mine subsidence ENGINEERING CONSULTANTS

South32

Illawarra Metallurgical Coal

ILLAWARRA METALLURGICAL COAL:

Appin Colliery – Longwalls LW710A and LW711

The effects of the proposed modifications to the commencing ends of LW710A and LW711 on previous subsidence predictions and impact assessments

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01	Draft issue	JB	-	25 Jan 23
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Report produced to: support an application to modify the commencing ends of Appin LW710A and LW711 to be submitted to the Department of Planning and Environment

Previous reports: MSEC1117 (Rev. B) – Subsidence Predictions and Impact Assessments for the Natural and Built Features due to the Extraction of the Proposed Longwalls 709, 710A, 710B, 711 and 905 at Appin Colliery in Support of the Extraction Plan Application (May 2021).

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)

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Figures

Figures are prefixed by the number of the chapter or the letter of the appendix in which they are presented.

Drawings

Drawings referred to in this report are included in Appendix C at the end of this report.

Drawing No.	*Description*	*Rev.*
MSEC1318-01	General layout	A
MSEC1318-02	Depth of cover contours	A
MSEC1318-03	Natural features	A
MSEC1318-04	Surface infrastructure	A
MSEC1318-05	Built features	A
MSEC1318-06	Predicted additional subsidence contours due to LW710A and LW711	A
MSEC1318-07	Predicted total subsidence contours after LW711	A

1.1. Background

Illawarra Metallurgical Coal (IMC), a wholly owned subsidiary of South32 Limited (South32), operates Appin Colliery, which is located in the Southern Coalfield of New South Wales. IMC is currently mining longwalls in Areas 7 and 9 at the colliery.

IMC has completed the mining of Longwalls 701 to 708B (LW701 to LW708B) and is currently mining Longwall 709 (LW709) in Area 7. IMC has also completed the mining of Longwalls 901 to 904 (LW901 to LW904) and is currently mining Longwall 905 (LW905) in Area 9.

Mine Subsidence Engineering Consultants (MSEC) was previously commissioned by IMC to prepare subsidence predictions and impact assessments for LW709 to LW711 in Area 7 and LW905 in Area 9 at Appin Colliery. Report No. MSEC1117 (Rev. B) was issued in May 2021 in support of the Extraction Plan Application for these longwalls.

The Department of Planning and Environment (DPE) granted IMC approval for extraction of LW709 to LW711 and LW905 on 29 July 2022. The longwall layout adopted in the approved Extraction Plan and Report No. MSEC1117 is referred to as the *Previous Layout* in this report.

IMC now proposes to shorten the commencing (i.e. western) ends of LW710A and LW711 by 242 m and 225 m, respectively, from the positions that are adopted in the approved Extraction Plan and Report No. MSEC1117. No other changes are proposed to LW709 to LW711 and LW905 as adopted in the Extraction Plan Approval. The longwall layout that includes the shortened commencing ends of LW710A and LW711 is referred to as the *Modified Layout* in this report.

This subsidence report will support the modification application for the shortened commencing ends of LW710A and LW711 which will be submitted to the DPE.

1.2. Mining geometry

The locations of the longwalls in Areas 7 and 9 are shown in Drawing No. MSEC1318-01, in Appendix C. The commencing (i.e. western) ends of LW710A and LW711 based on the Previous and Modified Layouts are shown by the orange lines and magenta lines, respectively, in this drawing.

A summary of the dimensions for LW710A and LW711 based on each layout is provided in Table 1.1.

Table 1.1 Dimensions of LW710A and LW711 based the Previous and Modified Layouts

Layout (Report No.)	Longwall	Overall void length including installation heading (m)	Overall void width including first workings (m)	Overall tailgate chain pillar width (m)
Previous Layout (MSEC1117)	LW710A	1787	324	-
	LW711	4469	324	45
Modified Layout (MSEC1318)	LW710A	1545	324	-
	LW711	4244	324	45

The commencing ends of LW710A and LW711 are proposed to be shortened by 242 m and 225 m, respectively, from the positions adopted in the approved Extraction Plan and Report No. MSEC1117. The length of longwall mining (i.e. secondary extraction) is approximately 9 m less than the overall void lengths provided in Table 1.1.

The overall void widths and solid chain pillar widths are not proposed to be modified. The actual widths extracted by longwall mining (i.e. secondary extraction) are approximately 315 m.

1.3. Surface and seam

Areas 7 and 9 and located on the northern and western sides of the Nepean River valley. The commencing (i.e. western) ends of LW710A and LW711 are located beneath Razorback Range. The natural surface above the mining area falls towards the south and the Nepean River valley.

The surface levels directly above the mining area vary between 100 metres above Australian Height Datum (mAHD) and 320 mAHD. The lowest surface level occurs along Foot Onslow Creek where it crosses the finishing (i.e. eastern) end of LW710B. The highest surface level occurs at the top of Razorback Range above the western end of LW710A.

The level of the Bulli Seam beneath the commencing (i.e. western) ends of LW710A and LW711 varies between approximately -417 mAHD and -438 mAHD. In this location, the seam dips towards the north with an average gradient of approximately 3 %, or 1 in 333.

The surface and seam levels along the centrelines of LW710A and LW711, above the longwall commencing (i.e. western) ends, are shown in Fig. 1.1 and Fig. 1.2, respectively. The definition of the Study Area is provided in Section 3.1.

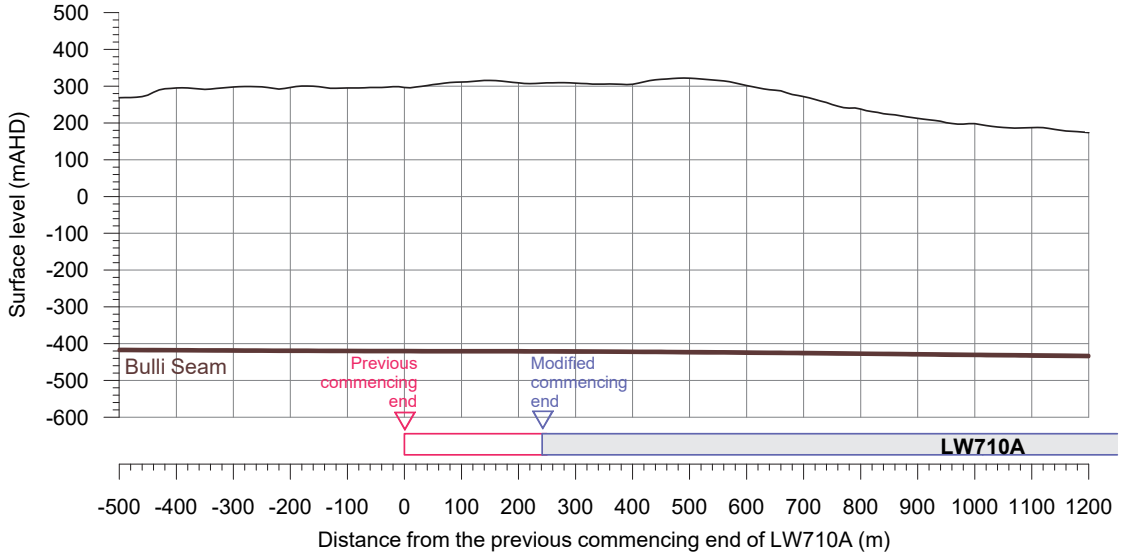


Fig. 1.1 Surface and seam levels along the centreline of LW710A

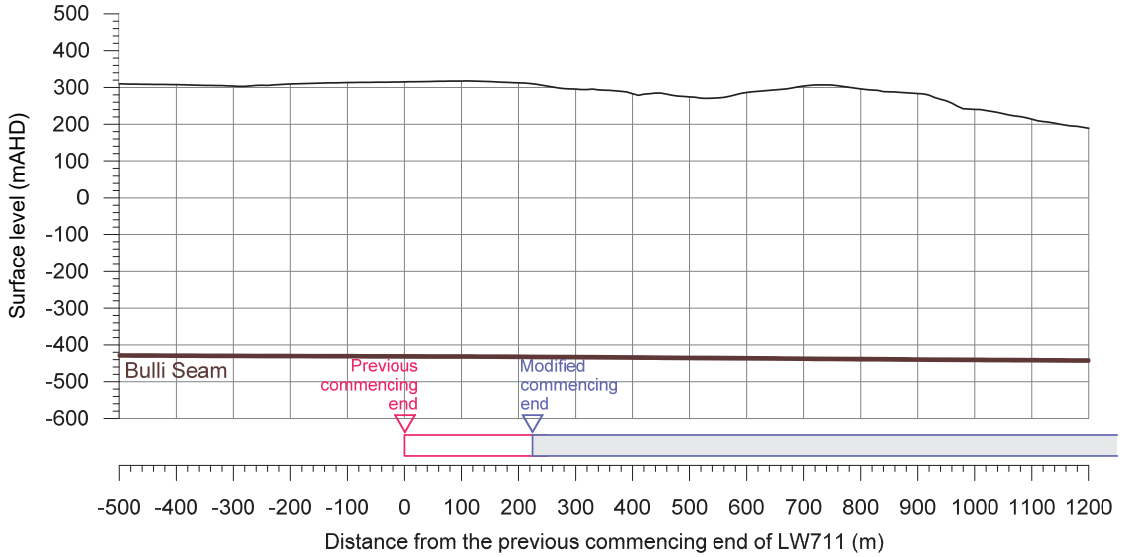


Fig. 1.2 Surface and seam levels along the centreline of LW711

The depth of cover contours for the Bulli Seam are shown in Drawing No. MSEC1318-02. The depth of cover directly above the commencing ends of LW710A and LW711 varies between 700 m and 750 m. The thickness of the Bulli Seam at the longwall commencing ends varies between 3.0 m and 3.2 m. IMC proposes to extract the full seam thickness.

2.1. Maximum predicted conventional subsidence effects

The Incremental Profile Method (IPM) was previously used to predict the conventional subsidence effects due to the mining of LW702 to LW711 and LW901 to LW905, based on the Previous Layout, and these are provided in Report No. MSEC1117. The IPM has now been used to predict the conventional subsidence effects for these longwalls based on the Modified Layout.

The predicted additional subsidence contours due to the mining of LW710A and LW711, based on the Modified Layout, are shown in Drawing No. MSEC1318-06. The predicted incremental 20 mm subsidence contour, based on the Previous Layout, is also shown in this drawing for comparison.

The extent of vertical subsidence decreases due to the proposed shortened commencing (i.e. western) ends of LW710A and LW711. The surface area located within the predicted total 20 mm subsidence contour for these two longwalls, based on the Modified Layout, is approximately 28 hectares (ha) less than that based on the Previous Layout.

A summary of the maximum predicted values of incremental vertical subsidence, tilt and curvature due to the mining of each of LW710A and LW711, based on the Previous and Modified Layouts, is provided in Table 2.1. The predicted strains directly above the longwall are discussed in Section 2.2.

Table 2.1 Maximum predicted incremental conventional vertical subsidence, tilt and curvature due to the mining of LW710A and LW711 based on the Previous and Modified Layouts

Layout (Report No.)	Longwall	Maximum predicted incremental vertical subsidence (mm)	Maximum predicted incremental tilt (mm/m)	Maximum predicted incremental hogging curvature (km^{-1})	Maximum predicted incremental sagging curvature (km^{-1})
Previous Layout (MSEC1117)	LW710A	1550	7.0	0.08	0.15
	LW711	1550	7.0	0.08	0.15
Modified Layout (MSEC1318)	LW710A	1550	7.0	0.08	0.15
	LW711	1550	7.0	0.08	0.15

The maximum predicted incremental subsidence effects for LW710A and LW711, based on the Modified Layout, are the same as the maximum predicted values based on the Previous Layout. That is, the shortened commencing ends of LW710A and LW711 do not affect the maximum predicted incremental values. The reason is that the maximum predicted incremental effects occur towards the eastern ends of these longwalls where the depths of cover are less.

The predicted total subsidence contours after the mining of LW711, based on the Modified Layout, are shown in Drawing No. MSEC1318-07. The predicted total 20 mm subsidence contours, based on the Previous Layout, are also shown in this drawing for comparison.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvature due to the mining of LW702 to LW711 and LW901 to LW905, based on the Previous and Modified Layouts, is provided in Table 2.2. The values are the maximum predicted subsidence effects anywhere above the mining area.

Table 2.2 Maximum predicted total conventional vertical subsidence, tilt and curvature anywhere above the mining area based on the Previous and Modified Layouts

Layout (Report No.)	Longwalls	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km^{-1})	Maximum predicted total sagging curvature (km^{-1})
Previous Layout (MSEC1117)	LW702 to LW711 and LW901 to LW905	1550	7.0	0.08	0.15
Modified Layout (MSEC1318)	LW702 to LW711 and LW901 to LW905	1550	7.0	0.08	0.15

The maximum predicted total subsidence effects within the mining area, based on the Modified Layout, are the same as the maximum predicted values based on the Previous Layout. That is, the shortened commencing ends of LW710A and LW711 do not affect the maximum predicted total values. The reason is that the maximum predicted total effects occur near the middle of the mining area (i.e. away from the longwall commencing ends) where the depths of cover are less.

While the maximum predicted total subsidence effects above the mining area do not change, the predicted subsidence effects above the commencing (i.e. western) ends of LW710A and LW711 reduce due to the shortened ends. The Study Area is defined in Chapter 3 and it is illustrated in Drawing No. MSEC1318-01. The Study Area represents the surface area where the predicted subsidence effects change due to the proposed modifications.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvature within the Study Area, based on the Previous and Modified Layouts, is provided in Table 2.3. The values are the maximum predicted subsidence effects within the Study Area due to the mining of all longwalls.

Table 2.3 Maximum predicted total conventional vertical subsidence, tilt and curvature within the Study Area based on the Previous and Modified Layouts

Layout (Report No.)	Longwalls	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km^{-1})	Maximum predicted total sagging curvature (km^{-1})
Previous Layout (MSEC1117)	LW702 to LW711 and LW901 to LW905	925	6.5	0.08	0.14
Modified Layout (MSEC1318)	LW702 to LW711 and LW901 to LW905	925	6.5	0.08	0.14

The maximum predicted total subsidence effects within the Study Area, based on the Modified Layout, are the same as the maximum predicted values based on the Previous Layout. While the maximum predicted tilt and curvatures do not change, the locations of the predicted longitudinal tilts and curvatures at the commencing ends of LW710A and LW711 move due to the proposed modifications.

This is illustrated along two prediction lines, referred to as Prediction Line 1 and Prediction Line 2, which are longitudinal sections through the commencing ends of LW710A and LW711, respectively, as shown in Drawings. Nos. MSEC1318-06 and MSEC1318-07, in Appendix C. The predicted profiles of total vertical subsidence, tilt and curvature along Prediction Lines 1 and 2 are illustrated in Figs. A.01 and A.02, respectively, in Appendix A. The profiles based on the Previous and Modified Layouts are shown by the red lines and blue lines, respectively, in these figures.

The locations of the maximum predicted longitudinal tilts and curvatures move approximately 225 m to 250 m towards the east due to the proposed modifications. However, these longitudinal effects are less than the maximum predicted values that occur transverse to the longwalls.

The maximum predicted total tilt within the Study Area is 6.5 mm/m (i.e. 0.65 %, or 1 in 154). The maximum predicted total curvatures are 0.08 km^{-1} hogging and 0.14 km^{-1} sagging, which represent minimum radii of curvature of 13 km and 7 km, respectively.

2.2. Predicted strains

The prediction of strain is more difficult than the prediction of subsidence, tilt and curvature. The reason for this is that strain is affected by many factors, including ground curvature and horizontal movement as well as local variations in the near surface geology, the locations of pre-existing natural joints at bedrock, and the depth of bedrock. Survey tolerance can also represent a substantial portion of the measured strain, in cases where the strains are of a low order of magnitude. The profiles of observed strain, therefore, can be irregular even when the profiles of observed subsidence, tilt and curvature are relatively smooth.

In previous MSEC subsidence reports, predictions of conventional strain were provided based on the best estimate of the relationship between curvature and strain. Similar relationships have been proposed by other authors. The reliability of the strain predictions was highlighted in these reports, where it was stated that measured strains can vary considerably from the predicted conventional values. Adopting a linear relationship between curvature and strain provides a reasonable prediction for the conventional tensile and compressive strains. The locations that are predicted to experience hogging or convex curvature are expected to be net tensile strain zones and locations that are predicted to experience sagging or concave curvature are expected to be net compressive strain zones.

In the Southern Coalfield, it was found that a factor of 15 provided a reasonable relationship between the maximum predicted conventional curvatures and the maximum predicted conventional strains. The maximum predicted conventional strains within the Study Area, based on applying a factor of 15 to the maximum predicted conventional curvatures, are approximately 1 mm/m tensile and 2 mm/m compressive for both of the longwall layouts.

At a point, however, there can be considerable variation from the linear relationship, resulting from non-conventional movements or from the normal scatters which are observed in strain profiles. When expressed as a percentage, observed strains at a point can be many times greater than the predicted conventional strains for low magnitudes of curvature. In this report, therefore, we have provided a statistical approach to account for the variability, instead of just providing a single predicted conventional strain.

The range of potential strains within the Study Area has been determined using monitoring data from the previously extracted longwalls in the Southern Coalfield. The monitoring data are used from Appin Colliery, as well as the nearby West Cliff, Tower and Tahmoor Collieries, where the overburden geology and mining geometry are reasonably similar to the longwalls in Areas 7 and 9. The range of strains measured during the mining of these completed longwalls should, therefore, provide a reasonable indication of the range of potential strains for LW710A and LW711.

The data used in the analysis of measured strains include those resulting from both conventional and non-conventional anomalous movements, but do not include those resulting from valley-related effects, which are addressed separately in this report. The strains resulting from damaged or disturbed survey marks have also been excluded.

The survey database has been analysed to extract the maximum total tensile and compressive strains that have been measured at any time during mining, for survey bays that were located directly above goaf or the chain pillars that are located between the extracted longwalls. A number of probability distribution functions have been fitted to the empirical data. It was found that a Generalised Pareto Distribution (GPD) provides a reasonable fit to the raw strain data.

The histogram of maximum observed total tensile and compressive strains measured in survey bays above goaf, for the previously extracted longwalls from the Southern Coalfield, is provided in Fig. 2.1. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

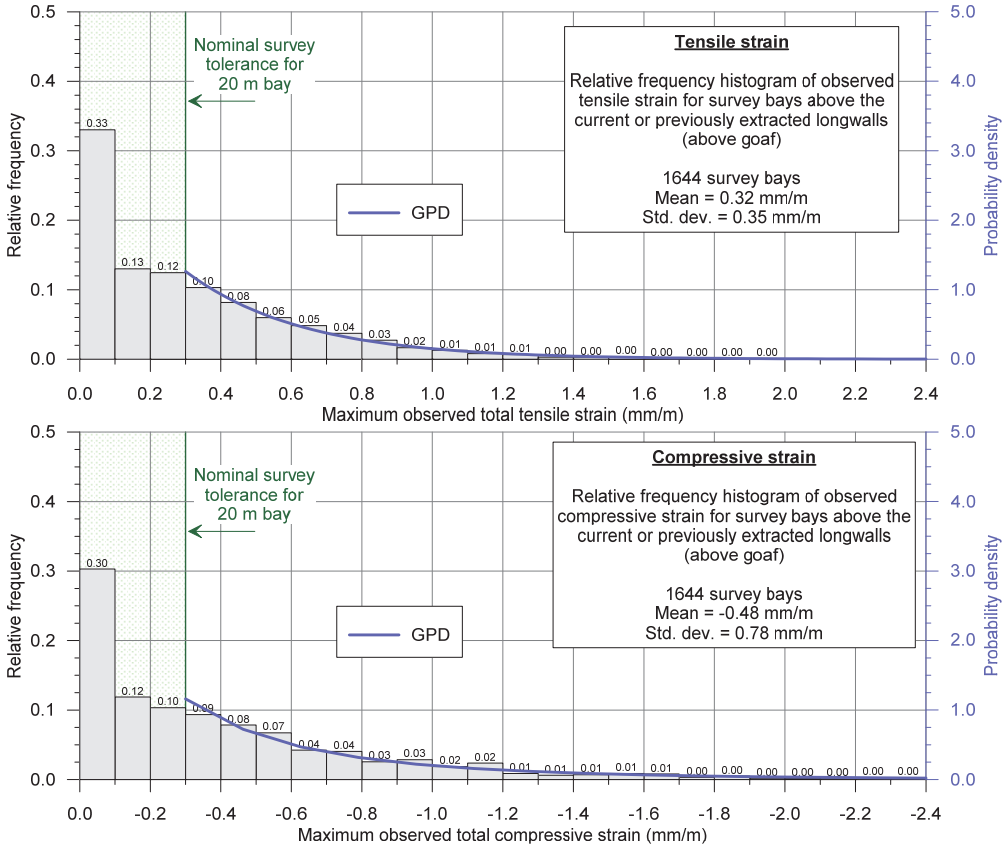


Fig. 2.1 Distributions of the maximum total tensile and compressive strains measured during the extraction longwalls for survey bays located above goaf

Confidence levels have been determined from the empirical strain data using the fitted GPDs. In the cases where survey bays were measured multiple times during a longwall extraction, the maximum tensile strain and the maximum compressive strain have been used in the analysis (i.e. single tensile strain and single compressive strain measurement per survey bay).

The 95 % confidence levels for the maximum strains that the individual survey bays experienced at any time during mining are 1.0 mm/m tensile and 1.6 mm/m compressive. The 99 % confidence levels for the maximum strains that the individual survey bays experienced at any time during mining are 1.5 mm/m tensile and 3.3 mm/m compressive.

2.3. Maximum predicted valley-related effects

The predicted valley-related effects along the streams at Appin Colliery have been determined using the methods outlined in ACARP Research Project No. C9067, which were published in the handbook entitled "*Management Information Handbook on the Undermining of Cliffs, Gorges and River Systems*", issued in September 2002. Details on the ACARP 2002 Prediction Method are provided in the background report entitled "*General Discussion on Mine Subsidence Ground Movements*" which can be obtained from *www.minesubsidence.com*.

The predicted upsidence and closure effects along the streams have been determined from the empirical database based on their lateral and longitudinal distances from the extracted longwalls, the depths of the valleys and the maximum predicted incremental subsidence resulting from the extraction of each longwall.

The Nepean River and its tributaries are located within or near the Study Area. The predicted valley-related effects for these streams are discussed in Chapter 3. The predicted valley-related effects for other streams located further outside the Study Area do not change due to the proposed modification.

3.1. The Study Area

The *Study Area* has been defined as the surface area where the predicted subsidence effects, based on the Modified Layout, are different to those predicted based on the Previous Layout. The Study Area has been based on the following:

- 35° angle of draw line around the commencing (i.e. western) ends of LW710A and LW711, based on both the Previous and Modified Layouts; and
- the limit where the change in the predicted incremental vertical subsidence, due to the modified commencing ends of LW710A and LW711, is greater than 20 mm.

The extent of the Study Area is shown in Drawing No. MSEC1318-01. Surface features that are located within 600 m of the commencing ends of LW710A and LW711, which will experience valley-related effects and could be sensitive to these effects, have also been included in the assessments provided in this report.

The natural and built features that are located within or adjacent to the Study Area are shown in Drawings Nos. MSEC1318-03 to MSEC1318-05. The surface features that have been included in the assessments provided in this report are:

- Navigation Creek;
- first and second order tributaries;
- cliffs;
- steep slopes;
- Top Ridge Road;
- 11 kV and low voltage powerlines;
- optical fibre cables and copper telecommunications cables;
- houses;
- non-residential and other structures; and
- Aboriginal heritage sites

The effects of the proposed modified commencing ends of LW710A and LW711 on the subsidence predictions and impact assessments for these features are provided in the following sections.

3.2. Navigation Creek

The location of Navigation Creek is shown in Drawing No. MSE1318-03.

The upper reaches of Navigation Creek are located above the western end of LW711. The section of creek within the Study Area is first and second order. The length of creek above the mining area, based on the Modified Layout, is the same as that based on the Previous Layout. While the extent of creek above the mining area does not change, the predicted subsidence effects reduce due to the greater end effects caused by the shortened commencing ends of LW710A and LW711.

A summary of the maximum predicted total vertical subsidence, upsidence and closure for Navigation Creek, based on the Previous and Modified Layouts, is provided in Table 3.1. The values are the maximum predicted subsidence effects for the section of first and second order creek located within the Study Area due to the mining in Areas 7 and 9.

Table 3.1 Maximum predicted total vertical subsidence, upsidence and closure for Navigation Creek due to mining in Areas 7 and 9

Layout (Report No.)	Maximum predicted total vertical subsidence (mm)	Maximum predicted total upsidence (mm)	Maximum predicted total closure (mm)
Previous Layout (MSEC1117)	900	350	600
Modified Layout (MSEC1318)	650	325	525

The maximum predicted total vertical subsidence for the section of Navigation Creek within the Study Area, based on the Modified Layout, is less than the maximum predicted value based on the Previous Layout. Similarly, the maximum predicted conventional tilts and strains reduce due to the proposed modifications.

The maximum predicted total upsidence and closure for the section of Navigation Creek within the Study Area, based on the Modified Layout, are less than the maximum predicted values based on the Previous Layout. Similarly, the maximum predicted compressive strain due to valley-related effects reduces due to the proposed modifications.

The assessed levels of potential impact for Navigation Creek, based on the Modified Layout, are less than those based on the Previous Layout. The assessments and recommended management strategies for the creek, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.3. First and second order tributaries

The locations of the tributaries are shown in Drawing No. MSE1318-03.

There are first and second order tributaries to Navigation Creek and the Nepean River within the Study Area. There are no third order tributaries within the Study Area nor within 600 m of the commencing (i.e. western) ends of LW710A and LW711.

There are tributaries to Navigation Creek partially located above LW710A and LW711. These tributaries could experience the full range of predicted subsidence effects, as summarised in Table 2.3. The maximum predicted subsidence effects within the Study Area, based on the Modified Layout, are the same as the maximum predicted values based on the Previous Layout. While the predicted tilts, curvatures and strains slightly increase for the tributary located above the modified commencing end of LW711, their values are less than the maximum predicted effects elsewhere in the Study Area.

The tributaries to the Nepean River are typically located south of LW710A and LW711. The maximum predicted subsidence effects for these tributaries, based on the Modified Layout, are similar to or less than the maximum predicted values based on the Previous Layout. The reason is that the tributaries are located further from the mining area due to the modified commencing ends of LW710A and LW711.

The assessed levels of potential impact for the first and second order tributaries, based on the Modified Layout, are similar to or less than those based on the Previous Layout. The assessments and recommended management strategies for the tributaries, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.4. Cliffs

The locations of the cliffs are shown in Drawing No. MSEC1318-03.

There are three cliffs within the Study Area, being Refs. RR-CL2, RR-CL3 and RR-CL4. These cliffs are located on the southern side of Razorback Range. A summary of the positions of the cliffs relative to the mining area is provided in Table 3.2.

Table 3.2 Positions of the cliffs relative to the mining area

Layout (Report No.)	Position of cliff relative to the mining area		
	RR-CL2	RR-CL3	RR-CL4
Previous Layout (MSEC1117)	420 m west of LW710A	Directly above LW710A	155 m south of LW710A
Modified Layout (MSEC1318)	660 m west of LW710A	Directly above LW710A	155 m south of LW710A

The distance of Cliff RR-CL2 outside the mining area, based on the Modified Layout, is 240 m greater than the distance based on the Previous Layout. Cliff RR-CL3 is located directly above the mining area based on both layouts. The distance of Cliff RR-CL4 outside the mining area does not change due to the proposed modifications.

A summary of the maximum predicted total vertical subsidence, tilt and curvatures for the cliffs within the Study Area, based on the Previous and Modified Layouts, is provided in Table 3.3. The values are the maximum predicted subsidence effects within 20 m of the mapped extents of each of the cliffs due to the mining in Areas 7 and 9.

Table 3.3 Maximum predicted total vertical subsidence, tilt and curvature for the cliffs within the Study Area due to mining in Areas 7 and 9

Layout (Report No.)	Cliff ref.	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km^{-1})	Maximum predicted total sagging curvature (km^{-1})
Previous Layout (MSEC1117)	RR-CL2	< 20	< 0.5	< 0.01	< 0.01
	RR-CL3	150	2.0	0.03	< 0.01
	RR-CL4	125	< 0.5	< 0.01	< 0.01
Modified Layout (MSEC1318)	RR-CL2	< 20	< 0.5	< 0.01	< 0.01
	RR-CL3	90	1.0	0.02	< 0.01
	RR-CL4	125	< 0.5	< 0.01	< 0.01

The maximum predicted subsidence effects for Cliffs RR-CL2 and RR-CL4, based on the Modified Layout, are the same as the maximum predicted values based on the Previous Layout. The predicted subsidence effects do not change due to the distances of these cliffs from the commencing ends of LW710A and LW711.

The maximum predicted subsidence effects for Cliff RR-CL3, based on the Modified Layout, are less than the predicted values based on the Previous Layout. The predicted subsidence effects reduce due to the greater end effects caused by the shortened commencing ends of LW710A and LW711.

The assessed levels of potential impact for the cliffs, based on the Modified Layout, are similar to or less than those based on the Previous Layout. The assessments and recommended management strategies for the cliffs, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.5. Steep slopes

The locations of the steep slopes are shown in Drawing No. MSEC1318-03.

The steep slopes associated with the south-facing, east-facing and north-facing slopes of Razorback Range are partially located above the western ends LW710A and LW711. The steep slopes associated with the upper reaches of the tributaries at the top of Razorback Range are located directly above the mining area.

A summary of the maximum predicted total vertical subsidence, tilt and curvatures for the steep slopes within the Study Area, based on the Previous and Modified Layouts, is provided in Table 3.4. The values are the maximum predicted subsidence effects within 20 m of the mapped extents of the steep slopes due to the mining in Areas 7 and 9.

Table 3.4 Maximum predicted total vertical subsidence, tilt and curvature for the steep slopes within the Study Area due to mining in Areas 7 and 9

Layout (Report No.)	Cliff ref.	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km^{-1})	Maximum predicted total sagging curvature (km^{-1})
Previous Layout (MSEC1117)	Razorback Range	925	6.5	0.08	0.14
	Valleys of streams	925	6.5	0.08	0.14
Modified Layout (MSEC1318)	Razorback Range	925	6.5	0.08	0.14
	Valleys of streams	925	6.5	0.08	0.14

The maximum predicted subsidence effects for the steep slopes, based on the Modified Layout, are the same as the maximum predicted values based on the Previous Layout. The predicted subsidence effects do not change as they occur at the steep slopes on the eastern side of the Study Area that are located away from the commencing ends of LW710A and LW711. The predicted subsidence effects for the steep slopes located in the southern and western parts of the Study Area reduce due to the greater end effects caused by the shortened commencing ends of LW710A and LW711.

The assessed levels of potential impact for the steep slopes, based on the Modified Layout, are similar to or less than those based on the Previous Layout. The assessments and recommended management strategies for the steep slopes, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.6. Top Ridge Road

The locations of the local roads are shown in Drawing No. MSEC1318-04.

Top Ridge Road and Gibraltar Drive cross the western ends of LW710A and LW711. Stonebrook Meadows Road and Donalds Range Road are located outside and to the west of the mining area.

The profiles of predicted total vertical subsidence, tilt and curvature along Top Ridge Road and Gibraltar Drive are illustrated in Fig. A.04, in Appendix A. The profiles based on the Previous and Modified Layouts are shown by the red lines and blue lines, respectively, in this figure.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvature along Top Ridge Road and Gibraltar Drive, based on the Previous and Modified Layouts, is provided in Table 3.5. The values are the maximum predicted subsidence effects for the sections of road within the Study Area due to the mining in Areas 7 and 9.

Table 3.5 Maximum predicted total conventional vertical subsidence, tilt and curvature along Top Ridge Road and Gibraltar Drive due to mining in Areas 7 and 9

Layout (Report No.)	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km^{-1})	Maximum predicted total sagging curvature (km^{-1})
Previous Layout (MSEC1117)	650	2.0	0.02	0.03
Modified Layout (MSEC1318)	600	2.0	0.02	0.01

The maximum predicted vertical subsidence and sagging curvature for Top Ridge Road and Gibraltar Drive, based on the Modified Layout, are slightly less than the maximum predicted values based on the Previous Layout. These predicted subsidence effects reduce due to the greater end effects caused by the shortened commencing ends of LW710A and LW711.

The maximum predicted tilt and hogging curvature for Top Ridge Road and Gibraltar Drive, based on the Modified Layout, are the same as the maximum predicted values based on the Previous Layout. These maximum values occur above the commencing end of LW710A and, therefore, while the values do not change, they move further towards the east due to the proposed modifications.

The maximum predicted subsidence effects for the remaining local roads within the Study Area, based on the Modified Layout, are the same or slightly less than the maximum predicted values based on the Previous Layout. Only low-level subsidence effects are predicted for these roads due to their distances outside the mining area.

The assessed levels of potential impact for the local roads, based on the Modified Layout, are similar to or less than those based on the Previous Layout. The assessments and recommended management strategies for the roads, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.7. Electrical services

The locations of the electrical services are shown in Drawing No. MSEC1318-04.

There are 11 kV and low voltage powerlines along Top Ridge Road and Gibraltar Drive that cross the western ends of LW710A and LW711. There are also 11 kV and low voltage powerlines along the local roads to the west of the mining area.

The profiles of predicted total vertical subsidence, tilt along and tilt across the 11 kV powerline adjacent to Top Ridge Road and Gibraltar Drive are illustrated in Fig. A.05, in Appendix A. The profiles based on the Previous and Modified Layouts are shown by the red lines and blue lines, respectively, in this figure.

A summary of the maximum predicted values of total vertical subsidence, tilt along and tilt across the alignment of the 11 kV powerline, based on the Previous and Modified Layouts, is provided in Table 3.6. The values are the maximum predicted subsidence effects for the section of powerline within the Study Area due to the mining in Areas 7 and 9.

Table 3.6 Maximum predicted total conventional vertical subsidence, tilt along and tilt across the alignment of the 11 kV powerline due to mining in Areas 7 and 9

Layout (Report No.)	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt along alignment (mm/m)	Maximum predicted total tilt across alignment (mm/m)
Previous Layout (MSEC1117)	650	2.0	1.0
Modified Layout (MSEC1318)	600	2.0	1.5

The maximum predicted vertical subsidence for the 11 kV and low voltage powerlines, based on the Modified Layout, is slightly less than the maximum predicted value based on the Previous Layout. The predicted subsidence reduces due to the greater end effects caused by the shortened commencing ends of LW710A and LW711.

The maximum predicted tilt along the alignment of the 11 kV and low voltage powerlines, based on the Modified Layout, is the same as the maximum predicted value based on the Previous Layout. The maximum value occurs above the commencing end of LW710A and, therefore, while the value does not change it moves further towards the east due to the proposed modifications.

The maximum predicted tilt across the alignment of the 11 kV and low voltage powerlines, based on the Modified Layout, is slightly greater than the maximum predicted value based on the Previous Layout. The maximum value occurs along Gibraltar Drive where the longitudinal tilt adjacent to the longwall commencing end increases due to the proposed modification.

While the maximum predicted tilt across the alignment of the 11 kV and low voltage powerlines increases, it is less than the maximum predicted value for the powerlines located elsewhere above the mining area. Also, the tilt is very small and not expected to result in adverse impacts on the powerlines.

The maximum predicted subsidence effects for the remaining powerlines within the Study Area, based on the Modified Layout, are the same or slightly less than the maximum predicted values based on the Previous Layout. Only low-level subsidence effects are predicted for these powerlines due to their distances outside the mining area.

The assessed levels of potential impact for the 11 kV and low voltage powerlines, based on the Modified Layout, are similar to or less than those based on the Previous Layout. The assessments and recommended management strategies for the powerlines, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.8. Telecommunications services

The locations of the telecommunications services are shown in Drawing No. MSEC1318-04.

There is a Telstra optical fibre cable located along Stonebrook Meadows Road and Donalds Range Road to the west of the mining area. The maximum predicted subsidence effects for the optical fibre cable, based on the Modified Layout, are the same or slightly less than the maximum predicted values based on the Previous Layout. Only low-level subsidence effects are predicted for the optical fibre cable due to its distance outside the mining area.

There are copper telecommunications cables located along Top Ridge Road and Gibraltar Drive directly above LW710A and LW711. The maximum predicted subsidence effects for the copper cables, based on the Modified Layout, are the same or slightly less than the maximum predicted values based on the Previous Layout. While the values do not change, the maximum predicted tilts and curvatures occur further to the east due to the proposed modifications.

The assessed levels of potential impact for the optical fibre and copper telecommunications cables, based on the Modified Layout, are similar to or less than those based on the Previous Layout. The assessments and recommended management strategies for the telecommunications services, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.9. Houses

The locations of the houses are shown in Drawing No. MSEC1318-05.

There are 42 houses located within the Study Area. It is noted that three additional houses have been constructed within the Study Area since the preparation of Report No. MSEC1117 and the Extraction Plan Application which have also been considered in this report.

There are three houses located above the western end of LW710A (Refs. O02h01, O03h01 and O04h01) and two houses located above the western end of LW711 (Refs. O05h01 and O08h01) based on the Modified Layout. The remaining houses within the Study Area are located outside the mining area. There are two additional houses above LW710A and three additional houses above LW711 based on the Previous Layout.

The maximum predicted values of total vertical subsidence, tilt and curvature for the houses within the Study Area are provided in Table B.01 for the Previous Layout and Table B.02 for the Modified Layout, in Appendix B. The values in these tables are based on the maximum predicted subsidence effects within 20 m of the perimeter of each house due to the mining in Areas 7 and 9.

A summary of the maximum predicted subsidence effects for the houses within the Study Area, based on the Previous and Modified Layouts, is provided in Table 3.7.

Table 3.7 Maximum predicted total conventional vertical subsidence, tilt and curvature for the houses within the Study Area due to mining in Areas 7 and 9

Layout (Report No.)	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km^{-1})	Maximum predicted total sagging curvature (km^{-1})
Previous Layout (MSEC1117)	925	5.0	0.05	0.13
Modified Layout (MSEC1318)	925	3.5	0.04	0.13

The maximum predicted vertical subsidence is 925 mm and the maximum predicted sagging curvature is 0.13 km^{-1} at House Ref. O08h01 based on both the Previous and Modified Layouts. This house is located above LW711 away from the longwall commencing end and, therefore, the predicted vertical subsidence and sagging curvature do not change due to the proposed modifications.

The maximum predicted tilt is 5.0 mm/m at House Ref. O19h01 based on the Previous Layout and 3.5 mm/m at House Ref. O08h01 based on the Modified Layout. The maximum predicted hogging curvature is 0.05 km^{-1} at House Refs. O05h01 and O19h01 based on the Previous Layout and 0.04 km^{-1} at House Ref. O05h01 based on the Modified Layout. The tilt and hogging curvature at House Ref. O19h01 reduce because it is located above the mining area based on the Previous Layout and outside the mining area based on the Modified Layout.

The predicted vertical subsidence for each of the houses within the Study Area reduce due to the proposed modifications. The reasons are there are increased longwall end effects for the houses located above the mining area and increased distances from LW710A and LW711 for the houses outside the mining area.

The predicted tilts and curvatures for some houses slightly increase and the predicted tilts and curvatures at other houses slightly decrease, due to the proposed modifications, depending on their positions relative to the commencing (i.e. western) ends of LW710A and LW711. The overall level of the predicted subsidence effects for the houses within the Study Area slightly reduce.

The assessed levels of potential impact for the houses, based on the Modified Layout, are similar to or less than those based on the Previous Layout. The assessments and recommended management strategies for the houses, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.10. Other structures

The locations of the building structures are shown in Drawing No. MSEC1318-05.

There are other non-residential building structures (i.e. sheds, garages, etc.) and other structures (i.e. tanks and pools) that are located within the Study Area. The predicted subsidence effects for these structures are similar to the houses, as described in Section 3.9.

The predicted subsidence effects for these structures, based on the Modified Layout, are similar to the predicted values based on the Previous Layout. The predicted tilts and curvatures slightly increase in some locations and slightly decrease in other locations. However, the overall level of predicted movement does not change due to the proposed modifications.

The assessed levels of potential impact for the other structures, based on the Modified Layout, are similar to those based on the Previous Layout. The assessments and recommended management strategies for the other structures, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.11. Aboriginal heritage sites

The locations of the Aboriginal heritage sites are shown in Drawing No. MSEC1318-04.

There are two Aboriginal heritage sites (Refs. 52-2-4226 and 52-2-4227) that are located within the Study Area. These two sites are Open Sites located above the western end of LW711.

A summary of the maximum predicted total vertical subsidence, tilt and curvatures for the Aboriginal heritage sites within the Study Area, based on the Previous and Modified Layouts, is provided in Table 3.8. The values are the maximum predicted subsidence effects within 20 m of the identified locations of each of the sites due to the mining in Areas 7 and 9.

Table 3.8 Maximum predicted total vertical subsidence, tilt and curvature for the Aboriginal heritage sites within the Study Area due to mining in Areas 7 and 9

Layout (Report No.)	Site ref.	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km^{-1})	Maximum predicted total sagging curvature (km^{-1})
Previous Layout (MSEC1117)	52-2-4226	275	3.0	0.05	< 0.01
	52-2-4227	475	5.5	0.06	< 0.01
Modified Layout (MSEC1318)	52-2-4226	90	1.0	0.01	< 0.01
	52-2-4227	225	3.0	0.03	< 0.01

The maximum predicted subsidence effects for Sites Refs. 52-2-4226 and 52-2-4227, based on the Modified Layout, are less than the predicted values based on the Previous Layout. The predicted subsidence effects reduce due to the greater end effects caused by the shortened commencing ends of LW710A and LW711.

The assessed levels of potential impact for the Aboriginal heritage sites, based on the Modified Layout, are less than those based on the Previous Layout. The assessments and recommended management strategies for the Aboriginal heritage sites, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

3.12. Summary

The maximum predicted subsidence effects, based on the Modified Layout, are the same as the maximum predicted values based on the Previous Layout. The locations of the maximum predicted longitudinal tilts and curvatures move towards the east due to the proposed modifications. However, these longitudinal effects are less than the maximum predicted values that occur transverse to the longwalls.

The maximum predicted subsidence effects for the natural and built features within the Study Area, based on the Modified Layout, are typically similar to or less than the maximum predicted values based on the Previous Layout. In these cases, the maximum predicted subsidence effects occur away from the commencing (i.e. western) ends of LW710A and LW711.

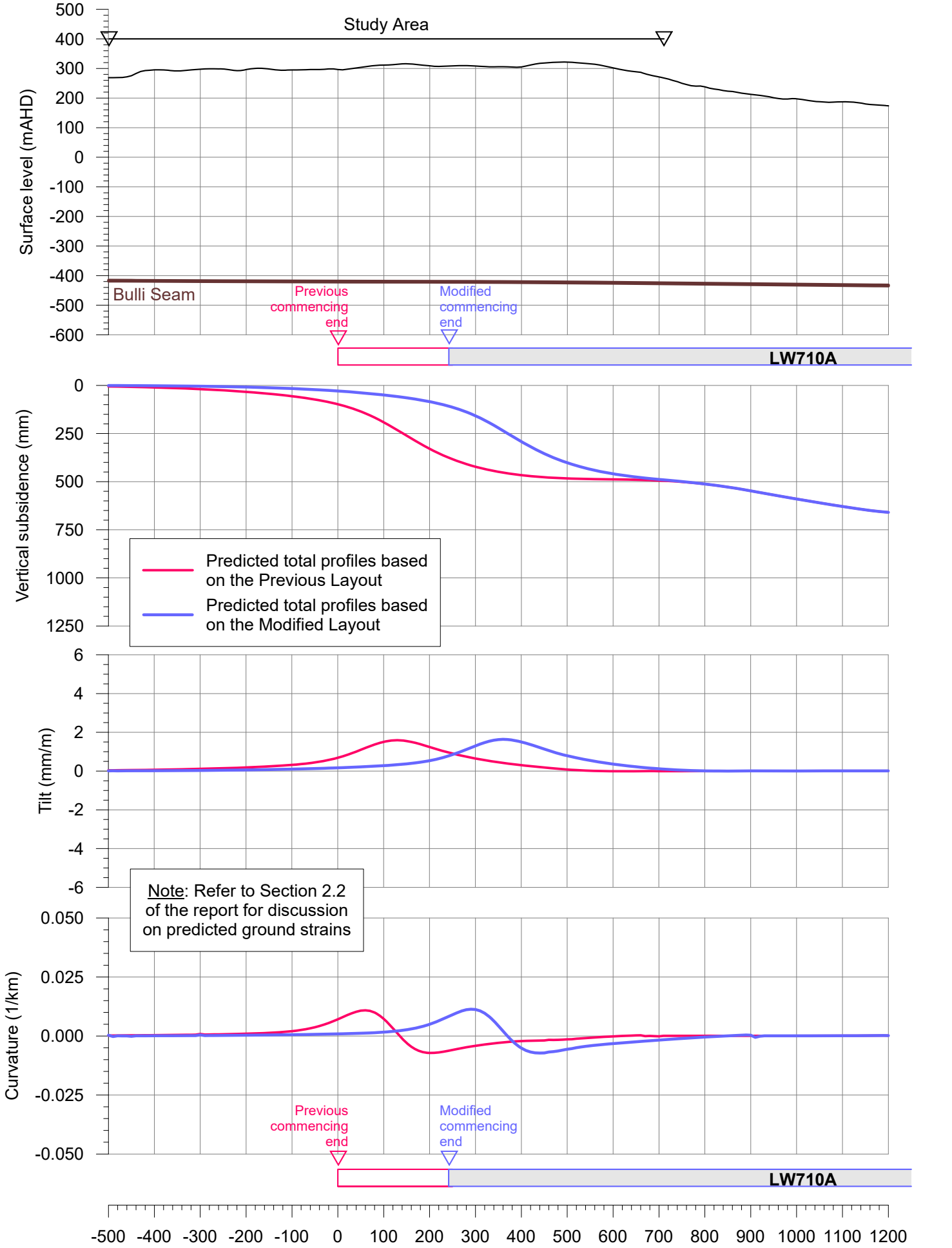
The predicted tilts and curvatures for the features located above and adjacent to the modified commencing (i.e. western) ends of LW710A and LW711 slightly increase. The predicted subsidence effects slightly increase where the features are located closer to the maximum longitudinal tilts and curvatures adjacent to the longwall commencing ends. However, these longitudinal tilts and curvatures are less than the maximum values that occur elsewhere above the mining area.

The predicted tilts and curvatures for the features located outside and adjacent to the modified commencing (i.e. western) ends of LW710A and LW711 slightly decrease. The predicted subsidence effects reduce due to the increased distances of these features outside of the mining area.

The assessed levels of potential impact for the natural and built features, based on the Modified Layout, are the same as those based on the Previous Layout. The assessments and recommended management strategies for these features, therefore, are the same as those previously provided in Report No. MSEC1117 and the Extraction Plan Application.

APPENDIX A. FIGURES

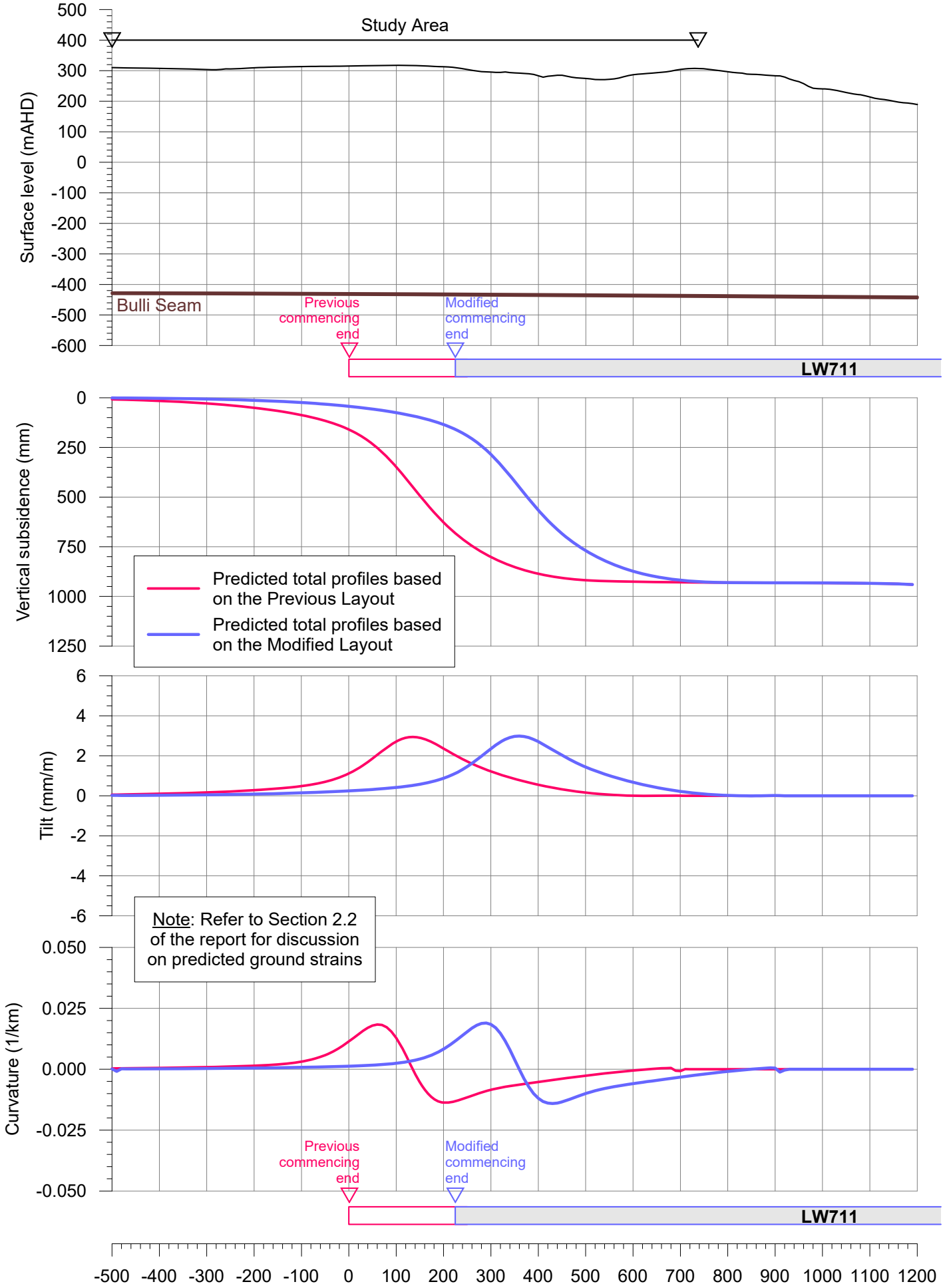
Predicted profiles of total vertical subsidence, tilt and curvature along Prediction Line 1 due to mining in Areas 7 and 9



msec

Fig. A.01

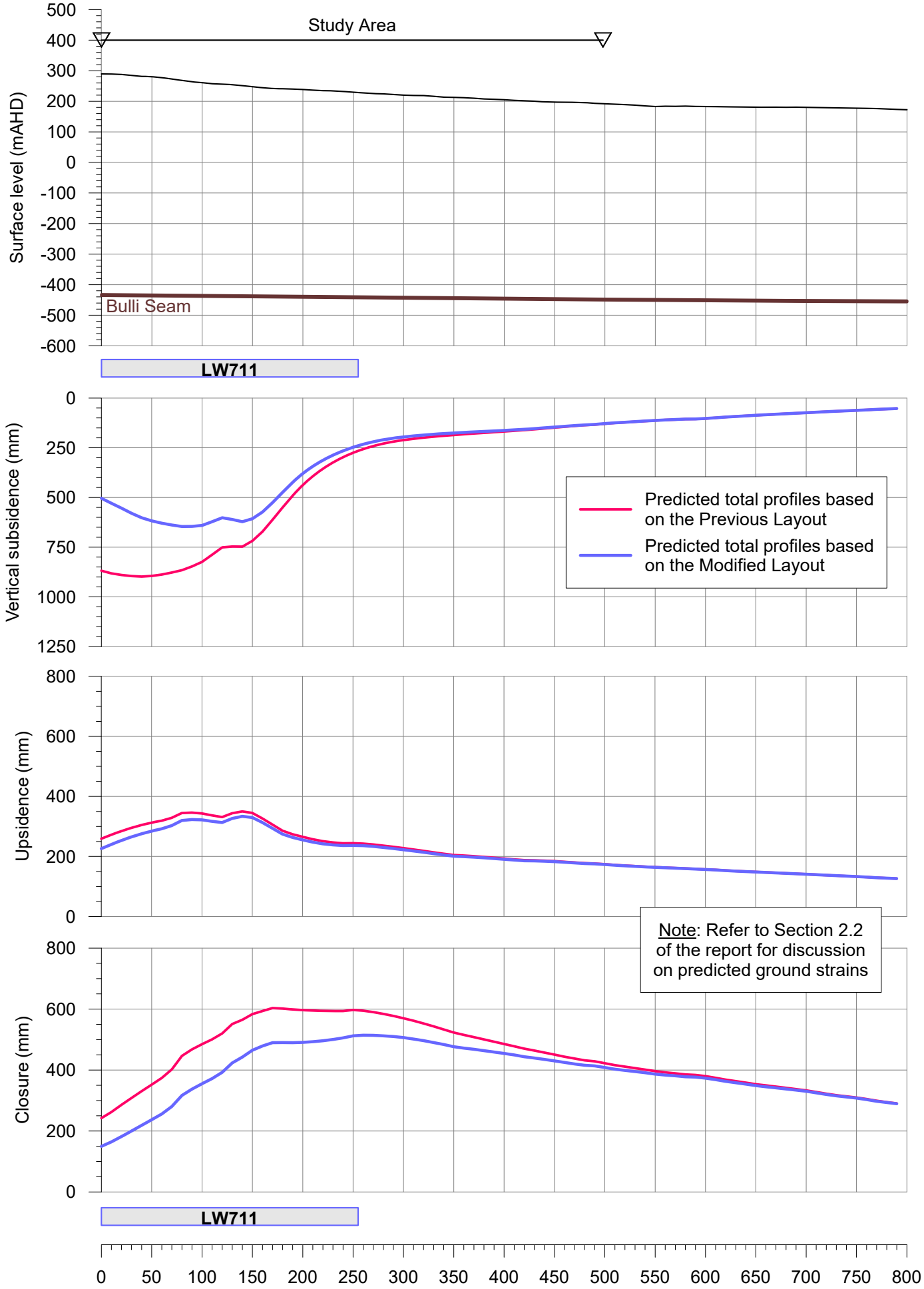
Predicted profiles of total vertical subsidence, tilt and curvature along Prediction Line 2 due to mining in Areas 7 and 9



msec

Fig. A.02

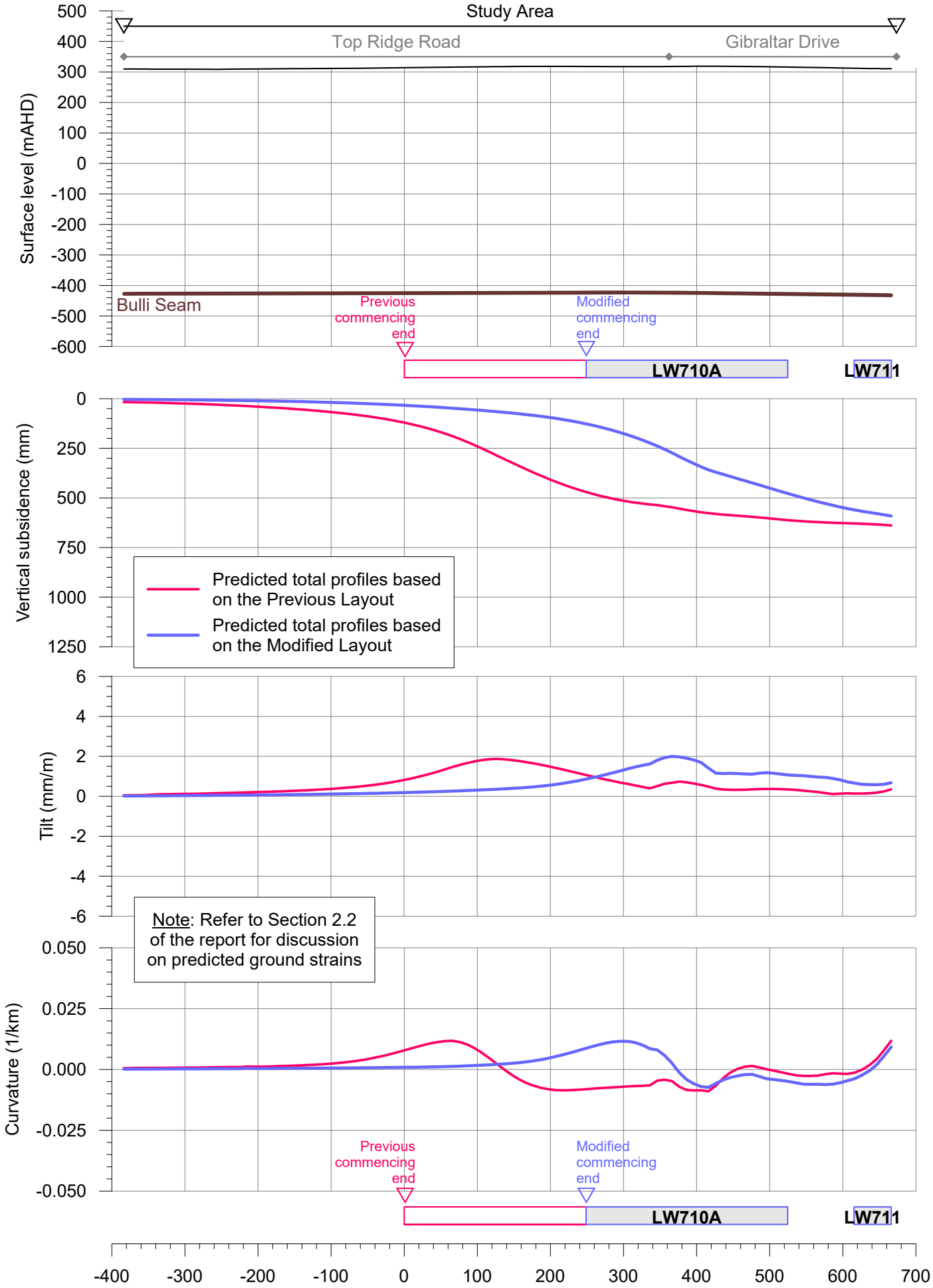
Predicted profiles of total vertical subsidence, upsidence and closure along Navigation Creek due to mining in Areas 7 and 9



msec

Fig. A.03

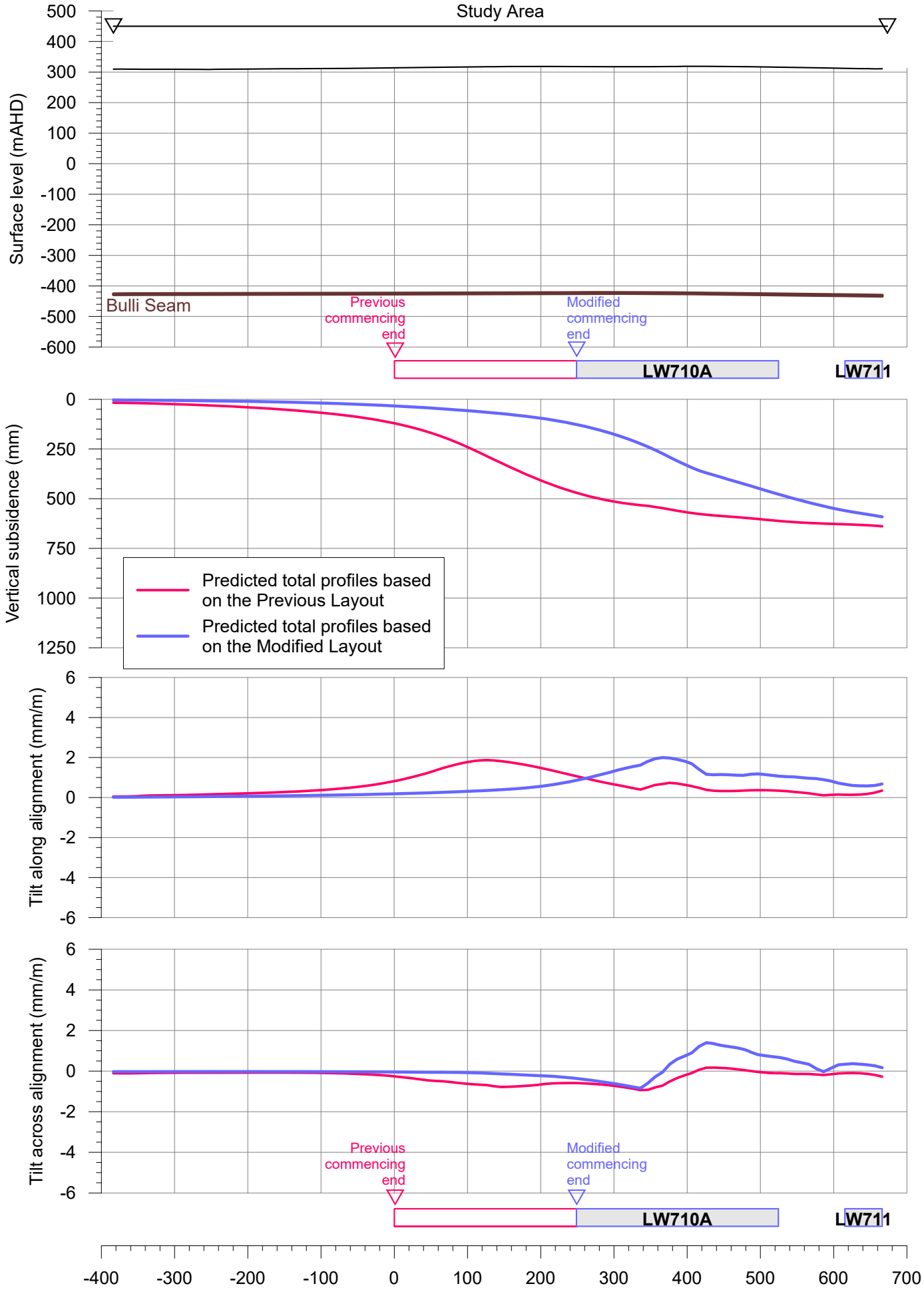
Predicted profiles of total vertical subsidence, tilt and curvature along Top Ridge Road due to mining in Areas 7 and 9



msec

Fig. A.04

Predicted profiles of total vertical subsidence, tilt along and tilt across the 11 kV powerline due to mining in Areas 7 and 9



msec

Fig. A.05

APPENDIX B. TABLES

Table B.01 - Predicted subsidence effects for the houses based on the Previous Layout

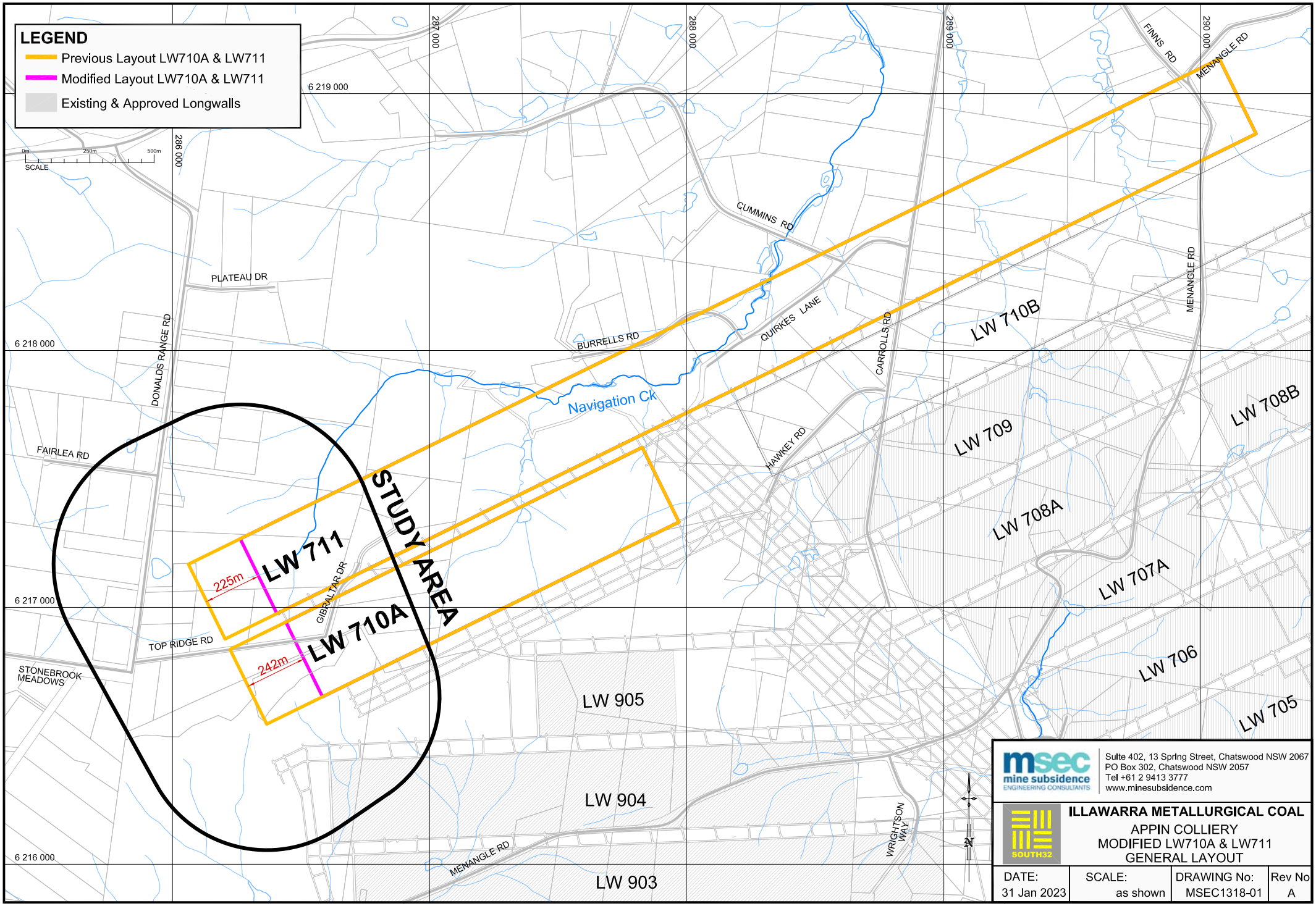
Structure Reference	Centroid MGA Easting	Centroid MGA Northing	Structure Type	Predicted total subsidence after LW711 (mm)	Predicted total tilt after LW711 (mm/m)	Predicted total hogging curvature after LW711 (1/km)	Predicted total sagging curvature after LW711 (1/km)	Predicted Probability of Nil or Category R0 Impact for Houses (%)	Predicted Probability of Category R1 or R2 Impact for Houses (%)	Predicted Probability of Category R3 and R4 Impact for Houses (%)	Predicted Probability of Category R5 Impact for Houses (%)
O01h01	286052	6216700	House	40	< 0.5	< 0.01	< 0.01	94.1	5.0	0.7	0.1
O02h01	286818	6216840	House	275	3.0	0.03	< 0.01	64.6	23.2	10.2	2.0
O03h01	286686	6216959	House	600	1.5	< 0.01	0.04	59.9	25.6	11.8	2.8
O04h01	286694	6217045	House	625	< 0.5	0.01	< 0.01	82.4	12.8	4.4	0.5
O05h01	286768	6217189	House	675	1.5	0.05	0.01	55.5	27.8	13.2	3.6
O08h01	286788	6217318	House	925	3.5	0.03	0.13	44.1	33.9	15.5	6.5
O09h01	286389	6216912	House	450	2.0	< 0.01	< 0.01	85.0	11.1	3.5	0.3
O10h01	286264	6217003	House	350	3.0	0.02	< 0.01	72.9	18.4	7.5	1.2
O10h02	286241	6216918	House	225	2.0	0.01	< 0.01	81.5	13.3	4.7	0.6
O11h01	286035	6216905	House	70	< 0.5	< 0.01	< 0.01	92.2	6.3	1.3	0.2
O11h02	286013	6216924	House	70	< 0.5	< 0.01	< 0.01	90.5	7.4	1.8	0.2
O12h01	285979	6217014	House	80	0.5	< 0.01	< 0.01	87.4	9.6	2.8	0.3
O13h01	286022	6217092	House	90	1.0	< 0.01	< 0.01	88.6	8.8	2.4	0.3
O14h01	286143	6217176	House	180	2.5	0.02	< 0.01	70.5	19.8	8.3	1.4
O15h01	286233	6217449	House	140	0.5	< 0.01	< 0.01	92.6	6.0	1.2	0.2
O16h01	285965	6217414	House	30	< 0.5	< 0.01	< 0.01	92.9	5.9	1.1	0.2
O17h01	286361	6216684	House	150	1.5	0.01	< 0.01	83.6	12.0	4.0	0.4
O18h01	286254	6216668	House	90	0.5	< 0.01	< 0.01	88.8	8.6	2.4	0.2
O18h02	286227	6216661	House	80	0.5	< 0.01	< 0.01	91.0	7.1	1.7	0.2
O19h01	286267	6217195	House	575	5.0	0.05	0.05	54.4	28.3	13.5	3.7
O21h01	286003	6217325	House	40	< 0.5	< 0.01	< 0.01	91.8	6.6	1.4	0.2
O21h02	285983	6217327	House	40	< 0.5	< 0.01	< 0.01	92.4	6.2	1.3	0.2
O22h01	286160	6217322	House	130	0.5	< 0.01	< 0.01	90.0	7.8	2.0	0.2
O23h01	285880	6216669	House	< 20	< 0.5	< 0.01	< 0.01	94.8	4.5	0.5	0.1
P01h01	285754	6216650	House	< 20	< 0.5	< 0.01	< 0.01	95.1	4.4	0.4	0.1
P39h01	285637	6216817	House	< 20	< 0.5	< 0.01	< 0.01	94.7	4.6	0.5	0.1
P40h01	285772	6216806	House	< 20	< 0.5	< 0.01	< 0.01	94.2	5.0	0.7	0.1
P41h01	285830	6216992	House	30	< 0.5	< 0.01	< 0.01	93.9	5.2	0.8	0.1
P42h01	285614	6217061	House	< 20	< 0.5	< 0.01	< 0.01	95.1	4.4	0.4	0.1
P44h01	285834	6217231	House	< 20	< 0.5	< 0.01	< 0.01	94.9	4.5	0.5	0.1
P45h01	285877	6217371	House	< 20	< 0.5	< 0.01	< 0.01	94.5	4.8	0.6	0.1
P46h01	285785	6217437	House	< 20	< 0.5	< 0.01	< 0.01	95.1	4.4	0.4	0.1
P47h01	285628	6217477	House	< 20	< 0.5	< 0.01	< 0.01	95.3	4.2	0.4	0.1
R01h01	286372	6217571	House	120	0.5	< 0.01	< 0.01	93.0	5.8	1.1	0.2
R02h01	286257	6217547	House	100	0.5	< 0.01	< 0.01	92.7	6.0	1.2	0.2
R03h01	286247	6217743	House	< 20	< 0.5	< 0.01	< 0.01	93.0	5.8	1.1	0.2
R03h02	286229	6217762	House	< 20	< 0.5	< 0.01	< 0.01	93.5	5.4	0.9	0.1
R04h01	286107	6217580	House	40	< 0.5	< 0.01	< 0.01	92.8	5.9	1.1	0.2
R05h01	286152	6217715	House	< 20	< 0.5	< 0.01	< 0.01	93.4	5.5	1.0	0.1
R06h01	286137	6217763	House	< 20	< 0.5	< 0.01	< 0.01	94.1	5.0	0.7	0.1
R10h01	285889	6217580	House	< 20	< 0.5	< 0.01	< 0.01	94.7	4.6	0.6	0.1
R10h02	285908	6217560	House	< 20	< 0.5	< 0.01	< 0.01	94.6	4.7	0.6	0.1
			Maximum	**925**	**5.0**	**0.05**	**0.13**				

Table B.02 - Predicted subsidence effects for the houses based on the Modified Layout

Structure Reference	Centroid MGA Easting	Centroid MGA Northing	Structure Type	Predicted total subsidence after LW711 (mm)	Predicted total tilt after LW711 (mm/m)	Predicted total hogging curvature after LW711 (1/km)	Predicted total sagging curvature after LW711 (1/km)	Predicted Probability of Nil or Category R0 Impact for Houses (%)	Predicted Probability of Category R1 or R2 Impact for Houses (%)	Predicted Probability of Category R3 and R4 Impact for Houses (%)	Predicted Probability of Category R5 Impact for Houses (%)
O01h01	286052	6216700	House	< 20	< 0.5	< 0.01	< 0.01	94.9	4.5	0.5	0.1
O02h01	286818	6216840	House	250	3.0	0.03	< 0.01	66.7	22.1	9.5	1.7
O03h01	286686	6216959	House	500	1.5	< 0.01	0.03	65.2	22.9	10.0	1.9
O04h01	286694	6217045	House	550	1.0	0.01	< 0.01	83.7	11.9	3.9	0.4
O05h01	286768	6217189	House	650	1.5	0.04	0.01	56.2	27.4	13.0	3.4
O08h01	286788	6217318	House	925	3.5	0.03	0.13	44.1	33.9	15.5	6.5
O09h01	286389	6216912	House	100	0.5	< 0.01	< 0.01	87.9	9.2	2.6	0.3
O10h01	286264	6217003	House	80	0.5	< 0.01	< 0.01	91.7	6.7	1.5	0.2
O10h02	286241	6216918	House	50	< 0.5	< 0.01	< 0.01	92.9	5.9	1.1	0.2
O11h01	286035	6216905	House	< 20	< 0.5	< 0.01	< 0.01	94.6	4.7	0.6	0.1
O11h02	286013	6216924	House	< 20	< 0.5	< 0.01	< 0.01	94.3	4.9	0.7	0.1
O12h01	285979	6217014	House	20	< 0.5	< 0.01	< 0.01	93.5	5.5	0.9	0.1
O13h01	286022	6217092	House	30	< 0.5	< 0.01	< 0.01	93.8	5.3	0.8	0.1
O14h01	286143	6217176	House	50	< 0.5	< 0.01	< 0.01	91.5	6.8	1.5	0.2
O15h01	286233	6217449	House	50	< 0.5	< 0.01	< 0.01	91.5	6.8	1.5	0.2
O16h01	285965	6217414	House	< 20	< 0.5	< 0.01	< 0.01	95.1	4.3	0.4	0.1
O17h01	286361	6216684	House	40	< 0.5	< 0.01	< 0.01	93.9	5.2	0.8	0.1
O18h01	286254	6216668	House	30	< 0.5	< 0.01	< 0.01	94.5	4.8	0.6	0.1
O18h02	286227	6216661	House	20	< 0.5	< 0.01	< 0.01	94.6	4.7	0.6	0.1
O19h01	286267	6217195	House	140	1.5	0.01	0.01	83.6	12.1	4.0	0.4
O21h01	286003	6217325	House	< 20	< 0.5	< 0.01	< 0.01	95.0	4.4	0.4	0.1
O21h02	285983	6217327	House	< 20	< 0.5	< 0.01	< 0.01	95.1	4.4	0.4	0.1
O22h01	286160	6217322	House	30	< 0.5	< 0.01	< 0.01	92.6	6.1	1.2	0.2
O23h01	285880	6216669	House	< 20	< 0.5	< 0.01	< 0.01	95.2	4.3	0.4	0.1
P01h01	285754	6216650	House	< 20	< 0.5	< 0.01	< 0.01	93.3	5.6	1.0	0.1
P39h01	285637	6216817	House	< 20	< 0.5	< 0.01	< 0.01	92.3	6.2	1.3	0.2
P40h01	285772	6216806	House	< 20	< 0.5	< 0.01	< 0.01	95.2	4.3	0.4	0.1
P41h01	285830	6216992	House	< 20	< 0.5	< 0.01	< 0.01	95.0	4.4	0.5	0.1
P42h01	285614	6217061	House	< 20	< 0.5	< 0.01	< 0.01	95.4	4.2	0.4	0.1
P44h01	285834	6217231	House	< 20	< 0.5	< 0.01	< 0.01	95.3	4.2	0.4	0.1
P45h01	285877	6217371	House	< 20	< 0.5	< 0.01	< 0.01	95.2	4.3	0.4	0.1
P46h01	285785	6217437	House	< 20	< 0.5	< 0.01	< 0.01	95.3	4.2	0.4	0.1
P47h01	285628	6217477	House	< 20	< 0.5	< 0.01	< 0.01	95.4	4.2	0.3	0.1
R01h01	286372	6217571	House	90	0.5	< 0.01	< 0.01	93.3	5.6	1.0	0.1
R02h01	286257	6217547	House	50	< 0.5	< 0.01	< 0.01	93.4	5.5	1.0	0.1
R03h01	286247	6217743	House	< 20	< 0.5	< 0.01	< 0.01	93.7	5.3	0.9	0.1
R03h02	286229	6217762	House	< 20	< 0.5	< 0.01	< 0.01	94.1	5.0	0.7	0.1
R04h01	286107	6217580	House	< 20	< 0.5	< 0.01	< 0.01	94.1	5.0	0.7	0.1
R05h01	286152	6217715	House	< 20	< 0.5	< 0.01	< 0.01	94.5	4.8	0.6	0.1
R06h01	286137	6217763	House	< 20	< 0.5	< 0.01	< 0.01	94.7	4.6	0.5	0.1
R10h01	285889	6217580	House	< 20	< 0.5	< 0.01	< 0.01	95.3	4.2	0.4	0.1
R10h02	285908	6217560	House	< 20	< 0.5	< 0.01	< 0.01	95.3	4.2	0.4	0.1
			Maximum	**925**	**3.5**	**0.04**	**0.13**				

APPENDIX C. DRAWINGS

I:\Projects\Appin\Area 7\MSEC1318 - Modification of LW710A and LW711\AcadData\MSEC1318-01 General Layout.dwg



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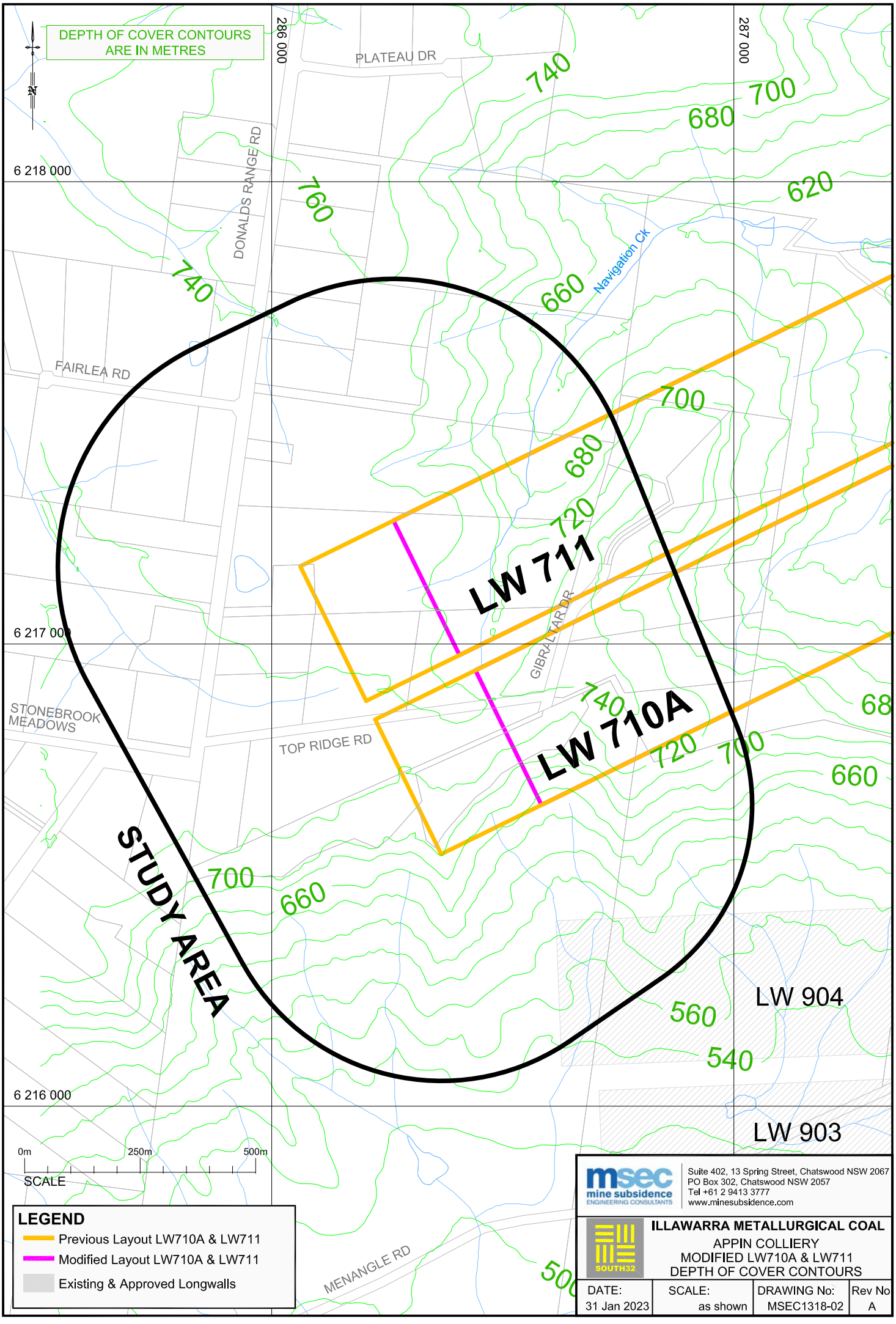
ILLAWARRA METALLURGICAL COAL

APPIN COLLIERY
MODIFIED LW710A & LW711
GENERAL LAYOUT

DATE:	SCALE:	DRAWING No:	Rev No
31 Jan 2023	as shown	MSEC1318-01	A

I:\Projects\Appin\Area 7\MSEC1318 - Modification of LW710A and LW711\AcadData\MSEC1318-02 Depth of Cover.dwg



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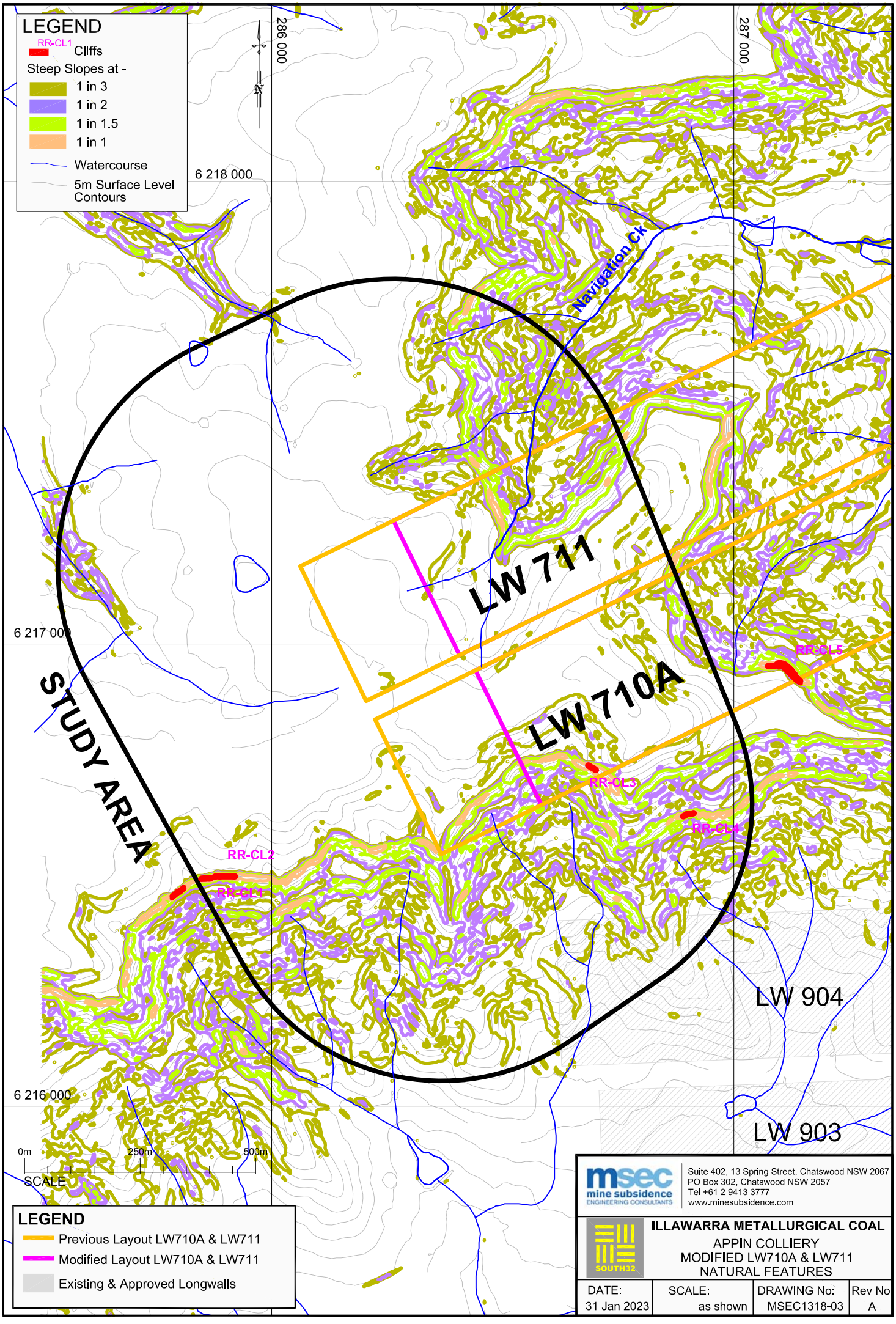
ILLAWARRA METALLURGICAL COAL

APPIN COLLIERY
MODIFIED LW710A & LW711
DEPTH OF COVER CONTOURS

DATE:	SCALE:	DRAWING No:	Rev No
31 Jan 2023	as shown	MSEC1318-02	A

I:\Projects\Appin\Area 7\MSEC1318 - Modification of LW710A and LW711\AcadData\MSEC1318-03 Natural Features.dwg



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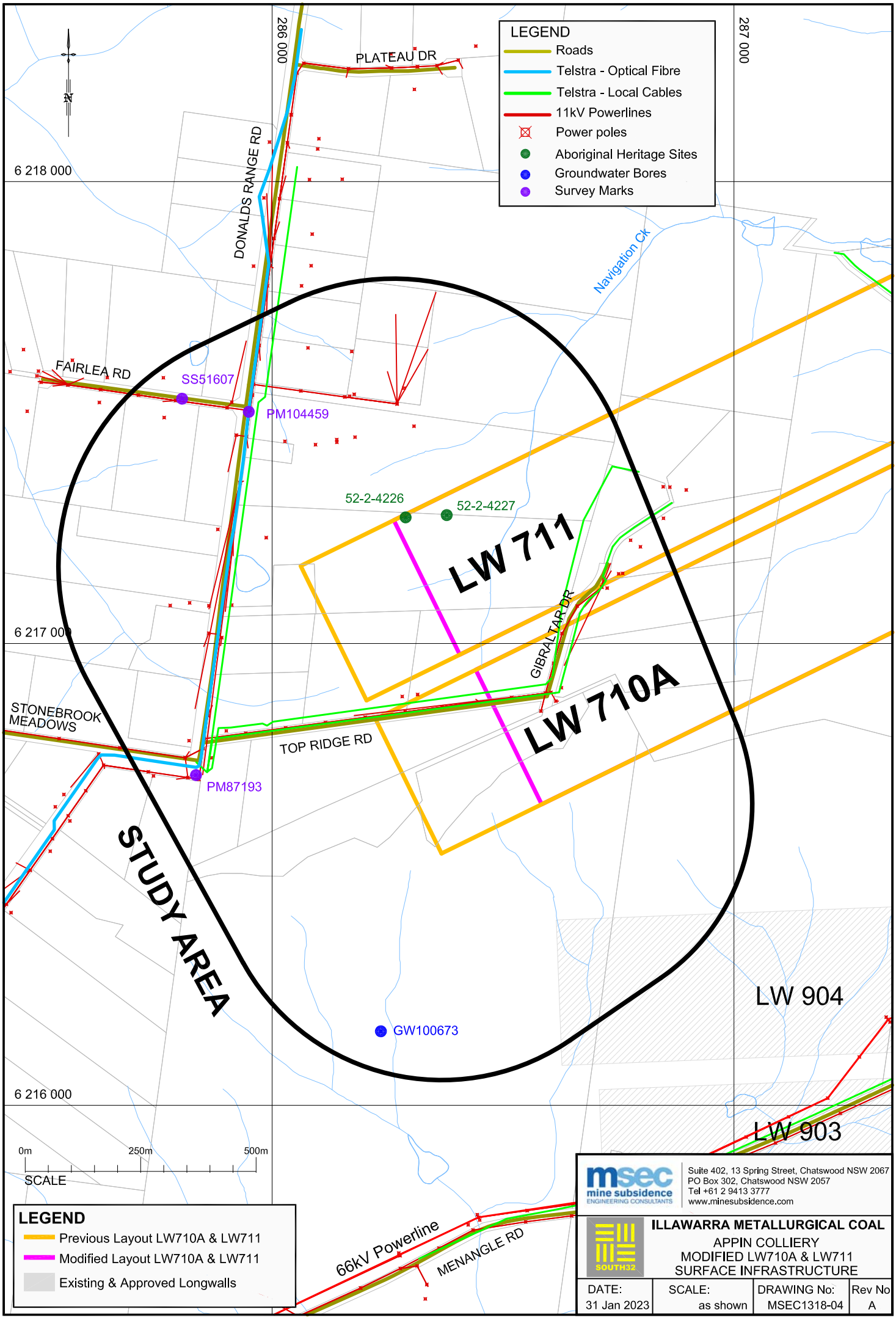
APPIN COLLIERY
MODIFIED LW710A & LW711
NATURAL FEATURES

DATE:	SCALE:	DRAWING No:	Rev No
31 Jan 2023	as shown	MSEC1318-03	A

I:\Projects\Appin\Area 7\MSEC1318 - Modification of LW710A and LW711\AcadData\MSEC1318-04 Surface Infrastructure.dwg



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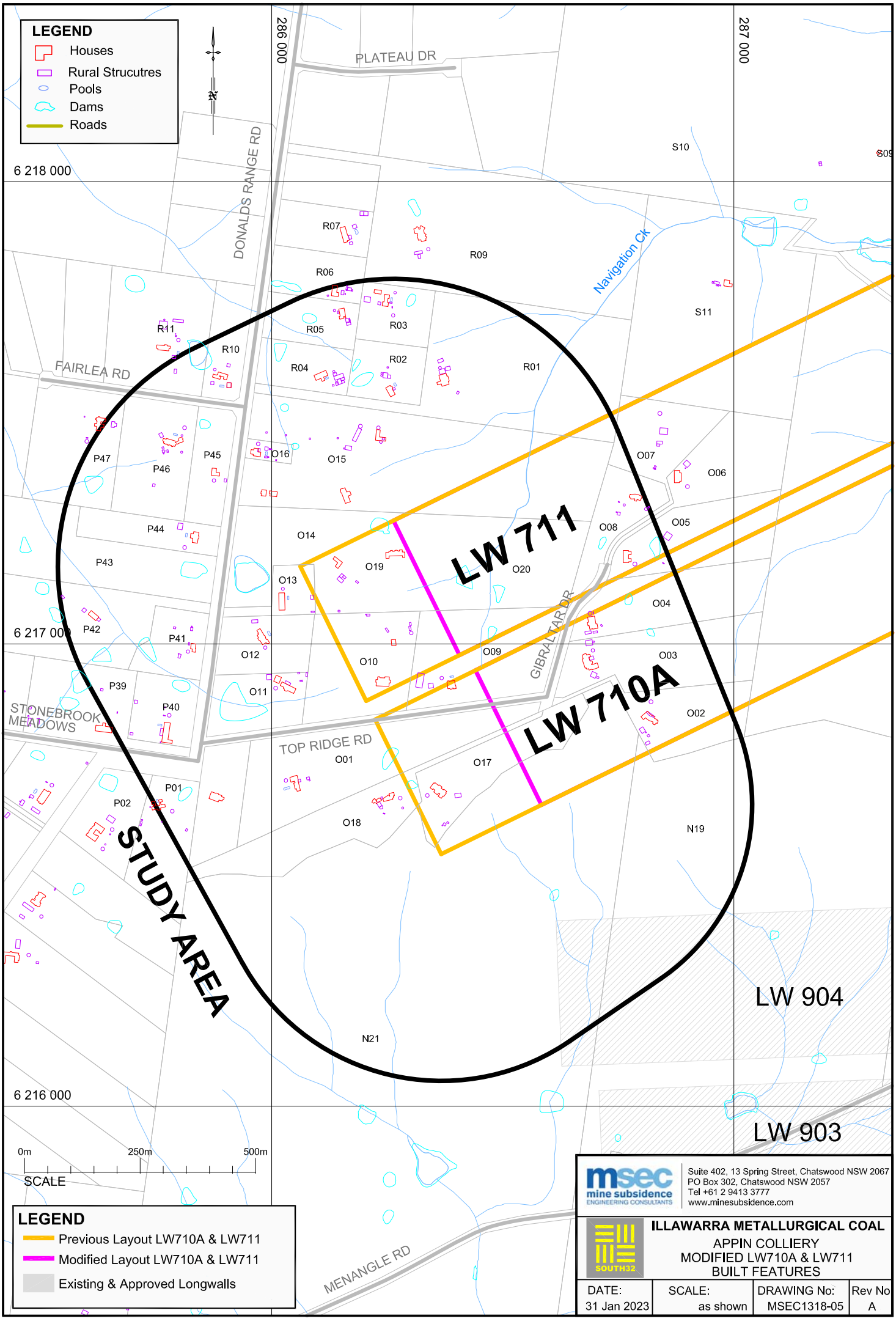
ILLAWARRA METALLURGICAL COAL

APPIN COLLIERY
MODIFIED LW710A & LW711
SURFACE INFRASTRUCTURE

DATE:	SCALE:	DRAWING No:	Rev No
31 Jan 2023	as shown	MSEC1318-04	A

I:\Projects\Appin\Area 7\MSEC1318 - Modification of LW710A and LW711\AcadData\MSEC1318-05 Built Features.dwg



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APPIN COLLIERY
MODIFIED LW710A & LW711
BUILT FEATURES

DATE:	SCALE:	DRAWING No:	Rev No
31 Jan 2023	as shown	MSEC1318-05	A

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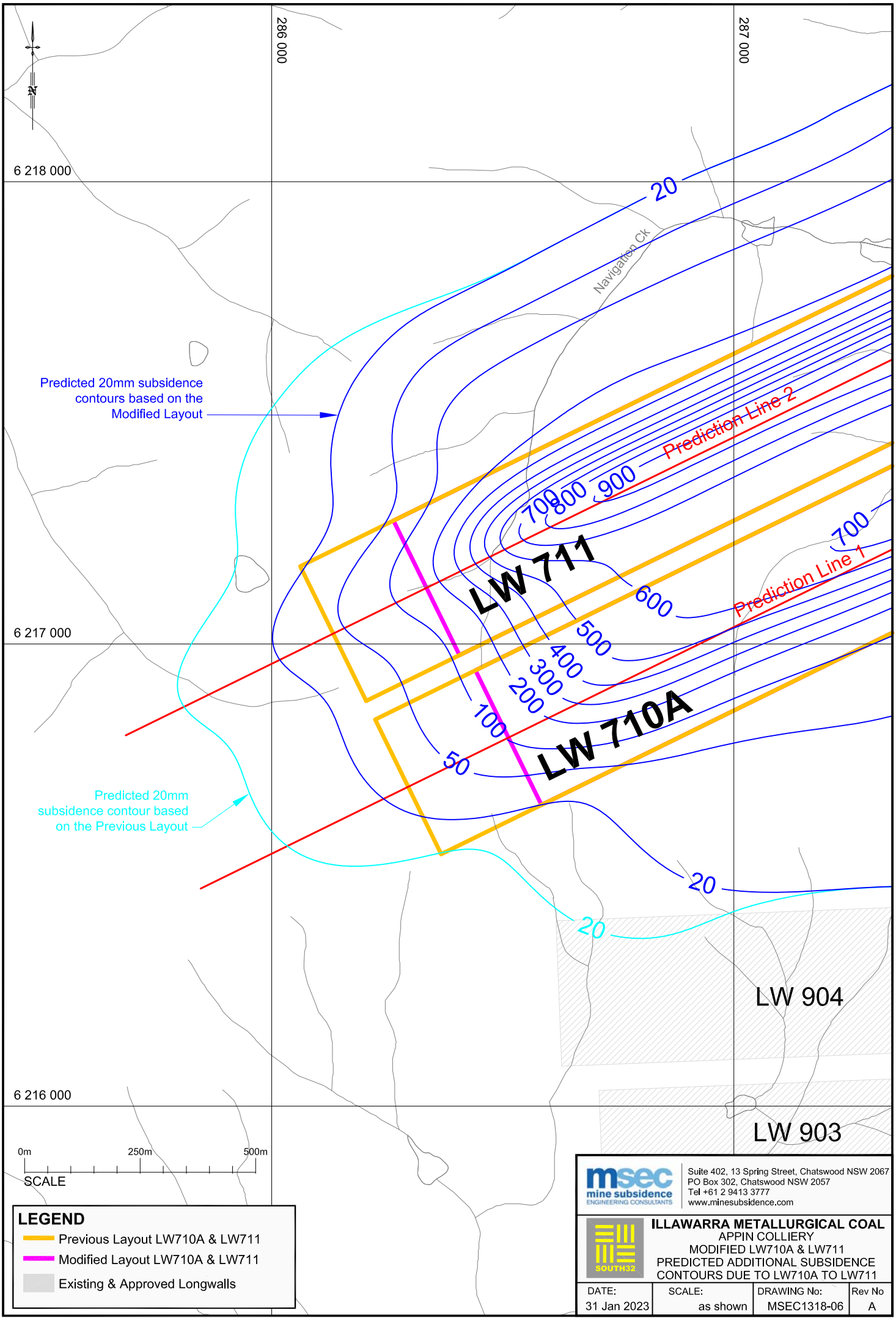

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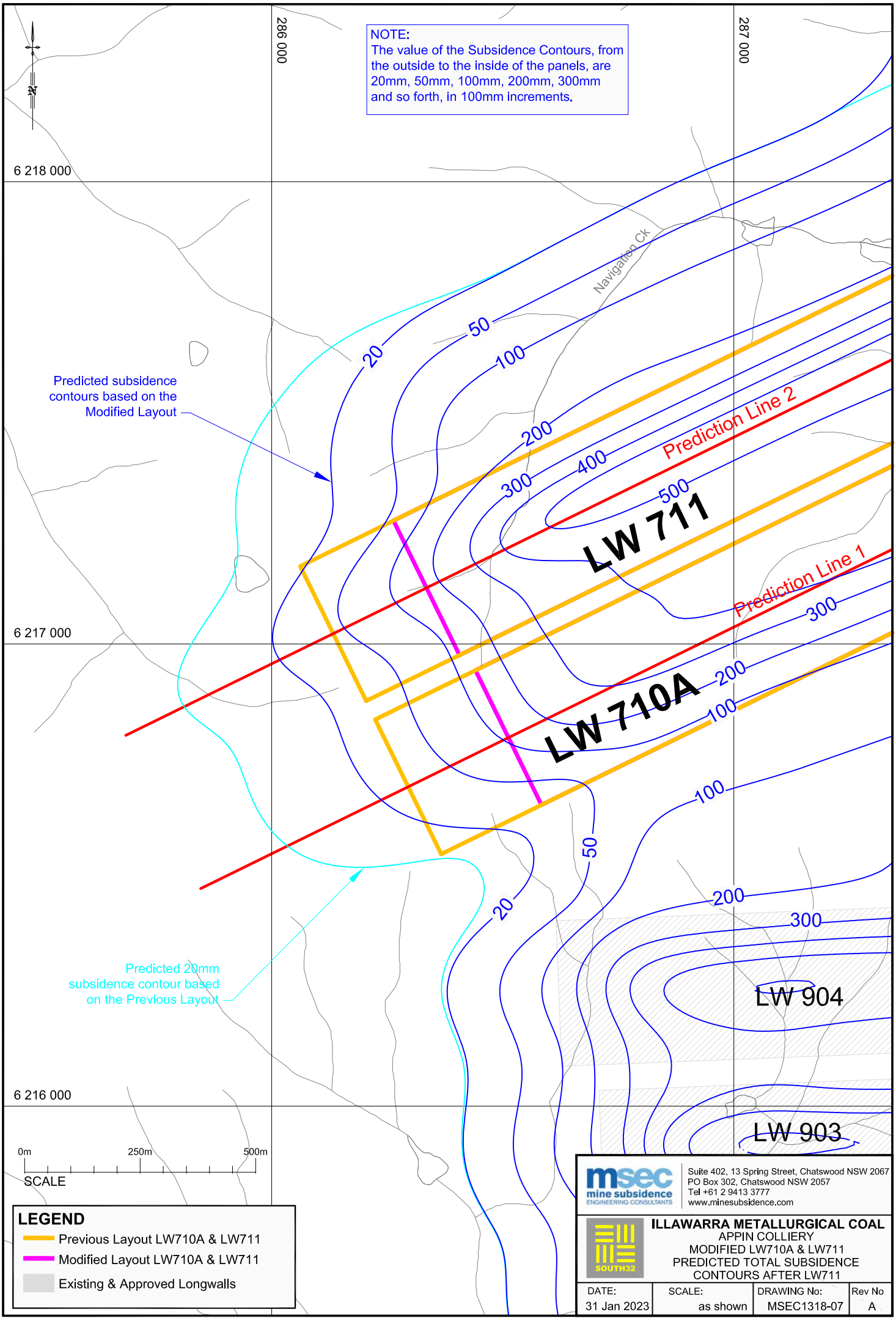
APPIN COLLIERY
MODIFIED LW710A & LW711
PREDICTED ADDITIONAL SUBSIDENCE
CONTOURS DUE TO LW710A TO LW711

DATE:	SCALE:	DRAWING No:	Rev No
31 Jan 2023	as shown	MSEC1318-06	A

I:\Projects\Appin\Area 7\MSEC1318 - Modification of LW710A and LW711\AcadData\MSEC1318-07 Pred Total Subs after LW711.dwg



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MODIFIED LW710A & LW711
PREDICTED TOTAL SUBSIDENCE
CONTOURS AFTER LW711

DATE:	SCALE:	DRAWING No:	Rev No
31 Jan 2023	as shown	MSEC1318-07	A