maximum Predicted Cumulative Systematic Tensile Strain (mm/m)	Maximum Predicted Cumulative Systematic Comp. Strain (mm/m)
LWA3 & LWA4	1170	5.3	0.7	1.8
LWA3 to LWA5	1380	5.7	0.7	1.8

It can be seen from the above tables, that the maximum predicted total systematic subsidence parameters resulting from the extraction of Longwalls A3 to A5, based on the Modified Layout, are similar to or slightly less than those based on the SMP Layout. It can also be seen from these tables, that the maximum predicted cumulative systematic subsidence parameters after the extraction of Longwall A4, based on the Modified Layout, are similar to or up to 5 % greater than those based on the SMP Layout, which is in the order of accuracy of the method of prediction.

It is noted, that the maximum predicted systematic subsidence parameters, based on the Modified Layout, also include the effects of the proposed extension to the commencing end of Longwall A4, which was subjected to a separate modification application.

2.2. Maximum Upperbound Systematic Subsidence Parameters

The predicted systematic subsidence parameters for a second case, referred to as the *Upperbound Case*, were also provided in Report No. MSEC275 and the SMP Application. The Upperbound Case, which was used for risk assessment purposes only, was determined by scaling up the predicted systematic subsidence parameters such that a maximum total subsidence of 65 % of the extracted seam thickness was achieved above the proposed longwalls.

It can be seen from Table 2.1 and Table 2.2, that the maximum predicted systematic subsidence resulting from the extraction of Longwalls A3 to A5, based on the Modified Layout, is similar to but slightly less than that based on the SMP Layout. The reason for this is that the additional subsidence resulting from the proposed increases in void widths of Longwalls A4 and A5 is compensated by the proposed increase in the chain pillar width between these longwalls.

The scaling factor used to determine the maximum upperbound systematic subsidence for the Modified Layout is, therefore, similar to that used for the SMP Layout. As a result, the maximum upperbound tilts and strains, based on the Modified Layout, are also similar to or slightly less than the maximum upperbound tilts and strains based on the SMP Layout.

Away from the points of maxima, the upperbound systematic subsidence parameters, based on the Modified Layout, will be slightly greater or slightly less than those based on the SMP Layout, depending on their positions relative to the modified Longwalls A4 and A5. However, in the locations where the predicted systematic subsidence parameters, based on the Modified Layout, are slightly less than the predicted systematic subsidence parameters based on the SMP Layout, then the upperbound systematic subsidence parameters will also be slightly less than the upperbound systematic subsidence parameters based on the SMP Layout, and visa versa.

Comparisons of the upperbound systematic subsidence parameters, between the SMP and Modified Layouts, therefore, have not been made in this report. Comparisons have only been made based on the predicted systematic subsidence parameters.

CHAPTER 3. THE EFFECTS OF THE PROPOSED MODIFICATIONS TO LONGWALLS A4 AND A5 ON THE IMPACT ASSESSMENTS FOR THE NATURAL FEATURES AND ITEMS OF SURFACE INSTRASTRUCTURE

3.1. Identification of the Natural Features and Items of Surface Infrastructure

Although the maximum predicted systematic subsidence parameters resulting from the extraction of Longwalls A3 to A5, based on the Modified Layout, are similar to or slightly less than those based on the SMP Layout, the maximum predicted tilts and strains occur in slightly different locations.

The predicted systematic subsidence parameters at the natural features and items of surface infrastructure located above or adjacent to Longwalls A4 and A5, based on the Modified Layout, will be slightly greater or slightly less than those previously provided in Report No. MSEC275, based on the SMP Layout, depending on their positions relative to these longwalls.

The *Affected Area* has been defined as the surface area where the predicted systematic subsidence parameters resulting from the extraction of Longwalls A4 and A5, based on the Modified Layout, will differ from those based on the SMP Layout. The *Affected Area* has been conservatively based on the 26½ degree angle of draw line around the proposed extents of Longwalls A4 and A5, based on the Modified Layout, which is shown in Drawing No. MSEC391-01.

There are a number of natural features and items of surface infrastructure located within the *Affected Area*, which are shown in Drawings Nos. MSEC391-02 to MSEC391-04, and include:-

- Quorrobolong and Cony Creeks,
- Steep Slopes,
- Nash Lane,
- 11 kV powerlines,
- Copper telecommunications lines,
- Water pipeline,
- Building structures, and
- Farm dams.

There are also a number of survey control marks located outside the *Affected Area* but in the vicinity of the proposed longwalls which could be affected by far-field movements. The survey control marks, therefore, have also been included in the assessments provided in this report.

For the remaining natural features and items of surface infrastructure located outside the *Affected Area*, the predicted mine subsidence movements, based on the Modified Layout, are the same as those based on the SMP Layout, which were provided in Report No. MSEC275. The impact assessments for these natural features and items of surface infrastructure located outside the *Affected Area* are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application.

3.2. The Effects of the Proposed Modifications to Longwalls A4 and A5 on the Impact Assessments Previously Provided In Report No. MSEC275

The predictions and impact assessments for the natural features and items of surface infrastructure within the *Affected Area*, based on the Modified Layout, are provided in the following sections. The locations of these features are shown in Drawings Nos. MSEC391-02 to MSEC391-04.

3.3. Quorrobolong and Cony Creeks

Quorrobolong and Cony Creeks cross directly above Longwalls A3 to A5 as shown in Drawing No. MSEC391-02.

The predicted profiles of systematic subsidence, upsidence and closure along Quorrobolong Creek, based on both the SMP and Modified Layouts, are shown in Fig. A.02 in Appendix A. A summary of the maximum predicted values of the total systematic subsidence, upsidence and closure movements at Quorrobolong Creek resulting from the extraction of Longwalls A3 to A5, based on both the SMP and Modified Layouts, is provided in Table 3.1.

Table 3.1 Maximum Predicted Total Subsidence, Upsidence and Closure at Quorrobolong Creek Resulting from the Extraction of Longwalls A3 to A5 Based on the SMP and Modified Layouts

Layout	Maximum Predicted Total Systematic Subsidence (mm)	Maximum Predicted Total Upsidence (mm)	Maximum Predicted Total Closure (mm)
SMP Layout Adopted in Report No. MSEC275	1140	185	125
Proposed Modified Layout	1065	185	120

The predicted profiles of systematic subsidence, upsidence and closure along Cony Creek, based on both the SMP and Modified Layouts, are shown in Fig. A.03 in Appendix A. A summary of the maximum predicted values of the total systematic subsidence, upsidence and closure movements at Cony Creek resulting from the extraction of Longwalls A3 to A5, based on both the SMP and Modified Layouts, is provided in Table 3.2.

Table 3.2 Maximum Predicted Total Subsidence, Upsidence and Closure at Cony Creek Resulting from the Extraction of Longwalls A3 to A5 Based on the SMP and Modified Layouts

Layout	Maximum Predicted Total Systematic Subsidence (mm)	Maximum Predicted Total Upsidence (mm)	Maximum Predicted Total Closure (mm)
SMP Layout Adopted in Report No. MSEC275	850	105	90
Proposed Modified Layout	825	105	90

It can be seen from the above tables, that the maximum predicted total systematic subsidence, upsidence and closure movements at Quorrobolong and Cony Creeks, based on the Modified Layout, are similar to or slightly less than those based on the SMP Layout. The differences in the maximum predicted systematic subsidence and valley related movements, between the SMP and Modified Layouts, are in the order of accuracy of the methods of prediction.

The impact assessments and proposed management strategies for Quorrobolong and Cony Creeks, based on the Modified Layout are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant impacts on the creeks.

3.4. Steep Slopes

For the purposes of this report, a steep slope has been defined as an area of land having a natural gradient greater than 1 in 3 (ie: a grade of 33 %, or an angle to the horizontal of 18°). The locations of the steep slopes which have been identified within the *Affected Area* are shown in Drawing No. MSEC391-02. The extents of the steep slopes were determined from the surface level contours generated from an aerial laser scan of the area.

It can be seen from Drawing No. MSEC391-02, that there are steep slopes located on the southern side of the hill above proposed Longwall A4. In this location, the predicted systematic subsidence parameters, based on the Modified Layout, are similar to or slightly less than those based on the SMP Layout, which is illustrated in Fig. A.01.

The impact assessments and proposed management strategies for the steep slopes within the *Affected Area*, based on the Modified Layout are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant impacts on the steep slopes.

3.5. Nash Lane

Nash Lane crosses directly above Longwalls A3 and A4 as shown in Drawing No. MSEC391-03. The road is located at a distance of 190 metres north of Longwall A5, based on the Modified Layout, at its closest point to this longwall.

The predicted profiles of systematic subsidence, tilt and strain along Nash Lane, based on both the SMP and Modified Layouts, are shown in Fig. A.04 in Appendix A. A summary of the maximum predicted systematic subsidence parameters at the road resulting from the extraction of Longwalls A3 to A5, based on both the SMP and Modified Layouts, is provided in Table 3.3.

Table 3.3 Maximum Predicted Total Systematic Subsidence, Tilt and Strain at Nash Lane Resulting from the Extraction of Longwalls A3 to A5 Based on the SMP and Modified Layouts

Layout	Maximum Predicted Total Systematic Subsidence (mm)	Maximum Predicted Total Systematic Tilt (mm/m)	Maximum Predicted Total Systematic Tensile Strain (mm/m)	Maximum Predicted Total Systematic Comp. Strain (mm/m)
SMP Layout Adopted in Report No. MSEC275	1000	3.7	0.3	1.0
Proposed Modified Layout	1080	3.8	0.4	1.0

It can be seen from the above table, that the maximum predicted systematic subsidence parameters at Nash Lane, based on the Modified Layout, are similar to or slightly greater than those based on the SMP Layout. The differences in the maximum predicted systematic subsidence parameters, between the SMP and Modified Layouts, are in the order of accuracy of the method of prediction.

It is also noted, that Nash Lane crosses Longwall A4 adjacent to the commencing (north-eastern) end of this longwall and, therefore, the small increases in the predicted systematic subsidence parameters at the road are primarily the result of the extension of the longwall commencing end, which was subject to a separate modification application.

The impact assessments and proposed management strategies for Nash Lane, based on the Modified Layout are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant impacts on the road.

3.6. 11 kV Powerlines

There are 11 kV powerlines within the *Affected Area* which cross directly above Longwalls A3 to A5, the locations of which shown in Drawing No. MSEC391-03. There are also consumer lines within the *Affected Area* which connect the rural properties with the powerlines.

The 11 kV powerlines cross the extents of Longwalls A3 to A5 and, therefore, are expected to experience the full range of predicted systematic subsidence movements. The maximum predicted systematic subsidence parameters at these powerlines, based on the Modified Layout are, therefore, similar to or slightly less than those based on the SMP Layout. The locations of these maxima above Longwalls A4 and A5, however, have moved slightly towards the south as the result of the proposed modifications to these longwalls.

The impact assessments and proposed management strategies for these powerlines, based on the Modified Layout are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant impacts on these powerlines.

3.7. Copper Telecommunications Lines

There are overhead copper telecommunications lines within the *Affected Area* which follow Nash Lane, the locations of which are shown in Drawing No. MSEC391-03. There are also consumer cables within the *Affected Area* which connect the rural properties with the main cables.

As described in Section 3.5, the maximum predicted systematic subsidence parameters at Nash Lane and, hence, at the copper telecommunications lines, based on the Modified Layout, are similar to or slightly greater than those based on the SMP Layout. The differences in the maximum predicted systematic subsidence parameters, between the SMP and Modified Layouts, are in the order of accuracy of the method of prediction.

It is also noted, that the copper telecommunications lines cross Longwall A4 adjacent to the commencing (north-eastern) end of this longwall and, therefore, the small increases in the predicted systematic subsidence parameters at the cables are primarily the result of the extension of the longwall commencing end, which was subject to a separate modification application.

The impact assessments and proposed management strategies for the copper telecommunications lines, based on the Modified Layout are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant impacts on the copper telecommunications lines.

3.8. Water Pipeline

There is a privately owned water pipeline within the *Affected Area* which follows Nash Lane, the location of which is shown in Drawing No. MSEC391-03.

As described in Section 3.5, the maximum predicted systematic subsidence parameters at Nash Lane and, hence, at the water pipeline, based on the Modified Layout, are similar or slightly greater than those based on the SMP Layout. The differences in the maximum predicted systematic subsidence parameters, between the SMP and Modified Layouts, are in the order of accuracy of the method of prediction.

It is also noted, that the water pipeline crosses Longwall A4 adjacent to the commencing (north-eastern) end of this longwall and, therefore, the small increases in the predicted systematic subsidence parameters at the pipeline are primarily the result of the extension of the longwall commencing end, which was subject to a separate modification application.

The impact assessments and proposed management strategies for the water pipeline, based on the Modified Layout are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant impacts on the water pipeline.

3.9. Building Structures

The locations of the building structures within the *Affected Area* are shown in Drawing No. MSEC391-04. There are six houses located within the *Affected Area*, being Structures Refs. A01a, A02a, A03a, A04a, A06a and A11a, of which four houses are located directly above the proposed longwalls, being Structures Refs. A01a, A03a, A04a and A11a. The proposed modifications to Longwalls A4 and A5 do not result in any additional houses being directly mined beneath.

A summary of the maximum predicted total systematic subsidence parameters at the houses within the *Affected Area* resulting from the extraction of Longwalls A3 to A5, based on the SMP Layout, is provided in Table 3.4.

Table 3.4 Maximum Predicted Total Systematic Subsidence, Tilt and Strain at the Houses within the Affected Area Based on the SMP Layout

Structure Ref.	Maximum Predicted Total Systematic Subsidence (mm)	Maximum Predicted Total Systematic Tilt (mm/m)	Maximum Predicted Total Systematic Tensile Strain (mm/m)	Maximum Predicted Total Systematic Comp. Strain (mm/m)
A01a	455	2.8	0.2	0.4
A02a	55	0.4	0.3	< 0.2
A03a	330	3.3	0.6	0.5
A04a	1355	3.2	0.4	1.8
A06a	< 20	0.2	< 0.2	< 0.2
A11a	355	2.3	0.4	0.2

A summary of the maximum predicted total systematic subsidence parameters at the houses within the *Affected Area* resulting from the extraction of Longwalls A3 to A5, based on the Modified Layout, is provided in Table 3.5.

Table 3.5 Maximum Predicted Total Systematic Subsidence, Tilt and Strain at the Houses within the Affected Area Based on the Modified Layout

Structure Ref.	Maximum Predicted Total Systematic Subsidence (mm)	Maximum Predicted Total Systematic Tilt (mm/m)	Maximum Predicted Total Systematic Tensile Strain (mm/m)	Maximum Predicted Total Systematic Comp. Strain (mm/m)
A01a	440	2.8	0.2	0.4
A02a	50	0.4	0.3	< 0.2
A03a	380	3.6	0.7	0.4
A04a	1355	2.8	0.4	1.7
A06a	< 20	< 0.2	< 0.2	< 0.2
A11a	385	2.7	0.5	0.2

The parameters provided in the above tables are the maximums which occur within 20 metres of the house centroids or vertices, at any time during or after the extraction of Longwalls A3 to A5.

It can be seen from Table 3.4 and Table 3.5, that the predicted maximum systematic subsidence parameters at Structures Refs. A03a and A11a, based on the Modified Layout, are similar to but slightly greater than those based on the SMP Layout. Similarly, the predicted maximum systematic subsidence parameters at the rural building structures and tanks on these properties, based on the Modified Layout, are also similar to but slightly greater than those based on the SMP Layout.

The small increases in the predicted maximum systematic subsidence parameters at the building structures on Properties A03 and A11 are primarily the result of the extension of the commencing (north-eastern) end of Longwall A4, which was subject to a separate modification application. In addition to this, the differences in the predicted maximum systematic subsidence parameters at the building structures on Properties A03 and A11, between the SMP and Modified Layouts, are in the order of accuracy of the method of prediction.

For the remaining houses within the *Affected Area*, the predicted maximum systematic subsidence parameters, based on the Modified Layout, are similar to or slightly less than those based on the SMP Layout. Similarly, the predicted maximum systematic subsidence parameters at the rural building structures and tanks on these properties, based on the Modified Layout, are also similar to or slightly less than those based on the SMP Layout. Again, the differences in the predicted maximum systematic subsidence parameters at these building structures, between the SMP and Modified Layouts, are in the order of accuracy of the method of prediction.

The impact assessments and proposed management strategies for the building structures within the *Affected Area*, based on the Modified Layout are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant impacts on the building structures. All houses are expected to remain in safe, serviceable and repairable conditions throughout the mining period.

3.10. Farm Dams

There are a number of farm dams within the *Affected Area* which are shown in Drawing No. MSEC391-04. The farm dams are typically located along the alignments of the natural watercourses.

The predicted maximum systematic subsidence at the farm dams within the *Affected Area*, based on the Modified Layout, are similar to those based on the SMP Layout. The maximum predicted increase in subsidence at the farm dams, resulting from the proposed modifications, is 60 mm at Dam A01d03, which is in the order of accuracy of the method of prediction. The maximum predicted decrease in subsidence at the farm dams, resulting from the proposed modifications, is 60 mm which occurs at Dams A04d04 and A04d06, which is also in the order of accuracy of the method of prediction

The predicted maximum systematic tilts at the farm dams within the *Affected Area*, based on the Modified Layout, are within ±0.5 mm/m of those predicted based on the SMP Layout, which is in the order of accuracy of the method of prediction. The predicted maximum systematic strains at the farm dams within the *Affected Area*, based on the Modified Layout, are within ±0.3 mm/m of those predicted based on the SMP Layout, which is in the order of accuracy of the method of prediction.

The impact assessments and proposed management strategies for the farm dams within the *Affected Area*, based on the Modified Layout are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant impacts on the farm dams.

3.11. Survey Control Marks

The locations of the survey control marks in the vicinity of the proposed longwalls are shown in Drawing No. MSEC391-04. It can be seen from this drawing, that there are no survey control marks within the *Affected Area*. There are, however, a number of survey control marks located along Sandy Creek Road which are just outside the *Affected Area*.

The predicted maximum far-field horizontal and vertical movements at the survey control marks along Sandy Creek Road, based on the Modified Layout, are similar to those based on the SMP Layout. The differences in the predicted far-field movements at these marks, between the SMP and Modified Layouts, are in the order of accuracy of the method of prediction.

The impact assessments and proposed management strategies for the survey control marks in the vicinity of the *Affected Area*, based on the Modified Layout are, therefore, the same as those provided in Report No. MSEC275 and the SMP Application. With these management strategies in place, it is unlikely that there would be any significant impacts on the survey control marks.

3.12. Summary

The maximum predicted total systematic subsidence parameters resulting from the extraction of Longwalls A3 to A5, based on the Modified Layout, are similar to or slightly less than those based on the SMP Layout. The maximum predicted cumulative systematic subsidence parameters after the extraction of Longwall A4, based on the Modified Layout, are similar to or up to 5 % greater than those based on the SMP Layout. It is noted, however, that predicted systematic subsidence parameters, based on the Modified Layout, also include the effects of the proposed extension to the commencing end of Longwall A4, which was subjected to a separate modification application.

The predicted maximum systematic subsidence and valley related movements at the natural features and items of surface infrastructure within the *Affected Area*, based on the Modified Layout, are similar to those previously provided in Report No. MSEC275 for the SMP Layout. There are some features where the predicted systematic subsidence parameters increase slightly, as the result of the proposed modifications, however, the differences in the predicted movements are in the order of accuracy of the methods of prediction.

The impact assessments and proposed management strategies for the natural features and items of surface infrastructure within the *Affected Area*, based on the Modified Layout are, therefore, the same as those based on the SMP Layout, which were provided in Report No. MSEC275 and the SMP Application.

With the appropriate management strategies in place, it is unlikely that there would be any significant changes in the levels of impact on the natural features and items of surface infrastructure resulting from the proposed modifications to Longwalls A4 and A5.

APPENDIX A. FIGURES AND DRAWINGS

Predicted Profiles of Systematic Subsidence, Tilt and Strain along Prediction Line A Based on the SMP and Modified Layouts

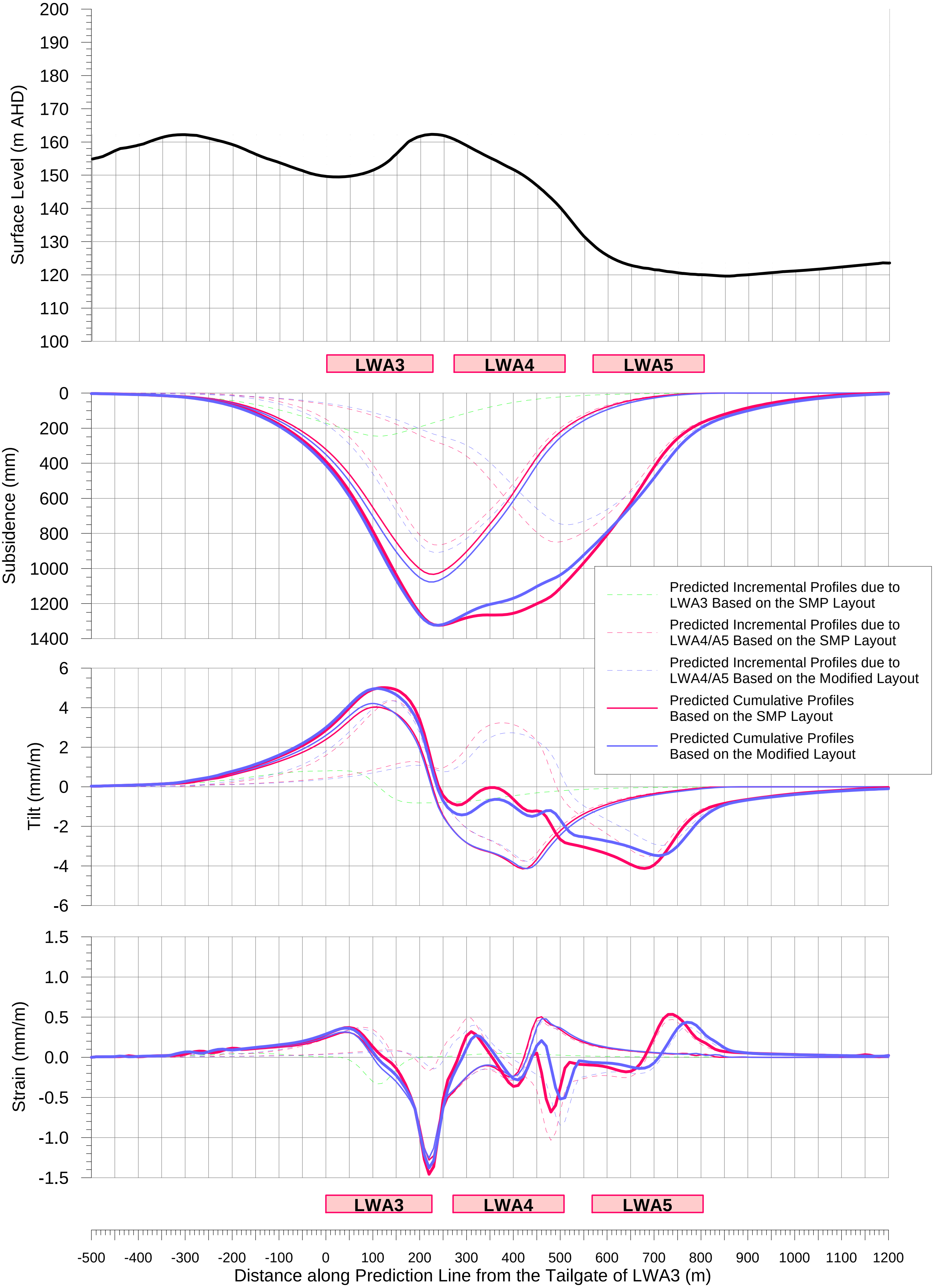

Fig. A.01

Predicted Profiles of Systematic Subsidence, Upsidence and Closure along Quorrobolong Creek Resulting from the Extraction of Longwalls A3 to A5

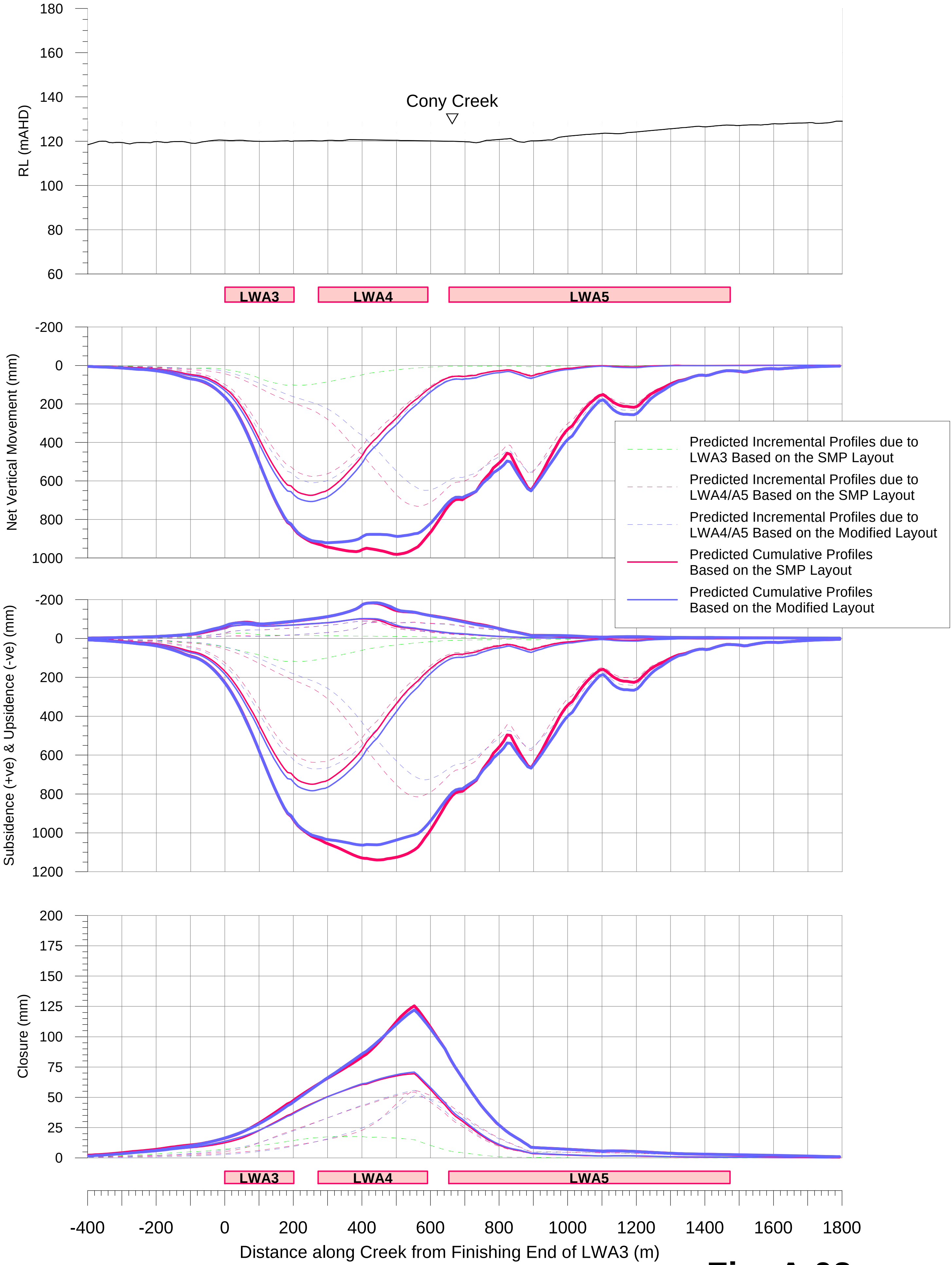

Fig. A.02

Predicted Profiles of Systematic Subsidence, Upsidence and Closure along Cony Creek Resulting from the Extraction of Longwalls A3 to A5

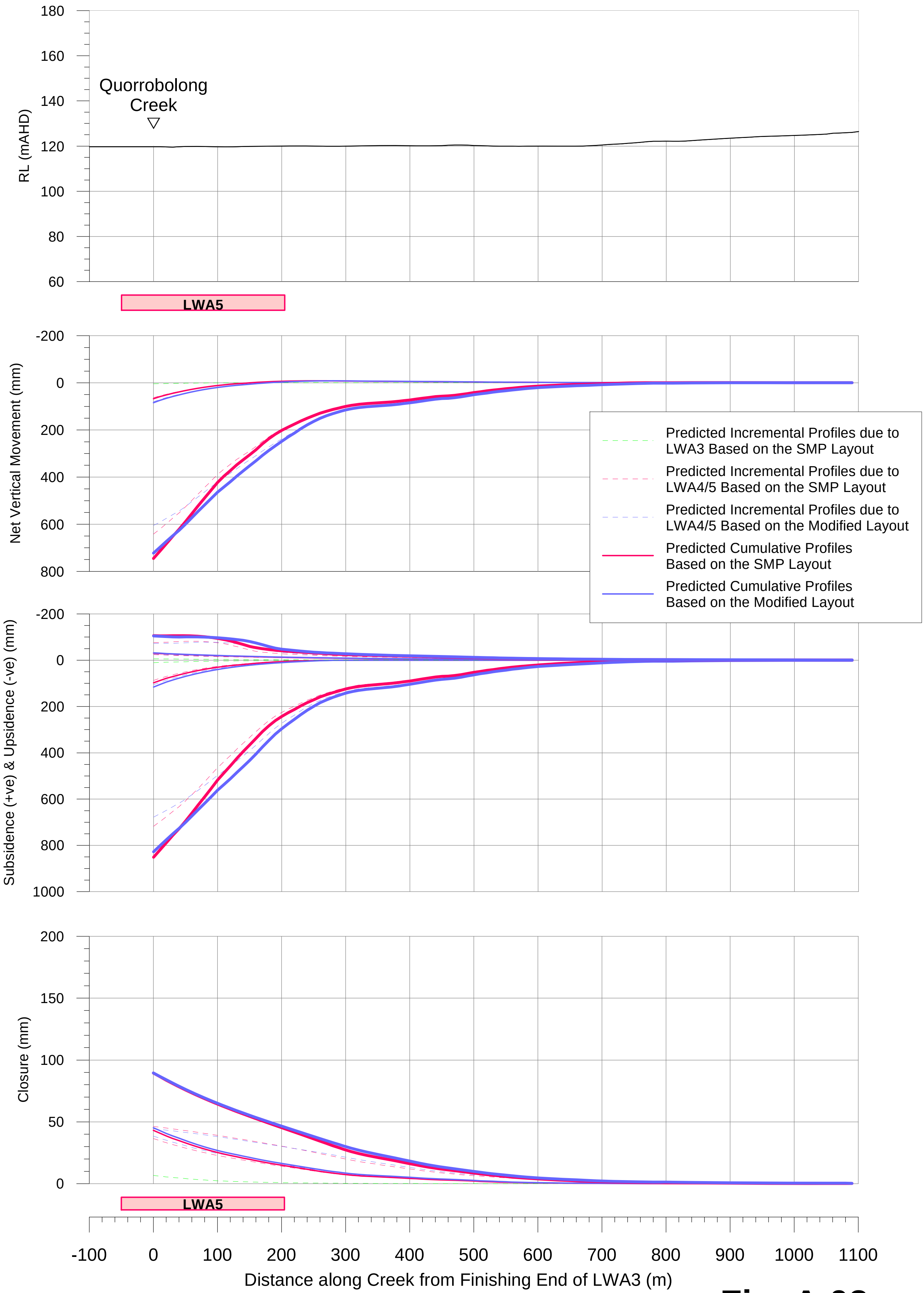

Fig. A.03

Predicted Profiles of Systematic Subsidence, Tilt and Strain along Nash Lane Based on the SMP and Modified Layouts

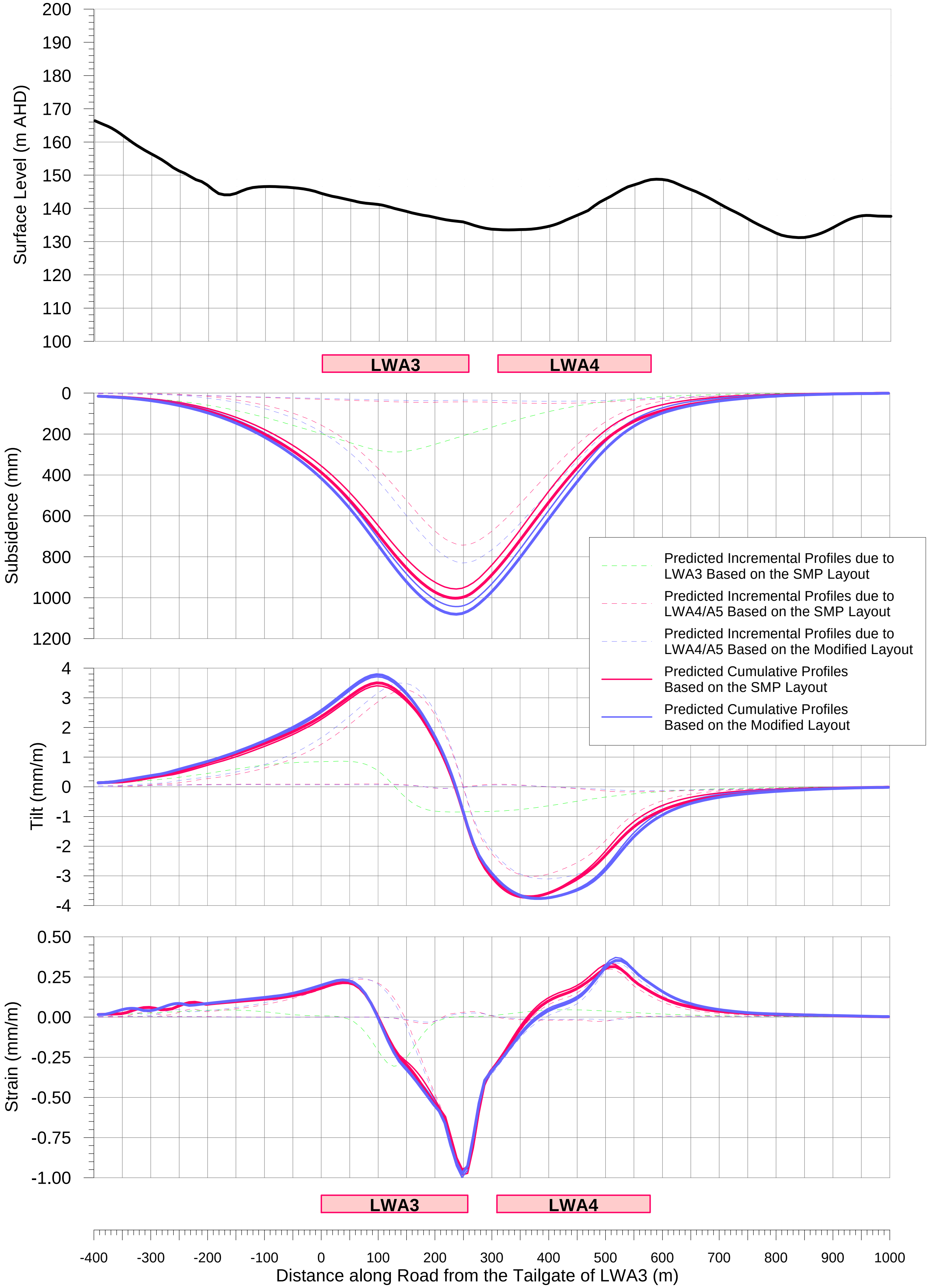

Fig. A.04

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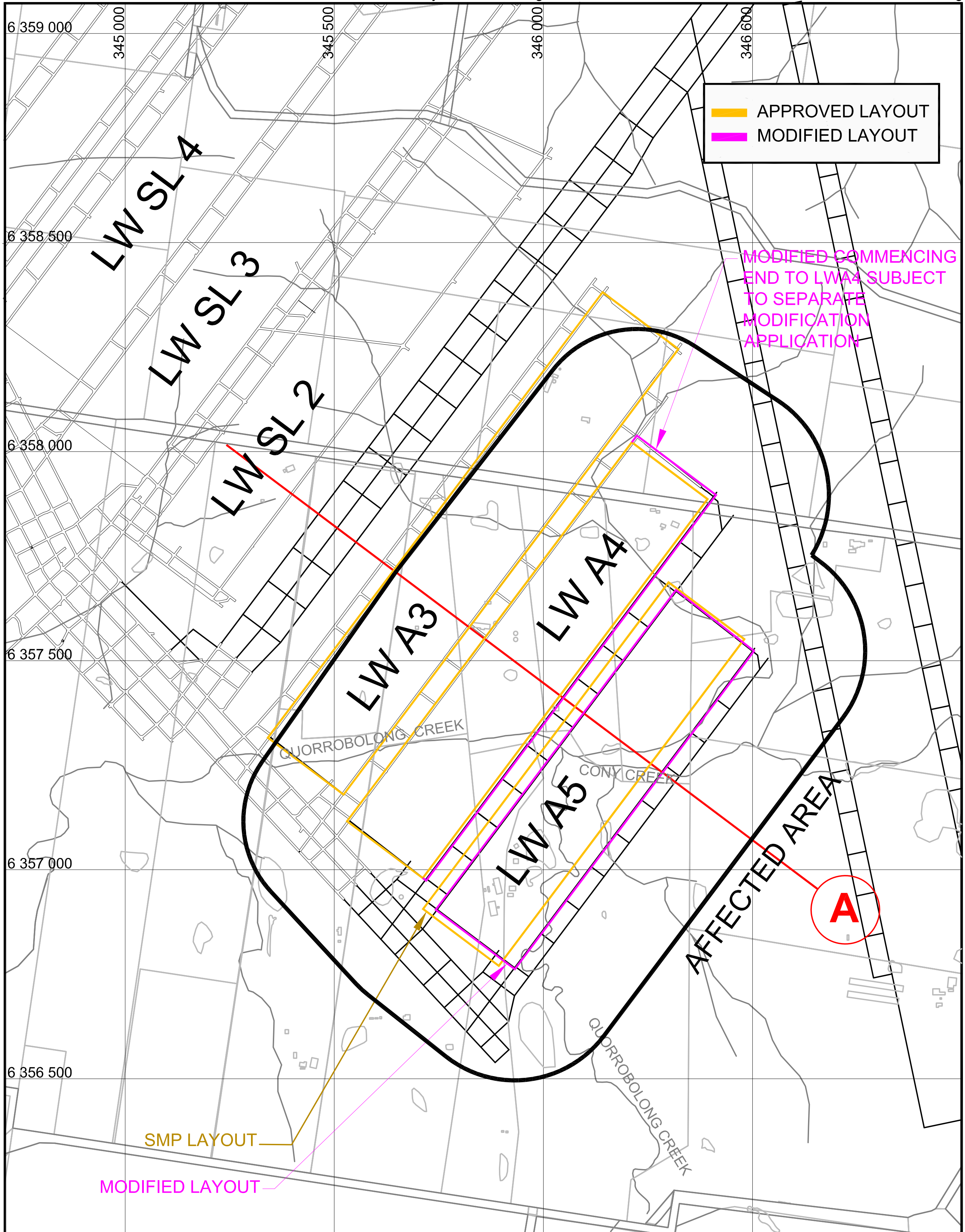

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AUSTAR COAL MINE
LONGWALLS A3 TO A5
GENERAL LAYOUT

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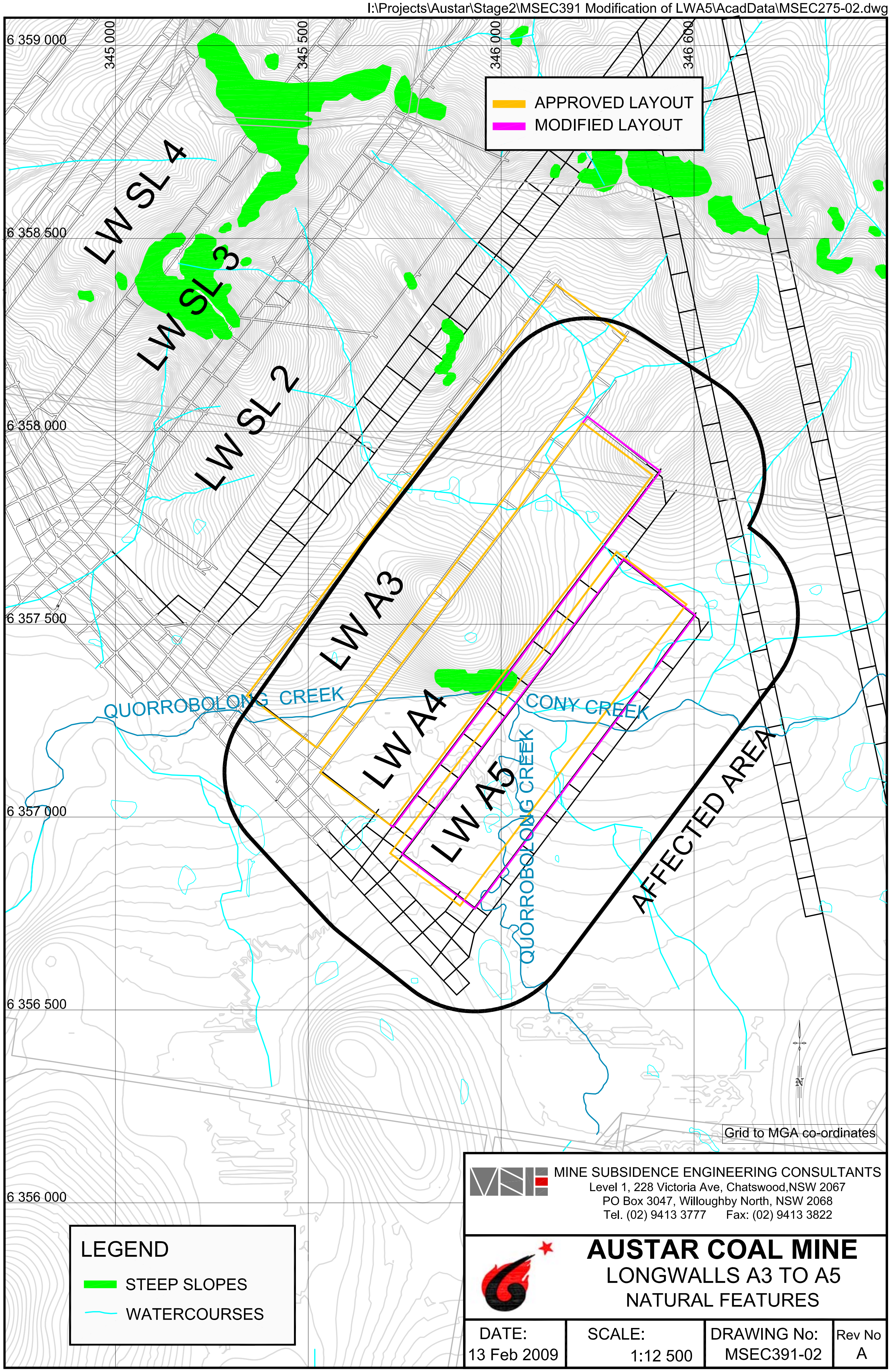

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AUSTAR COAL MINE
LONGWALLS A3 TO A5
NATURAL FEATURES

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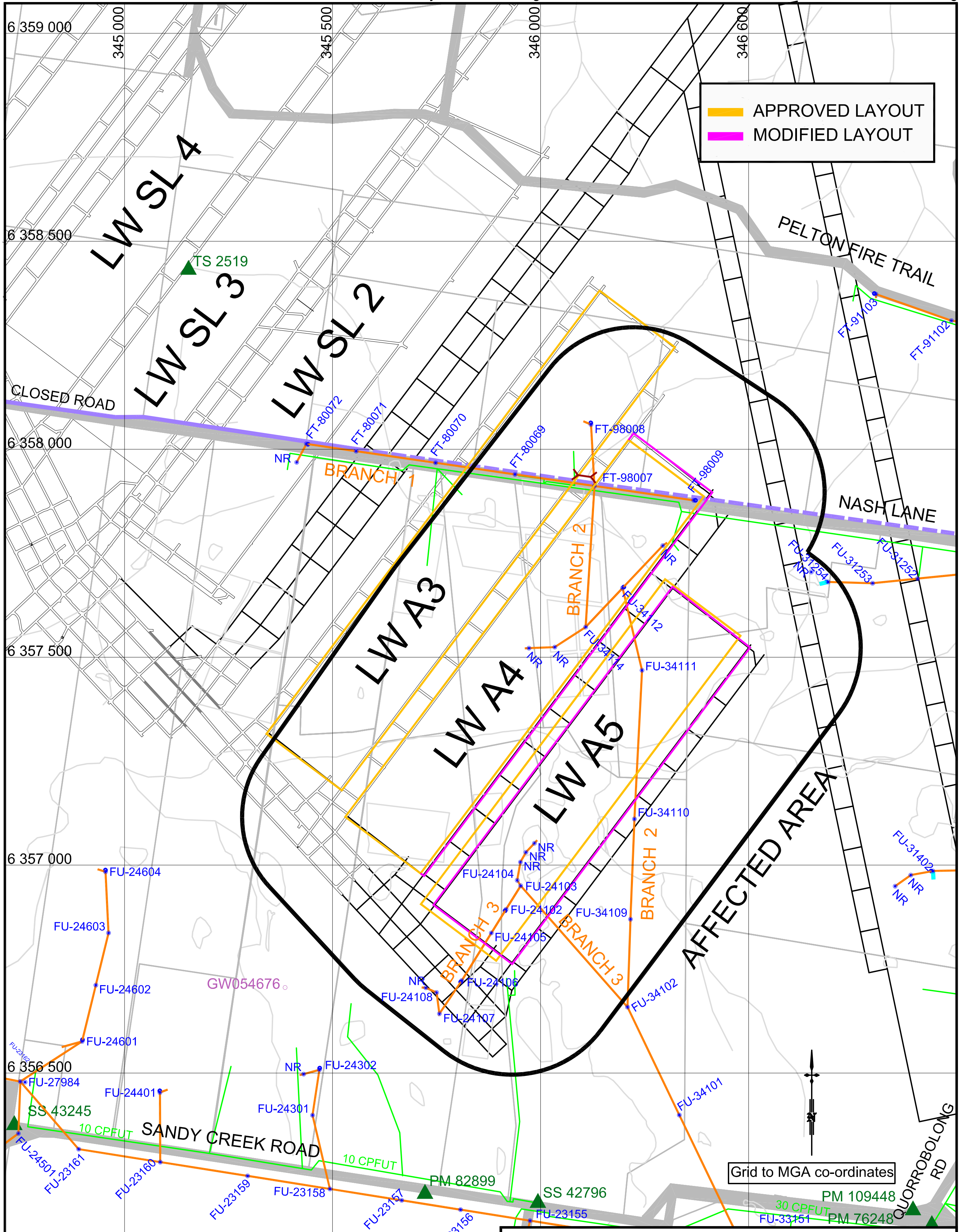

Legend

Registered Groundwater Bores
Survey Control Marks
Culvert

Water Pipeline (Private)
Approximate location from Hunter Water
Unconfirmed location

Telstra
Local Underground Copper Cables

Energy Australia
Above Ground Services
Power Poles & IDs
Underground Services

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AUSTAR COAL MINE
LONGWALLS A3 TO A5
SURFACE INFRASTRUCTURE

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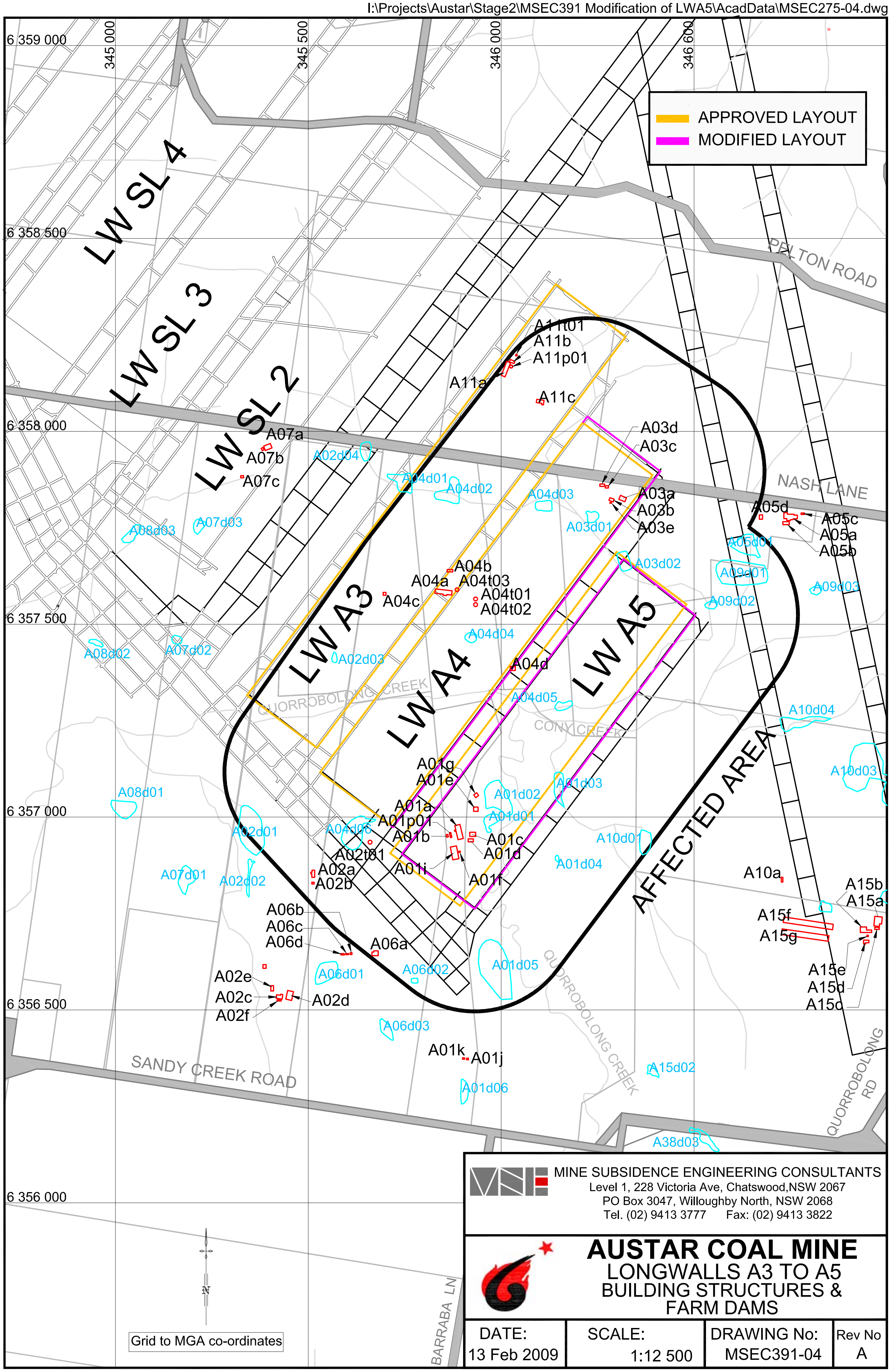

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AUSTAR COAL MINE
LONGWALLS A3 TO A5
BUILDING STRUCTURES & FARM DAMS

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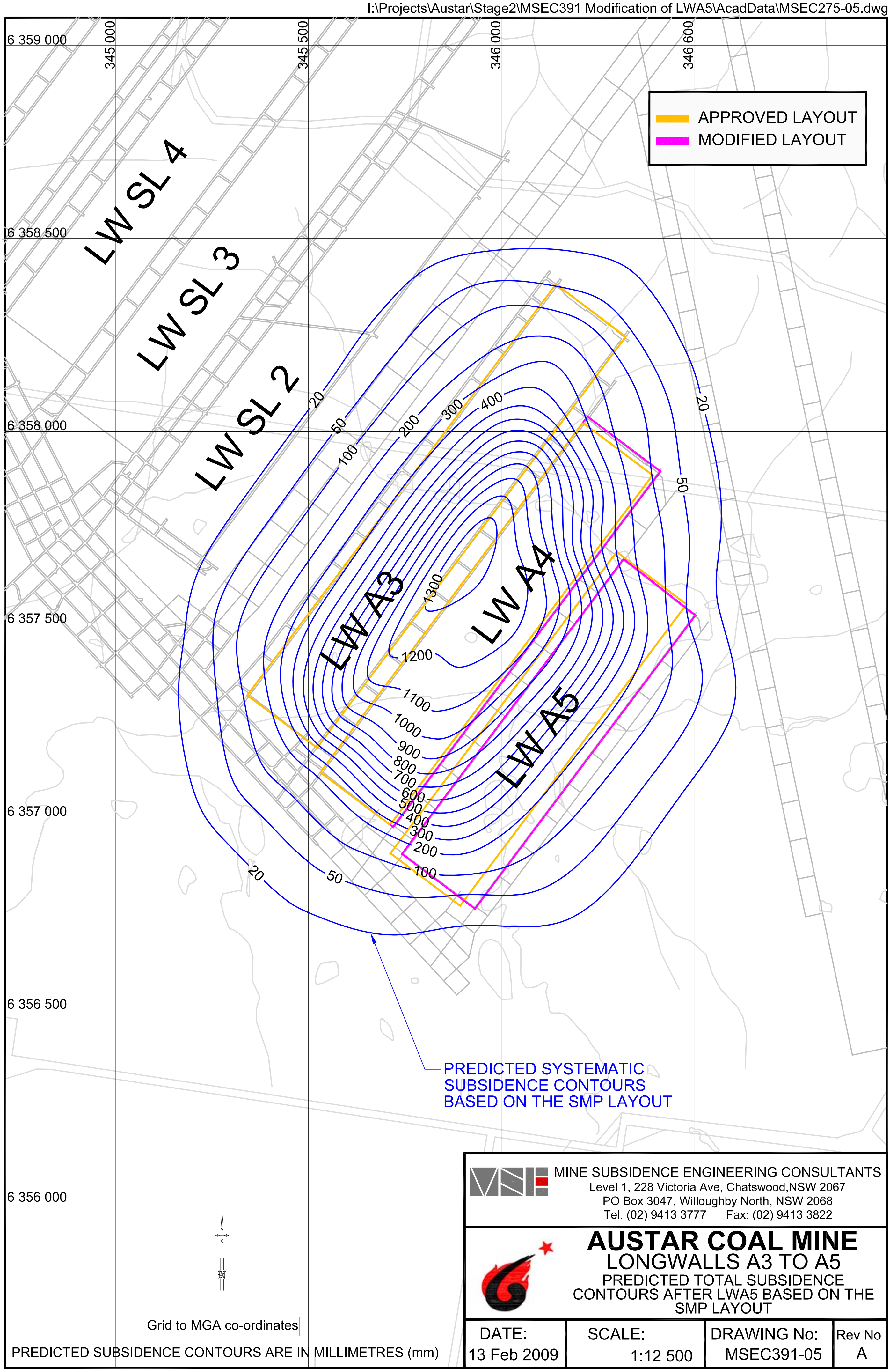

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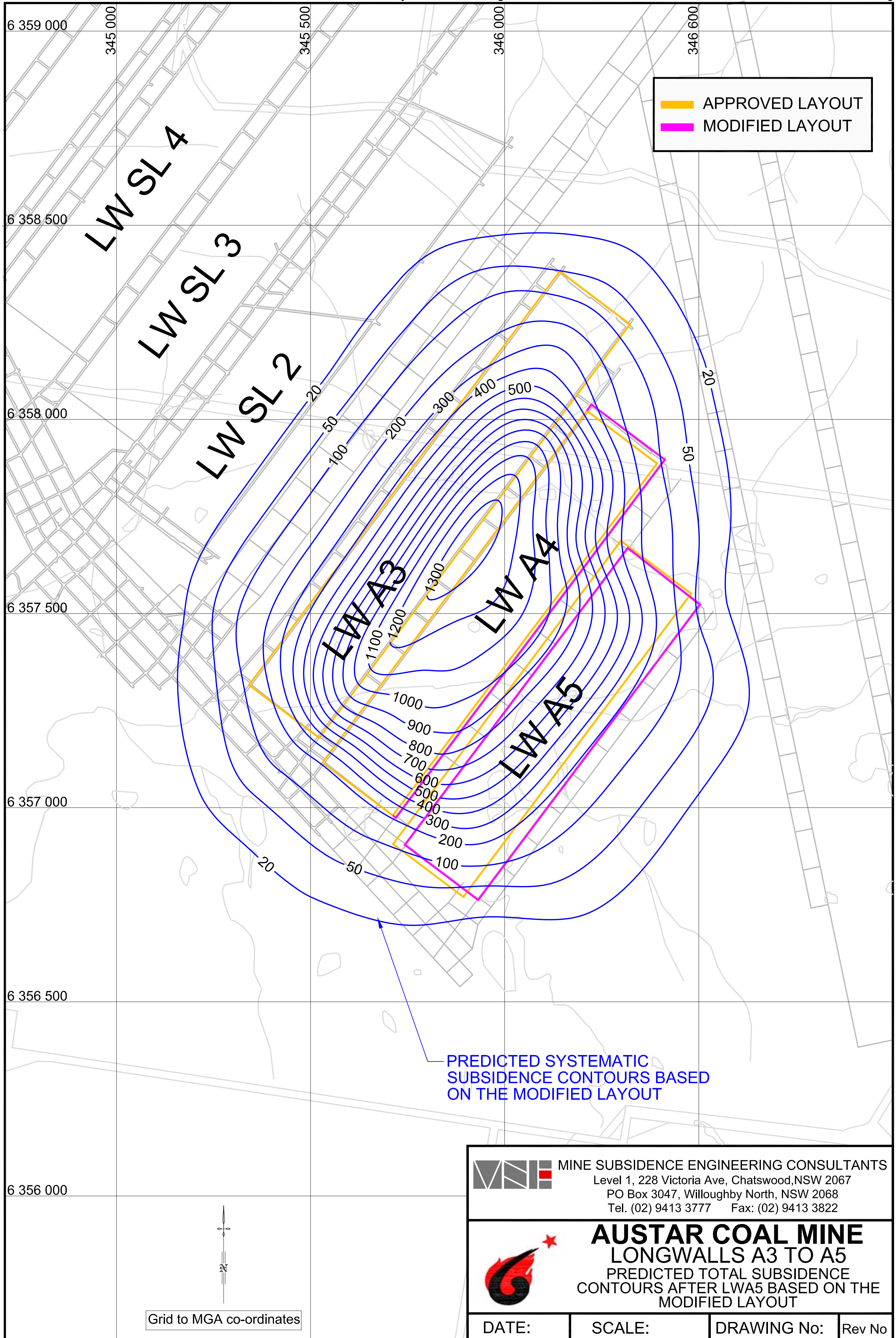

PREDICTED SUBSIDENCE CONTOURS ARE IN MILLIMETRES (mm)

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AUSTAR COAL MINE
LONGWALLS A3 TO A5
PREDICTED TOTAL SUBSIDENCE CONTOURS AFTER LWA5 BASED ON THE MODIFIED LAYOUT

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13 Feb 2009	1:12 500	MSEC391-06	A