

ILLAWARRA COAL HOLDINGS:

Appin – Longwalls 712 to 716

Subsidence Predictions and Impact Assessments for the Natural and Built Features due to the Mining of the Proposed Longwalls 712 to 716 at Appin Mine

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Previous reports:

MSEC342 (Rev. C) – *The prediction of subsidence parameters and the assessment of mine subsidence impacts on natural features and surface infrastructure resulting from the extraction of proposed Longwalls 705 to 710 at Appin Colliery in support of the SMP Application*, dated 27 June 2008

MSEC404 (Revision D) – *The prediction of subsidence parameters and the assessment of mine subsidence impacts on natural features and surface infrastructure resulting from the Bulli Seam Operations in support of the Part 3A Application*, dated 19 August 2009.

MSEC1117 (Rev. B) – Appin – Longwalls 709, 710A, 710B, 711 and 905 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 Mine, dated 18 May 2021.

Background reports available at www.minesubsidence.com¹:

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)

¹ Direct link: http://www.minesubsidence.com/index_files/page0004.htm

Illawarra Coal Holdings Pty Limited (ICHPL), a wholly owned subsidiary of Gear M Illawarra Met Coal Pty Ltd (GM³), operates Appin Mine, which is in the Southern Coalfield of New South Wales.

ICHPL is preparing an Extraction Plan (EP) Application for Longwalls 712 to 716 (LW712 to LW716) in the Bulli Seam. This subsidence report provides information to support the EP Application which will be submitted to the Department of Planning, Housing and Infrastructure.

The predicted subsidence effects for the existing, approved and proposed longwalls in Appin Areas 7 and 9 have been obtained using the Incremental Profile Method (IPM). The IPM has been calibrated for the local conditions using the available ground movement monitoring data from Appin Mine and other nearby collieries.

The maximum predicted total subsidence effects are: 1450 mm vertical subsidence, 6.5 mm/m tilt (i.e. 0.65 % or 1 in 154), 0.07 km⁻¹ hogging curvature (i.e. minimum radius of curvature of 14 km) and 0.14 km⁻¹ sagging curvature (i.e. minimum radius of curvature of 7 km). The maximum predicted strains (excluding valley-related effects) are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

The *Study Area* has been defined, as a minimum, as the surface area enclosed by the: 35° angle of draw line from the extents of LW712 to LW716; and the predicted additional 20 mm subsidence contour due to the mining of these longwalls. The features that are located within but not limited to 600 m of the proposed longwalls and are predicted to experience far-field or valley-related effects and could be sensitive to these movements have also been included in the assessments provided in this report.

The natural and built features are shown in Drawing Nos. MSEC1459-08 to MSEC1459-15. The surface features located within the Study Area include:

- Streams comprising Navigation Creek, Apps Gully, Foot Onslow Creek and their tributaries. The total lengths of the third order or greater streams are 4.9 km located directly above the proposed LW712 to LW716 and 10.0 km within the Study Area;
- Two cliffs (Refs. RR-CL5 and RR-CL8) and nine minor cliffs (Refs. MCL01 to MCL09) located on the side of Razorback Range above the western ends of the proposed longwalls. The total length of the cliffs and minor cliffs above the mining area is 440 m. The heights of the cliffs vary between 10 m and 20 m and the heights of the minor cliffs vary between 5 m and 10 m;
- Steep slopes along Razorback Range located on the side of Razorback Range above the western ends of the proposed longwalls;
- Local roads including Burrells Road, Carrolls Road, Cummins Road, Finns Road, Hawkey Road, Menangle Road, Quirkies Lane and Remembrance Drive. The total lengths of these roads are 7.7 km located directly above the proposed LW712 to LW716 and 15 km within the Study Area. Other associated infrastructure within the Study Area include road culverts and Moreton Park Road Bridge (North);
- 66 kV, 22 kV, 11 kV and 415 V powerlines. The total lengths of powerlines are 16 km located directly above the proposed LW712 to LW716 and 33 km within the Study Area. Other associated electrical infrastructure within the Study Area includes 40 substations;
- Two optical fibre cables owned by Telstra and NBN. The total lengths of cable are 2.0 km located directly above the proposed LW712 to LW716 and 3.3 km within the Study Area. Other telecommunications infrastructure includes local copper cables;
- Rural structures comprising animal shelters, awnings, cabanas, carports, decks, garages, gazebos, greenhouses, pergolas, porticos, sheds and verandahs. The total number of structures are 246 above the existing and approved LW709 to LW711, 405 above the proposed LW712 to LW716 and 166 outside the mining area;
- Other rural features comprising tanks, fences, farm dams, groundwater bores, pools, tennis courts and basketball courts;
- Aboriginal heritage sites comprising isolated finds (10 total), open camp sites (8 total) and PAD (1 total);
- Historic sites comprising Slab Hut, Mt Hercules homestead ruins, Dairy No.9 (EMAI Cottage 24) and Camden Park Estate and Belgenny Farm; and
- Houses with 62 located above the existing and approved LW709 to LW711, 110 located above the proposed LW712 to LW716 and 45 outside the mining area.

The assessed impacts for the natural and built features within the Study Area are similar to those assessed and observed for similar features located above the existing longwalls in Areas 7 and 9.

The assessments provided in this report indicate that the assessed levels of impact on the natural and built features can be managed by the preparation and implementation of appropriate management strategies. It should be noted, however, that more detailed assessments of some natural and built features have been undertaken by other specialist consultants, and the findings in this report should be read in conjunction with the findings in all other relevant reports.

1.0 INTRODUCTION	1
1.1. Background	1
1.2. Mining geometry	4
1.3. Surface and seam levels	4
1.4. Geological details	5
2.0 IDENTIFICATION OF SURFACE FEATURES	9
2.1. Definition of the Extent of the Longwall Mining Area	9
2.2. Definition of the Study Area	9
2.3. Natural and built features within the Study Area	9
3.0 OVERVIEW OF MINE SUBSIDENCE AND THE METHODS USED TO PREDICT THE SUBSIDENCE EFFECTS FOR THE EXISTING AND PROPOSED LONGWALLS	11
3.1. Introduction	11
3.2. Overview of conventional subsidence effects	11
3.3. Far-field movements	11
3.4. Overview of non-conventional subsidence movements	12
3.4.1. Non-conventional subsidence movements due to changes in geological conditions	12
3.4.2. Non-conventional subsidence movements due to steep topography	13
3.4.3. Valley-related effects	13
3.5. The Incremental Profile Method	14
3.6. Calibration of the IPM	14
3.7. Reliability of the calibrated IPM	18
4.0 MAXIMUM PREDICTED SUBSIDENCE EFFECTS FOR THE PROPOSED LONGWALLS	21
4.1. Introduction	21
4.2. Maximum predicted conventional subsidence, tilt and curvature	21
4.3. Predicted strains	22
4.3.1. Analysis of strains measured in survey bays	22
4.3.2. Analysis of strains measured along whole monitoring lines	26
4.3.3. Analysis of shear strains	26
4.4. Predicted conventional horizontal movements	28
4.5. Predicted far-field horizontal movements	28
4.6. Non-conventional ground movements	29
5.0 DESCRIPTIONS, PREDICTIONS AND IMPACT ASSESSMENTS FOR THE NATURAL FEATURES	30
5.1. Catchment Areas and Declared Special Areas	30
5.2. Rivers	30
5.3. Creeks and tributaries	30
5.3.1. Descriptions of the creeks and tributaries	30
5.3.2. Predictions for the creeks and tributaries	33
5.3.3. Impact assessments for the creeks and tributaries	37
5.3.4. Recommendations for the creeks and tributaries	41
5.4. Aquifers and known groundwater resources	41
5.5. Cliffs and minor Cliffs	41
5.5.1. Descriptions of the cliffs and minor cliffs	41

5.5.2.	Predictions for the cliffs and minor cliffs	44
5.5.3.	Impact assessments for the cliffs and minor cliffs	45
5.5.4.	Recommendations for the cliffs and minor cliffs	46
5.6.	Rock outcrops	47
5.7.	Steep slopes	47
5.7.1.	Descriptions of the steep slopes	47
5.7.2.	Predictions for the steep slopes	49
5.7.3.	Impact assessments for the steep slopes	49
5.7.4.	Recommendations for the steep slopes	51
5.8.	Escarments	51
5.9.	Land prone to flooding and inundation	51
5.10.	Swamps, wetlands and water related ecosystems	51
5.11.	Flora and fauna	51
6.0	DESCRIPTIONS, PREDICTIONS AND IMPACT ASSESSMENTS FOR THE BUILT FEATURES	52
6.1.	Main Southern Railway	52
6.2.	M31 Hume Motorway	52
6.3.	Local roads	52
6.3.1.	Descriptions of the local roads	52
6.3.2.	Predictions for the local roads	53
6.3.3.	Impact assessments for the local roads	55
6.3.4.	Recommendations for the local roads	58
6.4.	Road bridges	58
6.5.	Road culverts	60
6.6.	Water infrastructure	60
6.7.	Sewerage infrastructure	60
6.8.	Gas infrastructure	60
6.9.	Electrical infrastructure	61
6.9.1.	Descriptions of the electrical infrastructure	61
6.9.2.	Predictions for the electrical infrastructure	62
6.9.3.	Impact assessments for the powerlines	63
6.9.4.	Recommendations for the powerlines	64
6.10.	Telecommunications infrastructure	65
6.10.1.	Descriptions of the telecommunications infrastructure	65
6.10.2.	Predictions for the telecommunications infrastructure	65
6.10.3.	Impact assessments for the telecommunications cables	66
6.10.4.	Recommendations for the telecommunications infrastructure	67
6.11.	Agricultural utilisation	67
6.12.	Rural structures	68
6.12.1.	Descriptions of the rural structures	68
6.12.2.	Predictions for the rural structures	68
6.12.3.	Impact assessments for the rural structures	71
6.12.4.	Recommendations for the rural structures	71
6.13.	Tanks	71

6.14.	Fences	72
6.15.	Farm dams	72
6.15.1.	Descriptions of the farm dams	72
6.15.2.	Predictions for the farm dams	73
6.15.3.	Impact assessments for the farm dams	75
6.15.4.	Recommendations for the farm dams	76
6.16.	Groundwater bores	76
6.17.	Industrial, commercial and business establishments	77
6.18.	Exploration drill holes	77
6.19.	Aboriginal heritage sites	78
6.19.1.	Descriptions of the Aboriginal heritage sites	78
6.19.2.	Predictions for the Aboriginal heritage sites	78
6.19.3.	Impact assessments for the Aboriginal heritage sites	80
6.19.4.	Recommendations for the Aboriginal heritage sites	80
6.20.	Historic sites	80
6.20.1.	Descriptions of the historic sites	80
6.20.2.	Predictions for the historic sites	80
6.20.3.	Impact assessments for the historic sites	81
6.20.4.	Recommendations for the historic sites	82
6.21.	Survey control marks	82
6.22.	Houses	82
6.22.1.	Descriptions of the houses	82
6.22.2.	Predictions for the houses	86
6.22.3.	Reported impacts for houses at Appin Area 7	88
6.22.4.	Impact assessments for the Houses	89
6.22.5.	Houses located on or near steep slopes	93
6.22.6.	Management of potential impacts on houses	94
6.23.	Associated residential structures	95
6.23.1.	Non-residential building structures	95
6.23.2.	Swimming pools	95
6.23.3.	Tennis and Basketball Courts	96
6.23.4.	Rigid external pavements	97
6.24.	Conclusion	98
7.0 GLOSSARY OF TERMS AND DEFINITIONS		99
APPENDIX A. REFERENCES		101
APPENDIX B. METHOD OF IMPACT ASSESSMENTS FOR HOUSES		103
B.1.	Introduction	104
B.2.	Impact classification	104
B.3.	Relationships between ground movements and damage	106
B.3.1.	Method of impact assessment	107
APPENDIX C. FIGURES		
APPENDIX D. TABLES		
APPENDIX E. DRAWINGS		

Tables

Table numbers are prefaced by the number of the chapter in which they are presented.

Table No.	Description	Page
Table 1.1	Geometry of the proposed LW712 to LW716	4
Table 1.2	Typical stratigraphy for the Mine (Source: ICHPL)	6
Table 2.1	Natural and built features within the Study Area	10
Table 3.1	Comparison of the mine geometry for the longwalls at Appin Mine	19
Table 4.1	Maximum predicted incremental vertical subsidence, tilt and curvature due to the mining of each of LW712 to LW716	21
Table 4.2	Maximum predicted total vertical subsidence, tilt and curvature within the Study Area after the mining of each of LW712 to LW716	21
Table 4.3	Probabilities of exceedance for strain for survey bays located directly above goaf	23
Table 4.4	Probabilities of exceedance for strain for survey bays located above solid coal	25
Table 4.5	Probabilities of exceedance for mid-ordinate deviation for survey marks above goaf for monitoring lines in the Southern Coalfield	27
Table 5.1	Creeks of third and fourth order located within the Study Area based on the 600 m boundary	30
Table 5.2	Maximum predicted total vertical subsidence, tilt and curvature for Navigation Creek	33
Table 5.3	Maximum predicted total vertical subsidence, tilt and curvature for Tributary NavC14.5	34
Table 5.4	Maximum predicted total vertical subsidence, tilt and curvature for Tributary NavC16	34
Table 5.5	Maximum predicted total vertical subsidence, tilt and curvature for Tributary NavC17	34
Table 5.6	Maximum predicted total vertical subsidence, tilt and curvature for Tributary NavC20	34
Table 5.7	Maximum predicted total vertical subsidence, tilt and curvature for Apps Gully	35
Table 5.8	Maximum predicted total vertical subsidence, tilt and curvature for Foot Onslow Creek	35
Table 5.9	Maximum predicted total vertical subsidence, tilt and curvature for the third order sections of the creeks within the Study Area	35
Table 5.10	Maximum predicted total vertical subsidence, tilt and curvature for the fourth order sections of the creeks within the Study Area	36
Table 5.11	Maximum predicted closure for the streams above the mining area	36
Table 5.12	Experience of mining beneath creeks and tributaries in the Southern Coalfield	40
Table 5.13	Details of the cliffs located within the Study Area	42
Table 5.14	Details of the minor cliffs located within the Study Area	42
Table 5.15	Maximum predicted additional vertical subsidence, tilt and curvatures for the cliffs within the Study Area	44
Table 5.16	Maximum predicted total vertical subsidence, tilt and curvatures for the cliff within the Study Area	44
Table 5.17	Maximum predicted total vertical subsidence, tilt and curvatures for the minor cliffs within the Study Area	44
Table 5.18	Recorded cliff instabilities along the Cataract and Nepean River Valleys due to the mining of Tower Longwalls 1 to 17	46
Table 5.19	Maximum predicted total vertical subsidence, tilt and curvatures for the steep slopes along Razorback Range	49
Table 6.1	Main local roads located within the Study Area	53
Table 6.2	Maximum predicted total vertical subsidence, tilt and curvature for Menangle Road	54
Table 6.3	Maximum predicted total vertical subsidence, tilt and curvature for Remembrance Drive	54
Table 6.4	Maximum predicted total vertical subsidence, tilt and curvature for the other local roads	54
Table 6.5	Experience of mining beneath local roads at Appin Mine and other nearby mines	55
Table 6.6	Powerlines within the Study Area	61
Table 6.7	Substations within the Study Area	62
Table 6.8	Maximum predicted total vertical subsidence and tilt for the powerlines	62
Table 6.9	Maximum predicted total tilt in any direction for the powerlines	62
Table 6.10	Maximum predicted total vertical subsidence, tilt and curvature for the substations	63

Table 6.11	Experience of mining beneath powerlines in the Southern Coalfield	63
Table 6.12	Optical fibre cables located within the Study Area	65
Table 6.13	Maximum predicted total vertical subsidence, tilt and curvature for the optical fibre cables	65
Table 6.14	Examples of mining beneath optical fibre cables in the Southern Coalfield	66
Table 6.15	Details of the rural structures within the Study Area	68
Table 6.16	Maximum predicted total vertical subsidence, tilt and curvatures for the rural structures	69
Table 6.17	Details of the tanks within the Study Area	71
Table 6.18	Maximum predicted total vertical subsidence, tilt and curvatures for the tanks	72
Table 6.19	Summary of the farm dams within the Study Area	73
Table 6.20	Details of the larger farm dams within the Study Area	73
Table 6.21	Maximum predicted total vertical subsidence, tilt and curvatures for the farm dams	73
Table 6.22	Registered groundwater bores within the Study Area	77
Table 6.23	Aboriginal heritage sites identified within the Study Area	78
Table 6.24	Maximum predicted total vertical subsidence, tilt and curvatures for the Aboriginal heritage sites	79
Table 6.25	Historic heritage sites identified within the Study Area	80
Table 6.26	Maximum predicted total vertical subsidence, tilt and curvatures for the Aboriginal heritage sites	81
Table 6.27	Locations of the houses within the Study Area	82
Table 6.28	House type categories	83
Table 6.29	Distribution of houses by construction type	84
Table 6.30	Maximum predicted total vertical subsidence, tilt and curvatures for the houses	86
Table 6.31	Reported impacts for houses due to mining of LW702 to LW709	89
Table 6.32	Assessed impacts for the houses within the Study Area	92
Table 6.33	Maximum predicted subsidence effects for the houses at the top of Razorback Range	93
Table 6.34	Maximum predicted subsidence effects for the houses on or near steep slopes at the bottom of Razorback Range and along the associated ridgelines	94
Table 6.35	Details of the swimming pools within the Study Area	95
Table 6.36	Maximum predicted total vertical subsidence, tilt and curvatures for the pools	96
Table 6.37	Details of the tennis courts within the Study Area	97
Table 6.38	Maximum predicted total vertical subsidence, tilt and curvatures for the tennis courts	97
Table B.1	Impact classification based on the extent of repairs	105
Table B.2	Probabilities of impact based on curvature and construction type after ACARP Research Project C12015 (Waddington, 2009)	107
Table D.01	Details of the structures within the Study Area	App. D
Table D.02	Predicted subsidence effects for the structures within the Study Area	App. D
Table D.03	Details and predicted subsidence effects for the farm dams within the Study Area	App. D

Figures

Figure numbers are prefaced by the number of the chapter or the letter of the appendix in which they are presented.

Figure No.	Description	Page
Fig. 1.1	Existing, approved and proposed longwalls in Areas 7 and 9	2
Fig. 1.2	Orthophotograph showing LW712 to LW716 and the Study Area	3
Fig. 1.3	Surface and seam levels along Section 1	4
Fig. 1.4	Surface and seam levels along Section 2	5
Fig. 1.5	Stratigraphy at the Mine based on Drillhole S2629 (after ICHPL)	7
Fig. 1.6	Surface lithology within the Study Area (DPI Geological Series Sheets 9029)	8
Fig. 3.1	Valley formation in flat-lying sedimentary rocks (after Patton and Hendren 1972)	13
Fig. 3.2	Measured and predicted total vertical subsidence for the ARTC (Area 7) monitoring line	15
Fig. 3.3	Measured and predicted total vertical subsidence for the ARTC (Area 9) monitoring line	15
Fig. 3.4	Measured and predicted total vertical subsidence for the Early Warning monitoring line	15
Fig. 3.5	Measured and predicted total vertical subsidence for the HW2 East monitoring line	16
Fig. 3.6	Measured and predicted total vertical subsidence for the HW2 West monitoring line	16
Fig. 3.7	Measured and predicted total vertical subsidence for the Menangle Road (Area 7) monitoring line	16
Fig. 3.8	Measured and predicted total vertical subsidence for the Menangle Road (Area 9) monitoring line	17
Fig. 3.9	Measured and predicted total vertical subsidence for the Moreton Park Road monitoring line	17
Fig. 3.10	Measured and predicted total vertical subsidence for the Telstra monitoring line	17
Fig. 3.11	Comparison of maximum measured and maximum predicted (calibrated IPM) total vertical subsidence for the monitoring lines at Appin Mine	18
Fig. 3.12	Distribution of the ratio of maximum measured to maximum predicted total vertical subsidence for the monitoring lines at Appin Mine	19
Fig. 4.1	Distributions of the maximum measured tensile and compressive strains due to the extraction of longwalls in the Southern Coalfield for survey bays located directly above goaf	23
Fig. 4.2	Measured incremental strains versus normalised distance from the longwall maingate for extracted longwalls in the Southern Coalfield	24
Fig. 4.3	Distributions of the maximum measured tensile and compressive strains during the extraction of longwalls in the Southern Coalfield for survey bays located above solid coal	25
Fig. 4.4	Distributions of maximum measured tensile and compressive strains along the monitoring lines during the extraction of longwalls in the Southern Coalfield	26
Fig. 4.5	Distribution of maximum measured mid-ordinate deviation during the extraction of previous longwalls in the Southern Coalfield for marks located above goaf	27
Fig. 4.6	Distribution of the maximum measured horizontal movements for the 3D marks located directly above the longwalls in the Southern Coalfield	28
Fig. 4.7	Measured total far-field horizontal movements versus distance from the mining area	29
Fig. 5.1	Upper reaches of Navigation Creek, looking upstream (left-hand side) and looking downstream (right-hand side) at the Cummins Road crossing (Source: ICHPL, October 2024)	31
Fig. 5.2	Lower reaches of Navigation Creek, looking upstream (left-hand side) and looking downstream (right-hand side) at the Woodbridge Road bridge (Source: ICHPL, October 2024)	31
Fig. 5.3	Tributary NavC14.5, looking upstream (left-hand side) and looking downstream (right-hand side) from Finns Road crossing near Woodbridge Road (Source: ICHPL, October 2024)	32
Fig. 5.4	Tributary NavC16, looking upstream (left-hand side) from Carrolls Road near Hawkey Road and looking downstream (right-hand side) from the second Carrolls Road crossing (Source: ICHPL, October 2024)	32
Fig. 5.5	Tributary NavC20, from Cummins Road crossings: upper reaches looking downstream (left-hand side) and lower reaches looking downstream (right-hand side) (Source: ICHPL, October 2024)	32
Fig. 5.6	Foot Onslow Creek (Source: ICHPL)	33
Fig. 5.7	Existing and predicted post-mining surface levels along Navigation Creek	37
Fig. 5.8	Existing and predicted post-mining surface levels along Tributary NavC14.5	37

Fig. 5.9	Existing and predicted post-mining surface levels along Tributary NavC16	38
Fig. 5.10	Existing and predicted post-mining surface levels along Tributary NavC17	38
Fig. 5.11	Existing and predicted post-mining surface levels along Tributary NavC20	39
Fig. 5.12	Natural and predicted post-mining surface levels along Apps Gully	39
Fig. 5.13	Existing and predicted post-mining surface levels along Foot Onslow Creek	39
Fig. 5.14	Cliff RR-CL5 located above LW710B viewed from Menangle Road (Source: ICHPL)	42
Fig. 5.15	Cliff RR-CL8 above LW714 hidden behind vegetation viewed from Carrolls Road (Source: ICHPL)	43
Fig. 5.16	Minor cliff MCL07 adjacent to Remembrance Drive and above LW716 (Source: ICHPL)	43
Fig. 5.17	Razorback Range	47
Fig. 5.18	Section through Razorback Range transverse to the longwalls	48
Fig. 5.19	Distribution of the natural grades for the steep slopes along Razorback Range above the western end of the proposed longwalls	48
Fig. 5.20	Example of surface tension cracking along the top of a steep slope	50
Fig. 5.21	Photograph of natural soil erosion within the Study Area	50
Fig. 6.1	Photograph of Menangle Road in Area 9	53
Fig. 6.2	Bumps and dip along Carrolls Road above Appin LW710B (Source: Inglis, 10 Oct 2024)	56
Fig. 6.3	Compression bumps in Menangle Road (Source: Network Solutions)	56
Fig. 6.4	Bump in slip lane along Appin Road above West Cliff Longwall 32 (Source: Colin Dove)	57
Fig. 6.5	Surface level across the alignment of Remembrance Drive	57
Fig. 6.6	Moreton Park Road Bridge (North)	58
Fig. 6.7	Measured total horizontal movements at Moreton Park Road Bridge (North)	59
Fig. 6.8	Measured relative horizontal movements at Moreton Park Road Bridge (North)	59
Fig. 6.9	66 kV and 11 kV powerlines along Menangle Road	61
Fig. 6.10	Agricultural Land Classification within the Study Area (Source DTIRIS, November 2008)	67
Fig. 6.11	Maximum predicted vertical subsidence (left-hand side) and final tilt (right-hand side) for the rural structures	69
Fig. 6.12	Maximum predicted hogging curvature (left-hand side) and sagging curvature (right-hand side) at any time for the rural structures	69
Fig. 6.13	Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the rural structures based on the mean	70
Fig. 6.14	Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the rural structures based on the 95 % confidence level	70
Fig. 6.15	Maximum predicted vertical subsidence (left-hand side) and final tilt (right-hand side) for the farm dams	74
Fig. 6.16	Maximum predicted hogging curvature (left-hand side) and sagging curvature (right-hand side) at any time for the farm dams	74
Fig. 6.17	Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the farm dams based on the mean	75
Fig. 6.18	Predicted total tensile strain (left-side) and total compressive strain (right-side) for the farm dams based on the 95 % confidence level	75
Fig. 6.19	Predicted changes in freeboard for the farm dams within the Study Area	76
Fig. 6.20	Distribution of houses by maximum plan dimension (left-side) and plan area (right-side)	83
Fig. 6.21	Distributions of wall and footing construction for houses within the Study Area	84
Fig. 6.22	Distribution of houses by age	85
Fig. 6.23	Distribution of the maximum natural surface grades within 20 m of each of the houses within the Study Area	85
Fig. 6.24	Maximum predicted vertical subsidence (left-side) and tilt (right-side) for the houses	87
Fig. 6.25	Maximum predicted hogging curvature (left-side) and sagging curvature (right-side) for the houses	87
Fig. 6.26	Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the houses based on the mean	88
Fig. 6.27	Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the houses based on the 95 % confidence level	88
Fig. 6.28	Distribution of predicted final total tilts for the houses within the Study Area	90

Fig. 6.29	Distribution of maximum predicted total hogging curvature for the houses within the Study Area	91
Fig. 6.30	Distribution of maximum predicted total sagging curvature for the houses within the Study Area	91
Fig. B.1	Probability curves for impacts to building structures	108
Fig. C.01	Predicted profiles of total vertical subsidence, tilt and curvature along Prediction Line 1 due to the mining in Appin Areas 7 and 9	App. C
Fig. C.02	Predicted profiles of total vertical subsidence, tilt and curvature along Prediction Line 2 due to the mining in Appin Area 7	App. C
Fig. C.03	Predicted profiles of total vertical subsidence, tilt and curvature along Navigation Creek due to the mining in Appin Area 7	App. C
Fig. C.04	Predicted profiles of total vertical subsidence, tilt and curvature along Tributary NavC14.5 due to the mining in Appin Area 7	App. C
Fig. C.05	Predicted profiles of total vertical subsidence, tilt and curvature along Tributary NavC16 due to the mining in Appin Area 7	App. C
Fig. C.06	Predicted profiles of total vertical subsidence, tilt and curvature along Tributary NavC17 due to the mining in Appin Area 7	App. C
Fig. C.07	Predicted profiles of total vertical subsidence, tilt and curvature along Tributary NavC20 due to the mining in Appin Area 7	App. C
Fig. C.08	Predicted profiles of total vertical subsidence, tilt and curvature along Apps Gully due to the mining in Appin Area 7	App. C
Fig. C.09	Predicted profiles of total vertical subsidence, tilt and curvature along Foot Onslow Creek due to the mining in Appin Area 7	App. C
Fig. C.10	Predicted profiles of total vertical subsidence, tilt and curvature along Carrolls Road due to the mining in Appin Area 7	App. C
Fig. C.11	Predicted profiles of total vertical subsidence, tilt and curvature along Cummins Road due to the mining in Appin Area 7	App. C
Fig. C.12	Predicted profiles of total vertical subsidence, tilt and curvature along Finns Road due to the mining in Appin Area 7	App. C
Fig. C.13	Predicted profiles of total vertical subsidence, tilt and curvature along Menangle Road due to the mining in Appin Area 7	App. C
Fig. C.14	Predicted profiles of total vertical subsidence, tilt and curvature along Remembrance Drive due to the mining in Appin Area 7	App. C
Fig. C.15	Predicted profiles of vertical subsidence, tilt along and tilt across the 66 kV Powerline (Branch 1) due to mining in Appin Area 7	App. C
Fig. C.16	Predicted profiles of vertical subsidence, tilt along and tilt across the 11 kV Powerline (Branch 1) due to mining in Appin Area 7	App. C

Drawings

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

<i>Drawing No.</i>	<i>Description</i>	<i>Rev.</i>
MSEC1459-01	General layout and monitoring at Appin Mine	A
MSEC1459-02	Layout of LW712 to LW716	A
MSEC1459-03	Surface level contours	A
MSEC1459-04	Bulli Seam floor contours	A
MSEC1459-05	Bulli Seam thickness contours	A
MSEC1459-06	Bulli Seam depth of cover contours	A
MSEC1459-07	Geological structures	A
MSEC1459-08	Streams	A
MSEC1459-09	Cliffs, minor cliffs and steep slopes	A
MSEC1459-10	Roads and railway	A
MSEC1459-11	Electrical infrastructure	A
MSEC1459-12	Telecommunications infrastructure	A
MSEC1459-13	Water and gas infrastructure	A
MSEC1459-14	Building structures – Key plan	A
MSEC1459-14 – Map01	Building structures – Map 01	A
MSEC1459-14 – Map02	Building structures – Map 02	A
MSEC1459-14 – Map03	Building structures – Map 03	A
MSEC1459-14 – Map04	Building structures – Map 04	A
MSEC1459-15	Other built features	A
MSEC1459-16	Predicted additional subsidence contours due to LW712 to LW716	A
MSEC1459-17	Predicted total subsidence contours after LW712	A
MSEC1459-18	Predicted total subsidence contours after LW713	A
MSEC1459-19	Predicted total subsidence contours after LW714	A
MSEC1459-20	Predicted total subsidence contours after LW715	A
MSEC1459-21	Predicted total subsidence contours after LW716	A

1.1. Background

Illawarra Coal Holdings Pty Limited (ICHPL), a wholly owned subsidiary of Gear M Illawarra Met Coal Pty Ltd (GM³), operates Appin Mine (the Mine), which is located in the Southern Coalfield of New South Wales (NSW). The Mine is located north of Douglas Park and south-west of Menangle.

ICHPL previously submitted a Part 3A Application for the mining of future longwalls within the Bulli Seam including in Appin Area 7. Report No. MSEC404 (Rev. D) was issued in August 2009 in support of that application. A Preferred Project Report (PPR) under the *Environmental Planning and Assessment Act 1979* (EP&A Act) was prepared following a request by the Director-General of the NSW Department of Planning, Housing and Infrastructure (DPHI). The key changes made via the PPR comprised the excision of mining domains known as North Cliff, Area 2 and Area 3 (part only). DPHI granted ICHPL approval under the EPA Act on the 22 December 2011 (08_0150).

ICHPL has completed the mining of Longwalls 701 to 710A (LW701 to LW710A) in Area 7 and is currently mining Longwall 710B (LW710B). ICHPL also has approval to mine Longwall 711 (LW711) as a continuation of the current series.

The subsidence predictions and assessed impacts for these longwalls are provided in Report Nos. MSEC342 (Rev. C) and MSEC1117 (Rev. B) which supported the Subsidence Management Plan (SMP) and Extraction Plan Applications. Updated subsidence predictions and impact assessments are provided in Report Nos. MSEC825 (Rev. A), MSEC878 (Rev. A), MSEC973 (Rev. A), MSEC1133 (Rev. B) and MSEC1318 (Rev. A) which supported the Modification Applications.

ICHPL is now preparing an Extraction Plan Application for Longwalls 712 to 716 (LW712 to LW716) which are a continuation of the current longwall series in Area 7. These proposed longwalls are located on the northern side of the existing and approved longwalls in Area 7 and partially beneath Razorback Range.

Mine Subsidence Engineering Consultants (MSEC) has now been engaged by ICHPL to prepare subsidence predictions and impact assessments for LW712 to LW716 in support of the Extraction Plan Application.

The longwalls in Areas 7 and 9 have been modified from the layout of the *EA Base Plan Longwalls* which was indicated in the Part 3A Application. The longwall layout indicated in the Part 3A Application and in Report No. MSEC404 is referred to as the *Part 3A Layout* in this report.

The currently proposed LW712 to LW716 is referred to as the *Extraction Plan Layout* in this report. These longwalls extend across both Areas 7 and 9 as defined in the Part 3A Application. The Extraction Plan Layout also includes the as-extracted and approved longwalls in Areas 7 and 9.

The comparison between the longwalls based on the Part 3A Layout and the Extraction Plan Layout is provided in Fig. 1.1. The proposed LW712 to LW716 are located within the *Extent of Longwall Mining Areas* as defined in the Part 3A Application and Report No. MSEC404.

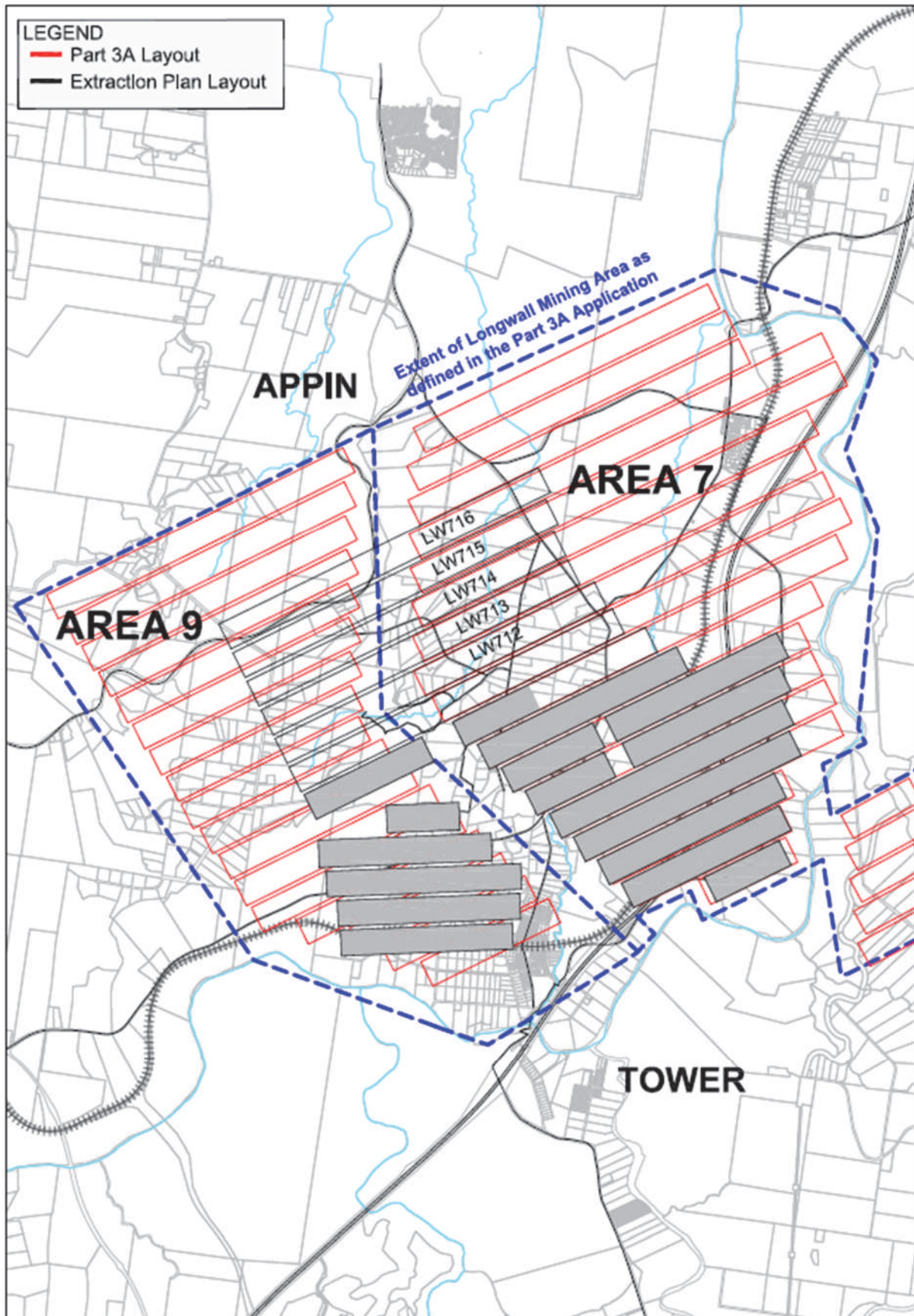


Fig. 1.1 Existing, approved and proposed longwalls in Areas 7 and 9

The existing, approved and proposed longwalls in Areas 7 and 9 are also shown in Drawing No. MSEC1459-01 in Appendix E. The proposed LW712 to LW716 and the Study Area, as defined in Section 2.2, have been overlaid on an orthophotograph of the area, as shown in Fig. 1.2.

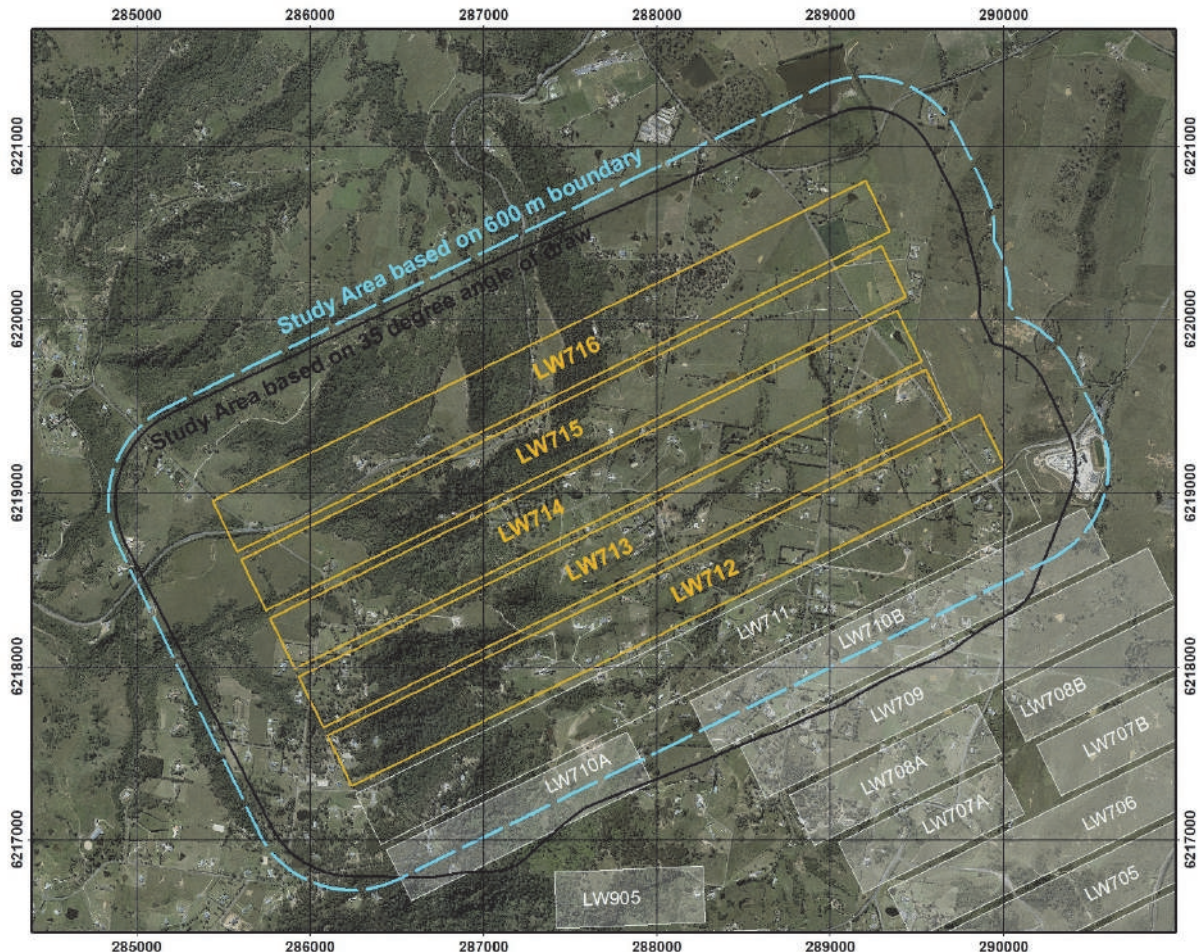


Fig. 1.2 Orthophotograph showing LW712 to LW716 and the Study Area

MSEC has been commissioned by ICHPL to:

- prepare subsidence predictions for the proposed LW712 to LW716 including the cumulative movements due to the previously extracted and approved longwalls in Areas 7 and 9;
- identify the natural and built features above and in the vicinity of the proposed longwalls;
- provide subsidence predictions for each of these surface features;
- prepare impact assessments, in conjunction with other specialist consultants, for each of the natural and built features; and
- recommend management strategies and monitoring.

This report has been prepared to support the Extraction Plan Application for the proposed LW712 to LW716 which will be submitted to the Department of Planning, Housing and Infrastructure (DPHI). In some cases, this report will refer to other sources of information on specific natural and built features. This report, therefore, should be read in conjunction with the other relevant reports associated with this application.

Chapter 1 provides background information on the study, including the mining geometry, surface and seam and overburden lithology.

Chapter 2 defines the Study Area and provides a summary of the natural and built features identified within this area.

Chapter 3 provides an overview of the methods that have been used to predict the mine subsidence movements due to the mining of the existing and proposed longwalls.

Chapter 4 provides the maximum predicted subsidence effects due to the mining of the proposed LW712 to LW716 including the accumulated effects due to the mining of the existing and approved longwalls.

Chapters 5 and 6 provide the descriptions, predictions and impact assessments for each of the natural and built features that have been identified within the Study Area. Recommendations for each of these features are also provided, which have been based on the predictions and impact assessments.

1.2. Mining geometry

The layout of the proposed LW712 to LW716 is shown in Drawing Nos. MSEC1459-01 and MSEC1459-02 in Appendix E. A summary of the dimensions for these longwalls is provided in Table 1.1. The longwalls are proposed to be extracted from the Bulli Seam.

Table 1.1 Geometry of the proposed LW712 to LW716

Longwall	Overall void length including installation heading (m)	Overall void width including first workings (m)	Overall tailgate chain pillar width (m)
LW712	4195	324	51
LW713	4030	324	51
LW714	4030	324	52
LW715	4110	324	52
LW716	4195	324	53

The lengths of longwall extraction excluding the installation headings are approximately 9 m less than the overall void lengths provided in Table 1.1. The longwall face widths excluding the first workings are 11 m less than the overall void widths provided in the above table, i.e. 313 m.

The proposed longwalls are located north of the existing and approved LW709 to LW711. The proposed longwalls will be extracted towards the main headings, i.e. retreat mining from west to east.

1.3. Surface and seam levels

The levels of the natural surface and the Bulli Seam are illustrated along Section 1 and Section 2 in Fig. 1.3 and Fig. 1.4, respectively. These sections are shown in Drawing Nos. MSEC1459-03 to MSEC1459-06 in Appendix E. The definition of the Study Area is provided in Section 2.2.

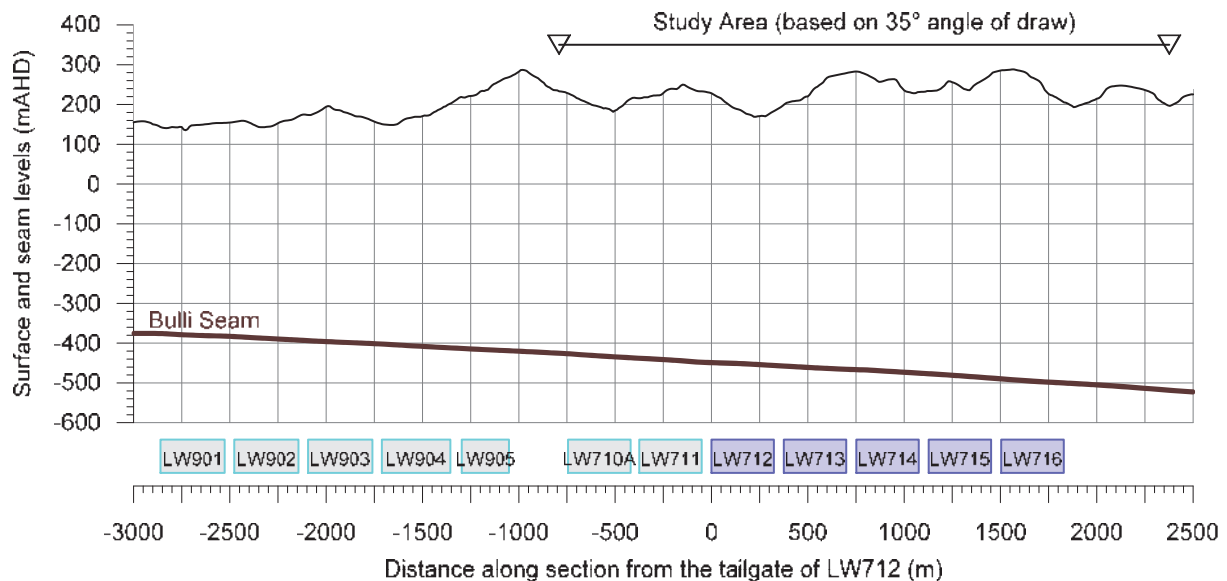


Fig. 1.3 Surface and seam levels along Section 1

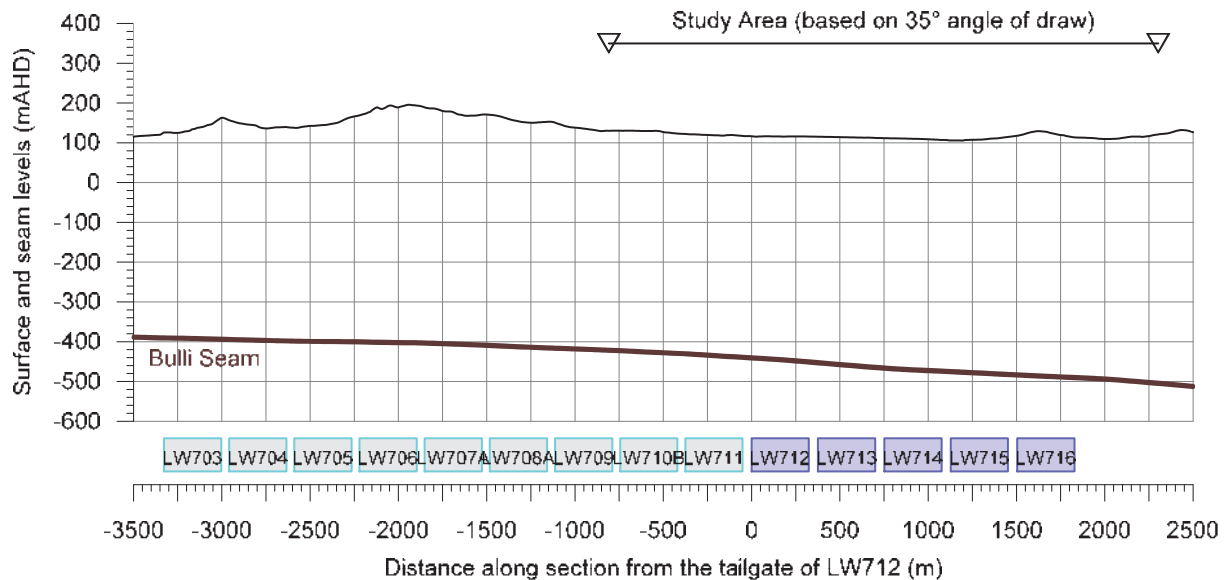


Fig. 1.4 Surface and seam levels along Section 2

The surface level contours are shown in Drawing No. MSEC1459-03.

The western ends of LW712 to LW716 are located beneath Razorback Range. The plain above the eastern ends of the proposed longwalls generally falls towards the north with the streams flowing into the Nepean River more than 3 km outside the mining area.

The surface levels directly above LW712 to LW716 vary between 95 metres above Australian Height Datum (mAHD) and 310 mAHD. The lowest surface level occurs along Navigation Creek where it crosses the finishing (i.e. eastern) end of LW716. The highest surface level occurs at the top of Razorback Range above the western ends of and LW713 and LW716.

The seam floor contours, seam thickness contours and depth of cover contours for the Bulli Seam are shown in Drawing Nos. MSEC1459-04, MSEC1459-05 and MSEC1459-06, respectively.

The floor of the Bulli Seam generally dips from the south-southeast to the north-northwest with an average grade across the mining area of approximately 3.0 % (i.e. 1 in 33). The seam is folded with gradual south-southeast to the north-northwest orientated synclines and anticlines above the mining area.

The thickness of the Bulli Seam within the extents of LW712 to LW716 varies between 3.0 m and 3.6 m. The proposed longwalls will mine the full seam thickness.

The depths of cover to the Bulli Seam above LW712 to LW716 vary between 555 m and 800 m. The minimum depth of cover occurs along a tributary to Navigation Creek above the tailgate of LW712. The maximum depth of cover occurs along the Razorback Range above the western end of LW716.

1.4. Geological details

The Mine lies in the southern part of the Permo-Triassic Sydney Basin, within which the main coal bearing sequence is the Illawarra Coal Measures, of Late Permian age. The Illawarra Coal Measures contain several seams, the uppermost is the Bulli Seam. The typical stratigraphy for the Mine is shown in Table 1.2 (Source: ICHPL).

Table 1.2 Typical stratigraphy for the Mine (Source: ICHPL)

Period	Group	Formation	Designation
Triassic	Wianamatta	Bringelly Shale	BRSH
		Minchinbury Sandstone	MNSS
		Ashfield Shale	ASSH
	Hawkesbury Sandstone	Hawkesbury Sandstone	HBSS
	Narrabeen Group	Newport Formation	NPFM
		Garie Formation	GRFM
		Bald Hill Claystone	BACS
		Bulgo Sandstone	BGSS
		Stanwell Park Claystone	SPCS
		Scarborough Sandstone	SBSS
		Wombarra Claystone	WBCS
		Coal Cliff Sandstone	CCSS
		Bulli Seam	BUSM
		Loddon Sandstone	LDSS
		Balgownie Seam	BASM
		Lawrence Sandstone	LRSS
Permian	Illawarra Coal Measures	Cape Horn Seam	CHSM
		Unnamed Member 2	UNM2
		Hargraves Seam	HGSM
		Unnamed Member 3	UNM3
		Wongawilli Seam	WWSM

The major sedimentary units at the Mine, from the top down, are the Wianamatta Group, Hawkesbury Sandstone, Narrabeen Group and Illawarra Coal Measures.

The topmost Wianamatta Group comprises Bringelly Shale (BRSH), Minchinbury Sandstone (MNSS) and Ashfield Shale (ASSH). These formations consist of interbedded shales and siltstones with a variable thickness. The overall thickness of the group at the Mine varies from less than 10 m to approximately 200 m.

The underlying Hawkesbury Sandstone is one of the largest members in the overburden with an average thickness at the Mine of approximately 170 m. This group consists of a series of bedded sandstone units which dates from the Middle Triassic.

The Narrabeen Group comprises, from the top down, the Newport Formation (NPFM), Garie Formation (GRFM), Bald Hill Claystone (BHCS), Bulgo Sandstone (BGSS), Stanwell Park Claystone (SPCS), Scarborough Sandstone (SBSS), Wombarra Claystone (WBCS) and Coal Cliff Sandstone (CCSS). The group dates from Lower to Middle Triassic and has an overall thickness at the Mine of approximately 350 m. Bulgo Sandstone is the largest member of this group with a thickness of approximately 190 m.

The rocks exposed in the Nepean River valley belong to the Hawkesbury Sandstone Group. The creeks and drainage lines above the Mine traverse the Wianamatta Group to where they enter the Nepean River valley north of the mining area. The claystones and shales generally within the Narrabeen Group exist in discrete but thinner beds of less than 15 m thickness, or are interbedded as thin bands within the sandstone.

The major claystone units are the Bald Hill and Stanwell Park Claystones, which lie above and below the Bulgo Sandstone at the base of the Hawkesbury Sandstone. The claystones vary in thickness and, in some places, are more than 25 m thick.

The stratigraphy at the Mine based on drillhole S2629 is illustrated in Fig. 1.5. The location of this drillhole is shown in Drawing No. MSEC1459-15.

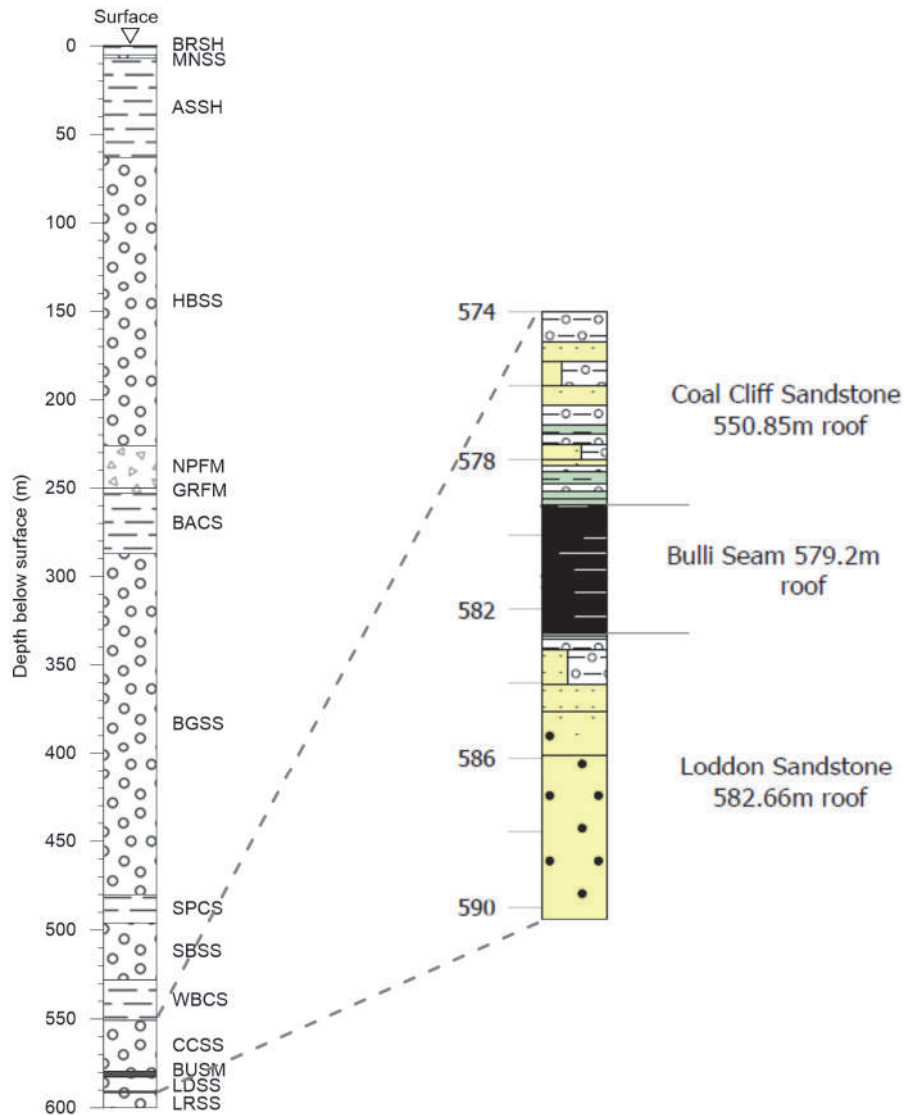


Fig. 1.5 Stratigraphy at the Mine based on Drillhole S2629 (after ICHPL)

The geological structures identified at seam level are shown in Drawing No. MSEC1459-07.

There are to NNW-SSE orientated *zones of geological structure* that cross the western ends of LW712 to LW716 and the eastern end of LW712 and possibly extending through the eastern ends of the other proposed longwalls. These zones comprise series of dykes with thicknesses up to approximately 3.5 m and minor faults with displacements up to approximately 3 m.

Increased vertical subsidence is not anticipated at the *zones of geological structure*, as it was not observed when LW703 to LW706, LW709 and LW901 to LW904 previously mined through these zones. Localised irregular surface movements (i.e. compressive strain and heaving) were observed near these zones; however, these appear to be due to surface topography (i.e. drainage lines and cuttings) rather than the geological structures. In any case, the surface features located above and near the *zones of geological structure* have been assessed for potential localised irregular ground movements.

Elsewhere, minor faults with displacements up to approximately 1 m cross the proposed LW712 to LW716. Increased subsidence or localised irregular movements are not anticipated in these locations, as it was when longwalls previously mined through similar geological structures in Appin Areas 7 and 9. Surface features have been assessed for potential anomalous irregular movements, as the predicted strains are based on statistical analyses of monitoring data that comprises these effects.

The surface lithology within the Study Area is illustrated in Fig. 1.6, which shows the proposed longwalls overlaid on Geological Series Sheets 9029, published in 1999 by the then NSW Department of Primary Industries (DPI).

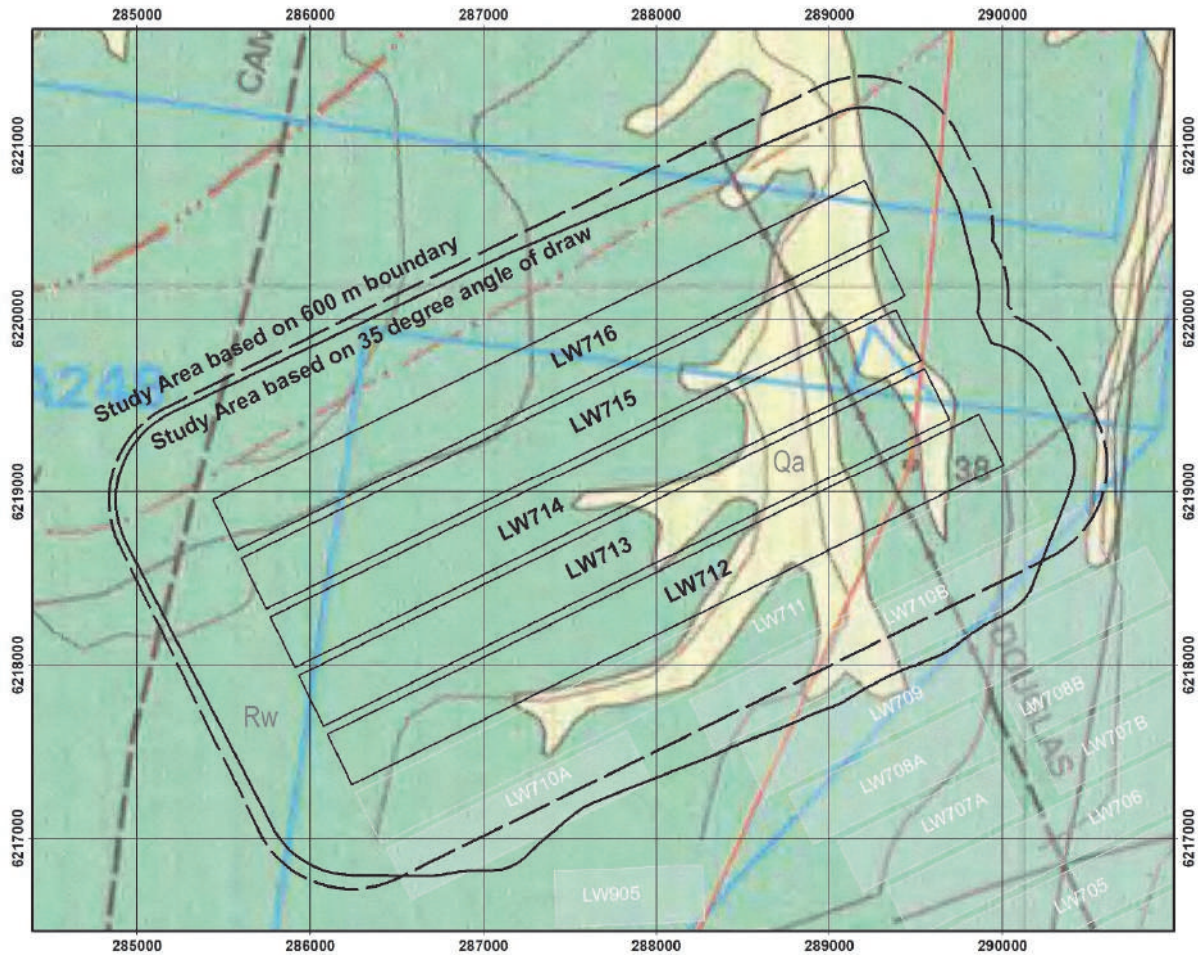


Fig. 1.6 Surface lithology within the Study Area (DPI Geological Series Sheets 9029)

The surface lithology above the proposed longwalls generally comprises the Wianamatta Group (Rw) with Quaternary Alluvium (Qa) exposed along Navigation Creek and its tributaries in the eastern part of the Study Area.

2.1. Definition of the Extent of the Longwall Mining Area

The *Extent of the Longwall Mining Area* is defined as the overall void area for the proposed LW712 to LW716 (i.e. second workings plus the immediately adjacent roadways) indicated by the orange outlines shown in Drawing Nos. MSEC1459-01 and MSEC1459-02.

2.2. Definition of the Study Area

The *Study Area* is defined as the surface area that could be affected by the mining of the proposed LW712 to LW716. Two areas have been considered in this report, being the *Study Area based on the 35° angle of draw* and the *Study Area based on the 600 m boundary*.

The Study Area based on the 35° angle of draw represents the minimum extent for the assessments for the conventional ground movements, i.e. vertical subsidence and its associated effects, as recommended by the Resource Regulator (DMR, 2003) for SMP Applications. While the limit of vertical subsidence is often represented by the 26.5° angle of draw, conventional ground movements can extend beyond both the 26.5° and 35° angles of draw above previously extracted longwalls and to a lesser extent above solid coal.

The Study Area based on the 35° angle of draw has been calculated by combining the areas bounded by the following limits:

- the 35° angle of draw line from the extents of the proposed LW712 to LW716; and
- the predicted limit of vertical subsidence, taken as the 20 mm subsidence contour, resulting from the mining of the proposed longwalls.

The depths of cover contours for the Bulli Seam are shown in Drawing No. MSEC1459-06. The depths of cover directly above the proposed LW712 to LW716 vary between 555 m and 800 m. The 35° angle of draw line, therefore, has been determined by drawing a line that is a horizontal distance varying between 390 m and 560 m around the extents of the proposed longwall voids.

The predicted limit of vertical subsidence, taken as the predicted total 20 mm subsidence contour, has been determined using the calibrated Incremental Profile Method (IPM), which is described in Chapter 3. The predicted total subsidence contours after the mining of LW712 to LW716, including the 20 mm subsidence contour, are shown in Drawing No. MSEC1459-21. The predicted 20 mm subsidence contour is located outside the 35° angle of draw line above the approved LW711 and it is located inside the angle of draw elsewhere above solid coal.

The Study Area based on the 600 m boundary represents the minimum extent of the assessments for the valley-related effects. This distance is based on the recommendations from the Southern Coalfield Inquiry (DPHI, 2008) for the risk management zones.

The natural and built features located within the 600 m boundary that are predicted to experience far-field or valley-related effects and could be sensitive to these movements have been included in the assessments provided in this report. These features include the streams, bridges and survey control marks.

The Study Area based on the 35° angle of draw and the Study Area based on a 600 m boundary are shown in Drawing Nos. MSEC1459-01 and MSEC1459-02.

There are additional features that are located outside the 600 m boundary that could experience either far-field or valley-related effects. The surface features that could be sensitive to such movements have been identified and have also been included in the assessments provided in this report. These features include the survey control marks.

2.3. Natural and built features within the Study Area

A summary of the natural and built features located within the Study Area is provided in Table 2.1. These features are shown in Drawing Nos. MSEC1459-08 to MSEC1459-15. The descriptions, predictions and impact assessments for the natural and built features are provided in Chapters 5 and 6. The section number references are provided in Table 2.1.

Table 2.1 Natural and built features within the Study Area

Item	Within Study Area	Section number reference
NATURAL FEATURES		
Catchment Areas or Declared Special Areas	x	5.1
Rivers or Creeks	✓	5.2 & 5.3
Aquifers or Known Groundwater Resources	✓	5.4
Springs	x	
Sea or Lake	x	
Shorelines	x	
Natural Dams	x	
Cliffs or Pagodas	✓	5.5 & 5.6
Steep Slopes	✓	5.7
Escarpments	✓	5.8
Land Prone to Flooding or Inundation	x	5.9
Swamps, Wetlands or Water Related Ecosystems	✓	5.10
Threatened or Protected Species	✓	5.11
National Parks	x	
State Forests	x	
State Conservation Areas	x	
Natural Vegetation	✓	5.11
Areas of Significant Geological Interest	x	
Any Other Natural Features Considered Significant	x	
PUBLIC UTILITIES		
Railways	x	6.1
Roads (All Types)	✓	6.2 & 6.3
Bridges	✓	6.4
Tunnels	x	
Culverts	✓	6.5
Water, Gas or Sewerage Infrastructure	x	6.6 to 6.8
Liquid Fuel Pipelines	x	
Electricity Transmission Lines or Associated Plants	✓	6.9
Telecommunication Lines or Associated Plants	✓	6.10
Water Tanks, Water or Sewage Treatment Works	x	
Dams, Reservoirs or Associated Works	x	
Air Strips	x	
Any Other Public Utilities	x	
PUBLIC AMENITIES		
Hospitals	x	
Places of Worship	x	
Schools	x	
Shopping Centres	x	
Community Centres	x	
Office Buildings	x	
Swimming Pools	x	
Bowling Greens	x	
Ovals or Cricket Grounds	x	
Race Courses	x	
Golf Courses	x	
Tennis Courts	x	
Any Other Public Amenities	x	
FARM LAND AND FACILITIES		
Agricultural Utilisation or Agricultural Suitability of Farm Land	✓	6.11
Farm Buildings or Sheds	✓	6.12
Tanks	✓	6.13
Gas or Fuel Storages	x	
Poultry Sheds	x	
Glass Houses	x	
Hydroponic Systems	x	
Irrigation Systems	x	
Fences	✓	6.14
Farm Dams	✓	6.15
Wells or Bores	✓	6.16
Any Other Farm Features	x	
INDUSTRIAL, COMMERCIAL AND BUSINESS ESTABLISHMENTS		
Factories	x	
Workshops	x	
Business or Commercial Establishments or Improvements	✓	6.17
Gas or Fuel Storages or Associated Plants	x	
Waste Storages or Associated Plants	x	
Buildings, Equipment or Operations that are Sensitive to Surface Movements	x	
Surface Mining (Open Cut) Voids or Rehabilitated Areas	x	
Mine Infrastructure Including Tailings Dams or Emplacement Areas	x	
Any Other Industrial, Commercial or Business Features	✓	6.18
AREAS OF ARCHAEOLOGICAL OR HERITAGE SIGNIFICANCE		
	✓	6.19 & 6.20
ITEMS OF ARCHITECTURAL SIGNIFICANCE		
	x	
PERMANENT SURVEY CONTROL MARKS		
	✓	6.21
RESIDENTIAL ESTABLISHMENTS		
Houses	✓	6.22
Flats or Units	x	
Caravan Parks	x	
Retirement or Aged Care Villages	x	
Associated Structures such as Workshops, Garages, On-Site Waste Water Systems, Water or Gas Tanks, Swimming Pools or Tennis Courts	✓	6.23
Any Other Residential Features	x	
ANY OTHER ITEM OF SIGNIFICANCE		
	x	
ANY KNOWN FUTURE DEVELOPMENTS		
	x	

3.1. Introduction

The following sections provide overviews of conventional and non-conventional mine subsidence effects and the methods that have been used to predict these movements. Further information is also provided in the background reports entitled *Introduction to Longwall Mining and Subsidence* and *General Discussion on Mine Subsidence Ground Movements* which can be obtained from www.minesubsidence.com.

3.2. Overview of conventional subsidence effects

The normal ground movements resulting from the mining of longwalls are referred to as conventional or systematic subsidence movements. These movements are described by the following parameters:

- **Subsidence** usually refers to vertical displacement of a point, but subsidence of the ground actually includes both vertical and horizontal displacements. These horizontal displacements in some cases, where the subsidence is small beyond the longwall goaf edges, can be greater than the vertical subsidence. Subsidence is usually expressed in units of *millimetres (mm)*.
- **Tilt** is the change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the distance between those points. Tilt is, therefore, the first derivative of the subsidence profile. Tilt is usually expressed in units of *millimetres per metre (mm/m)*. A tilt of 1 mm/m is equivalent to a change in grade of 0.1 % or 1 in 1000.
- **Curvature** is the second derivative of subsidence, or the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections. Curvature is usually expressed as the inverse of the **Radius of Curvature** with the units of *1/kilometres (km⁻¹)*, but the values of curvature can be inverted, if required, to obtain the radius of curvature, which is usually expressed in *kilometres (km)*.
- **Strain** is the relative differential horizontal movements of the ground. **Normal strain** is calculated as the change in horizontal distance between two points on the ground, divided by the original horizontal distance between them. Strain is typically expressed in units of *millimetres per metre (mm/m)*. **Tensile Strains** occur where the distances between two points increases and **Compressive Strains** occur when the distances between two points decreases. So that ground strains can be compared between different locations, they are typically measured over bay lengths that are equal to the depth of cover between the surface and seam divided by 20.

Whilst mining induced normal strains are measured along monitoring lines, ground shearing can also occur both vertically and horizontally across the directions of monitoring lines. Most of the published mine subsidence literature discusses the differential ground movements that are measured along subsidence monitoring lines; however, differential ground movements can also be measured across monitoring lines using 3D survey monitoring techniques.

- **Horizontal shear deformation** across monitoring lines can be described by various parameters including horizontal tilt, horizontal curvature, mid-ordinate deviation, angular distortion and shear index. It is not possible, however, to determine the horizontal shear strain across a monitoring line using 2D or 3D monitoring techniques. High deformations along monitoring lines (i.e. normal strains) are generally measured where high deformations have been measured across the monitoring line (i.e. shear deformations), and vice versa.

The **incremental** subsidence, tilts, curvatures and strains are the additional effects which result from the mining of each longwall. The **cumulative** subsidence, tilts, curvatures and strains are the accumulated effects which result from the mining of a series of longwalls. The **total** subsidence, tilts, curvatures and strains are the final effects at the completion of a series of longwalls. The **travelling** tilts, curvatures and strains are the transient movements as the longwall face mines directly beneath a given point.

3.3. Far-field movements

The measured horizontal movements at survey marks which are located beyond the longwall goaf edges and over solid unmined coal areas are often much greater than the observed vertical movements at those marks. These movements are often referred to as *far-field movements*.

Far-field horizontal movements tend to be bodily movements towards the mined goaf area and are accompanied by very low levels of strain. These movements generally do not result in impacts on natural features or built environments, except for very large structures which can be very sensitive to differential horizontal movements.

In some cases, higher levels of far-field horizontal movements have been observed where steep slopes or surface incisions exist nearby, as these features influence both the magnitude and the direction of ground movement patterns. Similarly, increased horizontal movements are often observed around sudden changes in geology or where blocks of coal are left between longwalls or near other previously extracted series of longwalls. In these cases, the levels of observed subsidence can be slightly higher than normally predicted, but these increased movements are generally accompanied by very low levels of tilt and strain.

Far-field horizontal movements and the method used to predict such movements are described further in Section 4.5.

3.4. Overview of non-conventional subsidence movements

Conventional subsidence profiles are typically smooth in shape and can be explained by the expected caving mechanisms associated with overlying strata spanning the extracted void. Normal conventional subsidence movements due to longwall extraction are easy to identify where longwalls are regular in shape, the extracted coal seams are relatively uniform in thickness, the geological conditions are consistent and surface topography is relatively flat.

As a general rule, the smoothness of the profile is governed by the depth of cover and lithology of the overburden, particularly the near surface strata layers. Where the depth of cover is greater than 400 m, such as the case within the Study Area, the observed subsidence profiles along monitoring lines are generally smooth. Where the depth of cover is less than 100 metres, the observed subsidence profiles along monitoring lines are generally irregular. Very irregular subsidence movements are observed with much higher tilts, curvatures and strains at very shallow depths of cover where the collapsed zone above the extracted longwalls extends up to or near to the surface.

Irregular subsidence movements are occasionally observed at the deeper depths of cover along an otherwise smooth subsidence profile. The cause of these irregular subsidence movements can be associated with:

- sudden or abrupt changes in geological conditions;
- steep topography; and
- valley-related mechanisms.

Non-conventional movements due to geological conditions, steep topography and valley-related effects are discussed in the following sections.

3.4.1. Non-conventional subsidence movements due to changes in geological conditions

Most non-conventional ground movements are a result of the reaction of near surface strata to increased horizontal compressive stresses due to mining operations. Some of the geological conditions that influence these irregular subsidence movements are the blocky nature of near surface sedimentary strata layers and the presence of unknown faults, dykes or other geological structures, cross bedded strata, thin and brittle near surface strata layers and pre-existing natural joints. The presence of these geological features near the surface can result in a bump in an otherwise smooth subsidence profile and these bumps are usually accompanied by locally increased tilts, curvatures and strains.

Even though it may be possible to attribute a reason behind most observed non-conventional ground movements, there remain some observed irregular ground movements that cannot be explained with available information. The term “anomaly” is therefore reserved for those non-conventional ground movement cases that were not expected to occur and cannot be explained by any of the above possible causes.

It is not possible to predict the locations and magnitudes of non-conventional anomalous movements. In some cases, approximate predictions for the non-conventional ground movements can be made where the underlying geological or topographic conditions are known in advance. It is expected that these methods will improve as further knowledge is gained through ongoing research and investigation.

In this report, non-conventional ground movements are being included statistically in the predictions and impact assessments, by basing these on the frequency of past occurrence of both the conventional and non-conventional ground movements and impacts. The analysis of strains provided in Section 4.3 includes those resulting from both conventional and non-conventional anomalous movements. The impact assessments for the natural and built features, which are provided in Chapters 5 and 6, include historical impacts resulting from previous longwall mining which have occurred as the result of both conventional and non-conventional subsidence movements.

3.4.2. Non-conventional subsidence movements due to steep topography

Non-conventional movements can also result from increased horizontal movements in the downslope direction where longwalls are extracted beneath steep slopes. In these cases, elevated tensile strains develop near the tops and on the sides of the steep slopes and elevated compressive strains develop near the bases of the steep slopes. The potential impacts resulting from the increased horizontal movements include the development of tension cracks at the tops and on the sides of the steep slopes and compression ridges at the bottoms of the steep slopes.

Further discussions on the potential for downslope movements for the steep slopes within the Study Area are provided in Section 5.7.

3.4.3. Valley-related effects

The streams within the Study Area will be affected by valley-related effects, which are commonly observed in the Southern Coalfield. Valley bulging movements are a natural phenomenon, resulting from the formation and ongoing development of the valley, as illustrated in Fig. 3.1. The potential for these natural movements is influenced by the geomorphology of the valley.

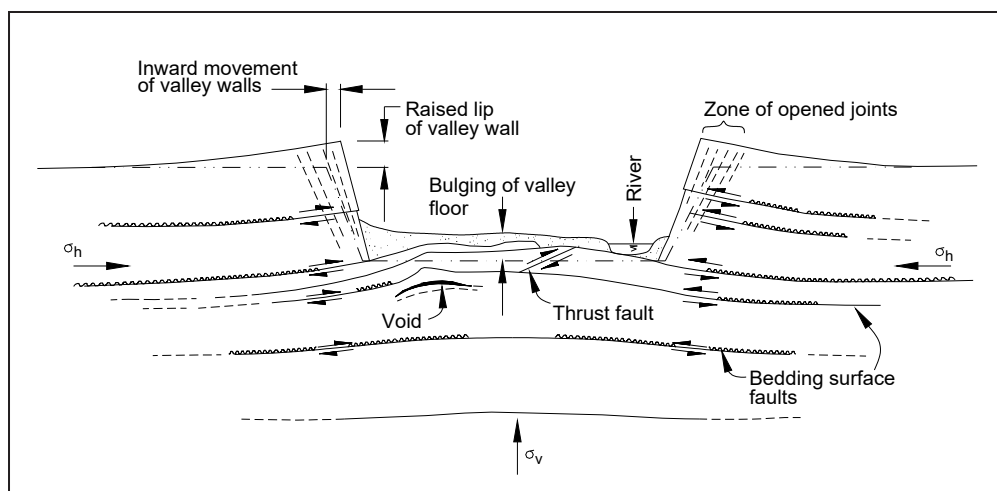


Fig. 3.1 Valley formation in flat-lying sedimentary rocks (after Patton and Hendren 1972)

Valley-related effects can be caused by or accelerated by mine subsidence as the result of a number of factors, including the redistribution of horizontal in situ stresses and downslope movements. Valley-related effects are normally described by the following parameters:

- **Upsidence** is the reduced subsidence, or the relative uplift within a valley which results from the dilation or buckling of near surface strata at or near the base of the valley. The magnitude of upsidence, which is typically expressed in the units of *millimetres (mm)*, is the difference between the observed subsidence profile within the valley and the conventional subsidence profile which would have otherwise been expected in flat terrain.
- **Closure** is the reduction in the horizontal distance between the valley sides. The magnitude of closure, which is typically expressed in the units of *millimetres (mm)*, is the greatest reduction in horizontal distance between any two points on the opposing valley sides.
- **Compressive Strains** occur within the bases of valleys as a result of valley closure and upsidence movements. **Tensile Strains** also occur in the sides and near the tops of the valleys as a result of valley closure movements. The magnitudes of these strains, which are typically expressed in the units of *millimetres per metre (mm/m)*, are calculated as the changes in horizontal distance over a standard bay length, divided by the original bay length.

The predicted valley-related effects for the streams due to the mining of the existing, approved and proposed longwalls have been determined using the empirical method outlined in ACARP Research Project No. C9067 (Waddington and Kay, 2002), referred to as the 2002 ACARP method.

More recently, the empirical prediction method has been refined based on further research undertaken as part of ACARP Research Project No. 18015 (Kay and Waddington, 2014), referred to as the 2014 ACARP method. This method only provides predictions for valley closure and not for upsidence.

The predicted valley closure movements for the streams within the Study Area have been determined using both methods. The predictions based on the 2002 ACARP method can be directly compared with the predictions provided in previous MSEC subsidence reports for Areas 7 and 9 and with other case studies. The assessments provided in this report, therefore, have been based on the predictions obtained using the 2002 ACARP method.

The predicted strains resulting from valley-related effects for the streams in the Study Area have been determined using the ground monitoring data for longwalls that have previously mined beneath or near to streams in the Southern Coalfield, including at Appin Mine. Refer to the impact assessments for the streams in Chapter 5 for further details.

Further details can be obtained from the background report entitled *General Discussion on Mine Subsidence Ground Movements* which can be obtained at www.minesubsidence.com.

3.5. The Incremental Profile Method

The predicted conventional subsidence effects for the existing and proposed longwalls have been determined using the Incremental Profile Method (IPM). The method is an empirical model developed by MSEC based on a large database of observed monitoring data from previous mining in the Southern, Newcastle, Hunter and Western Coalfields of NSW.

The database consists of detailed subsidence monitoring data from collieries in NSW including: Angus Place, Appin, Baal Bone, Bellambi, Beltana, Blakefield South, Bulli, Chain Valley, Clarence, Coalcliff, Cooranbong, Cordeaux, Corrimal, Cumnock, Dartbrook, Delta, Dendrobium, Eastern Main, Ellalong, Fernbrook, Glennies Creek, Gretley, Invincible, John Darling, Kemira, Lambton, Liddell, Mandalong, Metropolitan, Mt. Kembla, Munmorah, Nardell, Newpac, Newstan, Newvale, Newvale 2, South Bulga, South Bulli, Springvale, Stockton Borehole, Teralba, Tahmoor, Tower, Wambo, Wallarah, Western Main, Ulan, United, West Cliff, West Wallsend, and Wyee.

The database consists of the measured incremental subsidence profiles that represent the additional subsidence due to the mining of each longwall within a series of longwalls. It can be seen from the normalised incremental subsidence profiles within the database, that the measured shapes and magnitudes are reasonably consistent where the mining geometry and local geology are similar.

Subsidence predictions made using the IPM use the database of measured incremental subsidence profiles, the longwall geometries, local surface and seam information and geology. The method tends to over-predict the conventional subsidence effects (i.e. is slightly conservative) where the mining geometry and geology are within the range of the empirical database. The predictions can be further tailored to local conditions where observed monitoring data is available close to the mining area.

Further details on the IPM are provided in the background report entitled *General Discussion on Mine Subsidence Ground Movements* which can be obtained from www.minesubsidence.com.

3.6. Calibration of the IPM

The use of the IPM at the Appin Mine has been continually reviewed and refined based on the latest available ground movement monitoring data. The subsidence model has been reviewed after the completion of each longwall as part of the End of Panel reports.

The subsidence predictions for LW701 to LW708B in Area 7 and LW901 to LW904 in Area 9 were based on the standard IPM for the Southern Coalfield using monitoring data from the Bulli Seam available at that time.

The standard IPM was reviewed and calibrated based on the updated monitoring data from Appin Mine as part of the Extraction Plan Application for LW709 to LW711 and LW905. The details of the review and calibration are provided in Section 3.6 of Report No. MSEC1117 (Rev. B).

The IPM has been reviewed again as part of this current Extraction Plan Application based on the latest monitoring data from Appin Mine. The data from Area 7 include the ARTC monitoring line, Early Warning monitoring line, HW2 East monitoring line, HW2 West monitoring line, Menangle Road monitoring line, Moreton Park Road monitoring line and Telstra monitoring line. The data from Area 9 include the ARTC monitoring line and Menangle Road monitoring line.

Comparisons of the measured and predicted profiles of total vertical subsidence along the monitoring lines for ARTC (Area 7), ARTC (Area 9), Early Warning line, HW2 East, HW2 West, Menangle Road (Area 7), Menangle Road (Area 9), Moreton Park Road and Telstra are provided in Fig. 3.2 to Fig. 3.10, respectively.

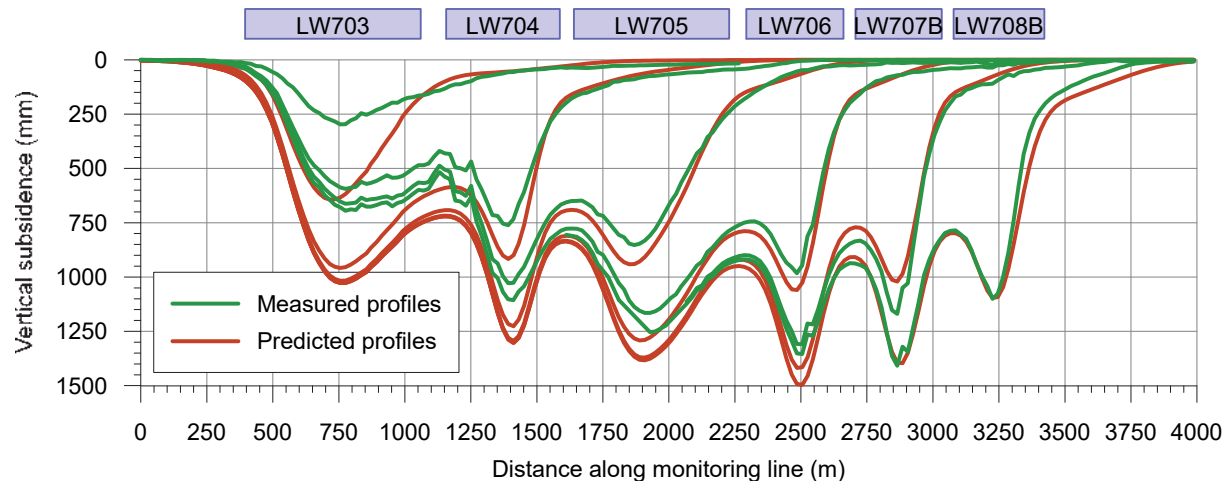


Fig. 3.2 Measured and predicted total vertical subsidence for the ARTC (Area 7) monitoring line

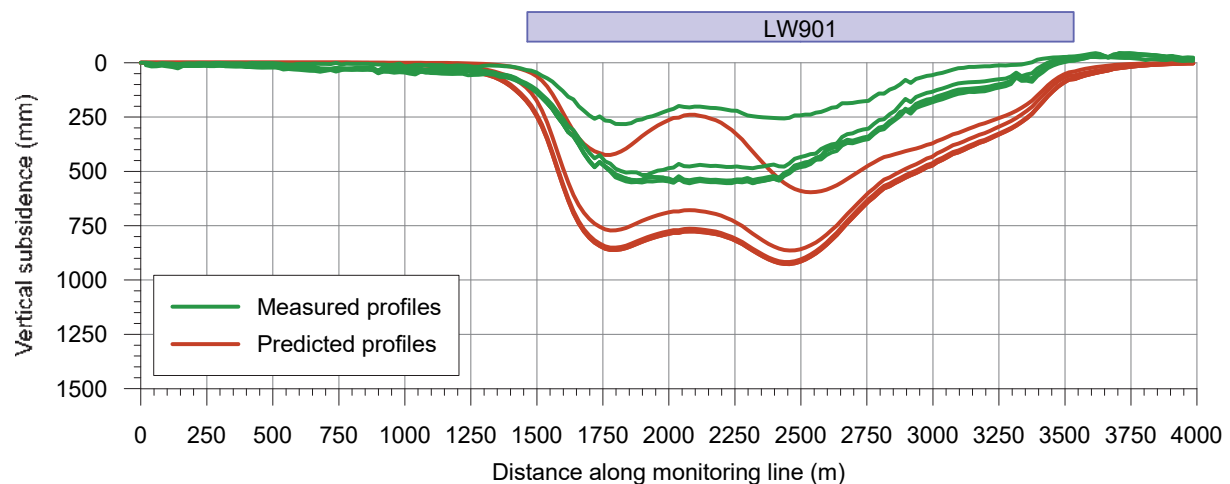


Fig. 3.3 Measured and predicted total vertical subsidence for the ARTC (Area 9) monitoring line

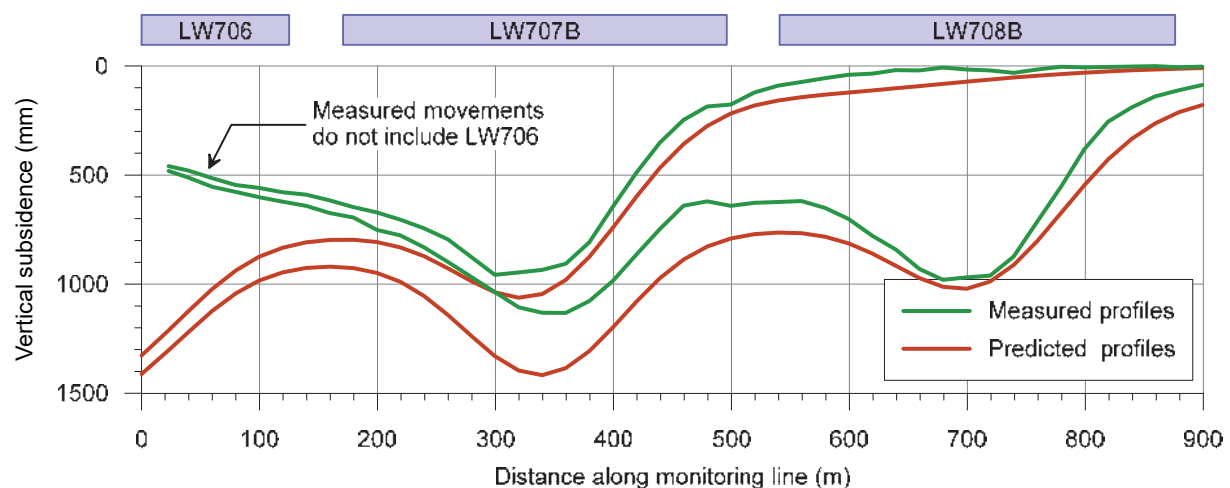


Fig. 3.4 Measured and predicted total vertical subsidence for the Early Warning monitoring line

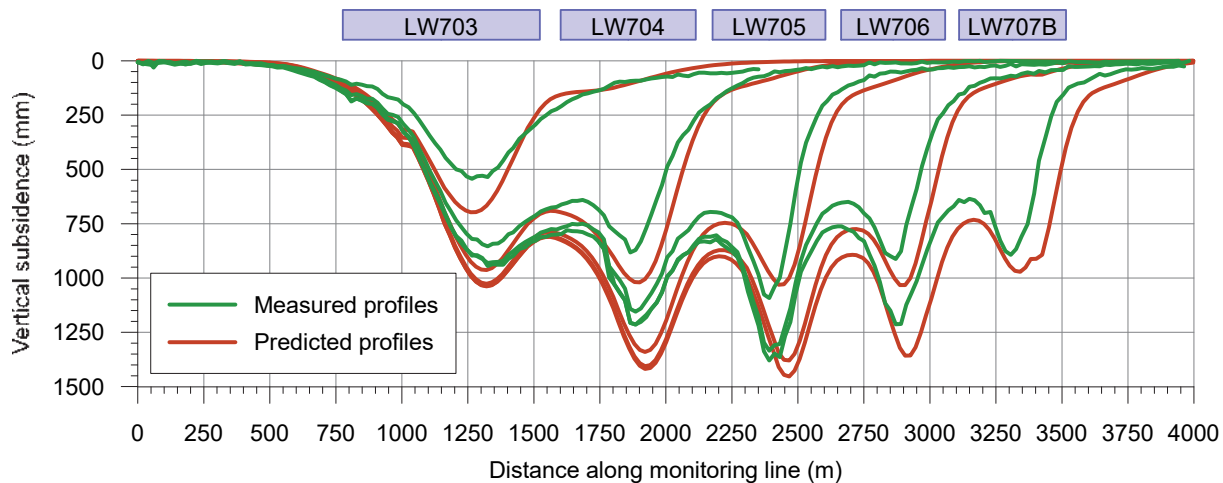


Fig. 3.5 Measured and predicted total vertical subsidence for the HW2 East monitoring line

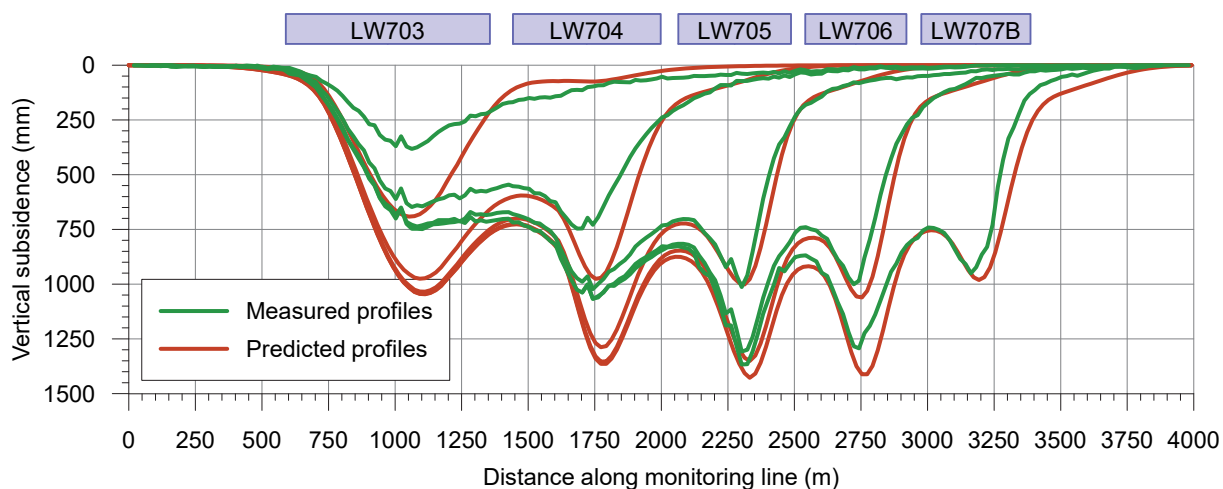


Fig. 3.6 Measured and predicted total vertical subsidence for the HW2 West monitoring line

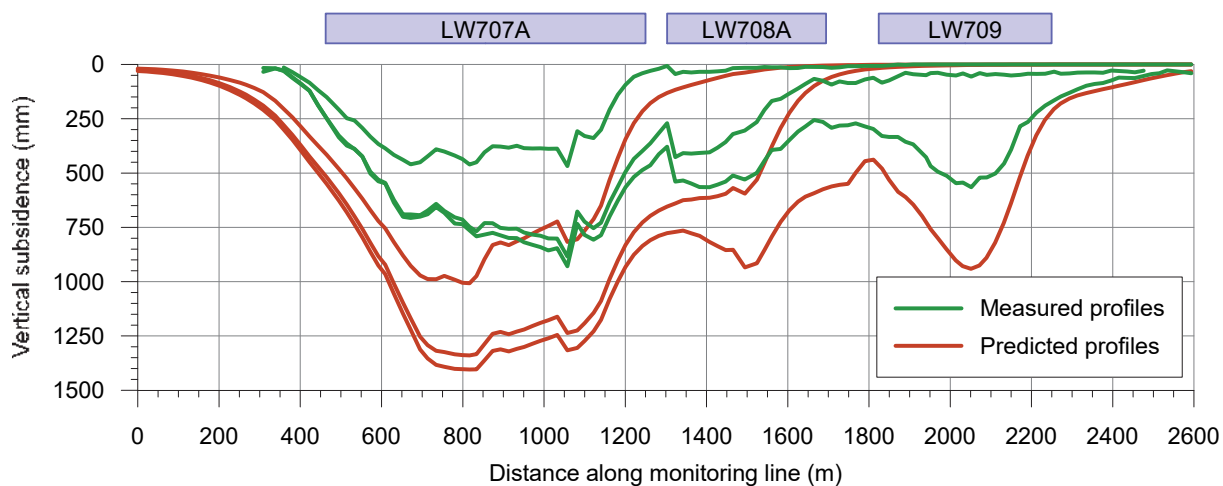


Fig. 3.7 Measured and predicted total vertical subsidence for the Menangle Road (Area 7) monitoring line

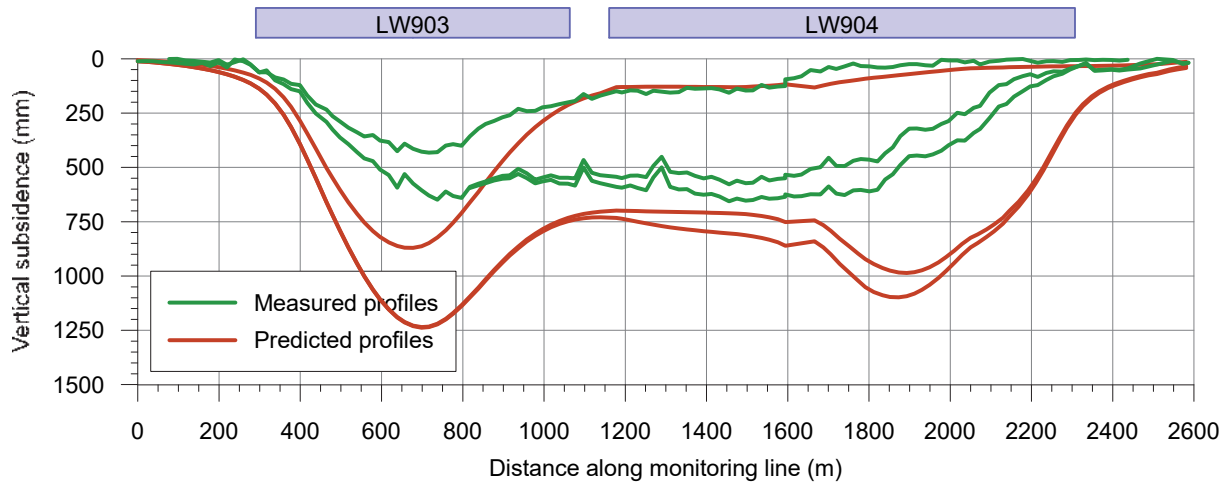


Fig. 3.8 Measured and predicted total vertical subsidence for the Menangle Road (Area 9) monitoring line

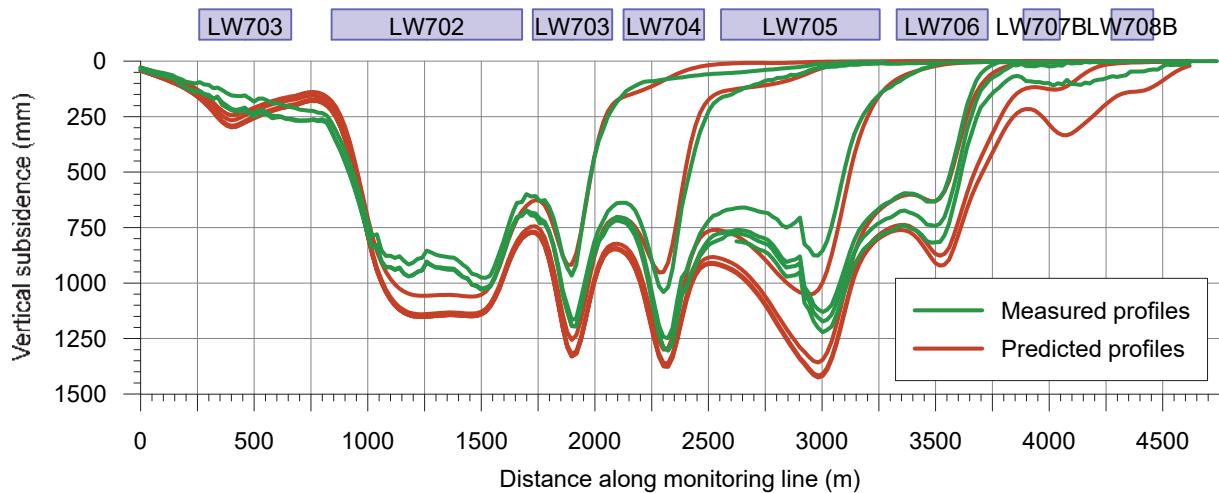


Fig. 3.9 Measured and predicted total vertical subsidence for the Moreton Park Road monitoring line

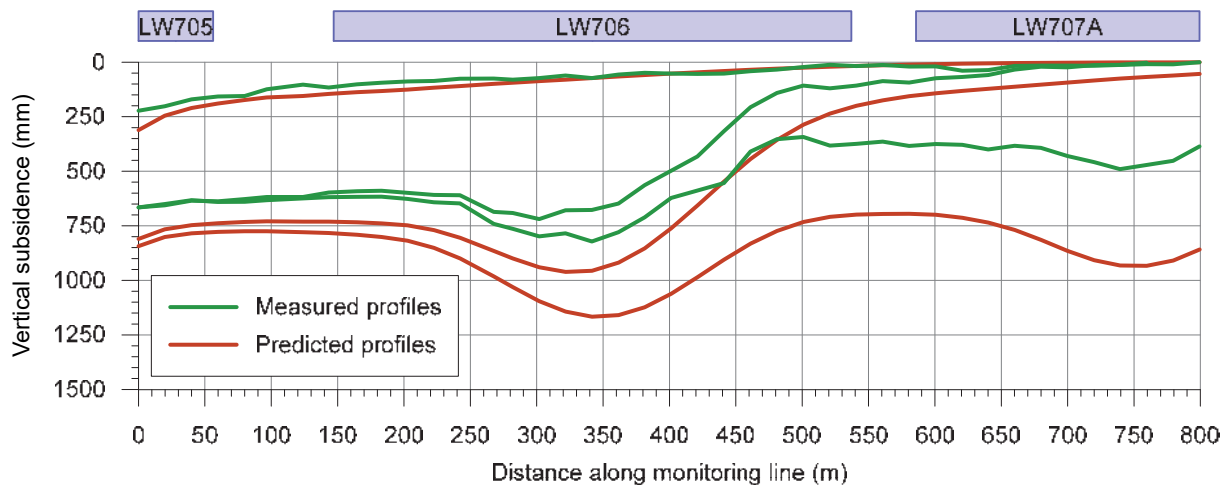


Fig. 3.10 Measured and predicted total vertical subsidence for the Telstra monitoring line

The measured profiles of vertical subsidence reasonably match the predicted profiles along each of the monitoring lines. The maximum measured total vertical subsidence values are similar to or less than the maximum predicted total subsidence values above each of the longwalls.

It is considered that the calibrated IPM provides reasonable, if not slightly conservative predictions of vertical subsidence. It can be inferred from the profiles, that the measured tilts and curvatures also reasonably match the predicted tilts and curvatures. No further calibration of the IPM is required based on the latest monitoring data from Appin Mine.

3.7. Reliability of the calibrated IPM

A comparison between the maximum measured and maximum predicted total vertical subsidence for the monitoring lines at Appin Mine is provided in Fig. 3.11. The predictions are based on the calibrated IPM as discussed in Section 3.6. The measured and predicted values represent the total movements after the mining of each longwall.

The maximum measured total vertical subsidence values are less than the maximum predicted total values.

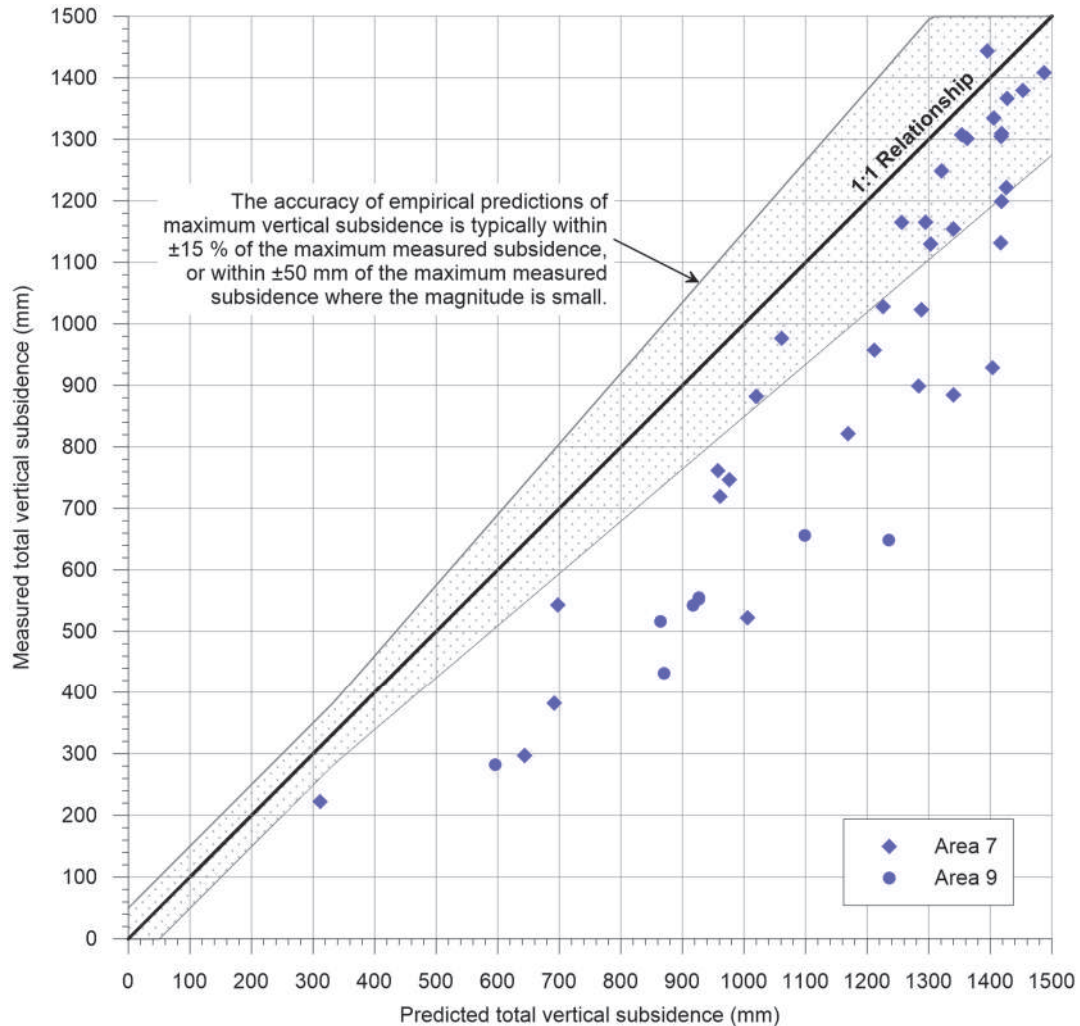


Fig. 3.11 Comparison of maximum measured and maximum predicted (calibrated IPM) total vertical subsidence for the monitoring lines at Appin Mine

The distribution of the ratio of the maximum measured to maximum predicted total vertical subsidence for the monitoring lines is illustrated on the left-side of Fig. 3.12. A gamma distribution has been fitted to the data and this is also shown on the left-side of this figure. The probabilities of exceedance based on the fitted gamma distribution are shown in the right-side of Fig. 3.12.

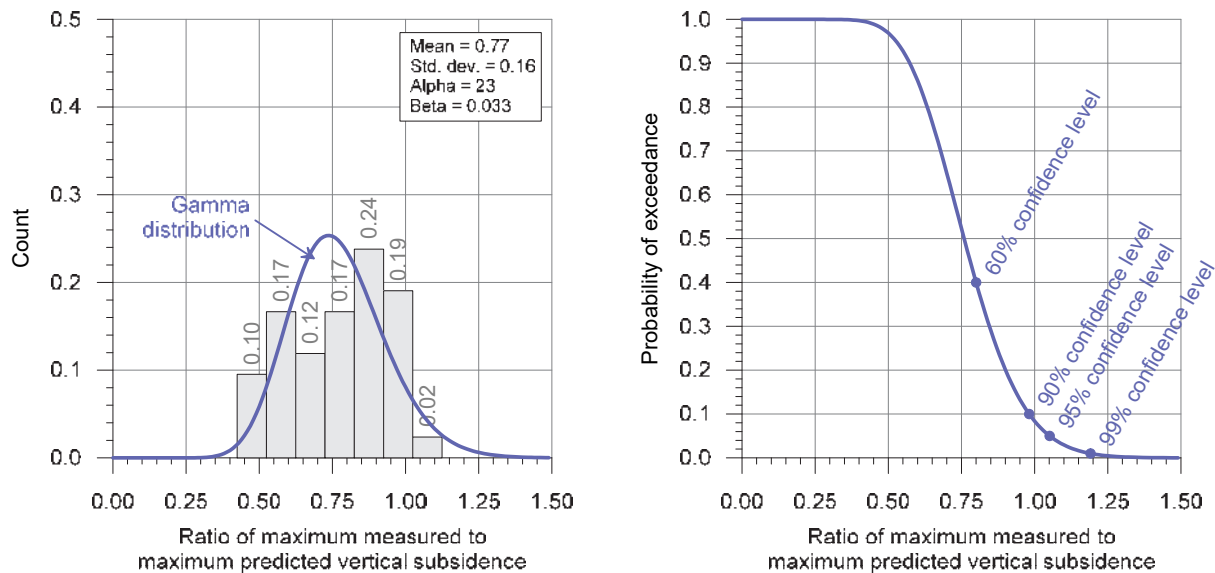


Fig. 3.12 Distribution of the ratio of maximum measured to maximum predicted total vertical subsidence for the monitoring lines at Appin Mine

The ratios of maximum measured to maximum predicted total vertical subsidence vary between 0.46 and 1.03. That is, the maximum measured total vertical subsidence varies between 46 % and 103 % of the maximum predicted total values based on the calibrated IPM.

The mean ratio of the maximum measured to maximum predicted total vertical subsidence for the monitoring lines is 0.77. The maximum measured vertical subsidence therefore is on average 77 % of the maximum predicted values based on the calibrated IPM.

The 90 % confidence level represents a ratio of maximum measured to maximum predicted total vertical subsidence of 0.98, i.e. approximately 1.0. That is, there is a probability of approximately 10 % that the maximum measured total vertical subsidence will exceed the maximum predicted value based on the calibrated IPM.

The 95 % and 99 % confidence levels represent ratios of maximum measured to maximum predicted total vertical subsidence of 1.05 and 1.19, respectively. That is, there are probabilities of 5 % and 1 % that the maximum measured total vertical subsidence will exceed the maximum predicted values by 5 % and 19 %, respectively.

A comparison of the mining geometry for the proposed LW712 to LW716 with that for the existing and approved longwalls in Appin Areas 7 and 9 is provided in Table 3.1.

Table 3.1 Comparison of the mine geometry for the longwalls at Appin Mine

Parameter	Existing and approved LW702 to LW711 and LW901 to LW905		Proposed LW712 to LW716	
	Range	Average	Range	Average
Longwall widths (m)	305 ~ 324	-	324	-
Depths of cover (m)	490 ~ 750	560	555 ~ 800	650
Width-to-depth ratios	0.44 ~ 0.64	0.57	0.41 ~ 0.58	0.50
Mining heights (m)	2.4 ~ 3.4	3.0	3.0 ~ 3.6	3.3

The void widths of the proposed LW712 to LW716 are the same as the void widths of existing and approved LW702 to LW711, LW904 and LW905 of 324 m. However, the existing LW901 to LW903 have a narrower void width of 305 m.

The depths of cover above the proposed LW712 to LW716 are greater than those above the existing and approved longwalls at the Mine. The depths of cover at the Mine progressively increases towards the north as the longwalls mine further beneath Razorback Range. The average depths of cover above the eastern ends of the proposed longwalls (i.e. away from Razorback Range) are similar to the average depths above the existing and approved LW707A to LW711 and LW904.

The width-to-depth ratios for the proposed LW712 to LW716 are similar to but less than the range of width-to-depth ratios for the existing and approved longwalls at the Mine. The predicted vertical subsidence for the proposed longwalls is therefore less than that for the existing and approved longwalls. However, this difference is small since the longwalls are all in a similar part of the subcritical range.

The mining heights for the proposed LW712 to LW716 are similar to but slightly greater than the mining heights for the existing and approved longwalls at the Mine. The thickness of the Bulli Seam slightly increases towards the north of the mining area.

It is expected that the calibrated model will provide reasonable, if not, slightly conservative predictions for the proposed LW712 to LW716. The model will be reviewed as part of the End of Panel reports and, if required, further refined as the depth of cover and seam thickness gradually increase as the longwall series is progressively mined towards the north.

4.1. Introduction

The following sections provide the maximum predicted conventional subsidence effects due to the mining of the proposed LW712 to LW716. The predicted subsidence effects and the impact assessments for the natural and built features are provided in Chapters 5 and 6.

The predicted subsidence effects have been obtained using the IPM, which has been calibrated based on the latest monitoring data from Appin Mine and other nearby collieries, as described in Section 3.6. The predicted strains have been determined from statistical analyses of strain measured in the NSW coalfields, where the longwall width-to-depth ratios and mining heights are similar to those for the proposed longwalls.

The maximum predicted subsidence effects and the predicted subsidence contours provided in this report describe and show the conventional movements and do not include the valley-related upsidence and closure movements, nor the effects of faults and other geological structures. Such effects have been addressed separately in the impact assessments for each feature provided in Chapters 5 and 6.

4.2. Maximum predicted conventional subsidence, tilt and curvature

A summary of the maximum predicted values of incremental conventional vertical subsidence, tilt and curvature due to the mining of each of LW712 to LW716 is provided in Table 4.1. The incremental values are the additional movements due to the mining of each proposed longwall.

Table 4.1 Maximum predicted incremental vertical subsidence, tilt and curvature due to the mining of each of LW712 to LW716

Due to 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)
LW712	925	6.5	0.07	0.13
LW713	950	6.5	0.06	0.12
LW714	925	6.5	0.06	0.11
LW715	900	6.0	0.06	0.11
LW716	875	6.0	0.06	0.10

The predicted cumulative vertical subsidence contours due to the mining of LW712 to LW716 only are shown in Drawing No. MSEC1459-16 in Appendix E. The predicted limit of vertical subsidence due to the mining of these proposed longwalls is shown by the predicted 20 mm subsidence contour (i.e. outside contour) in this drawing.

The predicted total vertical subsidence contours after the mining of each of LW712 to LW716 are shown in Drawing Nos. MSEC1459-17 to MSEC1459-21 in Appendix E. A summary of the maximum predicted values of total vertical subsidence, tilt and curvature is provided in Table 4.2. The total effects represent the accumulated movements within the Study Area due to the mining of the existing, approved and proposed longwalls in Areas 7 and 9.

Table 4.2 Maximum predicted total vertical subsidence, tilt and curvature within the Study Area after the mining of each of LW712 to LW716

After 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)
LW712	1400	6.5	0.07	0.14
LW713	1400	6.5	0.07	0.14
LW714	1400	6.5	0.07	0.14
LW715	1425	6.5	0.07	0.14
LW716	1450	6.5	0.07	0.14

The maximum predicted total vertical subsidence within the Study Area due to the mining of the existing, approved and proposed longwalls is 1450 mm. The maximum vertical subsidence occurs above LW713 and it represents 41 % of the proposed extraction height of 3.5 m in this location.

The maximum predicted total tilt within the Study Area is 6.5 mm/m (i.e. 0.65 % or 1 in 154) and it occurs adjacent to the maingate of LW716. The maximum predicted total conventional curvatures within the Study Area are 0.07 km⁻¹ hogging and 0.14 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 7 km, respectively.

The predicted conventional subsidence effects vary across the Study Area as the result of, among other factors, variations in the longwall geometry, depths of cover, seam thickness and overburden geology. To illustrate this variation, the predicted profiles of vertical subsidence, tilt and curvature have been determined along two prediction lines. The predicted profiles of total vertical subsidence, tilt and curvature along Prediction Lines 1 and 2 are shown in Figs. C.01 and C.02, respectively, in Appendix C. These prediction lines are shown in Drawing Nos. MSEC1459-16 to MSEC1459-21.

4.3. Predicted strains

The prediction of strain is more difficult than the predictions 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 in 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 measured 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 average 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 has been found that a factor of 15 provides a reasonable relationship between the predicted maximum curvatures and the predicted maximum conventional strains.

The maximum predicted conventional strains resulting due to the mining of LW712 to LW716, based on applying a factor of 15 to the maximum predicted curvatures, are 1 mm/m tensile and 2 mm/m compressive. These strains represent typical values when the ground subsides regularly with no localised or elevated strains due to near-surface geological structures or valley-related effects. The maximum strains can be much greater than these typical values, especially in the locations of near-surface geological structures, on steep slopes or within valleys.

At any 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 can be many times greater than the predicted conventional strain for low magnitudes of curvature. In this report, therefore, we have provided a statistical approach to account for the variability, rather than just providing a single predicted conventional strain.

The range of potential strains above the proposed longwalls has been determined using monitoring data from the extracted longwalls at Appin Mine and other nearby collieries, where the mining geometry and overburden geometry are similar. The range of strains measured during the mining of these longwalls should, therefore, provide a reasonable indication of the range of potential strains for the proposed longwalls.

The data used in the analysis of measured strains included those resulting from both conventional and non-conventional anomalous movements but did 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 been excluded.

4.3.1. Analysis of strains measured in survey bays

For features that are in discrete locations, such as building structures, farm dams and heritage sites, it is appropriate to assess the frequency of the maximum strains measured in individual survey bays.

The survey database has been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of longwalls at the mine, for survey bays that were located directly above goaf or the chain pillars that are located between the extracted longwalls, which has been referred to as “*above goaf*”.

A histogram of the maximum total tensile and compressive strains measured in survey bays located above goaf is provided in Fig. 4.1. A number of probability distribution functions have been fitted to the empirical data. It was found that a *Generalised Pareto Distribution (GPD)* provided a good fit to the raw strain data, which have also been shown in this figure.

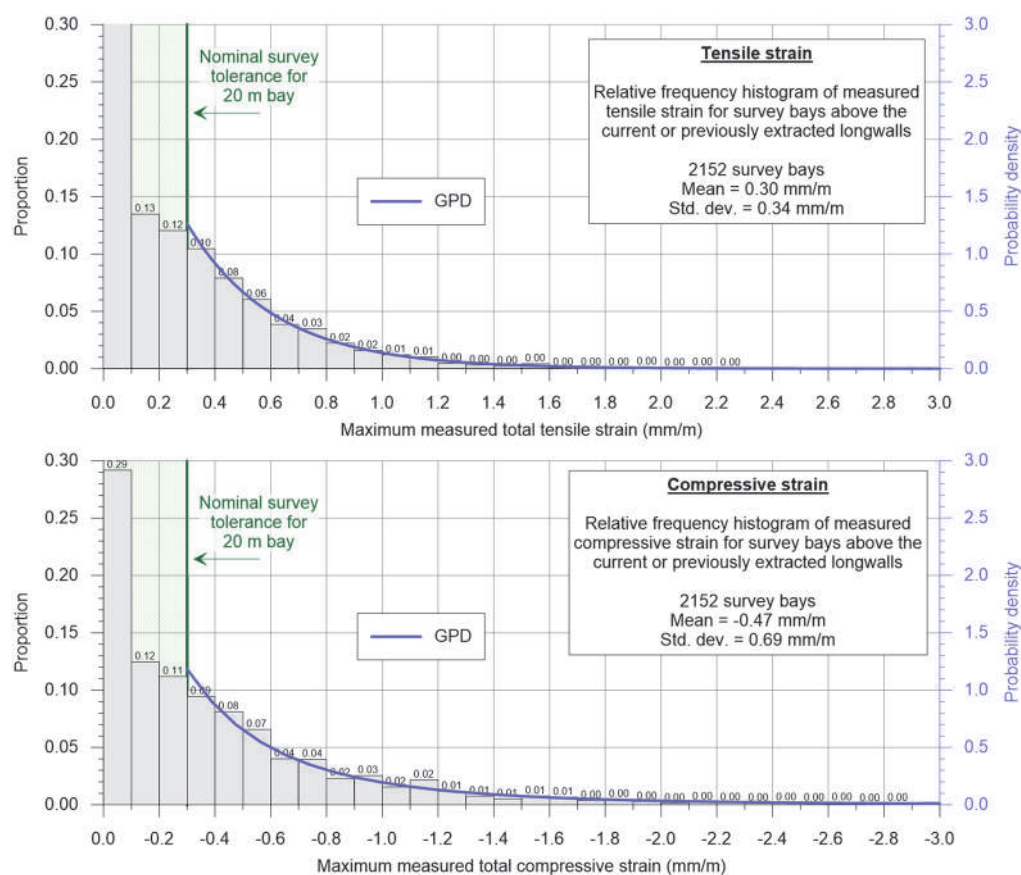


Fig. 4.1 Distributions of the maximum measured tensile and compressive strains due to the extraction of longwalls in the Southern Coalfield for survey bays located directly above goaf

Confidence levels have been determined from the empirical strain data using the fitted GPDs. In the cases where survey bays have been 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).

A summary of the probabilities of exceedance for tensile and compressive strains for survey bays located above goaf, based on the fitted GPDs, is provided in Table 4.3. The analysis does not include the strains resulting from valley-related effects, which are discussed separately in the impact assessments for the natural and built features provided in Chapters 5 and 6.

Table 4.3 Probabilities of exceedance for strain for survey bays located directly above goaf

Type	Strain (mm/m)	Probability of exceedance
Compression	-8.0	1 in 1250
	-6.0	1 in 540
	-4.0	1 in 175
	-2.0	1 in 32
	-1.0	1 in 8
	-0.5	1 in 3
	-0.3	1 in 2
Tension	+0.3	1 in 3
	+0.5	1 in 5
	+1.0	1 in 23
	+1.5	1 in 105
	+2.0	1 in 480
	+3.0	1 in 2150

The 95 % confidence levels for the maximum measured total strains for survey bays above goaf are 1.0 mm/m tensile and 1.6 mm/m compressive. The 99 % confidence levels for the maximum measured total strains for survey bays above goaf are 1.5 mm/m tensile and 3.2 mm/m compressive.

The probabilities for survey bays located above goaf are based on the strains measured anywhere above the extracted longwalls at the mine. As described previously, tensile strains are more likely to develop in the locations of hogging curvature and compressive strains are more likely to develop in the locations of sagging curvature.

The distribution of incremental strains measured above previously extracted longwalls in the Southern Coalfield is illustrated in Fig. 4.2 (after Barbato, 2017). The distances have been normalised, so that the measured strains are shown relative to the longwall maingate and tailgate sides. The approximate confidence levels for the incremental tensile and compressive strains are also shown in this figure, to help illustrate the variation in the data.

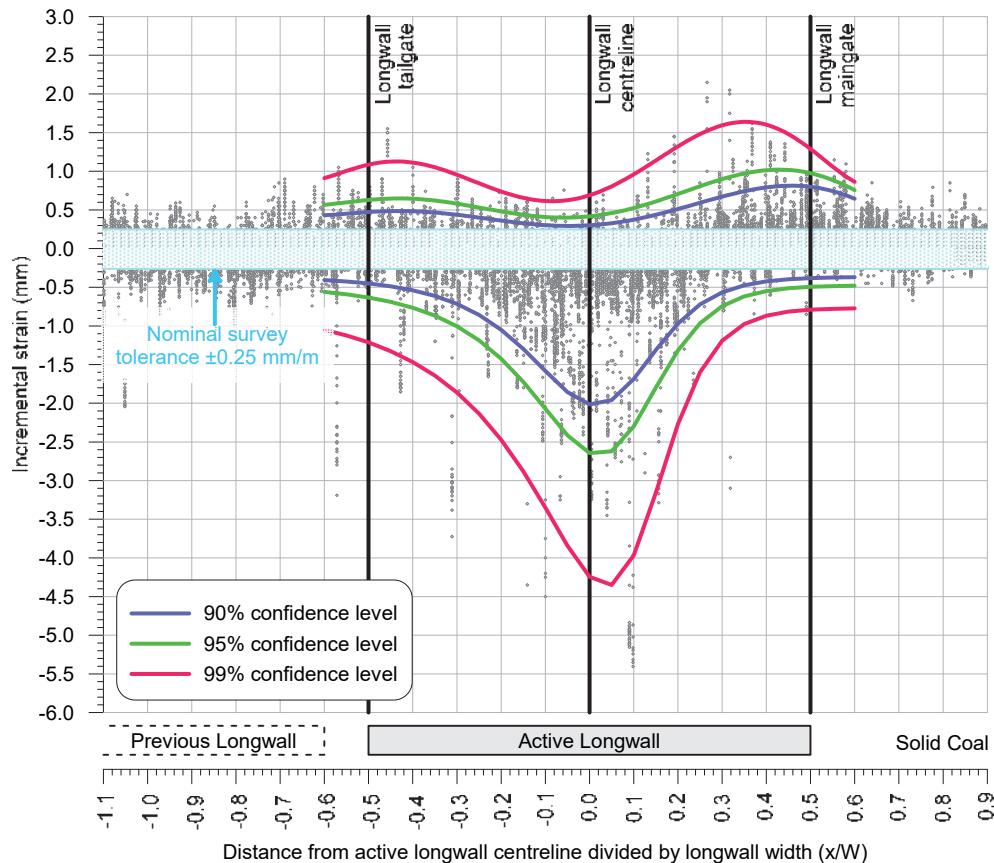


Fig. 4.2 Measured incremental strains versus normalised distance from the longwall maingate for extracted longwalls in the Southern Coalfield

The survey database has also been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of the longwalls at Appin Mine and other nearby collieries, for survey bays that were located outside and within 250 m of the nearest longwall goaf edge, which has been referred to as “*above solid coal*”.

A histogram of the maximum total tensile and compressive strains measured in survey bays located above solid coal is provided in Fig. 4.3. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

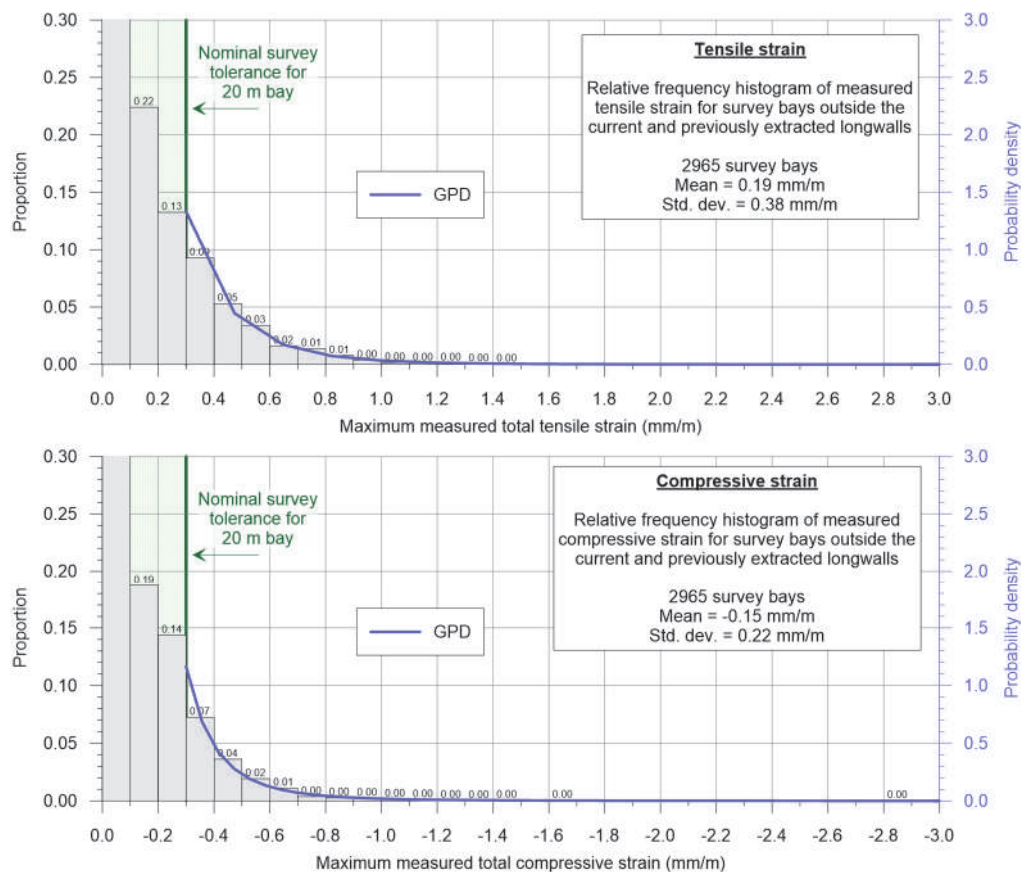


Fig. 4.3 Distributions of the maximum measured tensile and compressive strains during the extraction of longwalls in the Southern Coalfield for survey bays located above solid coal

Confidence levels have been determined from the empirical strain data using the fitted GPDs. In the cases where survey bays have been 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).

A summary of the probabilities of exceedance for tensile and compressive strains for survey bays located above solid coal, based the fitted GPDs, is provided in Table 4.4. The analysis does not include the strains resulting from valley-related effects, which are discussed separately in the impact assessments for the natural and built features provided in Chapters 5 and 6.

Table 4.4 Probabilities of exceedance for strain for survey bays located above solid coal

Type	Strain (mm/m)	Probability of exceedance
Compression	-2.0	1 in 1250
	-1.5	1 in 520
	-1.0	1 in 155
	-0.5	1 in 23
	-0.3	1 in 7
Tension	+0.3	1 in 4
	+0.5	1 in 13
	+1.0	1 in 105
	+1.5	1 in 510
	+2.0	1 in 1800

The 95 % confidence levels for the maximum measured total strains for survey bays above solid coal are 0.6 mm/m tensile and 0.5 mm/m compressive. The 99 % confidence levels for the maximum measured total strains for survey bays above solid coal are 1.0 mm/m tensile and 0.9 mm/m compressive.

4.3.2. Analysis of strains measured along whole monitoring lines

For linear features such as roads, cables and pipelines, it is more appropriate to assess the frequency of the maximum strains measured along whole monitoring lines, rather than for individual survey bays. That is, an analysis of the maximum strains measured anywhere along the monitoring lines, regardless of where the strain occurs.

A histogram of maximum measured total tensile and compressive strains measured anywhere along the monitoring lines, at any time during or after the mining of longwalls at Appin Mine and other nearby collieries, is provided in Fig. 4.4. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

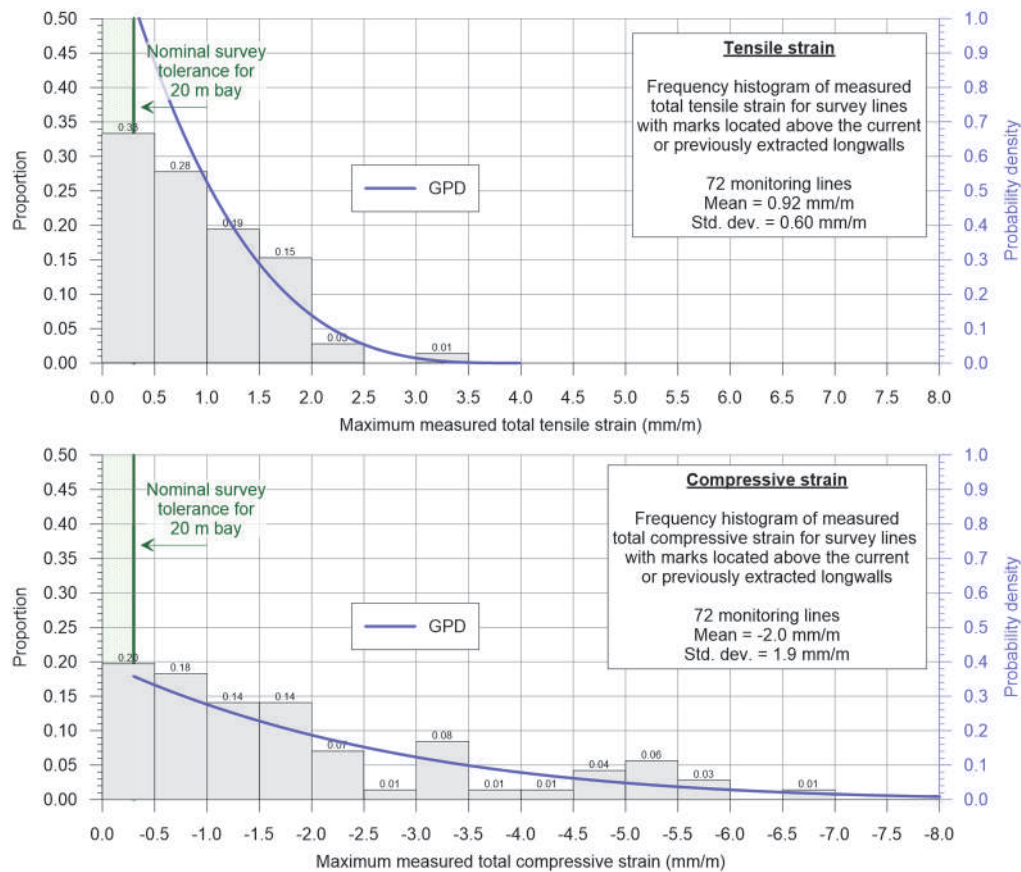


Fig. 4.4 Distributions of maximum measured tensile and compressive strains along the monitoring lines during the extraction of longwalls in the Southern Coalfield

The maximum measured total tensile strains along 44 of the 72 monitoring lines (i.e. 61 % of cases) were less than 1.0 mm/m. The maximum measured total compressive strains along 47 of the 72 monitoring lines (i.e. 65 % of cases) were less than 2.0 mm/m.

The 95th percentiles for the maximum measured total strains along the monitoring lines are 2.0 mm/m tensile and 5.5 mm/m compressive. The 99th percentiles for the maximum measured total strains along the monitoring lines are 2.5 mm/m tensile and 7.3 mm/m compressive

4.3.3. Analysis of shear strains

As described in Section 3.2, ground strain comprises two components, being normal strain and shear strain, that are interrelated by Mohr's Circle. The magnitudes of the normal strain and shear strain components are, therefore, dependent on the orientation in which they are measured. The maximum normal strains (i.e. principal strains) are those in the direction where the corresponding shear strain is zero.

Normal strains along monitoring lines can be measured using 2D and 3D techniques, by taking the change in horizontal distance between two points on the ground and dividing by the original horizontal distance between them. This provides the magnitude of normal strain along the orientation of the monitoring line and, therefore, this strain may not necessarily be the maximum (i.e. principal) strain.

Shear deformations are more difficult to measure, as they are the relative horizontal movements perpendicular to the direction of measurement. However, 3D monitoring techniques provide data on the direction and the absolute displacement of survey marks and, therefore, the shear deformations perpendicular to the monitoring line can be determined. But, in accordance with rigorous definitions and the principles of continuum mechanics, (e.g. Jaeger, 1969), it is not possible to determine horizontal shear strains in any direction relative to the monitoring line using 3D monitoring data from a straight line of survey marks.

Shear deformations perpendicular to monitoring lines can be described using various parameters including horizontal tilt, horizontal curvature, horizontal mid-ordinate deviation, angular distortion and shear index. In this report, horizontal mid-ordinate deviation has been used as the measure for shear deformation, which is defined as the differential horizontal movement of each survey mark, perpendicular to a line drawn between two adjacent survey marks.

The frequency distribution of the maximum total horizontal mid-ordinate deviations measured at survey marks above goaf, for previously extracted longwalls at Appin Mine and other nearby collieries, is provided in Fig. 4.5. As the typical survey bay length was 20 m, the calculated mid-ordinate deviations were over a chord length of 40 m. The probability distribution function, based on the fitted GPD, has also been shown in this figure.

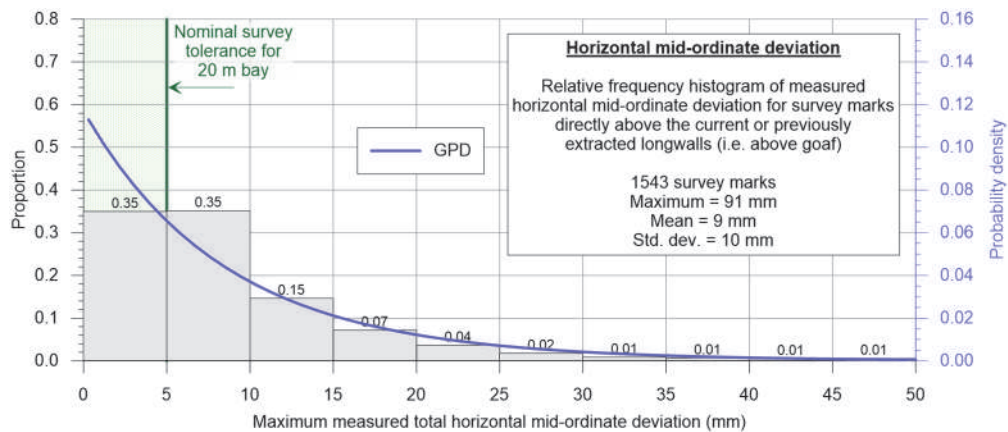


Fig. 4.5 Distribution of maximum measured mid-ordinate deviation during the extraction of previous longwalls in the Southern Coalfield for marks located above goaf

A summary of the probabilities of exceedance for total horizontal mid-ordinate deviation for survey bays located above goaf, based the fitted GPD, is provided in Table 4.5. The analysis does not include the strains resulting from valley-related effects, which are discussed separately in the impact assessments for the natural and built features provided in Chapters 5 and 6.

Table 4.5 Probabilities of exceedance for mid-ordinate deviation for survey marks above goaf for monitoring lines in the Southern Coalfield

	Horizontal mid-ordinate deviation (mm)	Probability of exceedance
Mid-ordinate deviation over a 40 m chord length	10	1 in 3
	20	1 in 9
	30	1 in 24
	40	1 in 67
	50	1 in 180
	60	1 in 460
	70	1 in 1150
	80	1 in 2800

The 95 % and 99 % confidence levels for the maximum measured total horizontal mid-ordinate deviations for survey marks located above goaf are 28 mm and 44 mm, respectively.

4.4. Predicted conventional horizontal movements

The predicted conventional horizontal movements above the existing and proposed longwalls are calculated by applying a factor to the predicted conventional tilt values. In the Southern Coalfield a factor of 15 is generally adopted, being the same factor as that used to determine the conventional strains from the conventional curvatures, and this has been found to give a reasonable correlation with measured data. This factor will vary and will be higher at low tilt values and lower at high tilt values. The application of this factor will therefore lead to over-prediction of horizontal movements where the tilts are high and under-prediction of the movements where the tilts are low.

The maximum predicted conventional tilt for the proposed longwalls is 6.5 mm/m. The maximum predicted conventional horizontal movement, therefore, is approximately 100 mm, i.e. 6.5 mm/m multiplied by a factor of 15. Greater movements can develop in incised terrain, due to the increased horizontal movements that develop in the downslope direction.

The distribution of the maximum measured horizontal movements for the 3D survey marks located directly above the longwalls in Appin Mine and other nearby collieries is provided in Fig. 4.6. The values represent the maximum horizontal movements at any time during or after the mining of the longwalls.

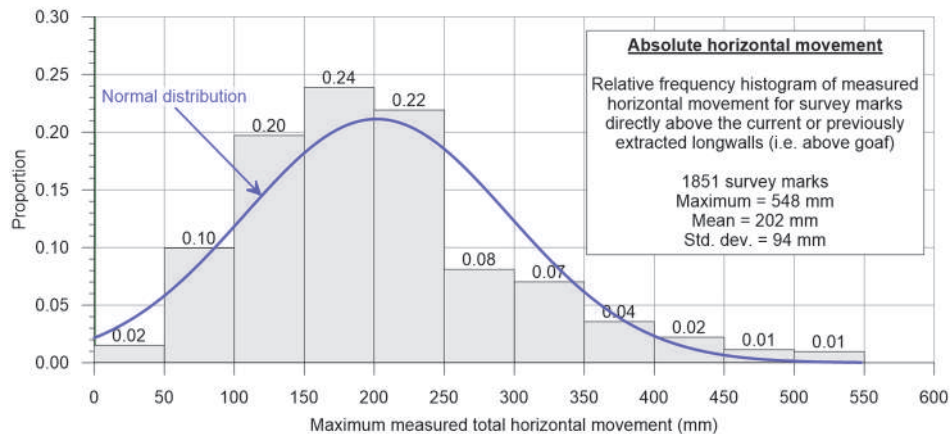


Fig. 4.6 Distribution of the maximum measured horizontal movements for the 3D marks located directly above the longwalls in the Southern Coalfield

The mean measured absolute horizontal movement above previous longwall mining at Appin and other nearby collieries is 202 mm and the 95th percentile is 386 mm. The maximum measured absolute horizontal movement is 548 mm.

Conventional horizontal movements do not directly impact on natural and built features, rather impacts occur as the result of differential horizontal movements. Strain is the rate of change of horizontal movement. The impacts of strain on the natural and built features are addressed in the impact assessments for each feature in Chapters 5 and 6.

4.5. Predicted far-field horizontal movements

In addition to the conventional subsidence movements that have been predicted above and adjacent to the proposed longwalls, and the predicted valley-related effects along the streams, it is also likely that far-field horizontal movements will be experienced during the mining of the proposed longwalls.

The measured total far-field horizontal movements versus the distance from the mining area are shown in Fig. 4.7. The confidence levels based on fitted GPDs have also been shown in this figure to illustrate the spread of the data. The data only includes survey marks above solid coal and not above previously extracted longwalls.

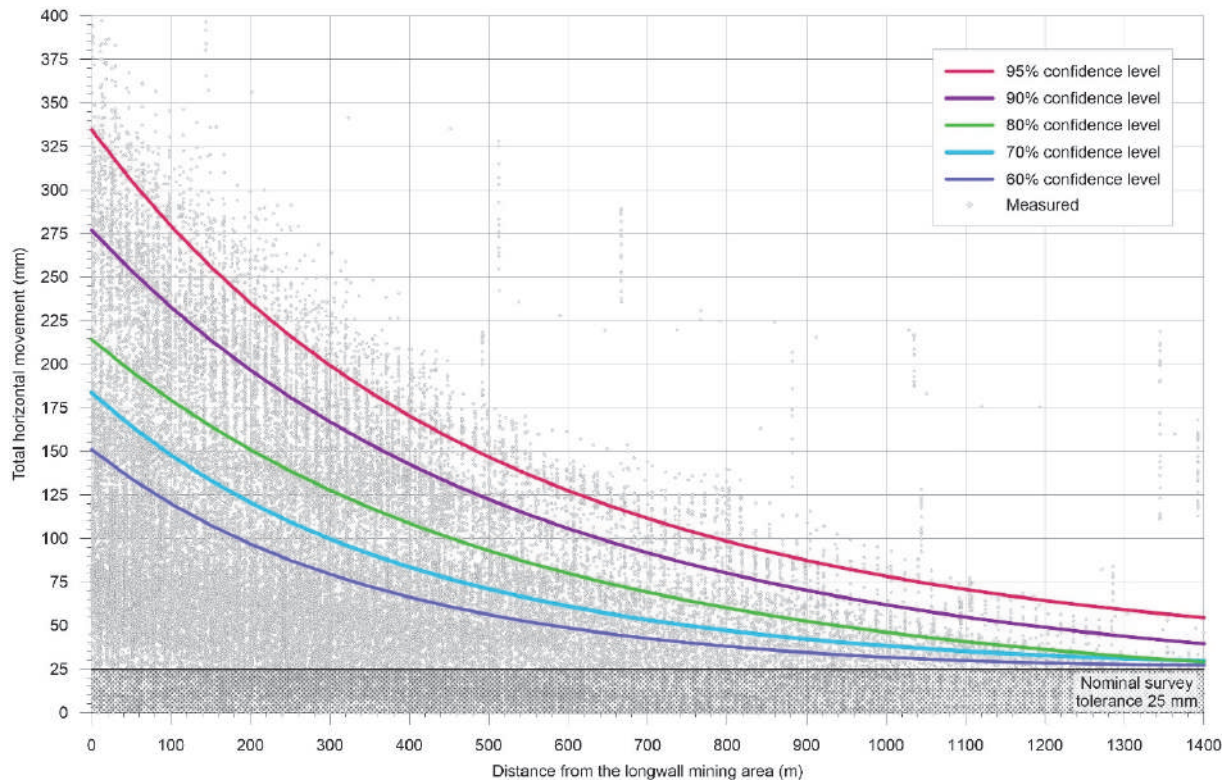


Fig. 4.7 Measured total far-field horizontal movements versus distance from the mining area

The mean measured total horizontal movements at distances of 0 m, 500 m and 1000 m are 140 mm, 57 mm and 31 mm, respectively. The 95 % confidence levels for the measured total horizontal movements at distances of 0 m, 500 m and 1000 m are 335 mm, 147 mm and 78 mm, respectively.

The predicted far-field horizontal movements due to the mining of the proposed longwalls are very small and could only be detected by precise surveys. Such movements tend to be bodily movements towards the extracted goaf area, and are accompanied by very low levels of strain, which are generally less than survey tolerance. The impacts of far-field horizontal movements on the natural features and items of surface infrastructure within the vicinity of the Study Area are not expected to be substantial, except where they occur at large structures which are sensitive to small differential movements.

4.6. Non-conventional ground movements

It is likely non-conventional ground movements will occur within the Study Area, due to near-surface geological conditions, steep topography and valley-related effects, which are discussed in Section 3.4. These non-conventional movements are often accompanied by elevated tilts and curvatures that are likely to exceed the conventional predictions.

Specific predictions of upsidence, closure and compressive strain due to the valley-related effects are provided for the streams in Section 5.3. The impact assessments for the streams are based on both the conventional and valley-related effects. The potential for non-conventional movements associated with steep topography is discussed in the impact assessments for the steep slopes provided in Section 5.7.

In most cases, it is not possible to predict the exact locations or magnitudes of the non-conventional anomalous movements due to near-surface geological conditions. For this reason, the strain predictions provided in this report are based on a statistical analysis of measured strains in the NSW coalfields, including both conventional and non-conventional anomalous strains, as previously discussed in Section 4.3. In addition to this, the impact assessments for the natural features and items of surface infrastructure, which are provided in Chapters 5 and 6, include historical impacts resulting from previous longwall mining which have occurred as the result of both conventional and non-conventional subsidence movements.

The following sections provide the descriptions, predictions and impact assessments for the natural features located within the Study Area. The major natural features located outside the Study Area, which may be subjected to far-field or valley-related movements and may be sensitive to these effects, have also been included as part of this assessment.

5.1. Catchment Areas and Declared Special Areas

There are no drinking water catchment areas or declared special areas within the Study Area.

5.2. Rivers

There are no rivers within the Study Area or within 600 m of the proposed longwalls. The closest river is the Nepean River which is located to the south and to the east of the proposed longwalls. The thalweg (i.e. centreline) of the Nepean River is 2.2 km south of the commencing (i.e. western) end of LW712 and 2.5 km east of the finishing (i.e. eastern) end of LW712 at its closest points to the proposed longwalls.

The predicted subsidence effects for the Nepean River, due to the mining of LW712 to LW716, are less than 5 mm vertical subsidence, less than 5 mm upsidence and less than 5 mm closure. While the river could experience very low levels of vertical subsidence or valley-related effects, it is not predicted to experience measurable tilts, curvatures or strains.

It is unlikely, therefore, that the Nepean River would experience adverse physical impacts due to the mining-induced movements from LW712 to LW716. Gas release zones have been observed along the river during the mining of longwalls in Areas 7 and 9. Reactivation of existing gas release zones or new gas release zones could develop due to the mining of the proposed longwalls.

5.3. Creeks and tributaries

5.3.1. Descriptions of the creeks and tributaries

The named creeks and their tributaries are shown on Drawing No. MSEC1459-08.

The NSW Government's Strategic Review into the Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield (DoP, 2008) recommended that Risk Management Zones (RMZs) be applied to all streams of third order or above in the Strahler stream classification.

The creeks that have third order sections that are located within the Study Area or within 600 m of the proposed longwalls are Navigation Creek, four tributaries to Navigation Creek (i.e. NavC14.5, NavC16, NavC17 and NavC20), Apps Gully and Foot Onslow Creek. There is also a fourth order section of Navigation Creek located within 600 m of the proposed longwalls.

A summary of the third and fourth order sections of creeks that are located within the Study Area based on the 600 m boundary is provided in Table 5.1.

Table 5.1 Creeks of third and fourth order located within the Study Area based on the 600 m boundary

Name	Location	Total length of third or fourth order section above the proposed LW712 to LW716 (km)	Total length of third or fourth order section within the Study Area (km)
Navigation Creek (third and fourth order)	Directly above LW711 to LW716	3.0 (third order) 1.4 (fourth order)	3.0 (third order) 2.1 (fourth order)
Tributaries to Navigation Creek (third order)	NavC14.5	Outside the mining area, 200 m north of LW716	1.3
	NavC16	Directly above LW710B to LW716	3.7
	NavC17	Directly above LW715	0.27
	NavC20	Directly above LW713 and LW714	1.1

Name	Location	Total length of third or fourth order section above the proposed LW712 to LW716 (km)	Total length of third or fourth order section within the Study Area (km)
Apps Gully (third order)	Outside the mining area, 250 m west of LW715	-	0.39
Foot Onslow Creek (third order)	Directly above the existing and approved LW706 to LW710B but outside the proposed longwalls at a minimum distance of 560 m south-east of LW712	-	0.29
Total	-	7.7	12.1

The third order creeks occur as shallow incisions into the surface soils, which have been derived from the Wianamatta Group, with some sandstone outcropping. Pools have naturally developed along the lengths of these creeks within the surface soils and rock platforms. Farm dams have also been established in some locations which are discussed further in Section 6.15.

The upper reaches of Navigation Creek, Apps Gully and their tributaries are first and second order. These streams commence along Razorback Range above the western ends of the proposed longwalls. These sections of stream have more substantial incisions into the surface soils, with exposed sandstone in the bases and rock outcropping in the valley sides.

Photographs of Navigation Creek and its tributaries and Foot Onslow Creek are provided in Fig. 5.1 to Fig. 5.6 (Source: ICHPL). The tributaries are all disturbed to some degree with only limited surface flow as they cross private properties and beneath local roads. The photograph locations are shown on Drawing No. MSEC1459-08.



Fig. 5.1 Upper reaches of Navigation Creek, looking upstream (left-hand side) and looking downstream (right-hand side) at the Cummins Road crossing (Source: ICHPL, October 2024)



Fig. 5.2 Lower reaches of Navigation Creek, looking upstream (left-hand side) and looking downstream (right-hand side) at the Woodbridge Road bridge (Source: ICHPL, October 2024)



Fig. 5.3 Tributary NavC14.5, looking upstream (left-hand side) and looking downstream (right-hand side) from Finns Road crossing near Woodbridge Road (Source: ICHPL, October 2024)



Fig. 5.4 Tributary NavC16, looking upstream (left-hand side) from Carrolls Road near Hawkey Road and looking downstream (right-hand side) from the second Carrolls Road crossing (Source: ICHPL, October 2024)



Fig. 5.5 Tributary NavC20, from Cummins Road crossings: upper reaches looking downstream (left-hand side) and lower reaches looking downstream (right-hand side) (Source: ICHPL, October 2024)



Fig. 5.6 Foot Onslow Creek (Source: ICHPL)

The existing gradients of the first and second order streams along Razorback Range typically vary between 100 mm/m (i.e. 10 % or 1 in 10) and 300 mm/m (i.e. 30 % or 1 in 3). The lower reaches of the streams on the flats away from Razorback Range typically vary from less than 5 mm/m (i.e. 0.5 % or 1 in 200) to 50 mm/m (i.e. 5 % or 1 in 20).

The average existing gradients for the third and fourth order sections of streams within the Study Area (i.e. along the flats away from Razorback Range) are typically between 5 mm/m (i.e. 0.5 % or 1 in 200) and 20 mm/m (i.e. 2 % or 1 in 50).

5.3.2. Predictions for the creeks and tributaries

The predicted profiles of total vertical subsidence, tilt and curvature along Navigation Creek, Tributaries NavC14.5, NavC16, NavC17 and NavC20, Apps Gully and Foot Onslow Creek are provided in Figs. C.03 to C.09, respectively, in Appendix C. The predicted profiles after the completion of the existing and approved longwalls are shown as the cyan lines. The predicted total profiles after the mining of each of the proposed LW712 to LW716 are shown as the blue lines.

Summaries of the maximum predicted values of total vertical subsidence, tilt and curvature for the third order sections of Navigation Creek, Tributaries NavC14.5, NavC16, NavC17 and NavC20, Apps Gully and Foot Onslow Creek are provided in Table 5.2 to Table 5.8, respectively. The values are the maximum predicted subsidence effects for the sections of the creeks within the Study Area due to the mining of the existing, approved and proposed longwalls.

Table 5.2 Maximum predicted total vertical subsidence, tilt and curvature for Navigation Creek

Location	After longwall	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)
Navigation Creek	LW711	925	6.5	0.07	0.13
	LW712	1250	6.0	0.07	0.14
	LW713	1300	6.5	0.07	0.14
	LW714	1350	6.5	0.07	0.14
	LW715	1400	6.0	0.07	0.14
	LW716	1450	5.0	0.07	0.14

Table 5.3 Maximum predicted total vertical subsidence, tilt and curvature for Tributary NavC14.5

Location	After longwall	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)
Tributary NavC14.5	LW711	< 20	< 0.5	< 0.01	< 0.01
	LW712	< 20	< 0.5	< 0.01	< 0.01
	LW713	< 20	< 0.5	< 0.01	< 0.01
	LW714	< 20	< 0.5	< 0.01	< 0.01
	LW715	< 20	< 0.5	< 0.01	< 0.01
	LW716	90	< 0.5	< 0.01	< 0.01

Table 5.4 Maximum predicted total vertical subsidence, tilt and curvature for Tributary NavC16

Location	After longwall	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)
Tributary NavC16	LW711	1300	6.5	0.06	0.12
	LW712	1350	6.5	0.06	0.12
	LW713	1400	6.5	0.06	0.12
	LW714	1400	6.5	0.06	0.12
	LW715	1400	5.5	0.06	0.12
	LW716	1400	5.0	0.06	0.12

Table 5.5 Maximum predicted total vertical subsidence, tilt and curvature for Tributary NavC17

Location	After longwall	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)
Tributary NavC17	LW711	<20	<0.5	<0.01	<0.01
	LW712	<20	<0.5	<0.01	<0.01
	LW713	<20	<0.5	<0.01	<0.01
	LW714	170	0.5	0.02	<0.01
	LW715	975	5.0	0.06	0.10
	LW716	1300	4.0	0.06	0.11

Table 5.6 Maximum predicted total vertical subsidence, tilt and curvature for Tributary NavC20

Location	After longwall	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)
Tributary NavC20	LW711	<20	<0.5	<0.01	<0.01
	LW712	70	<0.5	<0.01	<0.01
	LW713	975	6	0.06	0.11
	LW714	1300	5	0.06	0.12
	LW715	1350	4.5	0.06	0.12
	LW716	1350	4.5	0.06	0.12

Table 5.7 Maximum predicted total vertical subsidence, tilt and curvature for Apps Gully

Location	After longwall	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)
Apps Gully	LW711	< 20	< 0.5	< 0.01	< 0.01
	LW712	< 20	< 0.5	< 0.01	< 0.01
	LW713	60	< 0.5	< 0.01	< 0.01
	LW714	725	4.0	0.04	0.06
	LW715	1050	3.0	0.04	0.07
	LW716	1100	3.0	0.04	0.07

Table 5.8 Maximum predicted total vertical subsidence, tilt and curvature for Foot Onslow Creek

Location	After longwall	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)
Foot Onslow Creek	LW711	100	1.0	< 0.01	< 0.01
	LW712	100	1.0	< 0.01	< 0.01
	LW713	100	1.0	< 0.01	< 0.01
	LW714	100	1.0	< 0.01	< 0.01
	LW715	100	1.0	< 0.01	< 0.01
	LW716	100	1.0	< 0.01	< 0.01

A summary of the maximum predicted subsidence effects for the third order sections of Navigation Creek, Tributaries NavC14.5, NavC16, NavC17 and NavC20, Apps Gully and Foot Onslow Creek is provided in Table 5.9. The values are the maximum predicted subsidence effects for the third order sections of the creeks within the Study Area at any time during or after the mining of the existing, approved and proposed longwalls.

Table 5.9 Maximum predicted total vertical subsidence, tilt and curvature for the third order sections of the creeks within the Study Area

Location	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)
Navigation Creek	1450	6.5	0.07	0.14
Tributary NavC14.5	90	< 0.5	< 0.01	< 0.01
Tributary NavC16	1400	6.5	0.06	0.12
Tributary NavC17	1050	2.5	0.05	0.01
Tributary NavC20	1350	6.0	0.06	0.12
Apps Gully	50	< 0.5	< 0.01	< 0.01
Foot Onslow Creek	100	1.0	< 0.01	< 0.01
Maximum	1450	6.5	0.07	0.14

A summary of the maximum predicted subsidence effects for the fourth order section of Navigation Creek is provided in Table 5.10.

Table 5.10 Maximum predicted total vertical subsidence, tilt and curvature for the fourth order sections of the creeks within the Study Area

Location	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)
Navigation Creek (fourth order)	1250	6.0	0.06	0.11

The other creeks and tributaries are located across the mining area and therefore they will experience the full range of predicted subsidence effects due to the mining of the proposed LW712 to LW716. The maximum predicted vertical subsidence, tilt and curvatures are summarised in Table 4.2.

The maximum predicted total tilt for the third and fourth order sections of the creeks within the Study Area is 6.5 mm/m (i.e. 0.65 % or 1 in 154). The maximum predicted total conventional curvatures are 0.07 km⁻¹ hogging and 0.14 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 7 km, respectively.

The maximum predicted conventional strains for the third and fourth order sections of the creeks within the Study Area, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1 mm/m tensile and 2 mm/m compressive. The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The maximum predicted strains directly above the mining area are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

Non-conventional movements can also occur and have occurred in the NSW coalfields as a result of, amongst other things, anomalous movements. The analysis of strains provided in Chapter 4 includes those resulting from both conventional and non-conventional anomalous movements.

The creeks will also experience valley-related effects. The range of predicted closure movements for the streams within the Study Area has been determined from a statistical analysis of streams previously mined beneath at Appin and other nearby mines. There is a total of 121 monitoring lines that have been used to measure closure due to mining in the Bulli Seam. The effective valley heights for these streams range between 5 m and 80 m.

The survey database has been analysed to extract the maximum measured closure for each monitoring line located directly above longwalls mined in the Bulli Seam. The mean measured closure is 100 mm and the maximum measured closure is 640 mm.

A summary of the maximum predicted closure for the streams located above the mining area is provided in Table 5.11. The values have been provided for the mean and 95 % confidence level for a range of effective valley heights.

Table 5.11 Maximum predicted closure for the streams above the mining area

Effective valley height (m)	Maximum predicted total closure (mm)	
	Mean	95 % confidence level
10	30	125
20	40	200
40	60	350
60	80	500
80	100	650

The effective valley-height for the upper reaches (i.e. first and second order) section of Navigation Creek is up to 100 m. The closure for these sections of stream could be greater than that previously measured due to mining in the Bulli Seam, of 640 mm. However, the closure is expected to be less than the maximum measured value due to mining in the shallower and thicker Wongawilli Seam, of 880 mm.

Elsewhere, the effective valley heights for the lower reaches of Navigation Creek and the other streams within the Study Area typically vary between 10 m and 60 m. The predicted closures for these streams range between 125 mm and 500 mm based on the 95 % confidence level.

The compressive strains due to the valley-related effects are expected to be similar to those measured for streams previously mined beneath at Appin and other nearby mines. The maximum measured compressive strain due to closure for streams located above previous mining in the Bulli Seam is 7 mm/m based on the 95 % confidence level.

5.3.3. Impact assessments for the creeks and tributaries

The impact assessments for the creeks are provided in the following sections. The assessments provided in this report should be read in conjunction with the assessments provided in the reports by the other specialist consultants on the project.

Potential for increased levels of ponding, flooding and scouring due to the mining-induced tilts

Mining can result in increased levels of ponding in locations where the mining-induced tilts oppose and are greater than the gradients of the drainage lines that exist before mining. Mining can also potentially result in an increased likelihood of scouring of the banks in the locations where the mining-induced tilts considerably increase the natural drainage line gradients that exist before mining.

The maximum predicted tilt for the creeks and tributaries within the Study Area is 6.5 mm/m (i.e. 0.65 % or 1 in 154). The predicted mining-induced tilts are generally less than the average existing gradients of the creeks which vary between 5 mm/m (i.e. 0.5 % or 1 in 200) and 20 mm/m (i.e. 2 % or 1 in 50) for the third and fourth order sections, between 5 mm/m (i.e. 0.5 % or 1 in 200) to 50 mm/m (i.e. 5 % or 1 in 20) for the first and second order sections away from Razorback Range, and between 100 mm/m (i.e. 10 % or 1 in 10) and 300 mm/m (i.e. 30 % or 1 in 3) for the steeper first and second order sections of the streams along Razorback Range.

The existing grades and the predicted post-mining grades along Navigation Creek, Tributaries NavC14.5, NavC16, NavC17 and NavC20, Apps Gully and Foot Onslow Creek are illustrated in Fig. 5.7 to Fig. 5.13, respectively.

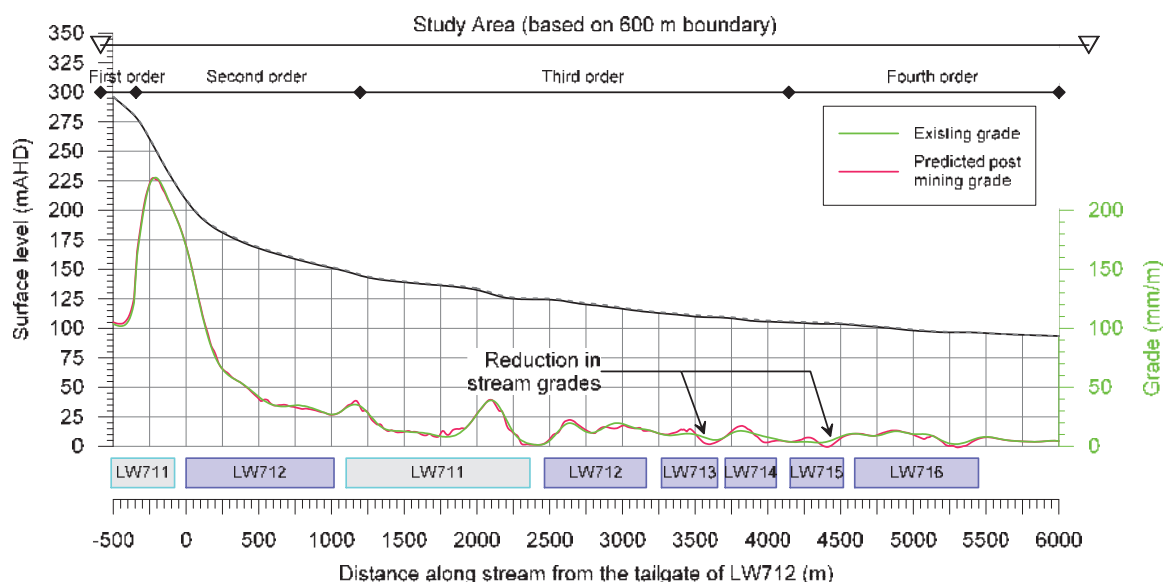


Fig. 5.7 Existing and predicted post-mining surface levels along Navigation Creek

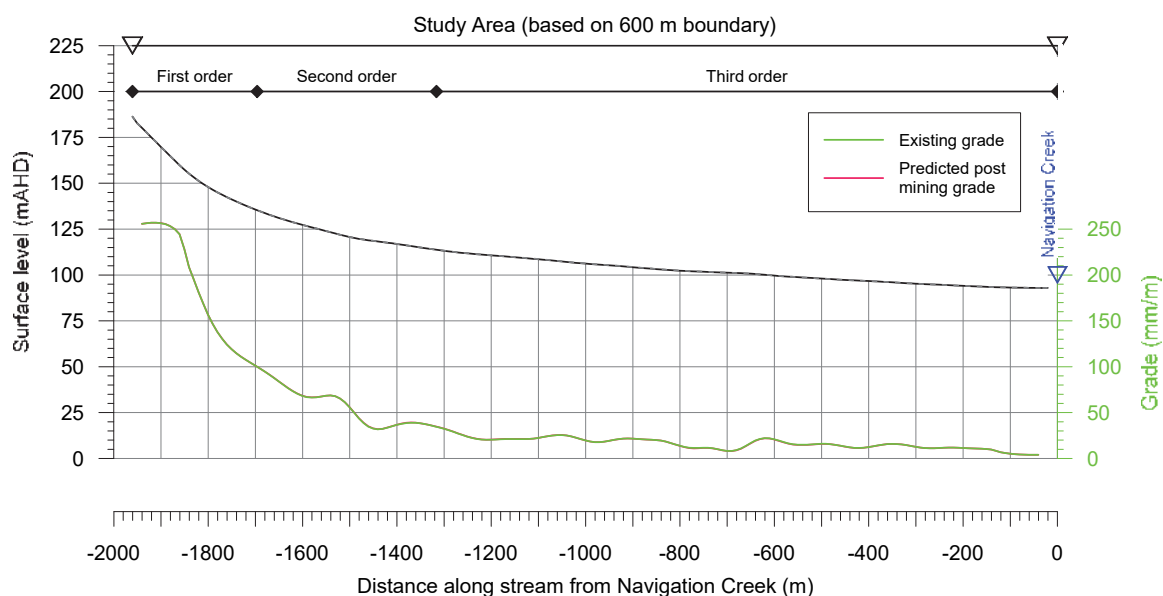


Fig. 5.8 Existing and predicted post-mining surface levels along Tributary NavC14.5

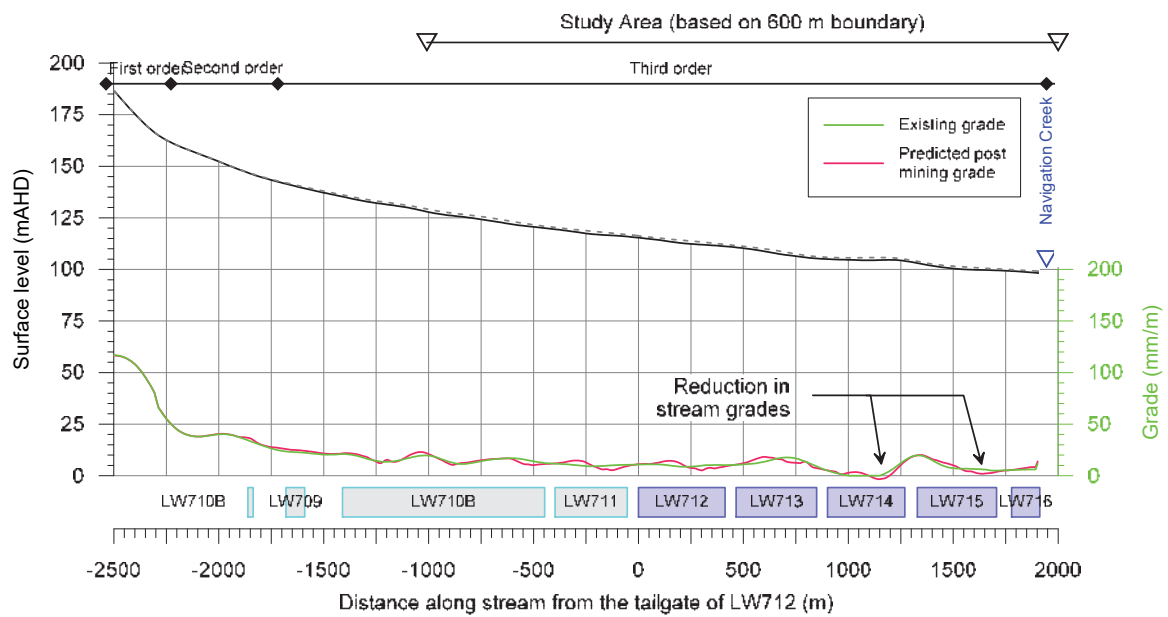


Fig. 5.9 Existing and predicted post-mining surface levels along Tributary NavC16

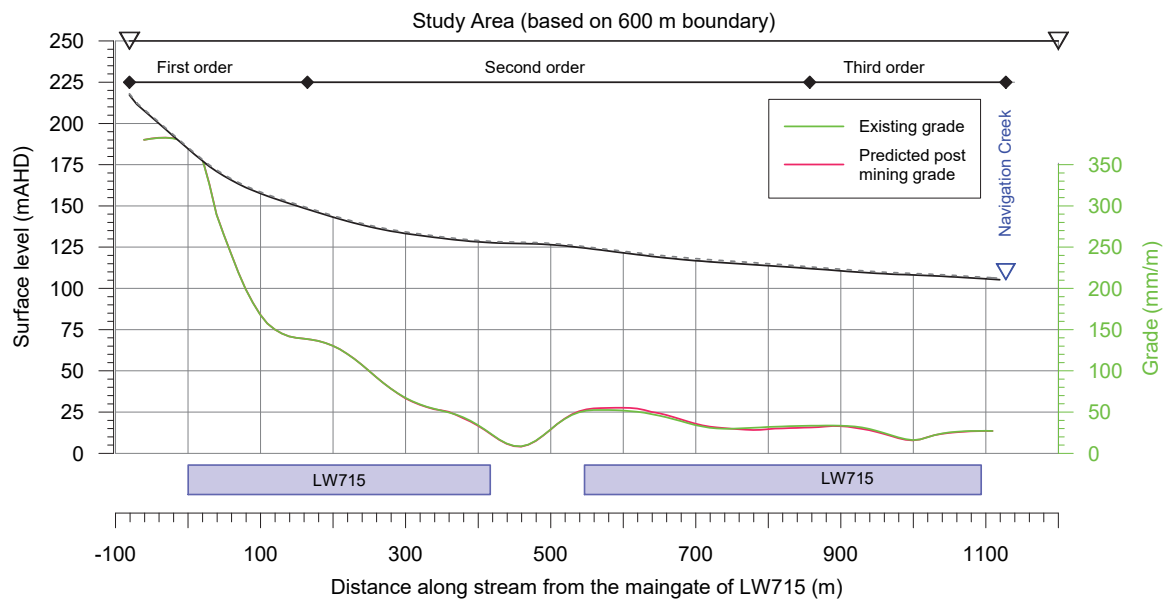


Fig. 5.10 Existing and predicted post-mining surface levels along Tributary NavC17

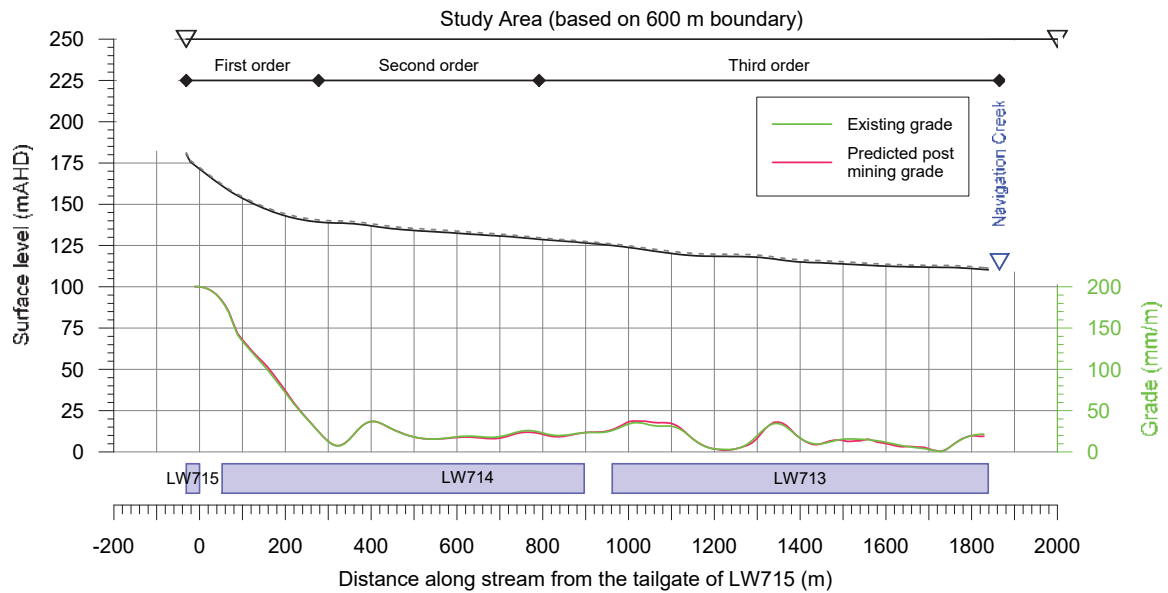


Fig. 5.11 Existing and predicted post-mining surface levels along Tributary NavC20

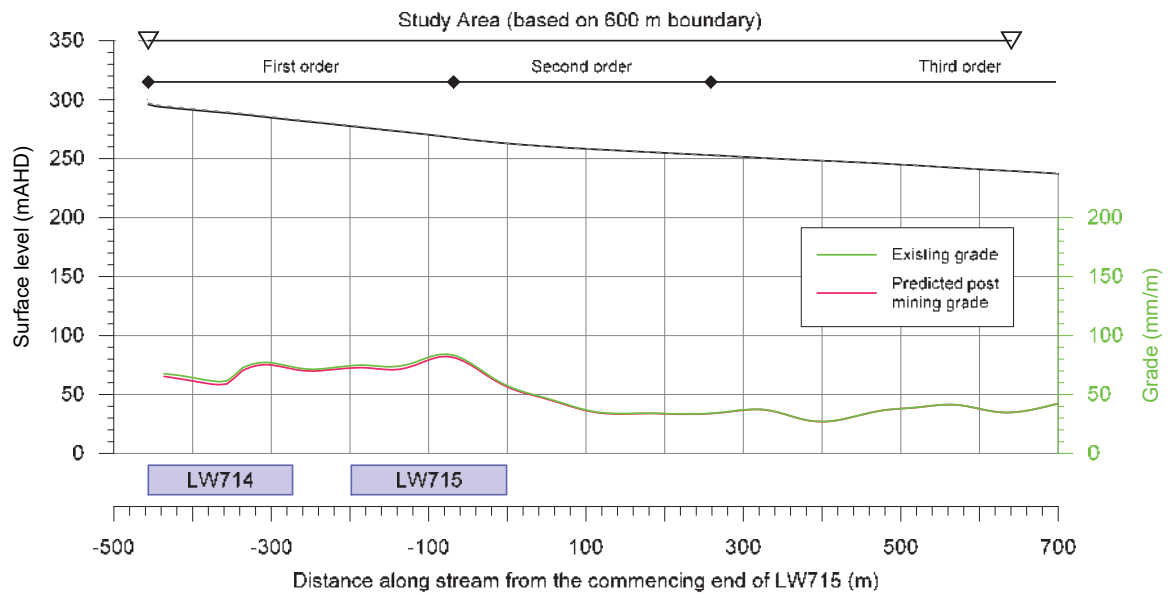


Fig. 5.12 Natural and predicted post-mining surface levels along Apps Gully

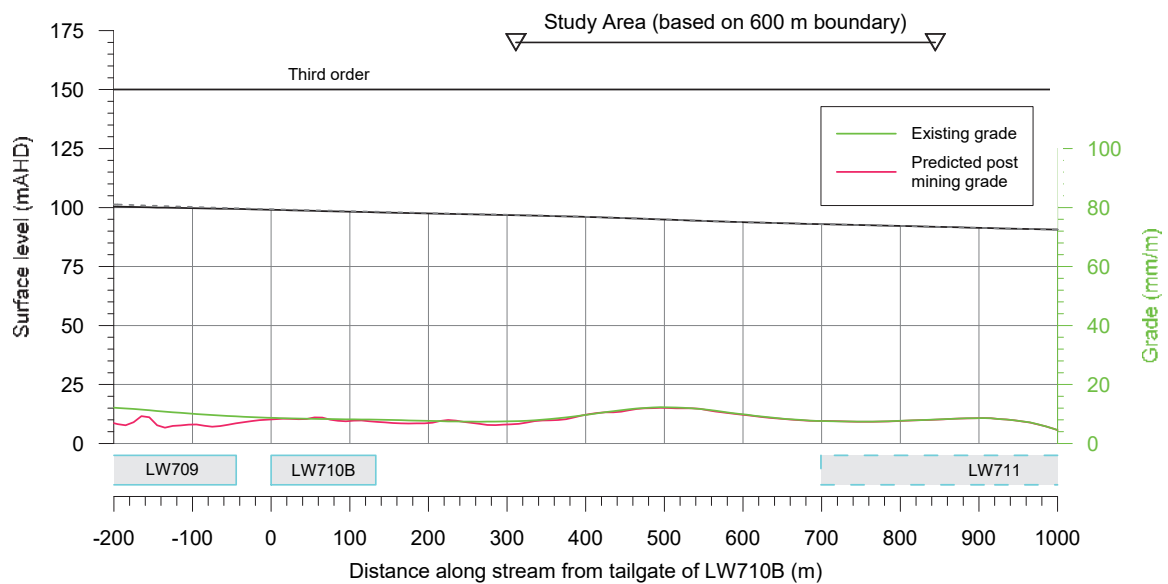


Fig. 5.13 Existing and predicted post-mining surface levels along Foot Onslow Creek

There are small reductions in the existing stream grades along Navigation Creek and some of its tributaries upstream of the maingates of the proposed longwalls. There are possible small reversals in stream grade along the flatter sections of the streams or in the locations of the existing farm dams.

It is unlikely, therefore, that there would be large-scale adverse changes in the levels of ponding or scouring of the banks along the creeks and tributaries within the Study Area due to the mining-induced tilt. It is possible that localised increased ponding could develop in some isolated locations, where the existing grades are small, and upstream of the chain pillars and the edges of the mining area.

The potential impacts of increased ponding and scouring of the drainage lines, therefore, are expected to be minor and localised. Impacts resulting from changes in surface water flows due to mining-induced tilt are expected to be small in comparison with those which occur during natural flooding conditions.

Potential for cracking in the creek bed and fracturing of bedrock

The third and fourth order sections of the creeks and tributaries within the Study Area are predicted to experience a maximum conventional tensile strain of 1.0 mm/m based on the 95 % confidence level. The maximum predicted compressive strain due to the valley-related effects is 7 mm/m based on the 95 % confidence level. The first and second order sections of the creeks and tributaries could experience similar levels of strains.

Fracturing in bedrock has been observed due to previous longwall mining in the Southern Coalfield where the tensile strains have been greater than 0.5 mm/m or where the compressive strains have been greater than 2 mm/m. Fracturing could therefore develop along the creeks and tributaries due to the mining of the proposed LW712 to LW716. Fracturing will predominately occur where the creeks and tributaries are located directly above the mining area. Impacts can also occur outside the mining area, with minor and isolated fracturing occurring at distances up to approximately 400 m outside the longwalls, as previously observed at Appin Mine and elsewhere in the Southern Coalfield.

The mining-induced compression due to valley-related effects can also result in dilation and the development of bed separation in the topmost bedrock, as it is less confined. This additional dilation due to valley closure is expected to develop predominately within the top 10 m to 20 m of the bedrock. Compression can also result in buckling of the topmost bedrock resulting in heaving in the overlying surface soils.

Surface water flow diversions could occur along the creeks and tributaries that are located directly above the mining area. In times of heavy rainfall, the majority of the runoff would flow over the fractured bedrock and soil beds and would not be diverted into the dilated strata below. In times of low flow, however, surface water flows can be diverted into the dilated strata below the beds. Most sections of the creeks and tributaries within the Study Area are ephemeral and, therefore, surface water flows only occur during and for short periods after rain events.

Creeks and tributaries have been directly mined beneath by the completed longwalls in Appin Areas 7 and 9 and at other nearby collieries. A summary of the experience of mining beneath ephemeral creeks and tributaries in the Southern Coalfield is provided in Table 5.12.

Table 5.12 Experience of mining beneath creeks and tributaries in the Southern Coalfield

Longwalls	Streams	Measured movements	Observed impacts
Appin Area 3 (LW301 and LW302)	2.7 km of streams directly mined beneath	650 mm subsidence 4.5 mm/m tilt 1.0 mm/m tensile strain 3.0 mm/m comp. strain (Measured M and N-Lines)	No reported fracturing which resulted in surface water flow diversions
Appin Area 4 (LW401 to LW409)	3.8 km of streams directly mined beneath, including Creek 2A, Rocky Ponds Creek and Simpsons Creek	1200 mm subsidence 6.0 mm/m tilt 3.0 mm/m tensile strain 6.5 mm/m comp. strain (Measured A6000-Line)	No reported fracturing which resulted in surface water flow diversions
Appin Area 7 (LW701 to LW710A)	19.4 km of streams directly mined beneath, including upper reaches of Harris Creek and Foot Onslow Creek	1450 mm subsidence 9.0 mm/m tilt 3.0 mm/m tensile strain 6.0 mm/m comp. strain (Measured ARTC-Line, M31-Lines and Menangle Road)	No reported fracturing which resulted in surface water flow diversions

Longwalls	Streams	Measured movements	Observed impacts
Appin Area 9 (LW901 to LW905)	10.5 km of streams directly mined beneath including tributaries to the Nepean River	650 mm subsidence 4.5 mm/m tilt 1.5 mm/m tensile strain 5.5 mm/m comp. strain (Measured ARTC-Line and Menangle Road)	No reported fracturing which resulted in surface water flow diversions
West Cliff Area 5 (LW29 to LW37)	5.6 km of streams directly mined beneath, including Unnamed Creek, Ousedale Creek, Mallaty Creek and Leafs Gully	1350 mm subsidence 11 mm/m tilt 1.5 mm/m tensile strain 5.5 mm/m comp. strain (Measured B-Line)	Fracturing observed in the bed of Mallaty Creek, loss of water holding capacity in one pool (Ref. MC109).

Based on the experience of mining beneath ephemeral creeks and tributaries in the Southern Coalfield, it is likely that some fracturing will occur along the streams within the Study Area, particularly those located directly above or adjacent to the mining area. There are a limited number of standing pools within the Study Area but some of these pools could experience a reduction or loss of water holding capacity.

Further assessments of the potential impacts on surface water are provided in the reports by the specialist surface water and groundwater consultants on the project (HGEO, 2025a and 2025b).

5.3.4. Recommendations for the creeks and tributaries

ICHPL has developed management strategies for creeks and tributaries that have been directly mined beneath by longwalls in Appin Areas 7 and 9. It is recommended that these management strategies are reviewed and updated to incorporate the proposed LW712 to LW716. It is also recommended that periodic inspections are carried out along the streams during active subsidence.

5.4. Aquifers and known groundwater resources

Shallow groundwater aquifers have been identified within the Study Area. The descriptions and assessment of potential impacts on the groundwater resources are provided in the report by the specialist groundwater consultant on the project.

5.5. Cliffs and minor Cliffs

5.5.1. Descriptions of the cliffs and minor cliffs

The cliffs and minor cliffs are shown in Drawing No. MSEC1459-09.

The definition of a *cliff* provided in the project approval (BSO, 2011) is:

“Cliff Continuous rock face, including overhangs, having a minimum height of 10 metres and a minimum slope of 2 to 1, ie having a minimum angle to the horizontal of 63°”

The definition of a *cliff* adopted in this report is a continuous rock face with a minimum slope of 2 in 1 (V : H, i.e. 63.4°), minimum height of 10 m and minimum continuous length of 20 m. There are two cliffs (Refs. RR-CL5 and RR-CL8) located within the Study Area that satisfy this definition for both minimum height and minimum continuous length.

The definition of a *minor cliff* adopted in this report is a continuous rock face with a minimum slope of 2 in 1 (V : H, i.e. 63.4°), a height between 5 m and 10 m and minimum continuous length of 20 m. There are nine minor cliffs (Refs. MC01 to MC09) located within the Study Area that satisfy this definition for both height and continuous length.

The cliffs and minor cliffs within the Study Area have been identified from the LiDAR surface level contours and from site investigations. These rockface features have been identified in the western part of the Study Area along Razorback Range and these have formed in the sandstone members (Rwb and Rwbh) of the Wianamatta Group.

Summaries of the cliffs and minor cliffs within the Study Area are provided in Table 5.13 and Table 5.14, respectively.

Table 5.13 Details of the cliffs located within the Study Area

Cliff Ref.	Overall length (m)	Maximum height (m)	Location
RR-CL5	100	20	Directly above existing LW710A
RR-CL8	40	10	Directly above LW714

Table 5.14 Details of the minor cliffs located within the Study Area

Minor Cliff Ref.	Overall length (m)	Maximum height (m)	Location
MCL01	43	7	Directly above LW715
MCL02	35	8	Directly above LW715
MCL03	50	8	Directly above LW715
MCL04	26	7	Directly above LW715
MCL05	46	9	Directly above LW716
MCL06	23	7	Directly above LW716
MCL07	41	5	Directly above LW716
MCL08	25	6	275 m north of LW716
MCL09	35	6	Directly above LW716

A photograph of cliff RR-CL5 located above the existing LW710A viewed from Menangle Road is provided in Fig. 5.14. Cliff RR-CL8 is not visible from Carrolls Road due to heavy vegetation, as shown in the photograph in Fig. 5.15.

**Fig. 5.14 Cliff RR-CL5 located above LW710B viewed from Menangle Road (Source: ICHPL)**



Fig. 5.15 Cliff RR-CL8 above LW714 hidden behind vegetation viewed from Carrolls Road
(Source: ICHPL)

A photograph of minor cliff MCL07 located adjacent to Remembrance Drive and above LW716 is provide in Fig. 5.16.



Fig. 5.16 Minor cliff MCL07 adjacent to Remembrance Drive and above LW716 (Source: ICHPL)

5.5.2. Predictions for the cliffs and minor cliffs

Cliff RR-CL5 is located directly above the existing LW710A. The predicted subsidence effects for this cliff, therefore, are predominately due to this existing longwall rather than the proposed longwalls. Cliff RR-CL8 is located above LW714 and, therefore, the predicted subsidence effects are due to the proposed longwalls.

Summaries of the maximum predicted values of additional and total vertical subsidence, tilt and curvature for the cliffs within the Study Area are provided in Table 5.15 and Table 5.15, respectively. The additional values are the maximum predicted subsidence effects within 20 m of the cliffs due to the mining of the proposed LW712 to LW716 only. The total values are the maximum predicted subsidence effects within 20 m of the cliffs due to the mining of the existing, approved and proposed longwalls.

Table 5.15 Maximum predicted additional vertical subsidence, tilt and curvatures for the cliffs within the Study Area

Feature	Reference	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)
Cliffs	RR-CL5	50	0.5	0.01	< 0.01
	RR-CL8	900	1.5	0.04	0.01

Table 5.16 Maximum predicted total vertical subsidence, tilt and curvatures for the cliff within the Study Area

Feature	Reference	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)
Cliffs	RR-CL5	275	3.0	0.03	< 0.01
	RR-CL8	900	1.5	0.04	0.01

A summary of the maximum predicted values of total vertical subsidence, tilt and curvature for the minor cliffs within the Study Area are provided in Table 5.17. The values are the maximum predicted subsidence effects within 20 m of the mapped extents of each of the minor cliffs due to the mining of the existing, approved and proposed longwalls.

Table 5.17 Maximum predicted total vertical subsidence, tilt and curvatures for the minor cliffs within the Study Area

Feature	Reference	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)
Minor cliffs	MCL01	1100	3.0	0.04	0.06
	MCL02	1150	3.0	0.02	0.08
	MCL03	1150	3.0	0.02	0.07
	MCL04	1150	3.0	0.02	0.08
	MCL05	650	5.5	0.05	0.02
	MCL06	350	3.5	0.06	< 0.01
	MCL07	800	6.0	0.05	0.06
	MCL08	70	0.5	< 0.01	< 0.01
	MCL09	950	5.0	0.02	0.09

The maximum predicted total tilt for the cliffs and minor cliffs within the Study Area is 6.0 mm/m (i.e. 0.6 % or 1 in 167). The maximum predicted total conventional curvatures are 0.06 km⁻¹ hogging and 0.09 km⁻¹ sagging and they represent minimum radii of curvature of 17 km and 11 km, respectively.

The maximum predicted conventional strains for the cliffs and minor cliffs, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1 mm/m tensile and 1.5 mm/m compressive. The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The maximum predicted strains directly above the mining area are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels. The maximum predicted strains outside the mining area are 0.6 mm/m tensile and 0.5 mm/m compressive based on the 95 % confidence levels.

Non-conventional movements can also occur and have occurred in the NSW coalfields as a result of, amongst other things, anomalous movements. The analysis of strains provided in Chapter 4 includes those resulting from both conventional and non-conventional anomalous movements.

The rock outcrops are located across the north-western part of the mining area and, therefore, they are expected to experience the full range of predicted subsidence effects. A summary of the maximum predicted conventional subsidence movements within the Study Area is provided in Chapter 4.

5.5.3. Impact assessments for the cliffs and minor cliffs

It is difficult to assess the likelihood of instabilities of the cliffs and minor cliffs based upon predicted ground movements. The likelihood of a cliff or minor cliff becoming unstable is dependent on many factors that are difficult to quantify. Some of these factors include jointing, inclusions, weathering within the rockmass, groundwater pressure and seepage flow behind the rockface. Even if these factors could be determined, it would still be difficult to quantify the extent to which these factors may influence the stability of a cliff or minor cliff naturally or when it is exposed to mine subsidence movements. It is therefore possible that instabilities may occur in a minor cliff during mining that may be attributable to either natural causes, mine subsidence, or both.

The likelihood of instabilities of the cliffs and minor cliffs within the Study Area has been assessed based on case studies where longwall mining has previously occurred directly beneath cliffs and minor cliffs in the Southern Coalfield. It is then noted that these case studies include cliffs with higher and longer rockfaces than the minor cliffs identified in the Study Area.

- *Appin LW905 and LW710A*

Appin LW905 and LW710A mined beneath four cliffs (Refs. RR-CL3 and RR-CL5 to RR-CL7) located along the side of Razorback Range. There were also three additional cliffs (Refs. RR-CL1, RR-CL2 and RR-CL4) along the side of Razorback Range located outside but within 35° angle of draw line from these longwalls.

The total length of cliffs located above and within the 35° angle of draw line for LW905 and LW710A was 300 m. The overall heights of the cliffs varied between 12 m and 20 m and they had formed within the Hawkesbury Sandstone Sedimentary Group.

There was one minor rockfall reported along Cliff RR-CL5 during the mining of LW905 and LW710A. The total length of impact due to the mining of these longwalls was therefore approximately 1 % of the total length of the cliffs.

- *Tower Longwalls 1 to 17 beneath the Cataract and Nepean Rivers*

Tower Longwalls 1 to 17 mined directly beneath the valleys of the Cataract and Nepean Rivers. The total length of cliffs that were directly mined beneath or located within the 35° angle of draw line from these longwalls was greater than 5 km. The overall heights of the cliffs varied between 10 m and 60 m and they had formed within the Hawkesbury Sandstone Sedimentary Group.

Tower Longwalls 1 and 17 had void widths varying between 110 m and 210 m and solid chain pillar widths varying between 35 m and 50 m. The longwalls were extracted from the Bulli Seam at depths of cover varying between 400 m and 540 m. The width-to-depth ratios of these longwalls therefore typically ranged between 0.4 and 0.5.

There were a total of 10 cliff instabilities recorded along the Cataract and Nepean Rivers, due to the mining of Tower Longwalls 1 to 17, all of which occurred where the longwalls mined directly beneath the cliffs. The details of the cliff instabilities are provided in Table 5.18.

Table 5.18 Recorded cliff instabilities along the Cataract and Nepean River Valleys due to the mining of Tower Longwalls 1 to 17

Colliery	River valley	Longwalls	Number of recorded cliff instabilities due to mining	Total length of recorded cliff instabilities due to mining	Total length of cliff within 0.7 times depth of cover from the longwalls	Observed rate of cliff instabilities due to mining (%)
Tower	Cataract	LW16 & LW17	8	160	3700	4.3
	Nepean	LW1 to LW17	2	40	1875	2.1
	Total		10	200	5575	3.5

The total length of cliff instabilities due to the mining of Tower Longwalls 1 to 17 was approximately 4 % of the total length of the cliffs. All the recorded cliff instabilities occurred where the cliffs were directly mined beneath.

- *Tahmoor Longwalls 14 to 19 beneath the Bargo River*

Tahmoor Longwalls 14 to 19 mined directly beneath the Bargo River. The total length of cliffs that were directly mined beneath or located within the 35° angle of draw line from these longwalls was approximately 2.5 km. The overall heights of the cliffs varied between 10 m and 25 m and they had formed within the Hawkesbury Sandstone Sedimentary Group.

Tahmoor Longwalls 14 to 19 had void widths of 240 m and solid chain pillar widths of 37 m. The longwalls were extracted from the Bulli Seam at depths of cover varying between 380 m and 390 m. The width-to-depth ratios of these longwalls therefore typically ranged between 0.6 and 0.65.

No cliff instabilities were observed during the mining period.

The experience from Appin, Tower and Tahmoor Collieries indicates that the cliff instabilities were less than 5 % of the total length and less than 3 % of the total face area of cliffs located directly above the mining area. It is anticipated that a similar rate of impact would occur for the cliffs and minor cliffs located above the proposed longwalls.

The two cliffs (Refs. RR-CL5 and RR-CL8) and eight of the minor cliffs (Refs. MCL01 to MCL07 and MCL09) are located above the mining area. The total length of these cliffs and minor cliffs is approximately 440 m and the total face area is approximately 4550 m².

It is assessed that the impacts on the cliffs and minor cliffs located directly above the mining area (Refs. RR-CL5, RR-CL8, MCL01 to MCL07 and MCL09) would represent a total length of less than approximately 22 m and a total face area of less than approximately 137 m².

Minor cliff MCL08 is located 275 m north of the proposed LW716. At this distance, adverse impacts are not anticipated at this minor cliff due to the proposed mining.

Minor cliff MCL07 is located adjacent to the eastern side of Remembrance Drive along the Razorback Range and is directly above the proposed LW716. While the potential for impacts on this minor cliff is considered low, it is recommended that ICHPL carry out periodic inspections of the minor cliffs along Remembrance Drive during active subsidence, to identify any fracturing, unstable rocks and rockfalls.

There are no building structures or other built features located directly beneath the cliffs or minor cliffs within the Study Area. The risk to public safety, therefore, is considered to be low. However, it is recommended that, subject to landholder access, ICHPL carry out periodic inspections of the minor cliffs at a safe distance during active subsidence, to identify any fracturing, unstable rocks and rockfalls.

5.5.4. Recommendations for the cliffs and minor cliffs

It is recommended that a Land Management Plan be developed and include the minor cliffs within the Study Area to monitor and manage any impacts that result from instabilities of minor cliff. It is also recommended that Wollondilly Shire Council be consulted regarding the minor cliffs located adjacent to Remembrance Drive, and in the development of management plans to monitor and manage impacts that result from instabilities of these minor cliffs on the safety or serviceability of the road.

5.6. Rock outcrops

The definition of a rock outcrop adopted in this report is an exposed rockface with a height of less than 5 m or a slope of less than 2 in 1 (V : H, i.e. 63.4°). There are rock outcrops located across the Study Area, primarily along the Razorback Range and the incised creeks and tributaries.

The rock outcrops are located across the Study Area and, therefore, they are expected to experience the full range of predicted subsidence effects. A summary of the maximum predicted conventional subsidence movements within the Study Area is provided in Chapter 4.

The mining of the proposed longwalls is likely to result in fracturing of the rock outcrops and, where the rock is marginally stable, this could then result in instabilities. Previous experience in the Southern Coalfield indicates that the percentage of rock outcrops that are likely to be impacted by mining is very small, representing on average less than 3 % of the total surface area.

The potential for isolated rockfalls, however, could result in a public safety risk where houses or infrastructure are located beneath large rock outcrops.

ICHPL has developed a *Cliff and Steep Slope Management Plan* for LW701 to LW711. The Management Plan addresses monitoring, response action, reporting and public safety. It is recommended that the management plan be reviewed and, where required, revised to include the proposed LW712 to LW716.

5.7. Steep slopes

5.7.1. Descriptions of the steep slopes

The steep slopes are shown in Drawing No. MSEC1459-09.

The definition of a steep slope provided in the project approval (BSO, 2011) is: “*an area of land having a gradient between 1 in 3 (33% or 18.3°) and 2 in 1 (200% or 63.4°)*”. This is consistent with the definition provided by the Australian Geomechanics Society (AGS, 2007).

The steep slopes within the Study Area have been identified along Razorback Range above the western ends of the proposed longwalls. A photograph of Razorback Range is provided in Fig. 5.17.



Fig. 5.17 Razorback Range

A section showing the surface topography and the natural grades through Razorback Range is illustrated in Fig. 5.18. The section has been taken in an approximately north-south orientation transverse to the proposed longwalls.

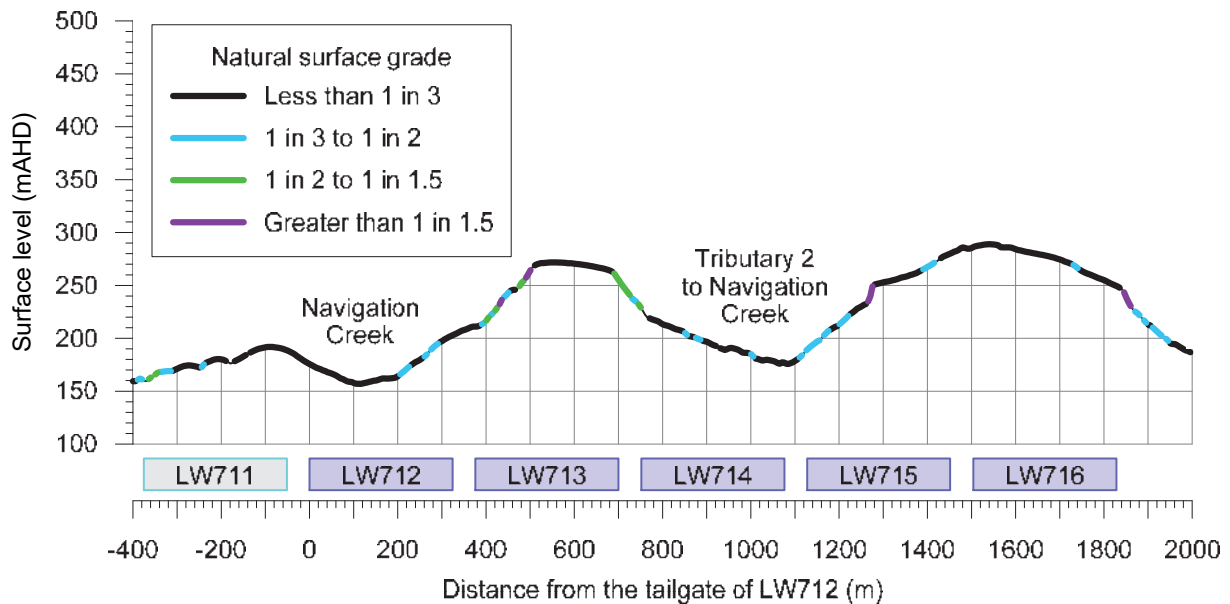


Fig. 5.18 Section through Razorback Range transverse to the longwalls

The distribution of the natural grades of the steep slopes along Razorback Range above the western ends of the proposed longwalls is illustrated in Fig. 5.19. The steep slopes have natural grades typically ranging between 1 in 3 and 1 in 2 (91 % of the surface area), but there are locations with natural grades ranging between 1 in 2 and 1 in 1.5 (6 % of the surface area), between 1 in 1.5 and 1 in 1 (2 % of the surface area) and greater than 1 in 1 (less than 1 % of the surface area).

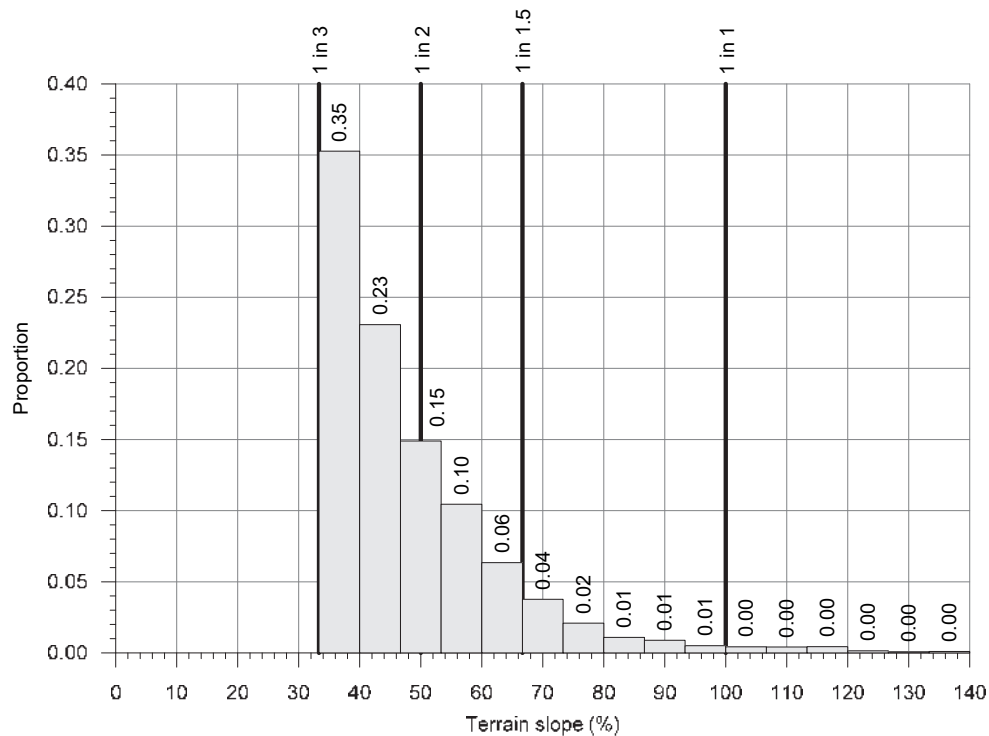


Fig. 5.19 Distribution of the natural grades for the steep slopes along Razorback Range above the western end of the proposed longwalls

There are also more isolated steep slopes above the eastern ends of the proposed longwalls associated with small ridgelines and the banks of the streams. The natural grades of these steep slopes typically vary up to approximately 1 in 2 (i.e. 27° or 50 %), with isolated areas with natural grades up to 1 in 1.5 (i.e. 34° or 67 %).

The surface soils for the steep slopes along Razorback Range have formed from the Wianamatta Group. The extent of the Wianamatta Shale within the Study Area has been mapped and further discussions are provided in the report by SLR (2025).

5.7.2. Predictions for the steep slopes

A summary of the maximum predicted values of total vertical subsidence, tilt and curvatures for the steep slopes along Razorback Range above the western ends of the proposed longwalls is provided in Table 5.19. The values in this table are the maximum predicted subsidence effects within the Study Area due to the mining of the existing, approved and proposed longwalls.

Table 5.19 Maximum predicted total vertical subsidence, tilt and curvatures for the steep slopes along Razorback Range

Location	After longwall	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)
Steep slopes along Razorback Range	LW712	900	6.0	0.07	0.12
	LW713	1200	6.0	0.07	0.13
	LW714	1300	6.0	0.07	0.13
	LW715	1300	5.5	0.07	0.13
	LW716	1300	6.0	0.07	0.13

The maximum predicted total tilt for the steep slopes along Razorback Range is 6 mm/m (i.e. 0.6 % or 1 in 167). The maximum predicted total conventional curvatures are 0.07 km⁻¹ hogging and 0.13 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 8 km, respectively.

The maximum predicted conventional strains for the steep slopes along Razorback Range, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1 mm/m tensile and 2 mm/m compressive. The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The maximum predicted strains directly above the mining area are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

Non-conventional movements can also occur and have occurred in the NSW coalfields as a result of, amongst other things, anomalous movements. The analysis of strains provided in Chapter 4 includes those resulting from both conventional and non-conventional anomalous movements.

The steep slopes located elsewhere with the Study Area could experience the full range of predicted subsidence effects. A summary of the maximum predicted conventional subsidence effects within the Study Area is provided in Chapter 4.

5.7.3. Impact assessments for the steep slopes

The maximum predicted tilts for the steep slopes are 6.0 mm/m (i.e. 0.6 % or 1 in 167) for Razorback Range above the western ends of the proposed longwalls and 6.5 mm/m (i.e. 0.65 % or 1 in 154) elsewhere above the eastern ends of the proposed longwalls. The predicted changes in grade are small when compared to the natural grades of the steep slopes, which are greater than 1 in 3 and, therefore, the mining-induced tilts themselves are unlikely to result in adverse impacts on the stability of the steep slopes.

The steep slopes are more likely to be impacted by the mining-induced curvatures and strains. The potential impacts would generally result from the increased horizontal movements in the downslope direction, causing tension cracks to appear at the tops and along the sides of the slopes and compression ridges to form at the bottoms of the slopes.

The maximum predicted curvatures for the steep slopes are 0.07 km⁻¹ hogging and 0.13 km⁻¹ sagging for the Razorback Range above the western ends of the proposed longwalls and 0.07 km⁻¹ hogging and 0.14 km⁻¹ sagging elsewhere above the eastern ends of the proposed longwalls. The maximum predicted strains are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

The maximum predicted curvatures and strains for the steep slopes within the Study Area are similar to those predicted for previous longwall mining beneath steep slopes elsewhere in the Southern Coalfield.

There is extensive experience of mining beneath steep slopes in the Southern Coalfield. This experience also includes the mining of LW709 and LW710B beneath Razorback Range, and the mining of longwalls at Appin and West Cliff Mines beneath the valleys of the Cataract, Nepean, Bargo and Georges Rivers.

No large-scale slope failures have been observed along these slopes in the Southern Coalfield where longwalls have been mined directly beneath them. Although no large-scale slope failures have been observed in the Southern Coalfield, tension cracking has been observed at the tops and along the sides of steep slopes due to the increased horizontal movements in the downslope direction.

Surface cracking due to mining beneath steep slopes in the Southern Coalfield have been observed with typical widths in the order of 25 mm to 50 mm. Larger cracks have also been observed at the tops of very steep slopes and adjacent to large rock formations having typical widths in the order of 100 mm to 150 mm or greater. A photograph of a tension crack near the top of a steep slope in the Southern Coalfield is provided in Fig. 5.20.



Fig. 5.20 Example of surface tension cracking along the top of a steep slope

The soils within the Study Area are generally derived from the Wianamatta Shale Group and there is extensive natural erosion in some locations. A photograph of natural erosion within the Study Area is provided in Fig. 5.21.



Fig. 5.21 Photograph of natural soil erosion within the Study Area

As the slopes along the Razorback range are steep, exhibit natural soil erosion and are predicted to experience the full range of predicted subsidence effects, it is likely that the mining of the proposed longwalls would result in large surface cracks near the tops and along the sides of these slopes. Detailed site investigations and studies of the potential impacts on the steep slopes along the Razorback Range have been undertaken and are described in the report by SLR (2025).

If tension cracks were to develop along the steep slopes, due to the mining of the proposed longwalls, it is possible that soil erosion could occur if these cracks were left untreated. It is possible, therefore, that some remediation would be required, including infilling of surface cracks with soil or other suitable materials, or by locally regrading and recompact the surface. In some cases, erosion protection measures may be needed, such as the planting of additional vegetation in order to stabilise the slopes in the longer term.

While in most cases, impacts on steep slopes are likely to consist of surface cracks, there remains a low probability of landslips, similar to those that naturally develop along the steep slopes in the region. Experience indicates that the probability of mining induced large-scale slippages is extremely low due to the substantial depth of cover within the Study Area.

While the risk is extremely low, some risk remains and it is recommended that attention is paid to any features or items of infrastructure located in the vicinity of steep slopes directly above the proposed longwalls, which include the:

- local roads;
- powerlines and copper telecommunications cables;
- houses;
- rural and other structures;
- survey control marks.

The built features and surface infrastructure are shown in Drawing Nos. MSEC1459-10 to MSEC1459-15.

The houses located on or near steep slopes are discussed in Section 6.22.5. The risks associated with the proximity of the steep slopes are discussed in the impact assessments for each item of infrastructure.

A Landslide Risk Assessment (LRA) for the proposed LW712 to LW716 has been carried out by SLR (2025). Monitoring and management measures have been recommended by SLR (2025) for properties located on the steep slopes associated with Razorback Range.

5.7.4. Recommendations for the steep slopes

ICHPL has engaged a team of consultants to assess the existing stability and the potential for subsidence impacts on the steep slopes associated with the Razorback Range. The assessed risks and recommendations are provided in the report by SLR (2025).

ICHPL has developed a *Cliff and Steep Slope Management Plan* for LW701 to LW711. The existing Management Plan addresses monitoring, response action, reporting and public safety. It is recommended that the management plan be reviewed and, where required, revised to include the proposed LW712 to LW716.

5.8. Escarpments

The Razorback Range forms a well-defined escarpment in the western and north-western part of the Study Area. The descriptions, predictions and impact assessments for the rock outcrops and steep slopes along the Razorback Range are provided in Sections 0 and 5.7, respectively.

5.9. Land prone to flooding and inundation

The catchment areas of the streams within the Study Area are relatively small and the land drains freely into the Nepean River. There are no major flood prone areas identified within the Study Area. The predicted changes in the surface levels of the streams are predicted to only have a marginal effect on their natural gradients, as described in 5.3.

5.10. Swamps, wetlands and water related ecosystems

There are no swamps or wetlands identified within the Study Area. There are water-related ecosystems within the Study Area associated with the major streams. Discussions on the water related ecosystems are provided in the reports by Stantec (2025) and Niche (2025).

5.11. Flora and fauna

The potential for impacts on the vegetation in the mining area is dependent on the surface cracking, changes in surface water and changes in groundwater. Assessments of the physical impacts due to the proposed longwall are provided in Sections 5.2 to 5.10. Assessments of the environmental consequences have been provided by the other specialist consultants on the project.

Assessments for the aquatic and terrestrial ecology are provided in the reports by Stantec (2025) and Niche (2025).

The following sections provide the descriptions, predictions and impact assessments for the built features within the Study Area. The major built features located outside the Study Area, which may be subjected to far-field or valley-related movements and may be sensitive to these effects, have also been included as part of these assessments.

6.1. Main Southern Railway

The location of the Main Southern Railway is shown in Drawing No. MSEC1459-10.

The Main Southern Railway is outside the Study Area based on the 600 m boundary. The railway is located more than 1 km east of LW712 at its closest point to the proposed longwalls. The railway is located directly above the existing LW703 to LW708B to the south of the Study Area.

The predicted additional vertical subsidence for the Main Southern Railway due to the mining of the proposed LW712 to LW716 is less than 20 mm. While the railway could experience very low levels of vertical subsidence, it is not predicted to experience measurable tilts, curvatures or strains.

It is not anticipated therefore that the Main Southern Railway or its associated infrastructure would experience adverse impacts due to the mining of the proposed LW712 to LW716, even if the predictions were exceeded by a factor of two-times.

6.2. M31 Hume Motorway

The location of the M31 Hume Motorway is shown in Drawing No. MSEC1459-10.

The M31 Hume Motorway is outside the Study Area based on the 600 m boundary. The motorway is located more than 1.3 km east LW712 at its closest point to the proposed longwalls. The motorway is located directly above the existing LW703 to LW708B to the south of the Study Area.

The predicted additional vertical subsidence for the M31 Hume Motorway due to the mining of the proposed LW712 to LW716 is less than 20 mm. While the motorway could experience very low levels of vertical subsidence, it is not predicted to experience measurable tilts, curvatures or strains.

It is not anticipated therefore that the M31 Hume Motorway would experience adverse impacts due to the mining of the proposed LW712 to LW716, even if the predictions were exceeded by a factor of two-times.

6.3. Local roads

6.3.1. Descriptions of the local roads

The local roads are shown in Drawing No. MSEC1459-10.

The main local roads within the Study Area are Menangle Road and Remembrance Drive. The minor local roads include Burrells Road, Carrolls Road, Cummins Road, Finns Road, Hawkey Road and Quirkies Lane.

Menangle Road is located above the existing and approved LW707A to LW711 and it is outside the proposed LW712 to LW716. This road provides a connection between the township of Campbelltown to the north-east of the Study Area, and Picton Road to the south-west of the Study Area.

Remembrance Drive is located above the proposed LW715 and LW716. This road provides a connection between the township of Camden to the north of the Study Area, and Picton to the west of the Study Area.

A summary of the main local roads within the Study Area is provided in Table 6.1. There are other local roads within the Study Area that are not included in this table.

Table 6.1 Main local roads located within the Study Area

Name	Location	Total length above the proposed longwalls (km)	Total length within the Study Area (km)
Burrells Road	Above approved LW711 and partially above proposed LW712	0.1	0.7
Carrolls Road	Above existing and approved LW709 to LW711 and above proposed LW712 to LW714	1.4	2.4
Cummins Road	Partially above the approved LW711 and above the proposed LW712 to LW714	1.8	1.9
Finns Road	Partially above approved LW711 and above LW712 to LW716	1.9	2.4
Hawkey Road	Above existing LW710B and LW905	-	0.6
Menangle Road	Directly above existing and approved LW707A to LW711	-	1.3
Quirkies Lane	Above approved LW711 and above proposed LW712	0.2	2.3
Remembrance Drive	Above proposed LW715 and LW716	2.3	3.4
Total	-	7.7	15

The local roads have single carriageways with bitumen seals. Some local roads also have concrete kerb and guttering. A photograph of Menangle Road is provided in Fig. 6.1.

**Fig. 6.1 Photograph of Menangle Road in Area 9**

The local roads are owned and maintained by the Wollondilly Shire Council.

6.3.2. Predictions for the local roads

The predicted profiles of total vertical subsidence, tilt and curvature along Carrolls Road, Cummins Road, Finns Road, Menangle Road and Remembrance Drive are shown in Figs. C.10 to C.14, respectively, in Appendix C. The predicted profiles after the completion of the existing and approved longwalls are shown as the cyan lines. The predicted total profiles after the mining of each of the proposed LW712 to LW716 are shown as the blue lines.

Summaries of the maximum predicted values of total vertical subsidence, tilt and curvature for Menangle Road and Remembrance Drive are provided in Table 6.2 and Table 6.3, respectively. The values are the maximum predicted subsidence effects for the sections of the roads within the Study Area due to the mining of the existing, approved and proposed longwalls.

Table 6.2 Maximum predicted total vertical subsidence, tilt and curvature for Menangle Road

Name	After 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)
Menangle Road	LW711	1300	5.0	0.06	0.12
	LW712	1350	4.5	0.06	0.12
	LW713	1350	4.5	0.06	0.12
	LW714	1350	4.5	0.06	0.12
	LW715	1350	4.5	0.06	0.12
	LW716	1350	4.5	0.06	0.12

Table 6.3 Maximum predicted total vertical subsidence, tilt and curvature for Remembrance Drive

Name	After 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)
Remembrance Drive	LW711	< 20	< 0.5	< 0.01	< 0.01
	LW712	< 20	< 0.5	< 0.01	< 0.01
	LW713	< 20	< 0.5	< 0.01	< 0.01
	LW714	30	< 0.5	< 0.01	< 0.01
	LW715	425	1.5	0.05	< 0.01
	LW716	925	5.5	0.06	0.09

A summary of the maximum predicted subsidence effects for the other local roads within the Study Area is provided in Table 6.4. The values are the maximum predicted subsidence effects for the sections of the roads within the Study Area due to the mining of the existing, approved and proposed longwalls.

Table 6.4 Maximum predicted total vertical subsidence, tilt and curvature for the other local roads

Location	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)
Burrells Road	1300	6.0	0.06	0.12
Carrolls Road	1400	5.5	0.06	0.13
Cummins Road	1350	6.5	0.07	0.12
Finns Road	1100	6.0	0.06	0.10
Hawkey Road	1300	3.5	0.04	0.10
Quirkes Lane	1350	6.5	0.07	0.14

The maximum predicted total tilt for the local roads within the Study Area is 6.5 mm/m (i.e. 0.65 % or 1 in 154). The maximum predicted total conventional curvatures are 0.07 km⁻¹ hogging and 0.14 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 7 km, respectively.

The maximum predicted conventional strains for the local roads, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1 mm/m tensile and 2 mm/m compressive. The conventional strains represent typical values when the ground subsides regularly with no localised or elevated strains due to near-surface geological structures or valley-related effects.

Non-conventional movements can also occur and have occurred in the NSW coalfields as a result of, amongst other things, anomalous movements. The analysis of strains provided in Chapter 4 includes those resulting from both conventional and non-conventional anomalous movements.

The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The predicted strains directly above the mining area are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels and 1.5 mm/m tensile and 3.2 mm/m compressive based on the 99 % confidence levels.

6.3.3. Impact assessments for the local roads

There is extensive experience of mining directly beneath local roads in the Southern Coalfield which indicates that impacts can be managed with the implementation of suitable monitoring and management strategies. The local roads have remained in safe and serviceable conditions and have been remediated using normal road maintenance techniques.

A summary of the experience of mining beneath local roads at Appin Mine and other nearby mines is provided in Table 6.5. The maximum predicted subsidence effects for the local roads within the Study Area are similar to the maximum predicted values for these case studies.

Table 6.5 Experience of mining beneath local roads at Appin Mine and other nearby mines

Road	Length mined beneath and longwalls	Measured movements	Observed impacts
Appin Road	3.9 km mined beneath by West Cliff LW5A3, LW5A4 and LW29 to LW37	1350 mm subsidence 11 mm/m tilt 1.5 mm/m tensile strain 5.5 mm/m comp. strain (Measured B-Line)	Localised depression above LW5A3. Bumps up to 100 mm and cracking up to 10 mm in pavement above LW32 to LW37
Brooks Point Road	2.4 km mined beneath by Appin LW1, LW2 and LW405 to LW409	700 mm subsidence 5 mm/m tilt 1 mm/m tensile strain 2 mm/m comp. strain (Measured A6000-Line)	Bump approximately 100 mm in pavement above LW408
Carrolls Road	0.9 km mined beneath by Appin LW709 and LW710B	575 mm subsidence 8 mm/m tilt 1.5 mm/m tensile strain 4.0 mm/m comp. strain (Measured Carrolls Road Monitoring Line)	Localised heaving and cracking in pavement due to LW709. Two compression bumps developed in pavement above LW710B
Hawkey Road	0.5 km mined beneath by Appin LW710B	525 mm subsidence 2.5 mm/m tilt < 0.5 mm/m tensile strain 0.5 mm/m comp. strain (Measured Hawkey Road Monitoring Line)	Minor undulations in the road pavement near the intersection with Carrolls Road
Menangle Road	3.9 km mined beneath by Appin LW707A, LW708A, LW709, LW903 and LW904	925 mm subsidence 8.5 mm/m tilt 2.0 mm/m tensile strain 90 mm/m comp. strain (Measured Mengale Road Monitoring Line)	Compressive heaving developed above LW707A near base of hill. Minor crack in pavement elsewhere along road. Localised heaving and cracking in pavement due to LW709.
Moreton Park Road	4 km mined beneath by Appin LW702 to LW708B	1300 mm subsidence 7.5 mm/m tilt 1.0 mm/m tensile strain 5.0 mm/m comp. strain (Measured Moreton Park Road Monitoring Line)	Minor cracking and localised bumps in pavement
Wilton Road	2.6 km mined beneath by Appin LW1, LW2, LW15, LW16, LW301 and LW302	650 mm subsidence 4.5 mm/m tilt 1 mm/m tensile strain 3 mm/m comp. strain (Measured M & N-Lines)	Some minor impacts to the road surface were observed above LW301 and LW302

The impacts on these local roads did not present an immediate public safety risk and were remediated using normal road maintenance techniques.

Photographs of the bumps and dip that developed along Carrolls Road during the mining of LW710B are provided in Fig. 6.2. These deformations developed over several weeks and were managed by weekly visual inspections and fortnightly ground monitoring. Speed restrictions were introduced during active subsidence and the road pavement was locally repaired during mining.



Fig. 6.2 Bumps and dip along Carrolls Road above Appin LW710B (Source: Inglis, 10 Oct 2024)

The mining of LW707A and LW708A beneath Menangle Road resulted in a dip developing in the pavement near the top of Spaniards Hill and a compression bump developing near the base of the hill. A photograph of these impacts is provided in Fig. 6.3. Menangle Road was maintained in safe and serviceable conditions using weekly ground monitoring and visual inspections. Preventive measures were carried out including milling of the compression bump and pavement repairs. Warning signs were also installed along the road during active subsidence.



Fig. 6.3 Compression bumps in Menangle Road (Source: Network Solutions)

Photographs of the bumps and tensile cracking observed along Appin Road due to the mining of West Cliff LW32 are provided in Fig. 6.4. These deformations developed over several weeks and were managed by weekly visual inspections and ground monitoring. Speed restrictions were introduced during active subsidence and the road pavement was locally repaired after mining.



Fig. 6.4 Bump in slip lane along Appin Road above West Cliff Longwall 32 (Source: Colin Dove)

There is also extensive experience of mining beneath local roads at Tahmoor Mine. Longwalls 22 to 27 at Tahmoor Mine have mined directly beneath more than 28 km of local roads and a total of 52 impact sites have been observed. The observed rate of impact on the local roads equates to an average of one impact for every 540 m of pavement. In most cases, the impacts were relatively minor and were remediated by locally resurfacing the pavements.

The most severe impacts at Tahmoor Mine were located where substantial non-conventional movements had developed. These impact sites were identified using visual and ground monitoring and remediation was undertaken during active subsidence to maintain these roads in safe and serviceable conditions. Impacts have also been observed to concrete kerbs, gutters and drainage pits. The impacts are most commonly focussed on driveway laybacks and involve cracking, spalling or buckling.

Remembrance Drive is located at the top of Razorback Range above the proposed longwalls and traverses down a ridgeline towards the north of the mining area. Other local roads at the top of Razorback Range and above the proposed longwalls include Donalds Range Road and Mt Hercules Road.

The surface level and natural grade across the alignment of the Remembrance Drive above the proposed LW716 are illustrated in Fig. 6.5.

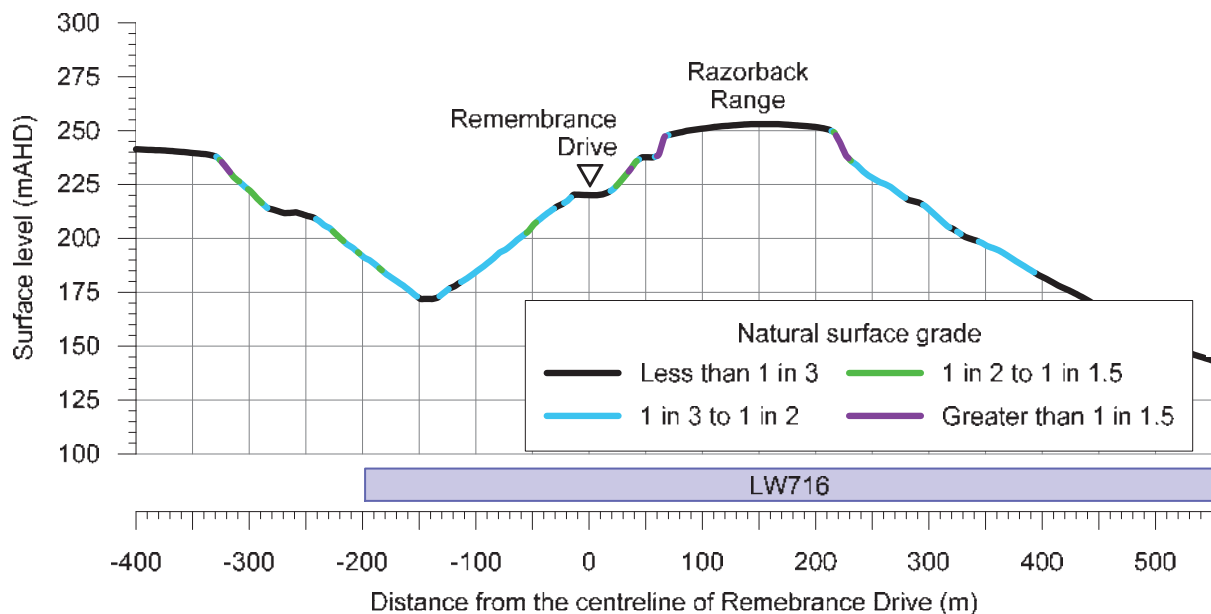


Fig. 6.5 Surface level across the alignment of Remembrance Drive

The mining of the proposed LW715 and LW716 beneath Remembrance Drive could result in increased horizontal movements in the downslope direction causing tensile cracking in the road pavement. Similarly, tensile cracking could also develop in the other local roads located on the top of the ridgeline and above the proposed longwalls. It is recommended that ground movement and visual monitoring are carried out along these roads during active subsidence to identify increased or irregular movements.

Minor cliff MCL07 is located adjacent to the eastern side of Remembrance Drive along the Razorback Range and is directly above the proposed LW716. While the potential for impacts on this minor cliff is considered low, it is recommended that ICHPL carry out periodic inspections of the minor cliffs along Remembrance Drive during active subsidence, to identify any fracturing, unstable rocks and rockfalls.

Further discussions on the potential impacts on the steep slopes are provided in the report by SLR (2025).

6.3.4. Recommendations for the local roads

ICHPL has developed management strategies for the local roads for previous mining in Appin Area 7 and Area 9. It is recommended that these management plans are reviewed and updated to incorporate the proposed LW712 to LW716.

6.4. Road bridges

The road bridges are shown in Drawing No. MSEC1459-10.

The Nepean Twin Bridges are located where the M31 Hume Motorway crosses the Nepean River (not shown in Drawing No. MSEC1459-10). These twin bridges are located more than 4 km south of LW712 at their closest point to the proposed longwalls. At this distance, the Nepean Twin Bridges are not predicted to experience measurable conventional subsidence or far-field effects. Adverse impacts on these bridges are therefore not anticipated due to the mining of the proposed LW712 to LW716.

Moreton Park Road Bridge (North) crosses the M31 Hume Motorway to the east of the mining area. The bridge is located 1.8 km from LW712 at its closest point to the proposed longwalls. While this bridge is located outside the Study Area, it could experience far-field horizontal movements and could be sensitive to these effects. Moreton Park Road Bridge (North) has therefore been included in the impact assessments.

Moreton Park Road Bridge (North) has an overall length of approximately 100 m and is supported by three single piers, spaced at approximately 30 m apart, with concrete abutments at each end. A photograph of the Moreton Park Road Bridge (North) is provided in Fig. 6.6.



Fig. 6.6 Moreton Park Road Bridge (North)

Management Plans have been developed for the bridge for the mining of longwalls in Appin Areas 7 and 9. A Technical Committee has been established, to review the monitoring data and carry out actions in accordance with the Trigger Action Response Plan (TARP).

Survey prisms were installed at each end of Moreton Park Road Bridge (North), referred to as MPRBNE and MPRBNW, to measure the absolute and relative movements of the bridge. Global Satellite Navigation System (GNSS) units were also installed at each end of Moreton Park Road Bridge (North) in September 2024. The GNSS units are fixed survey stations that continuously measure their absolute horizontal and vertical positions in near real time.

The total horizontal movements measured at each end of Moreton Park Road Bridge (North) are illustrated in Fig. 6.7. The movements have been monitored during the mining of LW706 to LW710B in Area 7 and the concurrent mining of LW901 to LW905 in Area 9. The Monitoring Review Point trigger level is also shown as the orange line in this figure.

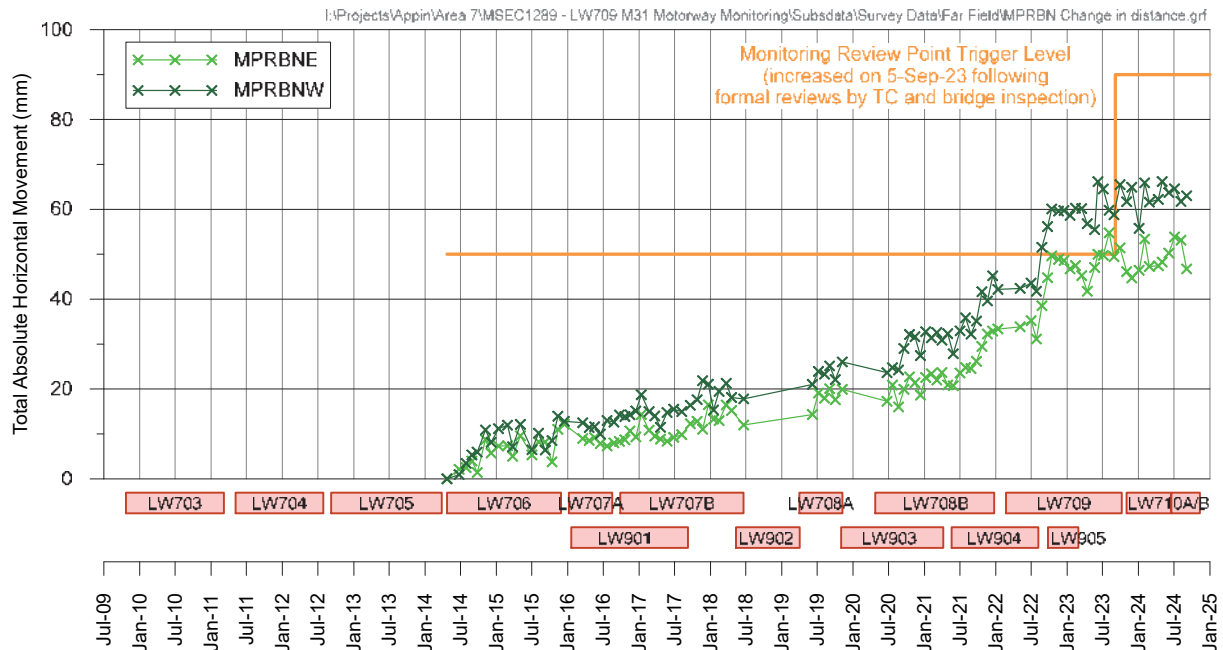


Fig. 6.7 Measured total horizontal movements at Moreton Park Road Bridge (North)

The measured relative movements between at each end of Moreton Park Road Bridge (North) are illustrated in Fig. 6.8. These movements have been monitored during the mining of LW706 to LW710B in Area 7 and the concurrent mining of LW901 to LW905 in Area 9.

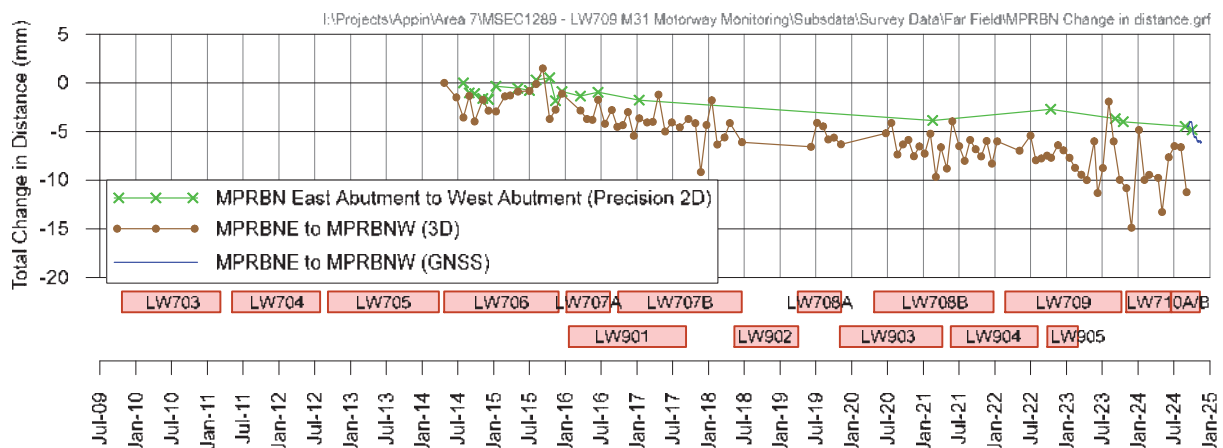


Fig. 6.8 Measured relative horizontal movements at Moreton Park Road Bridge (North)

The predictions, impact assessments and the recommended monitoring and management strategies for Moreton Park Road Bridge (North) are outlined in the Management Plan for the bridge in Report No. MSEC1460. It is expected that the bridge can be maintained in safe and serviceable conditions with the implementation of the recommended monitoring and management strategies.

6.5. Road culverts

Road culverts are located where the local roads cross the streams or other topographical depressions. The culverts within the Study Area comprise concrete pipes or concrete box culverts with concrete headwalls.

The road culverts are located across the Study Area and, therefore, they are expected to experience the full range of predicted subsidence effects. A summary of the maximum predicted conventional subsidence movements within the Study Area is provided in Chapter 4.

The maximum predicted tilt for road culverts is 6.5 mm/m (i.e. 0.65 % or 1 in 154). It is unlikely that the mining-induced tilts would result in adverse impacts on the serviceability of the culverts, as the changes in grade are less than 1 %. If the flow of water through the culverts were to be adversely affected, due to the proposed mining, they could be remediated by re-levelling the affected culverts.

The predicted curvatures and strains could be of sufficient magnitudes to result in cracking in the culverts or the headwalls. It is unlikely, however, that these movements would adversely impact on the stabilities or structural integrities of the culverts. The potential impacts on the road culverts could be managed by visual inspection and, where required, the affected culverts can be repaired or replaced.

The road culverts are located along the streams and therefore could experience valley related effects. The culverts are orientated along the alignments of the streams and, therefore, the upsidence and closure movements are orientated perpendicular to the main axes of the culverts and unlikely therefore to result in adverse impacts.

Experience of mining beneath road culverts in the Southern Coalfield indicates that the incidence of impacts is low. Impacts have generally been limited to cracking in the concrete headwalls which can be readily remediated. In some cases, however, cracking in the culvert pipes occurred which required the culverts to be replaced.

ICHPL has an approved management plan for the local roads, including the drainage culverts, for LW701 to LW711. It is recommended that this management plan is reviewed and updated to incorporate the proposed LW712 to LW716.

6.6. Water infrastructure

The locations and details of the potable water infrastructure have been obtained from a *Before You Dig Australia* search (BYDA, 2024) and follow up correspondence with Sydney Water.

There is no potable water infrastructure within the Study Area. Potable water pipelines are located at Douglas Park more than 2 km south of the proposed longwalls. At this distance, the potable water pipelines are not predicted to experience measurable conventional subsidence effects. It is not anticipated, therefore, that adverse impacts would occur to these pipelines due to the proposed mining.

6.7. Sewerage infrastructure

The locations and details of the sewerage infrastructure have been obtained from a *Before You Dig Australia* search (BYDA, 2024) and follow up correspondence with Sydney Water.

There is no sewerage infrastructure within the Study Area.

6.8. Gas infrastructure

The gas infrastructure is shown in MSEC1459-13.

The locations and details of the gas infrastructure have been obtained from a *Before You Dig Australia* search (BYDA, 2024) and follow up correspondence with AGL and Jemena.

There is no active gas infrastructure within the Study Area. All gas pipelines have been purged with air and have not been operational for more than one year. AGL is in the process of rehabilitating the pipework with some being removed, some being grouted and others being handed over for use by landowners.

6.9. Electrical infrastructure

6.9.1. Descriptions of the electrical infrastructure

The electrical infrastructure is shown in Drawing No. MSEC1459-11.

The electrical infrastructure within the Study Area comprises 66 kV, 22 kV, 11 kV and 415 V powerlines. These powerlines generally follow the local roads and they are located across the existing and proposed longwalls.

There are no transmission lines located within the Study Area.

A summary of the lengths of the powerlines within the Study Area is provided in Table 6.6.

Table 6.6 Powerlines within the Study Area

Type	Total length above the proposed longwalls (km)	Total length within the Study Area (km)
66 kV powerlines	1.7	3.4
22 kV powerlines	0.8	0.9
11 kV powerlines	8.5	17.8
415 V powerlines	4.5	10.9
Total	16	33

The 66 kV, 11 kV and low voltage powerlines consist of aerial copper cables supported on timber poles. A photograph of the 66 kV powerline (right-hand side) and an 11 kV powerline (left-hand side) along Menangle Road is provided in Fig. 6.9.



Fig. 6.9 66 kV and 11 kV powerlines along Menangle Road

There are also 40 substations located within the Study Area as shown in Drawing No. MSEC1459-11. A summary of the substations within the Study Area is provided in Table 6.7.

Table 6.7 Substations within the Study Area

Type	Location	Total number
Substations	Above existing or approved longwalls	14
	Above LW712	5
	Above LW713	3
	Above LW714	6
	Above LW715	3
	Above LW716	4
	Outside the proposed longwalls	5
	Total	40

The powerlines and substations are owned and operated by Endeavour Energy.

6.9.2. Predictions for the electrical infrastructure

The predicted profiles of total vertical subsidence, tilt along and tilt across the alignment of the 66 kV powerline (Branch 1) and 11 kV powerline (Branch 1) are shown in Figs. C.15 and C.16, respectively, in Appendix C. The predicted profiles after the completion of the existing and approved longwalls are shown as the cyan lines. The predicted total profiles after the mining of each of the proposed LW712 to LW716 are shown as the blue lines.

The predicted profiles of total vertical subsidence and tilt for the 11 kV powerlines located along Cummins Road, Finns Road, Menangle Road and Remembrance Drive are shown in Figs. C.11 to C.14, respectively, in Appendix C. The predicted profiles after the completion of the existing and approved longwalls are shown as the cyan lines. The predicted total profiles after the mining of each of the proposed LW712 to LW716 are shown as the blue lines.

Summaries of the maximum predicted values of total vertical subsidence and tilt in any direction for the powerlines are provided in Table 6.8 and Table 6.9, respectively. The values are the maximum predicted subsidence effects for the sections of the powerlines within the Study Area due to the mining of the existing, approved and proposed longwalls

Table 6.8 Maximum predicted total vertical subsidence and tilt for the powerlines

Longwall	Maximum predicted total vertical subsidence (mm)			
	66 kV powerlines	22 kV powerlines	11 kV powerlines	415 V powerlines
LW711	1300	425	1300	1300
LW712	1350	500	1350	1350
LW713	1400	600	1400	1400
LW714	1400	1000	1400	1400
LW715	1400	1250	1400	1400
LW716	1400	1300	1400	1400

Table 6.9 Maximum predicted total tilt in any direction for the powerlines

Longwall	Maximum predicted total tilt in any direction (mm/m)			
	66 kV powerlines	22 kV powerlines	11 kV powerlines	415 V powerlines
LW711	6.5	3.0	6.5	6.5
LW712	6.5	4.0	6.5	6.5
LW713	6.5	6.0	6.5	6.5
LW714	5.5	6.0	6.0	5.5
LW715	5.0	4.5	6.0	5.5
LW716	5.0	4.5	6.5	5.5

The maximum predicted total tilt in any direction for the powerlines is 6.5 mm/m (i.e. 0.65 % or 1 in 154).

The maximum predicted horizontal movement of the ground associated with the maximum predicted tilt is 100 mm, i.e. 15 times the maximum tilt of 6.5 mm/m. The maximum predicted horizontal movement at the tops of the poles (assuming a height of 15 m) therefore is 200 mm, i.e. horizontal movement at the ground plus the maximum tilt of 6.5 mm/m times the 15 m pole height.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvature for the substations is provided Table 6.10. The values are the maximum predicted subsidence effects for the substations within the Study Area due to the mining of the existing, approved and proposed longwalls.

Table 6.10 Maximum predicted total vertical subsidence, tilt and curvature for the substations

Name	After 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)
Substations	LW711	1250	6.0	0.06	0.11
	LW712	1300	6.5	0.06	0.12
	LW713	1400	6.0	0.06	0.13
	LW714	1400	6.0	0.06	0.13
	LW715	1400	5.0	0.06	0.13
	LW716	1400	5.0	0.06	0.13

6.9.3. Impact assessments for the powerlines

The 66 kV, 11 kV and low voltage powerlines will not be directly affected by the ground strains, as the cables are supported by the power poles above ground level. However, the cables may be affected by the changes in bay lengths, i.e. the distances between the poles at the levels of the cables, resulting from the differential subsidence, horizontal movements and tilt at the pole locations. The stabilities of the poles and the cable clearances may also be affected by the mining-induced tilts and the changes in the catenary profiles of the cables.

The maximum predicted tilt for the powerlines is 6.5 mm/m (i.e. 0.65 % or 1 in 154). A rule of thumb used by some electrical engineers is that the tops of the poles may displace up to two pole diameters horizontally before remediation works are considered necessary. Based on pole heights of 15 m and pole diameters of 250 mm, the maximum tolerable tilt at the pole locations is in the order of 20 mm/m.

There is extensive experience of mining directly beneath powerlines at Appin Mine and elsewhere in the Southern Coalfield. Examples of cases where the measured subsidence effects are similar to the predicted values for the powerlines within the Study Area is provided in Table 6.11.

Table 6.11 Experience of mining beneath powerlines in the Southern Coalfield

Colliery and longwalls	Length of powerline directly mined beneath (km)	Maximum measured movements at the powerlines	Observed impacts
Appin Area 1 (LW1 to LW12)	5.2 km of 11 kV 104 power poles	850 mm subsidence 6 mm/m tilt (Measured WX-Line)	No reported impacts
Appin Area 2 (LW14 to LW29)	1.0 km of 66 kV 4.6 km of 11 kV 76 power poles	1200 mm subsidence 7.0 mm/m tilt (Measured A-Line)	No reported impacts
Appin Area 3 (LW301 and LW302)	0.6 km of 66 kV 0.2 km of 11 kV 14 power poles	650 mm subsidence 4.5 mm/m tilt (Measured M and N-Lines)	No reported impacts
Appin Area 4 (LW401 to LW409)	3.8 km of 66 kV 0.6 km of 33 kV 3.3 km of 11 kV 112 power poles	1200 mm subsidence 6.0 mm/m tilt (Measured A6000-Line)	No reported impacts

Colliery and longwalls	Length of powerline directly mined beneath (km)	Maximum measured movements at the powerlines	Observed impacts
Appin Area 7 (LW702 to LW710B)	5.2 km of 66 kV 16.1 km of 11 kV 281 power poles	1450 mm subsidence 9.0 mm/m Tilt (Measured ARTC-Line, M31-Lines and Menangle Road)	No reported impacts
Appin Area 9 (LW901 to LW905)	3.1 km of 66 kV 4.3 km of 11 kV 118 power poles	650 mm subsidence 4.5 mm/m tilt (Measured ARTC-Line and Menangle Road)	No reported impacts
Dendrobium Area 2 (LW3 to LW5)	0.9 km of 33 kV	1100 mm subsidence 40 mm/m tilt (Measured 2000-Line)	No reported impacts
Dendrobium Area 3A (LW6 and LW7)	0.9 km of 33 kV	2500 mm subsidence (LiDAR surveys)	No reported impacts
Dendrobium Area 3C (LW21 and LW22)	0.8 km of 33 kV	2500 mm subsidence (LiDAR surveys)	No reported impacts
Tahmoor North (LW22 to LW32 and LW W1 to LW W4)	Approx. 47 km of electrical cables and 1112 power poles	1375 mm subsidence 12 mm/m tilt (Extensive street monitoring)	Some minor adjustments to cable catenaries, pole tilts and consumer cables required.
Tahmoor South (LW S1A to S3A)	Approx. 2.5 km of electrical cables and 47 power poles	830 mm subsidence 7.2 mm/m tilt (Measured Remembrance Drive, Caloola Road and Yarran Road)	No reported impacts
Tower (LW1 to LW10)	6.0 km of 66 kV 4.3 km of 11 kV 112 power poles	400 mm subsidence 3 mm/m tilt (Measured T & TE-Lines)	No reported impacts
West Cliff Areas 4 and 5 (LW5A3 to LW5A4 and LW29 to LW37)	1.8 km of a 66 kV 8.5 km of 11 kV 170 power poles	1350 mm subsidence 11 mm/m tilt (Measured B-Line)	No reported impacts

The past experiences demonstrate that there have only been minor impacts on aerial powerlines that have been directly mined beneath by previously extracted longwalls in the Southern Coalfield. Some remedial measures were required, which included adjustments to cable catenaries, pole tilts and to consumer cables which connect between the powerlines and houses. The incidence of these impacts was very low.

Based on this experience, it is likely that the extraction of the proposed longwalls would result in only minor impacts on the powerlines within the Study Area. It is expected that the remedial measures would include some adjustments of the cable catenaries, pole tilts and the consumer cables, as has been undertaken in the past, but any other impacts are expected to be relatively infrequent.

11 kV and low voltage powerlines follow Donalds Range Road and Mt Hercules Road across the Razorback Range above the western ends of the proposed LW713 to LW716. Increased horizontal movements could develop in the downslope direction due to mining beneath the steep slopes. It is recommended ground movement and visual monitoring are carried out along these powerlines during active subsidence to identify increased or irregular movements.

6.9.4. Recommendations for the powerlines

ICHPL has approved management plans for the powerlines for existing and approved LW701 to LW711 and LW901 to LW905. It is recommended that these management plans are reviewed and updated to incorporate the proposed LW712 to LW716.

6.10. Telecommunications infrastructure

6.10.1. Descriptions of the telecommunications infrastructure

The telecommunications infrastructure is shown in Drawing No. MSEC1459-12.

There are optical fibre cables within the Study Area owned by Telstra and the NBN. A summary of these optical fibre cables is provided in Table 6.12.

Table 6.12 Optical fibre cables located within the Study Area

Owner	Alignment	Above longwalls	Total length above the proposed longwalls (km)	Total length within the Study Area (km)
Telstra	Carrolls Road and Hawkey Road	Outside the proposed longwalls but directly above existing LW710B	-	0.3
NBN	Finns Road and Menangle Road	Above the eastern ends of LW712 to LW716	2.0	3.0
Total			2.0	3.3

Copper telecommunications cables are also located within the Study Area. These underground cables generally follow the local roads and they service the residential properties within the Study Area.

6.10.2. Predictions for the telecommunications infrastructure

The predicted profiles of total vertical subsidence, tilt and curvature along the Telstra and NBN optical fibre cables are the same as the predicted profiles along Carrolls Road and Finns Road shown in Figs. C.10 and C.12, respectively, in Appendix C. The predicted profiles after the completion of the existing and approved longwalls are shown as the cyan lines. The predicted total profiles after the mining of each of the proposed LW712 to LW716 are shown as the blue lines.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvature for the optical fibre cables is provided in Table 6.13. The values are the maximum predicted subsidence effects for the sections of the cables within the Study Area due to the mining of the existing, approved and proposed longwalls.

Table 6.13 Maximum predicted total vertical subsidence, tilt and curvature for the optical fibre cables

Feature	Owner	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)
Optical fibre cables	Telstra	1400	4.0	0.06	0.13
	NBN	1100	6.0	0.06	0.10

The maximum predicted total tilt for the optical fibre cables within the Study Area is 6.0 mm/m (i.e. 0.6 % or 1 in 167). The maximum predicted total conventional curvatures are 0.06 km⁻¹ hogging and 0.13 km⁻¹ sagging and they represent minimum radii of curvature of 17 km and 8 km, respectively.

The maximum predicted conventional strains for the optical fibre cables, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1 mm/m tensile and 2 mm/m compressive. The conventional strains represent typical values when the ground subsides regularly with no localised or elevated strains due to near-surface geological structures or valley-related effects.

Non-conventional movements can also occur and have occurred in the NSW coalfields as a result of, amongst other things, anomalous movements. The analysis of strains provided in Chapter 4 includes those resulting from both conventional and non-conventional anomalous movements.

The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The predicted strains directly above the mining area are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels and 1.5 mm/m tensile and 3.2 mm/m compressive based on the 99 % confidence levels.

The copper telecommunications cables are located across the Study Area and, therefore, could experience the full range of predicted subsidence effects. A summary of the maximum predicted conventional subsidence effects within the Study Area is provided in Chapter 4.

The optical fibres and copper telecommunications cables cross the streams directly above the proposed mining area and therefore could experience valley-related effects. The maximum predicted valley-related effects for these cables are 25 mm upsidence and 50 mm closure.

6.10.3. Impact assessments for the telecommunications cables

The Telstra and NBN optical fibre cables are direct buried and therefore could potentially be impacted by ground strains. The greatest potential for impacts will occur as the result of localised ground strains due to non-conventional movements or valley-related effects.

The tensile strains in the optical fibre cables could be higher than predicted, where the cables connect to the support structures, which may act as anchor points, preventing any differential movements that may have been allowed to occur with the ground. Tree roots have also been known to anchor cables to the ground. The extent to which the anchor points affect the ability of the cables to tolerate the mine subsidence movements depends on the cable size, type, age, installation method and ground conditions.

In addition to this, optical fibre cables contain additional fibre lengths over the sheath lengths, where the individual fibres are loosely contained within tubes. Compression of the sheaths can transfer to the loose tubes and fibres and result in “micro-bending” of the fibres constrained within the tubes, leading to higher attenuation of the transmitted signal. If the maximum predicted compressive strains were to be fully transferred into the optical fibre cables, the strains could be of sufficient magnitude to result in the reduction in capacities of the cables or transmission loss.

The strains transferred into the optical fibre cables can be monitored using Remote Fibre Monitoring Systems (RFMS) such as Optical Time Domain Reflectometry (OTDR), which can be used to notify the infrastructure owners of strain concentrations due to non-conventional ground movements or valley-related effects.

There is extensive experience of mining directly beneath optical fibre cables at Appin Mine and elsewhere in the Southern Coalfield. Examples of cases where the measured subsidence effects are similar to the predicted values for the optical fibre cables within the Study Area is provided in Table 6.14.

Table 6.14 Examples of mining beneath optical fibre cables in the Southern Coalfield

Colliery and longwalls	Length of optical fibre cable directly mined beneath (km)	Maximum measured movements at the optical fibre cables	Pre-mining mitigation, monitoring and observed impacts
Appin Area 3 (LW301 and LW302)	0.8	650 mm subsidence 1.0 mm/m tensile strain 3.0 mm/m comp. strain (Measured M and N-Lines)	600 m aerial cable on standby. Ground survey, visual, OTDR. No reported impacts.
Appin Area 7 (LW703 to LW710A)	41 total for five cable alignments	1450 mm subsidence 3.0 mm/m tensile strain 6.0 mm/m comp. strain (Measured ARTC-Line, M31-Lines and Menangle Road)	New cable redirection to avoid potential impacts to old optical fibre cable. Ground survey, visual, OTDR. Strain concentrations detected in three cables, attenuation losses were relieved by locally exposing the cables or by building a bypass cable.
Tahmoor North (LW22 to LW32)	4.6	1375 mm subsidence 3.0 mm/m tensile strain 8.0 mm/m comp. strain (Extensive street monitoring)	Ground survey, visual, OTDR, SBS. No reported impacts.
Tower (LW1 to LW10)	1.7	400 mm subsidence 3 mm/m tilt 0.5 mm/m tensile Strain 1 mm/m comp. Strain	No reported impacts
West Cliff Areas 4 & 5 (LW5A3, LW5A4 and LW29 to LW37)	3.6	1350 mm subsidence 1.5 mm/m tensile strain 5.5 mm/m comp. strain (Measured B-Line)	Survey, visual, OTDR, SBS. No reported impacts.

Note: SBS is a method of monitoring optical fibres and means Stimulated Brillouin Scattering

The experience of mining beneath optical fibre cables at Appin Mine and elsewhere in the Southern Coalfield indicates that the potential impacts can be managed with the implementation of suitable management and monitoring strategies. With an appropriate management plan in place, it is considered that potential impacts on the optical fibre cables due to the proposed mining can be managed, even if actual subsidence movements are greater than the predictions or substantial non-conventional movements occur.

The copper telecommunications cables are located across the Study Area. There is extensive experience of mining beneath copper telecommunications cables at Appin Mine and elsewhere in the Southern Coalfield. There has been no reported impacts on the direct buried copper telecommunications cables in these cases. It is not anticipated, therefore, that the copper telecommunications cables within the Study Area will experience adverse impacts.

Copper telecommunications cables follow Remembrance Drive at the top of Razorback Range above the proposed LW715 and LW716. Increased horizontal movements could develop in the downslope direction due to mining beneath the steep slopes. It is recommended ground movement and visual monitoring are carried out along these underground cables during active subsidence to identify increased or irregular movements.

6.10.4. Recommendations for the telecommunications infrastructure

ICHPL has approved management plans for the optical fibre and copper telecommunications for existing and approved LW701 to LW711 and LW901 to LW905. It is recommended that these management plans are reviewed and updated to incorporate the proposed LW712 to LW716.

6.11. Agricultural utilisation

The agricultural land classification types within the Study Area are illustrated in Fig. 6.10.

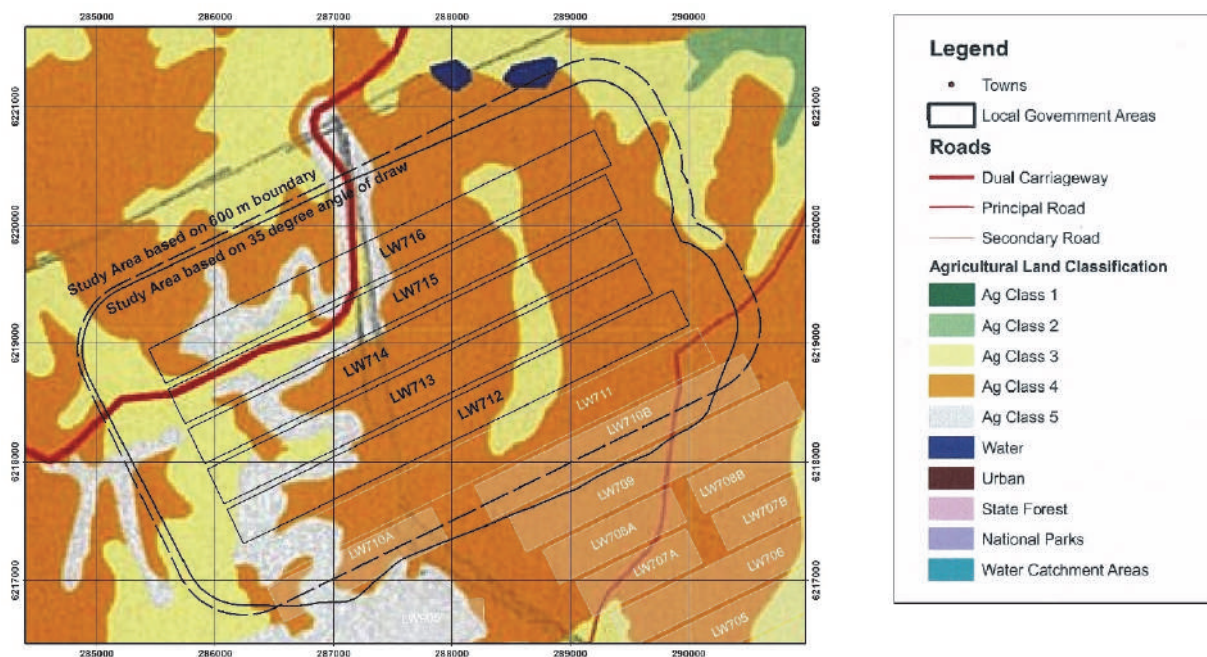


Fig. 6.10 Agricultural Land Classification within the Study Area (Source DTRIS, November 2008)

There are three main agricultural land classification types within the Study Area:

- Class 3 – grazing land or land well suited to pasture improvement,
- Class 4 – land suitable for grazing but not for cultivation, and
- Class 5 – land unsuitable for agriculture, or at best suited only to light grazing.

The flatter areas of land within the Study Area have been predominately cleared and are used for light agricultural and residential purposes. The hillier areas within the Study Area, including the Razorback Range, have generally not been cleared of the natural vegetation.

6.12. Rural structures

6.12.1. Descriptions of the rural structures

The rural structures are shown in Drawing No. MSEC1459-14.

There are 817 rural structures that have been identified within the Study Area. These structures include sheds, garages, carports and other non-residential building structures. Details of the rural structures are included in Table D.01, in Appendix D. A summary of the rural structures within the Study Area is provided in Table 6.15.

Table 6.15 Details of the rural structures within the Study Area

Type	Number located above the existing and approved LW709 to LW711	Number located above the proposed LW712 to LW716	Number located outside the mining area
Animal shelter	0	15	6
Awning	12	33	14
Cabana	1	6	2
Carport	17	14	4
Deck	0	2	0
Garage	22	28	15
Gazebo	4	7	4
Greenhouse	2	3	2
Pergola	9	9	3
Portico	1	1	0
Shed	178	285	116
Verandah	0	2	0
Total	246	405	166

There are 246 rural structures (i.e. 30 %) that are located above the existing and approved LW709 to LW711, 405 rural structures (i.e. 50 %) located above the proposed LW712 to LW716 and 166 rural structures (i.e. 20 %) located outside the mining area.

6.12.2. Predictions for the rural structures

Predictions of conventional vertical subsidence, tilt and curvature have been made at the centroid and at the vertices of each structure, as well as eight equally spaced points placed radially around the centroid and vertices at a distance of 20 m. In the case of a rectangular shaped structure, predictions have been made at a minimum of 45 points within and around the structure.

The maximum predicted values of total vertical subsidence, tilt and curvature for each of the rural structures within the Study Area are provided in Table D.02, in Appendix D. The predicted tilts represent the maximum values in any direction after the completion of each of the proposed LW712 to LW716. The predicted curvatures are the maximum values in any direction at any time during or after the mining of each of the proposed longwalls.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvatures for the rural structures is provided in Table 6.16. The table provides the maximum predicted values for the structures at any time during or after the mining of each longwall.

Table 6.16 Maximum predicted total vertical subsidence, tilt and curvatures for the rural structures

After longwall	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)
LW712	1425	6.5	0.07	0.14
LW713	1425	6.5	0.07	0.14
LW714	1425	6.5	0.07	0.14
LW715	1425	6.5	0.07	0.14
LW716	1425	6.5	0.07	0.14

The maximum predicted tilt for the rural structures is 6.5 mm/m (i.e. 0.65 % or 1 in 154). The maximum predicted curvatures are 0.07 km⁻¹ hogging and 0.14 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 7 km, respectively.

Distributions of the predicted vertical subsidence, tilt and curvatures for the rural structures within the Study Area are illustrated in Fig. 6.11 and Fig. 6.12.

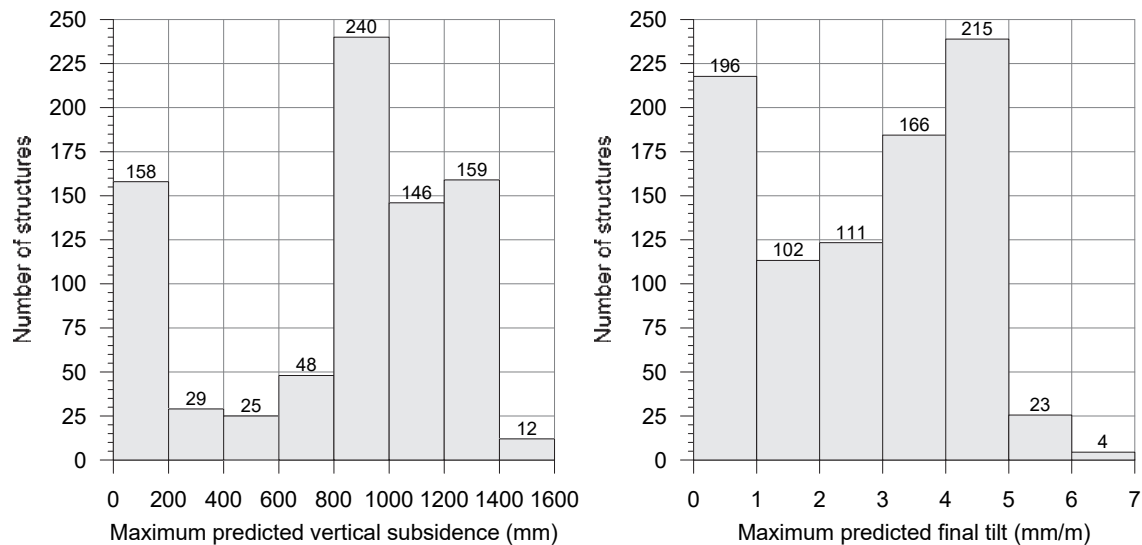


Fig. 6.11 Maximum predicted vertical subsidence (left-hand side) and final tilt (right-hand side) for the rural structures

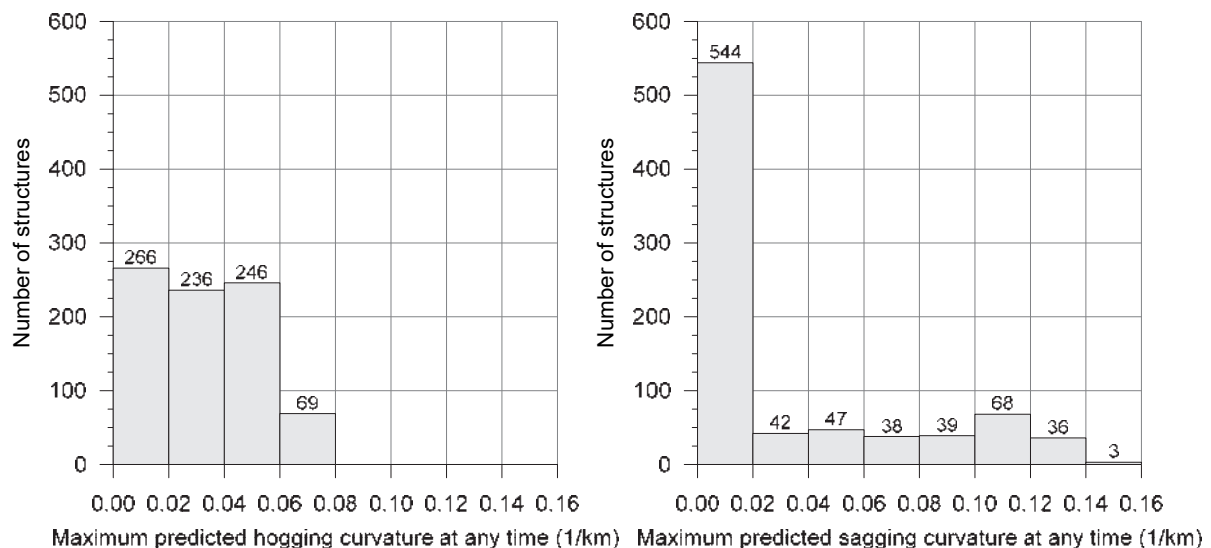


Fig. 6.12 Maximum predicted hogging curvature (left-hand side) and sagging curvature (right-hand side) at any time for the rural structures

The maximum predicted conventional strains for the rural, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1 mm/m tensile and 2 mm/m compressive. Higher strains could develop at the structures due to irregular ground movements or topographic effects.

The predicted distributions of strain due to the proposed mining are described in Chapter 4. The rural structures are at discrete locations and, therefore, the most relevant distribution of strain is the maximum strains measured in individual survey bays above previous longwall mining, which is summarised in Section 4.3.1. The maximum predicted total strains directly above the proposed longwalls are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

The strains have been predicted for each of the rural structures using the method described by Barbato (2017). This method considers the position of each structure relative to the longwalls, the surface slope, surface lithology and the potential for irregular anomalous movements.

The predicted total strains for each of the rural structures within the Study Area are provided in Table D.02, in Appendix D. Distributions of the predicted total strains based on the mean and on the 95 % confidence levels are provided in Fig. 6.13 and Fig. 6.14, respectively.

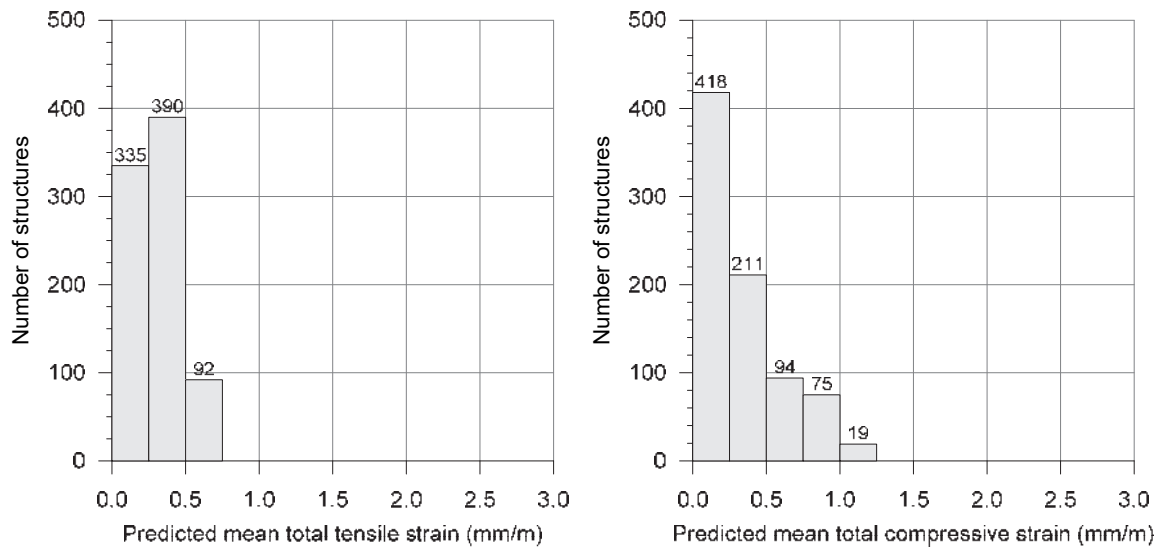


Fig. 6.13 Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the rural structures based on the mean

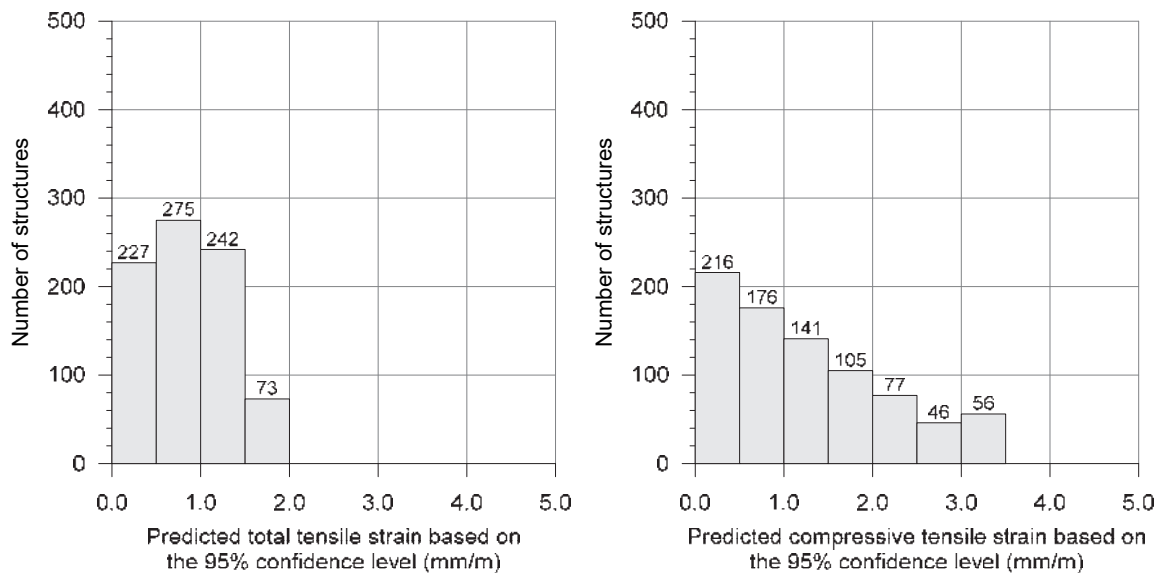


Fig. 6.14 Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the rural structures based on the 95 % confidence level

The rural structures within the Study Area are predicted to experience total tensile strains between 0.2 mm/m and 1.7 mm/m and total compressive strains between 0.2 mm/m and 3.5 mm/m based on the 95 % confidence levels. The predicted mean values range between 0.2 mm/m and 1.0 mm/m tensile and compressive.

6.12.3. Impact assessments for the rural structures

The majority of the rural structures within the Study Area are of lightweight construction and are expected to tolerate the predicted mining-induced tilt. It has been found from past longwall mining experience, that tilts of the magnitudes predicted for the proposed longwalls generally do not result in adverse impacts on rural structures. Some minor serviceability impacts could occur at the higher levels of predicted tilt, including door swings and issues with roof and pavement drainage. These serviceability impacts can generally be remediated using normal building maintenance techniques.

There is extensive experience of mining directly beneath rural structures at Appin Mine and elsewhere in the Southern Coalfield. This experience indicates that the incidence of impacts on rural structures is very low and these structures have remained in safe and serviceable conditions. This is not surprising as rural structures are generally small in size and of light-weight construction, which makes them less susceptible to impact than houses which are typically more rigid.

The nearby Tahmoor Mine has mined directly beneath more than 2000 rural structures and 1900 associated residential structures of similar construction during the mining of Longwalls 22 to 31. It has managed the mining-induced impacts with the implementation of suitable management strategies. The structures have remained safe and serviceable during mining.

Based on this experience, it is expected that the rural structures within the Study Area would remain safe and serviceable during the mining period, provided that they are in sound existing condition. The risk of impact could be greater if the structures are in poor existing condition, though the chances of there being a public safety risk remains very low. A number of rural structures that were in poor existing condition have been directly mined beneath and these structures have not experienced adverse impacts during mining.

Impacts on the rural structures that occur due to the mining of the proposed LW712 to LW716 are expected to be remediated using well established building techniques. With these remediation measures available, it is unlikely that there would be long term impacts on rural structures due to the extraction of the proposed longwalls.

6.12.4. Recommendations for the rural structures

ICHPL has approved management plans for building structures for LW701 to LW711. It is recommended that these management plans are reviewed and updated to incorporate the proposed LW712 to LW716.

The management plans provide for identification (where landholder access is provided) of buildings in poor pre-mining condition that are hazardous or may become hazardous due to mining, and monitoring of structures during active subsidence. If impacts occur, the structure will be repaired in accordance with the *Coal Mine Subsidence Compensation Act 2017*.

6.13. Tanks

The tanks are shown in Drawing No. MSEC1459-14.

There are 471 tanks that have been identified within the Study Area. These include water storage and gas tanks on the properties. Details of the tanks are included in Table D.01, in Appendix D. A summary of the tanks within the Study Area is provided in Table 6.17.

Table 6.17 Details of the tanks within the Study Area

Type	Number located above the existing and approved LW709 to LW711	Number located above the proposed LW712 to LW716	Number located outside the mining area
Tanks	239	151	81

The maximum predicted values of total vertical subsidence, tilt and curvature for each of the tanks within the Study Area are provided in Table D.02, in Appendix D. The predicted tilts represent the maximum values in any direction after the completion of each of the proposed longwalls. The predicted curvatures are the maximum values in any direction at any time during or after the mining of each of the proposed longwalls.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvatures for the tanks is provided in Table 6.18. The table provides the maximum predicted values for the tanks at any time during or after the mining of each longwall.

Table 6.18 Maximum predicted total vertical subsidence, tilt and curvatures for the tanks

After longwall	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)
LW712	1425	6.5	0.07	0.14
LW713	1425	6.5	0.07	0.14
LW714	1425	6.5	0.07	0.14
LW715	1425	6.5	0.07	0.14
LW716	1425	6.5	0.07	0.14

The maximum predicted tilt for the tanks is 6.5 mm/m (i.e. 0.65 % or 1 in 154). The maximum predicted curvatures are 0.07 km⁻¹ hogging and 0.14 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 7 km, respectively.

The maximum predicted conventional strains for the tanks, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1 mm/m tensile and 2 mm/m compressive. The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The maximum predicted strains directly above the mining area are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

Non-conventional movements can also occur and have occurred in the NSW coalfields as a result of, amongst other things, anomalous movements. The analysis of strains provided in Chapter 4 includes those resulting from both conventional and non-conventional anomalous movements.

The tanks themselves are typically constructed above ground level and, therefore, are unlikely to experience the full ground movements resulting from the proposed mining. It is possible that any buried water pipelines associated with the tanks within the Study Area could be impacted by the ground strains, if they are anchored by the tanks, or by other structures in the ground. Any impacts are expected to be of a minor nature and easily repaired.

ICHPL has approved management plans for structures (including tanks) for LW701 to LW711. It is recommended that these management plans are reviewed and updated to incorporate the proposed LW712 to LW716.

6.14. Fences

There are fences located across the Study Area. The fences are constructed in a variety of ways, generally using either timber or metal materials. Fences are generally flexible in construction and can usually tolerate mine subsidence movements in the Southern Coalfield.

There is extensive experience of mining beneath fences at Appin Mine and elsewhere in the Southern Coalfield. A higher incidence of impacts to urban fences has been observed, which is considered to be due to their typical type of construction, namely Colorbond fences and security gates that are fitted tightly between fences and houses. Rural fences are typically more flexible in construction by comparison. No adverse impacts to wire fences securing livestock have been reported due to mining in the Southern Coalfield. Damaged fences are relatively easy to rectify by re-tensioning of fencing wire, straightening of fence posts, and if necessary, replacing some sections of fencing.

The most vulnerable sections of farm fences are gates, particularly long gates or those with latches, as they are less tolerant to differential horizontal movements and tilts between the gate posts and the ground. If any gates are adversely impacted during the extraction of the proposed longwalls, they can be easily and quickly repaired.

6.15. Farm dams

6.15.1. Descriptions of the farm dams

The farm dams are shown in Drawing No. MSEC1459-14.

There are 278 farm dams that have been identified within the Study Area. Details of the dams are included in Table D.03, in Appendix D. A summary of the farm dams within the Study Area is provided in Table 6.19.

Table 6.19 Summary of the farm dams within the Study Area

Type	Number located above the existing and approved LW709 to LW711	Number located above the proposed LW712 to LW716	Number located outside the mining area
Farm dams	83	146	49

The details of the farm dams are included in Table D.03, in Appendix D.

The farm dams are typically of earthen construction and have been established by localised cut and fill operations within the natural streams. The dams are generally shallow, with the dam wall heights generally being less than 3 m. The dams have maximum dimensions ranging between 9 m and 585 m and plan areas ranging between 28 m² and 16.7 ha. There are five dams with area greater than 5000 m² and the details for these are summarised in Table 6.20.

Table 6.20 Details of the larger farm dams within the Study Area

Dam Ref.	Maximum plan dimension (m)	Area (ha)	Dam Location
C26d01	585	16.7	Northern boundary of Study Area
F57d04	313	0.94	Above LW714
S48d02	153	0.84	Above LW715
C23d01	101	0.63	Above LW715
F46d01	242	0.54	Above LW713

6.15.2. Predictions for the farm dams

Predictions of conventional vertical subsidence, tilt and curvature have been made at the centroid and at the vertices of each farm dam, as well as eight equally spaced points placed radially around the centroid and vertices at a distance of 20 m. In the case of a rectangular shaped dam, predictions have been made at a minimum of 45 points within and around the feature.

The maximum predicted values of total vertical subsidence, tilt and curvature for each of the farm dams within the Study Area are included in Table D.03, in Appendix D. The predicted tilts represent the maximum values in any direction after the completion of each of the proposed LW712 to LW716. The predicted curvatures represent the maximum values in any direction at any time during or after the mining of each of the proposed longwalls.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvatures for the farm dams is provided in Table 6.21. The table provides the maximum predicted values for the dams at any time during or after the mining of each proposed longwall.

Table 6.21 Maximum predicted total vertical subsidence, tilt and curvatures for the farm dams

After longwall	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)
LW712	1350	6.0	0.07	0.13
LW713	1400	6.5	0.07	0.13
LW714	1400	6.5	0.07	0.13
LW715	1400	6.0	0.07	0.13
LW716	1400	6.5	0.07	0.13

The maximum predicted tilt for the farm dams is 6.5 mm/m (i.e. 0.65 % or 1 in 154). The maximum predicted curvatures are 0.07 km⁻¹ hogging and 0.13 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 7 km, respectively.

Distributions of the predicted vertical subsidence, tilt and curvatures for the farm dams within the Study Area are illustrated in Fig. 6.15 and Fig. 6.16.

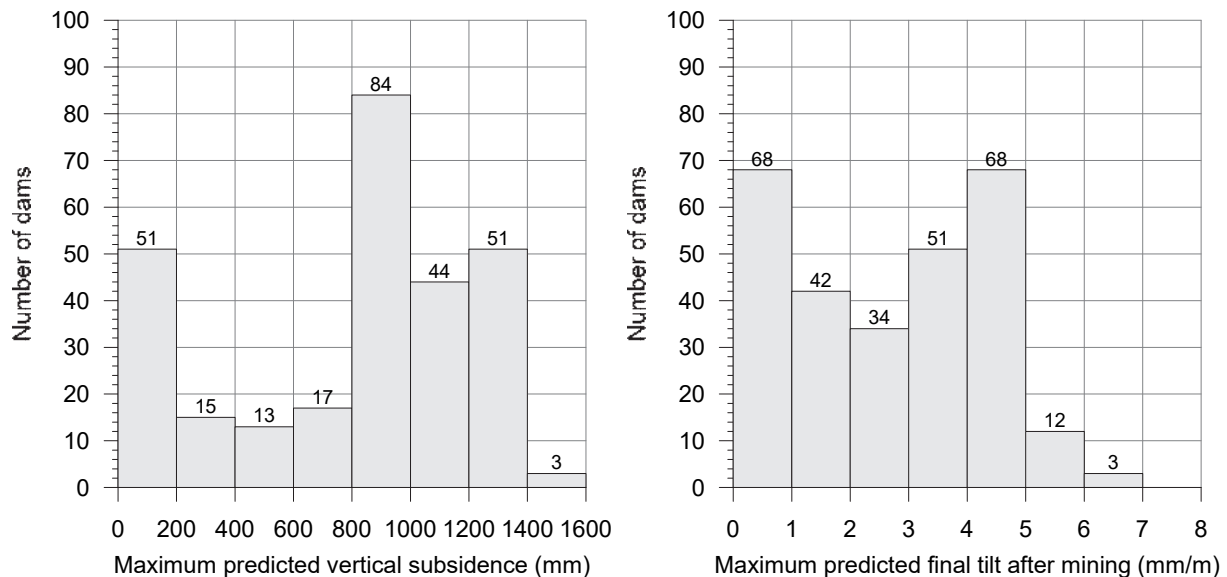


Fig. 6.15 Maximum predicted vertical subsidence (left-hand side) and final tilt (right-hand side) for the farm dams

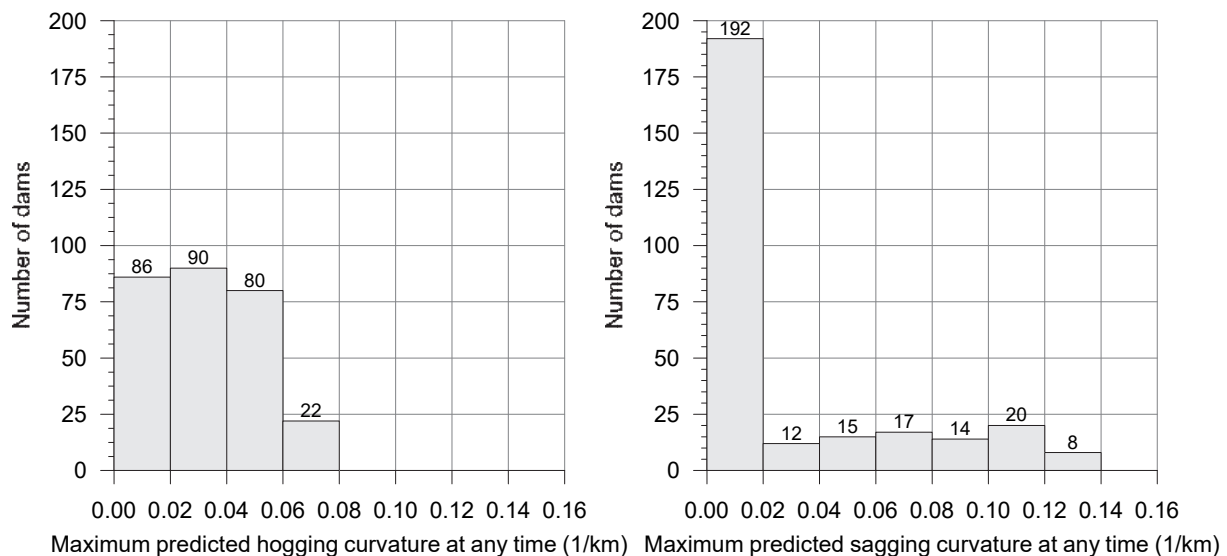


Fig. 6.16 Maximum predicted hogging curvature (left-hand side) and sagging curvature (right-hand side) at any time for the farm dams

The maximum predicted conventional strains for the farm dams, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1 mm/m tensile and 2 mm/m compressive. Higher strains could develop at the dams due to irregular ground movements or topographic effects.

The predicted distributions of strain due to the proposed mining are described in Chapter 4. The farm dams are at discrete locations and, therefore, the most relevant distribution of strain is the maximum strains measured in individual survey bays above previous longwall mining, which is summarised in Section 4.3.1. The maximum predicted total strains directly above the proposed longwalls are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

The strains have been predicted for each of the farm dams using the method described by Barbato (2017). This method considers the position of each feature relative to the longwalls, the surface slope, surface lithology and the potential for irregular anomalous movements.

The predicted total strains for each of the farm dams within the Study Area are provided in Table D.03, in Appendix D. The distributions of the predicted total strains based on the mean and on the 95 % confidence levels are provided in Fig. 6.17 and Fig. 6.18, respectively.

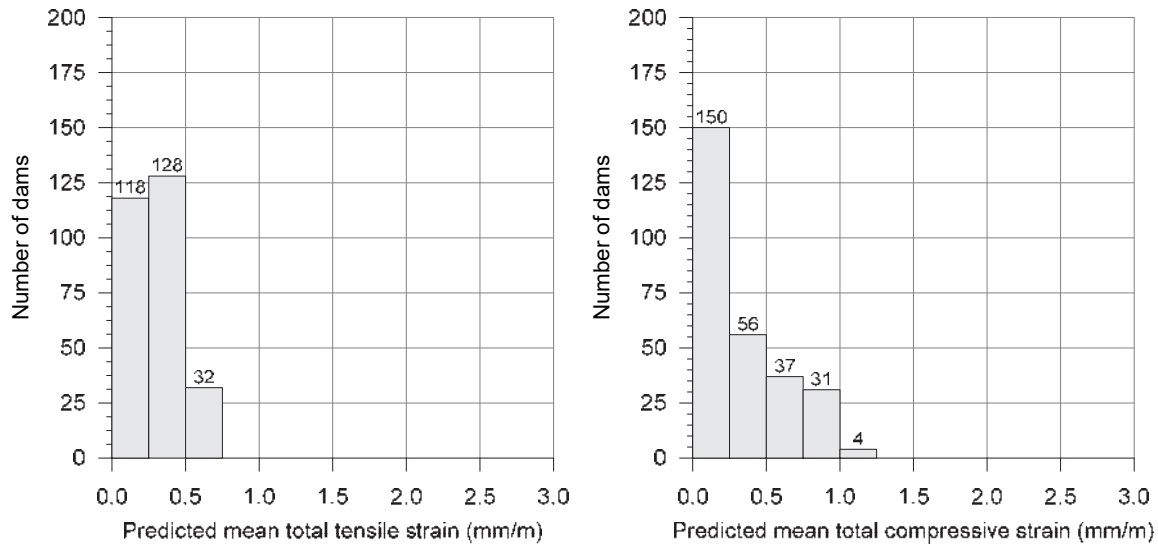


Fig. 6.17 Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the farm dams based on the mean

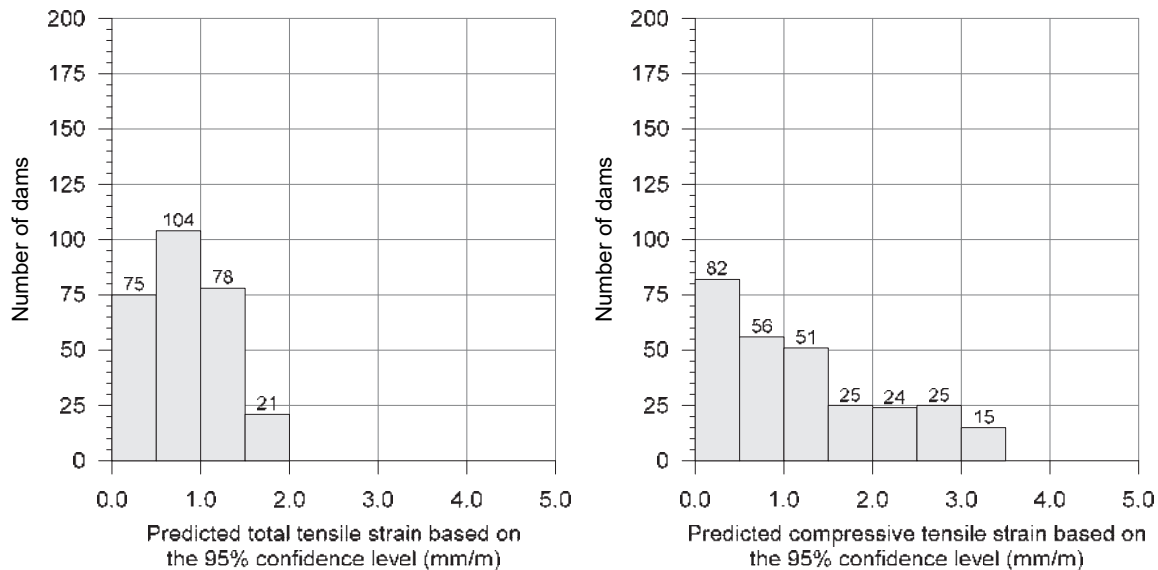


Fig. 6.18 Predicted total tensile strain (left-side) and total compressive strain (right-side) for the farm dams based on the 95 % confidence level

The farm dams within the Study Area are predicted to experience total tensile strains between 0.2 mm/m and 1.7 mm/m and total compressive strains between 0.2 mm/m and 3.4 mm/m based on the 95 % confidence levels. The predicted mean values range between 0.2 mm/m and 1.0 mm/m tensile and compressive.

The farm dams have typically been constructed along the alignments of streams and, therefore, may be subjected to valley-related effects due to the proposed mining. However, the equivalent valley heights at the dams are small and it is expected, therefore, that the predicted valley-related upsidence and closure movements at the dam walls would be considerably less than the predicted conventional subsidence effects and would not be substantial.

6.15.3. Impact assessments for the farm dams

The maximum predicted tilt for the farm dams within the Study Area is 6.5 mm/m (i.e. 0.65 % or 1 in 154). Mining-induced tilts can affect the water levels around the perimeters of farm dams, with the freeboard increasing on one side and decreasing on the other. Tilt can potentially reduce the storage capacity of farm dams, by causing them to overflow, or can affect the stability of the dam walls.

The predicted changes in freeboard at the farm dams within the Study Area have been determined by taking the difference between the maximum predicted vertical subsidence and the minimum predicted vertical subsidence anywhere around the perimeter of each farm dam. The maximum predicted changes in freeboard for the farm dams are provided in Table D.03, in Appendix D, and are illustrated in Fig. 6.19.

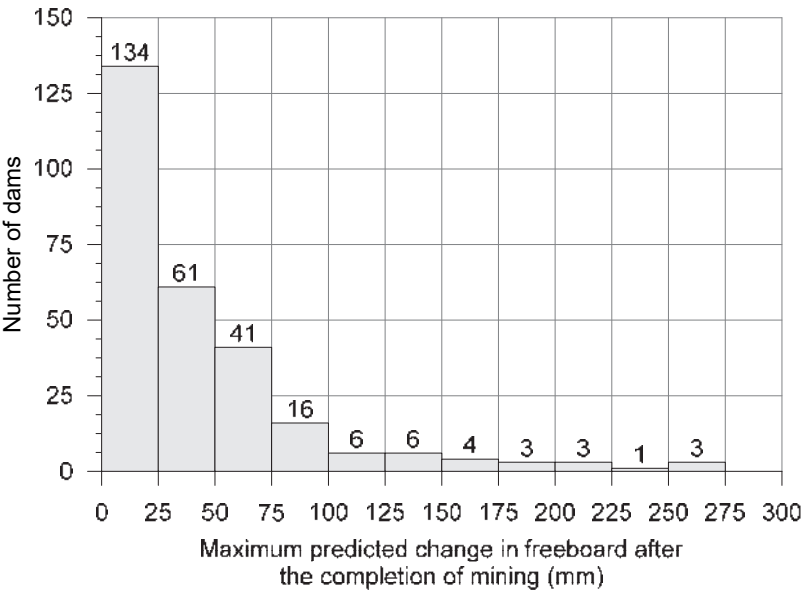


Fig. 6.19 Predicted changes in freeboard for the farm dams within the Study Area

The predicted changes in freeboard for the farm dams within the Study Area are small, varying from less than 25 mm to 275 mm. It is unlikely that the dams would experience adverse impacts on the storage capacities due to these small changes in freeboard.

The farm dams located directly above the proposed mining area could experience cracking in the bases or their walls due to the mining-induced curvatures and strains.

There is extensive experience of mining directly beneath farm dams in the Southern Coalfield, which indicates that the incidence of impacts on these features is low. Farm dams are commonly constructed with cohesive materials in the bases and walls which can absorb the conventional subsidence movements typically experienced in the Southern Coalfield without the development of substantial cracking. Non-conventional movements can result in localised cracking and deformations at the surface and, where coincident with farm dams, could result in impacts.

ICHPL has mined directly beneath more than 300 farm dams in Appin Areas 3, 4, 7 and 9 and West Cliff Area 5. Loss of water was reported for only a small number of dams. Similarly, Tahmoor Mine has mined Longwalls 22 to 32 and Longwalls W1 to W4 beneath approximately 112 dams. At the time of this report, only one farm dam is known to have experienced damage.

Cracking in the dam bases or walls could be repaired by reinstating them with cohesive materials. If any of the farm dams within the Study Area were to lose water due to the proposed mining, the mine would provide an alternative water source until the completion of repairs in accordance with the *Coal Mine Subsidence Compensation Act 2017*.

6.15.4. Recommendations for the farm dams

ICHPL has approved management plans for farm dams for LW701 to LW711. It is recommended that these management plans are reviewed and updated to incorporate the proposed LW712 to LW716.

6.16. Groundwater bores

The registered groundwater bores are shown in Drawing No. MSEC1459-15.

The locations and details of these were obtained from the Australian Groundwater Explorer, which is publicly available online (BOM, December 2024). A summary of the registered groundwater bores identified within the Study Area is provided in Table 6.22.

Table 6.22 Registered groundwater bores within the Study Area

Ground licence number	Location	Depth (m)	Type*
GW026516	240 m north of LW716	10	IRAG (proposed)
GW072196	Directly above LW712	unknown	HUSE
GW072874	750 m south-east of LW711	189	HUSE
GW100289	Above the tailgate of LW713	30	HUSE
GW102619	330 m north-west of LW716	224	IRAG
GW105376	440 m south-east of LW711	219	HUSE
GW105531	Above the tailgate of LW713	210	HUSE
GW105574	Directly above LW711	210	HUSE
GW106675	Directly above LW712	183	HUSE
GW107791	90 m east of LW715	231	HUSE
GW108907	Directly above LW712	210	HUSE
GW108990	490 m north-east of LW712	150	HUSE
GW112381	Directly above LW711	152	HUSE / STOK
GW112481	Above the maingate of LW714	633	INDS

Note: * denotes type HUSE refers to *Water supply for household needs e.g. washing, toilet*, type INDS refers to *Water supply for manufacturing and industry*, type IRAG refers to *Water supply for irrigated agriculture* and type STOK refers to *Water supply for livestock*.

The groundwater bores could experience adverse impacts due to the extraction of the proposed LW712 to LW716, particularly the bores located directly above the proposed mining area. Impacts could include lowering of the piezometric surface, blockage of the bores due to differential horizontal displacements at different horizons within the strata and changes to groundwater quality.

More detailed assessments are provided in the report by the specialist groundwater consultant for the project (HGEO, 2025b).

6.17. Industrial, commercial and business establishments

The commercial structures are shown in Drawing No. MSEC1459-14.

There are 13 commercial structures identified within the Study Area. The structures consist of the vent shaft and associated structures owned by ICHPL.

The vent shaft and associated structures are located outside the mining area at a minimum distance of 300 m east of the proposed LW712. At this distance, these structures are predicted to experience vertical subsidence up to approximately 50 mm. While the structures could experience low levels of vertical subsidence, they are not expected to experience measurable tilts, curvatures or strains.

ICHPL will manage the vent shaft and associated structures based on the predicted subsidence effects and assessed potential impacts.

6.18. Exploration drill holes

There are exploration drill holes located across the Study Area. Exploration drill holes to seam level are grouted and capped prior to the proposed longwalls mining directly beneath them.

6.19. Aboriginal heritage sites

6.19.1. Descriptions of the Aboriginal heritage sites

The Aboriginal heritage sites are shown in Drawing No. MSEC1459-15.

There are 19 Aboriginal heritage sites that have been identified within the Study Area based on the 35° angle of draw and/or the Study Area based on the 600 m boundary. Three of these sites are located above the proposed LW712 to LW716 (Refs. 52-2-3194, 52-2-3231 and 52-2-3232) and two are located above the approved LW711 (Refs. 52-2-4226 and 52-2-4227).

A summary of the Aboriginal heritage sites identified within Study Area is provided in Table 6.23. The details have been provided by Regal Heritage (2025).

Table 6.23 Aboriginal heritage sites identified within the Study Area

Reference	Type	Location relative to the longwalls
52-2-3053	Isolated find	25 m east of LW713
52-2-3054	PAD	335 m north of LW716
52-2-3056	Open camp site	25 m east of LW713
52-2-3190	Isolated find	500 m east of LW715
52-2-3191	Isolated find	485 m east of LW712
52-2-3192	Open camp site	45 m east of LW713
52-2-3193	Open camp site	30 m east of LW714
52-2-3194	Isolated find	Directly above LW713
52-2-3224	Open camp site	445 m north of LW716
52-2-3228	Isolated find	515 m north of LW716
52-2-3229	Isolated find	310 m north of LW716
52-2-3230	Open camp site	160 m north of LW716
52-2-3231	Isolated find	Directly above LW715
52-2-3232	Isolated find	Directly above LW715
52-2-3687	Isolated find	475 m east of LW711
52-2-4226	Open camp site	Directly above LW711
52-2-4227	Open camp site	Directly above LW711
52-2-4507	Open camp site	185 m east of LW715
52-2-4508	Isolated find	85 m north-east of LW712

Further details on the Aboriginal heritage sites are provided in the report by Regal Heritage (2025).

6.19.2. Predictions for the Aboriginal heritage sites

A summary of the maximum predicted total vertical subsidence, tilt and curvatures for the Aboriginal heritage sites located within the Study Area is provided in Table 6.24. The values are the maximum predicted subsidence effects within 20 m of the identified locations of each of the sites due to the mining of the existing, approved and proposed longwalls in Areas 7 and 9.

Table 6.24 Maximum predicted total vertical subsidence, tilt and curvatures for the Aboriginal heritage sites

Reference	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)
52-2-3053	180	1.5	0.02	< 0.01
52-2-3054	30	< 0.5	< 0.01	< 0.01
52-2-3056	180	1.5	0.02	< 0.01
52-2-3190	< 20	< 0.5	< 0.01	< 0.01
52-2-3191	< 20	< 0.5	< 0.01	< 0.01
52-2-3192	180	1.5	0.02	< 0.01
52-2-3193	200	2.0	0.02	< 0.01
52-2-3194	525	4.5	0.04	0.03
52-2-3224	< 20	< 0.5	< 0.01	< 0.01
52-2-3228	< 20	< 0.5	< 0.01	< 0.01
52-2-3229	30	< 0.5	< 0.01	< 0.01
52-2-3230	100	< 0.5	< 0.01	< 0.01
52-2-3231	1250	5.0	0.02	0.09
52-2-3232	1300	3.5	0.02	0.11
52-2-3687	< 20	< 0.5	< 0.01	< 0.01
52-2-4226	225	2.0	0.02	< 0.01
52-2-4227	450	3.5	0.03	< 0.01
52-2-4507	60	< 0.5	< 0.01	< 0.01
52-2-4508	50	< 0.5	< 0.01	< 0.01

Site Refs. 52-2-3194, 52-2-3231 and 52-2-3232 are located above LW713 and LW715 and Site Refs. 52-2-4226 and 52-2-4227 are located above the approved LW711. The maximum predicted total tilt for these sites is 5.0 mm/m (i.e. 0.5 % or 1 in 200). The maximum predicted total conventional curvatures are 0.04 km⁻¹ hogging and 0.11 km⁻¹ sagging and they represent minimum radii of curvature of 25 km and 9 km, respectively.

The maximum predicted conventional strains for the five sites located above the mining area, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 0.6 mm/m tensile and 1.7 mm/m compressive. The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The maximum predicted strains directly above the mining area are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

Non-conventional movements can also occur and have occurred in the NSW coalfields as a result of, amongst other things, anomalous movements. The analysis of strains provided in Chapter 4 includes those resulting from both conventional and non-conventional anomalous movements.

Site Refs. 52-2-3053, 52-2-3054, 52-2-3056, 52-2-3192, 52-2-3193, 52-2-3230, 52-2-4507 and 52-2-4508 are located outside but adjacent to LW712 to LW714. The maximum predicted tilt for these sites is 2.0 mm/m (i.e. 0.2 % or 1 in 500). The maximum predicted total conventional curvatures are 0.02 km⁻¹ hogging and less than 0.01 km⁻¹ sagging and they represent minimum radii of curvature of 50 km and greater than 100 km, respectively

The maximum predicted conventional strains for Site Refs. 52-2-3053, 52-2-3054, 52-2-3056, 52-2-3192, 52-2-3193, 52-2-3230, 52-2-4507 and 52-2-4508, based on applying a factor of 15 to the maximum predicted conventional curvatures, are less than 0.5 mm/m tensile and compressive. The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The maximum predicted strains directly outside the mining area are 0.6 mm/m tensile and 0.5 mm/m compressive based on the 95 % confidence levels.

The remaining sites Refs. 52-2-3190, 52-2-3191, 52-2-3224, 52-2-3228, 52-2-3229 and 52-2-3687 are located at distances varying between 310 m and 515 m outside the mining area. At these distances, the sites are predicted to experience low level subsidence up to approximately 60 mm. While the these sites could experience low level vertical subsidence, they are not expected to experience measurable tilts, curvatures or strains.

6.19.3. Impact assessments for the Aboriginal heritage sites

The Aboriginal heritage sites within the Study Area comprise isolated finds (10 total), open camp sites (8 total) and PAD (1 total).

Surface cracking will develop above the mining area and adjacent to the mining area. The maximum crack widths on the steep slopes are expected to be typically between 25 mm to 50 mm; however, larger crack widths can develop in isolated locations. The crack widths in relatively flat terrain are expected to be typically less than 25 mm. Minor and isolated fracturing can also occur along the streams at distances up to approximately 400 m outside the mining area.

It is unlikely that the artefacts and deposits themselves would be impacted by surface cracking. It is possible, however, that if remediation of the surface were required after mining, these works could potentially impact the Aboriginal heritage sites.

Further assessments of the potential impacts on the Aboriginal heritage sites are provided by the specialist heritage consultant on the project (Regal Heritage, 2025).

6.19.4. Recommendations for the Aboriginal heritage sites

It is recommended that ICHPL develop an Aboriginal Heritage Management Plan in consultation with the registered parties for the Aboriginal heritage sites.

6.20. Historic sites

6.20.1. Descriptions of the historic sites

The historic heritage sites are shown in Drawing No. MSEC1459-15.

There are four historic sites identified within the Study Area. A summary of these heritage sites is provided in Table 6.25. The details have been provided by Regal Heritage (2025).

Table 6.25 Historic heritage sites identified within the Study Area

Reference	Description	Location relative to the longwalls
Slab Hut	Timber hut with various wall claddings and corrugated iron roof	Directly above LW714 to LW716
Mt Hercules homestead ruins	Former house (completely collapsed) and dairy (partially collapsed). Brick rubble, roofing iron and other remains on the ground	Outside the mining area, adjacent to the western end of LW716
Dairy No.9 (EMAI Cottage 24)	Timber cottage with weatherboard cladding and corrugated iron roof	Outside the mining area, at a minimum distance of 190 m north of the eastern end of LW716
Camden Park Estate and Belgenny Farm	Farm landscape (exposed hills), Hawkey's Dam and west expanse	Outside the mining area, at a minimum distance of 800 m north-east of LW716

Further details on the Aboriginal heritage sites are provided in the report by Regal Heritage (2025).

6.20.2. Predictions for the historic sites

Slab Hut is located on Property Ref. F57 and the predictions are based on the maximum values for all mapped structures on that property (Refs. F57h01, F57h02 and F57r01 to F57r08, F57t01 and F57t02).

Mt Hercules homestead ruins and Dairy No.9 (EMAI Cottage 24) are located on Property Refs. R22 and C26, respectively. There are no mapped structures on these properties within the Study Area and, therefore, the predictions are based on the property boundaries closest to the mining area.

Camden Park Estate and Belgenny Farm is located outside the Study Area based on the 600 m boundary.

A summary of the maximum predicted total vertical subsidence, tilt and curvatures for the Aboriginal heritage sites located within the Study Area is provided in Table 6.24. The values are the maximum predicted subsidence effects within 20 m of the identified locations of each of the sites due to the mining of the existing, approved and proposed longwalls in Areas 7 and 9.

Table 6.26 Maximum predicted total vertical subsidence, tilt and curvatures for the Aboriginal heritage sites

Reference	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)
Slab Hut	1300	4.5	0.06	0.12
Mt Hercules homestead ruins	90	1.0	0.01	< 0.01
Dairy No.9 (EMAI Cottage 24)	30	< 0.5	< 0.01	< 0.01
Camden Park Estate and Belgenny Farm	< 20	< 0.5	< 0.01	< 0.01

Slab Hut is located above LW714 to LW716. The maximum predicted total tilt for the mapped structures on this site is 4.5 mm/m (i.e. 0.45 % or 1 in 222). The maximum predicted total conventional curvatures are 0.06 km⁻¹ hogging and 0.12 km⁻¹ sagging and they represent minimum radii of curvature of 17 km and 8 km, respectively.

The maximum predicted conventional strains for Slab Hut, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 0.9 mm/m tensile and 1.8 mm/m compressive. The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The maximum predicted strains directly above the mining area are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

Non-conventional movements can also occur and have occurred in the NSW coalfields as a result of, amongst other things, anomalous movements. The analysis of strains provided in Chapter 4 includes those resulting from both conventional and non-conventional anomalous movements.

Mt Hercules homestead ruins is located outside and adjacent to the mining area. The maximum predicted tilt for this site is 1.0 mm/m (i.e. 0.1 % or 1 in 1000). The maximum predicted total conventional curvatures are 0.01 km⁻¹ hogging and less than 0.01 km⁻¹ sagging and they represent minimum radii of curvature of 100 km and greater than 100 km, respectively.

The maximum predicted conventional strains for Mt Hercules homestead ruins, based on applying a factor of 15 to the maximum predicted conventional curvatures, are less than 0.5 mm/m tensile and compressive. The distribution of the predicted strains due to the mining of the longwalls is described in Section 4.3. The maximum predicted strains directly outside the mining area are 0.6 mm/m tensile and 0.5 mm/m compressive based on the 95 % confidence levels.

Dairy No.9 (EMAI Cottage 24) and Camden Park Estate and Belgenny Farm are located outside the mining area at minimum distances of 190 m and 800 m, respectively. At these distances, these sites are predicted to experience vertical subsidence of less than 20 mm. While these sites could experience low level vertical subsidence, they are not expected to experience measurable tilts, curvatures or strains.

6.20.3. Impact assessments for the historic sites

Slab Hut is a timber cottage located directly above the mining area. The potential impacts for the structures on this property (Ref. F57) have been assessed using the method developed as part of ACARP Research Project C12015 (Waddington, 2009).

The assessed likelihood of impacts on Slab Hut are approximately 47 % of Nil or Category R0 impacts, approximately 32 % of Category R1 or R2 impacts, approximately 15 % of Category R3 or R4 impacts and approximately 5 % of Category R5 impacts

It is most likely that Slab Hut will remain safe and serviceable during and after mining directly beneath it. Cracking and movements may occur in the structure including the light-weight wall cladding. Repairs on the mining-induced damage should consider the heritage aspects of the structure.

Mt Hercules homestead ruins is located outside the mining area but the property boundary is located adjacent to the northern side of LW716. The low-level predicted subsidence effects are unlikely to adversely impact the ruins themselves consisting of brick rubble, roofing iron and other remains on the ground.

Dairy No.9 (EMAI Cottage 24) and Camden Park Estate and Belgenny Farm are located well outside the mining area. It is unlikely that adverse impacts would occur on these properties due to their distances outside the mining area and very low-level predicted subsidence effects.

6.20.4. Recommendations for the historic sites

It is recommended that ICHPL develop an Historic Heritage Management Plan in consultation with the property owners and relevant agencies.

6.21. Survey control marks

The survey control marks are shown in Drawing No. MSEC1459-15. The locations and details of the survey control marks were obtained from *Spatial Services* using the *SCIMS Online* website (SCIMS, 2020).

There are 18 survey control marks located across the Study Area. The marks located directly above the proposed mining area could experience the full range of predicted movements. The marks located outside the mining area could experience far-field vertical and far-field horizontal effects.

It is possible that the survey control marks could be affected by far-field horizontal movements at distances of 1 km to 2 km outside the extents of the proposed longwalls. Far-field horizontal movements and the methods used to predict such movements are described further in Sections 3.3 and 4.5.

It is recommended that the survey control marks that are required for future use are re-established after the completion of mining in the area and after the ground has stabilised. Consultation between ICHPL and Spatial Services will be required to ensure that these survey control marks are reinstated at the appropriate time, as required.

6.22. Houses

6.22.1. Descriptions of the houses

The houses are shown in Drawing No. MSEC1459-14.

There are 217 houses that have been identified within the Study Area. The details of the houses are included in Table D.01, in Appendix D. The locations, sizes and construction details of the houses were determined from the orthophotographs, kerbside inspections and *Google Street View*®.

A summary of the houses within the Study Area is provided in Table 6.27.

Table 6.27 Locations of the houses within the Study Area

Type	Longwall	Number located above the longwall(s)	Percentage of houses located above longwall(s) within the Study Area
Existing and approved longwalls	LW709	5	2 %
	LW710A	4	2 %
	LW710B	21	10 %
	LW711	32	15 %
Proposed longwalls	LW712	35	16 %
	LW713	25	12 %
	LW714	30	14 %
	LW715	11	5 %
	LW716	9	4 %
Solid Coal		45	21 %
Total		217	100 %

There are 62 houses (i.e. 28 %) that are located above the existing and approved longwalls (i.e. LW709 to LW711), 110 houses (51 %) located above the proposed longwalls (i.e. LW712 to LW716) and 45 houses (i.e. 21 %) that are located outside the mining area.

Maximum plan dimension, plan area and height

Distributions of the maximum plan dimensions and plan areas of the houses within the Study Area are provided in Fig. 6.20. The majority of the houses have maximum dimensions between 10 m and 40 m, with an average value of approximately 26 m. The majority of the houses have plan areas between 100 m² and 600 m², with an average value of approximately 350 m².

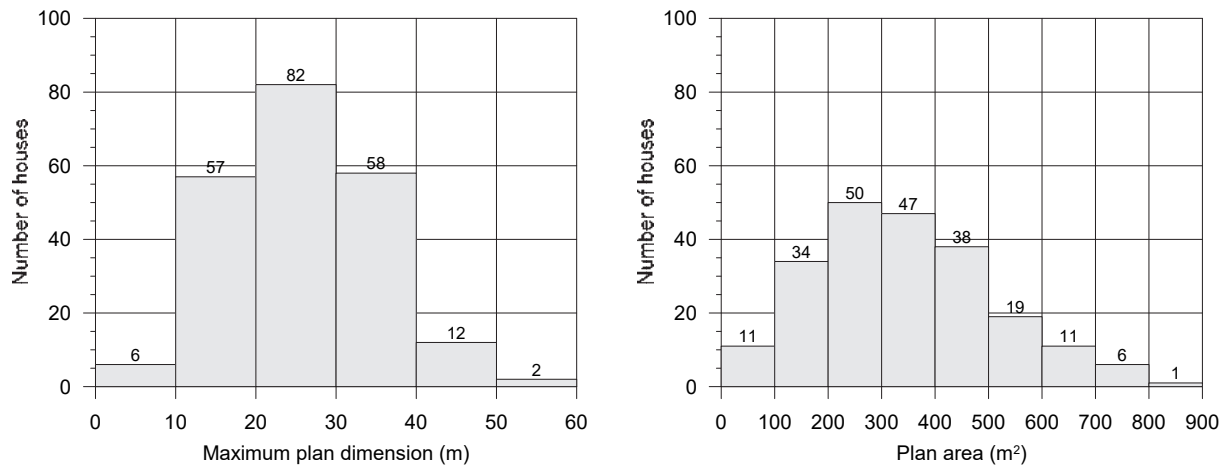


Fig. 6.20 Distribution of houses by maximum plan dimension (left-side) and plan area (right-side)

The houses have been categorised into four groups, on the basis of their maximum plan dimension and the number of stories. A summary of these house type categories is provided in Table 6.28. It is noted that two-storey houses include split-level houses.

Table 6.28 House type categories

House Type	Description	Number	Percentage
H1	Single-storey with maximum plan dimension less than 30 m	96	44 %
H2	Single-storey with maximum plan dimension of 30 m or greater	57	26 %
H3	Two-storey with maximum plan dimension less than 30 m	16	7 %
H4	Two-storey with maximum plan dimension of 30 m or greater	9	4 %
-	Other (number of storeys unknown)	39	19 %

Type of construction

Distributions of the wall and footing constructions of the houses within the Study Area are provided in Fig. 6.21. The majority of the houses within the Study Area comprise brick or brick-veneer structures founded on slabs on ground. There are 109 houses with unknown wall constructions and 114 houses with unknown footing constructions. The impact assessments have conservatively adopted brick structures on strip footings for these houses.

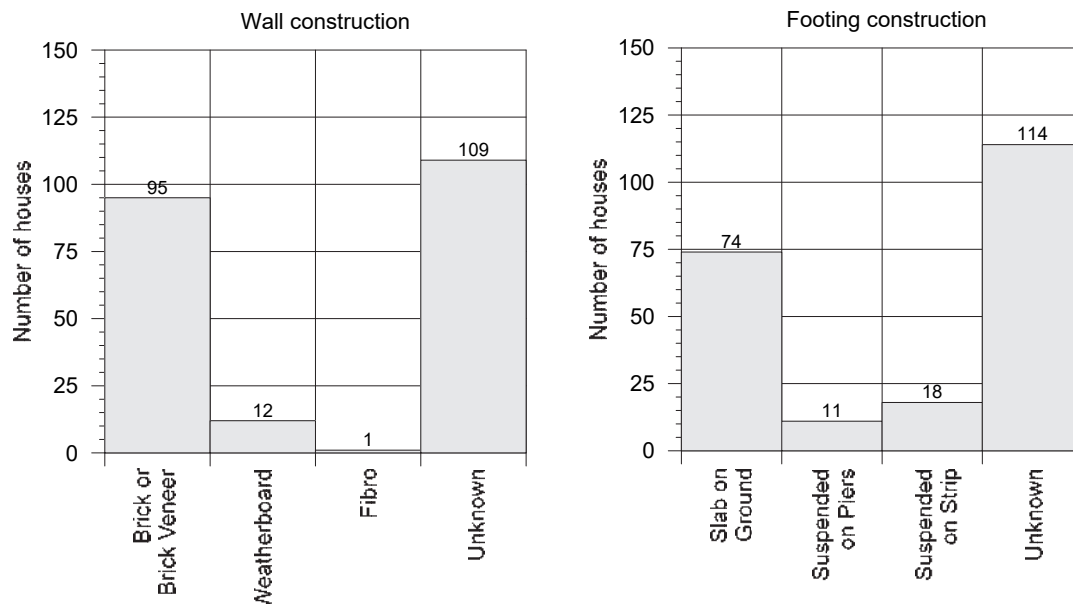


Fig. 6.21 Distributions of wall and footing construction for houses within the Study Area

Following a review of impacts to houses due to longwall mining in the Southern Coalfield, it was found that there was a noticeable difference in structural performance in response to mine subsidence movements between the following construction types:

- brick or brick-veneer houses constructed on a ground slab;
- brick or brick-veneer houses constructed on strip footings; and
- weatherboard or fibro houses constructed on either ground slabs or strip footings.

A summary of houses by construction type is provided in Table 6.29. It is noted that some houses have been constructed with masonry walls at basement level, with weatherboard linings for the main living areas above. These houses have been reported as brick in Table 6.29.

Table 6.29 Distribution of houses by construction type

Description	Number	Percentage
Brick or brick-veneer houses constructed on a ground slab	55	25 %
Brick or brick-veneer houses constructed on strip footings	40	18 %
Weatherboard or fibro houses constructed on either ground slabs or strip footings or other	13	6 %
Unknown	109	51 %

Age of houses

The ages of the houses have been determined by examination of a series of historical aerial photographs provided by Land and Property Information, ICHPL and Nearmap. The photographs that were available over the Study Area were taken from 1955 to 2024.

A histogram showing the distribution of houses by age is shown in Fig. 6.22.

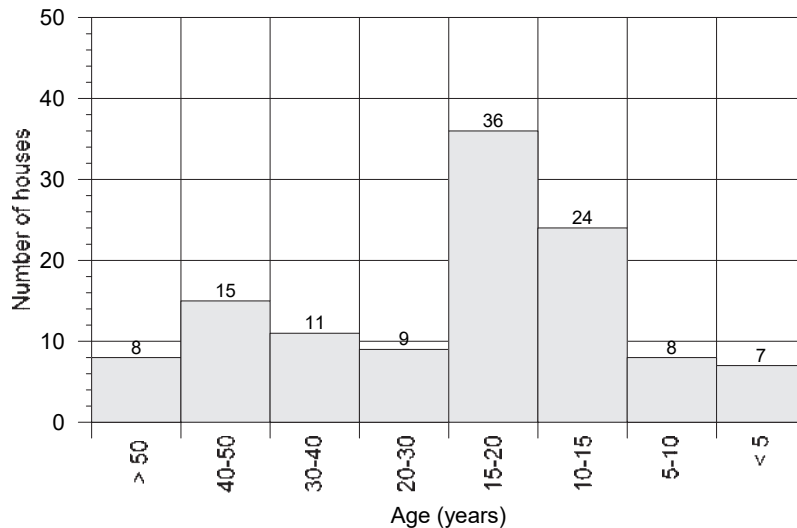


Fig. 6.22 Distribution of houses by age

Houses on steep slopes

Houses are located on or near steep slopes within the Study Area. These include houses at the top and near the base of Razorback Range in the western part of the Study Area. There are also other houses located on or near steep slopes in the eastern part of the Study Area.

The houses located on or within 20 m of the steep slopes are shown in Table D.01, in Appendix D. The houses are shown in Drawing No. MSEC1459-02. There are 85 houses within the Study Area located on or near the steep slopes, of which 65 are located at the top of Razorback Range and 20 houses are located at near the bottom of Razorback Range or along the ridgelines.

The distribution of the maximum natural surface grades within 25 m of each of the houses within the Study Area is illustrated in Fig. 6.23.

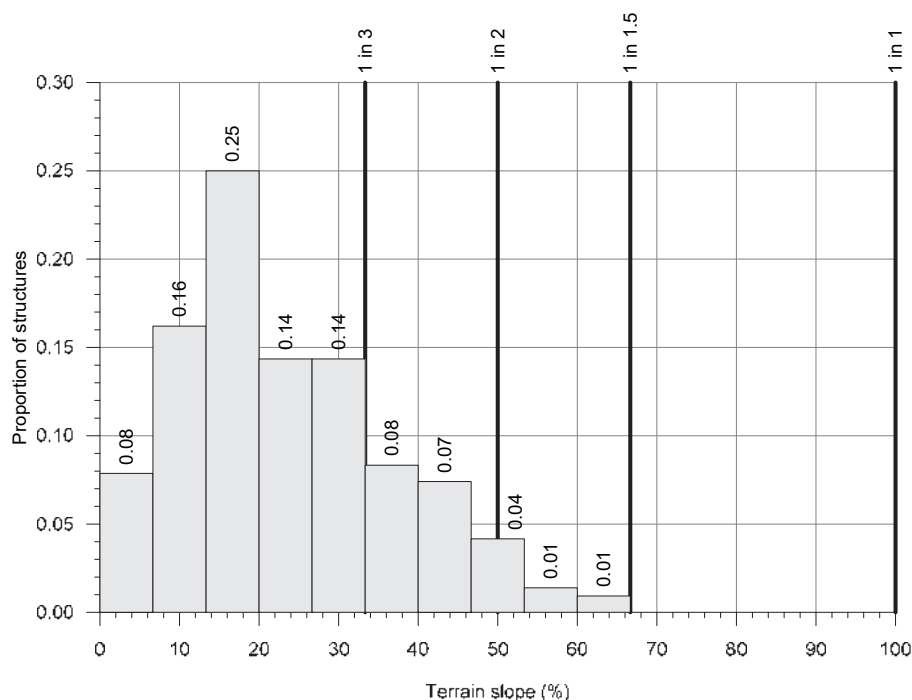


Fig. 6.23 Distribution of the maximum natural surface grades within 20 m of each of the houses within the Study Area

The maximum natural grades for 168 houses (i.e. 77 % of cases) within the Study Area are less than 1 in 3, i.e. less than the value used to define steep slopes. These houses therefore are not considered to be in close proximity to steep slopes. The maximum natural grades for the remaining houses are between 1 in 3 and 1 in 2 for 38 houses (i.e. 18 % of cases), between 1 in 2 and 1 in 1.5 for 10 houses (i.e. 5 % of cases) and greater than 1 in 1.5 for 1 house (i.e. 1 % of cases).

There are 65 houses within the Study Area that are located at the top of Razorback Range, of which, 6 houses are located above the existing and approved LW710A and LW711 and 26 houses are located above the proposed LW712 to LW716. The remaining 33 houses at the top of Razorback Range are located outside the mining area.

There are also 20 houses located on or near steep slopes at the bottom of Razorback Range or along the ridgelines within the Study Area, of which, 1 house is located above the existing LW710B and 16 houses are located above the proposed LW712 to LW716. The remaining 3 houses on or near steep slopes are located outside the mining area.

Houses outside declared Mine Subsidence Districts

The declared Mine Subsidence Districts (MSD) are shown in Drawing No. MSEC1459-14.

There are 216 houses (i.e. 99 %) that are located within the Wilton MSD which was declared on the 7 November 1979. The remaining 1 house (i.e. 1 %) is located within the South Campbelltown MSD which was declared on 30 June 1976.

It is estimated that less than 5 % of houses within the Study Area were constructed prior to the declarations of the Wilton MSD and South Campbelltown MSD. The hazard associated with these houses is that they may be less tolerant to mine subsidence movements as their designs have not been checked and approved by SA NSW (formally the Mine Subsidence Board). Some older houses may also be in poor condition. Many of the houses are constructed with timber frames and weatherboard panels or fibro sheets.

The analysis of impacts to structures as part of ACARP Research Project C12015 did not find any significant correlation between the rate of impact and structure age. In any case, ICHPL will conduct a building and/or structural inspection of the houses (where access is allowed) that were constructed prior to the declaration of the mine subsidence districts and that are predicted to experience more than 20 mm of subsidence due to the mining of the proposed longwalls.

6.22.2. Predictions for the houses

Predictions of conventional vertical subsidence, tilt and curvature have been made at the centroid and at the vertices of each house, as well as eight equally spaced points placed radially around the centroid and vertices at a distance of 20 m. In the case of a rectangular shaped structure, predictions have been made at a minimum of 45 points within and around the structure.

The maximum predicted values of total vertical subsidence, tilt and curvature for each of the houses within the Study Area are included in Table D.02, in Appendix D. The predicted tilts represent the maximum values in any direction after the completion of each of the proposed longwalls. The predicted curvatures represent the maximum values in any direction at any time during or after the mining of each of the proposed longwalls.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvatures for the houses is provided in Table 6.30. The table provides the maximum predicted values for the houses at any time during or after the mining of each longwall.

Table 6.30 Maximum predicted total vertical subsidence, tilt and curvatures for the houses

After longwall	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)
LW712	1375	6.5	0.07	0.14
LW713	1400	6.5	0.07	0.14
LW714	1400	6.5	0.07	0.14
LW715	1400	6.5	0.07	0.14
LW716	1425	6.5	0.07	0.14

The maximum predicted tilt for the houses is 6.5 mm/m (i.e. 0.65 % or 1 in 154). The maximum predicted curvatures are 0.07 km⁻¹ hogging and 0.14 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 7 km, respectively.

Distributions of the predicted vertical subsidence, tilt and curvatures for the houses within the Study Area are illustrated in Fig. 6.24 and Fig. 6.25.

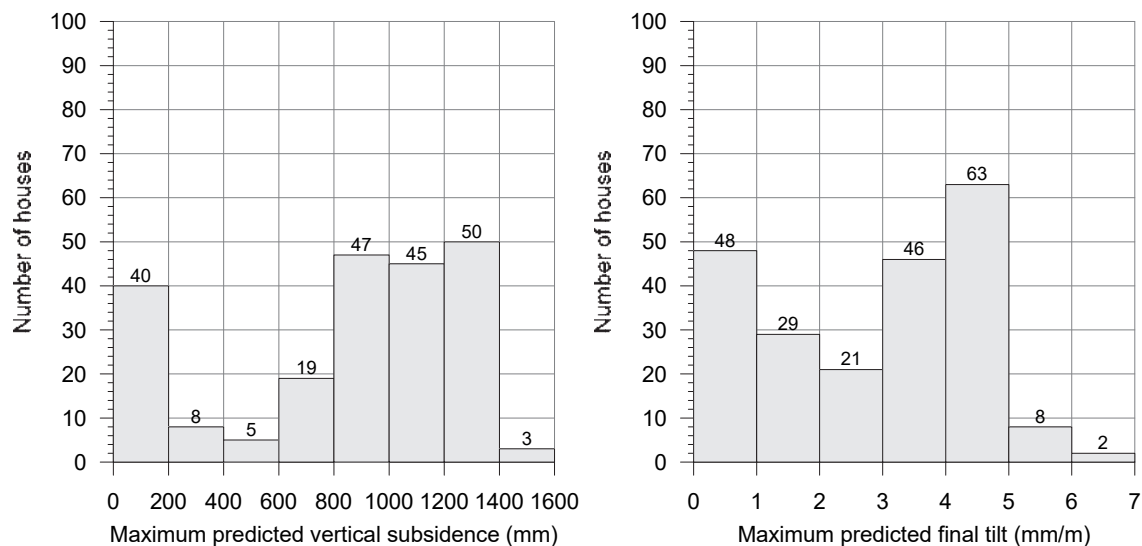


Fig. 6.24 Maximum predicted vertical subsidence (left-side) and tilt (right-side) for the houses

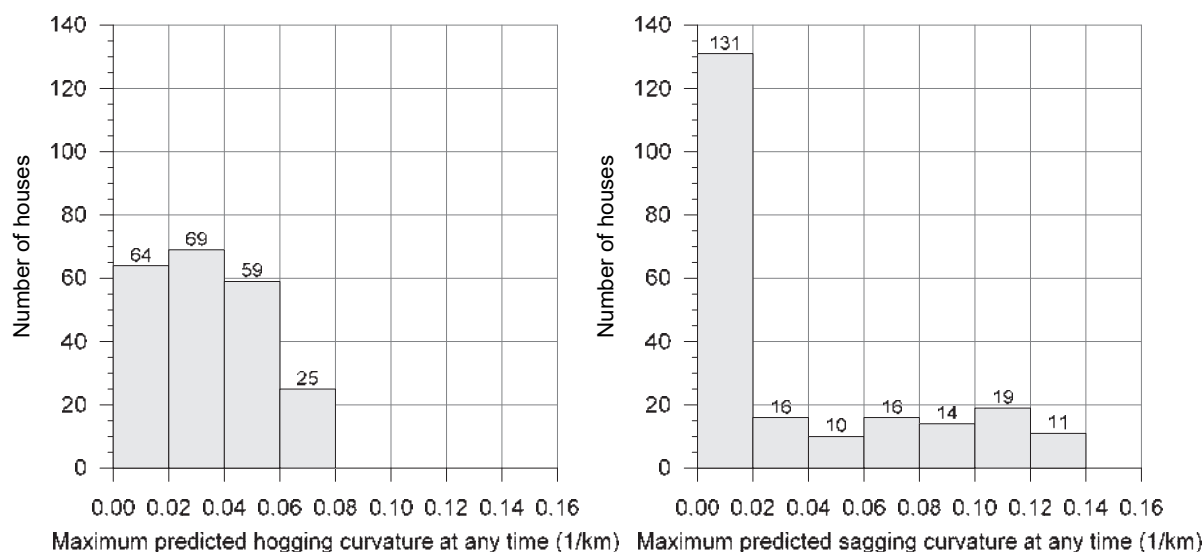


Fig. 6.25 Maximum predicted hogging curvature (left-side) and sagging curvature (right-side) for the houses

The maximum predicted conventional strains for the houses, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1 mm/m tensile and 2 mm/m compressive. Higher strains could develop at the houses due to irregular ground movements or topographic effects.

The predicted distributions of strain due to the mining of the proposed LW712 to LW716 are described in Chapter 4. The houses are at discrete locations and, therefore, the most relevant distribution of strain is the maximum strains measured in individual survey bays above previous longwall mining, which is summarised in Section 4.3.1. The maximum predicted total strains directly above the proposed longwalls are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

The strains have been predicted for each of the houses using the method described by Barbato (2017). This method considers the position of each house relative to the longwalls, the surface slope, surface lithology and the potential for irregular anomalous movements.

The predicted total strains for each of the houses within the Study Area are provided in Table D.02, in Appendix D. The distributions of the predicted total strains based on the mean and on the 95 % confidence levels are provided in Fig. 6.26 and Fig. 6.27, respectively.

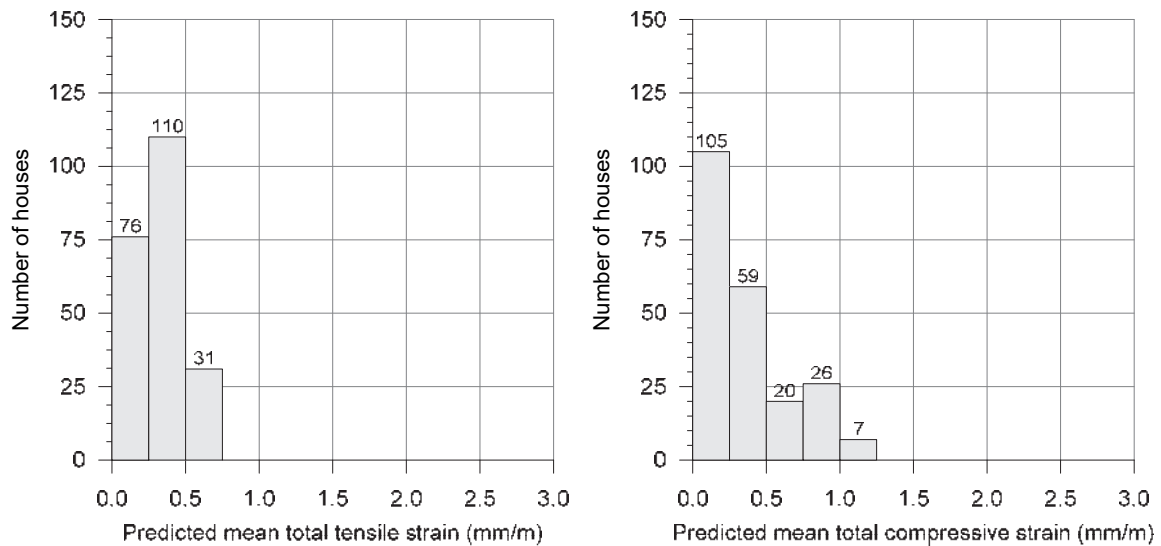


Fig. 6.26 Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the houses based on the mean

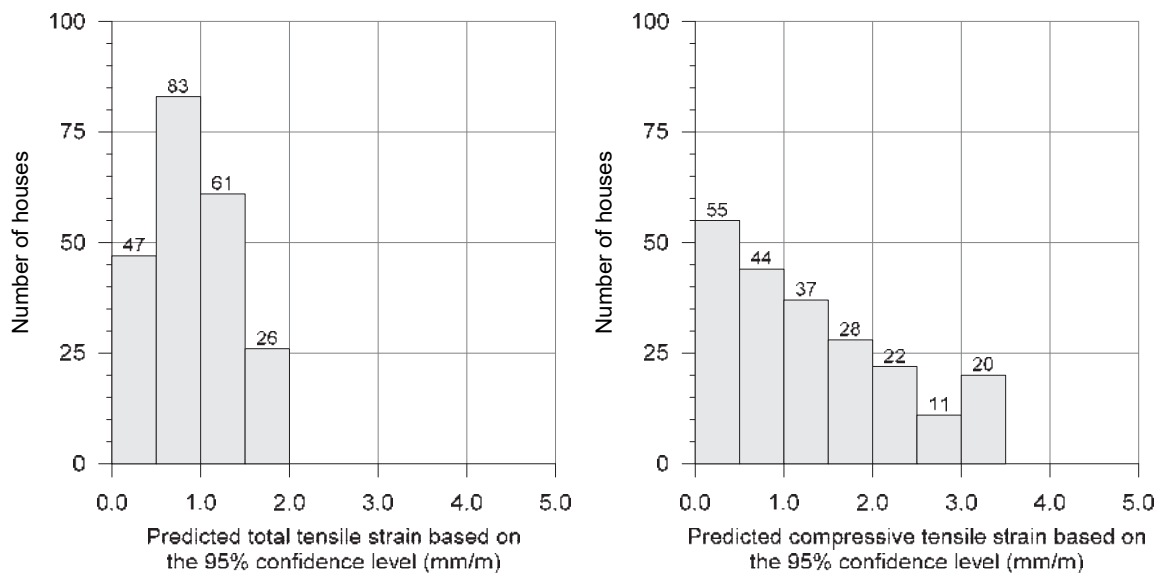


Fig. 6.27 Predicted total tensile strain (left-hand side) and total compressive strain (right-hand side) for the houses based on the 95 % confidence level

The houses within the Study Area are predicted to experience total tensile strains between 0.2 mm/m and 1.7 mm/m and total compressive strains between 0.2 mm/m and 3.4 mm/m based on the 95 % confidence levels. The predicted mean values range between 0.2 mm/m and 1.0 mm/m tensile and compressive.

6.22.3. Reported impacts for houses at Appin Area 7

The existing LW702 to LW709 have mined directly beneath 55 houses and there is an additional 74 houses located outside the mining area and within the 35° angle of draw. The impacts to these houses due to this existing mining should provide a guide to the potential impacts due to the proposed longwalls.

ICHPL has provided MSEC with details of the damage to houses that has been reported to them due to the mining of LW702 to LW710A. There are 30 claims that relate to damage of the houses that have been categorised into repair categories R0 to R5, as described in Appendix B.

A summary of the reported impacts for houses due to mining of LW702 to LW709 is provided in Table 6.31.

Table 6.31 Reported impacts for houses due to mining of LW702 to LW709

Location	Repair category			
	No Claim or R0	R1 or R2	R3 or R4	R5
Houses directly above the mining area (55 total)	51 % (28 houses)	25 % (14 houses)	20 % (11 houses)	4 % (2 houses)
Houses outside the mining area and within the 35° angle of draw (74 total)	96 % (71 houses)	4 % (3 house)	0 % (0 houses)	0 % (0 houses)
All houses within the 35° angle of draw (129 total)	76 % (99 houses)	13 % (17 houses)	9 % (11 houses)	2 % (2 houses)

It has been reported that 76 % of houses experienced Nil or Category R0 impacts, being 28 of the 55 houses (i.e. 51 %) located above the mining area and 71 of the 74 houses (i.e. 96 %) located outside the mining area. There were 17 houses (i.e. 13 %) that experienced Category R1 or R2 impacts, of which 14 houses (i.e. 25 %) were located above the mining area and 3 houses (i.e. 4 %) were located outside the mining area. There were also 11 houses (i.e. 9 %) that experience Category R3 or R4 impacts and 2 houses (i.e. 2 %) that experienced Category R5 impacts, all of which were located above the mining area.

In all cases, the houses remained in safe and serviceable conditions. The property owners were not exposed to immediate or sudden safety hazards due to the mining of LW702 to LW710A.

6.22.4. Impact assessments for the Houses

The following sections provide the impact assessments for the houses within the Study Area.

Potential impacts resulting from vertical subsidence

Vertical subsidence does not directly affect the stability or serviceability of houses. The potential for impacts on houses is affected by differential subsidence, which includes tilt, curvature and strain, and the impact assessments based on these parameters are described in the following sections.

Vertical subsidence can, in some cases, affect the heights of houses above the flood level. A detailed surface water assessment has been carried out by the special consultant on the project (HGEO, 2025a).

Potential impacts resulting from tilt

The maximum predicted tilt for the houses within the Study Area is 6.5 mm/m (i.e. 0.65 % or 1 in 154). The distribution of predicted final tilts for the houses within the Study Area is provided in Fig. 6.28. The greatest tilts occur at the houses located adjacent to the maingates of the existing and proposed longwalls.

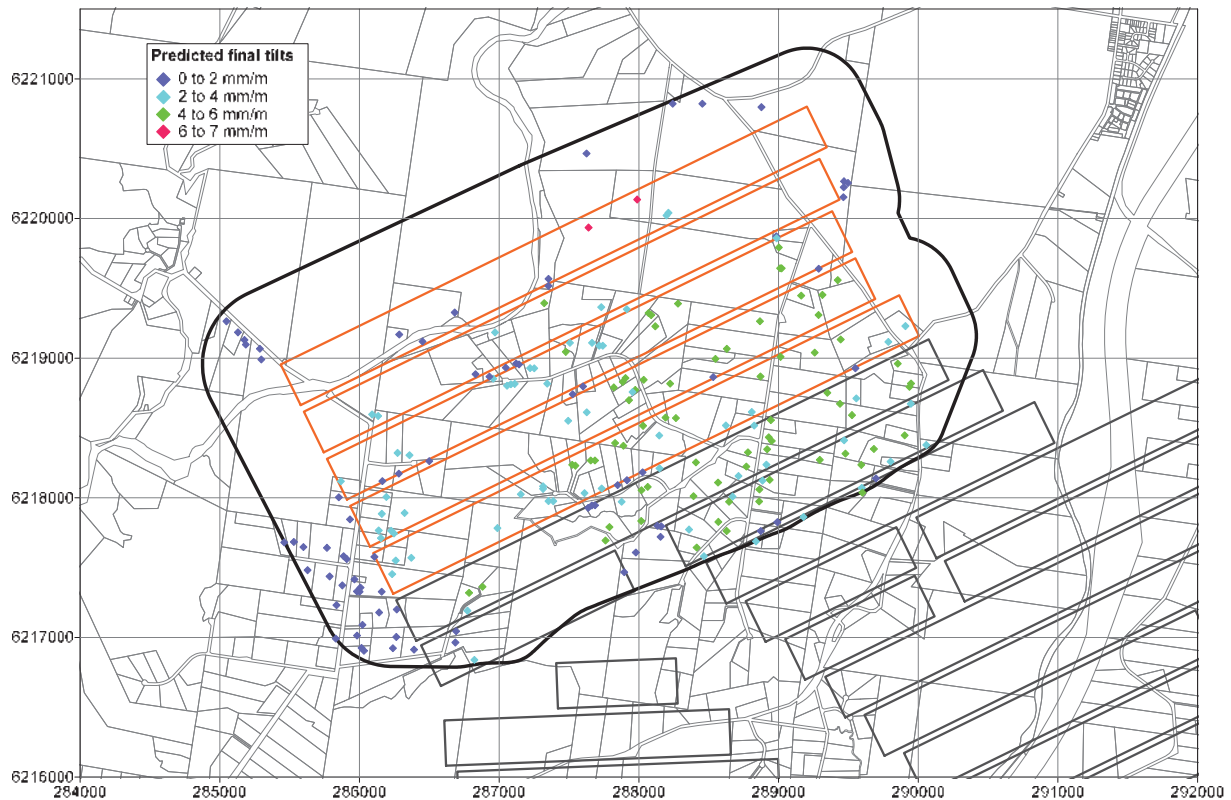


Fig. 6.28 Distribution of predicted final total tilts for the houses within the Study Area

It has been found from past longwall mining experience that tilts of 7 mm/m or less generally do not result in adverse impacts on houses. Some minor serviceability impacts can occur at these levels of tilt, including door swings and issues with roof gutter and wet area drainage, all of which can be remediated using normal building maintenance techniques.

It is expected, therefore, that only minor serviceability impacts would occur for the houses within the Study Area as a result of the mining-induced tilt. It is possible, however, that more substantial serviceability impacts could develop at some houses, as a result of non-conventional ground movements, which could require the relevening of wet areas or, in some cases, the relevening of parts of the building structures.

It is expected that, in all cases, the houses within the Study Area will remain in safe and serviceable condition as a result of the mining induced tilts, as tilts by themselves rarely impact on the stability of building structures at the levels that are predicted to occur.

Potential impacts resulting from curvature and strain

It has been found from past longwall mining experience that the majority of impacts on houses are a result of the mining-induced curvature and strains. The maximum predicted curvatures for the houses within the Study Area are 0.07 km^{-1} hogging and 0.14 km^{-1} sagging and they represent minimum radii of curvatures of 14 km and 7 km, respectively.

The distributions of the maximum predicted total hogging and sagging curvatures for the houses within the Study Area are provided in Fig. 6.29 and Fig. 6.30. The greatest predicted hogging curvatures occur adjacent to the maingates and the greatest predicted sagging curvatures occur near the centrelines of the existing and proposed longwalls.

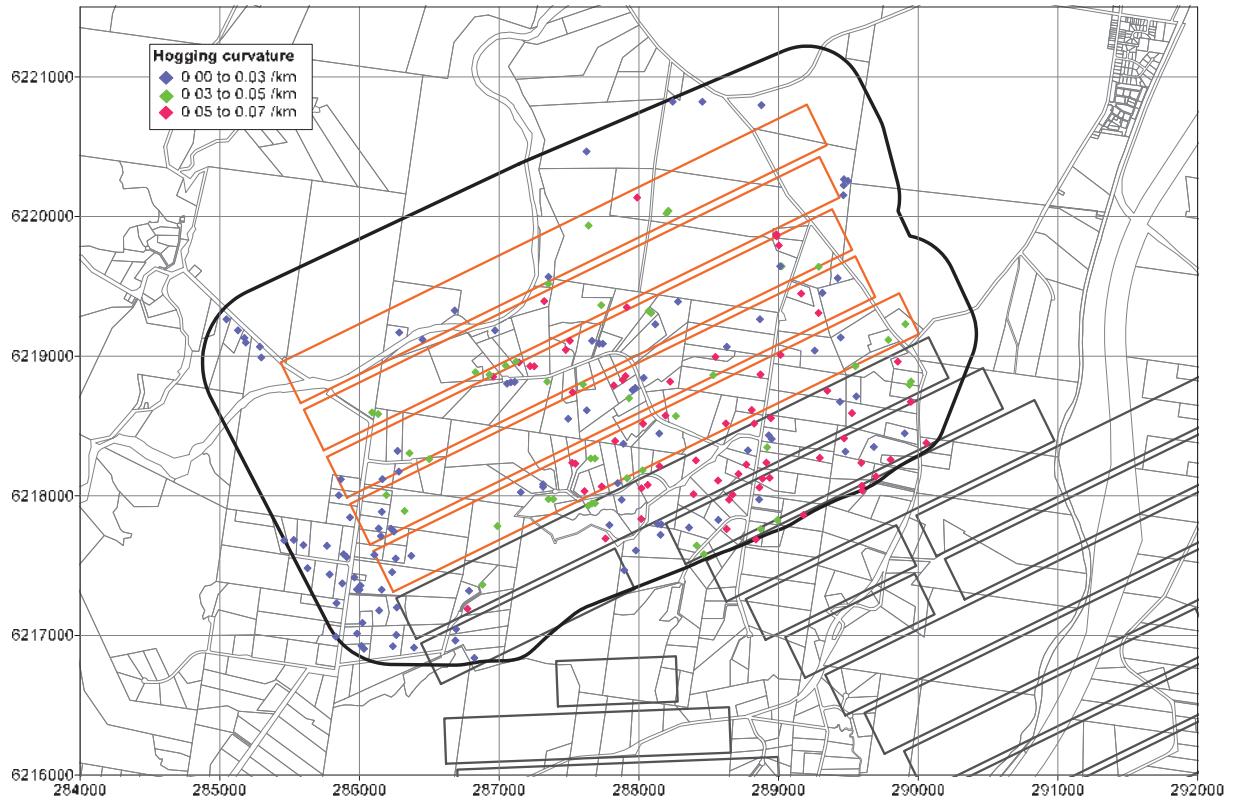


Fig. 6.29 Distribution of maximum predicted total hogging curvature for the houses within the Study Area

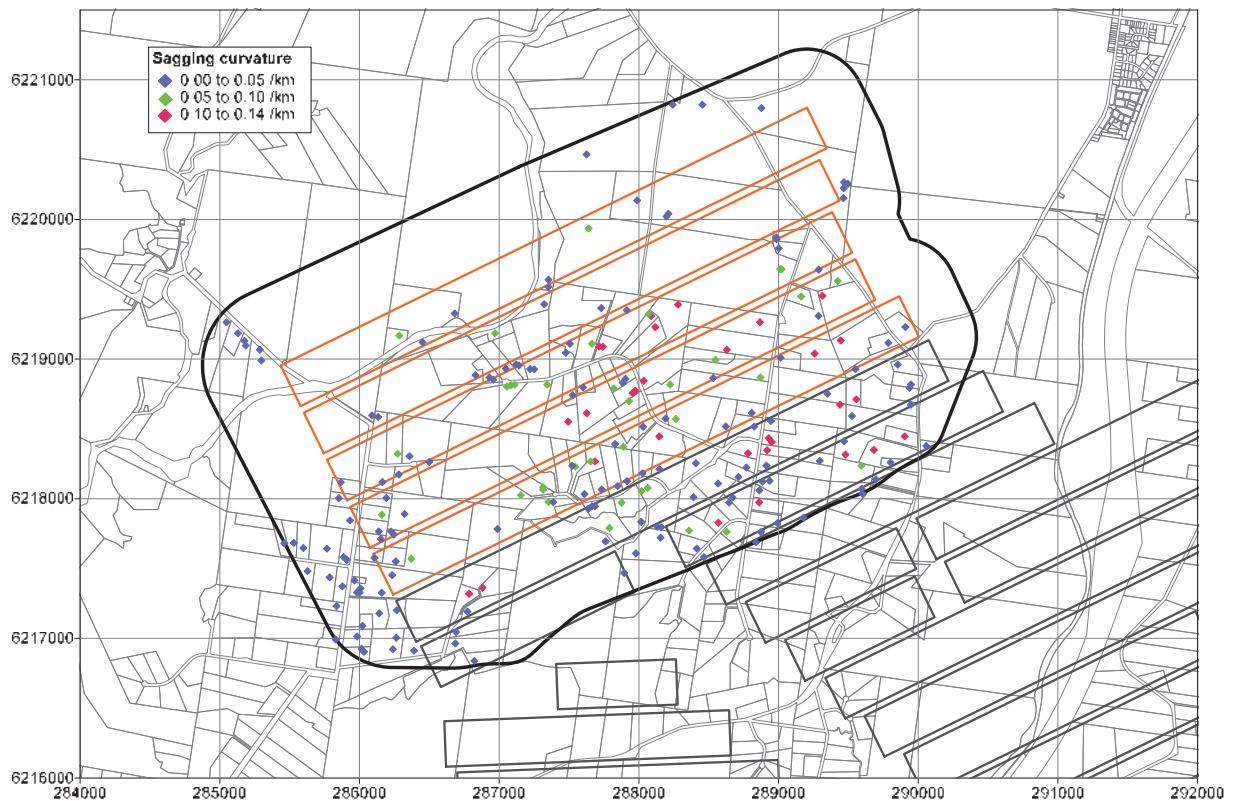


Fig. 6.30 Distribution of maximum predicted total sagging curvature for the houses within the Study Area

Building structures have been directly mined beneath at a number of mines throughout the NSW coalfields. The experience gained has provided substantial information that has been used to continually develop the methods of impact assessment for houses. The assessments provided in this report are based on the latest research which is summarised in Appendix B.

Trend analyses following the mining of longwalls in the Southern Coalfield indicate that the chance of impact is higher for the following houses:

- houses predicted to experience higher strains and curvatures;
- houses with masonry walls;
- masonry walled houses that are constructed on strip footings;
- larger houses; and
- houses with variable foundations, such as those with extensions added.

The probabilities of impacts for the houses within the Study Area have been assessed using the method developed as part of ACARP Research Project C12015 (Waddington, 2009) which has been updated based on more recent observations of impacts in the Southern Coalfield. This method uses the primary parameters of ground curvature and type of construction and is described in Appendix B. The parameter of strain is indirectly used in this method due to its relationship with curvature.

The maximum natural grades within 20 m of each of the houses within the Study Area (refer to Fig. 6.23) are less than 1 in 3 for 77 % of cases, between 1 in 3 and 1 in 2 for 18 % of cases and greater than 1 in 2 in 5 % of cases. The natural grades in close proximity to the houses within the Study Area are reasonably similar to those where houses have been directly mined beneath elsewhere in the Southern Coalfield. The ACARP method for assessing impacts on houses should therefore provide a reasonable indication of the overall levels of potential impact for the houses within the Study Area. However, some houses that are located on or near the steep slopes could experience higher impacts and this is discussed separately in Section 6.22.5.

A summary of the maximum predicted subsidence effects and the assessed impacts for the houses within the Study Area is provided in Table D.02, in Appendix D. The overall distribution of the assessed impacts for the houses within the Study Area is provided in Table 6.32. The assessments have been conservatively based on all houses comprising brick structures on strip footings.

Table 6.32 Assessed impacts for the houses within the Study Area

Location	Repair category			
	No Claim or R0	R1 or R2	R3 or R4	R5
Houses directly above the mining area (172 total)	47 % ~ 59 %	26 % ~ 32 %	12 % ! 16 %	3 % ~ 5 %
Houses outside the mining area (45 total)	83 % - 94 %	5 % - 11 %	1 % - 5 %	0 % - 1 %
All houses within the Study Area (217 total)	56 % - 67 %	22 % - 28 %	9 % - 13 %	2 % - 3 %

The repair categories R0 to R5 are described in Appendix B.

It has been assessed that approximately 56 % to 67 % of the houses within the Study Area will experience Nil or Category R0 impacts, approximately 22 % to 28 % will experience Category R1 or R2 impacts, approximately 9 % to 13 % will experience Category R3 or R4 impacts and approximately 2 % to 3 % will experience Category R5 impacts.

The reported impacts to houses due to the mining of LW702 to LW710A is described in Section 6.22.3. There were 129 houses located above the mining area or within the 35° angle of draw, of which, 76 % experienced Nil or Category R0 impacts, 13 % experienced Category R1 or R2 impacts, 9 % experienced Category R3 or R4 impacts and 2 % experienced Category R5 impacts.

The assessed impacts for the houses within the Study Area due to the proposed LW712 to LW716 are similar to that reported for the existing LW702 to LW709. While the assessed rate for minor impacts (i.e. R1 or R2) is greater for the proposed longwalls, the assessed rates for major impacts (i.e. R3, R4 or R5) are similar.

Severe impacts have previously occurred as a result of substantial non-conventional movements and in plateau areas away from incised valleys, the locations of which cannot be predicted before mining. The impacts, however, develop gradually such that they can be detected early and repairs can be undertaken incrementally to ensure that the houses remain safe and serviceable during mining.

As noted in Appendix B, at the time of writing ACARP Research Project C12015, the observed proportion of houses where SA NSW and affected landowners had decided to rebuild rather than repair (Category R5) impacts was less than 0.5 %. Since the publication of the research report, the proportion of houses where a decision has been made to rebuild has increased to approximately 1 %.

The observed proportion of houses with Category R1 to R4 impacts have also increased since the original ACARP study. This is partly due to the time lag effect between the mining impact, when damage is claimed by residents and when the nature and level of the damage requiring repairs is assessed in detail by SA NSW.

The primary risk associated with mining beneath houses is public safety. Historically, residents have not been exposed to immediate and sudden safety hazards as a result of impacts that occur due to mine subsidence movements in the NSW coalfields, where the depths of cover were greater than 400 m, such as the case above the proposed longwalls.

Emphasis is placed on the words “immediate and sudden” as in rare cases, some structures have experienced severe impacts, but the impacts did not present an immediate risk to public safety as they developed gradually with ample time for residents to relocate.

All houses within the Study Area are expected to remain safe throughout the mining period, provided that effective management measures are adopted during mining and these are described in the following section.

6.22.5. Houses located on or near steep slopes

Houses are located on or near steep slopes within the Study Area. These include houses at the top and near the base of Razorback Range in the western part of the Study Area. There are also other houses located along ridgelines in the eastern part of the Study Area.

The houses located on or near steep slopes are shown in Table D.01, in Appendix D.

A summary of the maximum predicted subsidence effects for the 65 houses located at the top of Razorback Range is provided in Table 6.33. The houses have been tabulated based on their locations above the longwalls or outside the mining area. The predicted subsidence effects are the maximum values within 20 m of the houses after the completion of all longwalls.

Table 6.33 Maximum predicted subsidence effects for the houses at the top of Razorback Range

Longwall(s)	Number of houses directly above longwall	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)
LW710A and LW711	6	1250	5.5	0.06	0.14
LW712	5	975	4.0	0.03	0.07
LW713	7	1025	4.0	0.04	0.06
LW714	6	1175	3.0	0.04	0.08
LW715	4	1175	4.0	0.05	0.09
LW716	5	900	2.0	0.05	0.09
Outside the mining area	33	225	2	0.02	< 0.01

A summary of the maximum predicted subsidence effects for the 20 houses located on or near steep slopes at the bottom of Razorback Range or along the ridgelines is provided in Table 6.34. The houses have been tabulated based on their locations above the longwalls or outside the mining area. The predicted subsidence effects are the maximum values within 20 m of the houses after the completion of all longwalls.

Table 6.34 Maximum predicted subsidence effects for the houses on or near steep slopes at the bottom of Razorback Range and along the associated ridgelines

Longwall(s)	Number of houses directly above longwall	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)
LW710B	1	975	3.5	0.02	0.06
LW712	4	1250	4	0.04	0.10
LW714	6	1200	4	0.06	0.09
LW715	5	975	3	0.05	0.01
LW716	1	900	6	0.05	0.09
Outside the mining area	3	250	2	0.02	< 0.01

The steep slopes on Razorback Range and the ridgelines could experience increased horizontal movements in the downslope direction, causing tension cracks to appear at the tops and along the sides of the slopes and compression ridges to form at the bottoms of the slopes. The houses located at the top of Razorback Range and the ridgelines could experience increased effects due to the potential for non-conventional ground movements. The assessment method for houses is based on observations of mining beneath houses on steep slopes with similar ranges of grades.

A Landslide Risk Assessment (LRA) for the proposed LW712 to LW716 has been carried out by SLR (2025). Monitoring and management measures have been recommended by SLR (2025) for properties located on the steep slopes associated with Razorback Range.

Monitoring has been established for the houses located at the top of Razorback Range for the mining of the existing and approved LW709 to LW712, as shown in Drawing No. MSEC1459-01. The monitoring includes Global Navigation Satellite System (GNSS) units on the private properties and survey marks around the houses.

Additional GNSS units and survey marks will be established on the private properties located at the top of Razorback Range and above the mining area where access is permitted by the landowners. Ground monitoring lines will also be established along the public roads at the top of Razorback Range including Remembrance Drive, Donalds Range Road and Hercules Drive.

Further ground monitoring lines and GNSS units will be established for LW712 to LW716 as part of the Structures Management Plans for these proposed longwalls.

6.22.6. Management of potential impacts on houses

ICHPL has extensive experience of mining beneath houses at Appin and West Cliff Collieries. It has developed and acted in accordance with risk management plans to manage potential impacts to residential structures during the mining of LW701 to LW710A and LW901 to LW905.

The Subsidence Management Process has been developed in consideration of the following facts and observations:

1. Australian standards have been available for use in the design of structures since 1948. The majority of the houses within the Study Area have been constructed within and after the declaration of the Wilton MSD and South Campbelltown MSD;
2. there is sufficient redundancy in structural design such that ductile deformation will develop and be noticeable to residents before structural failure occurs;
3. subsidence movements develop gradually over time at Appin Mine as they have above other previously extracted longwalls at similar depths of cover;
4. experiences during the mining at Appin Mine and other collieries in the Southern Coalfield have found that the most effective method of managing potential impacts on the safety and serviceability of structures are by way of community consultation. Residents living within the active subsidence zone have often provided early feedback to Appin Mine and/or SA NSW about impacts developing at their houses or along their local roads. Contact is made well before impacts develop to a level of severity sufficient to become a safety hazard;
5. on the basis of the above, there is sufficient time for residents to notify ICHPL or SA NSW of significant displacement or deflection well before structural failure will occur;

6. the conclusions are supported by the observation that residents have not been exposed to immediate and sudden safety hazards as a result of impacts that occur due to mine subsidence movements at Appin Mine or other collieries in the Southern Coalfield at similar depths of cover. This includes the recent experience at Tahmoor Mine during the mining of Longwalls 22 to 32, which have affected more than 2000 houses and civil structures; and
7. while severe impacts have developed during mining, there is sufficient redundancy in structural design such that when structures have experienced severe impacts, they have developed gradually with ample time for residents to notify ICHPL or SA NSW to repair the structure and/or relocate residents before structural failure occurs.

While the three most important factors in managing risks to public safety are redundancy in structural design, gradual development of subsidence movements and an effective community consultation program, a number of additional management measures have been undertaken, including site specific investigations, regular surveys and inspections during mining and triggered response measures.

With appropriate management plans in place, it is considered that the houses will remain safe at all times during the extraction of the proposed longwalls, even if actual subsidence movements were greater than the predictions or substantial non-conventional movements occurred.

Impacts to the houses would be repaired or, if required, replaced in accordance with the *Coal Mine Subsidence Compensation Act 2017*.

6.23. Associated residential structures

6.23.1. Non-residential building structures

The descriptions, predictions and impact assessments for the rural structures are provided in Section 6.12.

6.23.2. Swimming pools

The swimming pools are shown in Drawing No. MSEC1459-14.

There are 70 privately owned swimming pools that have been identified within the Study Area. Details of the pools are included in Table D.01, in Appendix D. A summary of the swimming pools within the Study Area is provided in Table 6.35.

Table 6.35 Details of the swimming pools within the Study Area

Type	Longwall	Number located above the longwall(s)	Percentage of houses located above longwall(s) within the Study Area
Existing and approved longwalls	LW710B	9	13 %
	LW711	11	15 %
	LW712	20	28 %
	LW713	5	7 %
Proposed longwalls	LW714	6	8 %
	LW715	3	4 %
	LW716	3	4 %
Solid Coal		15	21 %
Total		72	100 %

There are 20 pools (i.e. 28 %) that are located above the existing and approved LW710A and LW711, 37 pools (i.e. 51 %) located above the proposed LW712 to LW716 and 15 pools (i.e. 21 %) that are located outside the mining area.

Predictions of conventional subsidence, tilt and curvature have been made at the centroid and around the perimeters of each pool. A summary of the maximum predicted values of conventional subsidence, tilt and curvature for each pool within the Study Area is provided in Table D.02, in Appendix D.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvatures for the swimming pools is provided in Table 6.36. The table provides the maximum predicted values for the pools at any time during or after the mining of each longwall.

Table 6.36 Maximum predicted total vertical subsidence, tilt and curvatures for the pools

After longwall	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)
LW712	1400	6.5	0.07	0.12
LW713	1400	6.5	0.07	0.12
LW714	1400	6.5	0.07	0.12
LW715	1400	6.5	0.07	0.12
LW716	1400	6.5	0.07	0.12

The maximum predicted tilt for the pools is 6.5 mm/m (i.e. 0.65 % or 1 in 154). The maximum predicted curvatures are 0.07 km⁻¹ hogging and 0.12 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 8 km, respectively.

The predicted distributions of strain due to the proposed mining are described in Chapter 4. The pools are at discrete locations and, therefore, the most relevant distribution of strain is the maximum strains measured in individual survey bays above previous longwall mining, which is summarised in Section 4.3.1. The maximum predicted total strains directly above the proposed longwalls are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

Mining-induced tilts are more noticeable in pools than other structures due to the presence of the water line and the small gap to the edge coping, particularly when the pool lining has been tiled. Skimmer boxes are also susceptible to being lifted above the water line due to mining tilt.

The Australian Standard AS2783-1992 (Use of reinforced concrete for small swimming pools) requires that pools be constructed level ± 15 mm from one end to the other. This represents a tilt of approximately 3.3 mm/m for pools that are 10 metres in length. Australian Standard AS/NZS 1839:1994 (Swimming pools – Pre-moulded fibre-reinforced plastics – Installation) also requires that pools be constructed with a tilt of 3 mm/m or less.

It can be seen from Table D.02, that 41 pools within the Study Area (i.e. 57 % of the total) are predicted to experience final tilts greater than 3 mm/m, at the completion of the proposed longwalls, which is greater than the Australian Standard. It is likely, therefore that these pools would require remediation of the pool copings after the completion of active subsidence. It is possible, if the tilts were fully realised at the pools with the higher predicted tilts, that the final tilts could be difficult to remediate and, in these cases, the pools would need to be rebuilt.

The ranges of predicted maximum curvatures and strains for the pools are similar to those previously experienced at Appin Mine and other nearby collieries in the Southern Coalfield. The incidence and levels of impacts on the pools within the Study Area, therefore, are expected to be similar to those previously experienced in the Southern Coalfield.

Observations during the mining of Tahmoor Mine Longwalls 22 to 32 have shown that pools, particularly in-ground pools, are more susceptible to severe impacts than houses and other structures. Pools cannot be easily repaired and most of the impacted pools need to be replaced in order to restore them to pre-mining condition or better.

As of June 2017, a total of 157 pools have experienced mine subsidence movements during the mining of Tahmoor Mine Longwalls 22 to 30, of which 141 were located directly above the extracted longwalls. A total of 36 pools have reported impacts, all of which were located directly above the extracted longwalls. This represents an impact rate of approximately 23 %. A higher proportion of impacts have been observed for in-ground pools, particularly fibreglass pools. The majority of the impacts related to tilt or cracking, though in a small number of cases the impacts were limited to damage to skimmer boxes or the edge coping.

In addition to the above, a number of pool gates have been impacted by mine subsidence during the mining of Longwall 22 to 32. While the gates can be easily repaired, the consequence of breaching pool fence integrity is considered to be severe. As a result, with landholder agreement, ICHPL inspects the integrity of pool fences regularly during the active subsidence period.

Impacts to the pools, fences and gates would be repaired or, if required, replaced in accordance with the *Coal Mine Subsidence Compensation Act 2017*.

6.23.3. Tennis and Basketball Courts

The tennis and basketball courts are shown in Drawing No. MSEC1459-14.

There are 7 tennis courts and 1 basketball court that have been identified within the Study Area. Details of these courts are included in Table D.01, in Appendix D. A summary of the tennis and basketball courts within the Study Area is provided in Table 6.37.

Table 6.37 Details of the tennis courts within the Study Area

Type	Reference	Location
Tennis courts	D07r01	Above LW712
	D23r01	Above LW711
	F19r03	Outside mining area
	F21r02	Above LW710B
	F34r02	Above LW711
	F60r03	Above LW716
	O09r02	Outside mining area
Basketball court	S01r06	Above LW712

Predictions of conventional subsidence, tilt and curvature have been made at the centroid and around the perimeters of each tennis court. A summary of the maximum predicted values of conventional subsidence, tilt and curvature for each tennis court within the Study Area is provided in Table D.02, in Appendix D.

A summary of the maximum predicted values of total vertical subsidence, tilt and curvatures for the tennis courts and basketball court is provided in Table 6.38. The table provides the maximum predicted values for the courts at any time during or after the mining of each longwall.

Table 6.38 Maximum predicted total vertical subsidence, tilt and curvatures for the tennis courts

Type	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)
Tennis courts	1400	5.0	0.06	0.12
Basketball court	875	3.5	0.07	0.01

The maximum predicted tilt for the tennis and basketball courts is 5.0 mm/m (i.e. 0.5 % or 1 in 200). The maximum predicted curvatures are 0.07 km⁻¹ hogging and 0.12 km⁻¹ sagging and they represent minimum radii of curvature of 14 km and 8 km, respectively.

The predicted distributions of strain due to the proposed mining are described in Chapter 4. The tennis and basketball courts are at discrete locations and, therefore, the most relevant distribution of strain is the maximum strains measured in individual survey bays above previous longwall mining, which is summarised in Section 4.3.1. The maximum predicted total strains directly above the proposed longwalls are 1.0 mm/m tensile and 1.6 mm/m compressive based on the 95 % confidence levels.

The tennis and basketball courts within the Study Area comprise both grass and concrete surfaces. It is possible that the maximum predicted curvatures and strains could result in minor cracking in the grass surfaced tennis courts; however, cracking is expected to be minor and easily repairable. It is expected that ground strains of these magnitudes would arch around the concrete tennis courts and not be fully transferred into the pavements. It is possible, that some minor surface cracking could occur in the concrete surfaces, but it is expected to be of a minor nature and easily repairable.

6.23.4. Rigid external pavements

Adverse impacts on rigid external pavements, such as driveways and footpaths, are often reported to SA NSW in the Southern Coalfield. This is because pavements are typically thin relative to their length and width. The design of external pavements is also not regulated by Council or SA NSW.

A study by MSEC of 120 properties at Tahmoor and Thirlmere indicated that 98 % of the properties with external concrete pavements demonstrated some form of cracking prior to mining. These cracks are sometimes difficult to distinguish from cracks caused by mine subsidence. It is therefore uncertain how many claims for damage can be genuinely attributed to mine subsidence impacts.

Impacts to external pavements would be repaired or, if required, replaced in accordance with the *Coal Mine Subsidence Compensation Act 2017*.

6.24. Conclusion

The assessments provided in this report indicate that the assessed levels of impact on the natural and built features can be managed by the preparation and implementation of appropriate management strategies. It should be noted, however, that more detailed assessments of some natural and built features have been undertaken by other specialist consultants, and the findings in this report should be read in conjunction with the findings in all other relevant reports.

7.0 GLOSSARY OF TERMS AND DEFINITIONS

Some of the more common mining terms used in the report are defined below:

Angle of draw	The angle of inclination from the vertical of the line connecting the goaf edge of the workings and the limit of subsidence (which is usually taken as 20 mm of subsidence).
Chain pillar	A block of coal left unmined between the longwall extraction panels.
Cover depth (H)	The depth from the surface to the top of the seam. Cover depth is normally provided as an average over the area of the panel.
Closure	The reduction in the horizontal distance between the valley sides. The magnitude of closure, which is typically expressed in the units of <i>millimetres (mm)</i> , is the greatest reduction in distance between any two points on the opposing valley sides. It should be noted that the observed closure movement across a valley is the total movement resulting from various mechanisms, including conventional mining-induced movements, valley closure movements, far-field effects, downhill movements and other possible strata mechanisms.
Critical area	The area of extraction at which the maximum possible subsidence of one point on the surface occurs.
Curvature	The change in tilt between two adjacent sections of the tilt profile divided by the average horizontal length of those sections, i.e. curvature is the second derivative of subsidence. Curvature is usually expressed as the inverse of the Radius of Curvature with the units of <i>1/kilometres (km⁻¹)</i> , but the value of curvature can be inverted, if required, to obtain the radius of curvature, which is usually expressed in <i>kilometres (km)</i> . Curvature can be either hogging (i.e. convex) or sagging (i.e. concave).
Extracted seam	The thickness of coal that is extracted. The extracted seam thickness is thickness normally given as an average over the area of the panel.
Effective extracted seam thickness (T)	The extracted seam thickness modified to account for the percentage of coal left as pillars within the panel.
Face length	The width of the coalface measured across the longwall panel.
Far-field movements	The measured horizontal movements at pegs that are located beyond the longwall panel edges and over solid unmined coal areas. Far-field horizontal movements tend to be bodily movements towards the extracted goaf area and are accompanied by very low levels of strain.
Goaf	The void created by the extraction of the coal into which the immediate roof layers collapse.
Goaf end factor	A factor applied to reduce the predicted incremental subsidence at points lying close to the commencing or finishing ribs of a panel.
Horizontal displacement	The horizontal movement of a point on the surface of the ground as it settles above an extracted panel.
Inflection point	The point on the subsidence profile where the profile changes from a convex curvature to a concave curvature. At this point the strain changes sign and subsidence is approximately one half of S max.
Incremental subsidence	The difference between the subsidence at a point before and after a panel is mined. It is therefore the additional subsidence at a point resulting from the excavation of a panel.
Panel	The plan area of coal extraction.
Panel length (L)	The longitudinal distance along a panel measured in the direction of mining from the commencing rib to the finishing rib.
Panel width (W_v)	The transverse distance across a panel, usually equal to the face length plus the widths of the roadways on each side.
Panel centre line	An imaginary line drawn down the middle of the panel.
Pillar	A block of coal left unmined.
Pillar width (W_{pi})	The shortest dimension of a pillar measured from the vertical edges of the coal pillar, i.e. from rib to rib.

Shear deformations	The horizontal displacements that are measured across monitoring lines and these can be described by various parameters including; horizontal tilt, horizontal curvature, mid-ordinate deviation, angular distortion and shear index.
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points, i.e. strain is the relative differential displacement of the ground along or across a subsidence monitoring line. Strain is dimensionless and can be expressed as a decimal, a percentage or in parts per notation. Tensile Strains are measured where the distance between two points or survey pegs increases and Compressive Strains where the distance between two points decreases. Whilst mining-induced strains are measured along monitoring lines, ground shearing can occur both vertically, and horizontally across the directions of the monitoring lines.
Sub-critical area	An area of panel smaller than the critical area.
Subsidence	The vertical movement of a point on the surface of the ground as it settles above an extracted panel, but, 'subsidence of the ground' in some references can include both a vertical and horizontal movement component. The vertical component of subsidence is measured by determining the change in surface level of a peg that is fixed in the ground before mining commenced and this vertical subsidence is usually expressed in units of <i>millimetres (mm)</i>. Sometimes the horizontal component of a peg's movement is not measured, but in these cases, the horizontal distances between a particular peg and the adjacent pegs are measured.
Super-critical area	An area of panel greater than the critical area.
Tilt	The change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the horizontal distance between those points. Tilt is, therefore, the first derivative of the subsidence profile. Tilt is usually expressed in units of <i>millimetres per metre (mm/m)</i> . A tilt of 1 mm/m is equivalent to a change in grade of 0.1 % or 1 in 1000.
Uplift	An increase in the level of a point relative to its original position.
Upsidence	Upsidence results from the dilation or buckling of near-surface strata at or near the base of the valley. The magnitude of upsidence, which is typically expressed in the units of <i>millimetres (mm)</i> , is the difference between the observed subsidence profile within the valley and the conventional subsidence profile which would have otherwise been expected in flat terrain.

APPENDIX A. REFERENCES

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APPENDIX B. METHOD OF IMPACT ASSESSMENTS FOR HOUSES

APPENDIX B METHOD OF IMPACT ASSESSMENT FOR HOUSES

B.1. Introduction

The methods for predicting and assessing impacts on building structures have developed over time as knowledge and experience has grown. MSEC has provided predictions and impact assessments for the building structures using the latest methods available at the time.

Extensive research on the damage to building structures due to underground mining was carried out as part of ACARP Research Project C12015 (Waddington, 2009). That research was based on extensive longwall mining beneath building structures in the Southern Coalfield including Appin, West Cliff, Tower and Tahmoor Collieries. The most extensive data at that time came from the mining of Tahmoor Mine Longwalls 22 to 29 where approximately 1900 houses had experienced subsidence effects.

Substantial more ground monitoring data and experience of impacts on building structures have also been collected since the completion of ACARP Research Project C12015 in 2009. The methods to predict and assess damage to building structures have been refined based on the latest information.

B.2. Impact classification

The classification of damage for building structures has been based on the categories provided in Table C1 of Australian Standard AS2870 (2011). The descriptions of damage have been expanded to include other serviceability and structural impacts not covered by the Australian Standard.

The impact classifications for building structures provided in ACARP Research Project C12015 (Waddington, 2009) are provided in Table B.1. The classifications are based on the extent of repairs.

Categories R0 to R3 represents serviceability impacts or minor damage. Categories R3 and R4 represent major damage that may affect the structural integrity. Category R5 represents major damage where the cost of repair may exceed the cost of rebuilding the structure.

Table B.1 Impact classification based on the extent of repairs

Repair Category	Extent of Repairs
Nil	No repairs required
R0 Adjustment	One or more of the following, where the damage does not require the removal or replacement of any external or internal claddings or linings:- - Door or window jams or swings, or - Movement of cornices, or - Movement at external or internal expansion joints.
R1 Very Minor Repair	One or more of the following, where the damage can be repaired by filling, patching or painting without the removal or replacement of any external or internal brickwork, claddings or linings:- - Cracks in brick mortar only, or isolated cracked, broken, or loose bricks in the external façade, or - Cracks or movement < 5 mm in width in any external or internal wall claddings, linings, or finish, or - Isolated cracked, loose, or drummy floor or wall tiles, or - Minor repairs to any services or gutters.
R2 Minor Repair	One or more of the following, where the damage affects a small proportion of external or internal claddings or linings, but does not affect the integrity of external brickwork or structural elements:- - Continuous cracking in bricks < 5 mm in width in one or more locations in the total external façade, or - Slippage along the damp proof course of 2 to 5 mm anywhere in the total external façade, or - Cracks or movement ≥ 5 mm in width in any external or internal wall claddings, linings, finish, or - Several cracked, loose or drummy floor or wall tiles, or - Replacement of any services.
R3 Substantial Repair	One or more of the following, where the damage requires the removal or replacement of a large proportion of external brickwork, or affects the stability of isolated structural elements:- - Continuous cracking in bricks of 5 to 15 mm in width in one or more locations in the total external façade, or - Slippage along the damp proof course of 5 to 15 mm anywhere in the total external façade, or - Loss of bearing to isolated walls, piers, columns, or other load-bearing elements, or - Loss of stability of isolated structural elements.
R4 Extensive Repair	One or more of the following, where the damage requires the removal or replacement of a large proportion of external brickwork, or the replacement or repair of several structural elements:- - Continuous cracking in bricks > 15 mm in width in one or more locations in the total external façade, or - Slippage along the damp proof course of 15 mm or greater anywhere in the total external façade, or - Relevelling of building, or - Loss of stability of several structural elements.
R5 Re-build	Extensive damage to house where the MSB (now SA NSW) and the owner have agreed to rebuild as the cost of repair is greater than the cost of replacement.

B.3. Relationships between ground movements and damage

Trend analyses were carried out as part of ACARP Research Project C12015 (Waddington, 2009) to identify relationships between ground movements and damage to building structures. The following observations were found from that research:

- *Ground tilt*

This was found to be an ineffective parameter for assessing potential impacts as ground tilts have been relatively benign and a low number of claims have been made solely in relation to tilt.

- *Ground strain*

There is a clear link between ground strain and impacts to building structures, particularly compressive strain. The difficulty with adopting ground strain as a predictive factor lies in the ability to accurately predict ground strain at a point.

The above issue is less problematic for curvature and the statistical analysis on the relationship between strain and curvature shows that the observed frequency of high strains increased with increasing observed curvature.

- *Ground curvature*

Curvature appears to be considered to be the most effective subsidence parameter for assessing the potential impacts on building structures. The trend analysis shows that the frequency of impacts increased with increasing observed curvatures.

It should be noted that we are referring to conventional curvature and not curvatures that have developed as a result of non-conventional subsidence behaviour. This is because conventional curvature can be readily predicted with reasonable correlation with observations. It is also a relatively straight-forward exercise to estimate the observed smoothed or “conventional” mining-related curvature that has previously been experienced at houses.

Non-conventional curvature cannot be predicted prior to mining and is accounted for by using a probabilistic method of impact assessment. It has also been shown that the observed frequency of high strains increased with increasing observed curvature.

- *Position of structure relative to longwall*

There is a clear trend showing that structures located directly above longwalls are substantially more likely to experience impacts. An effective probabilistic method can be used to develop a link between the magnitude of differential subsidence movements and impact.

- *Construction type*

Two trends have been observed. Not surprisingly, structures constructed with light-weight flexible external linings are able to accommodate a far greater range of subsidence movements than brittle inflexible linings such as masonry. The analyses merely quantified what was already well known. The second observation was that houses constructed with strip footings were noticeably more likely to experience impacts than houses constructed with a ground slab, particularly in relation to higher levels of impact. This is because houses with strip footings are more susceptible to slippage along the damp proof course.

- *Structure size*

Trend analysis shows that larger structures attract a higher likelihood of impact. This is understandable as the chance of impacts increases with increasing footprint area. However, it is noted that the probability of severe impacts was not substantially greater for larger structures even though this would be expected if considering probabilities theoretically rather than empirically.

- *Structure age*

The trend analysis for structure age did not reveal any noticeable trends.

- *Extensions, variable foundations and building joints*

There is a clear trend of a higher frequency of impacts for structures that include extensions, variable foundations and building joints. The increased frequency appears to be related mainly to lower impact categories.

- *Urban or rural setting*

While trends were observed, it is considered that they can be explained by other factors. However, consideration can be made to provide a more conservative estimate of probabilities in rural areas if structure size has not been considered.

B.3.1. Method of impact assessment

A method of assessing potential impacts on building structures was developed as part of ACARP Research Project C12015 (Waddington, 2009). The method is predominately based on the predicted conventional curvature and construction type. While strain is an important factor in assessing the potential for damage, it is accounted for based on the relationship between curvature and strain. The prediction of conventional curvature is considerably more reliable than the prediction of strain at a point.

The method is probabilistic and provides the likelihoods of the building structures experience each of the damage categories R0 to R5. These probabilities have been reviewed and refined as following experience is gained in mining beneath building structures.

A summary of the assessed probabilities of impact for building structures based on the predicted conventional curvatures and construction type is provided in Table B.2.

Table B.2 Probabilities of impact based on curvature and construction type after ACARP Research Project C12015 (Waddington, 2009)

R (km)	Repair category			
	No Repair or R0	R1 or R2	R3 or R4	R5
Brick or brick-veneer houses with slab on ground				
> 50	90 ~ 95 %	3 ~ 10 %	1 %	~ 1 %
15 to 50	70 ~ 75 %	20 ~ 25 %	5 ~ 10 %	~ 1 %
2.5 to 15	45 ~ 65 %	25 ~ 35 %	10 ~ 15 %	1 ~ 3 %
Brick or brick-veneer houses with strip footing				
> 50	85 ~ 90 %	5 ~ 15 %	1 ~ 3 %	< 2 %
15 to 50	60 ~ 75 %	20 ~ 30 %	5 ~ 15 %	1 ~ 3 %
2.5 to 15	45 ~ 65 %	25 ~ 30 %	5 ~ 15 %	5 ~ 10 %
Timber-framed houses with flexible external linings of any foundation type				
> 50	90 ~ 95 %	3 ~ 10 %	1 %	~ 1 %
15 to 50	75 ~ 85 %	10 ~ 20 %	5 ~ 10 %	~ 1 %
2.5 to 15	70 ~ 80 %	20 ~ 25 %	7 ~ 12 %	~ 1 %

The results have been expressed as ranges of values rather than single numbers, recognising that the data had considerable scatter within each curvature range. While structure size and building extensions have not been included in the predictive tables, it is recommended to adopt percentages at the higher end of the range for larger structures or those with building extensions.

The percentages stated in each table are the percentages of building structures of that type that would be likely to be damaged to the level indicated within each curvature range. The levels of damage in the tables are indicated with reference to the repair categories described in the damage classification given in Table B.1.

The ranges provided in Table B.2 have been converted into a set of probability curves to remove artificial discontinuities that are formed by dividing curvatures into three categories. These are shown in Fig. B.1. The probability curves are applicable for all houses and civil structures.

At the time of writing ACARP Research Project C12015 (Waddington, 2009), the observed proportion of houses where the MSB (now SA NSW) and affected landowners had agreed to rebuild rather than repair (Category R5) impacts was less than 0.5 %. Since the publication of the research report, the proportion of houses where a decision has been made to rebuild has increased to approximately 1.1% overall and 3.2% above Tahmoor Longwalls 24A to 27 within the observed zone of increased subsidence.

The decision to rebuild rather than repair a house is based on a variety of factors. Whilst acknowledging the significance of a decision to rebuild compared to repair a house, all houses previously impacted at Tahmoor Mine could have been repaired rather than replaced, including those where a decision has been made to rebuild them. This does not diminish the significance of this category from a social and economic impact point of view and it is important to continue recording the number of instances where a decision has been made to rebuild a house.

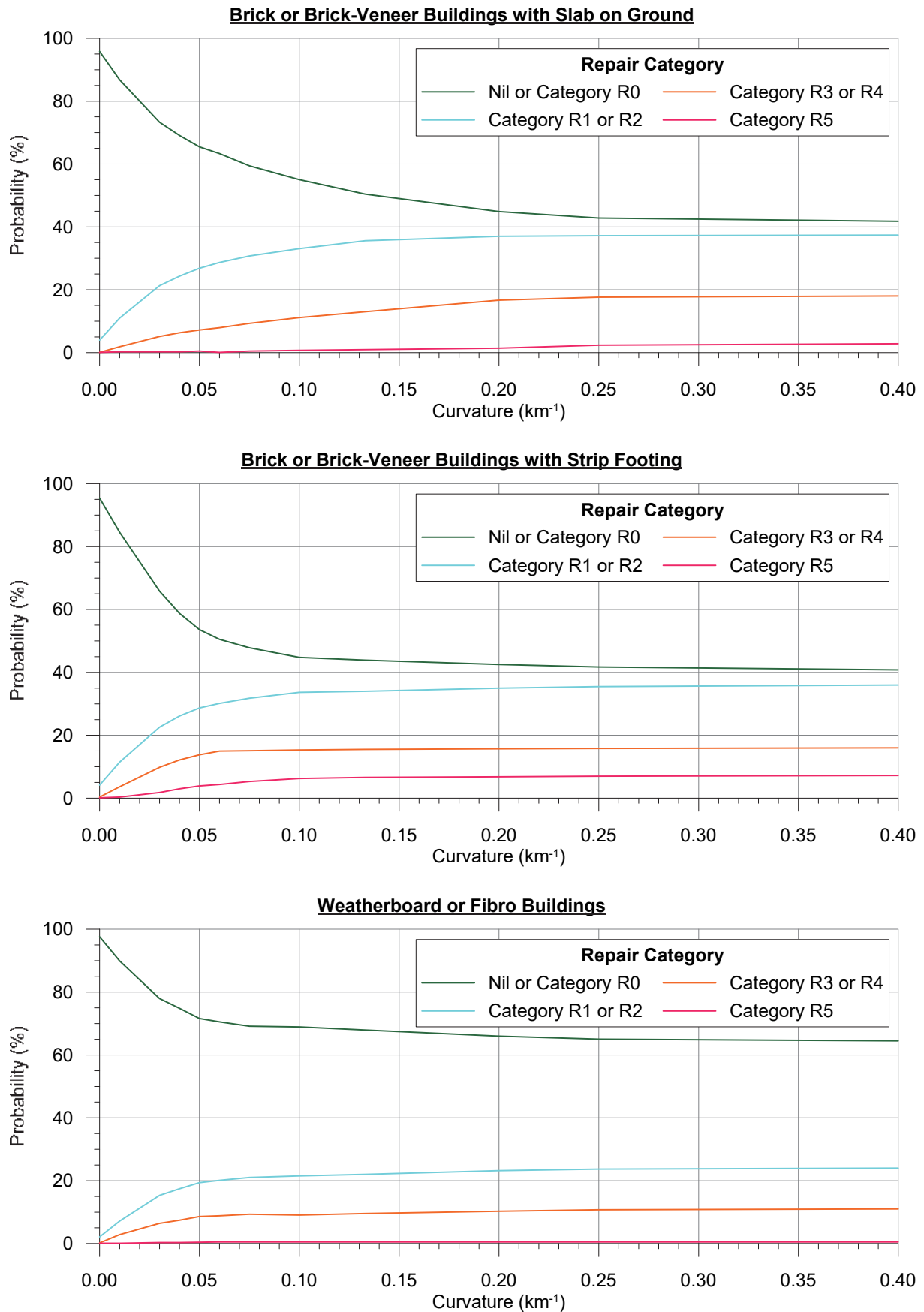
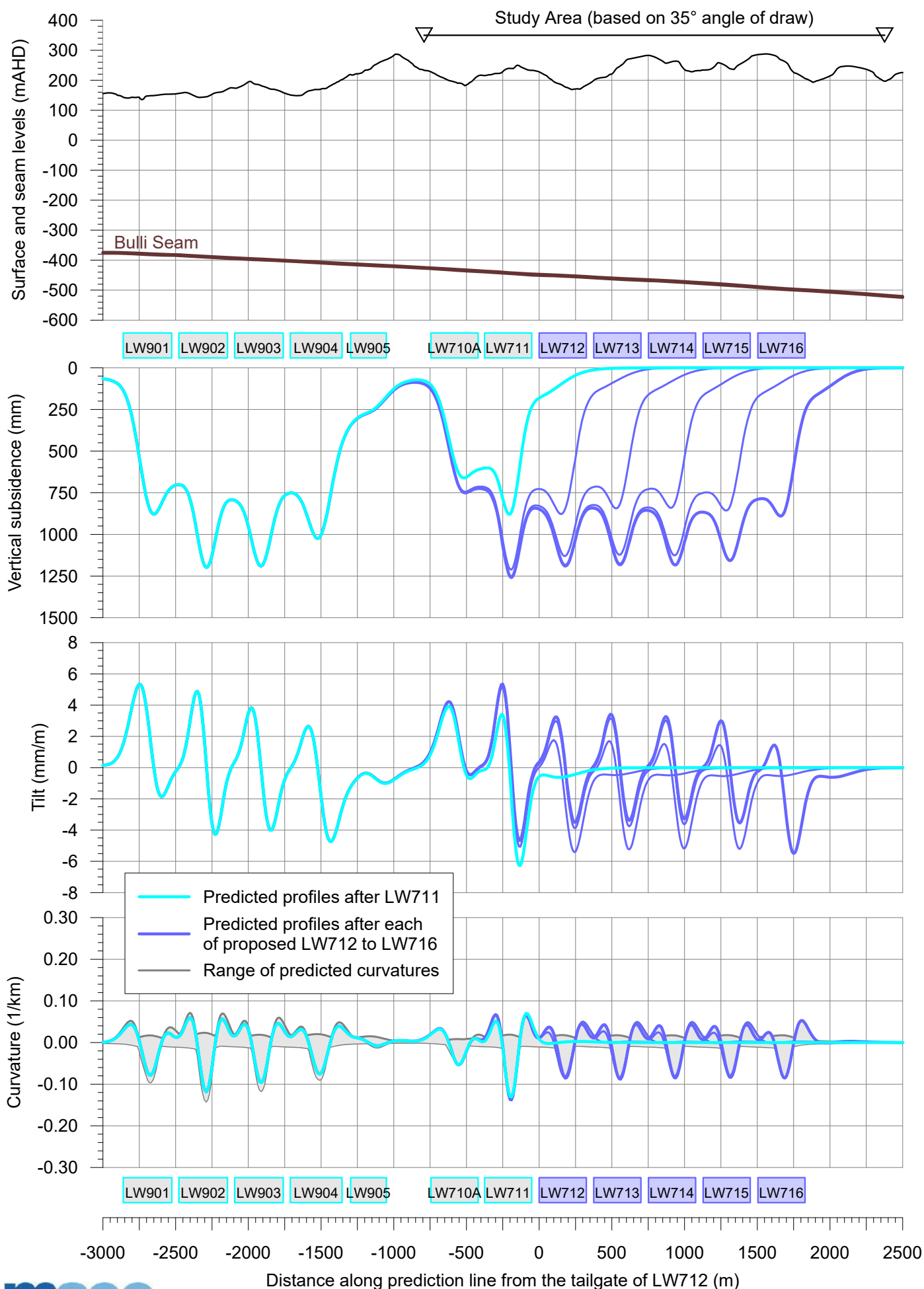


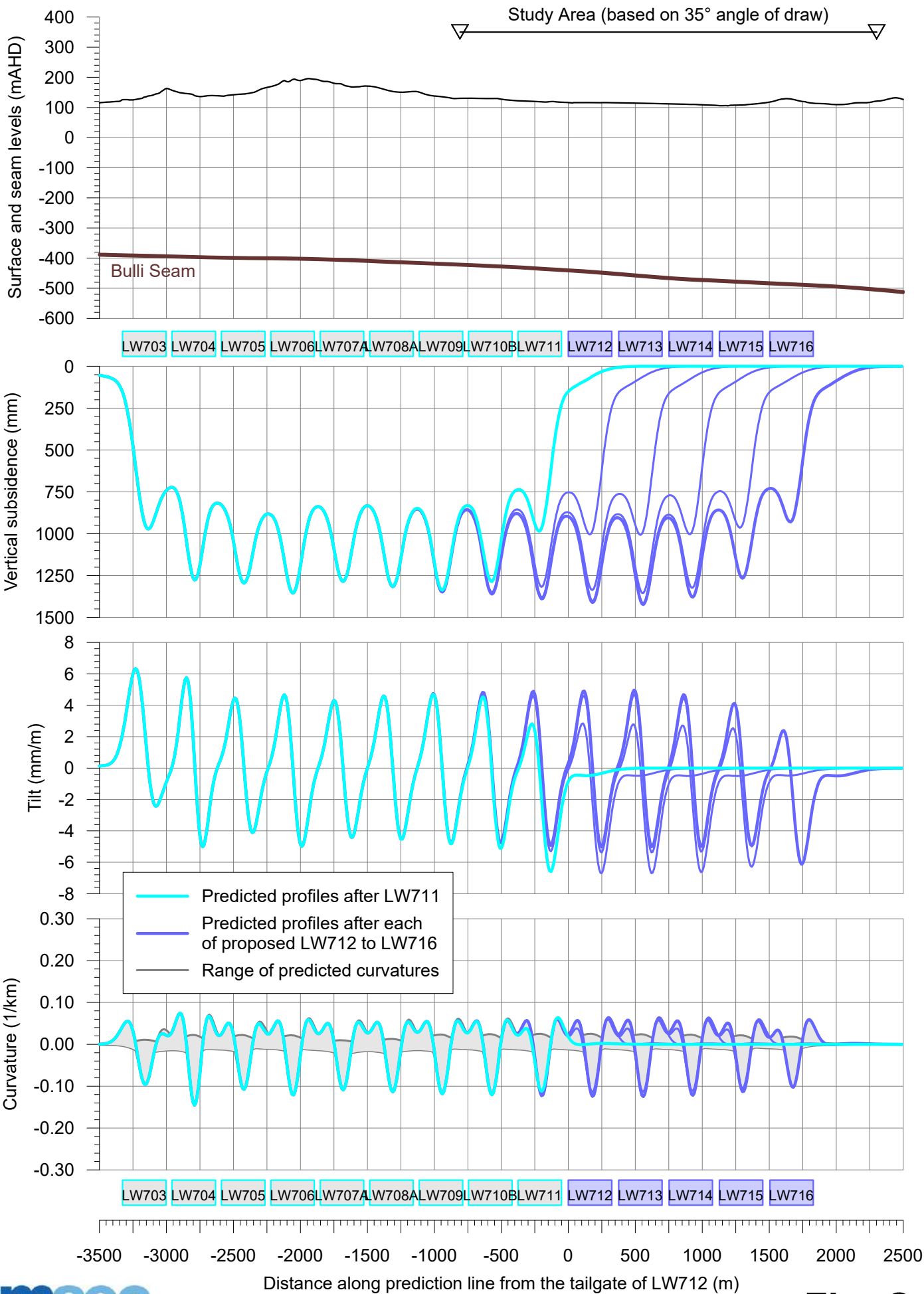
Fig. B.1 Probability curves for impacts to building structures

APPENDIX C. FIGURES

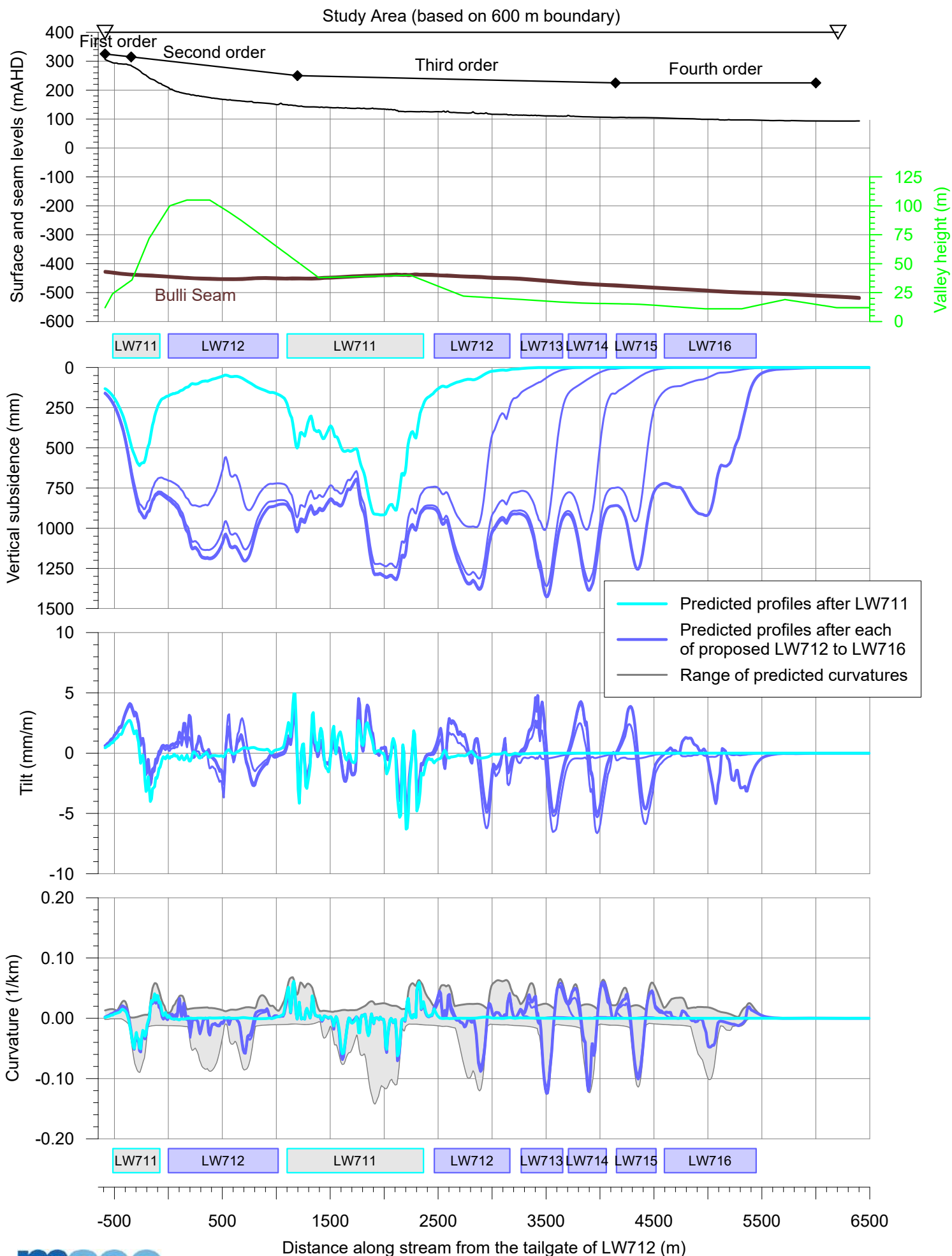
Predicted profiles of total vertical subsidence, tilt and curvature along Prediction Line 1 due to mining in Appin Areas 7 and 9



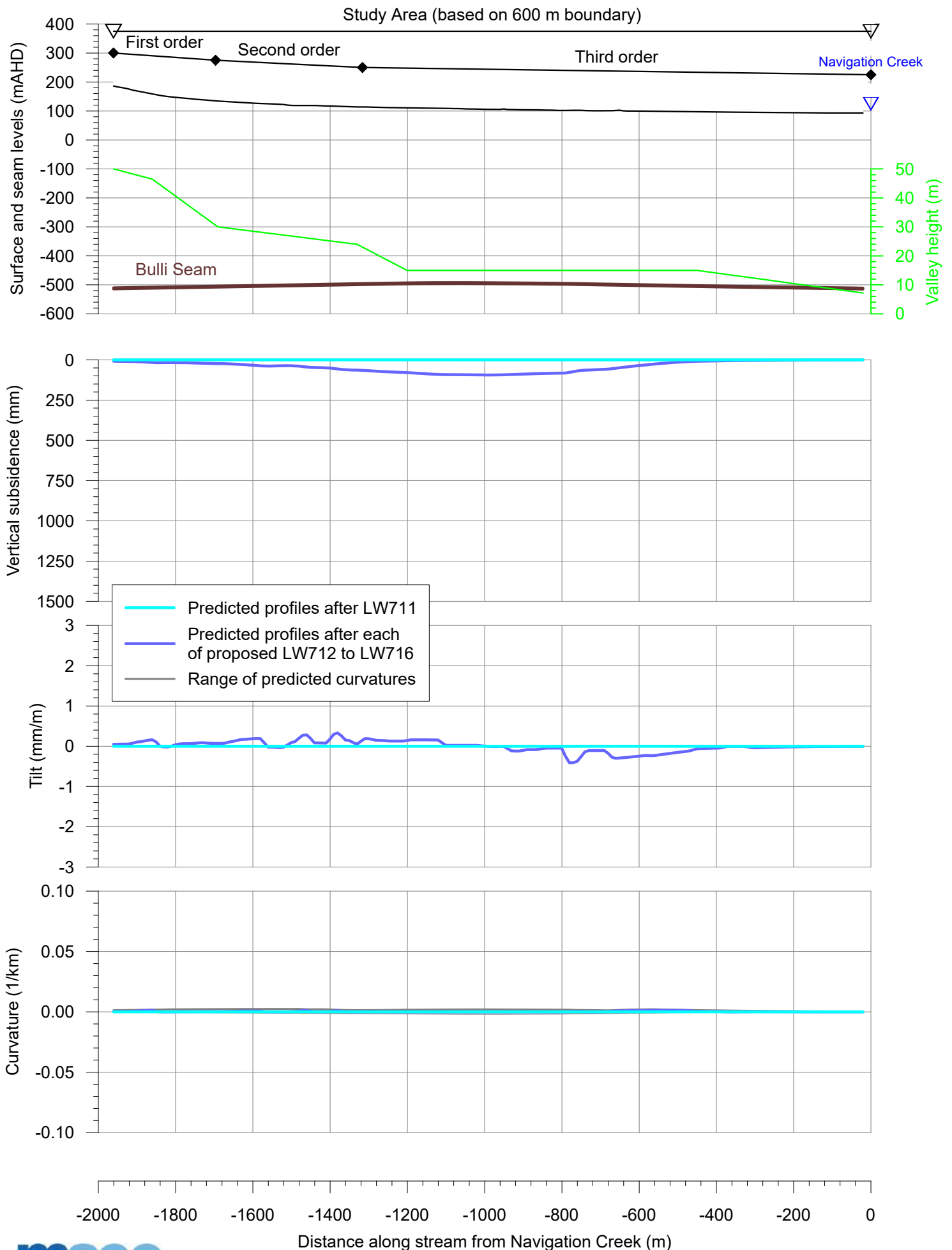
Predicted profiles of total vertical subsidence, tilt and curvature along Prediction Line 2 due to mining in Appin Area 7



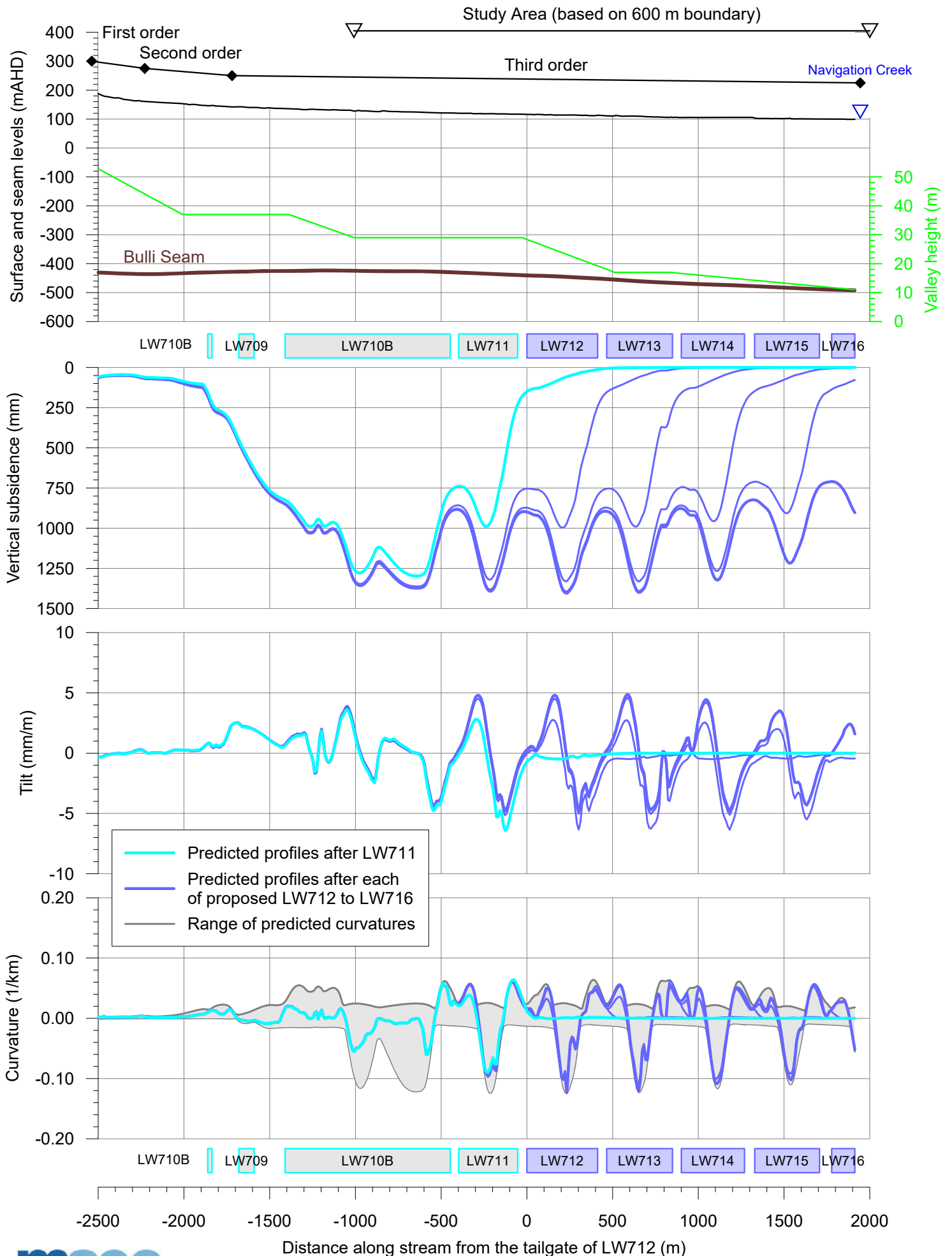
Predicted profiles of total vertical subsidence, tilt and curvature along Navigation Creek due to mining in Appin Area 7



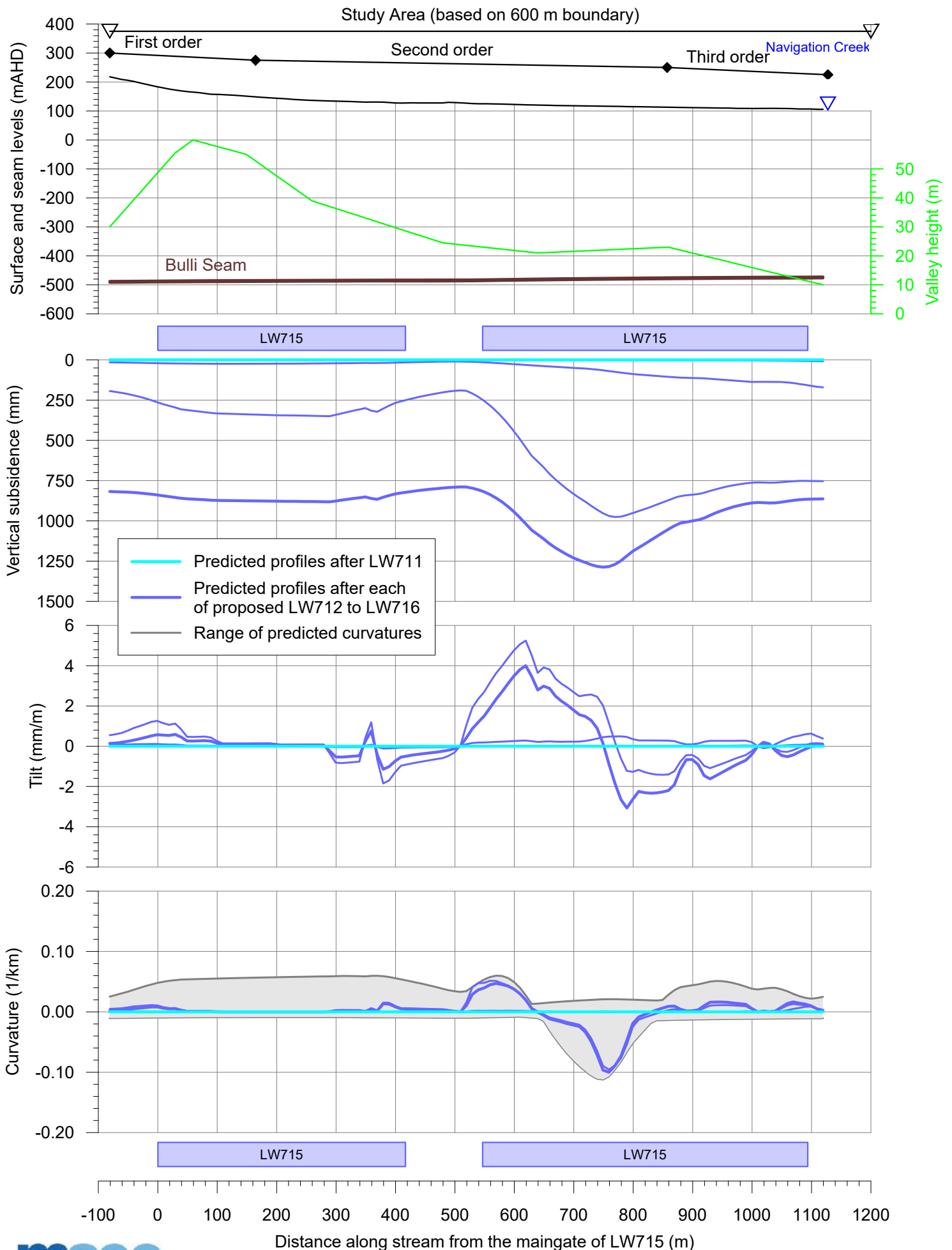
Predicted profiles of vertical subsidence, tilt and curvature along Tributary NavC14.5 due to mining in Appin Area 7



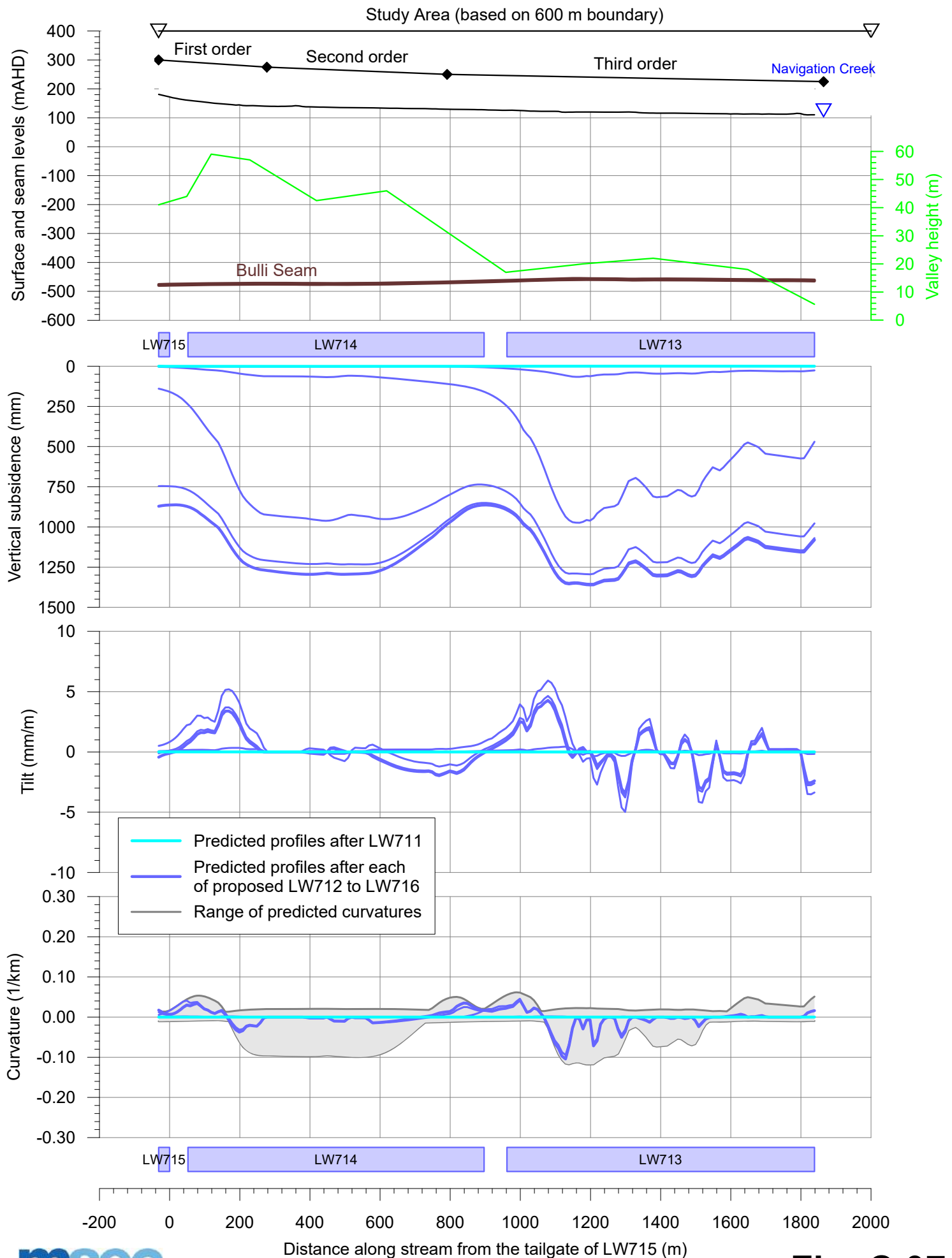
Predicted profiles of total vertical subsidence, tilt and curvature along Tributary NavC16 due to mining in Appin Area 7



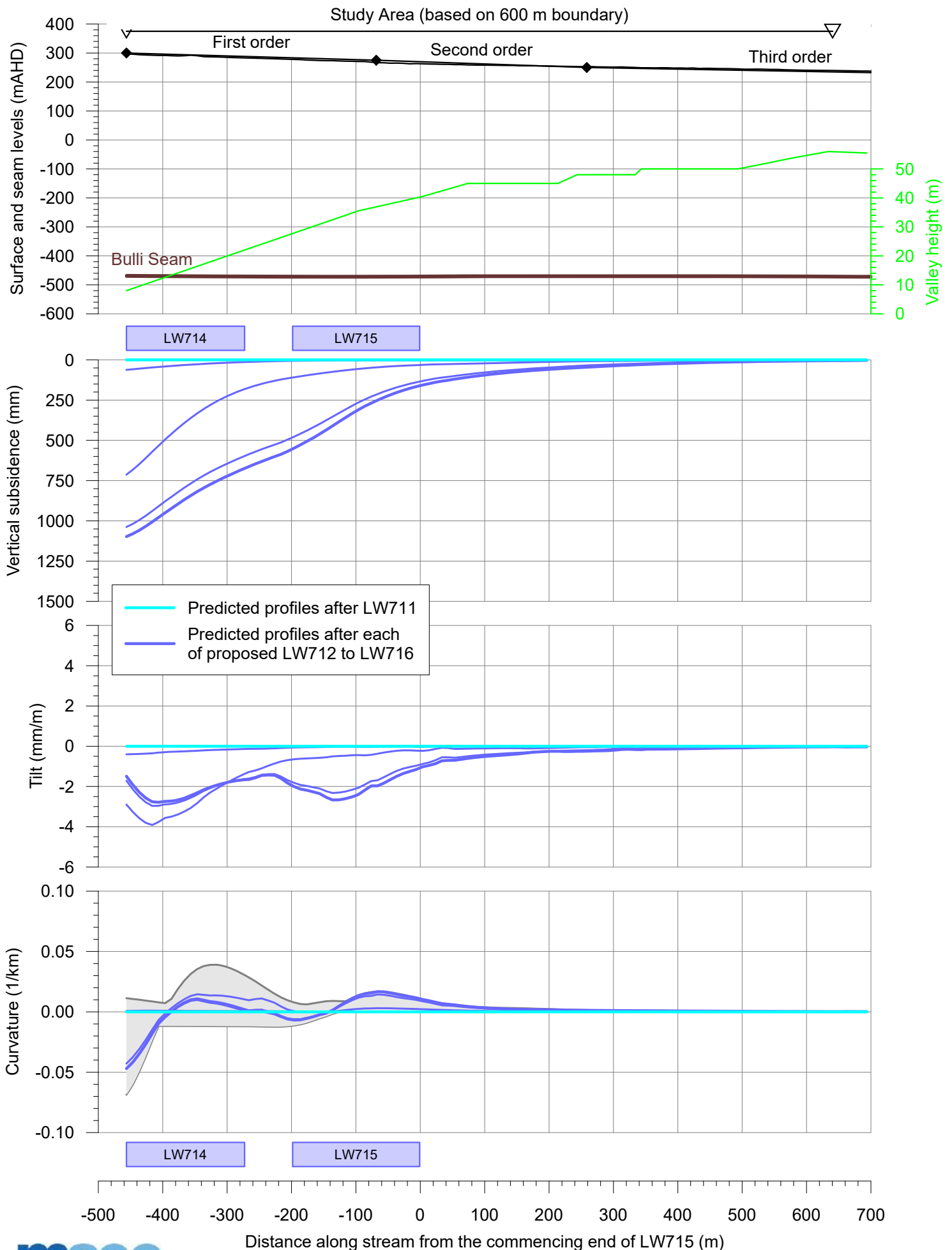
Predicted profiles of vertical subsidence, tilt and curvature along Tributary NavC17 due to mining in Appin Area 7



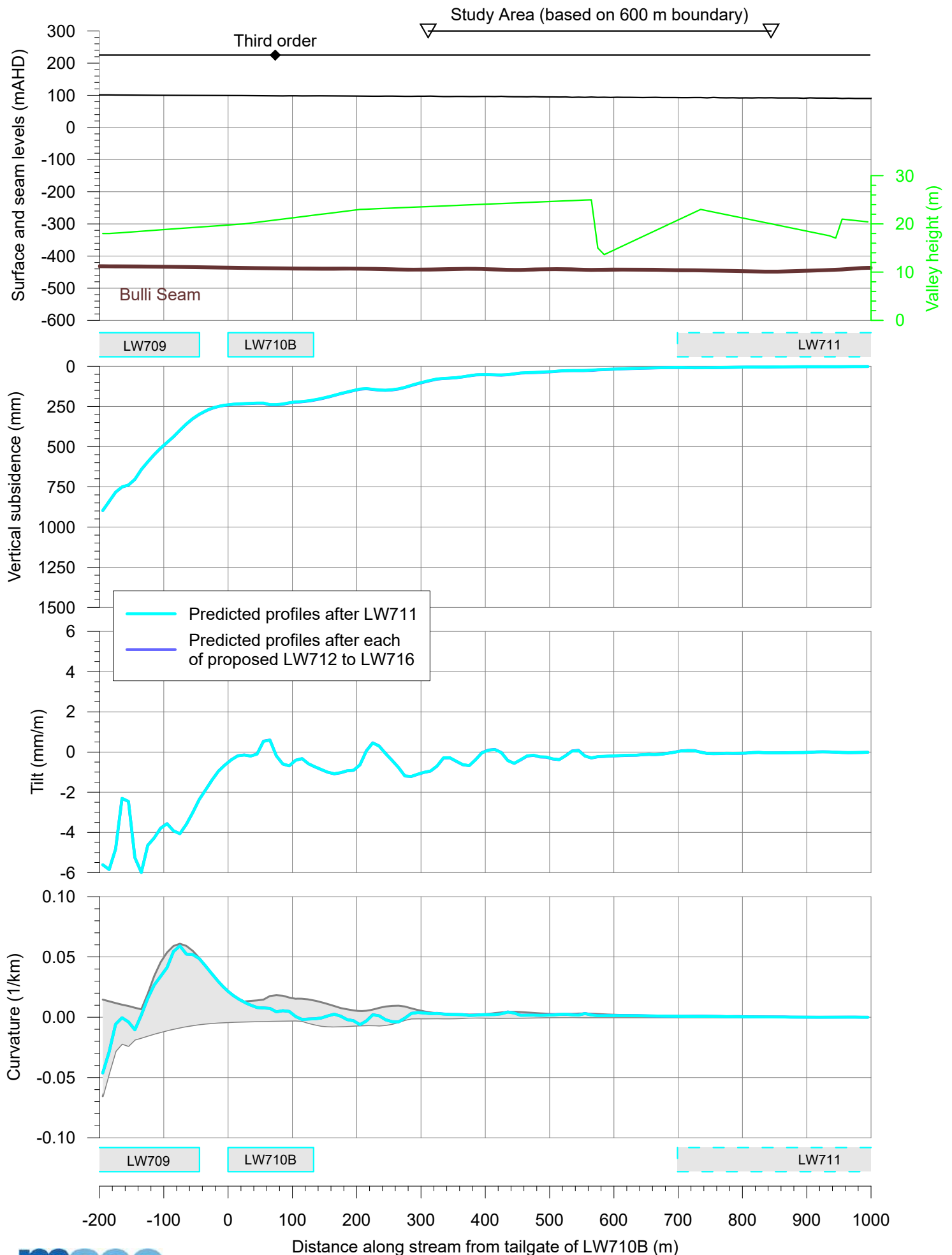
Predicted profiles of vertical subsidence, tilt and curvature along Tributary NavC20 due to mining in Appin Area 7



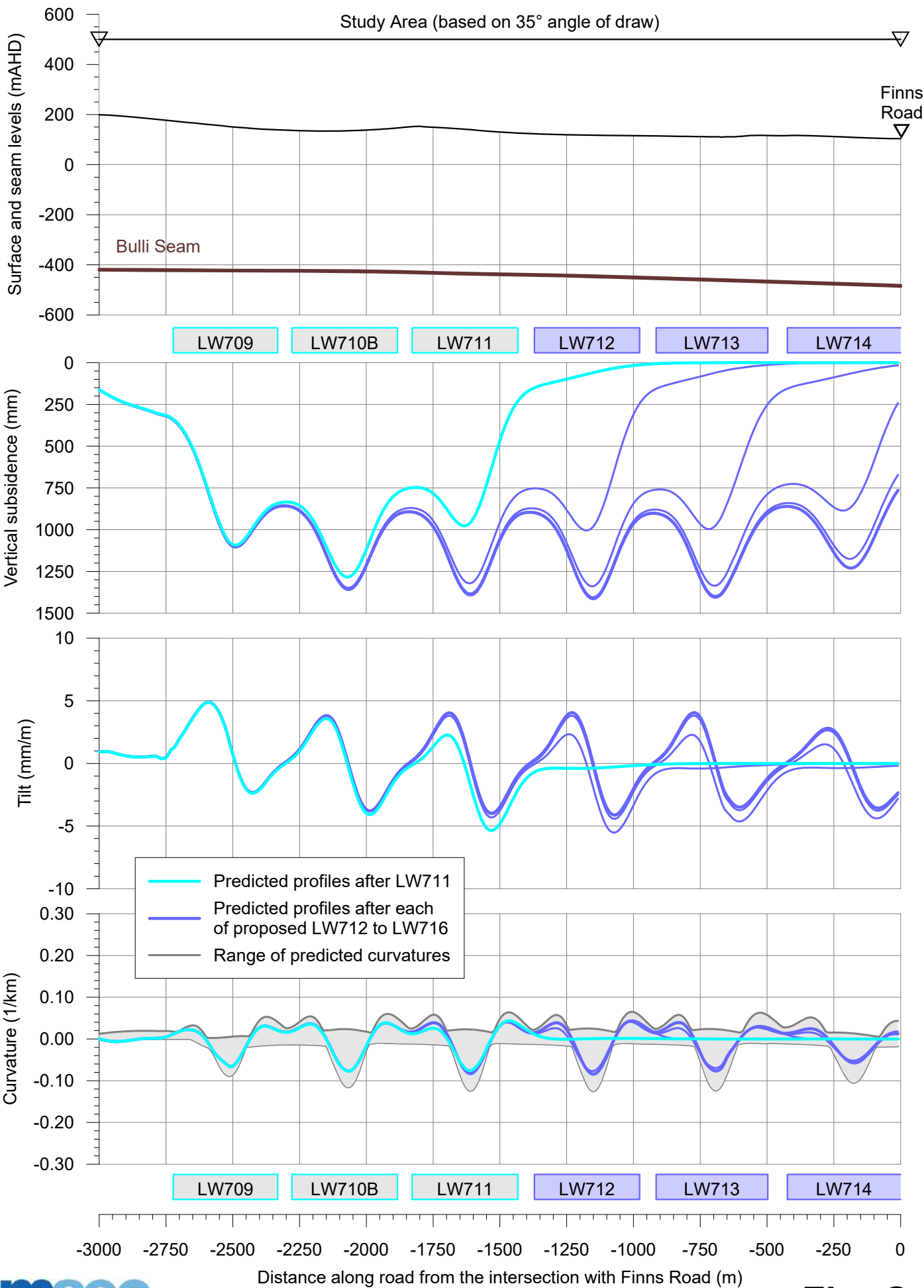
Predicted profiles of vertical subsidence, tilt and curvature along Apps Gully due to mining in Appin Area 7



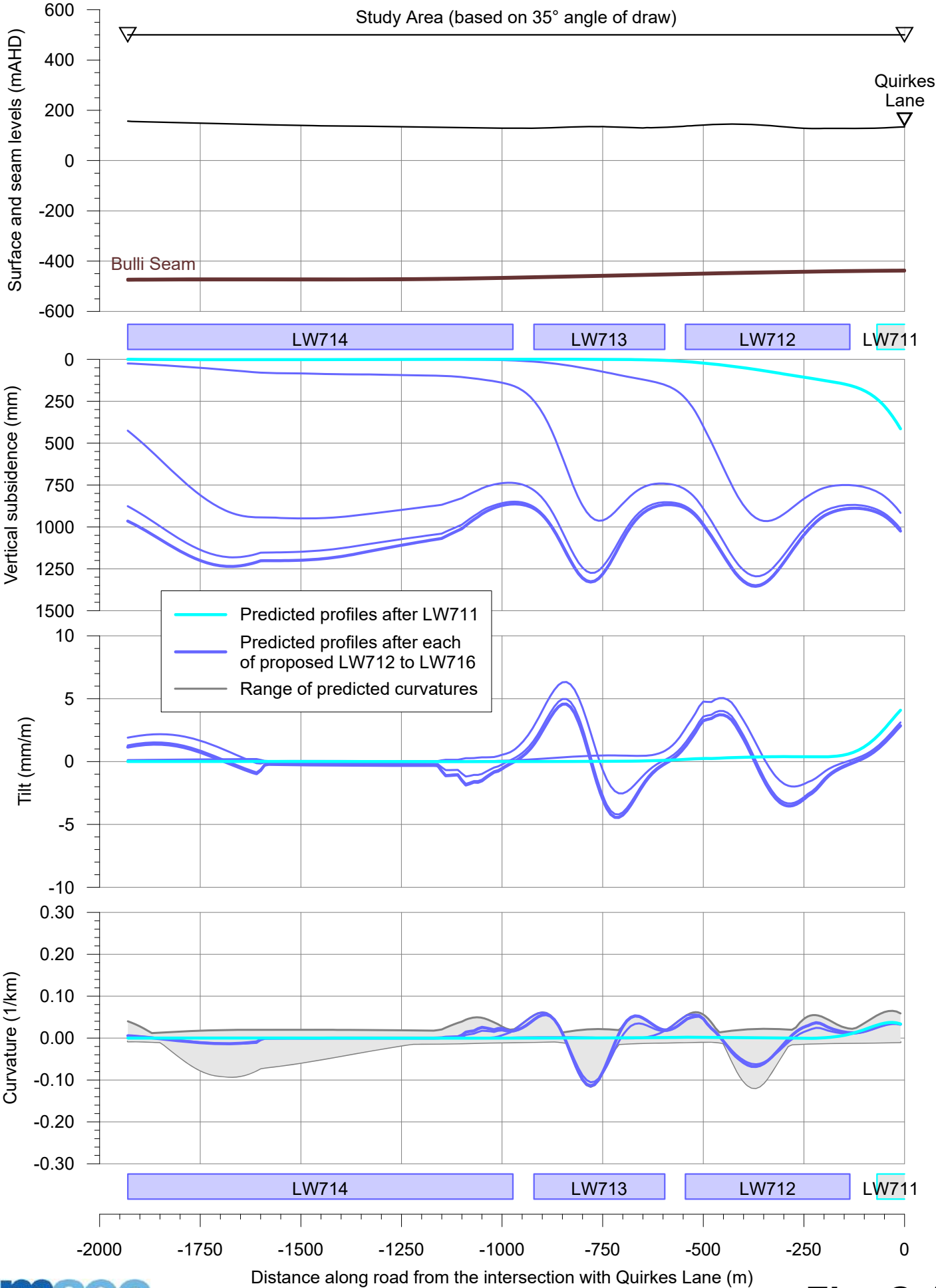
Predicted profiles of vertical subsidence, tilt and curvature along Foot Onslow Creek due to mining in Appin Area 7



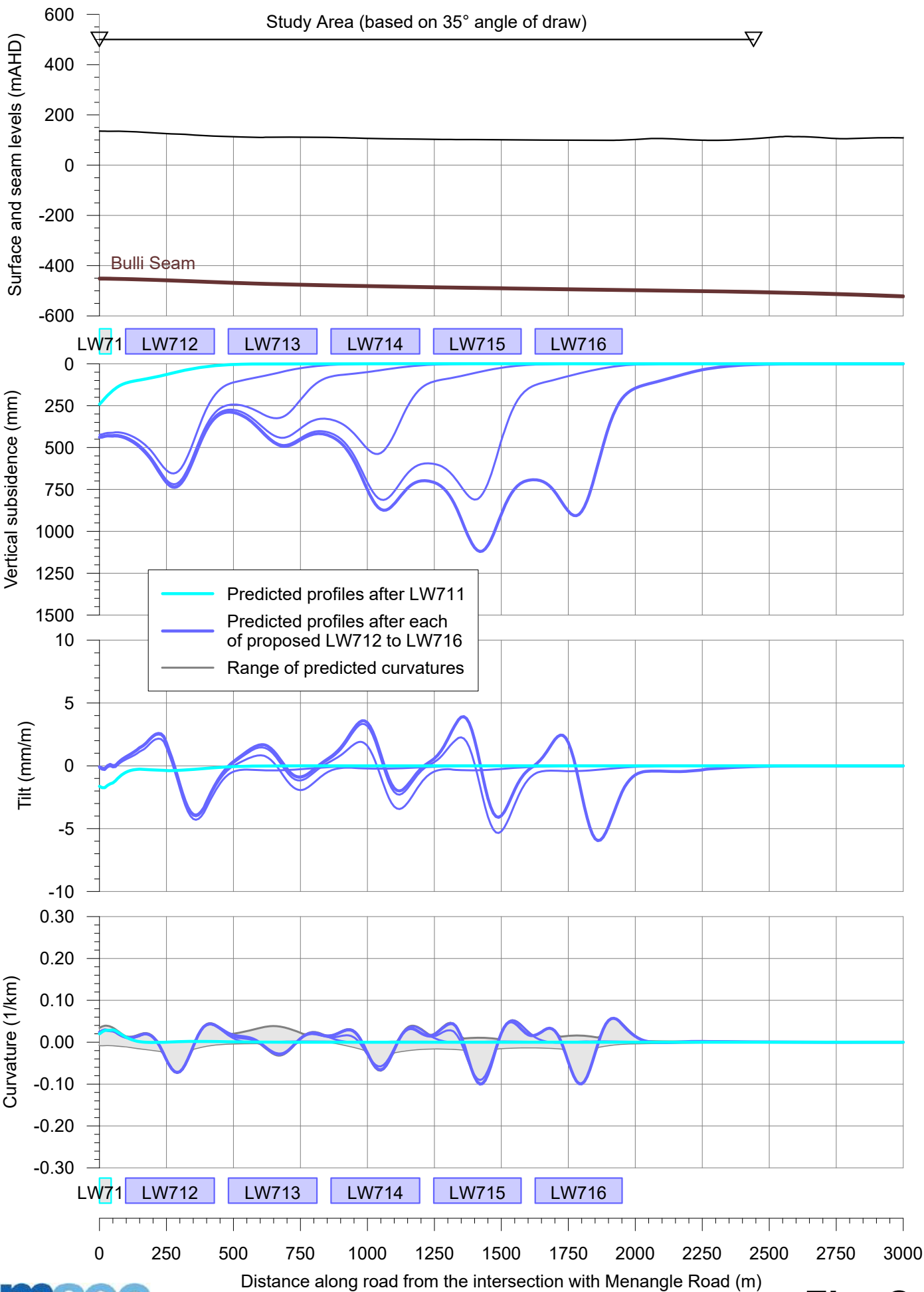
Predicted profiles of total vertical subsidence, tilt and curvature along Carrolls Road due to mining in Appin Area 7



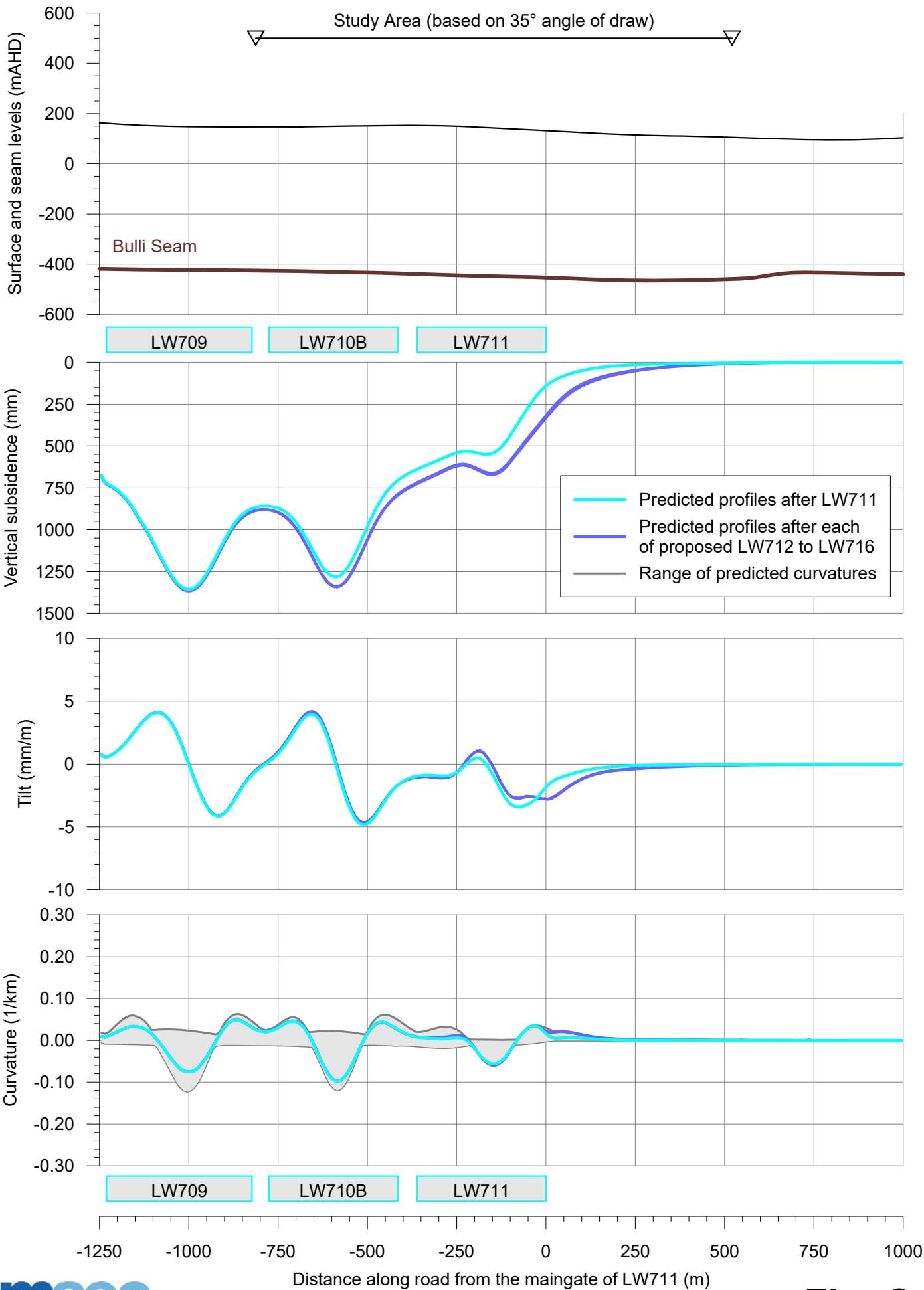
Predicted profiles of total vertical subsidence, tilt and curvature along Cummins Road due to mining in Appin Area 7



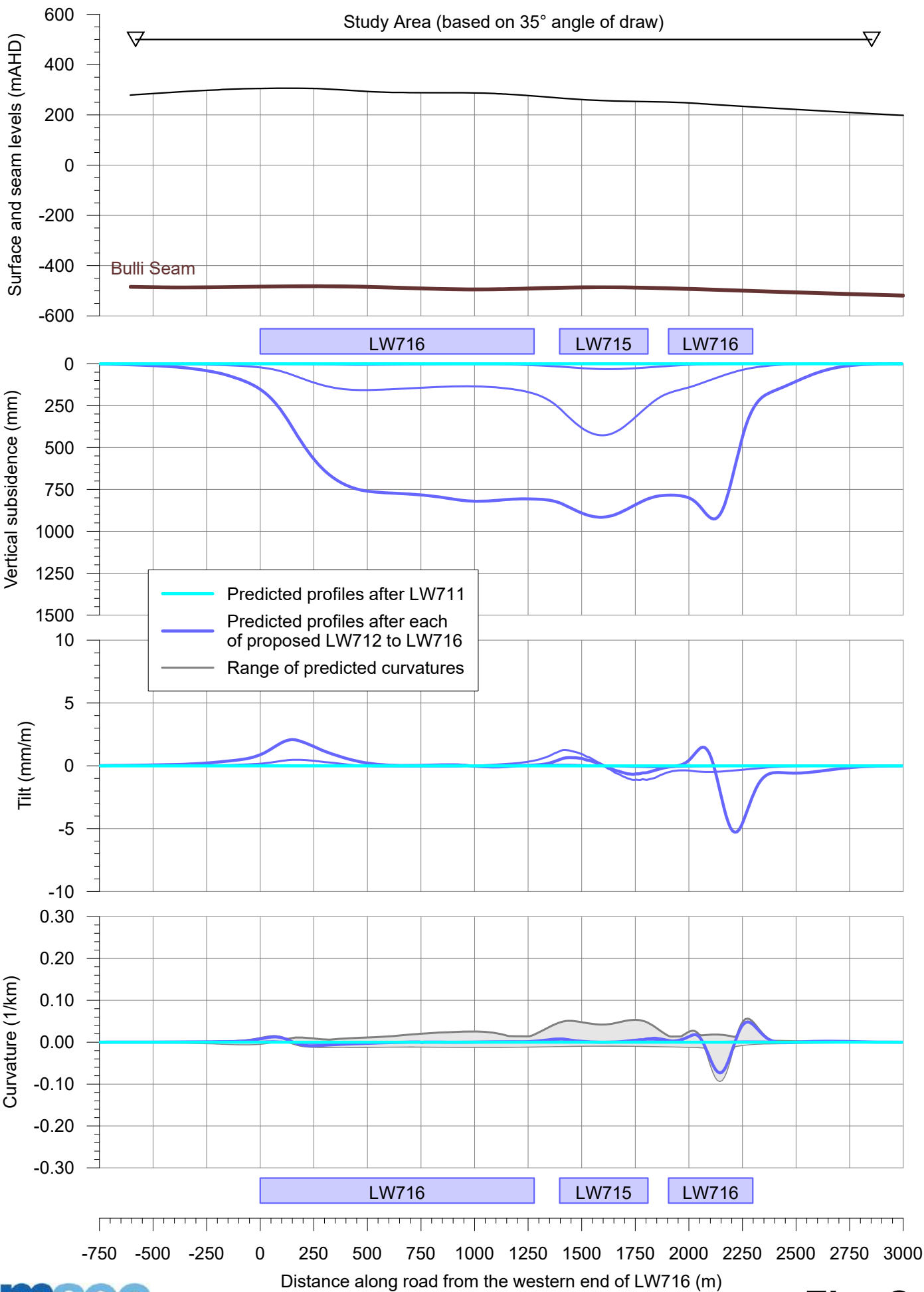
Predicted profiles of total vertical subsidence, tilt and curvature along Finns Road due to mining in Appin Area 7



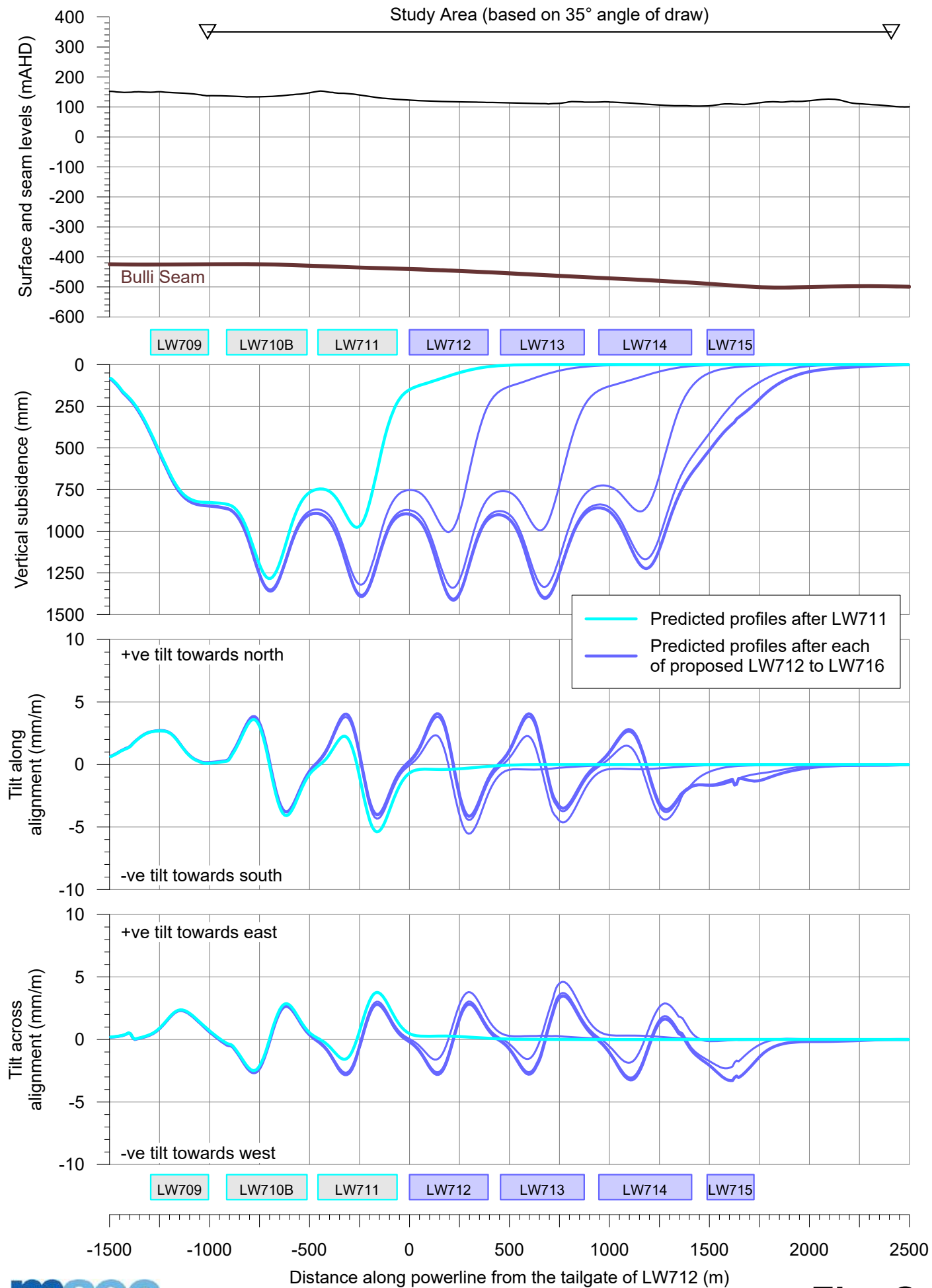
Predicted profiles of total vertical subsidence, tilt and curvature along Menangle Road due to mining in Appin Area 7



Predicted profiles of total vertical subsidence, tilt and curvature along Remembrance Drive due to mining in Appin Area 7

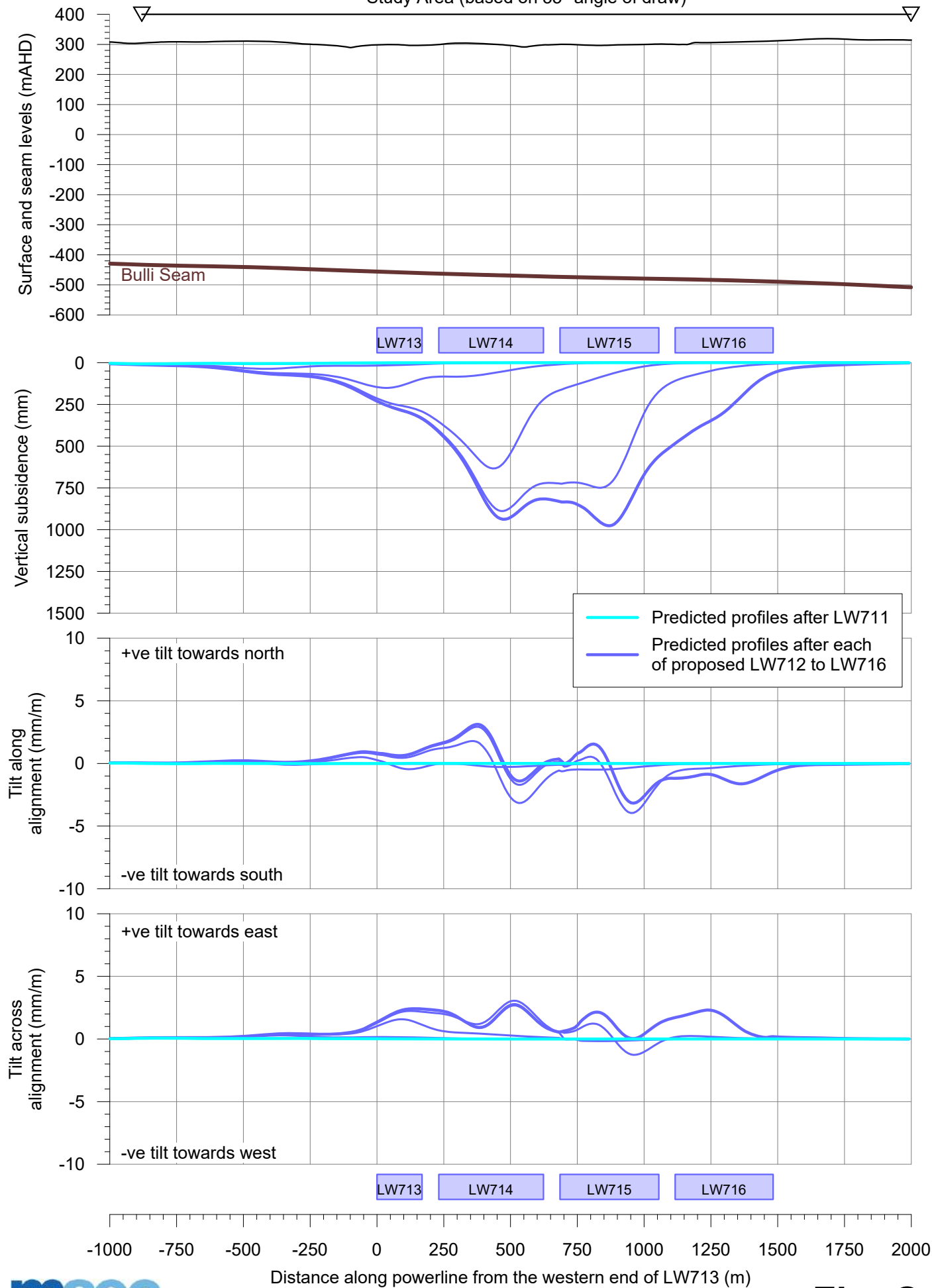


Predicted profiles of total vertical subsidence, tilt along and tilt across 66 kV Powerline (Branch 1) due to mining in Appin Area 7



Predicted profiles of total vertical subsidence, tilt along and tilt across 11 kV Powerline (Branch 1) due to mining in Appin Area 7

Study Area (based on 35° angle of draw)



APPENDIX D. TABLES

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
C10a	290060	6218377	House	-	19	239				1	1				1			1												
C10b	290068	6218352	Rural	Shed	7	50																	1							
C10c	290045	6218333	Rural	Shed	11	97																	1							
C10e	290062	6218394	Rural	Garage	6	38																	1							
C10f	290067	6218387	Rural	Shed	2	24																	1							
C10g	290069	6218391	Rural	Shed	2	40																	1							
C10h	290078	6218413	Rural	Shed	2	3																	1							
C10r01	290056	6218384	Rural	Pergola	10	53																	1							
C10r02	290073	6218414	Rural	Shed	1	1																	1							
C10r03	290075	6218413	Rural	Shed	2	3																	1							
C10r01	290068	6218404	Tank	-	8	55																			1					
C10r04	290082	6218338	Tank	-	2	3																			1					
C10r05	290043	6218325	Tank	-	2	2																			1					
C20h01	289907	6219227	House	-	47	710				2			1		1			1		1										
C20p01	289919	6219226	Pool	-	12	67																		1						
C20r01	289920	6219269	Rural	Shed	5	18																	1							
C20r02	289921	6219245	Rural	Gazebo	9	62																	1							
C23h01	289464	6220155	House	-	24	329																								
C23h02	289501	6220255	House	-	32	518																								
C23h03	289468	6220225	House	-	18	260																								
C23h04	289469	6220267	House	-	17	203																								
C23p01	289456	6220161	Pool	-	7	32																		1						
C23r01	289475	6220143	Rural	Garage	7	49																	1							
C23r02	289530	6220247	Rural	Shed	7	34																	1							
C23r03	289455	6220244	Rural	Gazebo	6	29																	1							
C23r04	289496	6220277	Rural	Animal shelter	4	7																	1							
C23r05	289476	6220360	Rural	Shed	18	167																	1							
C23r06	289495	6220370	Rural	Shed	20	227																	1							
C23r07	289467	6220184	Rural	Gazebo	6	29																	1							
C23r01	289513	6220233	Tank	-	15	167																			1					
C23r02	289519	6220255	Tank	-	3	9																			1					
C23r03	289443	6220260	Tank	-	2	4																			1					
C23r04	289491	6220356	Tank	-	4	12																			1					
C23r05	289498	6220382	Tank	-	4	12																			1					
C24h01	288878	6220799	House	-	17	212																				1				
C24r01	288868	6220787	Rural	Garage	9	57																	1							
C24r02	288878	6220754	Rural	Shed	14	148																	1							
C24r03	288893	6220754	Rural	Shed	20	104																	1							
C24r04	288892	6220759	Rural	Shed	5	11																	1							
C24r05	288882	6220730	Rural	Shed	21	114																	1							
C24r06	288933	6220772	Rural	Animal shelter	5	15																	1							
C24r07	288938	6220788	Rural	Shed	14	79																	1							
C24r08	288928	6220788	Rural	Animal shelter	3	11																	1							
C24r09	288880	6220782	Rural	Shed	4	7																	1							
C24r10	288883	6220786	Rural	Shed	4	7																	1							
C24r11	288953	6220835	Rural	Animal shelter	7	18																	1							
C24r12	288951	6220878	Rural	Animal shelter	3	8																	1							
C24r01	288912	6220800	Tank	-	7	38																				1				
D03a	289288	6219310	House	-	28	442				1	1							1												
D03c	289299	6219252	Rural	Shed	15	103																	1							
D03d	289317	6219267	Rural	Shed	7	16																	1							
D03r01	289310	6219226	Rural	Shed	19	189																	1							
D03r02	289312	6219250	Rural	Shed	11	98																	1							
D03r03	289299	6219270	Rural	Shed	5	13																	1							
D03r04	289295	6219293	Rural	Garage	8	43																	1							
D03r05	289319	6219249	Rural	Shed	5	18																	1							
D03r01	289284	6219253	Tank	-	7	40																			1					
D03r02	289297	6219247	Tank	-	3	8																			1					
D03r03	289298	6219219	Tank	-	2	4																			1					
D03r04	289293	6219219	Tank	-	4	10																			1					
D04a	289314	6219449	House	-	35	429				1		1			1															
D04r01	289295	6219480	Rural	Shed	10	61																	1							
D04r02	289301	6219482	Rural	Shed	6	16																			1					
D04r01	289309	6219472	Tank	-	2	4																								
D05a	289262	6219040	House	-	25	609				1	1				1			1												

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
D05b	289276	6219063	Rural	Awning	21	69																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
											H1	H2	H3	H4									R	P	T	TC	PA	PU	C	
D10t03	289932	6218913	Tank	-	3	8																								
D10t04	289936	6218914	Tank	-	3	8																								
D10t05	289926	6218912	Tank	-	2	2																								
D10t06	289835	6218983	Tank	-	7	43																								
D11a	289948	6218816	House	-	29	367				1	1					1														
D11b	289961	6218832	Rural	Shed	13	91																	1							
D11c	289910	6218809	Rural	Shed	6	20																	1							
D11d	289820	6218822	Rural	Shed	6	27																	1							
D11p01	289942	6218832	Pool	-	9	36																		1						
D11r01	289936	6218804	Rural	Shed	3	8																	1							
D11r02	289940	6218820	Rural	Awning	14	84																	1							
D11r03	289969	6218829	Rural	Carport	7	26																	1							
D11r04	289954	6218836	Rural	Shed	8	15																	1							
D11r05	289925	6218804	Rural	Shed	6	11																	1							
D11r06	289930	6218803	Rural	Shed	5	10																	1							
D11t01	289923	6218811	Tank	-	6	26																								
D11t02	289957	6218842	Tank	-	2	5																								
D11t03	289973	6218833	Tank	-	2	2																								
D12a	289942	6218794	House	-	28	325				1	1						1						1							
D12c	289951	6218765	Rural	Shed	4	13																	1							
D12d	289812	6218732	Rural	Shed	4	13																	1							
D12e	289951	6218713	Rural	Shed	10	46																	1							
D12f	289857	6218810	Rural	Shed	5	24																	1							
D12r01	289804	6218722	Rural	Shed	6	18																	1							
D12r02	289896	6218788	Rural	Shed	11	104																	1							
D12r03	289882	6218792	Rural	Shed	12	68																	1							
D12r04	289894	6218781	Rural	Awning	8	28																	1							
D12r05	289900	6218780	Rural	Carport	7	19																	1							
D12r06	289934	6218724	Rural	Shed	5	25																	1							
D12r07	289927	6218792	Rural	Awning	9	41																	1							
D12r08	289995	6218788	Rural	Shed	3	8																	1							
D12r09	289962	6218797	Rural	Shed	2	3																	1							
D12t01	289925	6218775	Tank	-	7	39																								
D12t02	289917	6218780	Tank	-	2	2																								
D12t03	289919	6218779	Tank	-	2	2																								
D12t04	289870	6218798	Tank	-	3	8																								
D13a	289948	6218675	House	-	26	271				1	1					1							1							
D13b	289892	6218664	Rural	Shed	16	142																	1							
D13c	289867	6218667	Rural	Shed	9	40																	1							
D13p01	289939	6218690	Pool	-	7	18																								
D13t01	289948	6218661	Tank	-	4	10																		1						
D14a	289556	6218709	House	-	23	371				2			1			1							1							
D14b	289577	6218756	Rural	Shed	9	58																	1							
D14r02	289501	6218747	Rural	Shed	3	5																	1							
D14t01	289546	6218738	Tank	-	7	43																								
D14t02	289572	6218723	Tank	-	2	2																								
D14t03	289575	6218723	Tank	-	2	2																								
D15a	289350	6218750	House	-	51	794				1		1				1														
D15b	289406	6218708	Rural	Shed	17	230																	1							
D15c	289384	6218771	Rural	Gazebo	7	42																	1							
D15d	289427	6218699	Rural	Shed	10	70																	1							
D15p01	289370	6218774	Pool	-	13	60																								
D15r01	289437	6218717	Rural	Shed	3	10																	1							
D15t01	289412	6218700	Tank	-	2	5																								
D16h01	289442	6218674	House	-	24	281																								
D16t01	289444	6218681	Tank	-	2	5																								
D16t02	289020	6218751	Tank	-	2	4																								
D17a	289526	6218591	House	-	16	163				1	1					1														
D17b	289520	6218584	Rural	Carport	5	21																	1							
D17c	289490	6218594	Rural	Shed	9	60																	1							
D17p01	289515	6218610	Pool	-	9	32																								
D17t01	289514	6218581	Tank	-	5	17																								
D17t02	289491	6218588	Tank	-	3	7																								
D18a	289905	6218449	House	-	31	558				1		1				1	1													
D18b	289918	6218423	Rural	Shed	10	101																	1							

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piled Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
D18d	289840	6218448	Rural	Shed	3	9																1							
D18e	289780	6218487	Rural	Shed	3	7																1							
D18f	289887	6218473	Rural	Shed	4	14																1							
D18p01	289878	6218462	Pool	-	12	53																	1						
D18r01	289920	6218416	Rural	Shed	6	20																1							
D18r02	289929	6218390	Rural	Shed	8	29																1							
D18r03	289880	6218448	Rural	Shed	3	7																1							
D18r05	289897	6218466	Rural	Shed	1	2																1							
D18r07	289862	6218427	Rural	Shed	2	4																1							
D18r01	289916	6218416	Tank	-	3	6																							
D18r02	289900	6218476	Tank	-	7	44																			1				
D19a	289796	6218258	House	-	38	828				2			1	1			1		1										
D19d	289843	6218284	Rural	Shed	4	13																1							
D19r01	289767	6218250	Rural	Carport	6	34																1							
D19r02	289763	6218276	Rural	Shed	8	60																1							
D19r03	289763	6218284	Rural	Shed	8	39																1							
D19r04	289757	6218283	Rural	Shed	5	14																1							
D19r01	289776	6218285	Tank	-	8	56																							
D19r03	289765	6218254	Tank	-	2	4																							
D19r04	289768	6218254	Tank	-	2	4																							
D20b	289663	6218259	Rural	Shed	9	65																1							
D20h01	289681	6218350	House	-	21	190				1	1				1			1	1				1						
D20r01	289646	6218295	Rural	Shed	13	141																1							
D20r02	289618	6218276	Rural	Shed	7	29																1							
D20r01	289655	6218259	Tank	-	3	8																							
D20r02	289656	6218255	Tank	-	3	8																							
D20r03	289636	6218295	Tank	-	3	8																							
D20r04	289655	6218292	Tank	-	3	8																							
D20r05	289629	6218299	Tank	-	3	8																							
D20r06	289691	6218340	Tank	-	3	5																							
D21a	289481	6218316	House	-	18	231				1	1							1	1										
D21b	289514	6218283	Rural	Shed	5	26																1							
D21c	289466	6218411	House	-	47	693				1		1			1			1	1										
D21d	289452	6218392	Rural	Garage	2	116																1							
D21r01	289452	6218424	Rural	Awning	12	110																1							
D21r01	289474	6218312	Tank	-	2	5																							
D21r02	289493	6218322	Tank	-	3	8																							
D21r03	289511	6218370	Tank	-	3	8																							
D21r04	289511	6218366	Tank	-	3	8																							
D21r05	289469	6218445	Tank	-	8	49																							
D22a	288944	6218555	House	-	34	387				2			1	1				1	1										
D22c	288981	6218570	Rural	Shed	12	75																1							
D22p01	288958	6218547	Pool	-	11	41																							
D22r01	288920	6218528	Rural	Garage	14	113																1	1						
D22r02	288946	6218573	Rural	Carport	7	21																1							
D22r03	289079	6218471	Rural	Shed	4	10																1							
D22r04	289118	6218554	Rural	Shed	3	10																1							
D22r05	289001	6218572	Rural	Shed	3	6																1							
D22r06	288924	6218502	Rural	Shed	2	4																1							
D22r07	288911	6218529	Rural	Carport	9	38																1							
D22r08	288972	6218571	Rural	Carport	6	19																1							
D22r09	289086	6218511	Rural	Shed	5	18																1							
D22r10	289075	6218472	Rural	Shed	4	10																1							
D22r01	288994	6218567	Tank	-	8	48																							
D22r02	288966	6218573	Tank	-	2	2																							
D22r03	288965	6218571	Tank	-	2	2																							
D22r04	288993	6218571	Tank	-	3	8																							
D23a	288932	6218433	House	-	24	492				1	1				1			1	1										
D23b	288914	6218445	Rural	Garage	13	110																1							
D23d	288952	6218407	House	-	18	209				1	1				1			1											
D23e	288958	6218429	Rural	Pergola	6	29																1							
D23f	288978	6218456	Rural	Shed	8	56																1							
D23g	288983	6218401	Rural	Garage	11	65																1							
D23h	289121	6218371	Rural	Shed	21	252																1							
D23p01	288957	6218420	Pool	-	12	39																	1						

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures						
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
											H1	H2	H3	H4									R	P	T	TC	PA	PU	C
D23r01	288973	6218413	Tennis court	-	33	510																							
D23r02	289071	6218427	Rural	Shed	6	21																1							
D23r03	288946	6218482	Rural	Shed	5	15																1							
D23r04	288992	6218399	Rural	Garage	11	81																1							
D23r05	288939	6218404	Rural	Shed	4	14																1							
D23r06	288939	6218407	Rural	Shed	3	7																1							
D23r07	288941	6218484	Rural	Shed	3	9																1							
D23t01	288950	6218437	Tank	-	5	16																							
D23t02	288961	6218437	Tank	-	2	4																			1				
D24a	288917	6218345	House	-	21	343				1	1				1				1		1								
D24b	288916	6218329	Rural	Garage	10	54																1							
D24d	288968	6218324	Rural	Shed	23	272																1							
D24p01	288951	6218345	Pool	-	12	58																	1						
D24r01	288949	6218327	Rural	Gazebo	9	60																							
D24r02	288926	6218350	Rural	Pergola	11	83																	1						
D24r03	288954	6218318	Rural	Shed	3	8																	1						
D24t01	288998	6218317	Tank	-	8	43																							
D24t02	288982	6218313	Tank	-	2	3																							
D25a	288911	6218237	House	-	23	207				1	1				1			1		1									
D25b	288930	6218290	Rural	Shed	11	55																	1						
D25r01	288927	6218225	Rural	Gazebo	9	60																	1						
D25r02	288911	6218253	Rural	Shed	3	9																	1						
D25r03	288912	6218281	Rural	Shed	6	16																	1						
D25r04	288913	6218286	Rural	Shed	5	10																	1						
D25t01	288925	6218281	Tank	-	2	4																							
D26a	288990	6218235	House	-	29	515				1	1				1			1			1				1				
D26b	289632	6218183	Rural	Shed	12	89																	1						
D26p01	289595	6218249	Pool	-	9	54																		1					
D26t01	289639	6218178	Tank	-	3	9																							
D26t02	289568	6218218	Tank	-	2	3																							
D26t03	289567	6218220	Tank	-	2	3																							
D26t04	289568	6218231	Tank	-	8	56																							
D26t08	289537	6218258	Tank	-	3	8																							
D27a	289696	6218143	House	-	37	528				1		1			1			1		1									
D27b	289699	6218177	Rural	Shed	10	89																	1						
D27p01	289679	6218142	Pool	-	11	34																		1					
D27r01	289677	6218127	Rural	Gazebo	9	38																		1					
D27r02	289678	6218150	Rural	Awning	5	14																		1					
D27r03	289694	6218185	Rural	Shed	10	85																		1					
D27r04	289708	6218219	Rural	Greenhouse	25	329																		1					
D27t02	289717	6218168	Tank	-	6	27																							
D27t04	289683	6218164	Tank	-	4	10																							
D27t05	289687	6218183	Tank	-	2	5																							
D30a	289591	6218071	House	-	39	674				1		1			1			1			1								
D30b	289586	6218035	Rural	Shed	3	7																	1						
D30c	289600	6218036	House	-	18	188				1	1				1			1			1								
D30e	288400	6218069	Rural	Shed	13	142																		1					
D30r02	289605	6218071	Rural	Portico	9	41																		1					
D30r03	289546	6218051	Rural	Shed	3	6																		1					
D30r05	289395	6218062	Rural	Shed	11	62																		1					
D30t01	288568	6218043	Tank	-	8	54																		1					
D31a	288938	6218129	House	-	14	140				1	1							1		1									
D31b	288898	6218144	Rural	Shed	11	78																	1						
D31d	288886	6218124	House	-	25	296				1	1				1			1		1									
D31t01	288896	6218105	Tank	-	8	51																							
D31t02	288941	6218135	Tank	-	2	3																							
D31t03	288942	6218137	Tank	-	2	3																							
D32a	288858	6217974	House	-	28	326				1	1				1			1		1									
D32c	288869	6217928	Rural	Shed	10	67																		1					
D32r01	288871	6217969	Rural	Shed	9	50																		1					
D32r02	288864	6217959	Rural	Carport	7	21																			1				
D32t01	288867	6217993	Tank	-	8	48																							
D32t02	288875	6217992	Tank	-	2	3																							
D33a	288993	6217827	House	-	23	356				1	1							1		1									
D33b	288959	6217810	Rural	Shed	12	108																	1						

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures								
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
H1	H2	H3	H4																											
D33c	289016	6217855	Rural	Shed	6	21																	1							
D33d	288963	6217852	Rural	Shed	5	15																	1							
D33e	288951	6217811	Rural	Shed	9	33																	1							
D33f	288966	6217809	Rural	Shed	9	32																	1							
D33p01	289005	6217862	Pool		8	32																		1						
D33r01	288948	6217813	Rural	Shed	5	9																	1							
D33r02	289014	6217859	Rural	Shed	2	4																	1							
D33t01	288983	6217805	Tank	-	8	46																	1							
D34a	289180	6217863	House	-	36	567			1		1			1			1	1												
D39r01	289021	6217776	Rural	Shed	17	185																	1							
D39r02	289026	6217784	Rural	Awning	7	19																	1							
D39t03	288998	6217768	Tank	-	2	3																								
D39t05	288996	6217759	Tank	-	8	52																								
D40a	288842	6217694	House	-	47	421																								
D40b	288867	6217717	Rural	Garage	9	60			1		1			1			1	1					1							
D40r07	288869	6217703	Rural	Shed	12	145																	1							
D40t02	288872	6217719	Tank	-	2	3																								
D40t03	288872	6217717	Tank	-	2	3																								
D40t05	288819	6217685	Tank	-	7	42																								
D56h01	289297	6218273	House	-	30	446			1		1						1					1								
D56r01	289290	6218301	Rural	Shed	10	68																								
D56t01	289278	6218265	Tank	-	8	46																	1							
D56t02	289291	6218307	Tank	-	2	4																								
D56t03	289279	6218290	Tank	-	2	4																								
D57h01	288874	6217760	House	-	15	125			1	1				1			1		1											
D57r01	288863	6217755	Rural	Garage	6	31																	1							
D57r03	288878	6217755	Rural	Awning	9	39																	1							
D57t01	288882	6217764	Tank	-	2	4																								
D57t02	288847	6217734	Tank	-	5	17																								
D57t03	288870	6217769	Tank	-	4	11																								
D57t04	288883	6217761	Tank	-	2	3																								
F10a	288630	6217762	House	-	25	375			1	1				1				1		1			1							
F10b	288647	6217716	Rural	Shed	13	70																								
F10p01	288618	6217756	Pool	-	7	17																		1						
F10r01	288641	6217721	Rural	Carport	9	18																	1							
F10r03	288664	6217713	Rural	Shed	21	259																	1							
F10r04	288622	6217732	Rural	Shed	6	22																	1							
F10t01	288640	6217734	Tank	-	8	46																								
F10t02	288653	6217706	Tank	-	2	2																								
F11f	288552	6217594	Rural	Shed	25	344																	1							
F11g	288546	6217645	Rural	Shed	7	29																	1							
F11r01	288543	6217607	Rural	Shed	14	72																	1							
F12h01	288466	6217584	House	-	22	315			1	1				1			1	1					1							
F12p01	288474	6217566	Pool	-	13	48																								
F12r01	288460	6217565	Rural	Garage	12	78																	1							
F12r03	288506	6217597	Rural	Shed	18	130																	1							
F12r04	288532	6217591	Rural	Shed	9	28																	1							
F12t01	288491	6217579	Tank	-	8	56																								
F12t02	288468	6217552	Tank	-	2	4																								
F12t03	288513	6217606	Tank	-	2	5																								
F19h01	287897	6217471	House	-	39	629			1		1			1			1		1				1							
F19r01	287897	6217484	Rural	Carport	13	98																	1							
F19r02	287927	6217467	Rural	Shed	15	127																	1							
F19r03	287908	6217544	Tennis court	-	33	483																								
F19r04	287891	6217518	Rural	Shed	12	100																	1							
F19t01	287917	6217455	Tank	-	7	44																								
F19t02	287923	6217453	Tank	-	4	12																								
F19t03	287928	6217457	Tank	-	4	12																								
F20h01	287763	6217696	House	-	19	318			1	1				1			1					1								
F20r01	287773	6217667	Rural	Shed	14	108																	1							
F20t01	287781	6217707	Tank	-	8	51																								
F20t02	287770	6217659	Tank	-	3	9																								
F20t03	287768	6217662	Tank	-	3	9																								
F21a	288154	6217720	House	-	34	471	1	Top	1		1			1			1	1												
F21b	288132	6217714	Rural	Shed	18	108																	1							

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures						
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
H1	H2	H3	H4																										
F21f	287980	6217608	House	-	18	143				1	1					1		1											
F21p01	288179	6217725	Pool	-	9	41														1									
F21r02	288218	6217722	Tennis court	-	33	553																							
F21r03	287952	6217609	Rural	Shed	9	40														1									
F21r04	287986	6217604	Rural	Awning	12	51														1									
F22a	288133	6217800	House	-	30	238		1	Bottom	1		1				1					1								
F22b	288161	6217796	House	-	14	134		1	Bottom	1	1																		
F22c	288150	6217790	Rural	Shed	7	48																							
F22d	288096	6217797	Rural	Garage	12	71																							
F22e	288093	6217880	Rural	Shed	7	50																							
F22p01	288134	6217815	Pool	-	9	34																							
F22r01	288147	6217799	Rural	Pergola	11	76																							
F22r02	288133	6217792	Rural	Pergola	6	27																							
F22r04	288117	6217843	Rural	Shed	17	171																							
F22r01	288091	6217793	Tank	-	2	2																							
F23a	288363	6217774	House	-	28	309																							
F23b	288366	6217798	Rural	Garage	11	62																							
F23c	288409	6217853	Rural	Shed	17	182																							
F23d	288418	6217853	Rural	Carport	8	37																							
F23e	288404	6217860	Rural	Carport	8	37																							
F23f	288342	6217767	Rural	Shed	28	246																							
F23p01	288349	6217794	Pool	-	9	47																							
F23r01	288359	6217783	Rural	Awning	16	89																							
F23r02	288364	6217791	Rural	Carport	4	13																							
F23r01	288363	6217803	Tank	-	2	5																							
F23r02	288411	6217864	Tank	-	4	10																							
F24a	288571	6217829	House	-	26	328				2			1																
F24b	288562	6217802	Rural	Shed	7	41																							
F24c	288552	6217834	Rural	Shed	8	57																							
F24d	288539	6217841	Rural	Shed	10	41																							
F24e	288543	6217849	Rural	Shed	7	30																							
F24f	288546	6217855	Rural	Shed	7	28																							
F24r03	288533	6217833	Rural	Shed	3	11																							
F24r04	288550	6217823	Rural	Shed	19	58																							
F25a	288394	6218014	House	-	28	348				1	1					1													
F25b	288416	6218037	Rural	Garage	11	83																							
F25c	288417	6218076	Rural	Shed	8	52																							
F25d	288404	6218076	Rural	Shed	8	37																							
F25e	288390	6218095	Rural	Shed	15	128																							
F25p01	288405	6218086	Pool	-	8	36																							
F25r01	288385	6218003	Rural	Awning	4	10																							
F25r02	288412	6218029	Rural	Greenhouse	6	30																							
F25r03	288366	6217995	Rural	Shed	2	4																							
F25r04	288414	6218090	Rural	Shed	2	4																							
F25r01	288385	6218087	Tank	-	2	4																							
F26a	288569	6218110	House	-	23	301				1	1					1													
F26b	288496	6218081	Rural	Shed	10	69																							
F26c	288504	6218070	Rural	Shed	4	13																							
F26d	288508	6218067	Rural	Shed	5	15																							
F26e	288503	6218065	Rural	Shed	3	9																							
F26h	288561	6218140	Rural	Garage	5	25																							
F26r01	288586	6218111	Rural	Shed	3	6																							
F26r02	288501	6218078	Rural	Awning	5	13																							
F26r01	288493	6218087	Tank	-	3	8																							
F26r02	288489	6218204	Tank	-	3	9																							
F27a	288671	6218008	House	-	34	380																							
F27r01	288661	6218006	Rural	Pergola	6	29																							
F27r01	288700	6218023	Tank	-	7	41																							
F27r02	288659	6217994	Tank	-	2	2																							
F27r03	288671	6217985	Tank	-	2	2																							
F27r04	288673	6217983	Tank	-	2	2																							
F28a	288716	6218154	House	-	32	499				1		1				1													
F28b	288754	6218174	Rural	Garage	12	81																							
F28c	288747	6218184	Rural	Shed	9	63																							
F28f	288760	6218187	Rural	Shed	14	131																							

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piled Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
											H1	H2	H3	H4								R	P	T	TC	PA	PU	C	
F28p01	288695	6218156	Pool	-	10	41																							
F28r01	288751	6218168	Rural	Carport	12	95																1							
F28r02	288761	6218171	Rural	Shed	7	22																1							
F28r03	288757	6218179	Rural	Shed	11	40																1							
F28r04	288688	6218149	Rural	Shed	4	9																1							
F28t01	288694	6218144	Tank	-	7	39																		1					
F28t02	288745	6218176	Tank	-	2	3																		1					
F28t03	288746	6218178	Tank	-	2	3																		1					
F28t04	288755	6218195	Tank	-	2	5																		1					
F28t05	288763	6218176	Tank	-	2	5																		1					
F29a	288770	6218222	House	-	15	164				1	1				1			1			1								
F29b	288759	6218249	Rural	Shed	9	48																1							
F29t01	288760	6218237	Tank	-	7	39																		1					
F29t02	288749	6218252	Tank	-	4	11																		1					
F29t03	288782	6218214	Tank	-	2	2																		1					
F29t04	288784	6218217	Tank	-	2	2																		1					
F30a	288780	6218325	House	-	20	304				1	1				1			1	1										
F30b	288782	6218310	Rural	Shed	6	17																1							
F30r01	288766	6218366	Rural	Shed	12	125																1							
F30t01	288758	6218329	Tank	-	8	49																		1					
F30t02	288761	6218371	Tank	-	3	8																		1					
F31a	287791	6217789	House	-	23	202				2			1			1	1		1	1									
F31b	287780	6217800	Rural	Pergola	11	87										1	1		1	1		1							
F31c	287756	6217797	Rural	Shed	12	68																1							
F31t01	287780	6217792	Tank	-	3	6																1							
F32a	288648	6217972	House	-	19	195				2			1		1			1	1					1					
F32b	288610	6217968	Rural	Shed	17	102																1							
F32c	288580	6217949	Rural	Shed	11	116																1							
F32p01	288635	6217982	Pool	-	11	39																	1						
F32r01	288638	6217979	Rural	Pergola	4	15																1							
F32r02	288622	6217975	Rural	Shed	8	45																1							
F32t01	288605	6217940	Tank	-	7	41																		1					
F33a	288414	6217647	House	-	18	270				2			1		1			1		1				1					
F33b	288389	6217630	Rural	Cabana	6	30																1							
F33c	288394	6217648	Rural	Shed	6	22																1							
F33d	288452	6217674	Rural	Garage	8	50																1							
F33p01	288392	6217637	Pool	-	7	28																	1						
F33r01	288384	6217633	Rural	Shed	2	3																1							
F33r02	288406	6217654	Rural	Awning	10	37																1							
F33r03	288457	6217679	Rural	Shed	6	36																1							
F33r04	288342	6217654	Rural	Shed	2	4																1							
F33r05	288448	6217697	Rural	Shed	3	7																1							
F33t01	288439	6217661	Tank	-	7	36																		1					
F33t02	288400	6217621	Tank	-	2	4																		1					
F33t03	288385	6217626	Tank	-	3	7																		1					
F33t04	288460	6217684	Tank	-	2	3																		1					
F33t05	288461	6217682	Tank	-	2	3																		1					
F34a	288406	6218255	House	-	39	494				2			1		1			1			1								
F34b	288370	6218191	Rural	Shed	20	273																1							
F34r01	288407	6218229	Rural	Garage	10	77																1							
F34r02	288363	6218241	Tennis court	-	34	572																1							
F34t01	288370	6218265	Tank	-	9	58																			1				
F34t02	288362	6218200	Tank	-	4	10																			1				
F35a	288148	6218446	House	-	24	287				1	1				1			1											
F35b	288138	6218450	Rural	Pergola	10	65																1							
F35c	288140	6218460	Rural	Carport	6	41																1							
F35p01	288145	6218429	Pool	-	10	42																	1						
F35t01	288140	6218420	Rural	Gazebo	8	45																1							
F36b	288272	6218537	Rural	Garage	10	56																1							
F36c	288228	6218551	Rural	Shed	13	97																1							
F36d	288308	6218594	Rural	Gazebo	10	214																1							
F36h01	288265	6218573	House	-	37	472				1		1			1			1											
F36p01	288296	6218567	Pool	-	10	37																	1						
F36t01	288307	6218578	Tank	-	7	40																		1					
F37a	288621	6218515	House	-	21	780				1	1				1			1			1								

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
F37b	288588	6218508	Rural	Shed	11	114																	1						
F37c	288593	6218520	Rural	Shed	11	77																	1						
F37r01	288606	6218556	Rural	Shed	11	114																	1						
F37r02	288580	6218547	Rural	Shed	5	17																	1						
F3701	288639	6218519	Tank	-	8	52																			1				
F3702	288649	6218540	Tank	-	2	3																			1				
F3703	288588	6218516	Tank	-	3	7																			1				
F3704	288591	6218515	Tank	-	3	7																			1				
F3705	288594	6218513	Tank	-	3	7																			1				
F3706	288608	6218563	Tank	-	3	7																			1				
F3707	288582	6218551	Tank	-	2	3																			1				
F39a	288827	6218517	House	-	15	188				1	1				1			1		1									
F39b	288796	6218507	Rural	Shed	18	155																	1						
F39c	288800	6218498	Rural	Shed	7	45																	1						
F39d	288797	6218488	Rural	Shed	6	15																	1						
F39e	288775	6218522	Rural	Shed	14	33																	1						
F39r01	288782	6218523	Rural	Shed	4	13																	1						
F39r02	288785	6218503	Rural	Shed	3	9																	1						
F3901	288778	6218517	Tank	-	3	7																			1				
F3902	288786	6218517	Tank	-	7	37																				1			
F40a	288808	6218615	House	-	17	302				2			1					1					1						
F40b	288785	6218602	Rural	Shed	7	46																	1						
F40c	288829	6218603	Rural	Shed	12	109																	1						
F40d	288843	6218598	Rural	Shed	15	108																	1						
F40e	288856	6218591	Rural	Shed	3	7																	1						
F40p01	288791	6218614	Pool	-	12	39																		1					
F40r01	288798	6218624	Rural	Pergola	11	67																	1						
F4001	288771	6218606	Tank	-	8	47																			1				
F4002	288779	6218620	Tank	-	2	3																			1				
F4003	288852	6218594	Tank	-	2	3																			1				
F41a	288533	6218866	House	-	25	337				1	1							1											
F41b	288494	6218851	Rural	Shed	14	121																	1						
F41c	288474	6218843	Rural	Shed	4	10																	1						
F4101	288490	6218842	Tank	-	2	5																			1				
F43a	288021	6217832	House	-	34	470				1		1						1		1					1				
F43b	287965	6217768	Rural	Garage	17	246																	1						
F4301	288041	6217848	Tank	-	8	56																			1				
F4302	288032	6217853	Tank	-	2	2																			1				
F4303	288031	6217856	Tank	-	2	2																			1				
F4304	287956	6217773	Tank	-	2	2																			1				
F45h01	288871	6218872	House	-	27	347				1	1							1		1					1				
F45p01	288851	6218872	Pool	-	1	40																							
F45r01	288836	6218863	Rural	Shed	15	212																	1						
F45r02	288860	6218881	Rural	Carport	13	121																	1						
F45r03	288807	6218857	Rural	Shed	10	35																	1						
F45r04	288789	6218886	Rural	Greenhouse	12	70																	1						
F4501	288830	6218854	Tank	-	3	9																			1				
F4502	288840	6218852	Tank	-	3	9																			1				
F4503	288839	6218916	Tank	-	2	3																			1				
F46h01	288629	6219068	House	-	22	330				1	1							1											
F46r01	288647	6219071	Rural	Pergola	12	88																	1						
F46r02	288586	6219057	Rural	Shed	17	137																	1						
F46r03	288563	6219059	Rural	Shed	9	58																	1						
F46r04	288589	6219079	Rural	Shed	2	3																	1						
F46r05	288656	6219094	Rural	Shed	2	3																	1						
F46r06	288658	6219097	Rural	Shed	2	3																	1						
F46t01	288576	6219058	Tank	-	3	5																			1				
F46t02	288576	6219061	Tank	-	2	3																			1				
F46t03	288609	6219075	Tank	-	7	37																			1				
F50h01	288191	6218575	House	-	16	185				1	1							1								1			
F50r01	288178	6218575	Rural	Carport	7	45																	1						
F50r02	288187	6218569	Rural	Pergola	6	27																	1						
F50r03	288140	6218599	Rural	Shed	6	41																	1						
F50r04	288203	6218564	Rural	Shed	8	22																	1						
F50r05	288205	6218556	Rural	Shed	9	26																	1						

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
F50r06	288180	6218551	Rural	Shed	3	9																							
F50t01	288171	6218573	Tank	-	3	9																	1						
F50t02	288200	6218575	Tank	-	3	6																							
F50t03	288200	6218578	Tank	-	3	6																							
F50t04	288172	6218560	Tank	-	2	4																							
F51h01	288032	6218521	House	-	36	514				1		1						1											
F51p01	288012	6218510	Pool	-	8	24																							
F51r01	287947	6218467	Rural	Shed	12	87																							
F51r02	287951	6218476	Rural	Shed	9	55																							
F51r03	287992	6218516	Rural	Shed	3	7																							
F51r04	287981	6218473	Rural	Shed	2	3																							
F51r05	288039	6218535	Rural	Awning	14	54																							
F51r06	288018	6218525	Rural	Awning	13	44																							
F51r07	288052	6218514	Rural	Shed	8	50																							
F51r08	288056	6218520	Rural	Shed	5	9																							
F51r09	288010	6218507	Rural	Shed	4	7																							
F51r10	288047	6218542	Rural	Shed	3	6																							
F51r11	288022	6218508	Rural	Shed	2	4																							
F51r12	288008	6218528	Rural	Shed	2	4																							
F51t01	287973	6218539	Tank	-	10	72																							
F51t02	287980	6218516	Tank	-	7	43																							
F51t03	287939	6218464	Tank	-	3	6																							
F52h01	287830	6218391	House	-	25	305				1	1							1											
F52h02	287890	6218373	House	-	10	74				1	1							1											
F52r01	287807	6218402	Rural	Shed	8	69																							
F52r02	287803	6218381	Rural	Shed	14	118																							
F52r03	287795	6218380	Rural	Pergola	6	29																							
F52r04	287883	6218373	Rural	Carport	7	29																							
F52r05	287787	6218469	Rural	Shed	6	33																							
F52r06	287748	6218463	Rural	Shed	5	20																							
F52r07	287742	6218462	Rural	Shed	5	29																							
F52r08	287783	6218526	Rural	Shed	4	11																							
F52r09	287801	6218403	Rural	Awning	8	19																							
F52t01	287896	6218365	Tank	-	3	9																							
F52t02	287804	6218477	Tank	-	3	9																							
F54PA01	288853	6218418	Public Amenity	Bus shelter	3	7																							
F55h01	288549	6218996	House	-	32	491				1		1																	
F55r01	288573	6218976	Rural	Garage	7	46																							
F55r02	288570	6219031	Rural	Shed	13	134																							
F55r03	288556	6219053	Rural	Shed	3	7																							
F55t01	288571	6219043	Tank	-	8	55																							
F55t02	288561	6219045	Tank	-	3	9																							
F55t03	288558	6219046	Tank	-	3	9																							
F55t04	288543	6219054	Tank	-	3	9																							
F55t05	288546	6219054	Tank	-	2	4																							
F56h01	288866	6219263	House	-	19	229				1	1							1											
F56r01	288858	6219261	Rural	Awning	15	68																							
F56r02	288850	6219241	Rural	Shed	12	83																							
F56r03	288830	6219255	Rural	Shed	5	25																							
F56r04	288822	6219264	Rural	Shed	5	24																							
F56r05	288838	6219279	Rural	Shed	9	63																							
F56r06	288797	6219255	Rural	Shed	11	58																							
F56r07	288767	6219255	Rural	Shed	10	58																							
F56r08	288964	6219313	Rural	Shed	12	67																							
F56r09	288972	6219313	Rural	Shed	4	7																							
F56r10	288833	6219280	Rural	Awning	3	7																							
F56t01	288839	6219239	Tank	-	2	3																							
F56t02	288840	6219242	Tank	-	2	3																							
F56t03	288795	6219248	Tank	-	4	15																							
F56t04	288774	6219252	Tank	-	2	3																							
F56t05	288760	6219256	Tank	-	2	3																							
F56t06	288760	6219259	Tank	-	2	3																							
F56t07	288833	6219275	Tank	-	2	3																							
F56t08	288838	6219285	Tank	-	1	1																							
F56t09	288840	6219285	Tank	-	1	1																							

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures								
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
																														H1
F56t10	288972	6219310	Tank	-	2	4																								
F57h01	289023	6219643	House	-	8	59																								
F57h02	289011	6219643	House	-	5	27																								
F57r01	289018	6219639	Rural	Awning	3	9																								
F57r02	288989	6219699	Rural	Shed	18	119																								
F57r03	289034	6219582	Rural	Shed	4	13																								
F57r04	289035	6219568	Rural	Animal shelter	23	89																								
F57r05	289023	6219543	Rural	Shed	14	91																								
F57r06	289023	6219531	Rural	Shed	5	22																								
F57r07	288962	6219434	Rural	Shed	17	243																								
F57r08	288674	6219723	Rural	Shed	30	391																								
F57t01	288984	6219691	Tank	-	2	3																								
F57t02	288679	6219740	Tank	-	2	4																								
F58h01	289003	6219794	House	-	33	450				1		1						1												
F58p01	288989	6219828	Pool	-	10	30																								
F58r01	288996	6219804	Rural	Awning	11	45																								
F58t01	289018	6219826	Tank	-	8	48																								
F59h01	288989	6219874	House	-	22	238				1								1												
F59h02	288987	6219859	House	-	13	79				1	1																			
F59r01	288974	6219886	Rural	Shed	7	46																								
F59r02	288983	6219866	Rural	Awning	3	6																								
F59r03	288979	6219859	Rural	Shed	6	11																								
F59r04	288977	6219904	Rural	Gazebo	4	12																								
F59r05	289019	6219911	Rural	Animal shelter	3	6																								
F59r06	289022	6219919	Rural	Animal shelter	4	10																								
F59r07	289104	6219923	Rural	Shed	3	7																								
F59r08	289109	6219923	Rural	Shed	6	17																								
F59t01	288977	6219903	Tank	-	8	48																								
F59t02	288970	6219898	Tank	-	2	4																								
F60h01	288214	6220041	House	-	23	318													1											
F60h02	288199	6220022	House	-	17	145																								
F60p01	288197	6220032	Pool	-	12	63																								
F60r01	288221	6220021	Rural	Garage	6	31																								
F60r02	288171	6220019	Rural	Shed	22	198																								
F60r03	288314	6220112	Tennis court	-	33	549																								
F60r04	288504	6219971	Rural	Shed	16	93																								
F60r05	288505	6219958	Rural	Shed	6	27																								
F60r06	288494	6219974	Rural	Shed	6	14																								
F60r07	288867	6220073	Rural	Shed	18	94																								
F60r08	289015	6220094	Rural	Animal shelter	4	18																								
F60r09	289044	6220096	Rural	Animal shelter	4	18																								
F60r10	289000	6220140	Rural	Animal shelter	4	18																								
F60r11	289029	6220142	Rural	Animal shelter	4	18																								
F60r12	288986	6220186	Rural	Animal shelter	4	18																								
F60r13	289014	6220188	Rural	Animal shelter	4	18																								
F60t01	288206	6220061	Tank	-	8	44																								
F60t02	288189	6219998	Tank	-	8	44																								
F61h01	288242	6220822	House	-	29	393				1	1																			
F61r01	288249	6220839	Rural	Awning	9	46																								
F61r02	288236	6220835	Rural	Awning	18	56																								
F61r03	288327	6220832	Rural	Animal shelter	6	23																								
F61r04	288332	6220805	Rural	Shed	10	42																								
F61r05	288339	6220811	Rural	Shed	6	27																								
F61r06	288352	6220813	Rural	Shed	10	99																								
F61r07	288398	6220858	Rural	Shed	9	59																								
F61r08	288392	6220853	Rural	Shed	3	10																								
F61r09	288456	6220822	House	-	13	156																								
F61r10	288405	6220785	Rural	Shed	4	16																								
F61t01	288259	6220802	Tank	-	7	37																								
F61t02	288460	6220808	Tank	-	6	27																								
F63h01	289161	6219445	House	-	30	451																								
F63r01	289179	6219467	Rural	Garage	12	81																								
F63r02	289171	6219450	Rural	Awning	27	40				1																				
F63r03	289173	6219497	Rural	Shed	10	67																								
F63t01	289141	6219453	Tank	-	8	45																								

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
H1	H2	H3	H4																											
F63t02	289172	6219490	Tank	-	3	5																								
F64h01	289287	6219641	House	-	19	225				1	1								1											
F64r01	289252	6219639	Rural	Garage	8	49																	1							
F64r02	289258	6219630	Rural	Garage	9	52																	1							
F64r03	289273	6219631	Rural	Shed	7	28																	1							
F64r04	289313	6219631	Rural	Shed	8	38																	1							
F64r05	289251	6219597	Rural	Shed	18	137																	1							
F64t01	289247	6219630	Tank	-	8	45																								
F64t02	289280	6219633	Tank	-	3	5																								
F65h01	289423	6219558	House	-	20	290				1	1								1											
F65t01	289421	6219541	Tank	-	3	8																								
F65t02	289487	6219566	Tank	-	2	5																								
K01a	288143	6218214	House	-	41	630				1		1			1			1		1										
K01r01	288114	6218235	Rural	Garage	13	156																	1							
K01r02	288194	6218255	Rural	Shed	5	13																	1							
K01r03	288153	6218226	Rural	Awning	4	17																	1							
K01t01	288207	6218251	Tank	-	8	48																								
K01t02	288198	6218255	Tank	-	2	4																								
K01t03	288176	6218216	Tank	-	2	4																								
K02a	288027	6218182	House	-	31	416				1		1			1			1		1										
K02p01	288033	6218195	Pool	-	11	31																		1						
K02r01	288020	6218189	Rural	Pergola	10	53																	1							
K02r02	287961	6218219	Rural	Shed	3	7																	1							
K02r03	287994	6218188	Rural	Shed	2	5																	1							
K02r04	288041	6218197	Rural	Cabana	4	16																	1							
K02t01	288062	6218192	Tank	-	8	44																								
K02t02	288054	6218183	Tank	-	2	3																								
K02t03	288053	6218186	Tank	-	2	3																								
K03a	287915	6218127	House	-	29	470				1	1				1			1		1										
K03r01	287888	6218106	Rural	Shed	12	119																	1							
K03r02	287886	6218114	Rural	Shed	10	38																	1							
K03r03	287880	6218130	Rural	Shed	2	4																	1							
K03r04	287880	6218274	Rural	Animal shelter	3	10																	1							
K03r05	287881	6218101	Rural	Shed	5	21																	1							
K03r06	287898	6218160	Rural	Shed	3	6																	1							
K03r07	287948	6218303	Rural	Shed	3	8																	1							
K03t01	287937	6218147	Tank	-	7	41																								
K03t02	287940	6218137	Tank	-	2	4																								
K04a	288021	6218051	House	-	19	323				1	1				1				1		1									
K04h01	288065	6218076	House	-	33	482				1		1			1			1		1										
K04p01	288066	6218063	Pool	-	10	25																		1						
K04r01	288043	6218072	Rural	Garage	16	134																	1							
K04r02	288036	6218023	Rural	Shed	16	186																	1							
K04r03	288044	6218000	Rural	Shed	12	93																	1							
K04r04	288044	6218056	Rural	Shed	7	23																	1							
K04r05	287994	6218079	Rural	Shed	3	10																	1							
K04r06	288034	6218032	Rural	Shed	5	13																	1							
K04r07	288035	6218014	Rural	Shed	4	10																	1							
K04t01	288087	6218069	Tank	-	8	48																								
K04t02	288025	6218032	Tank	-	8	48																								
K04t03	288039	6218015	Tank	-	3	9																								
K04t04	288032	6218042	Tank	-	2	4																								
K05a	287878	6217974	House	-	29	375				1	1				1			1		1										
K05r01	287914	6217951	Rural	Shed	10	99																	1							
K05r02	287906	6217949	Rural	Shed	10	51																	1							
K05r03	287889	6217968	Rural	Carport	7	25																	1							
K05t01	287851	6217952	Tank	-	8	53																								
K05t02	287914	6217944	Tank	-	2	3																								
K05t03	287876	6217940	Tank	-	2	3																								
L01a	288859	6218058	House	-	30	451				1		1			1			1		1										
L01r01	288961	6218011	Rural	Shed	6	21																	1							
L01t01	288875	6218036	Tank	-	9	57																								
L01t02	288862	6218032	Tank	-	2	3																								
L01t03	288862	6218030	Tank	-	2	3																								
L01t04	288829	6218067	Tank	-	2	3																								

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Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
											H1	H2	H3	H4									R	P	T	TC	PA	PU	C	
O02h01	286819	6216843	House	-	37	445	1		Top	1			1						1											
O02r01	286822	6216852	Rural	Awning	20	60																	1							
O02r02	286805	6216818	Rural	Shed	11	105																	1							
O02r04	286819	6216807	Rural	Shed	5	15																	1							
O02r07	286822	6216809	Rural	Shed	3	6																	1							
O02t01	286823	6216878	Tank	-	9	58																								
O02t02	286812	6216813	Tank	-	2	3																			1					
O03h01	286686	6216962	House	-	36	675	1		Top	1			1		1				1		1									
O03r01	286698	6216934	Rural	Garage	12	131																	1							
O03r02	286693	6216971	Rural	Pergola	10	75																	1							
O03r03	286687	6217004	Rural	Garage	15	168																	1							
O03t01	286696	6216987	Tank	-	7	43																			1					
O03t02	286706	6216929	Tank	-	5	18																			1					
O03t03	286697	6217006	Tank	-	3	9																			1					
O03t04	286708	6216934	Tank	-	4	12																			1					
O04h01	286694	6217046	House	-	27	450	1		Top	2				1		1				1		1								
O04r01	286684	6217024	Rural	Garage	14	80																	1							
O04r02	286700	6217026	Rural	Shed	10	39																	1							
O04r03	286713	6217040	Rural	Shed	5	13																	1							
O04r04	286699	6217021	Rural	Shed	5	14																	1							
O04r05	286693	6217024	Rural	Shed	4	8																	1							
O04r06	286786	6217052	Rural	Shed	4	17																	1							
O04r07	286707	6217057	Rural	Shed	3	8																	1							
O04t01	286689	6217067	Tank	-	8	55																			1					
O04t02	286696	6217067	Tank	-	2	2																			1					
O04t03	286696	6217070	Tank	-	2	2																			1					
O05h01	286769	6217191	House	-	26	377	1		Top	2				1		1			1	1										
O05r01	286857	6217234	Rural	Shed	15	213																	1							
O05t01	286787	6217174	Tank	-	9	60																			1					
O05t02	286847	6217176	Tank	-	2	3																			1					
O05t03	286849	6217175	Tank	-	2	3																			1					
O06h01	286879	6217362	House	-	22	367	1		Top	1	1								1					1						
O06r01	286899	6217389	Rural	Shed	12	134																	1							
O06t01	286900	6217342	Tank	-	8	55																			1					
O06t02	286896	6217381	Tank	-	2	2																			1					
O07r01	286849	6217461	Rural	Shed	17	233																	1							
O07r02	286840	6217435	Rural	Shed	6	44																	1							
O07r03	286831	6217384	Rural	Shed	4	10																	1							
O07r04	286837	6217431	Rural	Shed	7	15																	1							
O07r05	286843	6217438	Rural	Shed	7	16																	1							
O07r06	286837	6217429	Rural	Shed	6	12																	1							
O07r07	286844	6217505	Rural	Shed	2	5																	1							
O07t01	286841	6217500	Tank	-	9	60																			1					
O07t02	286830	6217379	Tank	-	3	8																			1					
O07t03	286828	6217380	Tank	-	3	8																			1					
O08h01	286787	6217320	House	-	28	277	1		Top	1	1				1				1	1				1						
O08r01	286753	6217282	Rural	Shed	8	52																			1					
O08r02	286752	6217307	Rural	Shed	3	7																			1					
O08t01	286811	6217293	Tank	-	7	43																			1					
O08t02	286817	6217297	Tank	-	4	11																			1					
O08t03	286765	6217301	Tank	-	5	20																			1					
O08t05	286745	6217280	Tank	-	4	10																			1					
O09h01	286389	6216914	House	-	18	292	1		Top	2				1		1			1	1				1						
O09r01	286346	6216911	Rural	Garage	11	106																		1						
O09r02	286321	6216923	Tennis court	-	31	444																								
O09t01	286369	6216927	Tank	-	8	45																				1				
O10h01	286265	6217005	House	-	13	151	1		Top	1	1					1			1			1								
O10h02	286241	6216920	House	-	32	548	1		Top	1			1						1		1									
O10r02	286301	6217044	Rural	Shed	7	25																		1						
O10r03	286300	6217035	Rural	Shed	11	40																		1						
O10r04	286209	6217063	Rural	Shed	5	30																			1					
O10r05	286248	6217033	Rural	Shed	10	22																		1						
O10r06	286252	6217028	Rural	Shed	5	21																		1						
O10t01	286303	6217025	Tank	-	8	45																								

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
																														H1
O10t03	286260	6216921	Tank	-	2	4																								
O11h01	286036	6216906	House	-	34	379	1	Top		1				1				1												
O11h02	286013	6216924	House	-	14	178	1	Top		1	1							1												
O11r01	286067	6216921	Rural	Shed	3	7																	1							
O11r02	286062	6216921	Rural	Shed	2	4																	1							
O11r03	286077	6216934	Rural	Shed	6	29																	1							
O11r04	286036	6216916	Rural	Awning	12	56																	1							
O11r05	285995	6216929	Rural	Shed	11	113																	1							
O11r06	286059	6216938	Rural	Shed	5	16																	1							
O11r07	286032	6216873	Rural	Shed	3	9																	1							
O11r08	285976	6216909	Rural	Shed	6	21																	1							
O11r09	286031	6216937	Rural	Shed	3	7																	1							
O11t01	286009	6216905	Tank	-	8	53																								
O11t02	286078	6216940	Tank	-	2	3																								
O12h01	285980	6217016	House	-	36	435	1	Top		1		1						1			1									
O12p01	285995	6217024	Pool	-	11	46																								
O12r01	285964	6217050	Rural	Shed	13	90																	1							
O12r02	285977	6217048	Rural	Shed	3	6																	1							
O12t01	285987	6216993	Tank	-	7	42																								
O13h01	286022	6217093	House	-	38	549	1	Top		1		1						1			1									
O13p01	286036	6217100	Pool	-	7	22																								
O13r01	286088	6217102	Rural	Shed	9	59																	1							
O13r02	286089	6217071	Rural	Shed	7	19																	1							
O13r03	286031	6217093	Rural	Awning	25	74																	1							
O13t01	286024	6217120	Tank	-	7	34																								
O14h01	286143	6217177	House	-	21	240	1	Top		1	1							1			1									
O14r01	286149	6217140	Rural	Shed	15	102																	1							
O14r02	286185	6217135	Rural	Shed	7	22																	1							
O14r03	286151	6217149	Rural	Shed	9	50																	1							
O14r04	286157	6217146	Rural	Shed	70	33																	1							
O14r05	286146	6217072	Rural	Shed	4	16																	1							
O15h01	286233	6217450	House	-	23	297	1	Top		1	1							1					1							
O15r02	286238	6217438	Rural	Carport	7	44																								
O15r03	286183	6217453	Rural	Shed	30	249																	1							
O15r08	286166	6217424	Rural	Shed	13	117																	1							
O15t01	286231	6217469	Tank	-	8	45																								
O15t02	286192	6217472	Tank	-	8	57																								
O15t04	286157	6217423	Tank	-	3	7																								
O16h01	285966	6217415	House	-	22	275	1	Top		1	1							1			1									
O16p01	285989	6217413	Pool	-	8	28																								
O16r01	285989	6217423	Rural	Garage	7	54																	1							
O16r02	285988	6217405	Rural	Shed	7	23																	1							
O16r03	285996	6217422	Rural	Shed	6	7																	1							
O16r04	286010	6217398	Rural	Shed	3	7																	1							
O16r05	285999	6217421	Rural	Shed	3	5																	1							
O16r06	285974	6217420	Rural	Pergola	7	35																	1							
O16t01	285970	6217433	Tank	-	8	48																								
O16t02	285993	6217405	Tank	-	2	4																								
O19h01	286267	6217198	House	-	41	475	1	Top																						
O19r01	286236	6217160	Rural	Shed	18	213																	1							
O19t01	286229	6217150	Tank	-	3	8																								
O19t02	286233	6217150	Tank	-	3	8																								
O21h01	286003	6217327	House	-	17	173	1	Top		1	1							1			1									
O21h02	285983	6217328	House	-	13	138	1	Top		1	1							1			1									
O21r09	285989	6217458	Rural	Shed	3	10																	1							
O21r10	286031	6217452	Rural	Shed	3	10																	1							
O21r11	286083	6217444	Rural	Shed	3	10																	1							
O21r12	286143	6217446	Rural	Shed	3	10																	1							
O21r13	286126	6217424	Rural	Shed	22	347																	1							
O21r14	286123	6217401	Rural	Shed	16	243																	1							
O21r15	286009	6217358	House	-	15	108	1	Top																						
O21r16	286035	6217328	Rural	Awning	4	16																	1							
O21r17	286116	6217480	Rural	Shed	3	10																	1							
O21t05	286137	6217426	Tank	-	3	9																								
O21t06	286136	6217422	Tank	-	3	9																								

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
																														H1
O21t07	286027	6217324	Tank	-	8	52																								
O21t08	286008	6217373	Tank	-	2	4																								
O21t09	286009	6217376	Tank	-	2	4																								
O22h01	286161	6217324	House	-	33	430	1		Top												1									
O22t01	286169	6217345	Tank	-	8	51																								
O22t02	286135	6217345	Tank	-	4	11																								
P41h01	285831	6216994	House	-	18	169	1		Top	1	1										1									
P41r05	285821	6217001	Rural	Shed	6	16																								
P44h01	285834	6217232	House	-	24	337	1		Top	1	1												1							
P44p01	285815	6217236	Pool	-	8	29																								
P44r02	285802	6217255	Rural	Garage	14	143																		1						
P44t01	285812	6217209	Tank	-	8	52																								
P44t02	285794	6217250	Tank	-	2	4																								
P45h01	285878	6217371	House	-	18	218	1		Top	1	1																			
P45r01	285901	6217355	Rural	Shed	7	35																								
P45r02	285840	6217406	Rural	Shed	21	285																								
P45t01	285875	6217355	Tank	-	8	44																								
P46h01	285786	6217438	House	-	31	450	1		Top	1		1																		
P46p01	285792	6217454	Pool	-	9	32																								
P46r01	285761	6217453	Rural	Garage	10	71																								
P46r02	285766	6217418	Rural	Shed	6	29																								
P46r03	285745	6217345	Rural	Shed	6	33																								
P46r05	285806	6217452	Rural	Gazebo	6	13																								
P46r06	285774	6217419	Rural	Shed	5	20																								
P46r07	285765	6217425	Rural	Shed	5	19																								
P46r08	285800	6217407	Rural	Shed	14	131																								
P46t01	285811	6217468	Tank	-	8	53																								
P46t05	285810	6217407	Tank	-	2	4																								
P46t06	285809	6217405	Tank	-	2	2																								
P46t07	285775	6217406	Tank	-	2	4																								
P47h01	285629	6217479	House	-	30	429	1		Top	2				1	1															
P47r02	285659	6217475	Rural	Garage	13	117																								
P47t01	285600	6217439	Tank	-	8	53																								
P47t02	285602	6217447	Tank	-	2	3																								
P47t03	285599	6217447	Tank	-	2	3																								
P47t04	285626	6217369	Tank	-	2	4																								
R01h01	286372	6217572	House	-	27	472	1		Top	1	1																			
R01r01	286369	6217590	Rural	Shed	13	125																								
R01r02	286381	6217596	Rural	Shed	10	86																								
R01r03	286365	6217613	Rural	Shed	12	84																								
R01r04	286403	6217544	Rural	Shed	6	26																								
R01t01	286364	6217598	Tank	-	6	32																								
R02h01	286257	6217549	House	-	22	264	1		Top	1	1																			
R02p01	286267	6217561	Pool	-	7	30																								
R02r01	286266	6217552	Rural	Pergola	5	24																								
R02r02	286246	6217582	Rural	Shed	11	114																								
R02r03	286254	6217579	Rural	Shed	8	49																								
R02r04	286251	6217600	Rural	Shed	3	10																								
R02r05	286248	6217562	Rural	Carport	9	60																								
R02r06	286240	6217601	Rural	Shed	7	53																								
R02t01	286238	6217582	Tank	-	4	12																								
R02t02	286238	6217586	Tank	-	4	12																								
R02t03	286246	6217597	Tank	-	3	7																								
R03h01	286247	6217744	House	-	27	281	1		Top	1	1																			
R03h02	286229	6217764	House	-	15	123	1		Top	1	1																			
R03p01	286260	6217745	Pool	-	9	27																								
R03r01	286233	6217738	Rural	Carport	6	40																								
R03r02	286207	6217747	Rural	Shed	13	154																								
R03r03	286258	6217738	Rural	Shed	6	14																								
R03r04	286253	6217745	Rural	Awning	8	40																								
R03r05	286241	6217747	Rural	Awning	9	33																								
R03t01	286263	6217712	Tank	-	7	42																								
R03t02	286267	6217760	Tank	-	5	23																								
R03t03	286261	6217730	Tank	-	2	2																								
R03t04	286261	6217727	Tank	-	2	2																								

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures						
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
H1	H2	H3	H4																										
R04h01	286107	6217581	House	-	28	372	1		Top	2				1					1										
R04p01	286120	6217576	Pool	-	7	23																		1					
R04r01	286137	6217584	Rural	Carport	8	49																	1						
R04r02	286146	6217579	Rural	Shed	21	187																	1						
R04r03	286147	6217568	Rural	Shed	11	87																	1						
R04r04	286154	6217574	Rural	Shed	8	46																	1						
R04r05	286154	6217568	Rural	Shed	6	32																	1						
R04r06	286141	6217563	Rural	Shed	5	24																	1						
R04r07	286140	6217566	Rural	Shed	3	10																	1						
R04r08	286133	6217560	Rural	Shed	4	15																	1						
R04t01	286135	6217590	Tank	-	5	19																			1				
R05h01	286152	6217716	House	-	22	256	1		Top	1	1								1		1								
R05r01	286144	6217718	Rural	Pergola	6	16																	1						
R05r02	286164	6217701	Rural	Shed	9	58																	1						
R05r03	286167	6217694	Rural	Shed	9	52																	1						
R05t01	286136	6217723	Tank	-	5	20																			1				
R05t02	286169	6217702	Tank	-	2	3																			1				
R05t03	286170	6217700	Tank	-	2	3																			1				
R06h01	286137	6217764	House	-	23	279	1		Top	1	1								1										
R06r01	286154	6217761	Rural	Garage	9	55																	1						
R06r02	286122	6217754	Rural	Shed	3	10																	1						
R06r03	286162	6217772	Rural	Shed	9	25																	1						
R06r04	286169	6217768	Rural	Shed	9	56																	1						
R06r05	286175	6217765	Rural	Shed	4	6																	1						
R06t01	286159	6217757	Tank	-	2	3																			1				
R06t02	286162	6217765	Tank	-	2	3																			1				
R07h01	286158	6217886	House	-	33	394	1		Top	1		1							1										
R07p01	286184	6217893	Pool	-	11	53																		1					
R07r01	286170	6217881	Rural	Pergola	8	50																	1						
R07r02	286172	6217868	Rural	Shed	7	38																	1						
R07r03	286180	6217904	Rural	Cabana	9	73																	1						
R07r04	286196	6217932	Rural	Shed	9	72																	1						
R07r05	286205	6217931	Rural	Shed	9	81																	1						
R07t01	286185	6217909	Tank	-	3	6																			1				
R09h01	286322	6217889	House	-	34	559	1		Top	1		1							1										
R09r01	286318	6217846	Rural	Shed	18	104																	1						
R09r02	286320	6217838	Rural	Shed	9	47																	1						
R09r03	286314	6217840	Rural	Shed	3	8																	1						
R09t01	286339	6217854	Tank	-	7	42																			1				
R10h01	285888	6217582	House	-	23	306	1		Top	2			1						1										
R10h02	285908	6217560	House	-	11	99	1		Top	1	1								1		1								
R10p01	285893	6217559	Pool	-	9	36																		1					
R10r01	285906	6217604	Rural	Shed	7	46																	1						
R10r03	285872	6217565	Rural	Shed	7	31																	1						
R10r04	285877	6217594	Rural	Gazebo	6	29																	1						
R11h01	285766	6217640	House	-	29	298	1		Top	1	1								1										
R11p01	285798	6217630	Pool	-	7	25																		1					
R11r01	285766	6217689	Rural	Shed	17	290																	1						
R11r02	285798	6217699	Rural	Shed	23	141																	1						
R11r03	285789	6217622	Rural	Garage	8	56																	1						
R11r04	285792	6217591	Rural	Shed	9	47																	1						
R11r05	285793	6217667	Rural	Shed	3	8																	1						
R11r06	285739	6217614	Rural	Shed	3	7																	1						
R11r07	285737	6217616	Rural	Shed	3	5																	1						
R11r08	285786	6217608	Rural	Shed	4	15																	1						
R11t01	285798	6217658	Tank	-	8	45																			1				
R11t02	285792	6217671	Tank	-	2	2																			1				
R11t03	285769	6217701	Tank	-	3	9																			1				
R12h01	285596	6217645	House	-	26	281	1		Top	1	1																		
R12p01	285618	6217663	Pool	-	10	34																		1					
R12r02	285597	6217652	Rural	Awning	12	55																	1						
R12r03	285618	6217644	Rural	Garage	6	32																	1						
R12r04	285625	6217643	Rural	Shed	7	39																	1						
R12r05	285587	6217666	Rural	Shed	7	24																	1						
R12r06	285624	6217663	Rural	Shed	4	8																	1						

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Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
R12r07	285567	6217679	Rural	Greenhouse	4	10																1							
R12r08	285578	6217678	Rural	Greenhouse	4	10																1							
R12r09	285574	6217691	Rural	Shed	6	39																1							
R12r10	285569	6217691	Rural	Shed	5	12																1							
R12r11	285578	6217692	Rural	Shed	3	6																1							
R12r01	285571	6217668	Tank	-	8	46																		1					
R12r02	285580	6217659	Tank	-	2	3																			1				
R13r01	285532	6217681	House	-	27	287	1		Top	1	1																		
R13r01	285540	6217687	Rural	Awning	10	45																	1						
R13r02	285548	6217704	Rural	Shed	2	5																	1						
R13r03	285546	6217731	Rural	Shed	3	6																	1						
R13r04	285549	6217715	Rural	Shed	2	3																	1						
R13r01	285514	6217703	Tank	-	8	46																			1				
R14r01	285460	6217679	House	-	23	224	1		Top	1	1														1				
R14r03	285443	6217717	Rural	Shed	9	41																			1				
R14r01	285461	6217698	Tank	-	5	22																				1			
R14r03	285443	6217724	Tank	-	2	4																				1			
R16r01	285931	6217844	House	-	37	667	1		Top	1		1						1											
R16r01	285932	6217807	Rural	Shed	27	290																	1						
R16r02	285915	6217810	Rural	Shed	9	41																	1						
R16r01	285926	6217792	Tank	-	10	70																			1				
R16r02	285905	6217816	Tank	-	8	50																			1				
R16r03	285915	6217802	Tank	-	3	5																			1				
R17r01	285849	6218003	House	-	47	740	1		Top	1		1														1			
R17p01	285833	6218014	Pool	-	15	91																		1					
R17r01	285820	6217960	Rural	Shed	18	208																					1		
R17r02	285839	6217993	Rural	Awning	29	117																					1		
R17r03	285861	6218030	Rural	Garage	15	119																					1		
R17r04	285851	6218031	Rural	Shed	6	24																					1		
R17r05	285825	6218015	Rural	Cabana	8	42																					1		
R17r01	285826	6217979	Tank	-	8	50																					1		
R17r02	285841	6217967	Tank	-	2	3																					1		
R17r03	285841	6217969	Tank	-	2	3																					1		
R18r01	285861	6218116	House	-	32	528	1		Top	1		1																	
R18r01	285862	6218138	Rural	Carport	6	22																			1				
R18r02	285940	6218077	Rural	Shed	17	174																			1				
R18r03	285935	6218085	Rural	Shed	6	35																			1				
R18r04	285898	6218138	Rural	Shed	4	10																			1				
R18r05	285901	6218138	Rural	Shed	3	6																			1				
R18r06	285904	6218138	Rural	Shed	2	2																			1				
R18r01	285893	6218091	Tank	-	8	46																				1			
R18r02	285894	6218079	Tank	-	2	5																				1			
R18r03	285956	6218073	Tank	-	8	46																				1			
R19r01	286091	6218597	House	-	15	123	1		Top	1	1						1	1		1									
R19r01	286082	6218555	Rural	Shed	6	31																		1					
R19r02	286082	6218571	Rural	Shed	17	126																		1					
R19r01	286103	6218610	Tank	-	7	42																				1			
R19r02	286059	6218584	Tank	-	3	7																				1			
R20r01	285623	6218923	Rural	Animal shelter	11	50																					1		
R20r02	285628	6218945	Rural	Animal shelter	15	63																					1		
R20r03	285956	6219581	Rural	Shed	7	21																					1		
R20r04	285965	6219586	Rural	Shed	12	56																					1		
R20r01	285962	6219593	Tank	-	2	2																						1	
R21pu01	285458	6218979	Public Utility	Telecom shed	10	56																							1
R21pu02	285464	6218970	Public Utility	Telecom shed	3	7																							1
R21pu03	285466	6218968	Public Utility	Telecom shed	3	9																							1
R25r01	285049	6219264	House	-	14	168	1		Top																				
R25r01	285041	6219277	Rural	Shed	6	21																					1		
R25r02	285059	6219232	Rural	Shed	7	27																					1		
R25r03	285014	6219300	Rural	Shed	14	67																					1		
R25r04	285019	6219305	Rural	Shed	3	8																					1		
R25r05	285016	6219308	Rural	Shed	2	4																					1		
R25r01	285044	6219274	Tank	-	2	5																						1	
R25r02	285041	6219272	Tank	-	1	1																						1	
R25r03	285038	6219267	Tank	-	2	5																						1	

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
																														H1
R26h01	285133	6219185	House	-	18	201	1		Top	1	1				1			1												
R26r01	285123	6219197	Rural	Garage	9	76																	1							
R26r02	285130	6219200	Rural	Carport	13	63																	1							
R26r03	285125	6219184	Rural	Awning	11	40																	1							
R26r04	285128	6219175	Rural	Awning	5	20																	1							
R26r05	285134	6219168	Rural	Carport	10	58																	1							
R26r06	285129	6219163	Rural	Garage	10	85																	1							
R26r07	285135	6219157	Rural	Carport	8	44																	1							
R26r08	285121	6219157	Rural	Shed	13	93																	1							
R26r09	285126	6219152	Rural	Awning	12	70																	1							
R26r10	285144	6219145	Rural	Shed	18	279																	1							
R26r11	285130	6219136	Rural	Shed	12	74																	1							
R26r12	285118	6219118	Rural	Shed	15	216																	1							
R26r13	285115	6219148	Rural	Shed	4	13																	1							
R26r14	285088	6219158	Rural	Shed	4	11																	1							
R26t01	285124	6219171	Tank	-	7	36																			1					
R26t02	285126	6219128	Tank	-	3	6																			1					
R26t03	285146	6219133	Tank	-	2	5																			1					
R27h01	285178	6219130	House	-	21	295	1		Top																					
R27h02	285186	6219098	House	-	6	29																								
R27p01	285165	6219117	Pool	-	11	35	1		Top																					
R27r01	285177	6219119	Rural	Awning	9	25																	1							
R27r02	285172	6219113	Rural	Cabana	10	35																	1							
R27r03	285178	6219112	Rural	Awning	6	35																	1							
R27r04	285201	6219093	Rural	Carport	11	71																	1							
R27r05	285192	6219092	Rural	Garage	11	63																	1							
R27r06	285200	6219086	Rural	Shed	8	47																	1							
R27r07	285180	6219099	Rural	Shed	3	3																	1							
R27r08	285205	6219080	Rural	Shed	2	2																	1							
R27r09	285204	6219078	Rural	Shed	2	2																	1							
R27t01	285166	6219134	Tank	-	7	41																			1					
R27t02	285182	6219093	Tank	-	3	9																			1					
R28h01	285295	6218990	House	-	37	579	1		Top	1		1						1												
R28h02	285286	6219068	House	-	15	145	1		Top	1	1				1			1												
R28p01	285290	6218974	Pool	-	7	25																	1							
R28pu01	285254	6219069	Public Utility	Telecom shed	4	12																							1	
R28pu02	285246	6219071	Public Utility	Telecom shed	6	16																							1	
R28pu03	285250	6219076	Public Utility	Telecom shed	3	6																							1	
R28r01	285256	6219045	Rural	Shed	24	265																	1							
R28r02	285262	6219069	Rural	Shed	3	8																	1							
R28t01	285261	6218985	Tank	-	8	49																								
R28t02	285289	6219060	Tank	-	3	7																			1					
R28t03	285257	6219028	Tank	-	3	7																			1					
R28t04	285308	6218962	Tank	-	2	4																			1					
R30pa01	285709	6218823	Public Amenity	Picnic shelter	7	26																						1		
R31h01	286135	6218587	House	-	36	551	1		Top	1		1			1			1												
R31r01	286147	6218593	Rural	Deck	8	50																	1							
R31r02	286155	6218589	Rural	Deck	8	37																	1							
R31r03	286182	6218485	Rural	Shed	16	185																	1							
R31t01	286168	6218540	Tank	-	8	48																				1				
R31t02	286187	6218524	Tank	-	2	3																				1				
R31t03	286187	6218521	Tank	-	2	3																				1				
R31t04	286192	6218488	Tank	-	3	8																				1				
R31t05	286192	6218484	Tank	-	3	8																				1				
R32h01	286275	6218320	House	-	33	445	1		Top					1	1			1												
R32p01	286290	6218332	Pool	-	9	49																								
R32r01	286249	6218383	Rural	Shed	24	283																	1							
R32r02	286256	6218439	Rural	Shed	4	9																	1							
R33h01	286358	6218302	House	-	41	721	1		Top	1		1			1			1												
R33r01	286333	6218317	Rural	Garage	21	234																	1							
R33t01	286381	6218303	Tank	-	8	50																					1			
R33t02	286375	6218309	Tank	-	8	50																					1			
R33t03	286350	6218337	Tank	-	3	6																					1			
R34h01	286499	6218261	House	-	20	209	1		Top	1	1																			
R34r01	286505	6218255	Rural	Awning	7	28																	1							

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
R34r02	286480	6218268	Rural	Garage	10	69																	1						
R34r03	286544	6218266	Rural	Shed	6	19																	1						
R34r04	286415	6218221	Rural	Shed	3	5																	1						
R34t01	286511	6218252	Tank	-	5	23																			1				
R34t02	286516	6218253	Tank	-	5	23																			1				
R34t03	286528	6218244	Tank	-	2	2																			1				
R35h01	286282	6218175	House	-	34	464	1		Top	1		1					1												
R35pu01	286282	6218140	Public Utility	Telecom shed	6	18												1											
R35pu02	286278	6218138	Public Utility	Telecom shed	3	7																							1
R35r01	286265	6218164	Rural	Shed	6	33																	1						1
R35r02	286239	6218062	Rural	Shed	12	78																	1						
R35r03	286359	6218097	Rural	Animal shelter	7	15																	1						
R35r04	286391	6218105	Rural	Animal shelter	6	14																	1						
R35r05	286354	6218124	Rural	Shed	2	5																	1						
R35t01	286289	6218144	Tank	-	7	38																			1				
R35t02	286247	6218065	Tank	-	3	6																			1				
R36h01	286166	6218119	House	-	20	195	1		Top	2			1					1											
R36r01	286161	6218110	Rural	Awning	5	17																	1						
R36r02	286168	6218112	Rural	Awning	9	49																	1						
R36r03	286175	6218116	Rural	Awning	7	30																	1						
R36r04	286230	6218115	Rural	Shed	12	140																	1						
R36r05	286227	6218065	Rural	Shed	11	67																	1						
R36r06	286214	6218070	Rural	Shed	18	103																	1						
R36r07	286128	6218108	Rural	Shed	6	24																	1						
R36r08	286232	6218127	Rural	Shed	6	13																	1						
R36r09	286238	6218132	Rural	Shed	3	8																	1						
R36t01	286161	6218099	Tank	-	7	38																			1				
R36t02	286203	6218070	Tank	-	2	4																			1				
R36t03	286232	6218108	Tank	-	2	4																			1				
R36t04	286121	6218085	Tank	-	1	1																			1				
R37h01	286195	6218005	House	-	24	285	1		Top	1	1							1											
R37r01	286203	6218003	Rural	Awning	24	100																	1						
R37r02	286194	6218033	Rural	Shed	17	207																	1						
R37r03	286206	6217989	Rural	Shed	5	20																	1						
R37r04	286208	6217982	Rural	Shed	9	58																	1						
R37r05	286199	6217968	Rural	Shed	16	97																	1						
R37t01	286220	6218020	Tank	-	8	49																			1				
R37t02	286187	6217970	Tank	-	4	11																			1				
R37t03	286186	6217965	Tank	-	4	11																			1				
R37t04	286191	6217963	Tank	-	4	11																			1				
R37t05	286195	6217960	Tank	-	3	5																			1				
R39r04	284957	6218736	Rural	Shed	32	480																	1						
R39r05	284940	6218720	Rural	Shed	15	136																	1						
R39r06	284937	6218689	Rural	Shed	11	82																	1						
R39r07	284961	6218689	Rural	Shed	20	179																	1						
R40h01	286286	6219172	House	-	53	767	1		Top																				
R40p01	286284	6219185	Pool	-	15	65																		1					
R40r01	286275	6219142	Rural	Garage	13	131																	1						
R40r02	286335	6219197	Rural	Shed	11	68																	1						
R40r03	286341	6219199	Rural	Shed	6	32																	1						
R40r04	286223	6219084	Rural	Shed	16	202																	1						
R40t01	286252	6219113	Tank	-	11	91																			1				
R40t02	286343	6219203	Tank	-	2	2																			1				
R41h01	286682	6219327	House	-	27	428	1		Top																				
R41r01	286629	6219300	Rural	Shed	26	312																	1						
R41r02	286648	6219283	Rural	Shed	4	16																	1						
R41r03	286640	6219277	Rural	Shed	3	8																	1						
R41t01	286654	6219333	Tank	-	8	49																			1				
S01h01	287845	6218090	House	-	41	667				1		1						1		1					1				
S01r01	287794	6218083	Rural	Shed	16	214																	1						
S01r02	287794	6218127	Rural	Shed	4	11																	1						
S01r03	287799	6218129	Rural	Shed	2	4																	1						
S01r04	287787	6218109	Rural	Shed	9	33																	1						
S01r05	287805	6218106	Rural	Shed	2	5																	1						
S01r06	287809	6218137	Basketball court	-	15	127																				1			

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
											H1	H2	H3	H4									R	P	T	TC	PA	PU	C	
S01t01	287793	6218058	Tank	-	2	4																								
S01t02	287871	6218064	Tank	-	2	4																								
S02h01	287735	6218069	House	-	31	529																								
S02p01	287714	6218090	Pool	-	8	20			2								1													
S02r01	287765	6218075	Rural	Garage	12	104																								
S02t01	287761	6218093	Tank	-	10	72																	1							
S02t02	287778	6218052	Tank	-	2	2																								
S02t03	287779	6218049	Tank	-	2	2																								
S03h01	287609	6218034	House	-	37	518																								
S03p01	287590	6218043	Pool	-	9	29																								
S03r01	287654	6218056	Rural	Shed	18	248																								
S03r02	287621	6218079	Rural	Shed	3	5																								
S03t01	287676	6218033	Tank	-	8	46																								
S04h01	287688	6218266	House	-	44	616																								
S04h02	287656	6218268	House	-	9	74																								
S04p01	287691	6218281	Pool	-	10	36																								
S04p02	287694	6218281	Pool	-	2	4																								
S04r01	287650	6218266	Rural	Awning	13	50																								
S04r02	287615	6218232	Rural	Shed	17	146																								
S04r03	287701	6218281	Rural	Cabana	7	47																								
S04r04	287722	6218282	Rural	Garage	14	181																								
S04r05	287607	6218224	Rural	Carport	9	33																								
S04r06	287689	6218253	Rural	Portico	5	26																								
S04r07	287690	6218272	Rural	Awning	5	26																								
S04r08	287701	6218286	Rural	Awning	7	19																								
S04t01	287633	6218269	Tank	-	9	58																								
S04t02	287643	6218278	Tank	-	2	5																								
S04t03	287646	6218279	Tank	-	2	5																								
S04t04	287609	6218236	Tank	-	2	5																								
S04t05	287611	6218238	Tank	-	2	5																								
S05h01	287545	6218232	House	-	32	418																								
S05h02	287524	6218237	House	-	15	156																								
S05p01	287547	6218249	Pool	-	10	41																								
S05r01	287587	6218235	Rural	Shed	13	150																								
S05r02	287568	6218228	Rural	Garage	10	81																								
S05t01	287516	6218258	Tank	-	9	58																								
S05t02	287528	6218261	Tank	-	2	5																								
S05t03	287531	6218262	Tank	-	2	5																								
S05t04	287596	6218239	Tank	-	4	11																								
S09a	287314	6218063	House	-	9	84																								
S09h02	287316	6218082	House	-	26	290		1	Bottom	2				1																
S09t01	287314	6218045	Tank	-	8	51																								
S10h01	287155	6218025	House	-	35	464		1	Bottom	1		1																		
S10p01	287167	6218019	Pool	-	5	18																								
S10r03	287128	6218019	Rural	Garage	11	98																								
S10r04	287135	6218021	Rural	Carport	8	30																								
S10r05	287160	6218016	Rural	Awning	9	31																								
S10r06	287090	6217999	Rural	Shed	6	17																								
S10r07	287088	6217998	Rural	Shed	6	12																								
S10r08	287092	6218000	Rural	Shed	5	10																								
S10r09	287053	6217987	Rural	Shed	4	11																								
S10t01	287114	6218012	Tank	-	2	4																								
S11h01	286986	6217781	House	-	17	207		1	Bottom	1	1																			
S11r01	286963	6217783	Rural	Shed	12	64																								
S11r02	286954	6217784	Rural	Shed	4	13																								
S11t01	286971	6217777	Tank	-	3	6																								
S11t02	286966	6217777	Tank	-	3	6																								
S11t03	286963	6217778	Tank	-	3	6																								
S12h01	287352	6217977	House	-	48	500																								
S12h02	287393	6217979	House	-	37	376																								
S12r01	287301	6217971	Rural	Garage	22	215																								
S12t01	287350	6217954	Tank	-	9	68																								
S12t02	287326	6217943	Tank	-	2	2																								
S12t03	287324	6217943	Tank	-	2	2																								
S13r01	287646	6217878	Rural	Shed	4	10																								

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures								
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial		
																														H1	H2
S14h01	287639	6217927	House	-	15	168				1	1						1														
S14h02	287664	6217944	House	-	12	82																									
S14h03	287684	6217947	House	-	24	293				1	1																				
S14r01	287649	6217897	Rural	Shed	6	15																	1								
S14t01	287620	6217950	Tank	-	9	60																									
S14t02	287638	6217911	Tank	-	1	2																									
S14t03	287639	6217909	Tank	-	1	2																									
S14t04	287714	6217935	Tank	-	2	4																									
S15h01	287496	6218552	House	-	25	286				2			1																		
S15r01	287472	6218534	Rural	Shed	13	72																	1								
S15r02	287512	6218648	Rural	Shed	11	117																	1								
S15r03	287506	6218654	Rural	Shed	5	11																	1								
S15t01	287468	6218530	Tank	-	3	8																									
S15t02	287471	6218529	Tank	-	2	3																									
S15t03	287504	6218524	Tank	-	2	3																									
S15t04	287510	6218543	Tank	-	2	3																									
S16h01	287528	6218742	House	-	19	236																									
S16r01	287515	6218727	Rural	Shed	12	69																	1								
S17h01	287343	6218816	House	-	22	226				1	1				1			1													
S17r01	287322	6218803	Rural	Shed	5	22																	1								
S17r02	287327	6218798	Rural	Shed	3	7																	1								
S17r03	287332	6218798	Rural	Shed	4	12																	1								
S17r04	287341	6218782	Rural	Shed	5	22																	1								
S17r05	287361	6218780	Rural	Shed	6	22																	1								
S17r06	287305	6218733	Rural	Shed	2	6																	1								
S17t01	287323	6218799	Tank	-	1	1																									
S18h01	287113	6218817	House	-	15	144		1	Bottom	2			1				1														
S18h02	287085	6218813	House	-	13	76																									
S18h03	287057	6218803	House	-	22	255		1	Bottom																						
S18p01	287090	6218815	Pool	-	8	26																									
S18r01	287069	6218808	Rural	Shed	6	29																	1								
S18r02	287000	6218805	Rural	Shed	14	108																	1								
S18t01	287087	6218743	Tank	-	2	4																									
S18t02	287087	6218741	Tank	-	1	2																									
S18t03	287084	6218741	Tank	-	1	2																									
S18t04	287084	6218744	Tank	-	1	2																									
S19r01	286829	6218792	Rural	Shed	8	50																	1								
S19t01	286833	6218793	Tank	-	3	5																									
S20h01	286452	6219120	House	-	15	163		1	Top																						
S20r01	286448	6219084	Rural	Shed	25	338																	1								
S20t01	286450	6219073	Tank	-	7	38																									
S21h01	286832	6218883	House	-	23	268																									
S21r01	286755	6218870	Rural	Shed	19	265																	1								
S21r02	286747	6218863	Rural	Shed	4	13																	1								
S21r03	286854	6218903	Rural	Shed	3	8																									
S21t01	286831	6218864	Tank	-	7	40																									
S21t02	286768	6218870	Tank	-	2	5																									
S21t03	286766	6218867	Tank	-	2	5																									
S22h01	286959	6218853	House	-	14	129		1	Bottom																						
S22h02	286930	6218869	House	-	24	284		1	Bottom														1								
S22r01	286969	6218864	Rural	Shed	6	22																									
S22r02	286961	6218866	Rural	Shed	5	18																	1								
S22t01	286949	6218842	Tank	-	3	9																									
S22t02	286956	6218833	Tank	-	3	9																									
S23h01	287049	6218933	House	-	30	371		1	Bottom	1		1					1														
S23r01	287067	6218935	Rural	Veranda	4	16																	1								
S23r02	287033	6218924	Rural	Veranda	4	16																	1								
S23r03	287070	6218975	Rural	Shed	5	12																	1								
S23r04	287008	6218941	Rural	Shed	7	28																	1								
S23t01	287072	6218923	Tank	-	2	5																									
S24h01	287139	6218958	House	-	23	343		1	Bottom	2			1																		
S24h02	287120	6218960	House	-	14	85		1	Bottom																						
S24p01	287138	6218975	Pool	-	9	30																									

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial
											H1	H2	H3	H4								R	P	T	TC	PA	PU	C	
S24r03	287109	6218991	Rural	Shed	18	108																1							
S24r04	287185	6218873	Rural	Shed	21	152																1							
S24r05	287191	6218874	Rural	Awning	4	12																1							
S24t01	287066	6218996	Tank	-	3	7																		1					
S25h01	287221	6218929	House	-	34	320			1				1			1													
S25h02	287249	6218929	House	-	16	161			1		1							1											
S25r01	287243	6218931	Rural	Carport	8	28																1							
S25r02	287216	6218936	Rural	Awning	17	61																1							
S25r03	287206	6218936	Rural	Gazebo	3	7																1							
S25r04	287199	6218947	Rural	Shed	3	6																1							
S25r05	287314	6218954	Rural	Shed	18	148																1							
S25r06	287250	6218969	Rural	Greenhouse	10	30																1							
S25r07	287257	6218968	Rural	Shed	4	13																1							
S25r08	287257	6218966	Rural	Shed	2	3																1							
S25t01	287303	6218958	Tank	-	2	4																							
S25t02	287301	6218956	Tank	-	2	2																							
S25t03	287303	6218955	Tank	-	1	2																							
S25t04	287301	6218952	Tank	-	2	4																							
S25t05	287303	6218953	Tank	-	2	2																							
S26h01	287474	6219045	House	-	31	339		1	Bottom	1			1					1											
S26r01	287464	6219066	Rural	Shed	13	136																1							
S26r02	287379	6219009	Rural	Shed	4	12																1							
S26t01	287447	6219062	Tank	-	8	48																							
S26t02	287492	6219040	Tank	-	2	5																							
S27h01	287506	6219111	House	-	33	401		1	Bottom	1			1			1													
S27p01	287523	6219119	Pool	-	8	25																	1						
S27r01	287480	6219106	Rural	Garage	10	65																1							
S27r02	287472	6219104	Rural	Carport	7	45																1							
S27r03	287524	6219118	Rural	Awning	12	70																1							
S27r04	287533	6219137	Rural	Shed	9	42																1							
S27t01	287538	6219102	Tank	-	8	48																							
S27t02	287548	6219112	Tank	-	2	5																							
S28h01	287665	6219111	House	-	23	289												1											
S28r01	287669	6219124	Rural	Garage	7	40																1							
S28r02	287622	6219111	Rural	Shed	3	7																1							
S28r03	287644	6219034	Rural	Shed	4	8																1							
S28t01	287643	6219108	Tank	-	8	48																							
S28t02	287648	6219090	Tank	-	2	5																							
S29h01	287733	6219361	House	-	33	518		1	Bottom	1			1					1											
S29r01	287732	6219295	Rural	Shed	10	100																1							
S29r02	287706	6219383	Rural	Shed	3	8																1							
S29t01	287726	6219347	Tank	-	6	25																							
S29t02	287726	6219290	Tank	-	3	8																							
S29t03	287725	6219286	Tank	-	3	8																							
S29t04	287721	6219283	Tank	-	3	8																							
S29t05	287742	6219387	Tank	-	1	2																							
S29t06	287744	6219387	Tank	-	1	2																							
S31h01	287743	6219089	House	-	38	528																							
S31h02	287716	6219089	House	-	19	173																							
S31p01	287746	6219108	Pool	-	10	61																							
S31t01	287725	6219108	Tank	-	8	48																							
S32h01	287913	6219352	House	-	31	490												1											
S32p01	287915	6219369	Pool	-	9	35																							
S32r01	287867	6219207	Rural	Shed	12	128																							
S32r02	287919	6219314	Rural	Shed	10	45																							
S32r03	287956	6219332	Rural	Shed	3	8																							
S32r04	287905	6219383	Rural	Shed	3	11																							
S32r05	287903	6219442	Rural	Shed	4	12																							
S32r06	288049	6219410	Rural	Shed	5	14																							
S32t01	287946	6219365	Tank	-	8	54																							
S32t02	287866	6219198	Tank	-	5	4																							
S33h01	288090	6219309	House	-	31	490				1		1																	
S33p01	288104	6219308	Pool	-	9	30																							
S33r01	288063	6219315	Rural	Shed	10	96																							
S33r02	288071	6219322	House	-	16	127				1	1											1							

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piered Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
																														H1
S33I01	288108	6219288	Tank	-	7	38																								
S33I02	288121	6219292	Tank	-	2	2																								
S33I03	288123	6219293	Tank	-	2	2																								
S34H01	288119	6219228	House	-	22	221				1	1				1															
S34R01	288124	6219258	Rural	Garage	18	109																	1							
S34I01	288132	6219214	Tank	-	7	38																								
S35H01	288280	6219390	House	-	39	617				1		1			1															
S35R01	288206	6219374	Rural	Shed	15	207																								
S35I01	288323	6219378	Tank	-	8	48																								
S35I02	288332	6219391	Tank	-	2	3																								
S35I03	288335	6219391	Tank	-	2	3																								
S36H01	288037	6218843	House	-	25	280				1	1							1												
S36P01	288043	6218824	Pool	-	8	28																		1						
S36R01	288141	6218909	Rural	Shed	6	20																								
S36I01	288030	6218864	Tank	-	7	42																								
S37H01	288224	6218818	House	-	27	499																								
S37R01	288239	6218803	Rural	Garage	7	43																								
S37R02	288266	6218844	Rural	Shed	14	159																								
S37I01	288175	6218812	Tank	-	15	180																								
S37I02	288251	6218848	Tank	-	8	50																								
S38H01	287931	6218701	House	-	28	329				1	1							1												
S38P01	287954	6218717	Pool	-	9	30																			1					
S38R01	287945	6218710	Rural	Awning	6	33																								
S38R02	287919	6218689	Rural	Carport	7	40																								
S38R03	287894	6218674	Rural	Shed	14	157																								
S38R04	287883	6218673	Rural	Shed	3	8																								
S38R05	287870	6218654	Rural	Shed	11	97																								
S38R06	287880	6218653	Rural	Shed	10	36																								
S38R07	287885	6218647	Rural	Shed	6	12																								
S38R08	287869	6218666	Rural	Greenhouse	9	28																								
S38R09	287857	6218647	Rural	Shed	5	8																								
S38I01	287885	6218670	Tank	-	4	10																								
S38I02	287931	6218674	Tank	-	2	2																								
S38I03	287933	6218676	Tank	-	2	2																								
S39H01	287976	6218769	House	-	25	284				1	1							1												
S39H02	287957	6218758	House	-	16	166				1	1							1												
S39R01	287896	6218800	Rural	Shed	24	297																								
S39R02	287955	6218776	Rural	Shed	2	5																								
S39I01	287966	6218753	Tank	-	1	2																								
S39I02	287907	6218807	Tank	-	2	3																								
S39I03	287906	6218809	Tank	-	2	3																								
S39I04	287905	6218811	Tank	-	2	3																								
S39I05	288002	6218778	Tank	-	2	4																								
S40H01	287905	6218861	House	-	35	402				1		1			1															
S40H02	287885	6218828	House	-	19	220				1	1								1											
S40P01	287869	6218862	Pool	-	8	28																			1					
S40R01	287903	6218841	Rural	Shed	11	110																								
S40R02	287889	6218863	Rural	Awning	6	31																								
S40R03	287893	6218860	Rural	Awning	8	38																								
S40R04	287896	6218857	Rural	Awning	6	27																								
S40R05	287901	6218855	Rural	Awning	5	19																								
S40I01	287943	6218866	Tank	-	8	46																								
S40I02	287893	6218844	Tank	-	4	11																								
S41H01	287824	6218788	House	-	26	332				1	1																			
S41R01	287873	6218815	Rural	Shed	14	85																								
S41R02	287861	6218803	Rural	Shed	9	73																								
S41R03	287815	6218771	Rural	Shed	12	117																								
S41R04	287778	6218887	Rural	Shed	7	28																								
S41R05	287779	6218879	Rural	Shed	6	22																								
S41R06	287861	6218847	Rural	Shed	3	10																								
S41R07	287823	6218773	Rural	Shed	3	8																								
S41R08	287822	6218776	Rural	Shed	3	5																								

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type		House Roof Type		House Footing Type			Other Structures								
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piled Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
S43h01	287600	6218799	House	-	30	345				1	1						1													
S43r01	287615	6218777	Rural	Garage	9	51																	1							
S43r02	287653	6218786	Rural	Shed	17	158																	1							
S43r03	287652	6218765	Rural	Shed	6	18																	1							
S43r04	287647	6218765	Rural	Shed	3	6																	1							
S43r05	287673	6218810	Rural	Shed	3	8																	1							
S43t01	287577	6218812	Tank	-	8	55																			1					
S43t02	287666	6218786	Tank	-	2	4																			1					
S43t03	287667	6218793	Tank	-	2	2																			1					
S43t04	287666	6218795	Tank	-	2	2																			1					
S44h01	287627	6218612	House	-	32	443				1		1						1												
S44r01	287608	6218606	Rural	Garage	8	54																	1							
S44r02	287611	6218620	Rural	Awning	8	49																	1							
S44r03	287587	6218615	Rural	Shed	8	63																	1							
S44r04	287592	6218664	Rural	Animal shelter	8	24																	1							
S44r05	287578	6218607	Rural	Shed	12	52																	1							
S44r06	287576	6218601	Rural	Shed	7	43																	1							
S44r07	287582	6218602	Rural	Shed	6	27																	1							
S44r08	287587	6218603	Rural	Shed	6	32																	1							
S44r09	287588	6218594	Rural	Shed	10	47																	1							
S44r10	287583	6218591	Rural	Shed	14	66																	1							
S44r11	287577	6218591	Rural	Shed	14	99																	1							
S44r12	287570	6218588	Rural	Shed	11	59																	1							
S44r13	287597	6218580	Rural	Shed	9	51																	1							
S44r14	287572	6218579	Rural	Shed	3	7																	1							
S44r15	287587	6218492	Rural	Shed	20	187																	1							
S44r16	287680	6218606	Rural	Shed	10	104																	1							
S44r17	287689	6218612	Rural	Shed	10	50																	1							
S44t01	287597	6218611	Tank	-	7	35																			1					
S44t02	287569	6218598	Tank	-	3	8																			1					
S44t03	287569	6218559	Tank	-	2	5																			1					
S45h01	286972	6219185	House	-	31	384	1	Top		2		1						1					1							
S45r01	286934	6219173	Rural	Shed	24	281																		1						
S45r02	286889	6219199	Rural	Shed	7	43																	1							
S45t01	286973	6219161	Tank	-	7	40																			1					
S46h01	287323	6219395	House	-	35	625	1	Top		2		1		1			1													
S46p01	287339	6219397	Pool	-	15	99																		1						
S46r01	287343	6219380	Rural	Cabana	7	45																	1							
S46r02	287349	6219374	Rural	Gazebo	4	19																	1							
S46r03	287332	6219482	Rural	Shed	19	308																	1							
S46r04	287353	6219476	Rural	Shed	19	279																	1							
S46t01	287366	6219472	Tank	-	7	41																			1					
S46t02	287368	6219480	Tank	-	7	41																			1					
S46t03	287346	6219491	Tank	-	2	2																			1					
S47h01	287353	6219515	House	-	28	311	1	Top		1	1							1												
S47h02	287354	6219567	House	-	14	123	1	Top																						
S47r01	287350	6219587	Rural	Shed	9	61																	1							
S47r02	287356	6219586	Rural	Shed	6	19																	1							
S47r03	287371	6219588	Rural	Shed	9	46																	1							
S47r04	287377	6219590	Rural	Shed	4	15																	1							
S47r05	287377	6219586	Rural	Shed	4	12																	1							
S47r06	287333	6219621	Rural	Shed	5	14																	1							
S47r07	287390	6219673	Rural	Shed	3	9																	1							
S47r08	287334	6219498	Rural	Shed	3	5																	1							
S47t01	287370	6219511	Tank	-	7	41																			1					
S47t02	287361	6219502	Tank	-	2	2																			1					
S47t03	287358	6219558	Tank	-	3	8																			1					
S47t04	287362	6219566	Tank	-	2	2																			1					
S47t05	287351	6219573	Tank	-	2	2																			1					
S47t06	287371	6219581	Tank	-	3	8																			1					
S47t07	287380	6219589	Tank	-	2	2																			1					
S47t08	287380	6219591	Tank	-	2	2																			1					
S47t09	287332	6219626	Tank	-	3	8																			1					
S48h01	287641	6219936	House	-	44	523	1	Bottom		1		1						1												
S48r01	287927	6219975	Rural	Shed	19	211																	1							

Table D.01 - Details of the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Type	Description	Maximum Structure Plan Length (m)	Planar Area (m2)	Houses on Steep Slopes			Houses Number of Storeys	Houses				House Wall Type			House Roof Type		House Footing Type			Other Structures							
							Located at Top of Razorback Range	Located at Bottom of Razorback Range or along Ridgelines	Location of Houses relative to Steep Slopes		Single Storey with Length less than 30 metres	Single Storey with Length greater than 30 metres	Double Storey with Length less than 30 metres	Double Storey with Length greater than 30 metres	Brick or Brick Veneer	Weatherboard	Fibro	Tiled	Metal Sheet	Slab on Ground	Suspended on Piled Footings	Suspended on Strip Footings	Rural structures	Pools	Tanks	Tennis or Basketball Courts	Public Amenities	Public Utilities	Commercial	
							H1	H2	H3	H4								R	P	T	TC	PA	PU	C						
S48r02	287921	6219965	Rural	Shed	8	49																	1							
S48r03	287899	6219980	Rural	Shed	10	76																	1							
S48r04	287913	6219981	Rural	Gazebo	8	43																	1							
S48r05	287649	6219968	Rural	Shed	3	7																	1							
S48r06	287622	6219976	Rural	Shed	2	4																	1							
S48t01	287649	6219968	Tank	-	8	46																			1					
S48t02	287891	6219962	Tank	-	13	129																			1					
S48t03	287906	6219975	Tank	-	3	8																			1					
S48t04	287939	6219978	Tank	-	3	8																			1					
S48t05	287994	6219966	Tank	-	3	9																			1					
S49h01	287988	6220137	House	-	26	304				1	1							1												
S49p01	287999	6220153	Pool	-	12	53													1											
S49r01	287970	6220131	Rural	Garage	7	38																	1							
S49r02	287947	6220122	Rural	Shed	14	127																	1							
S49r03	287932	6220110	Rural	Shed	10	67																	1							
S49t01	287927	6220126	Tank	-	7	35																			1					
S50h01	287622	6220466	House	-	23	308				1	1								1											
S50p01	287622	6220485	Pool	-	10	33																		1						
S50r01	287611	6220464	Rural	Garage	10	73																	1							
S50r02	287678	6220374	Rural	Shed	14	186																	1							
S50r03	287727	6220368	Rural	Shed	15	140																	1							
S50r04	287802	6220389	Rural	Shed	33	851																	1							
S50r05	287629	6220403	Rural	Shed	3	7																	1							
S50r06	287833	6220421	Rural	Shed	6	24																	1							
S50r07	287892	6220507	Rural	Shed	3	8																	1							
S50t01	287635	6220418	Tank	-	8	46																			1					
S50t02	287678	6220407	Tank	-	2	2																			1					
S50t03	287678	6220404	Tank	-	2	2																			1					
S50t04	287687	6220375	Tank	-	2	2																			1					
S50t05	287686	6220373	Tank	-	2	2																			1					
S50t06	287791	6220370	Tank	-	8	46																			1					
S50t07	287832	6220425	Tank	-	2	2																			1					
S50t08	287834	6220426	Tank	-	2	2																			1					
S50t09	287895	6220508	Tank	-	2	2																			1					
S50t10	287895	6220506	Tank	-	2	2																			1					
VS06	290350	6219212	Commercial	Vent Shaft Building	61	874																								1
VS07	290388	6219218	Commercial	Vent Shaft Building	12	95																								1
VS09	290421	6219185	Commercial	Vent Shaft	31	900																								1
VS10	290401	6219196	Commercial	Vent Shaft Building	18	109																								1
VS11	290359	6219179	Commercial	Vent Shaft Building	16	214																								1
VS12	290359	6219161	Commercial	Vent Shaft Building	16	214																								1
VS13	290359	6219143	Commercial	Vent Shaft Building	16	214																								1
VS14	290375	6219161	Commercial	Vent Shaft Building	18	205																								1
VS15	290404	6219132	Commercial	Vent Shaft Building	31	909																								1
VS16	290385	6219130	Commercial	Vent Shaft Building	12	89																								1
VS19	290405	6219084	Commercial	Vent Shaft Building	21	303																								1
VS20	290387	6219088	Commercial	Vent Shaft Building	6	37																								1
VS109	290311	6219212	Commercial	Vent Shaft Tank	4	13																								1
Count											96	57	16	9	95	14	2	49	123	74	11	20	817	72	471	1	2	8	13	

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Structure Type	Predicted total subsidence after LW12 (mm)	Predicted total subsidence after LW12 (mm)	Predicted total subsidence after LW14 (mm)	Predicted total subsidence after LW15 (mm)	Predicted total subsidence after LW16 (mm)	Predicted total tilt after LW12 (mm/m)	Predicted total tilt after LW13 (mm/m)	Predicted total tilt after LW14 (mm/m)	Predicted total tilt after LW15 (mm/m)	Predicted total tilt after LW16 (mm/m)	Predicted total hogging curvature after LW12 (1/km)	Predicted total hogging curvature after LW13 (1/km)	Predicted total hogging curvature after LW14 (1/km)	Predicted total hogging curvature after LW15 (1/km)	Predicted total hogging curvature after LW16 (1/km)	Predicted total hogging curvature after LW12 (1/km)	Predicted total hogging curvature after LW13 (1/km)	Predicted total hogging curvature after LW14 (1/km)	Predicted total hogging curvature after LW15 (1/km)	Predicted total hogging curvature after LW16 (1/km)	Predicted total hogging curvature after LW12 (1/km)	Predicted total hogging curvature after LW13 (1/km)	Predicted total hogging curvature after LW14 (1/km)	Predicted total hogging curvature after LW15 (1/km)	Predicted total hogging curvature after LW16 (1/km)	Predicted mean total tensile strain (mm/mm)	Predicted 95% C.I. for total tensile strain (mm/mm)	Predicted mean total comp. strain (mm/mm)	Predicted 95% C.I. for total comp. strain (mm/mm)	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 or R4 Impact for Houses (%)	Predicted Probability of Category R5 Impact for Houses (%)
C10a	290058	6218378	House	925	925	925	925	925	2.0	2.0	2.0	2.0	2.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.7	-	-	-	-	52.9	29.0	14.1	4.0	
C10b	290067	6218352	Rural	875	875	875	875	875	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	-	-	-	-	-	-	-	-	
C10c	290045	6218332	Rural	875	900	900	900	900	1.0	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	-	-	-	-	
C10d	290062	6218390	Rural	900	900	900	900	900	2.5	2.5	2.5	2.5	2.5	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.8	-	-	-	-	-	-	-	-	
C10f	290066	6218387	Rural	925	925	925	925	925	2.0	2.0	2.0	2.0	2.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.7	-	-	-	-	-	-	-	-	
C10g	290069	6218390	Rural	925	925	925	925	925	2.5	2.5	2.5	2.5	2.5	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.7	-	-	-	-	-	-	-	-	
C10h	290078	6218413	Rural	950	975	975	975	975	3.0	3.0	3.0	3.0	3.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.9	-	-	-	-	-	-	-	-	
C10i01	290055	6218384	Rural	925	925	925	925	925	2.5	2.5	2.5	2.5	2.5	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.7	-	-	-	-	-	-	-	-	
C10i02	290073	6218414	Rural	975	975	975	975	975	3.0	3.0	3.0	3.0	3.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.2	-0.9	-	-	-	-	-	-	-	-	
C10i03	290075	6218413	Rural	975	975	975	975	975	3.0	3.0	3.0	3.0	3.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.2	-0.9	-	-	-	-	-	-	-	-	
C10i01	290068	6218405	Bank	950	975	975	975	975	3.0	3.0	3.0	3.0	3.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.9	-	-	-	-	-	-	-	-	
C10i04	290082	6218338	Rural	900	900	900	900	900	1.0	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	-	-	-	-	
C10i05	290043	6218326	Bank	875	900	900	900	900	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	-	-	-	-	
C20i01	291908	6219229	Rural	300	350	350	350	350	3.5	3.5	3.5	3.5	3.5	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.4	1.1	-0.4	-1.5	-	-	65.5	22.7	9.9	1.8			
C20i01	291919	6219227	Pool	750	725	300	300	300	2.5	3.0	3.0	3.0	3.0	0.03	0.03	0.03	0.03	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.0	-0.3	-1.4	-	-	-	-	-	-	-	
C20i01	291919	6219268	Rural	225	275	275	275	275	2.5	2.5	2.5	2.5	2.5	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.5	1.5	-0.5	-2.0	-	-	-	-	-	-	-	-	
C20i02	291921	6219245	Rural	250	275	275	275	275	2.5	3.0	3.0	3.0	3.0	0.03	0.03	0.03	0.03	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	1.2	-0.4	-1.6	-	-	-	-	-	-	-	-
C23i01	291864	6220153	House	<20	<20	<20	100	140	<0.5	<0.5	<0.5	1.0	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	0.3	-0.1	-0.4	81.3	13.4	4.7	0.6					
C23i02	291897	6220255	House	<20	<20	<20	110	110	<0.5	<0.5	<0.5	<0.5	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.3	0.8	-0.3	-1.1	85.7	10.7	1.3	0.3					
C23i03	291867	6220224	House	<20	<20	<20	80	140	<0.5	<0.5	<0.5	0.5	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.7	-0.2	-0.9	82.0	13.0	4.5	0.5					
C23i04	291869	6220267	House	<20	<20	<20	80	140	<0.5	<0.5	<0.5	0.5	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	-0.4	-1.4	82.7	12.6	4.2	0.5					
C23i01	2918455	6220161	Pool	<20	<20	<20	90	140	<0.5	<0.5	<0.5	<0.5	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	0.4	-0.1	-0.5	-	-	-	-	-	-	-	-	
C23i01	291931	6220144	Rural	<20	<20	<20	90	130	<0.5	<0.5	<0.5	<0.5	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	0.4	-0.1	-0.4	-	-	-	-	-	-	-	-	-
C23i02	291931	6220247	Rural	<20	<20	<20	50	80	<0.5	<0.5	<0.5	<0.5	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.6	-0.2	-0.9	-	-	-	-	-	-	-	-	-
C23i03	2918455	6220244	Rural	<20	<20	<20	80	150	<0.5	<0.5	<0.5	<0.5	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.3	0.9	-0.3	-1.2	-	-	-	-	-	-	-	-	-
C23i04	2918495	6220277	Rural	<20	<20	<20	60	100	<0.5	<0.5	<0.5	<0.5	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	1.0	-0.4	-1.4	-	-	-	-	-	-	-	-	-
C23i05	2918475	6220360	Rural	<20	<20	<20	60	110	<0.5	<0.5	<0.5	<0.5	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	1.5	-0.5	-1.2	-	-	-	-	-	-	-	-	-
C23i06	2918495	6220372	Rural	<20	<20	<20	50	100	<0.5	<0.5	<0.5	<0.5	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	1.5	-0.4	-2.1	-	-	-	-	-	-	-	-	-
C23i07	2918467	6220185	Rural	<20	<20	<20	80	130	<0.5	<0.5	<0.5	<0.5	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	1.0	-0.5	-1.6	-	-	-	-	-	-	-	-	-
C23i01	2919513	6220233	Bank	<20	<20	<20	60	100	<0.5	<0.5	<0.5	<0.5	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.6	-0.2	-0.8	-	-	-	-	-	-	-	-	-
C23i02	2919519	6220255	Bank	<20	<20	<20	50	90	<0.5	<0.5	<0.5	<0.5	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.3	0.7	-0.2	-1.0	-	-	-	-	-	-	-	-	-
C23i03	2918443	6220260	Rural	<20	<20	<20	90	160	<0.5	<0.5	<0.5	<0.5	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	1.0	-0.4	-1.5	-	-	-	-	-	-	-	-	-
C23i04	2918491	6220356	Bank	<20	<20	<20	50	100	<0.5	<0.5	<0.5	<0.5	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	1.6	-0.5	-2.2	-	-	-	-	-	-	-	-	-
C23i05	2918498	6220383	Bank	<20	<20	<20	40	80	<0.5	<0.5	<0.5	<0.5	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.4	-0.4	-2.0	-	-	-	-	-	-	-	-	-
C24i01	2918278	6220797	House	<20	<20	<20	100	100	<0.5	<0.5	<0.5	<0.5	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	1.0	-0.5	-1.0	93.0	5.0	1.1	0.2					
C24i01	2918869	6220788	Rural	<20	<20	<20	110	105	<0.5	<0.5	<0.5	<0.5	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	0.2	0.0	0.0	-	-	-	-	-	-	-	-	
C24i02	2918877	6220755	Rural	<20	<20	<20	120	120	<0.5	<0.5	<0.5	<0.5	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	0.3	0.0	0.0	-	-	-	-	-	-	-	-	
C24i03	2918892	6220774	Rural	<20	<20	<20	120	120	<0.5	<0.5	<0.5	<0.5	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	0.3	0.0	0.0	-	-	-	-	-	-	-	-	-
C24i04	2918892	6220774	Rural	<20	<20	<20	120	120	<0.5	<0.5	<0.																									

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid Mass Easting (mGA 2026)	Centroid Mass Northing (mGA 2026)	Structure Type	Predicted total subsidence after LW712 (mm)					Predicted total subsidence after LW712 (mm/m)	Predicted total subsidence after LW713 (mm/mm)	Predicted total subsidence after LW714 (mm/mm)	Predicted total subsidence after LW715 (mm/mm)	Predicted total subsidence after LW716 (mm/mm)	Predicted total hogging curvature after LW712 (1/m)	Predicted total hogging curvature after LW713 (1/m)	Predicted total hogging curvature after LW714 (1/m)	Predicted total hogging curvature after LW715 (1/m)	Predicted total hogging curvature after LW716 (1/m)	Predicted total sagging curvature after LW717 (1/m)	Predicted total sagging curvature after LW718 (1/m)	Predicted total sagging curvature after LW719 (1/m)	Predicted mean total tensile strain (mm/m)	Predicted 95% CL for total tensile strain (mm/m)	Predicted mean comp. for total strain (mm/m)	Predicted 95% CL for total comp. for total strain (mm/m)	Predicted Probability of Category A or B Impact for Houses (%)	Predicted Probability of Category C or D Impact for Houses (%)	Predicted Probability of Category E Impact for Houses (%)		
				LW712 (mm)	LW713 (mm)	LW714 (mm)	LW715 (mm)	LW716 (mm)																						
D0B-03	289738	6219131	Rural	750	850	850	875	875	2.5	3.5	4.0	4.0	4.0	0.03	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.3	0.9	-0.5	-1.6	-	-	-	
D0B-04	289738	6219144	Rural	625	725	725	750	750	2.0	3.0	3.5	3.5	3.5	0.03	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.3	0.9	-0.5	-1.6	-	-	-	
D0B-05	289738	6219101	Tank	675	775	775	775	750	2.0	2.5	3.0	3.0	3.0	0.03	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.1	0.4	-0.2	-0.9	-	-	-	
D0B-06	289738	6219101	Tank	650	725	725	725	725	1.5	2.5	2.5	2.5	2.5	0.03	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.2	0.1	0.4	-0.2	-0.8	-	-	-
D0B-07	289738	6219095	Tank	650	700	700	700	700	2.0	2.5	2.5	2.5	2.5	0.03	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.2	0.1	0.4	-0.2	-0.7	-	-	-
D0B-08	289738	6219092	Tank	650	700	700	725	725	2.0	2.5	2.5	2.5	2.5	0.03	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.2	0.1	0.4	-0.2	-0.8	-	-	-
D0B-09	289770	6219086	Tank	650	700	725	725	725	1.5	2.0	2.5	2.5	2.5	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.2	0.1	0.4	-0.2	-0.8	-	-	-
D0C-01	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-02	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-03	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-04	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-05	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-06	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-07	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-08	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-09	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-10	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-11	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-12	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-13	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-14	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-15	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-16	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-17	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-18	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-19	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-20	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-21	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-22	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-23	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-24	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-25	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-26	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-27	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-28	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-29	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-30	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-31	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-32	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-33	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-34	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-35	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-36	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-37	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-38	289750	6218928	House	750	850	850	875	875	1.5	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	54.1	28.5	18.6	
D0C-39	289750	62189																												

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid Mass Easting (m) (MGA 2020)	Centroid Mass Northing (m) (MGA 2020)	Structure Type	Predicted total subsidence after LW12 (mm)	Predicted total subsidence after LW13 (mm)	Predicted total subsidence after LW14 (mm)	Predicted total subsidence after LW15 (mm)	Predicted total subsidence after LW16 (mm)	Predicted total subsidence after LW17 (mm)	Predicted total sagging curvature after LW12 (1/m)	Predicted total sagging curvature after LW13 (1/m)	Predicted total sagging curvature after LW14 (1/m)	Predicted total sagging curvature after LW15 (1/m)	Predicted total sagging curvature after LW16 (1/m)	Predicted total sagging curvature after LW17 (1/m)	Predicted mean total tensile strain (mm/m)	Predicted 95% CL for total tensile strain (mm/m)	Predicted mean total compressive strain (mm/m)	Predicted 95% CL for total compressive strain (mm/m)	Predicted Probability of Nil Category B0 Impact for Houses (%)	Predicted Probability of Category A or B2 Impact for Houses (%)	Predicted Probability of Category A or B4 Impact for Houses (%)	Predicted Probability of Category A or B6 Impact for Houses (%)									
D18a	289802	6218259	House	1025	1025	1025	1025	1025	1025	3.5	3.5	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.1	-0.7	51.5	29.7	14.6	4.2
D18b	289843	6218261	Rural	975	975	975	975	975	975	2.5	2.5	2.5	2.5	2.5	2.5	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.1	-0.7	-	-	-	-
D18c	289787	6218260	Rural	975	975	975	975	975	975	3.0	3.0	3.0	3.0	3.0	3.0	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.2	-0.8	-	-	-	-
D18d	289763	6218276	Rural	1075	1075	1075	1075	1075	1075	4.0	4.5	4.5	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.3	-1.1	-	-	-	-
D18e	289762	6218283	Rural	1100	1100	1100	1100	1100	1100	4.5	4.5	4.5	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.3	-1.2	-	-	-	-
D18f	289767	6218284	Rural	1100	1100	1100	1100	1100	1100	4.5	4.5	4.5	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.2	-0.6	-	-	-	-
D18g	289767	6218285	Tank	1075	1100	1100	1100	1100	1100	4.5	4.5	4.5	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.2	-0.5	-	-	-	-
D18h	289765	6218255	Tank	975	1000	1000	1000	1000	1000	3.0	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.4	-0.2	-	-	-	-
D18i	289768	6218254	Tank	975	1000	1000	1000	1000	1000	3.0	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.2	-0.4	-	-	-	-
D20a	289662	6218259	Rural	1175	1200	1200	1200	1200	1200	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20b	289662	6218250	Rural	1375	1400	1400	1400	1400	1400	4.5	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.6	-	-	-	-
D20c	289645	6218264	Rural	1350	1350	1350	1350	1350	1350	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.6	-	-	-	-
D20d	289619	6218277	Rural	1325	1325	1350	1350	1350	1350	4.5	4.5	4.5	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.09	0.09	0.09	0.09	0.09	0.09	0.09	-0.3	-0.8	-	-	-	-
D20e	289655	6218259	Rural	1200	1200	1200	1200	1200	1200	5.0	5.0	5.0	5.0	5.0	5.0	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-0.3	-0.9	-	-	-	-
D20f	289656	6218260	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20g	289656	6218261	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20h	289656	6218262	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20i	289656	6218263	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20j	289656	6218264	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20k	289656	6218265	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20l	289656	6218266	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20m	289656	6218267	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20n	289656	6218268	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20o	289656	6218269	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20p	289656	6218270	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20q	289656	6218271	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20r	289656	6218272	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20s	289656	6218273	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20t	289656	6218274	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20u	289656	6218275	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20v	289656	6218276	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20w	289656	6218277	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20x	289656	6218278	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20y	289656	6218279	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D20z	289656	6218280	Rural	1175	1175	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	5.0	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.12	0.12	-0.3	-0.8	-	-	-	-
D21a	289479	6218316	Tank	1375	1400	1400	1400	1400	1400	4.5	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-0.6	-1.0	-3.2	-	-	-
D21b	289479	6218316	Tank	1375	1400	1400	1400	1400	1400	4.5	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-0.6	-1.0	-3.2	-	-	-
D21c	289479	6218316	Tank	1375	1400	1400	1400	1400	1400	4.5	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-0.6	-1.0	-3.2	-	-	-
D21d	289479	6218316	Tank	1375	1400	1400	1400	1400	1400	4.5	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-0.6	-1.0	-3.2	-	-	-
D21e	289479	6218316	Tank	1375	1400	1400	1400	1400	1400	4.5	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-0.6	-1.0	-3.2	-	-	-
D21f	289479	6218316	Tank	1375	1400	1400	1400	1400	1400	4.5	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-0.6	-1.0	-3.2	-	-	-
D21g	289479	6218316	Tank	1375	1400	1400	1400	1400	1400	4.5	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-0.6	-1.0	-3.2	-	-	-
D21h	289479	6218316	Tank	1375	1400	1400	1400	1400	1400	4.5	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-0.6	-1.0	-3.2	-	-	-

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Structure Type	Predicted total subsidence after LW12 (mm)	Predicted total subsidence after LW22 (mm)	Predicted total subsidence after LW34 (mm)	Predicted total subsidence after LW45 (mm)	Predicted total subsidence after LW716 (mm)	Predicted total tilt after LW12 (mm/m)	Predicted total tilt after LW13 (mm/m)	Predicted total tilt after LW14 (mm/m)	Predicted total tilt after LW15 (mm/m)	Predicted total tilt after LW16 (mm/m)	Predicted total hogging curvature after LW12 (1/km)	Predicted total hogging curvature after LW13 (1/km)	Predicted total hogging curvature after LW14 (1/km)	Predicted total hogging curvature after LW15 (1/km)	Predicted total hogging curvature after LW16 (1/km)	Predicted total sagging curvature after LW12 (1/km)	Predicted total sagging curvature after LW13 (1/km)	Predicted total sagging curvature after LW14 (1/km)	Predicted total sagging curvature after LW15 (1/km)	Predicted total sagging curvature after LW16 (1/km)	Predicted total hogging curvature after LW17 (1/km)	Predicted mean total tensile strain (mm/mm)	Predicted 95% C _u for total tensile strain (mm/mm)	Predicted mean total comp. strain (mm/mm)	Predicted 95% C _u for total comp. strain (mm/mm)	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 (%)
D30-05	289395	6218063	Rural	925	925	950	950	950	2.5	2.5	2.5	2.5	2.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	-	-	-	-
D30-01	289568	6218043	Tank	975	975	975	975	975	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.1	0.4	1.1	0.0	-0.1	-	-	-	
D31a	289896	6218129	House	1050	1075	1075	1075	1075	4.5	4.5	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.1	0.0	-0.2	50.5	30.1	15.0	4.4	
D31b	289897	6218145	Rural	950	950	950	950	950	2.5	2.5	2.5	2.5	2.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.6	-	-	-	-	
D31d	288885	6218123	House	1000	1025	1025	1025	1025	3.5	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.2	50.5	30.2	15.0	4.4	
D11-01	288896	6218105	Tank	1050	1075	1075	1075	1075	4.0	4.0	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.1	-0.1	-0.2	-	-	-	-	
D11-02	289941	6218135	Tank	1000	1025	1025	1025	1025	4.0	4.0	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D31-03	288942	6218137	Tank	1000	1025	1025	1025	1025	3.5	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.1	0.0	-0.1	-	-	-	-	
D32a	288861	6217974	House	1350	1350	1375	1375	1375	4.0	4.0	4.0	4.0	4.0	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.12	0.5	1.6	-0.9	-3.3	44.3	33.8	15.4	6.4
D32b	288868	6217928	Rural	1350	1350	1350	1350	1350	4.5	4.5	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.11	0.5	1.5	-0.9	-2.9	-	-	-	-
D32-01	288871	6217968	Rural	1350	1350	1375	1375	1375	3.0	3.0	2.5	2.5	2.5	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.12	0.6	1.7	-1.0	-3.4	-	-	-	-
D32-02	288865	6217959	Tank	1350	1350	1375	1375	1375	3.0	3.0	3.0	3.0	3.0	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.12	0.6	1.7	-1.0	-3.4	-	-	-	-
D32-03	288867	6217953	Tank	1350	1350	1375	1375	1375	4.5	4.5	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.12	0.6	1.7	-1.0	-3.4	-	-	-	-
D32-02	288875	6217992	Tank	1350	1350	1375	1375	1375	4.0	4.0	4.0	4.0	4.0	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.12	0.5	1.5	-0.8	-3.0	-	-	-	-
D33a	288991	6217825	House	875	900	900	900	900	1.5	1.5	1.5	1.5	1.5	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	58.9	26.1	12.1	2.9	
D33b	289558	6217811	Rural	875	900	900	900	900	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	
D33c	289015	6217854	Rural	900	900	900	900	900	1.5	1.5	1.5	1.5	1.5	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	-	-	-	-	
D34	288962	6217852	Rural	950	950	950	950	950	2.5	2.5	2.5	2.5	2.5	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.7	-	-	-	-	
D34a	289551	6217812	Rural	875	900	900	900	900	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	
D31F	288966	6217810	Rural	875	875	875	875	875	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	
D33-01	289005	6217862	Pool	925	925	925	925	925	2.0	2.0	2.0	2.0	2.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	-	-	-	-	
D31-01	289048	6217813	Rural	900	900	900	900	900	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	
D31-02	289014	6217803	Rural	900	900	900	900	900	1.5	1.5	1.5	1.5	1.5	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	
D33-01	288983	6217805	Tank	875	875	875	875	875	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	
D34a	289178	6217883	House	925	925	925	925	925	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	50.5	30.2	15.0	4.4	
D31-01	289020	6217736	Rural	950	950	950	950	950	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D31-02	289026	6217783	House	925	925	925	925	925	2.5	2.5	2.5	2.5	2.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D31-03	289098	6217688	House	925	925	925	925	925	2.5	2.5	2.5	2.5	2.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D31-05	289096	6217759	House	950	975	975	975	975	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D40a	288838	6217688	House	950	975	975	975	975	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	50.9	30.0	14.9	4.3	
D40b	288866	6217717	Rural	900	900	900	900	900	2.0	2.0	2.0	2.0	2.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D40-07	288868	6217703	Rural	950	950	950	950	950	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D40-02	288872	6217719	Tank	900	900	900	900	900	2.0	2.0	2.0	2.0	2.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D40-03	288872	6217717	Tank	900	900	900	900	900	2.0	2.0	2.0	2.0	2.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D40-05	288819	6217687	Tank	925	925	925	925	925	2.5	2.5	2.5	2.5	2.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-	
D56-01	289296	6218271	House	1225	1225	1225	1225	1225	5.0	5.0	5.0	5.0	5.0	0.06	0.06	0.06	0.06	0.06	0.04	0.04	0.04	0.04	0.04	0.4	1.0	-0.1	-0.5	50.2	30.4	15.0	4.5	
D56-01	289289	6218301	Rural	1025	1050	1050	1050	1050	4.0	4.0	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.1	0.0	-0.2	-	-	-	-	
D56-01	289278	6218265	Tank	1150	1175	1175	1175	1175	5.0	5.0	5.0	5.0	5.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	-0.1	-0.4	-	-	-	-	
D56-02	289291	6218307	Rural	1000	1000	1000	1000	1000	3.5	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.1	0.0	-0.1	-	-	-	-	
D56-03	289279	6218290	Tank	1025	1050	1050	1050	1050	4.0	4.0	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	-0.1	-0.2	-	-	-	-	
D57-01	288872	6217761	House	875	875	875	875	875	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	59.9	25.6	11.8	2.8	
D57-01	288863	6217752	Rural	875	875	875	875	875	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-	
D57-03	288877	6217755	House	875	875	875	875	875	0.5	0.5	0.5	0.5	0.5	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.3	-	-	-	-	
D57-01	288882	6217764	Tank																													

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Structure Type	Predicted total subsidence after LW712 (mm)	Predicted total subsidence after LW713 (mm)	Predicted total subsidence after LW714 (mm)	Predicted total subsidence after LW715 (mm)	Predicted total subsidence after LW716 (mm)	Predicted total tilt after LW712 (mm/m)	Predicted total tilt after LW713 (mm/m)	Predicted total tilt after LW714 (mm/m)	Predicted total tilt after LW715 (mm/m)	Predicted total tilt after LW716 (mm/m)	Predicted total hogging curvature after LW712 (1/km)	Predicted total hogging curvature after LW713 (1/km)	Predicted total hogging curvature after LW714 (1/km)	Predicted total hogging curvature after LW715 (1/km)	Predicted total hogging curvature after LW716 (1/km)	Predicted total sagging curvature after LW712 (1/km)	Predicted total sagging curvature after LW713 (1/km)	Predicted total sagging curvature after LW714 (1/km)	Predicted total sagging curvature after LW715 (1/km)	Predicted total sagging curvature after LW716 (1/km)	Predicted total mean tensile strain (mm/mm)	Predicted 95% sagging tensile strain (mm/mm)	Predicted mean total comp. strain (mm/mm)	Predicted 95% comp. strain (mm/mm)	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 (%)
F23-01	288359	6217784	Rural	925	950	950	950	950	3.0	3.0	3.0	3.0	3.0	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.2	0.7	-0.2	-1.0	-	-	-	-
F23-02	288364	6217791	Rural	925	950	950	950	950	3.0	3.0	3.0	3.0	3.0	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.2	0.6	-0.2	-0.9	-	-	-	-
F23-01	288363	6217803	Tank	900	925	925	925	925	3.0	3.0	3.0	3.0	3.0	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.2	0.6	-0.1	-0.6	-	-	-	-	
F23-02	288411	6217864	Tank	905	950	950	950	950	3.0	3.0	3.0	3.0	3.0	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.2	0.9	-0.1	-1.2	-	-	-	-	
F24a	288569	6217827	House	1325	1350	1350	1350	1350	4.0	4.0	4.0	4.0	4.0	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.5	1.6	-0.9	-3.2	44.3	33.8	15.4	6.4
F24b	288561	6217801	Rural	1325	1325	1325	1325	1325	3.5	3.5	3.5	3.5	3.5	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.6	1.7	-1.0	-3.2	-	-	-	-
F24c	288551	6217831	Rural	1325	1325	1325	1325	1325	4.0	4.0	4.0	4.0	4.0	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.5	1.5	-0.7	-2.9	-	-	-	-
F24d	288539	6217841	Rural	1300	1300	1325	1325	1325	4.5	4.5	4.5	4.5	4.5	0.01	0.01	0.01	0.01	0.01	0.11	0.11	0.11	0.11	0.11	0.4	1.2	-0.6	-2.4	-	-	-	-
F24e	288542	6217848	Rural	1300	1300	1300	1300	1300	4.5	4.5	4.5	4.5	4.5	0.01	0.01	0.01	0.01	0.01	0.10	0.10	0.10	0.10	0.10	0.3	1.1	-0.5	-2.2	-	-	-	-
F24f	288546	6217854	Rural	1300	1300	1300	1300	1300	4.5	4.5	4.5	4.5	4.5	0.01	0.01	0.01	0.01	0.01	0.10	0.10	0.10	0.10	0.10	0.3	1.0	-0.5	-2.1	-	-	-	-
F24-03	288533	6217833	Rural	1300	1300	1325	1325	1325	4.0	4.0	4.0	4.0	4.0	0.01	0.01	0.01	0.01	0.01	0.11	0.11	0.11	0.11	0.11	0.4	1.3	-0.6	-2.6	-	-	-	-
F24-04	288549	6217824	Rural	1325	1325	1325	1325	1325	4.0	3.5	3.5	3.5	3.5	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.5	1.6	-0.8	-2.6	-	-	-	-
F25a	288593	6218012	House	1025	1050	1075	1075	1075	4.0	4.0	4.0	4.0	4.0	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.5	-0.2	-1.1	52.6	29.2	14.2	4.0
F25b	288415	6218037	Rural	1050	1100	1100	1100	1100	4.0	4.5	4.5	4.5	4.5	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.6	-0.3	-1.3	-	-	-	-
F25c	288416	6218076	Rural	1250	1250	1250	1250	1250	4.5	4.5	4.5	4.5	4.5	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.6	0.6	-0.6	-2.0	-	-	-	-
F25d	288404	6218076	Rural	1200	1250	1275	1275	1275	4.5	4.5	4.5	4.5	4.5	0.04	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06	0.4	1.1	-0.7	-2.1	-	-	-	-
F25e	288389	6218094	Rural	1275	1350	1350	1350	1350	4.5	4.5	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.11	0.11	0.11	0.11	0.11	0.5	1.4	-0.9	-2.7	-	-	-	-
F25-01	288405	6218085	Pool	1250	1300	1300	1300	1300	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.03	0.08	0.08	0.08	0.08	0.08	0.4	1.2	-0.7	-2.3	-	-	-	-
F25-02	288395	6218003	Rural	975	1000	1000	1000	1000	3.0	3.5	3.5	3.5	3.5	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.5	-0.3	-1.0	-	-	-	-
F25-02	288411	6218029	Rural	1025	1050	1050	1050	1050	4.0	4.0	4.0	4.0	4.0	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.6	-0.3	-1.2	-	-	-	-
F25-03	288366	6217995	Rural	950	1000	1000	1000	1000	3.0	3.5	3.5	3.5	3.5	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.5	-0.3	-1.0	-	-	-	-
F25-04	288413	6218090	Rural	1225	1300	1300	1300	1300	4.5	4.5	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.03	0.08	0.08	0.08	0.08	0.08	0.4	1.2	-0.7	-2.4	-	-	-	-
F25-01	288385	6218081	Tank	1250	1325	1325	1325	1325	4.5	4.5	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.09	0.09	0.09	0.09	0.09	0.2	0.7	-0.4	-1.5	-	-	-	-
F26a	288567	6218109	House	1075	1125	1125	1125	1125	4.5	4.5	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.06	0.02	0.02	0.02	0.02	0.02	0.2	0.6	-0.3	-1.2	51.7	29.6	14.5	4.2
F26b	288496	6218082	Rural	1075	1125	1125	1125	1125	4.0	4.5	4.5	4.5	4.5	0.05	0.05	0.05	0.05	0.06	0.02	0.02	0.02	0.02	0.02	0.2	0.7	-0.4	-1.4	-	-	-	-
F26c	288504	6218060	Rural	1050	1050	1050	1050	1050	3.0	3.0	3.0	3.0	3.0	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.5	-0.3	-1.0	-	-	-	-
F26d	288508	6218067	Rural	1000	1025	1025	1025	1025	3.5	3.5	3.5	3.5	3.5	0.05	0.05	0.05	0.05	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.3	-1.1	-	-	-	-
F26e	288503	6218066	Rural	1000	1025	1025	1025	1025	3.5	3.5	3.5	3.5	3.5	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.3	-1.1	-	-	-	-
F26b	288561	6218117	Rural	1075	1075	1075	1075	1075	4.5	4.5	4.5	4.5	4.5	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.3	-1.1	-	-	-	-
F26-01	288586	6218111	Rural	1000	1050	1050	1050	1050	3.5	4.0	4.0	4.0	4.0	0.05	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.6	-0.3	-1.1	-	-	-	-
F26-02	288500	6218077	Rural	1050	1075	1075	1100	1100	4.0	4.0	4.5	4.5	4.5	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.6	-0.3	-1.3	-	-	-	-
F26-01	288493	6218087	Rural	1100	1125	1125	1125	1125	4.5	4.5	4.5	4.5	4.5	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.7	-0.4	-1.5	-	-	-	-
F26-02	288489	6218204	Tank	1325	1375	1375	1375	1375	4.0	3.5	3.5	3.5	3.5	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.5	1.6	-0.9	-3.2	-	-	-	-
F27a	288671	6218009	House	1000	1025	1025	1025	1025	3.5	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	50.5	30.2	15.0	4.4
F27-01	288662	6218006	Rural	975	1000	1000	1000	1000	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-
F27-01	288700	6218023	Tank	975	1000	1000	1000	1000	3.5	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-
F27-02	288659	6217995	Tank	1000	1025	1025	1025	1025	3.5	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.1	0.0	-0.2	-	-	-	-
F27-03	288671	6217985	Tank	1050	1075	1075	1075	1075	4.0	4.0	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	-0.1	-0.3	-	-	-	-
F27-04	288673	6217983	Tank	1075	1075	1075	1075	1075	4.5	4.5	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	-0.1	-0.3	-	-	-	-
F28a	288713	6218156	House	975	1000	1025	1025	1025	3.0	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.2	-0.9	51.2	29.8	14.7	4.3
F28b	288753	6218175	Rural	975	1000	1000	1000	1000	3.0	3.0	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.2	-0.9	-	-	-	-
F28c	288746	6218184	Rural	1000	1000	1000	1000	1000	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.2	-0.9	-	-	-	-
F28f	288759	6218186	Rural	1000	1025	1050	1050	1050	3.5	4.0	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.3	-1.0	-	-	-	-
F28-01	288694	6218155	Pool	975	1025	1025	1025	1025	3.5																						

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Control MGA Easting (GDA 2020)	Control MGA Northing (GDA 2020)	Structure Type	Predicted total subsidence after LW12 (mm)	Predicted total subsidence after LW12 (mm)	Predicted total subsidence after LW14 (mm)	Predicted total subsidence after LW15 (mm)	Predicted total subsidence after LW16 (mm)	Predicted total tilt after LW12 (mm)	Predicted total tilt after LW13 (mm)	Predicted total tilt after LW14 (mm)	Predicted total tilt after LW15 (mm)	Predicted total tilt after LW16 (mm)	Predicted total hogging curvature after LW12 (1/km)	Predicted total hogging curvature after LW13 (1/km)	Predicted total hogging curvature after LW14 (1/km)	Predicted total hogging curvature after LW15 (1/km)	Predicted total hogging curvature after LW16 (1/km)	Predicted total sagging curvature after LW12 (1/km)	Predicted total sagging curvature after LW13 (1/km)	Predicted total sagging curvature after LW14 (1/km)	Predicted total sagging curvature after LW15 (1/km)	Predicted total sagging curvature after LW16 (1/km)	Predicted mean total tensile strain (mm/mm)	Predicted 95% C _u for total tensile strain (mm/mm)	Predicted mean total comp. strain (mm/mm)	Predicted 95% C _u for total comp. strain (mm/mm)	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 or R4 Impact for Houses (%)	Predicted Probability of Category R5 Impact for Houses (%)
F36d	288309	6218595	Rural	825	1250	1300	1325	1325	6.5	5.0	5.0	5.0	5.0	0.04	0.04	0.04	0.04	0.04	0.08	0.09	0.09	0.09	0.09	0.3	0.9	-0.3	-1.2	-	-	-	-
F36d01	288266	6218571	House	850	1250	1300	1325	1325	6.5	5.0	5.0	5.0	5.0	0.05	0.05	0.05	0.05	0.05	0.08	0.09	0.09	0.09	0.09	0.3	0.8	-0.3	-1.2	46.3	32.7	15.2	5.8
F36d01	288295	6218567	Pool	800	1275	1290	1290	1290	6.5	5.0	5.0	5.0	5.0	0.02	0.02	0.02	0.02	0.02	0.10	0.11	0.11	0.11	0.11	0.3	0.9	-0.4	-1.9	-	-	-	-
F36d01	288307	6218579	House	875	1275	1325	1325	1325	6.5	5.0	5.0	5.0	5.0	0.02	0.02	0.02	0.02	0.02	0.09	0.10	0.10	0.10	0.10	0.3	0.8	-0.4	-1.7	-	-	-	-
F37a	288623	6218518	House	825	1000	1025	1025	1025	2.0	3.5	3.5	3.5	3.5	0.04	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.8	52.1	29.4	14.4	4.1
F37b	288589	6218507	Rural	800	950	1000	1000	1000	2.0	3.0	3.0	3.0	3.0	0.04	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.8	-	-	-	-
F37c	288592	6218510	Rural	825	975	1025	1025	1025	2.0	3.0	3.0	3.0	3.0	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.2	-0.9	-	-	-	-
F37d01	288607	6218555	Rural	900	1100	1125	1125	1125	2.5	4.5	4.5	4.5	4.5	0.04	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.6	-0.4	-1.3	-	-	-	-
F37d01	288580	6218547	Rural	900	1075	1125	1125	1125	2.5	4.5	4.5	4.5	4.5	0.04	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.7	-0.4	-1.4	-	-	-	-
F37d01	288629	6218519	Tank	775	925	950	950	950	1.5	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.7	-	-	-	-
F37d02	288649	6218540	Tank	800	950	975	975	975	2.0	2.5	3.0	3.0	3.0	0.04	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.8	-	-	-	-
F37d03	288588	6218516	Tank	825	975	1000	1000	1000	2.0	3.0	3.0	3.0	3.0	0.04	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.2	-0.9	-	-	-	-
F37d04	288591	6218515	Tank	800	950	1000	1000	1000	2.0	3.0	3.0	3.0	3.0	0.04	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.9	-	-	-	-
F37d05	288594	6218514	Tank	800	950	975	975	975	2.0	2.5	3.0	3.0	3.0	0.04	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.9	-	-	-	-
F37d06	288608	6218563	Tank	800	1100	1125	1125	1125	2.5	4.5	4.5	4.5	4.5	0.04	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.7	-0.4	-1.4	-	-	-	-
F37d07	288582	6218551	Tank	900	1100	1125	1125	1125	2.5	4.5	4.5	4.5	4.5	0.04	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.2	0.7	-0.4	-1.5	-	-	-	-
F38a	288825	6218517	House	875	975	1000	1000	1000	3.5	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	49.8	30.6	15.0	4.6
F38b	288795	6218508	Rural	875	975	975	975	975	3.0	3.0	3.0	3.0	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-
F38c	288800	6218498	Rural	875	975	1000	1000	1000	3.5	3.5	3.5	3.5	3.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-
F38d	288797	6218489	Rural	900	1000	1025	1025	1025	4.0	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	-	-	-	-
F38e	288775	6218521	Rural	800	900	925	925	925	1.5	1.5	1.5	1.5	1.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.3	-	-	-	-
F39d01	288782	6218523	Tank	800	925	925	925	925	1.5	1.5	1.5	1.5	1.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.4	0.0	-0.3	-	-	-	-
F39d02	288780	6218501	Rural	800	950	950	950	950	2.0	2.5	2.5	2.5	2.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.2	-1.0	-	-	-	-
F39d01	288778	6218517	Tank	800	900	925	925	925	2.0	1.5	1.5	1.5	1.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.4	0.0	-0.3	-	-	-	-
F39d02	288786	6218518	Tank	825	925	925	925	925	2.0	2.0	2.0	2.0	2.0	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.4	0.0	-0.3	-	-	-	-
F40a	288809	6218504	House	825	1000	1000	1000	1000	3.5	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.4	1.0	0.0	-0.1	51.7	29.6	14.5	4.2
F40b	288784	6218602	Rural	800	950	975	975	975	1.5	2.5	3.0	3.0	3.0	0.04	0.05	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.8	-	-	-	-
F40c	288828	6218602	Rural	750	950	950	950	950	1.0	1.5	2.0	2.0	2.0	0.03	0.03	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	-	-	-	-
F40d	288842	6218597	Rural	775	900	925	925	925	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	-	-	-	-
F40d	288856	6218591	Rural	750	875	900	900	900	0.5	0.5	1.0	1.0	1.0	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.4	-	-	-	-
F40d01	288790	6218613	Pool	800	975	1000	1000	1000	2.0	3.0	3.0	3.0	3.0	0.04	0.05	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.9	-	-	-	-
F40d01	288797	6218624	Rural	825	1000	1025	1025	1025	2.0	3.5	3.5	3.5	3.5	0.06	0.06	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.2	-1.0	-	-	-	-
F40d01	288771	6218606	Tank	825	975	1000	1000	1000	2.0	3.0	3.5	3.5	3.5	0.04	0.05	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.9	-	-	-	-
F40d02	288779	6218620	Tank	825	1000	1025	1025	1025	2.5	3.5	3.5	3.5	3.5	0.04	0.05	0.06	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.3	-1.0	-	-	-	-
F40d03	288823	6218594	Rural	750	900	925	925	925	1.0	1.0	1.0	1.0	1.0	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	-	-	-	-
F41a	288532	6218864	House	180	775	900	925	950	1.5	1.0	1.5	1.5	1.5	0.03	0.03	0.04	0.05	0.05	<0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	55.6	27.7	13.2	3.5
F41b	288494	6218850	Rural	170	775	900	925	925	1.0	1.0	1.5	1.5	1.5	0.03	0.03	0.04	0.04	0.04	<0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	-	-	-	-
F41c	288474	6218841	Rural	160	775	900	925	925	1.0	0.5	1.0	1.5	1.5	0.02	0.03	0.04	0.04	0.04	<0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.7	-	-	-	-
F41d01	288490	6218842	Tank	170	750	875	900	925	1.0	<0.5	1.0	1.0	1.0	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	-	-	-	-
F41a	288017	6217834	House	575	625	625	625	625	5.0	5.0	5.0	5.0	5.0	0.05	0.05	0.05	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.6	-0.3	-1.2	52.3	29.3	14.3	4.1
F41b	287965	6217766	Rural	525	625	625	625	625	3.0	3.5	3.5	3.5	3.5	0.04	0.04	0.04	0.04	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.4	-0.2	-0.8	-	-	-	-
F41d01	288041	6217840	Rural	600	650	650	650	650	5.0	5.0	5.0	5.0	5.0	0.06	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.5	-0.2	-0.9	-	-	-	-
F43d02	288032	6217853	Tank	625	650	675	675	675	5.0	5.0	5.0	5.0	5.0	0.05	0.05	0.05	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.7	-0.4	-1.5	-	-	-	-
F43d03	288031	6217856	Tank	625	675	675	675	675	5.0	5.5	5.5	5.5	5.5	0.05																	

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid GMA Easting (NAD83 2020)	Centroid GMA Northing (GDA 2020)	Structure Type	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted total	Predicted 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Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid MGA Easting (mGA 2020)	Centroid MGA Northing (MGA 2020)	Structure Type	Predicted total subsidence after LW121 (mm)	Predicted total subsidence after LW123 (mm)	Predicted total subsidence after LW174 (mm)	Predicted total subsidence after LW175 (mm)	Predicted total subsidence after LW176 (mm)	Predicted total subsidence after LW177 (mm)	Predicted total sagging curvature after LW1712 (1/mm)	Predicted total sagging curvature after LW1713 (1/mm)	Predicted total sagging curvature after LW1714 (1/mm)	Predicted total sagging curvature after LW1715 (1/mm)	Predicted total sagging curvature after LW1716 (1/mm)	Predicted total sagging curvature after LW1717 (1/mm)	Predicted mean total strain (mm/mm)	Predicted 95% Cl for total tensile strain (mm/mm)	Predicted mean total strain (mm/mm)	Predicted 95% Cl for total comp. for strain (mm/mm)	Predicted Probability of Nil Impact for Houses (%)	Predicted Probability of R2 impact for Houses (%)	Predicted Probability of R3 impact for Houses (%)	Predicted Probability of R4 impact for Houses (%)	
F64001	289251	6219095	Rural	< 20	250	725	825	850	< 0.5	1.0	3.0	2.0	2.0	1.5	< 0.01	0.05	0.05	0.05	0.1	0.1	-0.1	-0.4	-	-
F64001	289247	6219083	Tank	< 20	675	875	875	875	< 0.5	1.0	1.5	1.0	1.0	1.5	< 0.01	0.03	0.03	0.03	0.1	0.1	-0.1	-0.5	-	-
F64002	289280	6219633	Tank	< 20	170	675	775	800	< 0.5	1.5	1.5	1.5	1.5	1.5	< 0.01	0.03	0.03	0.03	0.1	0.1	-0.1	-0.5	-	-
F65001	289242	6219582	House	50	625	925	1000	1000	< 0.5	5.0	5.0	5.0	5.0	5.0	< 0.01	0.03	0.03	0.03	0.2	0.2	-0.2	-0.6	-0.2	-0.9
F65001	289421	6219542	Tank	50	600	950	1025	1025	< 0.5	5.0	5.0	5.0	5.0	5.0	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.01	0.01	-0.3	-1.3	-
F65001	289487	6219666	Tank	50	600	950	1025	1025	< 0.5	5.0	5.0	5.0	5.0	5.0	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.01	0.01	-0.3	-1.3	-
N01A	288148	6218211	House	800	900	900	900	900	2.5	2.0	2.0	2.0	2.0	2.0	0.06	0.06	0.06	0.06	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-01	288113	6218236	Rural	750	850	875	875	875	0.5	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.01	0.01	0.01	-0.2	-0.4	-
K01-01	288195	6218255	Rural	750	850	875	875	875	0.5	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.01	0.01	0.01	-0.2	-0.4	-
K01-03	288154	6218226	Rural	750	875	875	875	875	1.5	1.0	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-01	288207	6218251	Tank	750	875	875	875	875	1.5	1.0	1.0	1.0	1.0	1.0	0.05	0.05	0.05	0.05	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-01	288198	6218255	Tank	750	850	875	875	875	1.0	0.5	0.5	0.5	0.5	0.5	0.04	0.04	0.04	0.04	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-03	288176	6218216	Tank	800	900	900	900	900	2.0	2.0	2.0	2.0	2.0	2.0	0.06	0.06	0.06	0.06	0.01	0.01	0.01	-0.4	-0.1	-0.4
K02A	288027	6218183	House	750	850	875	875	875	1.0	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.01	0.01	0.01	-0.4	-0.1	-0.4
K02-01	288032	6218195	Rural	725	850	875	875	875	1.0	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.01	0.01	0.01	-0.4	-0.1	-0.4
K02-01	288039	6218189	Rural	725	850	875	875	875	< 0.5	1.0	1.0	1.0	1.0	1.0	0.03	0.03	0.03	0.03	0.01	0.01	0.01	-0.4	-0.1	-0.4
K02-02	287960	6218219	Rural	775	950	975	975	975	2.0	3.5	3.5	3.5	3.5	3.5	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K02-03	287984	6218248	Rural	725	850	875	875	875	1.5	1.5	1.5	1.5	1.5	1.5	0.04	0.04	0.04	0.04	0.01	0.01	0.01	-0.2	-0.6	-0.4
K02-04	288041	6218197	Rural	725	850	875	875	875	0.5	1.0	1.0	1.0	1.0	1.0	0.03	0.03	0.03	0.03	0.01	0.01	0.01	-0.4	-0.1	-0.4
K02-01	288062	6218192	Tank	750	850	875	875	875	1.0	0.5	0.5	0.5	0.5	0.5	0.04	0.04	0.04	0.04	0.01	0.01	0.01	-0.4	-0.1	-0.4
K02-01	288064	6218183	Tank	750	850	875	875	875	1.0	0.5	0.5	0.5	0.5	0.5	0.04	0.04	0.04	0.04	0.01	0.01	0.01	-0.4	-0.1	-0.4
K02-03	288053	6218186	Tank	750	850	875	875	875	1.0	0.5	0.5	0.5	0.5	0.5	0.04	0.04	0.04	0.04	0.01	0.01	0.01	-0.4	-0.1	-0.4
N01A	287915	6218126	House	700	800	825	825	825	1.0	0.5	1.0	0.5	0.5	0.5	0.03	0.03	0.03	0.03	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-01	287887	6218107	Tank	675	875	875	875	875	0.5	0.5	0.5	0.5	0.5	0.5	0.03	0.03	0.03	0.03	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-02	287885	6218114	Rural	650	775	800	800	800	0.5	0.5	0.5	0.5	0.5	0.5	0.03	0.03	0.03	0.03	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-03	287880	6218130	Rural	650	775	800	800	800	< 0.5	1.0	1.0	1.0	1.0	1.0	0.03	0.03	0.03	0.03	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-02	287880	6218130	Rural	650	775	800	800	800	< 0.5	1.0	1.0	1.0	1.0	1.0	0.03	0.03	0.03	0.03	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-05	287880	6218274	Rural	650	775	800	800	800	< 0.5	1.0	1.0	1.0	1.0	1.0	0.03	0.03	0.03	0.03	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-05	287881	6218101	Rural	650	775	800	800	800	< 0.5	1.0	1.0	1.0	1.0	1.0	0.03	0.03	0.03	0.03	0.01	0.01	0.01	-0.4	-0.1	-0.4
K01-06	287888	6218160	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01	0.01	0.01	-0.2	-0.6	-0.4
K01-07	287945	6218232	Rural	675	825	850	850	850	1.0	2.0	2.0	2.0	2.0	2.0	0.04	0.05	0.05	0.05	0.01					

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid MGA Easting (m) (MGA 2020)	Centroid MGA Northing (m) (MGA 2020)	Structure Type	Predicted total subsidence after LW712 (mm)	Predicted total subsidence after LW713 (mm)	Predicted total subsidence after LW714 (mm)	Predicted total subsidence after LW715 (mm)	Predicted total subsidence after LW716 (mm)	Predicted total subsidence after LW717 (mm)	Predicted total sag after LW712 (mm/m)	Predicted total sag after LW713 (mm/m)	Predicted total sag after LW714 (mm/m)	Predicted total sag after LW715 (mm/m)	Predicted total sag after LW716 (mm/m)	Predicted total sag after LW717 (mm/m)	Predicted total sag after LW718 (mm/m)	Predicted total sag after LW719 (mm/m)	Predicted mean total strain (mm/m)	Predicted 95% CL for total tensile strain (mm/m)	Predicted mean strain (mm/m)	Predicted 95% CL comp. for total strain (mm/m)	Predicted Probability of Nil Impact for Houses (%)	Predicted Probability of Category A1 or B2 Impact for Houses (%)	Predicted Probability of Category A2 and B4 Impact for Houses (%)	Predicted Probability of Category C1 and B5 Impact for Houses (%)
P40D01	285786	6217437	House	< 20	30	40	40	40	40	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.0	0.3	0.0	-0.4	94.2	5.0	0.7	0.1
P40E01	285791	6217454	Pool	< 20	30	40	40	40	40	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.2	0.0	0.2	-0.3	-	-	-	-
P40F01	285790	6217454	Rural	< 20	30	40	40	40	40	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.0	0.1	0.0	-0.1	-	-	-	-
P40G02	285786	6217418	Rural	< 20	20	30	30	30	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.1	0.3	-0.1	-0.4	-	-	-	-
P40H03	285745	6217444	Rural	< 20	20	20	20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.2	0.8	-0.2	-1.2	-	-	-	-
P40I05	281882	6217452	Rural	< 20	40	40	40	40	40	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.0	0.2	0.0	-0.2	-	-	-	-
P40J06	285774	6217418	Rural	< 20	30	30	30	30	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.1	0.3	-0.1	-0.5	-	-	-	-
P40K06	285765	6217426	Rural	< 20	20	30	30	30	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.0	0.3	0.0	-0.4	-	-	-	-
P40L08	281799	6217406	Rural	< 20	30	40	40	40	40	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.1	0.5	-0.1	-0.1	-	-	-	-
P40M01	285811	6217468	Tank	< 20	30	40	40	40	40	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.0	0.2	0.0	-0.3	-	-	-	-
P40N05	285830	6217407	Tank	< 20	30	30	40	40	40	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.1	0.5	-0.1	-0.8	-	-	-	-
P40O06	285809	6217405	Tank	< 20	30	40	40	40	40	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.1	0.5	-0.1	-0.1	-	-	-	-
P40P07	285775	6217406	Tank	< 20	30	30	30	30	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.1	0.4	-0.1	-0.6	-	-	-	-
P47Q01	285628	6217482	House	< 20	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.4	0.9	-0.3	-1.2	94.8	4.6	0.5	0.1
P47R02	285660	6217475	Tank	< 20	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.3	0.8	-0.1	-1.0	-	-	-	-
P47S01	285600	6217439	Rural	< 20	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.3	0.7	-0.3	-1.0	-	-	-	-
P47T02	285602	6217447	Tank	< 20	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.8	0.8	-0.3	-1.0	-	-	-	-
P47U03	285599	6217447	Tank	< 20	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.3	0.8	-0.1	-1.0	-	-	-	-
P47V04	285626	6217369	Tank	< 20	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.2	0.0	0.0	-0.3	-	-	-	-
R01D01	286371	6217570	House	675	925	960	975	975	975	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.7	0.5	-0.6	-2.4	49.5	30.8	15.0	4.7
R01E01	286367	6217590	Rural	675	900	950	975	975	975	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.7	0.4	-0.5	-2.3	-	-	-	-
R01F01	286380	6217595	Rural	700	925	975	975	975	975	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.7	0.7	-0.7	-2.3	-	-	-	-
R01G03	286364	6217612	Rural	625	900	950	950	950	950	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	0.6	0.6	0.3	-1.2	-0.4	-1.9	-	-
R01H04	286403	6217544	House	700	900	925	950	950	950	2.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	0.6	0.6	0.6	-2.5	-	-	-	-
R01I05	286364	6217598	Tank	650	900	925	950	950	950	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.6	0.6	0.3	-1.3	-	-	-	-
R01J06	286329	6217551	House	425	600	625	625	625	625	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.1	0.2	0.2	-0.3	-1.8	58.2	26.4	12.3
R01K01	286267	6217561	Pool	425	625	650	650	650	650	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	< 0.01	0.1	0.4	0.4	0.4	0.4	0.4	0.4
R01L01	286266	6217552	Rural	425	600	625	625	625	625	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.2	0.2	0.4	0.4	0.3	1.3	-	-
R02G02	286245	6217581	Rural	350	550	600	600	600	600	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.1	0.2	0.2	0.2	0.3	0.3	0.2	0.2
R02H03	286254	6217578	Rural	375	575	600	625	625	625	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0	< 0.01	0.1	0.3	0.3	0.3	0.3	0.2	0.2
R02I04	286251	6217592	Rural	325	500	525	550	550	550	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R02J05	286247	6217562	Rural	375	550	600	600	600	600	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3
R02K06	286239	6217601	Rural	300	525	575	575	575	575	3.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R02L01	286238	6217582	Rural	300	550	550	550	550	550	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R02M02	286238	6217586	Tank	300	500	550	550	550	550	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R02N03	286246	6217597	Tank	325	525	575	575	575	575	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
R01H01	286217	6217744	House	130	550	550	550	550	550	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	< 0.01	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R02H02	286227	6217764	House	110	525	575	650	650	650	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R01D01	286200	6217745	Pool	130	550	650	650	650	650	1.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R01E01	286213	6217718	Rural	125	525	575	575	575	575	1.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R01F02	286208	6217747	Rural	100	475	575	575	575	575	0.5	1.0	1.5	1.5	1.5	1.5	1.5	1.5	0.02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R01G03	286218	6217738	Rural	140	550	625	650	650	650	1.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R01H04	286213	6217744	Rural	130	525	575	575	575	575	1.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R01I05	286242	6217747	Rural	120	525	625	625	625	625	1.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R01J06	286263	6217718	Tank	170	550	625	650	650	650	1.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
R02K01	286267	6217750	Tank	130	575	675	675	675	675	1.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R02L03	286261	6217730	Tank	140	500	550	550	550	550	1.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
R02M04	286261	6217727	Tank	150	550	625	650	650	650	1.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R03D01	286307	6217577	House	100	200	225	225	225	225	1.0	1.5	2.0	2.0	2.0	2.0	2.0	2.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R03E01	286319	6217575	Pool	100	200	225	225	225	225	1.0	1.5	2.0	2.0	2.0	2.0	2.0	2.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R04G01	286318	6217584	Rural	120	250	275	275	275	275	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	< 0.01	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R04H02	286344	6217577	Rural	140	275	300	300	300	300	1.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R04I03	286349	6217569	Rural	150	275	300	300	300	300	1.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2
R04K04	286355	6217573	Rural	150	275	300	300	300	300																

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Control MGA Easting (GDA 2020)	Control MGA Northing (GDA 2020)	Structure Type	Predicted total subsidence after LW12 (mm)	Predicted total subsidence after LW13 (mm)	Predicted total subsidence after LW14 (mm)	Predicted total subsidence after LW15 (mm)	Predicted total subsidence after LW16 (mm)	Predicted total tilt after LW12 (mm/m)	Predicted total tilt after LW13 (mm/m)	Predicted total tilt after LW14 (mm/m)	Predicted total tilt after LW15 (mm/m)	Predicted total tilt after LW16 (mm/m)	Predicted total hogging curvature after LW12 (1/km)	Predicted total hogging curvature after LW13 (1/km)	Predicted total hogging curvature after LW14 (1/km)	Predicted total hogging curvature after LW15 (1/km)	Predicted total hogging curvature after LW16 (1/km)	Predicted total sagging curvature after LW12 (1/km)	Predicted total sagging curvature after LW13 (1/km)	Predicted total sagging curvature after LW14 (1/km)	Predicted total sagging curvature after LW15 (1/km)	Predicted total sagging curvature after LW16 (1/km)	Predicted mean total tensile strain (mm/m)	Predicted 95% tensile strain (mm/m)	Predicted mean total comp. strain (mm/m)	Predicted 95% comp. strain (mm/m)	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 (%)	Cs for total impact for Houses (%)
R11001	285798	6217658	Tank	< 20	40	60	70	70	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.6	1.5	-0.5	-2.0	-	-	-	-	-	
R11002	285792	6217671	Tank	< 20	40	60	70	70	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.5	1.5	-0.5	-2.1	-	-	-	-	-	
R11003	285769	6217701	Tank	< 20	40	60	70	70	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.5	-0.4	-2.1	-	-	-	-	-	
R112001	285199	6217641	House	< 20	< 20	20	30	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	1.3	-0.3	-1.8	94.5	4.8	0.6	0.1	-	
R12001	285618	6217664	Pool	< 20	< 20	30	30	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	1.2	-0.3	-1.8	-	-	-	-	-	
R12002	285599	6217651	Rural	< 20	< 20	20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	1.2	-0.3	-1.8	-	-	-	-	-	
R12003	285618	6217645	Rural	< 20	< 20	20	30	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.4	-0.3	-2.0	-	-	-	-	-	
R12004	285624	6217644	Rural	< 20	< 20	30	30	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.4	-0.3	-2.0	-	-	-	-	-	
R12005	285587	6217667	Rural	< 20	< 20	20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.2	1.0	-0.2	-1.5	-	-	-	-	-	
R12006	285624	6217663	Rural	< 20	< 20	30	30	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	1.2	-0.3	-1.8	-	-	-	-	-	
R12007	285567	6217679	Rural	< 20	< 20	< 20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.2	0.8	-0.1	-1.2	-	-	-	-	-	
R12008	285578	6217678	Rural	< 20	< 20	20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.2	0.9	-0.2	-1.3	-	-	-	-	-	
R12009	285572	6217691	Rural	< 20	< 20	20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.7	-0.1	-1.1	-	-	-	-	-	
R12010	285570	6217691	Rural	< 20	< 20	< 20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.7	-0.1	-1.0	-	-	-	-	-	
R12011	285577	6217692	Rural	< 20	< 20	20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.7	-0.1	-1.1	-	-	-	-	-	
R12012	285571	6217668	Tank	< 20	< 20	20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.6	-0.1	-0.9	-	-	-	-	-	
R12002	285580	6217659	Tank	< 20	< 20	< 20	20	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.2	1.1	-0.2	-1.6	-	-	-	-	-	
R13001	285530	6217684	House	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.6	0.1	0.9	94.7	4.6	0.6	0.1	-	
R13001	285541	6217687	Rural	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.6	-0.1	-0.9	-	-	-	-	-	
R13002	285548	6217705	Tank	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.5	-0.1	-0.7	-	-	-	-	-	
R13003	285546	6217731	Rural	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.3	-0.1	-0.5	-	-	-	-	-	
R13004	285548	6217715	Tank	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.4	-0.1	-0.6	-	-	-	-	-	
R14001	285514	6217701	House	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.6	-0.1	-0.6	-	-	-	-	-	
R14001	285461	6217681	House	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.4	-0.1	-0.5	94.9	4.5	0.5	0.1	-	
R14003	285443	6217718	Rural	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.2	0.0	-0.2	-	-	-	-	-	
R14001	285461	6217686	Tank	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.2	0.0	-0.2	-	-	-	-	-	
R14003	285443	6217724	Tank	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.1	0.0	-0.2	-	-	-	-	-	
R16001	285932	6217845	House	< 20	120	190	200	200	< 0.5	1.0	1.5	1.5	1.5	< 0.01	< 0.01	0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.2	0.9	-0.2	-1.4	80.5	13.9	5.0	0.7	-	
R16001	285931	6217804	Rural	< 20	120	190	200	200	< 0.5	1.0	1.5	1.5	1.5	< 0.01	< 0.01	0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.8	-0.1	-1.3	-	-	-	-	-	
R16002	285915	6217810	Rural	< 20	150	170	170	170	< 0.5	0.5	1.0	1.0	1.0	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	1.2	-0.3	-1.7	-	-	-	-	-	
R16001	285926	6217792	Tank	< 20	110	160	160	160	< 0.5	0.5	1.0	1.0	1.0	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.4	-0.3	-2.0	-	-	-	-	-	
R16002	285905	6217810	Rural	< 20	150	160	160	160	< 0.5	0.5	1.0	1.0	1.0	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	1.1	-0.2	-1.6	-	-	-	-	-	
R16001	285915	6217802	Tank	< 20	150	160	160	160	< 0.5	0.5	1.0	1.0	1.0	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	1.3	-0.3	-1.8	-	-	-	-	-	
R17001	285882	6218004	House	< 20	30	130	160	170	< 0.5	< 0.5	1.0	1.0	1.0	< 0.01	< 0.01	0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	0.9	0.3	-1.2	83.7	12.0	3.9	0.4	-	
R17001	285833	6218004	Rural	< 20	110	150	150	150	< 0.5	< 0.5	1.0	1.0	1.0	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.0	-0.4	-1.4	-	-	-	-	-	
R17001	285818	6217993	Tank	< 20	90	110	120	120	< 0.5	< 0.5	0.5	0.5	0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	0.7	-0.2	-0.9	-	-	-	-	-	
R17002	285839	6217996	Rural	< 20	30	110	140	150	< 0.5	< 0.5	0.5	0.5	1.0	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3	0.9	0.3	-1.2	-	-	-	-	-	
R17001	285860	6218030	Rural	< 20	30	140	180	180	< 0.5	< 0.5	1.0	1.5	1.5	< 0.01	< 0.01	0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.0	-0.4	-1.4	-	-	-	-	-	
R17004	285851	6218031	Tank	< 20	130	160	170	170	< 0.5	< 0.5	1.0	1.0	1.0	<																		

Table D.02 - Predicted subsidence effects for the structures within the Study Area

[illegible]

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Structure Type	Predicted total subsidence after LW12 (mm)	Predicted total subsidence after LW13 (mm)	Predicted total subsidence after LW14 (mm)	Predicted total subsidence after LW15 (mm)	Predicted total subsidence after LW16 (mm)	Predicted total tilt after LW12 (mm/m)	Predicted total tilt after LW13 (mm/m)	Predicted total tilt after LW14 (mm/m)	Predicted total tilt after LW15 (mm/m)	Predicted total tilt after LW16 (mm/m)	Predicted total hogging curvature after LW12 (1/km)	Predicted total hogging curvature after LW13 (1/km)	Predicted total hogging curvature after LW14 (1/km)	Predicted total hogging curvature after LW15 (1/km)	Predicted total hogging curvature after LW16 (1/km)	Predicted total sagging curvature after LW12 (1/km)	Predicted total sagging curvature after LW13 (1/km)	Predicted total sagging curvature after LW14 (1/km)	Predicted total sagging curvature after LW15 (1/km)	Predicted total sagging curvature after LW16 (1/km)	Predicted mean total tensile strain (mm/mm)	Predicted 95% C _u for total tensile strain (mm/mm)	Predicted mean total comp. strain (mm/mm)	Predicted 95% C _u for total comp. strain (mm/mm)	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 (%)	
S0102	287871	6218065	Tank	675	775	775	775	775	1.0	1.0	1.0	1.0	1.0	0.04	0.04	0.04	0.04	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	0.4	-0.1	-0.4	-	-	-	-	
S0201	287734	6218066	House	620	775	800	800	800	1.0	2.0	2.0	2.0	2.0	0.04	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.4	-0.2	-0.9	50.5	30.1	15.0	4.4	
S0201	287735	6218090	Pool	620	800	825	825	850	2.0	3.0	3.0	3.0	3.0	0.05	0.07	0.07	0.07	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.6	-0.3	-1.2	-	-	-	-	
S0201	287764	6218074	Rural	625	775	775	775	750	0.5	1.0	1.5	1.5	1.5	0.01	0.04	0.04	0.04	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.4	-0.2	-0.8	-	-	-	-	
S0201	287761	6218093	Tank	625	775	800	800	800	1.0	2.0	2.0	2.0	2.0	0.04	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.5	-0.3	-1.0	-	-	-	-	
S0202	287778	6218052	Tank	625	775	750	750	750	<0.5	<0.5	<0.5	<0.5	<0.5	0.02	0.02	0.02	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	0.4	-0.1	-0.6	-	-	-	-	
S0203	287779	6218049	Tank	625	775	750	750	750	<0.5	<0.5	<0.5	<0.5	<0.5	0.03	0.03	0.03	0.03	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	0.4	-0.1	-0.6	-	-	-	-	
S0301	287611	6218033	House	700	850	875	875	875	2.0	3.0	3.5	3.5	3.5	0.05	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.6	-0.3	-1.2	49.9	30.5	15.0	4.6	
S0301	287589	6218044	Pool	725	875	925	925	925	2.5	3.5	4.0	4.0	4.0	0.04	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.3	0.7	-0.4	-1.5	-	-	-	-	
S0301	287622	6218057	Rural	675	825	850	850	850	2.0	3.0	3.5	3.5	3.5	0.05	0.06	0.07	0.07	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.6	-0.3	-1.2	-	-	-	-	
S0302	287620	6218080	Rural	750	925	975	975	975	3.0	4.5	5.0	5.0	5.0	0.05	0.06	0.07	0.07	0.07	0.01	0.01	0.01	0.01	0.01	0.3	0.9	-0.6	-1.8	-	-	-	-	
S0301	287676	6218033	Tank	625	750	775	775	775	0.5	1.0	1.5	1.5	1.5	0.03	0.04	0.04	0.04	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	0.4	-0.2	-0.8	-	-	-	-	
S0401	287686	6218267	House	875	1225	1300	1300	1300	6.0	5.0	4.5	4.5	4.5	0.02	0.03	0.03	0.03	0.03	0.12	0.12	0.12	0.12	0.12	0.5	1.0	-0.4	-2.1	43.9	24.0	15.5	6.6	
S0402	287655	6218267	House	800	1175	1250	1250	1250	6.0	5.0	4.5	4.5	4.5	0.04	0.04	0.04	0.04	0.04	0.09	0.10	0.10	0.10	0.10	0.3	0.8	-0.3	-1.6	45.0	33.5	15.3	6.2	
S0401	287690	6218281	Pool	800	1200	1250	1275	1275	6.0	5.0	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.03	0.10	0.10	0.10	0.10	0.10	0.3	0.8	-0.3	-1.7	-	-	-	-	
S0402	287694	6218281	Pool	800	1175	1250	1250	1250	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.09	0.10	0.10	0.10	0.10	0.3	0.8	-0.4	-1.7	-	-	-	-	
S0401	287652	6218266	Rural	800	1175	1250	1250	1250	6.0	5.0	4.5	4.5	4.5	0.04	0.04	0.04	0.04	0.04	0.09	0.10	0.10	0.10	0.10	0.3	0.8	-0.3	-1.6	-	-	-	-	
S0401	287614	6218231	Rural	850	1200	1275	1275	1275	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.11	0.12	0.12	0.12	0.12	0.3	1.0	-0.5	-2.1	-	-	-	-	
S0403	287701	6218281	Rural	825	1275	1275	1275	1275	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.10	0.11	0.11	0.11	0.11	0.3	0.9	-0.4	-1.8	-	-	-	-	
S0404	287721	6218281	Rural	875	1225	1300	1300	1300	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.12	0.13	0.13	0.13	0.13	0.3	1.1	-0.5	-2.2	-	-	-	-	
S0405	287607	6218225	Rural	850	1200	1275	1275	1275	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.12	0.13	0.13	0.13	0.13	0.3	1.1	-0.5	-2.2	-	-	-	-	
S0406	287688	6218254	Rural	875	1225	1275	1300	1300	6.0	4.5	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.12	0.13	0.13	0.13	0.13	0.3	1.2	-0.6	-2.5	-	-	-	-	
S0407	287627	6218271	Rural	825	1200	1275	1275	1275	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.12	0.13	0.13	0.13	0.13	0.3	1.2	-0.6	-2.5	-	-	-	-	
S0401	287701	6218285	Rural	800	1175	1250	1250	1250	6.0	5.0	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.03	0.09	0.10	0.10	0.10	0.10	0.3	0.8	-0.4	-1.7	-	-	-	-	
S0401	287633	6218279	Tank	725	1125	1200	1200	1200	6.0	5.0	4.5	4.5	4.5	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.3	0.9	-0.2	-1.2	-	-	-	-	
S0402	287643	6218278	Tank	675	1100	1175	1175	1175	6.0	5.0	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.06	0.04	0.04	0.04	0.04	0.04	0.3	0.9	-0.2	-1.1	-	-	-	-	
S0403	287646	6218279	Tank	675	1100	1175	1175	1175	6.0	5.0	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.06	0.04	0.04	0.04	0.04	0.04	0.3	0.9	-0.2	-1.1	-	-	-	-	
S0404	287609	6218236	Tank	800	1175	1250	1250	1250	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.09	0.10	0.10	0.10	0.10	0.3	0.9	-0.4	-1.8	-	-	-	-	
S0405	287611	6218236	Tank	800	1175	1250	1250	1250	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.09	0.10	0.10	0.10	0.10	0.3	0.9	-0.4	-1.8	-	-	-	-	
S0405	287611	6218236	Tank	800	1175	1250	1250	1250	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.09	0.10	0.10	0.10	0.10	0.3	0.9	-0.4	-1.8	-	-	-	-	
S0501	287545	6218230	House	725	1125	1200	1200	1200	6.0	5.0	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.3	0.9	-0.2	-1.1	48.8	31.2	15.1	5.0	
S0502	287523	6218236	House	625	1050	1125	1125	1125	6.0	4.5	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.06	0.01	0.02	0.02	0.02	0.02	0.4	1.0	-0.1	-0.7	49.9	30.5	15.0	4.6	
S0501	287547	6218250	Pool	600	1000	1050	1050	1050	6.0	4.5	4.5	4.5	4.5	0.06	0.06	0.06	0.06	0.06	0.01	0.02	0.02	0.02	0.02	0.4	1.0	-0.1	-0.7	-	-	-	-	
S0501	287585	6218235	Rural	775	1175	1250	1250	1250	6.0	5.0	4.5	4.5	4.5	0.05	0.05	0.05	0.05	0.05	0.09	0.10	0.10	0.10	0.10	0.3	0.8	-0.3	-1.5	-	-	-	-	
S0502	287567	6218228	Rural	775	1150	1225	1225	1225	6.0	5.0	4.5	4.5	4.5	0.05	0.05	0.05	0.05	0.05	0.08	0.09	0.09	0.09	0.09	0.3	0.8	-0.3	-1.5	-	-	-	-	
S0501	287518	6218234	Tank	475	925	1000	1000	1000	5.5	4.0	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.0	-0.1	-0.4	-	-	-	-
S0502	287528	6218262	Tank	450	925	1000	1000	1000	5.5	4.0	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.0	-0.1	-0.4	-	-	-	-	
S0501	287531	6218262	Tank	475	925	1000	1025	1025	5.5	4.0	4.0	4.0	4.0	0.06	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.0	-0.1	-0.4	-	-	-	-	
S0504	287596	6218239	Tank	750	1200	1225	1225	1225	6.0	5.0	4.5	4.5	4.5	0.03	0.03	0.03	0.03	0.03	0.08	0.08	0.08	0.08	0.08	0.3	0.8	-0.3	-1.5	-	-	-	-	
S0504	S0504	287614	6218064	House	875	1175	1225	1250	1250	6.0	5.0	4.5	4.5	4.5	0.02	0.02	0.02	0.02	0.02	0.10	0.10	0.10	0.10	0.10	0.3	0.9	-0.4	-1.7	45.4	33.3	15.3	6.1
S0501	287614	6218083	House	850	1150	1225	1225	1225	5.5	4.0	4.0	4.0	4.0	0.02	0.02	0.02	0.02	0.02	0.09	0.09	0.09	0.09	0.09	0.3	1.1	-0.5	-2.2	45.5	33.2	15.3	6.0	
S0501	287614	6218045	Tank	800	1175	1225	1250	1250	5.0	3.0	2.5	2.5	2.5	0.02	0.02	0.02	0.02	0.02	0.09	0.10	0.10	0.10	0.10	0.3	1.1	-0.5	-2.2	-	-	-	-	
S1001	287614	6218021	House	775	1150	1200	1200	1200	5.5	4.0	3.5	3.5	3.5	0.03	0.03	0.03	0.03	0.03	0.07	0.07	0.											

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Structure Type	Predicted total subsidence after LW712 (mm)	Predicted total subsidence after LW713 (mm)	Predicted total subsidence after LW714 (mm)	Predicted total subsidence after LW715 (mm)	Predicted total subsidence after LW716 (mm)	Predicted total tilt after LW712 (mm)	Predicted total tilt after LW713 (mm)	Predicted total tilt after LW714 (mm)	Predicted total tilt after LW715 (mm)	Predicted total tilt after LW716 (mm)	Predicted total hogging curvature after LW712 (1/um)	Predicted total hogging curvature after LW713 (1/um)	Predicted total hogging curvature after LW714 (1/um)	Predicted total hogging curvature after LW715 (1/um)	Predicted total hogging curvature after LW716 (1/um)	Predicted total sagging curvature after LW712 (1/um)	Predicted total sagging curvature after LW713 (1/um)	Predicted total sagging curvature after LW714 (1/um)	Predicted total sagging curvature after LW715 (1/um)	Predicted total sagging curvature after LW716 (1/um)	Predicted mean total tensile strain (mm/mm)	Predicted 95% tensile strain (mm/mm)	Predicted mean total comp. strain (mm/mm)	Predicted 95% comp. strain (mm/mm)	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 Impact for Houses (%)	Predicted Probability of Category R4 Impact for Houses (%)	Predicted Probability of Category R5 Impact for Houses (%)	Cs for total impact for houses
S2001	286449	6219083	Rural	< 20	< 20	< 20	225	825	< 0.5	< 0.5	< 0.5	2.0	0.5	< 0.01	< 0.01	< 0.01	0.04	0.04	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.5	-0.3	-1.1	-	-	-	-	-	
S2001	286450	6219073	Tank	< 20	< 20	< 20	225	825	< 0.5	< 0.5	< 0.5	2.0	0.5	< 0.01	< 0.01	< 0.01	0.04	0.04	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.5	-0.3	-1.0	-	-	-	-	-	
S2101	286881	6218885	House	< 20	< 20	170	750	900	< 0.5	< 0.5	1.0	< 0.5	1.0	< 0.01	< 0.01	0.02	0.02	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.7	-0.4	-1.4	64.5	23.3	10.3	2.0	0	
S2101	286793	6218870	Rural	< 20	< 20	150	750	900	< 0.5	< 0.5	0.5	1.0	1.5	< 0.01	< 0.01	< 0.01	0.03	0.04	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.8	-0.5	-1.7	-	-	-	-	-	
S2102	286747	6218863	Rural	< 20	< 20	140	750	900	< 0.5	< 0.5	0.5	0.5	1.5	< 0.01	< 0.01	< 0.01	0.02	0.04	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.8	-0.5	-1.6	-	-	-	-	-	
S2103	286853	6218904	Rural	< 20	< 20	150	750	900	< 0.5	< 0.5	0.5	< 0.5	1.0	< 0.01	< 0.01	0.01	0.02	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.7	-0.4	-1.5	-	-	-	-	-	
S2101	286831	6218964	Tank	< 20	< 20	180	750	900	< 0.5	< 0.5	1.0	< 0.5	< 0.5	< 0.01	< 0.01	0.03	0.03	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.6	-0.3	-1.2	-	-	-	-	-	
S2102	286768	6218870	Tank	< 20	< 20	150	750	900	< 0.5	< 0.5	0.5	0.5	1.0	< 0.01	< 0.01	< 0.01	0.02	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.8	-0.5	-1.6	-	-	-	-	-	
S2103	286766	6218867	Tank	< 20	< 20	150	750	900	< 0.5	< 0.5	0.5	0.5	1.0	< 0.01	< 0.01	0.01	0.02	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.8	-0.5	-1.6	-	-	-	-	-	
S2201	286957	6218853	House	< 20	< 20	350	825	925	< 0.5	< 0.5	4.0	2.5	2.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.4	1.0	0.0	-0.2	53.1	28.9	14.0	4.0	0	
S2202	286931	6218868	House	< 20	< 20	275	775	875	< 0.5	< 0.5	3.0	1.5	1.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	53.8	28.6	13.7	3.9	0	
S2201	286965	6218864	House	< 20	< 20	300	800	900	< 0.5	< 0.5	3.5	2.0	2.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	1.0	0.0	-0.2	-	-	-	-	-	
S2202	286962	6218865	Rural	< 20	< 20	300	800	900	< 0.5	< 0.5	3.5	2.0	1.5	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	1.0	0.0	-0.2	-	-	-	-	-	
S2201	286949	6218843	Tank	< 20	< 20	350	825	925	< 0.5	< 0.5	4.0	2.5	2.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	1.0	0.0	-0.2	-	-	-	-	-	
S2202	286956	6218833	Tank	< 20	< 20	400	850	950	< 0.5	< 0.5	4.5	3.0	2.5	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.1	0.1	-0.1	-0.4	-	-	-	-	
S2301	287047	6218932	House	< 20	< 20	250	775	875	< 0.5	< 0.5	3.5	1.0	1.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	55.1	27.9	13.3	3.6	0	
S2301	287067	6218935	Tank	< 20	< 20	250	775	875	< 0.5	< 0.5	2.5	1.0	1.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	-	-	-	-	-	
S2303	287033	6218924	Rural	< 20	< 20	225	775	875	< 0.5	< 0.5	2.5	1.0	0.5	< 0.01	< 0.01	0.04	0.04	0.04	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	-	-	-	-	-	
S2303	287069	6218975	Rural	< 20	< 20	180	750	875	< 0.5	< 0.5	1.5	< 0.5	< 0.5	< 0.01	< 0.01	0.03	0.03	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.5	-0.3	-1.0	-	-	-	-	-	
S2304	287008	6218941	Rural	< 20	< 20	180	750	875	< 0.5	< 0.5	1.5	< 0.5	< 0.5	< 0.01	< 0.01	0.03	0.03	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.5	-0.3	-1.0	-	-	-	-	-	
S2301	287072	6218923	Tank	< 20	< 20	275	775	900	< 0.5	< 0.5	3.0	1.5	1.5	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.3	-0.1	-0.7	-	-	-	-	-	
S2401	287142	6218955	House	< 20	< 20	800	900	900	< 0.5	< 0.5	3.5	2.0	2.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.0	0.0	-0.1	52.7	29.1	14.2	4.0	0	
S2402	287121	6218961	House	< 20	< 20	700	875	900	< 0.5	< 0.5	3.0	1.5	1.5	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.4	1.0	0.0	-0.1	54.1	28.5	13.7	3.8	0	
S2401	287138	6218975	Pool	< 20	< 20	225	775	875	< 0.5	< 0.5	2.5	1.0	1.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	-	-	-	-	-	
S2401	287108	6218960	Rural	< 20	< 20	250	775	875	< 0.5	< 0.5	2.5	1.0	1.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	-	-	-	-	-	
S2402	287140	6218984	Rural	< 20	< 20	240	875	900	< 0.5	< 0.5	2.0	1.5	0.5	< 0.01	< 0.01	0.04	0.04	0.04	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	-	-	-	-	-	
S2403	287108	6218991	Tank	< 20	< 20	190	750	875	< 0.5	< 0.5	1.5	< 0.5	< 0.5	< 0.01	< 0.01	0.03	0.03	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.5	-0.3	-1.0	-	-	-	-	-	
S2404	287184	6218975	Tank	< 20	< 20	50	800	1125	< 0.5	< 0.5	6.0	4.0	3.5	< 0.01	< 0.01	0.04	0.04	0.04	< 0.01	< 0.01	0.07	0.07	0.07	0.3	0.8	-0.3	-1.6	-	-	-	-	-	
S2405	287191	6218871	Rural	< 20	< 20	775	1125	1275	< 0.5	< 0.5	6.0	4.0	3.5	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	0.07	0.07	0.07	0.3	0.8	-0.3	-1.6	-	-	-	-	-	
S2405	287066	6218996	Tank	< 20	< 20	160	750	875	< 0.5	< 0.5	1.0	< 0.5	0.5	< 0.01	< 0.01	0.02	0.02	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.6	-0.4	-1.3	-	-	-	-	-	
S2501	287221	6218929	House	< 20	< 20	625	1025	1100	< 0.5	< 0.5	6.0	4.0	4.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	0.05	0.05	0.05	0.4	1.0	-0.1	-0.7	52.5	29.2	14.2	4.1	0	
S2502	287251	6218927	House	< 20	< 20	600	1025	1100	< 0.5	< 0.5	6.0	4.0	4.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	0.05	0.05	0.05	0.4	1.0	-0.1	-0.7	54.4	28.8	13.9	3.9	0	
S2501	287242	6218932	Tank	< 20	< 20	625	1025	1100	< 0.5	< 0.5	6.0	4.0	4.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	0.05	0.05	0.05	0.4	1.0	-0.1	-0.7	-	-	-	-	-	
S2502	287215	6218936	Rural	< 20	< 20	550	975	1050	< 0.5	< 0.5	5.5	4.0	3.5	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.0	-0.1	-0.6	-	-	-	-	-	
S2503	287225	6218930	Rural	< 20	< 20	30	625	925	< 0.5	< 0.5	5.5	4.0	3.5	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.0	-0.1	-0.6	-	-	-	-	-	
S2504	287198	6218947	Rural	< 20	< 20	425	875	975	< 0.5	< 0.5	5.0	3.5	3.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.1	0.1	-0.1	-	-	-	-	-	
S2505	287313	6218953	Rural	< 20	< 20	725	1100	1175	< 0.5	< 0.5	6.0	4.5	4.0	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	0.04	0.05	0.05	0.3	0.9	-0.2	-1.1	-	-	-	-	-	
S2506	287249	6218969	Rural	< 20	< 20	475	900	1000	< 0.5	< 0.5	5.5	3.5	3.5	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.4	1.1	-0.1	-0.3	-	-	-	-	-	
S2507	287257	6218964	Rural	< 20	< 20	475	925	1000	< 0.5	< 0.5	5.5	4.0	3.5	< 0.01	< 0.01	0.05	0.05	0.05	< 0.01	< 0.0													

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Control MGA Easting (GDA 2020)	Control MGA Northing (GDA 2020)	Structure Type	Predicted total subsidence after LW712 (mm)	Predicted total subsidence after LW713 (mm)	Predicted total subsidence after LW714 (mm)	Predicted total subsidence after LW715 (mm)	Predicted total subsidence after LW716 (mm)	Predicted total tilt after LW712 (mm/mm)	Predicted total tilt after LW713 (mm/mm)	Predicted total tilt after LW714 (mm/mm)	Predicted total tilt after LW715 (mm/mm)	Predicted total tilt after LW716 (mm/mm)	Predicted total hogging curvature after LW712 (1/Lm)	Predicted total hogging curvature after LW713 (1/Lm)	Predicted total hogging curvature after LW714 (1/Lm)	Predicted total hogging curvature after LW715 (1/Lm)	Predicted total hogging curvature after LW716 (1/Lm)	Predicted total sagging curvature after LW712 (1/Lm)	Predicted total sagging curvature after LW713 (1/Lm)	Predicted total sagging curvature after LW714 (1/Lm)	Predicted total sagging curvature after LW715 (1/Lm)	Predicted total sagging curvature after LW716 (1/Lm)	Predicted mean total tensile strain (mm/mm)	Predicted 95% sagging tensile strain (mm/mm)	Predicted mean total comp. strain (mm/mm)	Predicted 95% sagging comp. strain (mm/mm)	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 or R4 Impact for Houses (%)	Predicted Probability of Category R5 Impact for Houses (%)	Co. for total
536001	288043	6218824	Pool	70	975	1275	1325	1350	<0.5	5.0	3.5	3.0	3.0	<0.01	0.02	0.02	0.02	0.02	<0.01	0.11	0.12	0.12	0.12	0.5	1.6	-0.9	-3.2	-	-	-	-	-
536002	288141	6218910	Rural	50	900	1275	1325	1350	<0.5	6.5	5.0	4.5	4.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.10	0.11	0.11	0.11	0.3	0.9	-0.4	-1.9	-	-	-	-	-
536003	288030	6218864	Rural	50	875	1250	1300	1350	<0.5	6.5	5.0	4.5	4.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.09	0.10	0.10	0.10	0.3	0.8	-0.4	-1.6	-	-	-	-	-
537001	288224	6218817	House	120	1500	1825	1900	1950	<0.5	2.5	4.0	4.5	4.5	<0.01	0.05	0.04	0.05	0.05	<0.01	0.05	0.06	0.06	0.06	0.4	1.0	-0.6	-2.1	52.4	29.3	14.3	4.1	-
537002	288238	6218803	Rural	120	875	1075	1100	1125	<0.5	2.5	4.0	4.5	4.5	<0.01	0.04	0.05	0.05	0.05	<0.01	0.01	0.01	0.01	0.01	0.3	0.8	-0.5	-1.6	-	-	-	-	-
537003	288267	6218845	Rural	110	950	1200	1250	1250	<0.5	2.5	4.5	4.5	4.5	<0.01	0.03	0.04	0.05	0.05	<0.01	0.05	0.05	0.05	0.05	0.4	1.1	-0.7	-2.2	-	-	-	-	-
537004	288175	6218812	Tank	110	1201	1275	1275	1275	<0.5	2.5	4.5	4.5	4.5	<0.01	0.02	0.04	0.04	0.04	<0.01	0.07	0.07	0.07	0.07	0.5	1.3	-0.8	-2.5	-	-	-	-	-
537005	288251	6218848	Tank	100	975	1225	1275	1275	<0.5	2.5	4.5	4.5	4.5	<0.01	0.02	0.04	0.04	0.04	<0.01	0.06	0.06	0.06	0.06	0.5	1.2	-0.8	-2.5	-	-	-	-	-
538001	287930	6218699	House	100	950	1225	1275	1275	<0.5	2.5	4.0	4.5	4.5	<0.01	0.02	0.03	0.03	0.03	<0.01	0.09	0.09	0.09	0.09	0.5	1.4	-0.9	-2.8	46.3	32.7	15.2	5.8	-
538002	287954	6218717	Pool	90	950	1225	1275	1275	<0.5	2.5	4.0	4.5	4.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.08	0.08	0.08	0.08	0.5	1.4	-0.9	-2.9	-	-	-	-	-
538003	287920	6218689	Rural	100	950	1200	1250	1250	<0.5	2.5	4.0	4.5	4.5	<0.01	0.02	0.03	0.04	0.04	<0.01	0.07	0.07	0.07	0.07	0.5	1.3	-0.9	-2.7	-	-	-	-	-
538004	287953	6218674	Rural	100	950	1200	1250	1250	<0.5	2.5	4.0	4.5	4.5	<0.01	0.02	0.04	0.04	0.04	<0.01	0.07	0.07	0.07	0.07	0.5	1.3	-0.9	-2.6	-	-	-	-	-
538005	287869	6218654	Rural	100	950	1200	1225	1250	<0.5	2.5	4.0	4.5	4.5	<0.01	0.02	0.03	0.03	0.03	<0.01	0.07	0.07	0.07	0.07	0.5	1.3	-0.9	-2.7	-	-	-	-	-
538006	287869	6218655	Rural	110	925	1175	1200	1225	<0.5	2.5	4.0	4.5	4.5	<0.01	0.03	0.05	0.05	0.05	<0.01	0.06	0.06	0.06	0.06	0.5	1.2	-0.8	-2.5	-	-	-	-	-
538007	287869	6218652	Rural	120	925	1150	1175	1175	<0.5	2.5	4.0	4.5	4.5	<0.01	0.03	0.05	0.05	0.05	<0.01	0.06	0.06	0.06	0.06	0.5	1.2	-0.8	-2.4	-	-	-	-	-
538008	287865	6218646	Rural	110	900	1100	1125	1150	<0.5	2.5	4.0	4.5	4.5	<0.01	0.03	0.05	0.05	0.05	<0.01	0.02	0.02	0.02	0.02	0.4	1.0	-0.7	-2.1	-	-	-	-	-
538009	287869	6218665	Rural	100	950	1200	1250	1250	<0.5	2.5	4.0	4.5	4.5	<0.01	0.02	0.03	0.03	0.03	<0.01	0.07	0.07	0.07	0.07	0.5	1.3	-0.9	-2.7	-	-	-	-	-
538010	287867	6218647	Rural	905	1175	1200	1200	1200	<0.5	2.5	4.0	4.5	4.5	<0.01	0.02	0.04	0.04	0.04	<0.01	0.05	0.05	0.05	0.05	0.5	1.2	-0.8	-2.4	-	-	-	-	-
538011	287865	6218670	Rural	100	920	1200	1225	1225	<0.5	2.5	4.0	4.5	4.5	<0.01	0.02	0.03	0.04	0.04	<0.01	0.06	0.06	0.06	0.06	0.5	1.3	-0.9	-2.6	-	-	-	-	-
538012	287931	6218675	Tank	110	900	1125	1150	1150	<0.5	2.5	4.0	4.5	4.5	<0.01	0.03	0.05	0.05	0.05	<0.01	0.03	0.03	0.03	0.03	0.4	1.1	-0.7	-2.2	-	-	-	-	-
538013	287931	6218676	Tank	110	900	1125	1150	1150	<0.5	2.5	4.0	4.5	4.5	<0.01	0.03	0.05	0.05	0.05	<0.01	0.03	0.03	0.03	0.03	0.4	1.1	-0.7	-2.2	-	-	-	-	-
539001	287974	6218777	House	80	1075	1275	1325	1350	<0.5	6.5	5.0	4.5	4.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.11	0.12	0.12	0.12	0.9	2.4	-1.0	-3.4	44.4	33.8	15.4	6.4	-
539002	287954	6218757	House	80	950	1275	1325	1325	<0.5	3.5	3.5	4.0	4.0	<0.01	0.02	0.02	0.02	0.02	<0.01	0.11	0.12	0.12	0.12	0.6	1.7	-1.0	-3.4	44.4	33.8	15.4	6.4	-
539003	287895	6218798	Rural	50	850	1225	1275	1300	<0.5	6.5	5.0	4.5	4.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.09	0.10	0.10	0.10	0.3	0.8	-0.4	-1.7	-	-	-	-	-
539004	287895	6218794	Rural	70	950	1275	1325	1325	<0.5	6.5	5.0	4.5	4.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.11	0.12	0.12	0.12	0.3	0.8	-0.4	-1.7	-	-	-	-	-
539005	287966	6218753	Tank	80	950	1275	1325	1325	<0.5	2.0	4.0	4.0	4.0	<0.01	0.02	0.02	0.02	0.02	<0.01	0.11	0.11	0.11	0.11	0.6	1.7	-1.0	-3.4	-	-	-	-	-
539006	287907	6218808	Tank	50	825	1200	1275	1275	<0.5	6.5	5.0	4.5	4.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.07	0.08	0.08	0.08	0.3	0.8	-0.3	-1.5	-	-	-	-	-
539007	287906	6218809	Tank	800	1250	1250	1250	1250	<0.5	6.5	5.0	4.5	4.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.07	0.07	0.07	0.07	0.3	0.8	-0.3	-1.4	-	-	-	-	-
539008	287905	6218812	Tank	40	800	1200	1250	1250	<0.5	6.5	5.0	4.5	4.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.06	0.07	0.07	0.07	0.3	0.8	-0.3	-1.4	-	-	-	-	-
539009	288002	6218778	Tank	80	975	1275	1325	1325	<0.5	2.5	3.5	3.5	3.5	<0.01	0.02	0.02	0.02	0.02	<0.01	0.11	0.12	0.12	0.12	0.6	1.7	-1.0	-3.4	-	-	-	-	-
540001	287904	6218808	House	40	1075	1275	1325	1350	<0.5	6.5	5.0	4.5	4.5	<0.01	0.06	0.06	0.06	0.06	<0.01	0.11	0.12	0.12	0.12	0.6	1.7	-1.0	-3.4	50.3	30.3	15.0	4.4	-
540002	287885	6218830	House	40	700	1125	1200	1200	<0.5	6.5	5.0	4.5	4.5	<0.01	0.06	0.06	0.06	0.06	<0.01	0.03	0.04	0.04	0.04	0.4	1.0	-0.7	-2.1	50.7	30.1	14.9	4.3	-
540003	287869	6218863	Pool	30	450	925	1000	1000	<0.5	5.5	4.0	4.0	4.0	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	0.0	-0.2	-	-	-	-	-
540004	287902	6218841	Rural	40	975	1275	1325	1325	<0.5	6.5	5.0	4.5	4.5	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	0.0	-0.2	-	-	-	-	-
540005	287888	6218863	Rural	30	475	950	1025	1050	<0.5	6.0	4.5	4.0	4.0	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	0.0	-0.2	-	-	-	-	-
540006	287882	6218860	Rural	30	525	975	1050	1050	<0.5	6.0	4.5	4.5	4.5	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	0.0	-0.3	-	-	-	-	-
540007	287896	6218857	Rural	30	500	1000	1075	1075	<0.5	6.0	5.0	4.5	4.5	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	0.0	-0.3	-	-	-	-	-
540008	287901	6218851	Rural	30	500	1075	1100	1100	<0.5	6.0	5.0	4.5	4.5	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	0.0	-0.3	-	-	-	-	-
540009	287943	6218866	Tank	30	625	1075	1125	1150	<0.5	6.5	5.0	4.5	4.5	<0.01	0.06	0.06	0.06	0.06	<0.01	0.01	0.01	0.01	0.01	0.4	1.0	-0.1	-0.5	-	-	-	-	-
540010	287893	6218844	Tank	30	600	1050	1100	1125	<0.5	6.5	5.0	4.5	4.5	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.0	-0.1	-0.5	-	-	-	-	-
541001	287821	6218786	House	40	1075	1275	1325	1350	<0.5	6.5	5.0	4.5	4.5	<0.01	0.06	0.06	0.06	0.06	<0.01	0.11	0.12	0.12	0.12	0.9	2.4	-1.0	-3.4	50.3	30.3	15.0	4.4	-
541002	287872	6218815	Rural	40	725	115																										

Table D.02 - Predicted subsidence effects for the structures within the Study Area

Structure Reference	Centroid MGA Easting (GDA 2020)	Centroid MGA Northing (GDA 2020)	Structure Type	Predicted total subsidence after LW712 (mm)	Predicted total subsidence after LW713 (mm)	Predicted total subsidence after LW714 (mm)	Predicted total subsidence after LW715 (mm)	Predicted total subsidence after LW716 (mm)	Predicted total tilt after LW712 (mm/m)	Predicted total tilt after LW713 (mm/m)	Predicted total tilt after LW714 (mm/m)	Predicted total tilt after LW715 (mm/m)	Predicted total tilt after LW716 (mm/m)	Predicted total hogging curvature after LW712 (1/km)	Predicted total hogging curvature after LW713 (1/km)	Predicted total hogging curvature after LW714 (1/km)	Predicted total hogging curvature after LW715 (1/km)	Predicted total hogging curvature after LW716 (1/km)	Predicted total sagging curvature after LW712 (1/km)	Predicted total sagging curvature after LW713 (1/km)	Predicted total sagging curvature after LW714 (1/km)	Predicted total sagging curvature after LW715 (1/km)	Predicted total sagging curvature after LW716 (1/km)	Predicted mean total tensile strain (mm/mm)	Predicted 95% C.I. for total tensile strain (mm/mm)	Predicted mean total comp. strain (mm/mm)	Predicted 95% C.I. for total comp. strain (mm/mm)	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 (%)
S4705	287376	6219586	Rural	< 20	< 20	< 20	170	825	< 0.5	< 0.5	< 0.5	0.5	0.5	< 0.01	< 0.01	< 0.01	0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.7	-0.5	-1.5	-	-	-	-
S4706	287333	6219621	Rural	< 20	< 20	< 20	140	875	< 0.5	< 0.5	< 0.5	0.5	1.5	< 0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.4	1.1	-0.7	-2.1	-	-	-	-
S4707	287390	6219673	Rural	< 20	< 20	< 20	130	925	< 0.5	< 0.5	< 0.5	0.5	1.5	< 0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.5	1.2	-0.8	-2.4	-	-	-	-
S4708	287334	6219486	Rural	< 20	< 20	< 20	250	825	< 0.5	< 0.5	< 0.5	2.0	1.0	< 0.01	< 0.01	< 0.01	0.04	0.04	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	-	-	-	-
S4709	287370	6219511	Tank	< 20	< 20	< 20	250	825	< 0.5	< 0.5	< 0.5	2.5	1.0	< 0.01	< 0.01	< 0.01	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	-	-	-	-
S4702	287361	6219502	Tank	< 20	< 20	< 20	250	825	< 0.5	< 0.5	< 0.5	2.5	1.0	< 0.01	< 0.01	< 0.01	0.05	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.1	0.4	-0.2	-0.8	-	-	-	-
S4703	287358	6219508	Tank	< 20	< 20	< 20	180	800	< 0.5	< 0.5	< 0.5	1.0	< 0.5	< 0.01	< 0.01	< 0.01	0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.6	-0.4	-1.2	-	-	-	-
S4704	287362	6219566	Tank	< 20	< 20	< 20	180	800	< 0.5	< 0.5	< 0.5	1.0	< 0.5	< 0.01	< 0.01	< 0.01	0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.2	0.7	-0.4	-1.3	-	-	-	-
S4705	287351	6219573	Tank	< 20	< 20	< 20	170	800	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.7	-0.5	-1.4	-	-	-	-
S4706	287371	6219581	Tank	< 20	< 20	< 20	170	825	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.7	-0.5	-1.4	-	-	-	-
S4707	287380	6219589	Tank	< 20	< 20	< 20	170	825	< 0.5	< 0.5	< 0.5	0.5	0.5	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.7	-0.5	-1.5	-	-	-	-
S4708	287380	6219591	Tank	< 20	< 20	< 20	170	825	< 0.5	< 0.5	< 0.5	0.5	0.5	< 0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.7	-0.5	-1.5	-	-	-	-
S4709	287323	6219626	Tank	< 20	< 20	< 20	140	875	< 0.5	< 0.5	< 0.5	0.5	1.5	< 0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.7	-0.5	-1.5	-	-	-	-
S4801	287640	6219935	House	< 20	< 20	< 20	70	900	< 0.5	< 0.5	< 0.5	< 0.5	6.0	< 0.01	< 0.01	< 0.01	< 0.01	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.09	0.2	0.7	-0.3	-1.4	45.5	33.2	15.3	6.0
S4801	287325	6219974	Rural	< 20	< 20	< 20	100	975	< 0.5	< 0.5	< 0.5	0.5	2.5	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.11	0.5	1.3	-0.8	-2.7	-	-	-	-
S4802	287320	6219966	Rural	< 20	< 20	< 20	100	975	< 0.5	< 0.5	< 0.5	0.5	2.5	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.11	0.5	1.3	-0.8	-2.6	-	-	-	-
S4803	287899	6219981	Rural	< 20	< 20	< 20	90	975	< 0.5	< 0.5	< 0.5	0.5	3.0	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.11	0.5	1.4	-0.8	-2.8	-	-	-	-
S4804	287914	6219981	Rural	< 20	< 20	< 20	90	975	< 0.5	< 0.5	< 0.5	0.5	2.5	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.11	0.5	1.4	-0.8	-2.8	-	-	-	-
S4805	287649	6219969	Rural	< 20	< 20	< 20	40	675	< 0.5	< 0.5	< 0.5	< 0.5	6.0	< 0.01	< 0.01	< 0.01	< 0.01	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.8	-0.1	-0.8	-	-	-	-
S4806	287622	6219976	Rural	< 20	< 20	< 20	40	550	< 0.5	< 0.5	< 0.5	< 0.5	6.0	< 0.01	< 0.01	< 0.01	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.3	0.8	-0.1	-0.5	-	-	-	-
S4801	287649	6219968	Tank	< 20	< 20	< 20	50	675	< 0.5	< 0.5	< 0.5	< 0.5	6.0	< 0.01	< 0.01	< 0.01	< 0.01	0.05	< 0.01	< 0.01	< 0.01	< 0.01	0.02	0.3	0.8	-0.1	-0.8	-	-	-	-
S4802	287891	6219962	Tank	< 20	< 20	< 20	100	975	< 0.5	< 0.5	< 0.5	0.5	2.0	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.11	0.5	1.3	-0.8	-2.7	-	-	-	-
S4803	287906	6219975	Tank	< 20	< 20	< 20	90	975	< 0.5	< 0.5	< 0.5	0.5	2.0	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.11	0.5	1.4	-0.8	-2.7	-	-	-	-
S4804	287939	6219978	Tank	< 20	< 20	< 20	100	975	< 0.5	< 0.5	< 0.5	0.5	2.5	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.10	0.5	1.3	-0.8	-2.6	-	-	-	-
S4805	287994	6219966	Tank	< 20	< 20	< 20	110	950	< 0.5	< 0.5	< 0.5	< 0.5	2.5	< 0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.04	0.4	1.0	-0.7	-2.1	-	-	-	-
S4901	287988	6220136	House	< 20	< 20	< 20	40	700	< 0.5	< 0.5	< 0.5	< 0.5	6.5	< 0.01	< 0.01	< 0.01	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	0.07	0.3	0.8	-0.1	-0.7	50.3	30.3	15.0	4.4
S4901	287999	6220153	Pool	< 20	< 20	< 20	40	600	< 0.5	< 0.5	< 0.5	< 0.5	6.5	< 0.01	< 0.01	< 0.01	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	0.3	0.8	-0.1	-0.5	-	-	-	-	
S4901	287971	6220132	Rural	< 20	< 20	< 20	40	650	< 0.5	< 0.5	< 0.5	< 0.5	6.5	< 0.01	< 0.01	< 0.01	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	0.3	0.8	-0.1	-0.6	-	-	-	-	
S4902	287946	6220123	Rural	< 20	< 20	< 20	40	550	< 0.5	< 0.5	< 0.5	< 0.5	6.5	< 0.01	< 0.01	< 0.01	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	0.3	0.8	-0.1	-0.5	-	-	-	-	
S4903	287933	6220111	Rural	< 20	< 20	< 20	40	675	< 0.5	< 0.5	< 0.5	< 0.5	6.5	< 0.01	< 0.01	< 0.01	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	0.3	0.8	-0.1	-0.6	-	-	-	-	
S4901	287927	6220126	Tank	< 20	< 20	< 20	40	550	< 0.5	< 0.5	< 0.5	< 0.5	6.0	< 0.01	< 0.01	< 0.01	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	0.3	0.8	-0.1	-0.4	-	-	-	-	
S5001	287625	6220465	House	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.0	0.0	0.0	99.1	3.7	1.1	0.2	
S5001	287621	6220485	Pool	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.0	0.0	0.0	-	-	-	-	
S5001	287610	6220464	Rural	< 20	< 20	< 20	< 20	< 20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.0	0.0	0.0	-	-	-	-	
S5002	287677	6220373	Rural	< 20	< 20	< 20	< 20	60	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.0	0.0	0.0	-	-	-	-	
S5003	287725	6220368	Rural	< 20	< 20	< 20	< 20	70	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.1	0.0	0.0	-	-	-	-	
S5004	287799	6220387	Rural	< 20	< 20	< 20	< 20	80	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.1	0.0	0.0	-	-	-	-	
S5005	287629	6220403	Rural	< 20	< 20	< 20	< 20	30	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0	0.0	0.0	0.0	-	-	-	-	
S5006	287832	6220420	Rural	< 20	< 20	< 20	< 20	60	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.01</																	

Table D.03 - Details and predicted subsidence effects for the farm dams within the Study Area

[illegible]

Table D.03 - Details and predicted subsidence effects for the farm dams within the Study Area

Reference	Centroid MSA Easting	Centroid MSA Northing	Maximum Dimension (m)	Plan Area (m ²)	Predicted total subsidence after LW715 (mm)	Predicted total subsidence after LW725 (mm)	Predicted total subsidence after LW735 (mm)	Predicted total subsidence after LW745 (mm)	Predicted total subsidence after LW755 (mm)	Predicted total ttt after LW715 (mm/m)	Predicted total ttt after LW725 (mm/m)	Predicted total ttt after LW735 (mm/m)	Predicted total ttt after LW745 (mm/m)	Predicted total ttt after LW755 (mm/m)	Predicted total sagging curvature after LW715 (2.4/m)	Predicted total sagging curvature after LW725 (2.4/m)	Predicted total sagging curvature after LW735 (2.4/m)	Predicted total sagging curvature after LW745 (2.4/m)	Predicted total sagging curvature after LW755 (2.4/m)	Predicted mean total ttt after LW715 (mm/m)	Predicted 95% CI for total ttt after LW715 (mm/m)	Predicted mean total ttt after LW725 (mm/m)	Predicted 95% CI for total ttt after LW725 (mm/m)	Predicted Change in Freeboard after LW715 (mm)	Predicted Change in Freeboard after LW725 (mm)	Predicted Change in Freeboard after LW735 (mm)	Predicted Change in Freeboard after LW745 (mm)	Predicted Change in Freeboard after LW755 (mm)								
F41801	2888891	6218718	28	517	130	925	1150	1200	1200	1200	0.5	0.0	4.5	5.0	5.0	0.01	0.04	0.05	0.06	0.06	<0.01	0.02	0.02	0.02	0.02	0.02	0.3	0.8	-0.5	-1.7	<50	<50	50	50		
F41801	2888814	6218810	18	609	130	800	930	1000	1000	1000	0.5	0.0	5.0	5.0	5.0	0.01	0.04	0.05	0.05	0.05	<0.01	0.03	0.04	0.04	0.04	0.04	0.1	0.4	-0.1	-0.1	<50	<50	50	50		
F43801	2877948	6217792	18	425	325	400	425	425	425	425	0.5	0.0	4.0	4.0	4.0	0.01	0.04	0.04	0.04	0.04	<0.01	0.03	0.03	0.03	0.03	0.03	0.2	0.6	-0.3	-1.1	<50	<50	50	50		
F46001	287970	6218945	47	1153	230	800	925	1025	1025	1025	0.5	0.0	5.0	5.0	5.0	0.01	0.05	0.05	0.05	0.05	<0.01	0.05	0.05	0.05	0.05	0.05	0.01	0.2	0.4	-0.1	-0.4	<50	<50	50	50	
F46001	287970	6219036	30	5401	<20	30	60	1125	1200	1200	<0.5	0.0	6.5	5.5	5.0	0.01	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	0.01	0.01	0.01	0.01	0.4	1.0	-0.1	-0.4	<50	<50	400	300	
F46002	288088	6219181	224	4094	<20	40	825	1100	1175	1200	<0.5	0.0	6.5	5.5	5.0	0.01	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	0.01	0.01	0.01	0.01	0.4	1.0	-0.1	-0.5	<50	<50	150	150	
F51801	288114	6218722	35	645	<20	150	825	975	1000	1000	<0.5	0.0	5.0	5.0	5.0	0.01	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	0.01	0.01	0.01	0.01	0.2	0.7	-0.4	-1.3	<50	<50	50	50	
F51801	287793	6218502	35	787	<20	275	800	900	900	900	<0.5	0.3	2.0	2.0	2.0	0.01	0.06	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.4	1.0	0.0	-0.1	<50	<50	50	50	
F51801	287967	6218558	30	556	<20	150	800	875	875	875	<0.5	0.0	5.0	5.0	5.0	0.01	0.03	0.03	0.04	0.04	<0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	<50	<50	50	50	
F51801	288002	6218594	74	2366	<20	180	750	850	875	875	<0.5	0.5	1.5	0.5	<0.5	0.05	0.03	0.03	0.03	0.03	0.03	<0.01	<0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	<50	<50	50	50	
F52801	287930	6218445	62	1529	<20	180	775	925	925	925	<0.5	0.0	5.0	5.0	5.0	0.01	<0.01	0.03	0.05	0.05	0.05	<0.01	<0.01	0.01	0.01	0.01	0.01	0.2	0.5	-0.3	-1.0	<50	<50	50	50	
F52802	287765	6218495	28	413	<20	120	875	900	900	900	<0.5	0.0	5.0	5.0	5.0	0.01	0.02	0.02	0.03	0.03	0.03	<0.01	<0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.2	-0.8	<50	<50	50	50	
F52803	287820	6218499	54	1424	<20	180	750	875	875	875	<0.5	0.5	1.5	0.5	0.5	0.05	0.03	0.03	0.03	0.03	0.03	<0.01	<0.01	0.01	0.01	0.01	0.01	0.2	0.4	-0.1	-0.7	<50	<50	50	50	
F56801	288445	6219326	43	824	<20	120	1150	1225	1225	1225	<0.5	0.5	2.5	4.5	4.5	<0.01	<0.01	<0.01	0.04	0.05	0.06	<0.01	<0.01	0.01	0.01	0.01	0.01	0.2	0.3	-0.3	-1.3	<50	<50	50	50	
F57801	288160	6219144	31	508	<20	<20	<20	60	925	1275	<0.5	0.0	<0.5	<0.5	<0.5	0.40	<0.01	<0.01	<0.01	<0.02	0.02	<0.01	<0.01	<0.01	<0.01	0.01	0.10	0.11	0.3	1.2	-0.6	-2.4	<50	<50	50	50
F57802	288440	6219678	93	3671	<20	<20	<20	150	775	900	<0.5	0.0	<0.5	<0.5	0.5	0.10	<0.01	<0.01	<0.01	0.03	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.4	-0.2	-0.8	<50	<50	50	50	
F57803	288050	6219522	21	710	<20	<20	<20	150	875	925	<0.5	0.5	1.0	0.5	0.5	0.05	<0.01	<0.01	<0.01	0.04	0.04	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.2	0.4	-0.1	-0.5	<50	<50	50	50	
F57804	288014	6219718	313	1937	<20	<20	<20	50	800	1125	<0.5	0.0	6.5	5.0	5.0	0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.06	0.07	0.07	0.3	0.8	-0.3	-1.5	<50	<50	100	400	
F57805	288021	6219405	29	282	<20	<20	<20	50	1000	1125	<0.5	0.0	6.5	5.0	5.0	0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.12	0.12	0.12	0.6	1.7	-1.0	-3.4	<50	<50	50	50	
F57806	288182	6219403	29	282	<20	<20	<20	80	1000	1125	<0.5	0.0	6.5	5.0	5.0	0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.11	0.12	0.12	0.6	1.7	-1.0	-3.4	<50	<50	50	50	
F57807	288003	6219527	16	54	<20	<20	70	975	1125	1400	<0.5	0.0	6.0	4.5	4.0	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.11	0.12	0.12	0.5	1.5	-0.8	-3.0	<50	<50	50	50	
F57808	288018	6219544	25	101	<20	<20	<20	875	1150	1275	<0.5	0.0	6.5	5.5	5.0	0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.08	0.10	0.10	0.4	1.9	-0.4	-1.9	<50	<50	100	50	
F57809	288095	6219824	25	127	<20	<20	<20	30	475	1050	<0.5	0.0	<0.5	<0.5	4.5	0.01	<0.01	<0.01	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.4	1.1	-0.1	-0.2	<50	<50	50	50	
F57810	288065	6219847	14	11	<20	<20	<20	300	825	925	<0.5	0.0	<0.5	<0.5	4.0	0.01	<0.01	<0.01	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.4	1.0	0.0	-0.1	<50	<50	50	50	
F57811	288061	6219868	15	151	<20	<20	<20	625	875	925	<0.5	0.0	<0.5	<0.5	4.0	0.01	<0.01	<0.01	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.4	1.0	0.0	-0.1	<50	<50	50	50	
F57812	288088	6219760	64	194	<20	<20	<20	140	775	925	<0.5	0.0	<0.5	<0.5	0.5	0.10	<0.01	<0.01	<0.01	0.04	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.4	-0.2	-0.9	<50	<50	50	50	
F57813	288004	6219863	21	80	<20	<20	<20	100	825	925	<0.5	0.0	<0.5	<0.5	0.5	0.10	<0.01	<0.01	<0.01	0.04	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.4	-0.2	-0.9	<50	<50	50	50	
F57814	288088	6219408	17	83	<20	<20	<20	475	950	1050	<0.5	0.0	6.0	4.5	4.5	0.01	<0.01	<0.01	0.06	0.06	0.06	<0.01	<0.01	<0.01	0.01	0.01	0.4	1.1	0.0	-0.2	<50	<50	50	50		
F57815	288077	6219339	18	65	<20	<20	<20	825	1250	1325	<0.5	0.0	6.5	5.0	5.0	0.01	<0.01	0.02	0.02	0.02	0.02	<0.01	<0.01	0.07	0.08	0.08	0.3	0.8	-0.3	-1.2	<50	<50	50	50		
F58801	287941	6219895	41	765	<20	<20	<20	475	850	950	<0.5	0.0	<0.5	<0.5	5.0	0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.05	0.05	0.05	0.2	0.6	-0.1	-0.5	<50	<50	50	50	
F58802	288020	6219912	11	63	<20	<20	<20	325	750	825	<0.5	0.0	<0.5	<0.5	4.0	0.01	<0.01	<0.01	0.05	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.3	0.9	0.0	-0.2	<50	<50	50	50
F60801	288248	6220276	20	260	<20	<20	<20	400	1025	1125	<0.5	0.0	<0.5	<0.5	0.5	0.10	<0.01	<0.01	<0.01	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.3	0.9	0.0	-0.2	<50	<50	50	50
F60802	288613	6219898	75	1234	<20	<20	<20	90	950	1250	<0.5	0.0	<0.5	<0.5	0.5	0.10	<0.01	<0.01	<0.01	0.02	0.02	<0.01	<0.01	<0.01	<0.01	0.01	0.10	0.11	0.6	1.6	-1.0	-3.1	<50	<50	50	50
F60803	288027	6220335	192	3083	<20	<20	<20	250	775	<0.5	0.0	<0.5	<0.5	0.5	0.10	<0.01	<0.01	<0.01	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.4	0.9	0.0	0.0	<50	<50	300	200	
F60804	288063	6219961	190	3279	<20	<20	<20	1200	1275	1325	<0.5	0.0	<0.5	<0.5	0.5	0.10	<0.01	<0.01	<0.01	0.05	0.05	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.4	0.9	0.0	0.0	<50	<50	300	200	
F60805	288088	6219982	167	2416	<20	<20	<20	100	775	1100	<0.5	0.0	<0.5	<0.5	0.5	0.10	<0.01	<0.01	<0.01	0.03	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.4							

Table D.03 - Details and predicted subsidence effects for the farm dams within the Study Area

Reference	Centroid MSA Easting	Centroid MSA Northing	Maximum Dimension (m)	Plan Area (m2)	Predicted total subsidence after LW715 (mm)	Predicted total subsidence after LW725 (mm)	Predicted total subsidence after LW735 (mm)	Predicted total subsidence after LW745 (mm)	Predicted total subsidence after LW755 (mm)	Predicted total subsidence after LW765 (mm)	Predicted total tilt after LW715 (mm/m)	Predicted total tilt after LW725 (mm/m)	Predicted total tilt after LW735 (mm/m)	Predicted total tilt after LW745 (mm/m)	Predicted total tilt after LW755 (mm/m)	Predicted total tilt after LW765 (mm/m)	Predicted total sagging curvature after LW715 (1/km)	Predicted total sagging curvature after LW725 (1/km)	Predicted total sagging curvature after LW735 (1/km)	Predicted total sagging curvature after LW745 (1/km)	Predicted total sagging curvature after LW755 (1/km)	Predicted total sagging curvature after LW765 (1/km)	Predicted mean total benile strain (mm/m)	Predicted 95% CI for total benile strain (mm/m)	Predicted mean total comp. strain (mm/m)	Predicted 95% CI for total comp. strain (mm/m)	Predicted Change in Freshwater after LW715 (mm)	Predicted Change in Freshwater after LW725 (mm)	Predicted Change in Freshwater after LW735 (mm)	Predicted Change in Freshwater after LW745 (mm)	Predicted Change in Freshwater after LW755 (mm)	Predicted Change in Freshwater after LW765 (mm)							
510801	287145	6217915	29	524	90	900	1150	1200	1225	1225	0.5	3.5	2.0	2.0	2.0	2.0	<0.01	0.02	0.02	0.02	0.02	0.02	<0.01	0.09	0.09	0.09	0.09	0.5	1.6	-0.9	-3.1	<50	<50	<50	<50	<50	<50		
511001	287068	6217995	81	4008	100	900	1125	1200	1200	1200	0.5	2.5	2.5	3.0	3.0	3.0	<0.01	0.02	0.02	0.02	0.02	0.02	<0.01	0.08	0.09	0.09	0.09	0.4	1.4	-1.0	-3.1	<50	<50	50	50	50	50		
515001	287528	6218459	30	468	20	140	875	1100	1100	1125	<0.5	0.5	2.0	4.0	4.0	4.0	<0.01	<0.01	0.03	0.05	0.05	0.05	<0.01	<0.01	0.01	0.01	0.01	0.01	0.4	1.0	-0.6	-2.0	<50	<50	<50	50	50	50	
516601	287334	6218858	31	235	<20	<20	130	850	1000	1025	<0.5	<0.5	0.5	2.0	3.0	3.0	<0.01	<0.01	<0.01	0.03	0.04	0.04	<0.01	<0.01	<0.01	0.01	0.01	0.3	0.8	-0.4	-1.5	<50	<50	<50	<50	<50	<50		
516602	287483	6218886	39	677	<20	30	325	850	925	950	<0.5	<0.5	4.0	3.0	2.5	2.5	<0.01	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	0.0	-0.2	<50	<50	<50	<50	<50	<50		
517801	287295	6218798	32	637	<20	<20	100	925	1125	1175	<0.5	<0.5	0.5	2.0	3.0	3.5	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.06	0.06	0.5	1.3	-0.9	-2.7	<50	<50	<50	<50	<50	<50		
518801	287148	6218802	27	336	<20	<20	70	900	1150	1225	<0.5	<0.5	0.5	4.5	2.5	2.0	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.09	0.09	0.5	1.5	-0.8	-3.1	<50	<50	<50	<50	<50	<50		
519001	286175	6218839	33	597	<20	<20	<20	40	525	975	<0.5	<0.5	<0.5	<0.5	5.0	3.5	<0.01	<0.01	<0.01	<0.01	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	0.9	-0.2	-1.2	<50	<50	<50	<50	<50	<50		
520601	286560	6219014	53	827	<20	<20	<20	180	800	800	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	<0.01	<0.01	<0.01	<0.01	0.03	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.2	0.6	-0.4	-1.2	<50	<50	<50	<50	<50	<50	
520602	286536	6219117	61	1231	<20	<20	<20	225	825	<0.5	<0.5	<0.5	<0.5	2.0	0.5	<0.01	<0.01	<0.01	<0.01	0.04	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.5	-0.5	-1.0	<50	<50	<50	<50	<50	<50			
521801	286763	6219308	32	621	<20	<20	<20	40	875	1075	<0.5	<0.5	<0.5	<0.5	5.5	3.5	<0.01	<0.01	<0.01	<0.01	0.03	0.03	<0.01	<0.01	<0.01	<0.01	0.03	0.9	-0.2	-1.4	<50	<50	<50	100	50	50			
523801	287077	6218888	48	981	<20	<20	<20	400	875	950	<0.5	<0.5	<0.5	5.0	3.0	3.0	<0.01	<0.01	<0.01	0.05	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	-0.1	-0.4	<50	<50	<50	<50	<50	<50		
525101	287295	6218904	41	671	<20	<20	<20	60	875	1175	<0.5	<0.5	<0.5	6.0	4.0	3.5	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.08	0.09	0.9	0.9	0.9	0.9	<50	<50	100	50	50	50		
525601	287274	6218941	20	260	<20	<20	40	650	1050	1125	<0.5	<0.5	<0.5	6.0	4.0	4.0	<0.01	<0.01	<0.01	0.05	0.05	0.05	<0.01	<0.01	<0.01	0.01	0.02	0.02	0.4	1.0	-0.2	-1.0	<50	<50	<50	<50	<50	<50	
526601	287412	6218945	106	4762	<20	<20	60	935	1225	1275	<0.5	<0.5	<0.5	5.5	3.5	3.0	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.10	0.10	0.4	1.4	-0.7	-2.9	<50	<50	150	50	50	50		
528801	287620	6219074	35	842	<20	<20	50	875	1200	1275	<0.5	<0.5	<0.5	6.0	4.5	4.0	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.08	0.09	0.9	0.3	1.0	-0.4	-2.0	<50	<50	100	50	50	50	
530601	287704	6219488	65	1050	<20	<20	<20	80	950	1250	<0.5	<0.5	<0.5	<0.5	4.0	2.0	<0.01	<0.01	<0.01	<0.01	0.02	0.02	<0.01	<0.01	<0.01	<0.01	0.10	0.10	0.5	1.5	-0.8	-3.1	<50	<50	<50	<50	<50	<50	
531801	287700	6219098	19	250	<20	<20	80	950	1250	1275	<0.5	<0.5	0.5	3.0	3.0	3.0	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.10	0.10	0.5	1.7	-1.0	-3.4	<50	<50	<50	<50	<50	<50		
532801	287949	6219250	77	2164	<20	<20	50	800	1200	1250	<0.5	<0.5	<0.5	6.0	4.5	4.5	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.06	0.07	0.7	0.3	0.8	-0.3	-1.5	<50	<50	100	100	100	100	
532802	287968	6219455	52	1171	<20	<20	<20	160	775	900	<0.5	<0.5	<0.5	1.0	0.5	1.0	<0.01	<0.01	<0.01	0.02	0.03	0.04	<0.01	<0.01	<0.01	<0.01	0.01	0.2	0.4	-0.2	-0.9	<50	<50	<50	<50	<50	<50		
533801	288003	6219205	33	504	<20	<20	80	950	1275	1325	<0.5	<0.5	<0.5	3.0	3.0	3.5	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.10	0.11	0.1	0.6	1.7	-1.0	-3.4	<50	<50	<50	<50	<50	<50	
535801	288271	6219266	40	1017	<20	<20	110	950	1200	1225	<0.5	<0.5	0.5	2.5	4.5	4.5	<0.01	<0.01	<0.01	0.02	0.04	0.05	<0.01	<0.01	<0.01	0.04	0.04	0.4	1.2	-0.7	-2.3	<50	<50	100	100	100	100		
536801	288052	6218849	60	1950	<20	375	850	950	950	950	<0.5	<0.5	4.5	3.5	3.0	3.0	<0.01	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.4	1.0	0.0	-0.1	<50	<50	100	50	50	50	
536802	288440	6218812	114	1613	<20	60	975	1500	1500	1575	<0.5	<0.5	5.5	4.0	3.5	3.5	<0.01	<0.01	0.02	0.02	0.02	0.02	<0.01	<0.01	0.11	0.12	0.12	0.12	0.4	1.4	-0.7	-2.9	<50	<50	100	50	50	50	
537801	288118	6218811	31	378	<20	90	975	1250	1300	1300	<0.5	<0.5	2.5	4.5	4.5	4.5	<0.01	<0.01	0.02	0.02	0.02	0.02	<0.01	<0.01	0.09	0.09	0.4	1.5	-0.9	-3.0	<50	<50	50	50	50	50			
538801	287883	6218813	24	407	<20	130	825	1000	1000	1000	<0.5	<0.5	2.0	3.5	3.5	3.5	<0.01	<0.01	0.03	0.05	0.05	0.05	<0.01	<0.01	0.03	0.01	0.01	0.01	0.01	0.3	0.7	-0.4	-1.5	<50	<50	<50	<50	<50	<50
539801	287923	6218814	28	549	<20	50	825	1200	1275	1275	<0.5	<0.5	6.5	5.0	4.5	4.5	<0.01	<0.01	0.02	0.02	0.02	0.02	<0.01	<0.01	0.07	0.08	0.08	0.3	0.8	-0.4	-1.6	<50	<50	100	50	50	50		
540801	287885	6218935	58	1314	<20	<20	200	775	875	875	<0.5	<0.5	2.0	1.0	1.0	1.0	<0.01	<0.01	0.05	0.05	0.05	0.05	<0.01	<0.01	<0.01	0.01	0.01	0.1	0.4	-0.1	-0.5	<50	<50	<50	<50	<50	<50		
541801	287802	6218993	48	970	<20	<20	190	750	800	875	<0.5	<0.5	1.5	1.0	0.5	<0.5	<0.01	<0.01	0.04	0.04	0.04	0.04	<0.01	<0.01	<0.01	0.01	0.01	0.2	0.4	-0.1	-0.6	<50	<50	<50	<50	<50	<50		
544801	287804	6218721	48	1271	<20	40	450	950	1025	1025	<0.5	<0.5	5.5	4.0	3.5	3.5	<0.01	<0.01	0.06	0.06	0.06	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.1	-0.1	-0.1	<50	<50	100	50	50	50		
544802	287834	6218544	33	577	<20	120	925	1200	1225	1250	<0.5	0.5	2.5	4.0	4.5	4.5	<0.01	<0.01	0.02	0.03	0.03	0.03	<0.01	<0.01	0.06	0.06	0.06	0.06	0.5	1.3	-0.9	-2.6	<50	<50	<50	50	50	50	
545801	288613	6219131	23	243	<20	<20	<20	40	375	1025	<0.5	<0.5	<0.5	5.5	3.5	3.5	<0.01	<0.01	<0.01	<0.01	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.0	-0.2	-1.0	<50	<50	<50	<50	<50	<50	
546801	287283	6219330	97	1562	<20	<20	<20	40	575	1025	<0.5	<0.5	<0.5	<0.5	5.5	4.0	<0.01	<0.01	<0.01	<0.01	0.05	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.4	1.0	-0.2	-1.0	<50	<50	<5				

APPENDIX E. DRAWINGS

0m 500m 1000m
SCALE

LEGEND

- Proposed LW712 to LW716
- Existing Workings
- Existing Monitoring and points
- Existing GNSS units
- Existing Far Field marks

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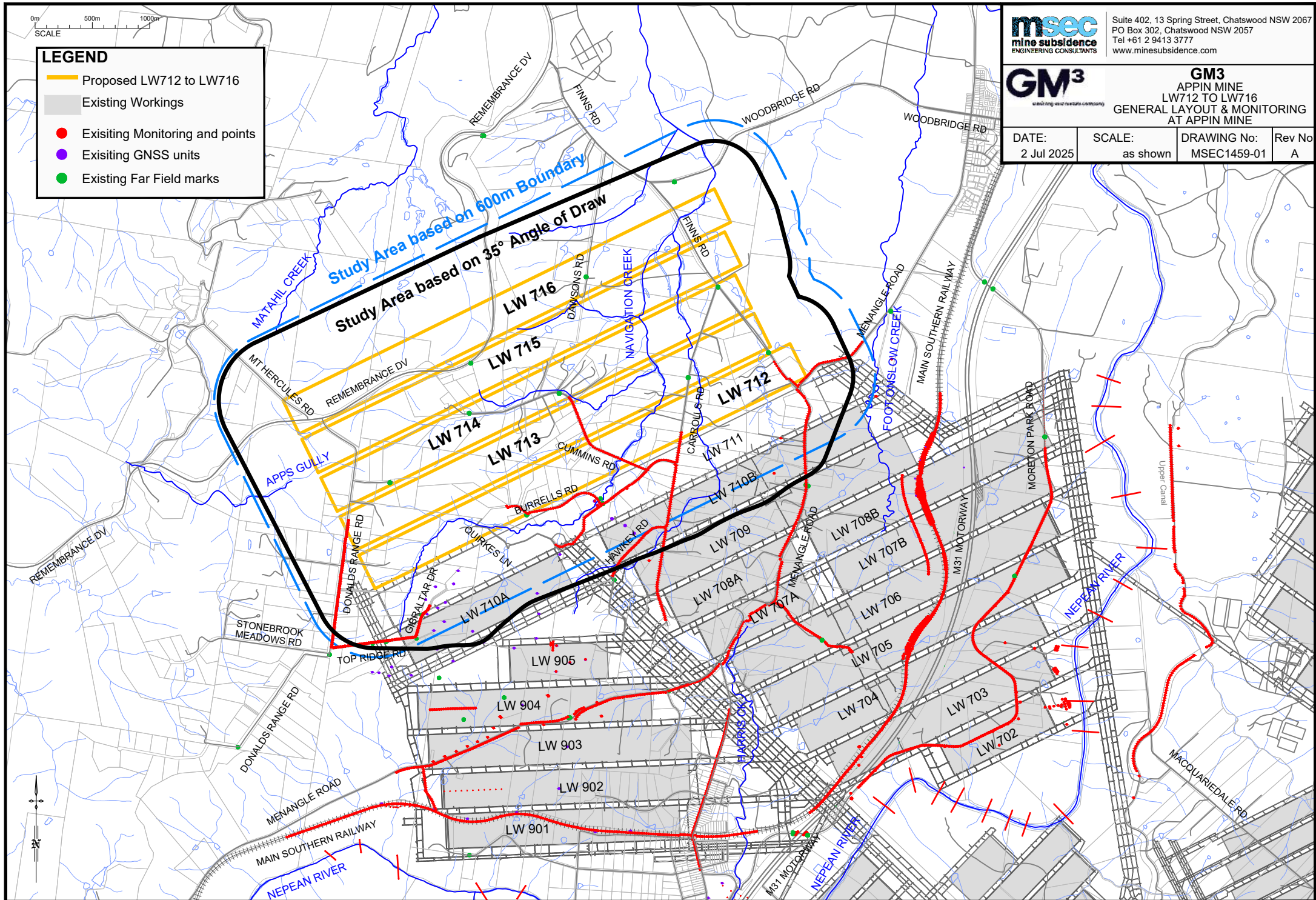
GM3
APPIN MINE
LW712 TO LW716
GENERAL LAYOUT & MONITORING
AT APPIN MINE

DATE:
2 Jul 2025

SCALE:
as shown

DRAWING No:
MSEC1459-01

Rev No:
A





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GM3

APPIN MINE
LW712 TO LW716
LAYOUT OF LW712 TO LW716

DATE: 2 Jul 2025	SCALE: as shown	DRAWING No: MSEC1459-02	Rev No A
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0m 500m 1000m
SCALE

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls

Study Area based on 600m Boundary

Study Area based on 35° Angle of Draw

MATAHIL CREEK

APPS GULLY

NAVIGATION CREEK

FOOT ONSLOW CREEK

MT HERCULES RD

REMEMBRANCE DV

DAWSONS RD

FINNS RD

WOODBIDGE RD

WOODBIDGE RD

MENANGLE ROAD

M31 MOTORWAY

LW 704

LW 705

LW 706

LW 707B

LW 708B

LW 709

LW 708A

LW 707A

LW 905

LW 710A

LW 711

LW 712

LW 713

LW 714

LW 715

LW 716

CUMMINS RD

CARROLLS RD

QUIRKES LN

BURRELLS RD

HAWKEY RD

GIBRALTAR DR

DONALDS RANGE RD

STONEBROOK MEADOWS RD

TOP RIDGE RD



SURFACE LEVEL CONTOURS
ARE IN m AHD0m 500m 1000m
SCALE**LEGEND**

- Proposed LW712 to LW716
- Existing Longwalls

Study Area based on 600m Boundary

Study Area based on 35° Angle of Draw

Section 2

Section 1

LW 716

LW 715

LW 714

LW 713

LW 711

LW 712

LW 710B

LW 709

LW 708B

LW 707B

LW 706

LW 705

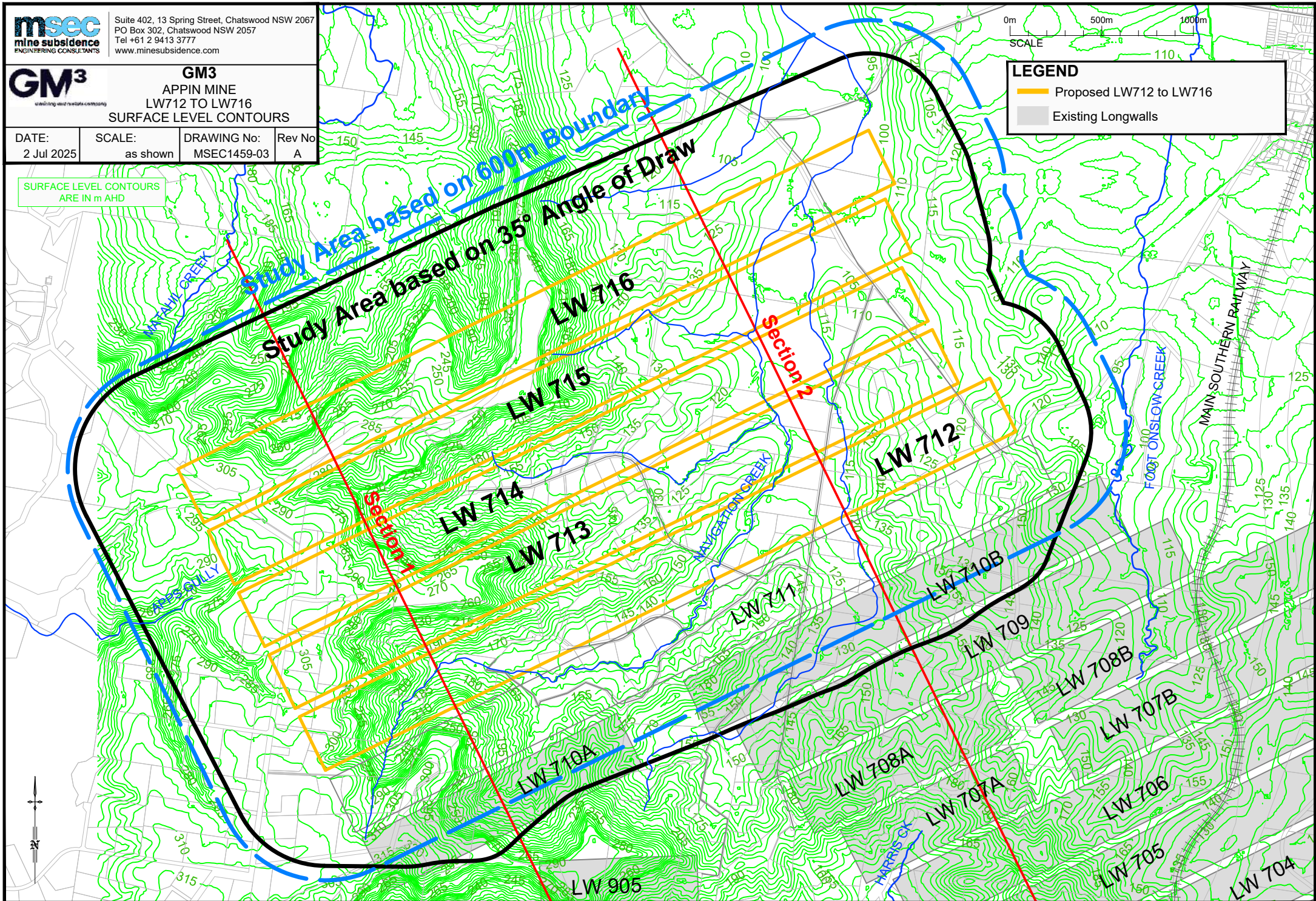
LW 704

LW 905

LW 708A

LW 707A

LW 710A



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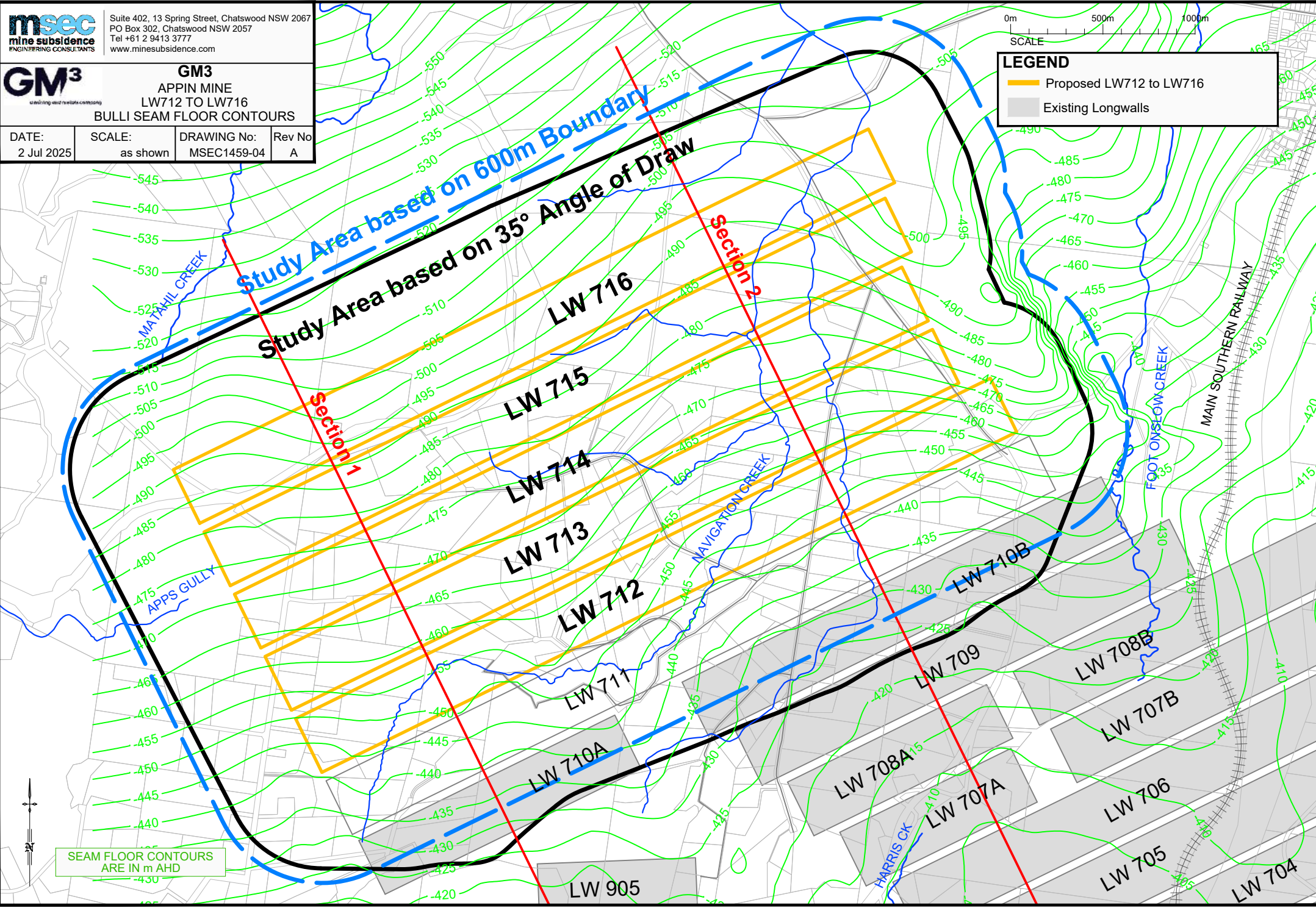
GM3
APPIN MINE
LW712 TO LW716
BULLI SEAM FLOOR CONTOURS

DATE:
2 Jul 2025

SCALE:
as shown

DRAWING No:
MSEC1459-04

Rev No
A





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APPIN MINE

LW712 TO LW716

BULLI SEAM THICKNESS CONTOURS

DATE:

2 Jul 2025

SCALE:

as shown

DRAWING No:

MSEC1459-05

Rev No

A

SEAM THICKNESS
CONTOURS ARE IN METRES

0m 500m 1000m
SCALE

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls

Study Area based on 600m Boundary

Study Area based on 35° Angle of Draw

Section 2

Section 1

LW 716

LW 715

LW 714

LW 713

LW 712

LW 711

LW 710A

LW 710B

LW 709

LW 708A

LW 708B

LW 707B

LW 707A

LW 706

LW 705

LW 704

LW 905

MATAHIL CREEK

APPS GULLY

NAVIGATION CREEK

FOOT ONSLOW CREEK

HARRIS CK

MAIN SOUTHERN RAILWAY

DEPTH OF COVER
 CONTOURS ARE IN METRES

0m 500m 1000m

SCALE

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls

Study Area based on 600m Boundary

Study Area based on 35° Angle of Draw

Section 2

Section 1

LW 716

LW 715

LW 714

LW 713

LW 712

LW 711

LW 710B

LW 709

LW 708B

LW 707B

LW 706

LW 705

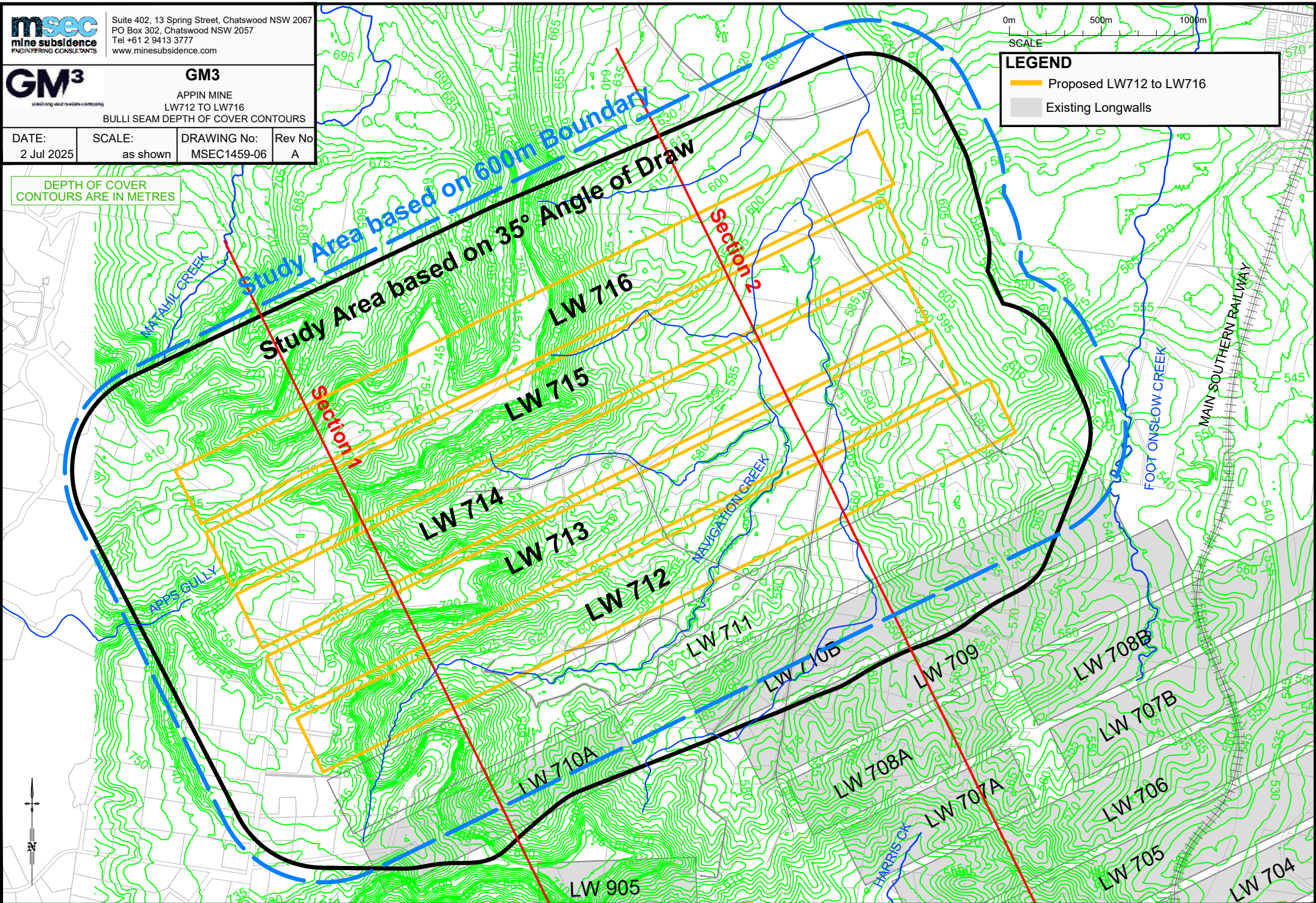
LW 704

LW 905

LW 710A

LW 708A

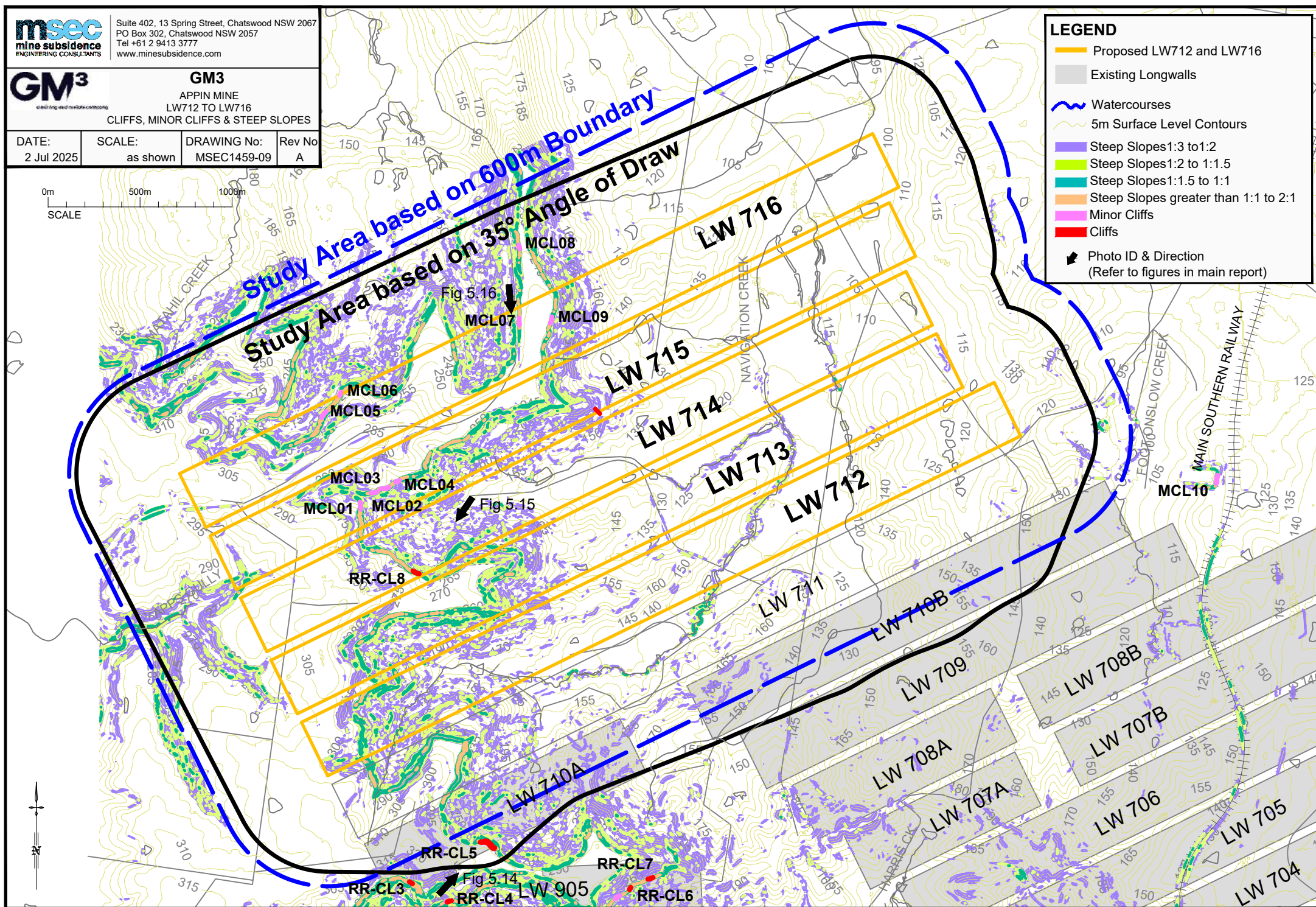
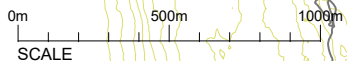
LW 707A

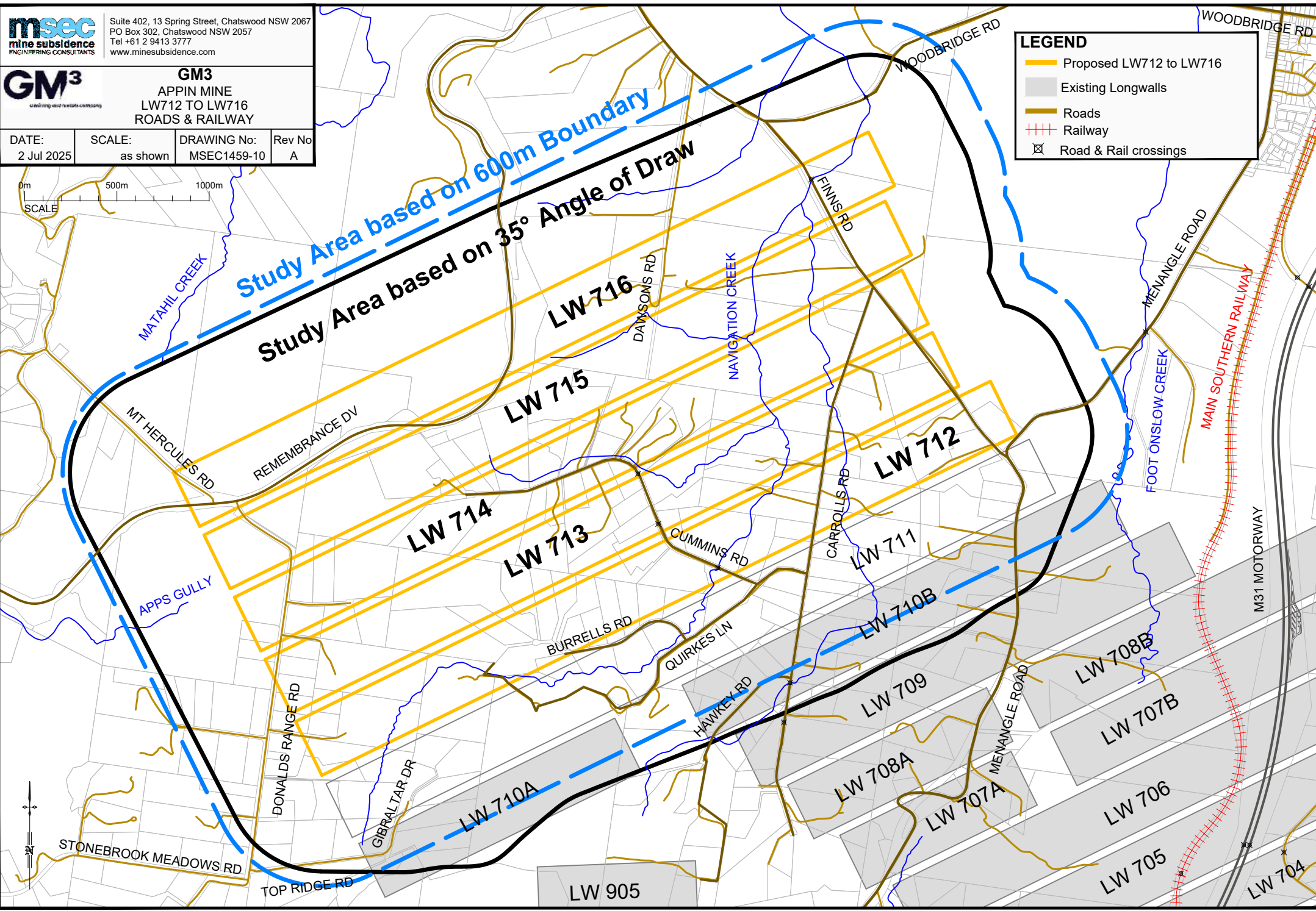


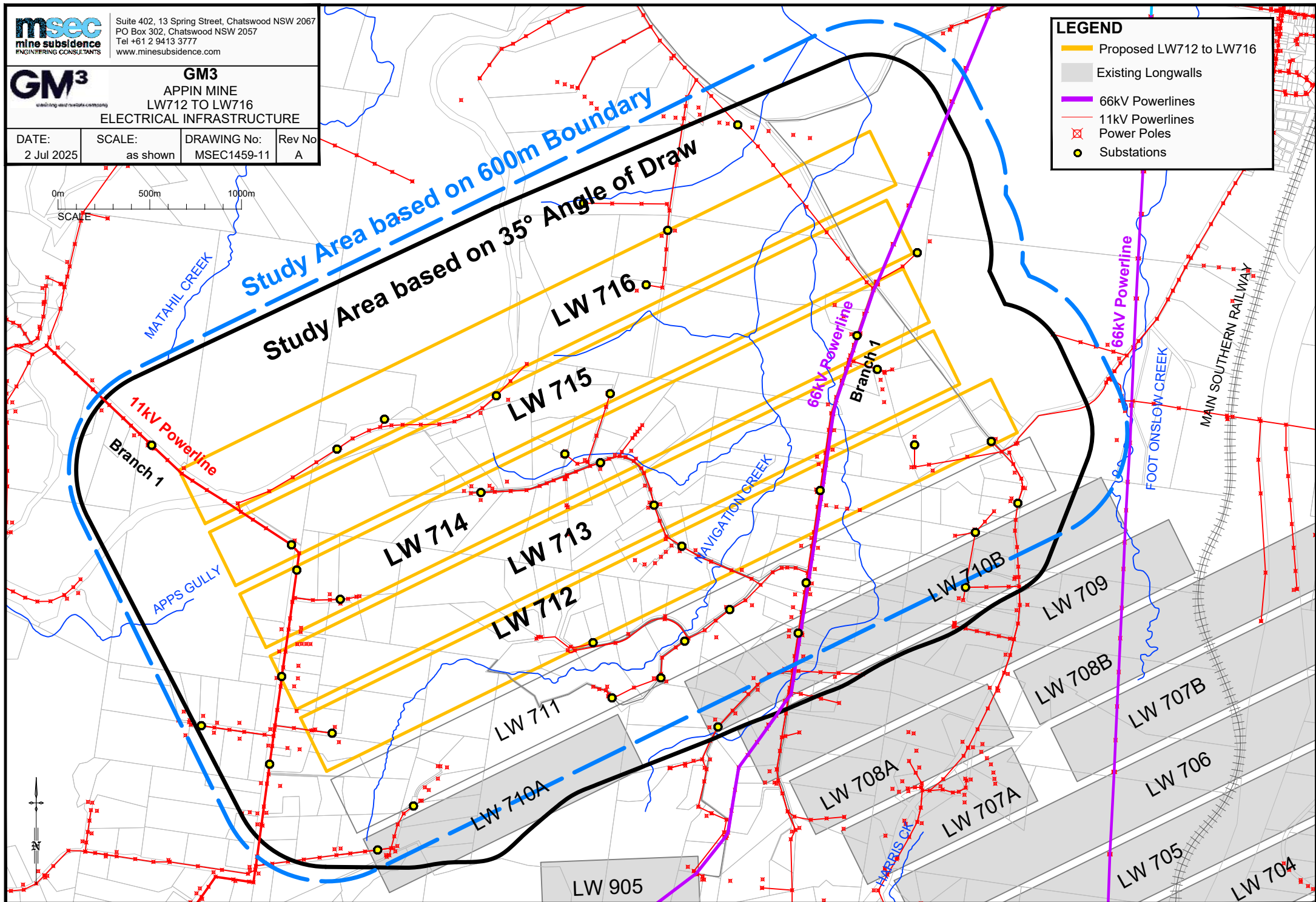
GM³
driving and results.

CLIFFS, MINOR CLIFFS & STEEP SLOPES

A





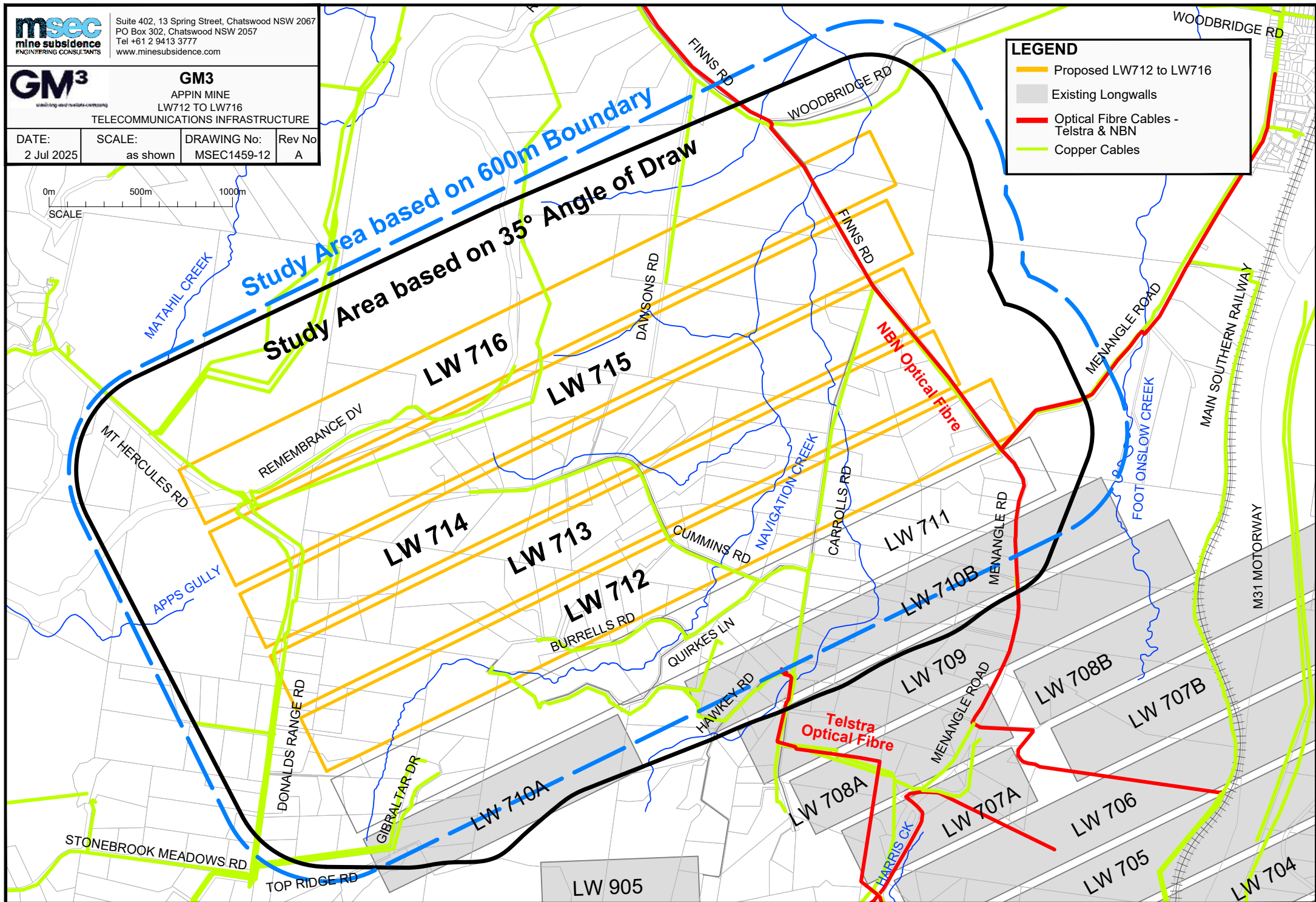


Study Area based on 600m Boundary

Study Area based on 35° Angle of Draw

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls
- Optical Fibre Cables - Telstra & NBN
- Copper Cables





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GM3
APPIN MINE
LW712 TO LW716
WATER & GAS INFRASTRUCTURE

DATE: 2 Jul 2025	SCALE: as shown	DRAWING No: MSEC1459-13	Rev No A
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0m 500m 1000m
SCALE

Study Area based on 600m Boundary
Study Area based on 35° Angle of Draw

LW 716

LW 715

LW 714

LW 713

LW 712

LW 711

LW 710B

LW 709

LW 708A

LW 708B

LW 707B

LW 710A

LW 905

LW 708A

LW 707A

LW 706

LW 705

LW 704

MATAHIL CREEK

APPS GULLY

NAVIGATION CREEK

FOOT ONSLOW CREEK

MAIN SOUTHERN RAILWAY

HARRIS CK

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls
- Water Pipelines
- AGL Gas Pipelines (decommissioned)



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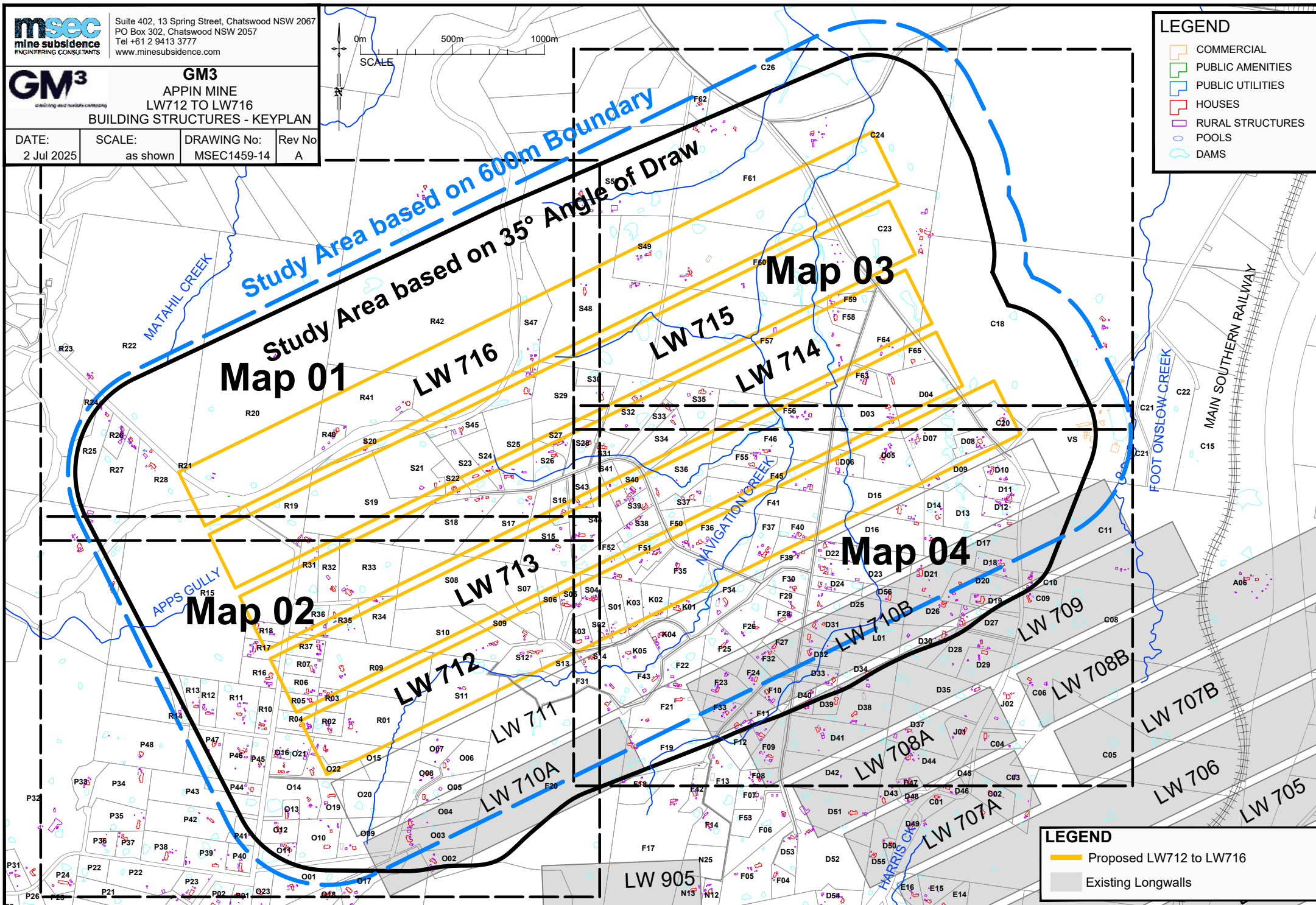


GM3
APPIN MINE
LW712 TO LW716
BUILDING STRUCTURES - KEYPLAN

DATE: 2 Jul 2025	SCALE: as shown	DRAWING No: MSEC1459-14	Rev No: A
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- LEGEND**
- COMMERCIAL
 - PUBLIC AMENITIES
 - PUBLIC UTILITIES
 - HOUSES
 - RURAL STRUCTURES
 - POOLS
 - DAMS



- LEGEND**
- Proposed LW712 to LW716
 - Existing Longwalls

LEGEND

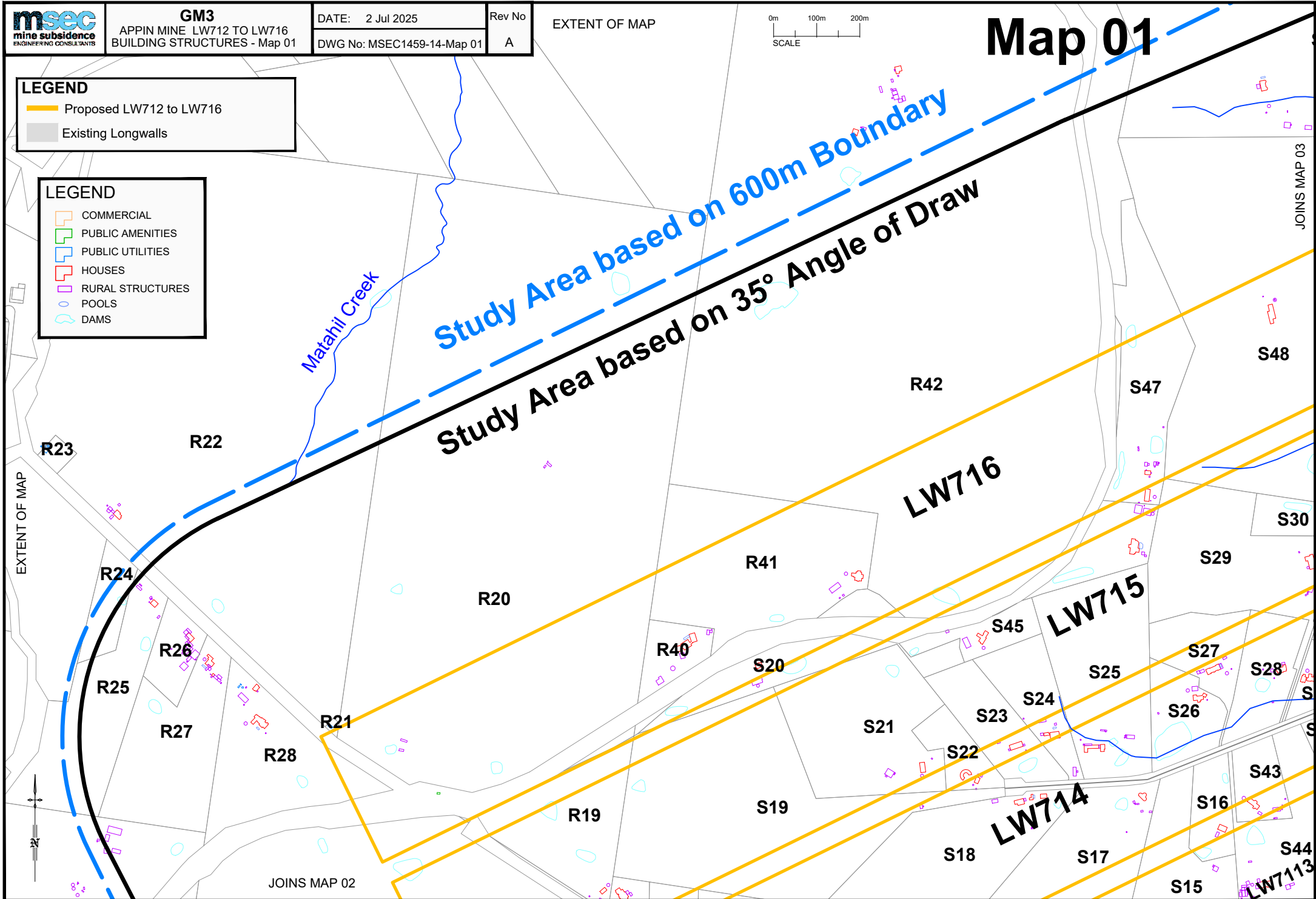
- Proposed LW712 to LW716
- Existing Longwalls

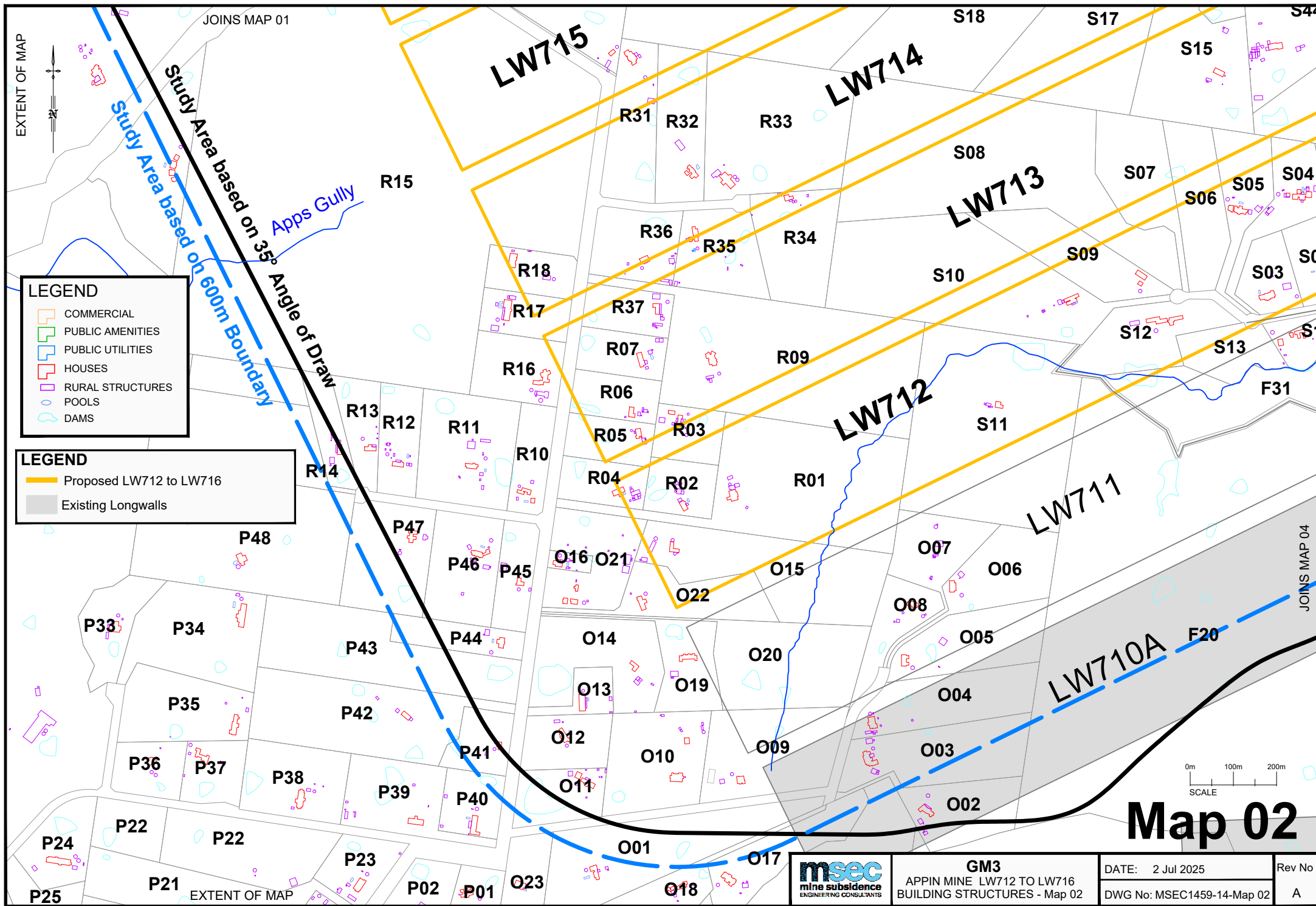
LEGEND

- COMMERCIAL
- PUBLIC AMENITIES
- PUBLIC UTILITIES
- HOUSES
- RURAL STRUCTURES
- POOLS
- DAMS

Study Area based on 600m Boundary

Study Area based on 35° Angle of Draw



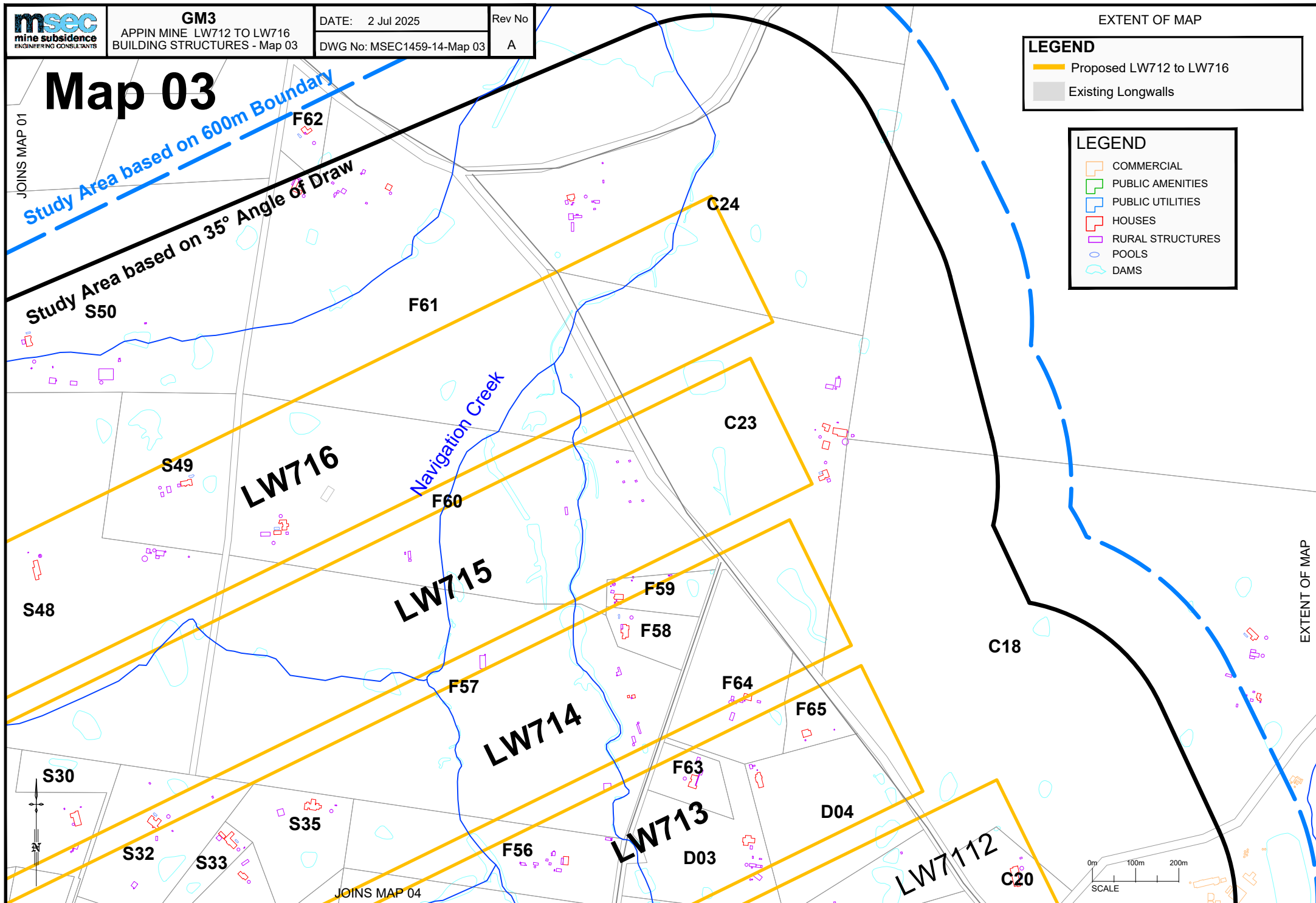


Map 03

JOINS MAP 01

Study Area based on 600m Boundary

Study Area based on 35° Angle of Draw





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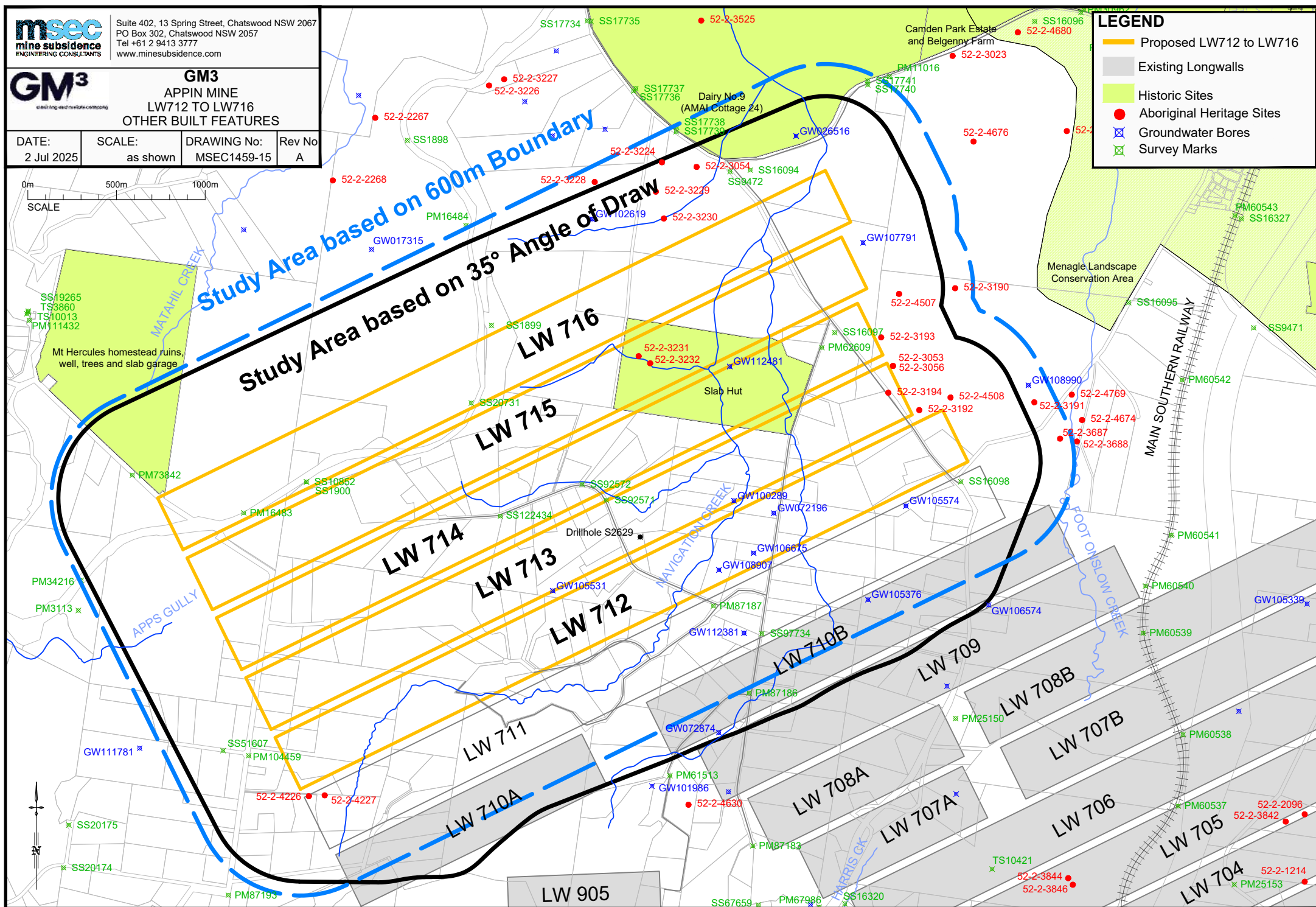
GM3
APPIN MINE
LW712 TO LW716
OTHER BUILT FEATURES

DATE: 2 Jul 2025	SCALE: as shown	DRAWING No: MSEC1459-15	Rev No A
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0m 500m 1000m
SCALE

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls
- Historic Sites
- Aboriginal Heritage Sites
- ✕ Groundwater Bores
- ✕ Survey Marks



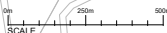


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GM3
APPIN MINE
LW712 TO LW716
PREDICTED ADDITIONAL SUBSIDIENCE
CONTOURS DUE TO LW712 TO LW716

DATE: 2 Jul 2025	SCALE: as shown	DRAWING No: MSEC1459-16	Rev No A
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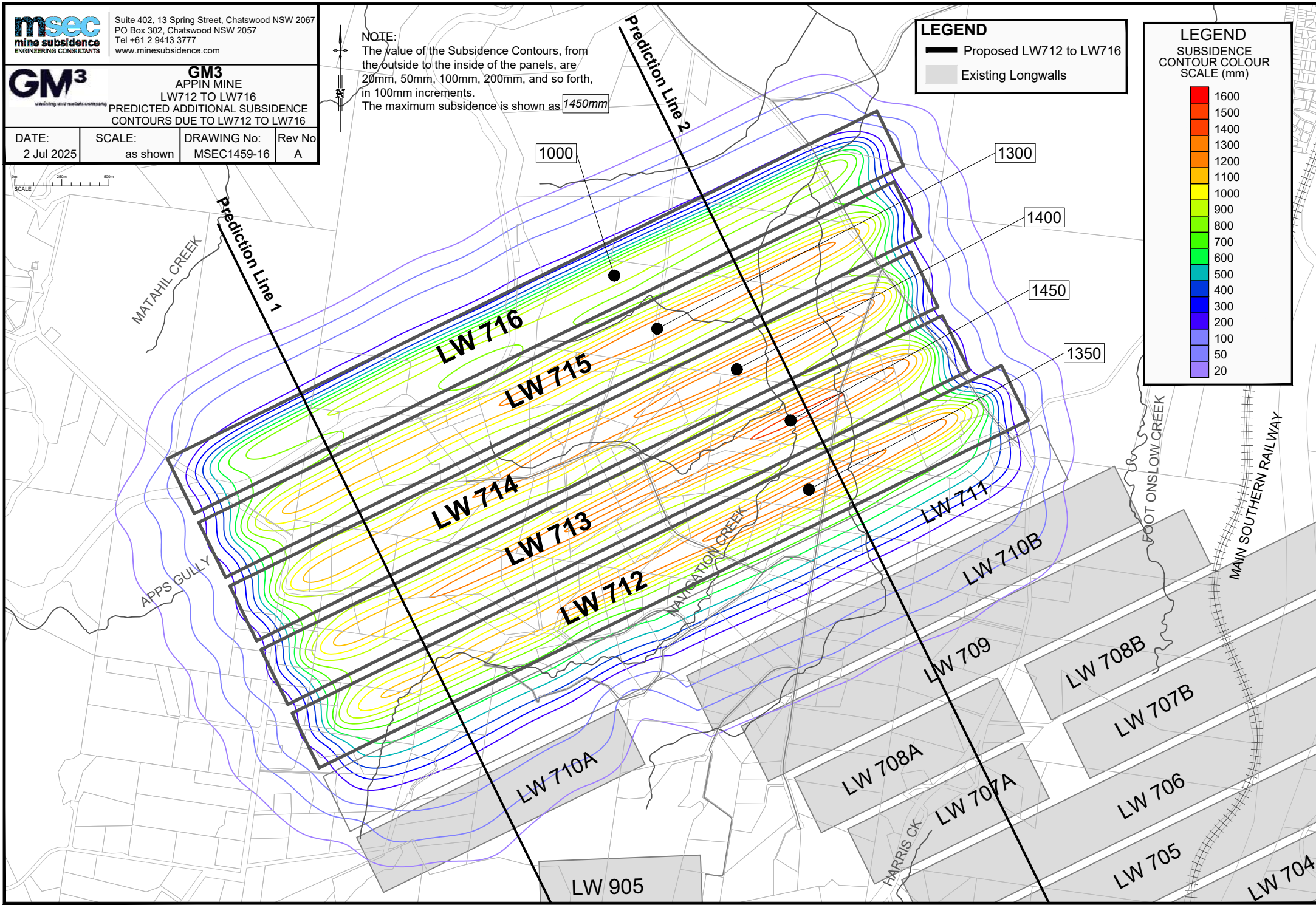
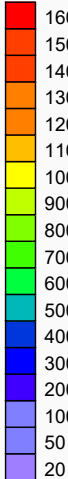


NOTE:
The value of the Subsidence Contours, from the outside to the inside of the panels, are 20mm, 50mm, 100mm, 200mm, and so forth, in 100mm increments.
The maximum subsidence is shown as **1450mm**

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls

LEGEND
SUBSIDIENCE
CONTOUR COLOUR
SCALE (mm)





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APPIN MINE
LW712 TO LW716
PREDICTED TOTAL SUBSIDENCE
CONTOURS AFTER LW712

DATE: 2 Jul 2025	SCALE: as shown	DRAWING No: MSEC1459-17	Rev No A
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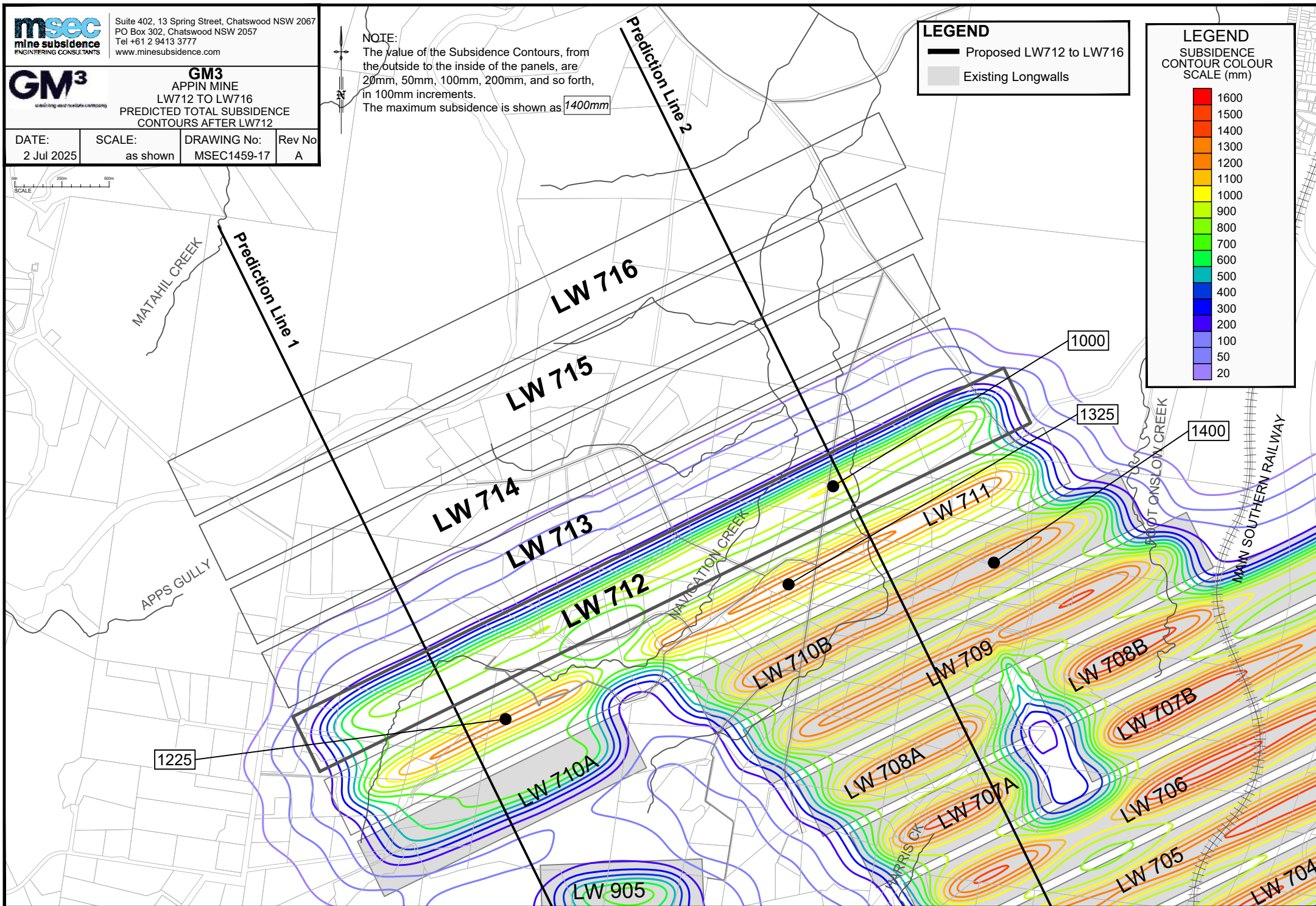
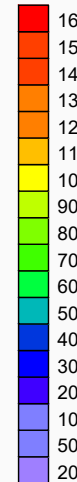
NOTE:
The value of the Subsidence Contours, from the outside to the inside of the panels, are 20mm, 50mm, 100mm, 200mm, and so forth, in 100mm increments.
The maximum subsidence is shown as 1400mm

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls

LEGEND

SUBSIDENCE
CONTOUR COLOUR
SCALE (mm)





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APPIN MINE
LW712 TO LW716
PREDICTED TOTAL SUBSIDENCE
CONTOURS AFTER LW713

DATE: 2 Jul 2025	SCALE: as shown	DRAWING No: MSEC1459-18	Rev No A
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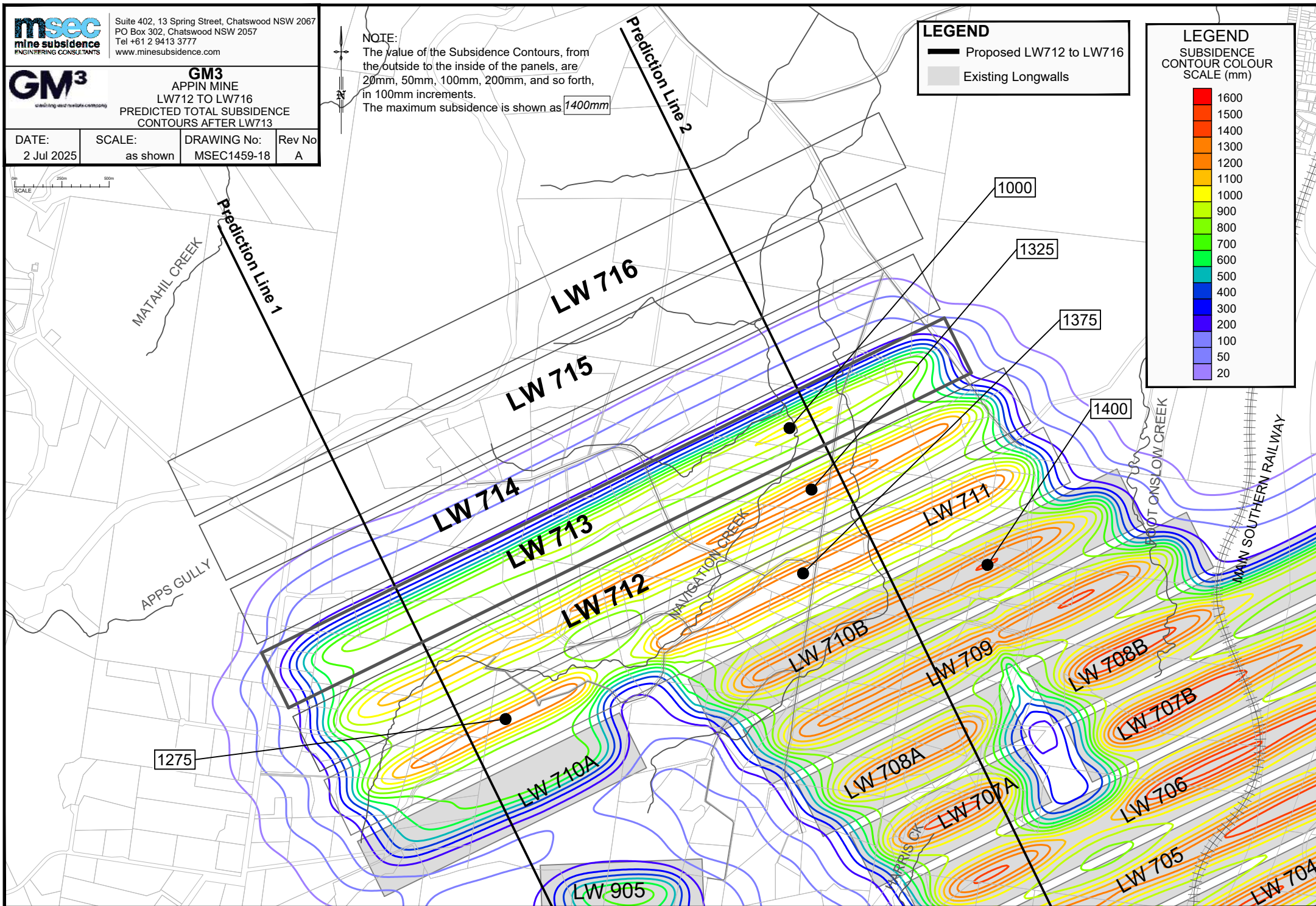
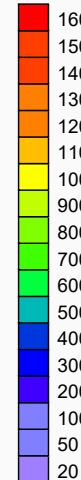
NOTE:
The value of the Subsidence Contours, from the outside to the inside of the panels, are 20mm, 50mm, 100mm, 200mm, and so forth, in 100mm increments.
The maximum subsidence is shown as 1400mm

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls

LEGEND

SUBSIDENCE
CONTOUR COLOUR
SCALE (mm)



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LW712 TO LW716
PREDICTED TOTAL SUBSIDENCE
CONTOURS AFTER LW714

DATE:
2 Jul 2025

SCALE:
as shown

DRAWING No:
MSEC1459-19

Rev No
A

NOTE:
The value of the Subsidence Contours, from the outside to the inside of the panels, are 20mm, 50mm, 100mm, 200mm, and so forth, in 100mm increments.
The maximum subsidence is shown as 1400mm

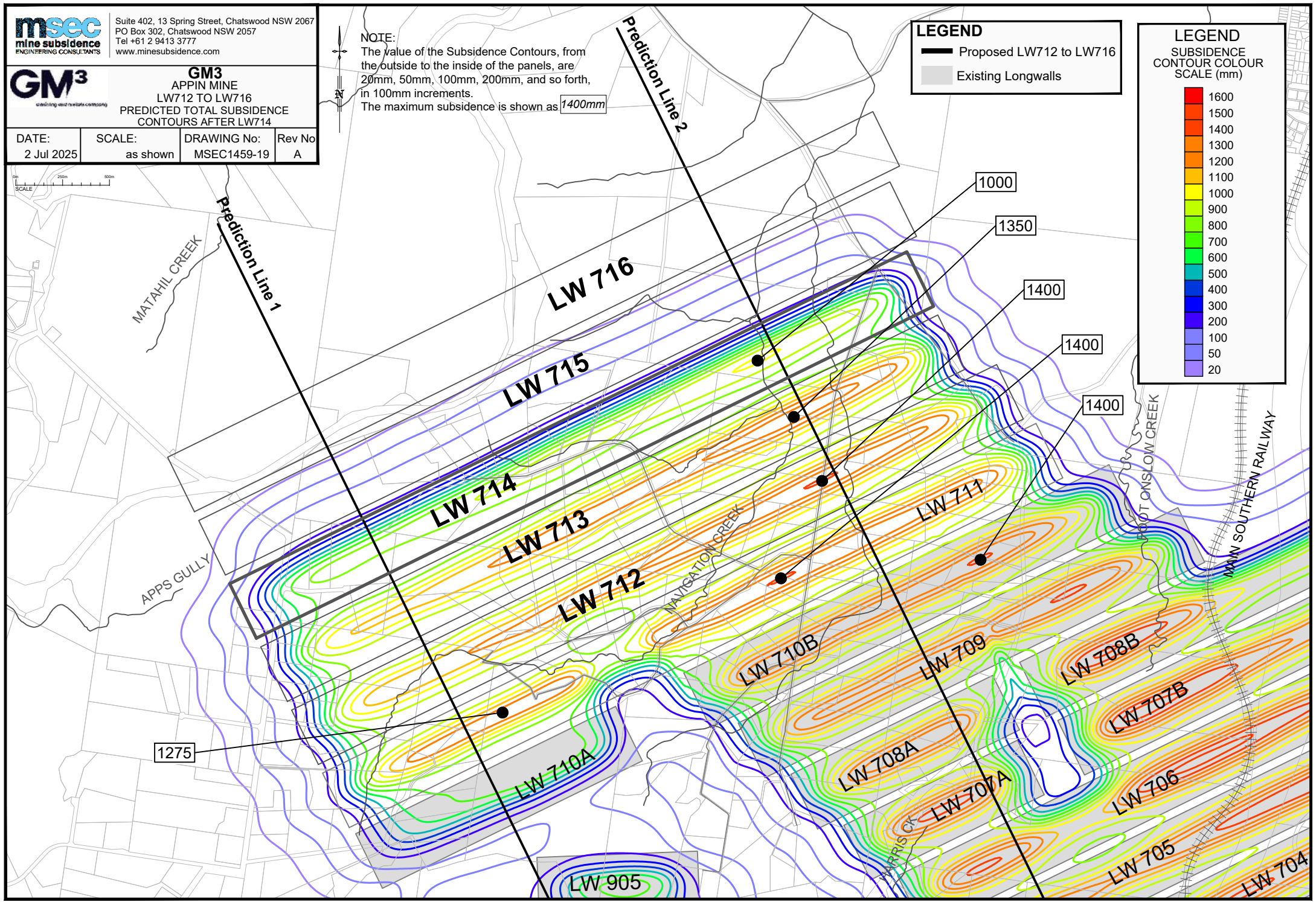
LEGEND

Proposed LW712 to LW716

Existing Longwalls

LEGEND
SUBSIDENCE
CONTOUR COLOUR
SCALE (mm)

1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
50
20





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GM3
APPIN MINE
LW712 TO LW716
PREDICTED TOTAL SUBSIDIENCE
CONTOURS AFTER LW715

DATE: 2 Jul 2025	SCALE: as shown	DRAWING No: MSEC1459-20	Rev No A
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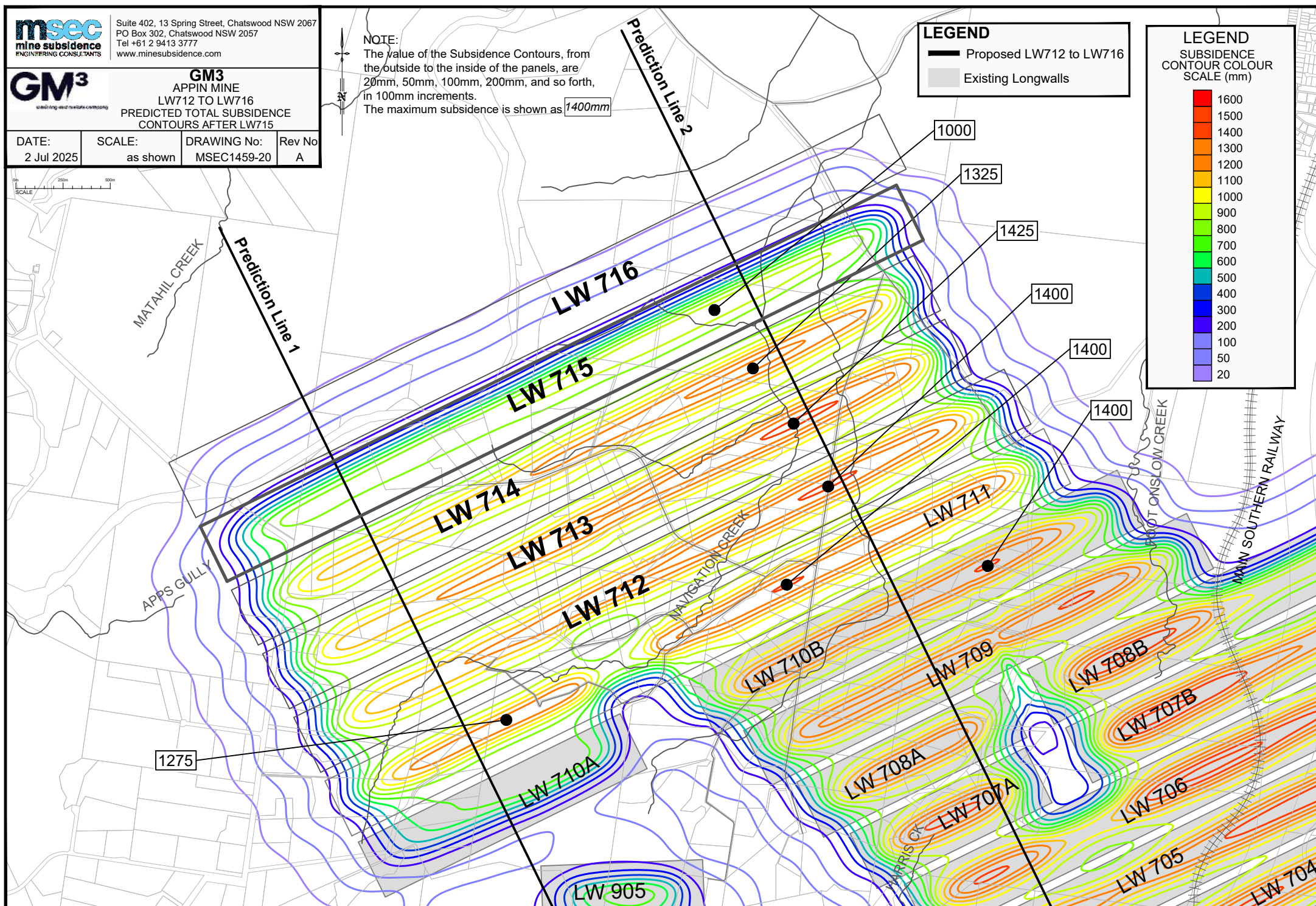
NOTE:
The value of the Subsidence Contours, from the outside to the inside of the panels, are 20mm, 50mm, 100mm, 200mm, and so forth, in 100mm increments.
The maximum subsidence is shown as 1400mm

LEGEND

- Proposed LW712 to LW716
- Existing Longwalls

LEGEND

SUBSIDIENCE
CONTOUR COLOUR
SCALE (mm)



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LW712 TO LW716
PREDICTED TOTAL SUBSIDENCE
CONTOURS AFTER LW716

DATE:
2 Jul 2025

SCALE:
as shown

DRAWING No:
MSEC1459-21

Rev No
A

NOTE:
The value of the Subsidence Contours, from the outside to the inside of the panels, are 20mm, 50mm, 100mm, 200mm, and so forth, in 100mm increments.
The maximum subsidence is shown as 1450mm

LEGEND

Proposed LW712 to LW716

Existing Longwalls

LEGEND
SUBSIDENCE
CONTOUR COLOUR
SCALE (mm)

1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
50
20

