NARRABRI MINE

EXTRACTION PLAN
HERITAGE MANAGEMENT PLAN

LW 203 – LW 206

Prepared by:

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Acronyms and abbreviations

Acronym	Description
ACHMP	Aboriginal Cultural Heritage Management Plan
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ATSIHP Act	Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cwlth)
CF	Cut and flit
Cwlth	Commonwealth
DECCW	NSW Department of Environment Climate Change & Water
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DGS	Ditton Geotechnical Services
DPE	NSW Department of Planning and Environment
DPHI	NSW Department of Planning, Housing and Infrastructure
EP 203-206	Extraction Plan for LW 203 to LW 206
EP-HMP	Extraction Plan - Heritage Management Plan (this document)
EP-WMP	Extraction Plan – Water Management Plan
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)
GNAC	Gomeroi Narrabri Aboriginal Corporation
ha	hectare
IEAPM	Independent Expert Advisory Panel for Mining – formerly Independent Advisory Panel for Underground Mining (IAPUM)
IEA	Independent Environmental Audit
km	kilometre
km^2	square kilometre
LW	longwall panel
m	metre
ML	Mining Lease
mm	millimetre
mm/m	millimetre per meter
Mtpa	million tonnes per annum
NCOPL	Narrabri Coal Operations Pty Ltd
NLALC	Narrabri Local Aboriginal Land Council
NP&W Act	National Parks and Wildlife Act 1974
NNTT	National Native Title Tribunal
RAP	Registered Aboriginal Party
ROM	run of mine
SoC	Statement of Commitments

Acronym	Description
U95%CL	upper 95 % confidence level
WHC	Whitehaven Coal
XL	Cross section cross-line across the longwall panels

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1. Introduction

1.1 Background

The Narrabri Mine is an existing underground coal mining operation situated in the Gunnedah Coalfield. It is located approximately 25 kilometres (**km**) south-east of Narrabri and approximately 60 km north-west of Gunnedah, within the Narrabri Shire Council Local Government Area in New South Wales (**NSW**). The Narrabri Mine includes an underground coal mine, a coal handling and preparation plant and associated rail siding and surface infrastructure.

The Narrabri Mine is operated by Narrabri Coal Operations Pty Ltd (**NCOPL**), on behalf of the Narrabri Mine Joint Venture, which consists of two Whitehaven Coal Limited (**WHC**) wholly owned subsidiaries, and other joint-venture partners[1]. The underground mine is covered by Mining Lease (**ML**) 1609 which covers an area of 5,298 hectares (**ha**) for the predominant purpose of mining for coal from the Hoskissons Coal Seam.

Stage 1 of the Narrabri Mine was approved in November 2007 under Part 3A of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**). Construction of the mine and supporting infrastructure commenced in 2008, with production using a continuous miner commencing in 2010. Following the approval of the Stage 2 Environmental Assessment (R.W Corkery & Co., 2009) (the **EA**) and the issue of the Stage 2 Project Approval 08_0144 (**Project Approval**) in July 2010, and *Environmental Protection and Biodiversity Conservation Act 1999* **(EPBC Act)** approval (**2009/5003**) in January 2011, the Narrabri Mine was converted to an 8 million tonnes per annum (**Mtpa**) run of mine (**ROM**) longwall mining operation, which commenced in 2012.

The Project Approval has subsequently been modified on a number of occasions. The environmental assessment for Modification 5 (Resource Strategies, 2015) (**MOD 5**), approved in December 2015, changed the mine geometry by reducing the number of longwall (**LW**) panels from 26 to 20, increased some LW panel widths and increased the production to 11 Mtpa of ROM coal until July 2031.

Modification 7, the most recent modification of the Project Approval, was approved on 23 November 2021. The environmental assessment for Modification 7 (Resource Strategies, 2021) (**MOD 7**) describes the change in mining method within the extent of the previously approved LW 201 and LW 202 and allows for up to 0.7 Mtpa via bord and pillar extraction at pillar reduction panels Cut and Flit (**CF**) 201 to CF 205. There is no change to the previously approved longwall panels LW 203 to LW 209. The bord and pillar mining will occur concurrently with existing longwall operations for a period of approximately five years, with the maximum ROM coal production rate remaining within the approved limit of 11 Mtpa.

1.2 Purpose and scope

This Extraction Plan - Heritage Management Plan (**EP-HMP** or **Plan**) for LW 203 to LW 206 has been prepared in accordance with Schedule 3 Condition 4(h) of the Project Approval and the Department of Planning, Housing and Infrastructure (**DPHI**) (formerly the Department of Planning and Environment [**DPE**] *Extraction Plan Guideline* (DPE, 2022).

The EP-HMP sets out the objectives, performance measures and management actions required to manage and monitor the potential impacts from subsidence on Aboriginal cultural heritage sites above LW 203 to LW 206 (the **Extraction Plan Area**[2]). This Plan forms Appendix D of the Extraction Plan for LW 203 to LW 206 (**EP 203-206**).

[1] For full details on the joint venture ownership, refer to the introduction of the Extraction Plan.

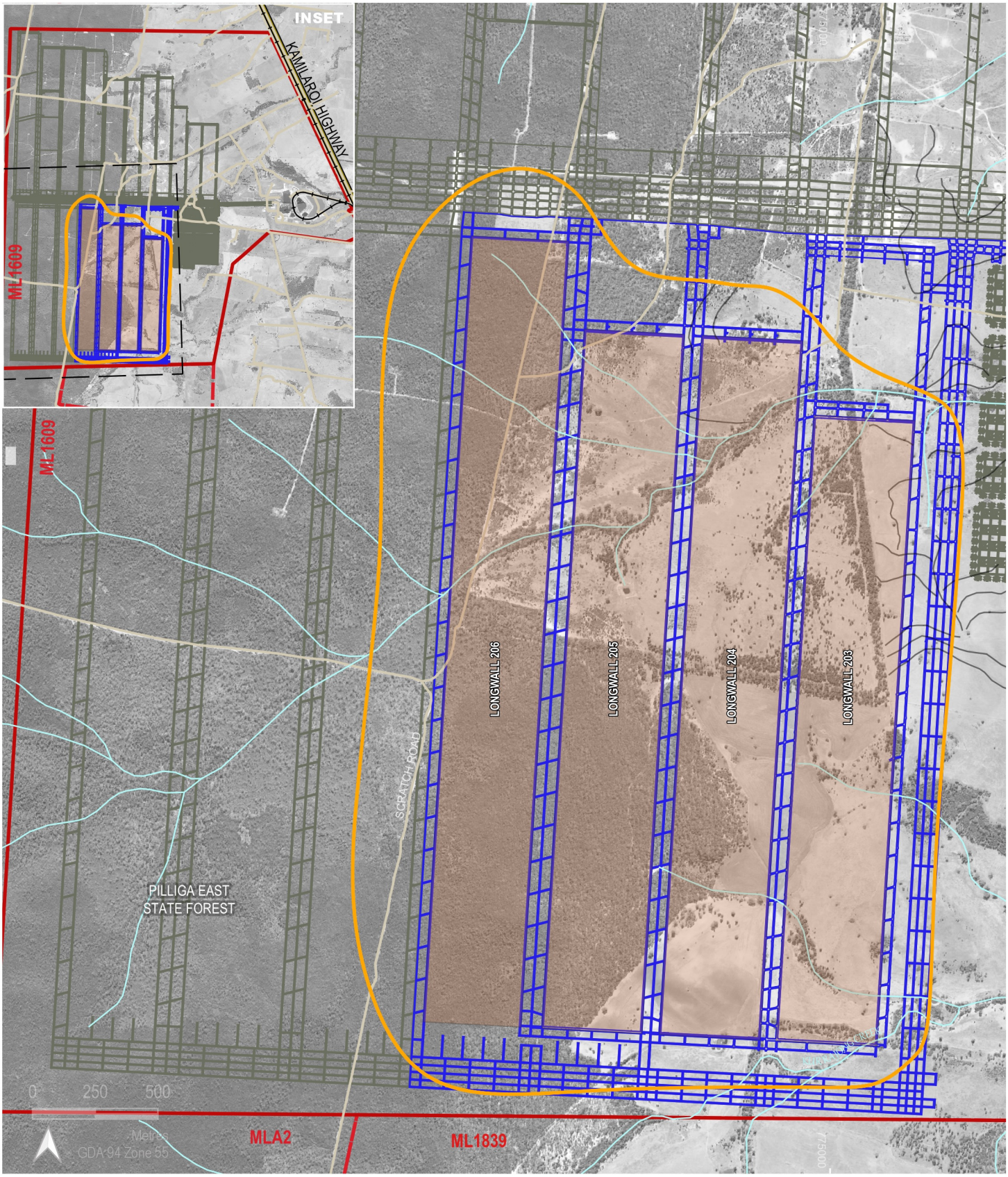
[2] The area located within the 45° Angle of Draw as shown on Figure 1-1.

The Ditton Geotechnical Services Pty Ltd (**DGS**) *Mine Subsidence Assessment Report for LW 203 to LW 206* (DGS 2022) (**Mine Subsidence Assessment Report**) and the *Review of the proposed strain relieving slots at the 'Mayfield' grinding groove site due to LW203 to 206 at the Narrabri Mine* (DGS 2024) (**Mayfield GG1 Technical Review**) have been used as a basis for developing the performance measures and management actions in response to the predicted impacts on Aboriginal cultural heritage sites within the Extraction Plan Area. The Mine Subsidence Assessment Report is presented in full as Appendix J to EP 203-206. Management and monitoring measures have also been developed based on previous Archaeological surveys and current management plans implemented at the Narrabri Mine (refer to section 11).

The purpose of this EP-HMP is to ensure that impacts to the identified Aboriginal cultural heritage sites are managed in accordance with the Project Approval and aims to:

1. Provide a precise set of procedures to enable the identification and conservation of Aboriginal cultural heritage places, objects, and artefacts within the Extraction Plan Area.
2. Ensure all personnel are aware of their obligations, responsibilities and the procedures under the NSW *National Parks and Wildlife Act 1974* (**NP&W Act**) and the NSW *Heritage Act 1977*.
3. Establish a consultation protocol with the Registered Aboriginal Parties (**RAPs**), who are representatives of the local Aboriginal community.

The Extraction Plan Area and underground mining layout for LW 203 to LW 206 is presented in Figure 1-1. A detailed description of the underground mining method is provided within the EP 203-206.



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LEGEND

- ML1609
- ML1839
- MLA2
- Underground mining layout
- Longwalls 203 to 206
- Proposed longwall voids (LW203-206)
- 45 degree angle of draw
- Road
- Watercourse
- Contour bank

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FIGURE 1-1

Extraction Plan Area and Underground Mining Layout for LW 203 to LW 206

1.3 Objectives

The objectives of this EP-HMP are to:

- provide details of the relevant statutory requirements, including any relevant approval, licence or lease conditions;
- identify Aboriginal cultural heritage sites within the Extraction Plan Area predicted to be impacted by subsidence;
- detail the management actions required to manage the predicted impacts and/or environmental consequences of subsidence on the identified Aboriginal cultural heritage sites;
- provide triggers to inform additional and/or adaptive management actions;
- describe the protocol for managing and reporting any incident, non-compliance or exceedance of any impact assessment criteria or performance criteria, complaint, or failure to comply with other statutory requirements;
- detail the regulatory reporting requirements;
- describe the protocol for periodic review of this Plan; and
- identify the roles and responsibilities for implementation of this Plan.

1.4 Statutory requirements

1.4.1 Relevant legislation

Environmental Planning and Assessment Act 1979 (NSW)

The EP&A Act requires that environmental and heritage impacts are considered by consent authorities prior to granting development approval. The original approvals for the Narrabri Mine were obtained under the Part 3A, 'Major Projects' provisions of the EP&A Act. While Part 3A has since been repealed, it remains applicable to NCOPL under transitionary provisions. Under Section 75U(d) of these provisions, an Aboriginal Heritage Impact Permit (**AHIP**) under the NP&W Act (NSW) is not required for a project approved under Part 3A. In such instances, management of Aboriginal heritage follows the applicable Aboriginal assessment guidelines and any relevant Statement of Commitments (**SoC**) included in the Project Approval, which usually requires the development of a regulator-approved Aboriginal Cultural Heritage Management Plan.

Environmental Protection and Biodiversity Conversation Act 1999 (Cwlth)

The EPBC Act (Commonwealth [**Cwlth**]) establishes the National Heritage List, which includes natural, Indigenous, and historic places that are of outstanding heritage value to the nation. Under the EPBC Act, there are penalties for anyone who takes an action that has or will have a significant impact on the Indigenous heritage values of a place that is recognised on the National Heritage List.

The Act also establishes the Commonwealth Heritage List, which includes places on Commonwealth lands and waters or under Australian Government control that have Indigenous heritage significance. In addition, the Act protects heritage on Commonwealth land and from actions undertaken by the Commonwealth.

Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cwlth)

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* **(ATSIHP Act)** protects areas and objects that are of particular significance to Indigenous people. The ATSIHP Act allows the Environment Minister, on the application of an Aboriginal person or group of persons, to make a declaration to protect an area, object or class of objects from a threat of injury or desecration.

There are no areas, objects or class of objects within or adjacent to the Narrabri Mine that are protected under the ATSIHP Act.

Native Title Act 1993 (Cwlth)

The *Native Title Act 1993* provides recognition and protection for native title by establishing the National Native Title Tribunal (**NNTT**) to administer native title claims to rights and interests over lands and waters by Aboriginal people. The NNTT also administers the future act processes that attract the right to negotiate under the *Native Title Act 1993*.

The Native Title Act 1993, where applicable, will be complied with in relation to the mining lease.

National Parks and Wildlife Act 1974 (NSW)

The NP&W Act provides blanket protection for Aboriginal objects (material evidence of Indigenous occupation) and Aboriginal places (areas of cultural significance to the Aboriginal community) across NSW. An Aboriginal place is any place declared to be an Aboriginal place by the Minister for the Environment, under section 84 of the Act. An Aboriginal object is defined as:

> *Any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction and includes Aboriginal remains.*

It is an offence to disturb Aboriginal objects or places without an AHIP administered under section 90 of the Act. In addition, anyone who discovers an Aboriginal object is obliged to report the discovery to the relevant authorities.

NCOPL is committed to avoiding destruction, damage or defacement of any known Aboriginal objects as defined under the NP&W Act.

Aboriginal Land Rights Act 1983 (NSW)

The *Aboriginal Land Rights Act 1983* allows for the transfer of ownership to a Local Aboriginal Land Council of vacant Crown Land not required for an essential purpose or for residential land. These lands are then managed and maintained by the Local Aboriginal Land Council.

Consultation throughout all stages of mine development has been conducted with the Narrabri Local Aboriginal Land Council (**NLALC**). The NLALC will be actively consulted regarding mine operations and rehabilitation activities that may have an impact on Aboriginal cultural heritage values.

1.4.2 Statutory approvals

Project Approval

This Plan has been developed in accordance with Schedule 3 Condition 4 of the Project Approval which requires NCOPL to prepare an Extraction Plan for all second workings within the area of the Approved Mine Plan (Appendix H of EP 203-206) to the satisfaction of the Secretary.

In accordance with Schedule 3 Condition 4(h), the Extraction Plan must include a Heritage Management Plan which has been prepared in consultation with Heritage NSW and the relevant stakeholders for Aboriginal heritage (section 1.6), and which provides for the management of potential environmental consequences of the proposed second workings on Aboriginal heritage sites or values.

Schedule 3 Condition 4(b) of the Project Approval requires the Extraction Plan and its sub plans to be approved by the Secretary prior to NCOPL carrying out any of the second workings covered by EP 203-206.

Project Approval Schedule 6 Condition 2 lists the requirements for the preparation of management plans which must be prepared in accordance with any relevant guidelines (section 1.2 and section 1.6) and include details of the relevant approval, licence or lease conditions. Attachment 1, Table A1-1 provides a summary of the Project Approval conditions relevant to this Plan and outlines the section of the EP-HMP in which each of these conditions have been addressed. Table A1-2 provides the relevant SoCs and a cross reference table to where these commitments have been addressed.

EPBC Act Approval

The Narrabri Mine was granted EPBC 2009/5003 in 2011 issued under the EPBC Act (last varied on 24 March 2021).

Mining lease

NCOPL are the holder of ML 1609 (issued in January 2008 and varied 19 August 2022).

1.5 Risk assessment

A subsidence risk assessment has been undertaken to identify the risks associated with subsidence at the Narrabri Mine. It builds on previous risk assessments completed for LW 101 to LW 110 and Panels 201 to 202 and is presented as Appendix I to EP 203-206. The updated risk assessment for LW 203 to LW 206 assessed risks identified within the Extraction Plan Area as either low or moderate.

The potential environmental impacts and consequences relevant to Aboriginal cultural heritage are further discussed in section 3 and section 4.

1.6 Preparation and consultation

Aboriginal stakeholder consultation undertaken for the preparation of this EP-HMP was conducted in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (NSW Department of Environment Climate Change & Water [**DECCW**] 2010), and Schedule 3 Condition 4(h) of the Project Approval.

The draft EP-HMP (Revision A) was provided to the RAPs (i.e. the Narrabri Local Aboriginal Land Council [**NLALC**] and the Gomeroi Narrabri Aboriginal Council [**GNAC**]) on 26 October 2022. The draft EP-HMP (Revision A) was also provided to Heritage NSW as Appendix D to EP 203-206 on 8 November 2022.

The NLALC provided a response with key issues raised regarding salvaging artefacts, NCOPLs keeping place and the protection of the Grinding Groove site (Mayfield GG1). NCOPL did not receive a response from the GNAC. Heritage NSW provided a consultation response email (dated 20 November 2022) which states that Heritage NSW have no additional comments on the draft EP-HMP. Attachment 2 provides evidence of the consultation process, including a cross reference table addressing the comments received and detailing the section of the Plan where these comments have been addressed (Table A2-1).

The EP 203-206 (Revision 0) was submitted to DPE for approval on 13 February 2023. NCOPL received post submission recommendations from the Independent Expert Advisory Panel for Mining (IEAPM [formerly IAPUM]) on 14 February 2023 and 30 March 2023.

Due to the timeframe required for NCOPL to adequately respond to the post submission recommendations from IEAPM, and to prevent a discontinuation of mining, NCOPL submitted a request to obtain progressive approval in accordance with Schedule 2 Condition 11 of the Project Approval. NCOPL received progressive approval from DPE on 7 May 2023 to continue mining in LW 203 only subject to conditions.

Condition 3 of the progressive approval states:

Within 6 months of this approval, Narrabri Coal must provide a detailed response to the Panel's recommendations in relation to Aboriginal heritage.

NCOPL addressed Condition 3 via a response letter dated 30 November 2023. DPE provided a response to this letter via email on 21 December 2023 requesting additional information prior to re-submitting the EP-HMP for approval as follows:

- IEAPM recommendations and advice has not been adequately addressed and there is key information missing or deferred from the response.
- DPE requests that a detailed response is provided to addresses the Panel's Aboriginal heritage recommendations in full. Specifically, the response should include:
  - revised subsidence predictions that confirm the estimated tensile and compressive strains with the implementation of proposed mitigation measures; and
  - all management plans relevant to complying with the performance measures for Mayfield GG1, in the form of an updated Extraction Plan – Heritage Management Plan LW 203-206.

Revision 0B of the EP-HMP (this Plan) has been revised to address DPHI and IEAPM's request for further refinement of NCOPLs response to Condition 3 of the progressive approval, including the Mayfield GG1 Action Plan (Attachment 3). This EP-HMP and Attachment 3 were both provided to NLALC on the 15 August 2024 and a consultation meeting between NCOPL and NLALC was held on 2 September 2024. Attachment 2 provides evidence of the consultation process, including a cross reference table addressing the comments received and detailing the section of the Plan where these comments have been addressed (Table A2-1).

1.7 Access to information

In accordance with Schedule 6 Condition 10 of the Project Approval, the approved EP 203-206, audits and reports, and summaries of all monitoring data (where relevant) will be made publicly available on the WHC website. All information will be kept up to date. Note that any printed copies of this EP-HMP are uncontrolled.

2. Cultural heritage sites

2.1 Known Aboriginal cultural heritage sites

Previous archaeological surveys have identified 37 Aboriginal cultural heritage sites within the Extraction Plan Area (Figure 2-1). The 37 sites comprise of 29 artefact scatters, seven isolated artefacts, and one grinding grooves site (Table 2-1).

Most of the 37 sites have been assessed as being of low scientific significance due to disturbed contexts and low artefact densities (<10 artefacts). Mayfield GG1 (AHIMS 19-6-0191) has been assessed as being of medium scientific significance due to the regional rarity of this site type (i.e. grinding grooves). Eight artefact scatters have also been assessed as being of medium scientific significance due to higher artefact numbers and the potential for in-situ subsurface deposits. Mayfield AS13 (19-6-0192) incorporates five other artefact scatters. All 37 sites are considered to be of high cultural significance to the RAPs.

Predictions of subsidence impacts and potential consequences to the identified Aboriginal cultural heritage sites are described in section 3.

Table 2-1 Identified Aboriginal heritage sites within the Extraction Plan Area

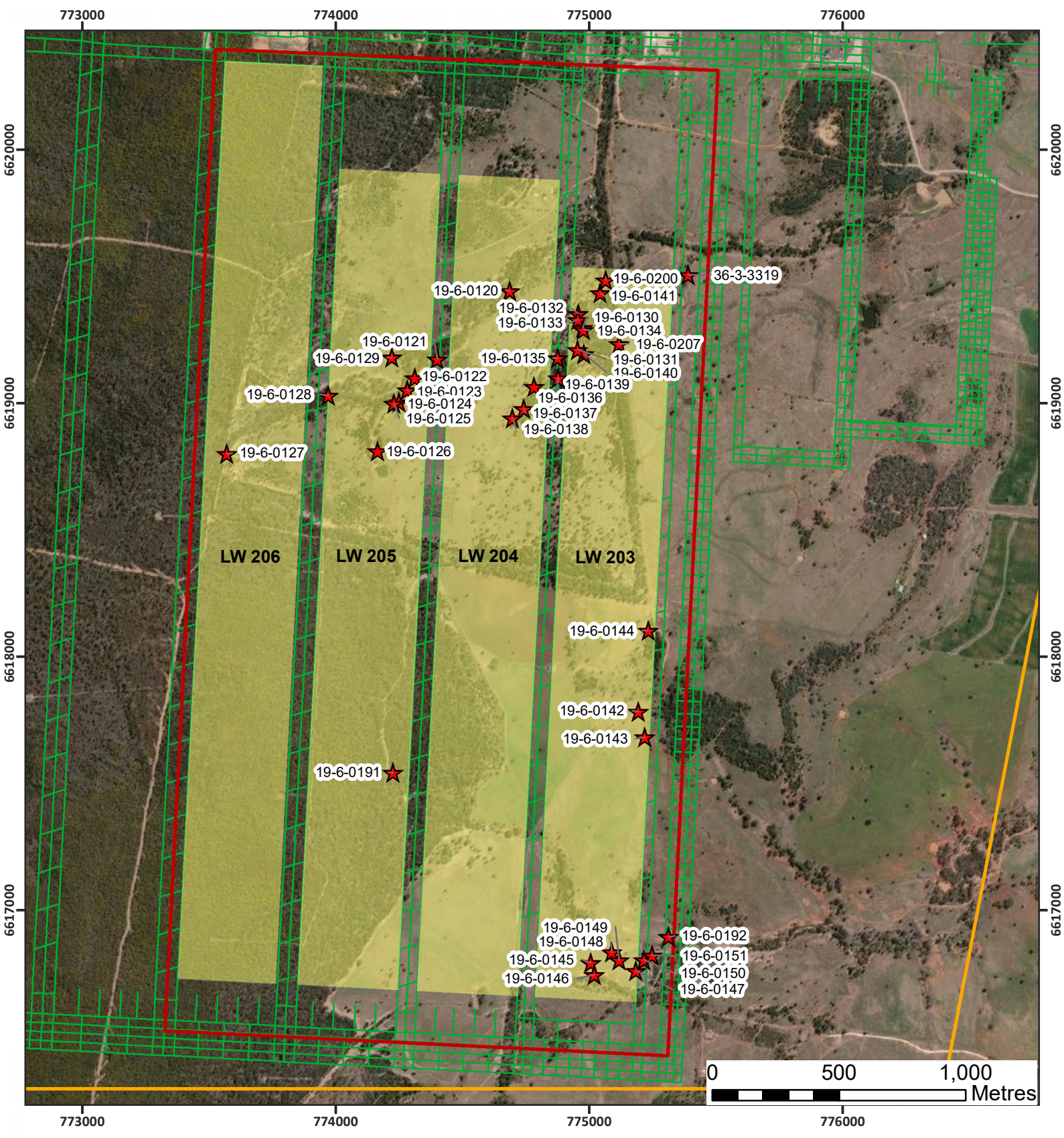
AHIMS ID	Site name	Easting Zone 55	Northing Zone 55	Type	Contents	Scientific significance	LW
19-6-0120	Kurrajong T1/ISO 81	774687	6619444	IA[1]	1	Low	204
19-6-0121	Kurrajong T1/OS 82	774400	6619174	AS[2]	9	Low	205
19-6-0122	Kurrajong T1/OS 83	774312	6619099	AS	7	Low	205
19-6-0123	Kurrajong T1/OS 84	774282	6619053	AS	5	Low	205
19-6-0124	Kurrajong T1/OS 85	774250	6619003	AS	3	Low	205
19-6-0125	Kurrajong T1/OS 86	774230	6618998	AS	2	Low	205
19-6-0126	Kurrajong T1/ISO 87	774166	6618811	IA	1	Low	205
19-6-0127	Kurrajong T1/OS 88	773570	6618800	AS	2	Low	206
19-6-0128	Kurrajong T1/ISO 89	773971	6619030	IA	1	Low	205
19-6-0129	Kurrajong T1/OS 90	774221	6619181	AS	5	Low	205
19-6-0130	Kurrajong T1/OS 91	774975	6619298	AS	2	Low	203
19-6-0131	Kurrajong T1/ISO 92	774954	6619212	IA	1	Low	203
19-6-0132	Kurrajong T1/OS 93	774958	6619354	AS	2	Low	203
19-6-0133	Kurrajong T1/OS 94	774955	6619330	AS	6	Low	203
19-6-0134	Kurrajong T1/OS 95	774977	6619291	AS	7	Low	203
19-6-0135	Kurrajong T1/OS 96	774877	6619178	AS	3	Low	203
19-6-0136	Kurrajong T1/ISO 97	774783	6619064	IA	1	Low	204
19-6-0137	Kurrajong T1/OS 98	774742	6618977	AS	2	Low	204
19-6-0138	Kurrajong T1/OS 99	774697	6618941	AS	2	Low	204

AHIMS ID	Site name	Easting Zone 55	Northing Zone 55	Type	Contents	Scientific significance	LW
19-6-0139	Kurrajong T1/OS 100	774878	6619099	AS	4	Low	203
19-6-0140	Kurrajong T1/ISO 101	774980	6619194	IA	1	Low	203
19-6-0141	Kurrajong T1/OS 102	775044	6619434	AS	3	Low	203
19-6-0142	Kurrajong CR/OS 103	775195	6617782	AS	3	Low	203
19-6-0143	Kurrajong CR/OS 104	775220	6617682	AS	2	Low	203
19-6-0144	Kurrajong CR/OS 105	775233	6618102	AS	3	Low	203
19-6-0145	Kurrajong CR/OS 106	775007	6616792	AS	3	Medium	203
19-6-0146	Kurrajong CR/OS 107	775020	6616744	AS	34	Medium	203
19-6-0147	Kurrajong CR/OS 108	775185	6616760	AS	12*	Medium*	203
19-6-0148	Kurrajong CR/OS 109	775089	6616834	AS	4*	Medium*	203
19-6-0149	Kurrajong CR/OS 110	775119	6616801	AS	3*	Medium*	203
19-6-0150	Kurrajong CR/OS 111	775217	6616803	AS	36*	Medium*	203
19-6-0151	Kurrajong CR/OS 112	775248	6616821	AS	50*	Medium*	203
19-6-0191	Mayfield GG1	774227	6617543	GG[3]	48	Medium	205
19-6-0192	Mayfield AS13	775312	6616894	AS	130	Medium	203
19-6-0200	Westhaven AS1	775066	6619486	AS	4	Low	203
19-6-0207	Westhaven IA1	775119	6619486	IA	1	Low	203
36-3-3319	Kurrajong T1 OS 136	775391	6619507	AS	11*	Low	203

Note:

* Has been subsumed into (is part of) the much larger Mayfield AS13.

[1] Individual artefact, [2] Artefact scatter, [3] Grinding groove.



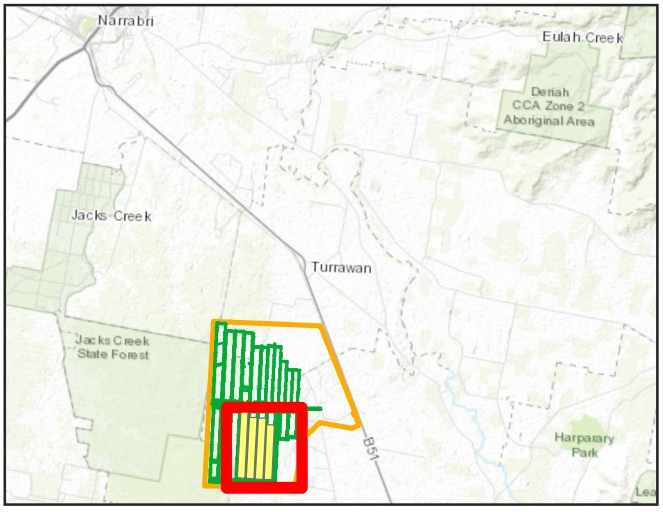


FIGURE 2-1: Aboriginal Cultural Heritage Sites Within the Extraction Plan Area

- AHIMS Search Area
- LW Panel
- Mine Plan
- ML 1609
- AHIMS Site

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Drawn by: K. Whincop, 3 Nov 2022
Projection: GDA 1994 MGA Zone 55
Data sources: Heritage NSW, Whitehaven Coal Group, Whitehaven Aerial Image 28/4/2019

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2.2 Potential for additional sites

The eastern half of the Extraction Plan Area is located on land that has been cleared and used for pastoral activities for more than 100 years. As a result, Aboriginal objects located within this area will likely not be in their original depositional context, having been impacted by a combination of land clearing, harrowing, ploughing, and the construction of contour banks and dams. The western half of the Extraction Plan Area is located within the regenerating scrub of the Pilliga East State Forest. While the ground surface in these areas has not been subject to significant disturbance, the nature of the thick scrub is considered a suboptimal landscape for occupation sites. It is unlikely that Aboriginal camp sites will occur in these areas, although resource acquisition sites (e.g. scarred trees) and burials (e.g. due to the sandy soils) remain possible.

Previous archaeological surveys have noted that the potential for larger unidentified sites is relatively low, given the lack of reliable water sources, few exposures of sandstone bedrock, and no rock overhangs. Archaeological surveys have identified a concentration of artefact sites along Kurrajong Creek and one of its tributaries, with little identified beyond these watercourses.

3. Subsidence predictions and environmental consequences

3.1 Subsidence predictions

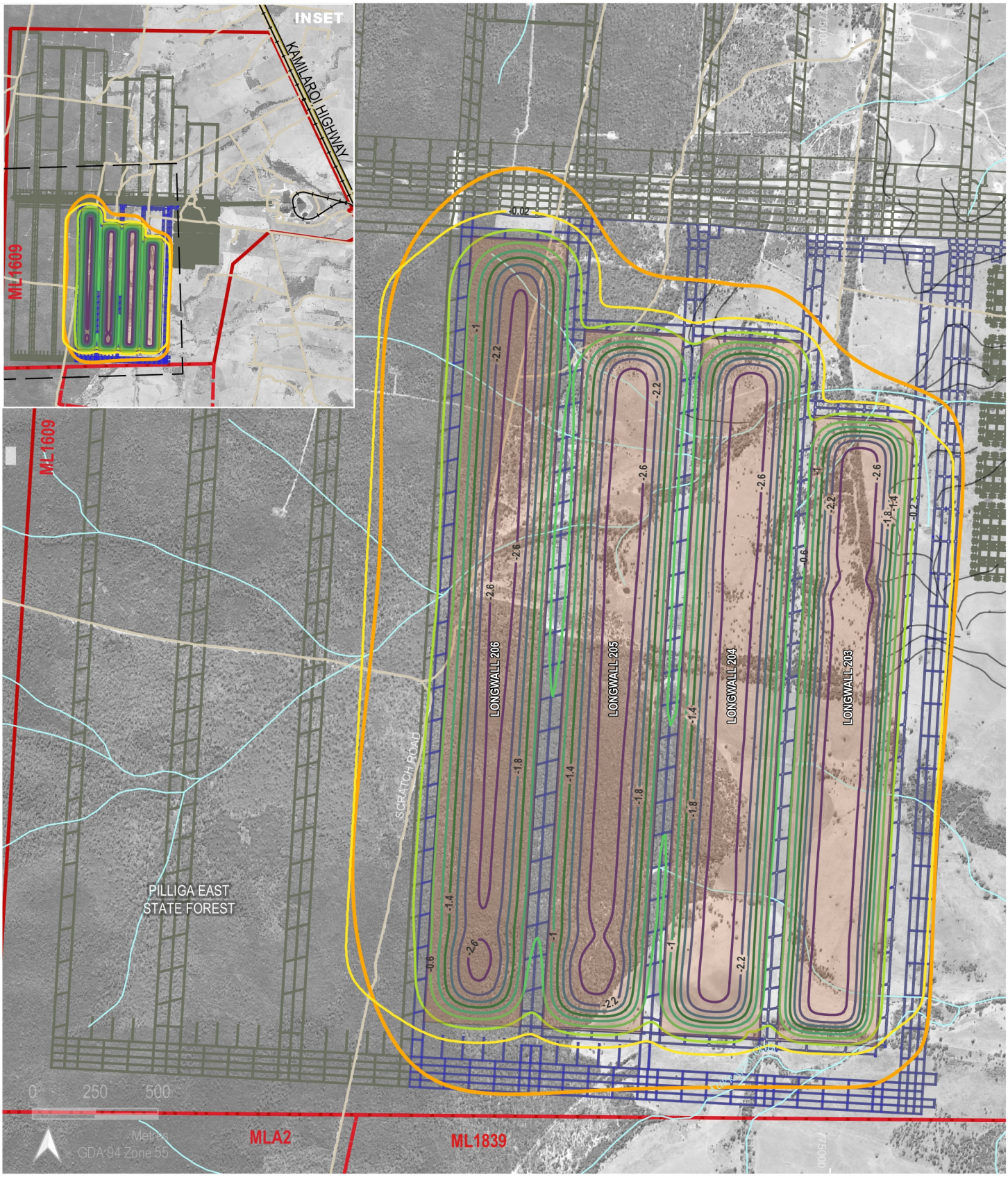
Subsidence predictions for the Extraction Plan Area were assessed and are presented in the Mine Subsidence Assessment Report (DGS 2022). The Mine Subsidence Assessment Report details the potential impacts to natural, man-made and Aboriginal heritage features within the Extraction Plan Area based on the predictions of conventional and non-conventional subsidence. The predictions include a review of the subsidence effects measured above previously mined LW 101 to LW 109.

The predicted maximum subsidence estimates for the Extraction Plan Area are summarised in Table 3-1 and shown in Figure 3-1.

Table 3-1 Maximum final subsidence effect predictions

LW	Cover depth (m)	Subsidence (m)	Tilt (mm/m)	Tensile strain (mm/m)	Compressive strain (mm/m)
203	200-208	2.63 - 2.80	34 - 54	15 - 32	16 - 35
204	230-242	2.72 - 2.80	29 - 47	11 - 26	12 - 27
205	248-282	2.75 - 2.80	24 - 39	9 - 19	9 - 21
206	280-311	2.75 - 2.80	20 - 33	7 - 15	7 - 16

Source: adapted from Table 4 (DGS, 2022)



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Subsidence contours (m)

- -0.02
- -0.2
- -0.6
- -1
- -1.4
- -1.8
- -2.2
- -2.6

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FIGURE 3-1

Predicted Subsidence Contours
for LW 203 to LW 206

3.1.1 Surface cracking

Based on the predicted range of maximum transverse tensile strains for the proposed longwall panels (i.e. 7 mm/m to 32 mm/m), surface crack widths are estimated to range from approximately 210 mm to 330 mm in cohesionless soils and from approximately 420 mm to 650 mm in cohesive soils or shallow rock (Table 3-2). Cracks usually develop within several days after a longwall face has retreated beneath a given location, with some of the cracks closing in the compression zone in the middle of the fully developed subsidence trough, together with new cracks developing in the tensile zones along and inside the panel sides approximately two to three weeks later.

Surface crack widths are upper 95% confidence level (**U95%CL**) values (to the nearest 10 millimetre [**mm**]), which means they may be exceeded 5% of the time (by definition) due to adverse topographic or geological conditions. Whilst this effect is unlikely to occur within the Extraction Plan Area, crack widths may exceed the predicted range near the crests of steep creek banks or elevated ridges. The steep rocky slopes above LW 204 and LW 205 are considered likely to be impacted by surface cracking more than 300 mm wide. Based on the above, it is estimated that approximately 0.02 kilometres squared (**km^2**) to 0.04 km^2 of the surface will be crack affected. This represents 0.13% to 0.27% of the extracted longwall area.

Based on reference to the Australian Coal Industry's Research Program (2003), surface cracks will likely develop by the time the longwall face has retreated past a given location for a distance equal to one to two times the cover depth (i.e. ranging from 170 m to 840 m, based on cover depths at the Narrabri Mine).

Further detail on steep slopes and sub surface cracking relevant to the Extraction Plan Area is presented in the Extraction Plan – Land Management Plan (appendix B to EP 203-206).

Table 3-2 Predicted maximum crack width in flat terrain

LW	Cross section cross-line (XL)	Panel width [W] (m)	Cover depth [H] (m)	Panel W/H	Effective bay length* (m)	Predicted maximum tensile strain (mm/m)		Predicted U95%CL crack width (mm)	
						Mean	U95%	Sand or Loam	Clay or Rock
203	6	402.8	208	1.94	10.4	15	29	300	600
	7	402.8	200	2.01	10.0	15	31	310	620
	8	402.8	204	1.97	10.2	16	32	330	650
204	6	402.8	232	1.74	11.6	12	24	280	560
	7	402.8	242	1.66	12.1	11	23	280	560
	8	402.8	230	1.75	11.5	13	26	300	600
205	6	399.7	248	1.61	12.4	10	20	250	500
	7	399.7	282	1.42	14.1	9	17	240	480
	8	399.7	275	1.45	13.8	9	19	260	520
206	6	395.3	280	1.41	14.0	8	15	210	420
	7	395.3	311	1.27	15.6	7	14	220	440
	8	395.3	304	1.3	15.2	8	15	230	460

Source: DGS, 2022 (Table 7)
* - max (H/20, 10m)

3.1.2 Ponding

The Mine Subsidence Assessment Report predicts a maximum panel subsidence of up to 2.8 m, which may result in closed form depressions forming in some of the central areas of the longwall panels with flatter surface gradients and disrupt natural drainage pathways to watercourses and farm dams. Analysis of the pre and post-mining surface levels suggests that ponding (if it occurs) is likely to develop along Kurrajong Creek and its tributaries.

A total of six potential ponding locations have been assessed within the Extraction Plan Area. Five of the potential ponding areas already exist along the watercourses and dams. Existing (pre-mining) and post-mining pond depths are estimated to range from 0.1 m to 4.7 m. Pond depths are estimated to increase by up to 1.3 m or decrease by up to 0.04 m.

The maximum changes in pond area (where positive represents an increase in pond area) are estimated to range from -0.42 ha to 2.92 ha. The maximum changes in pond volume (where positive represents an increase in pond volume) are estimated to range from -0.23 ML to 20.6 ML[3]. The largest ponding increases are estimated over LW 203 and LW 205.

Overall, the existing ponds are expected to extend laterally from the watercourses for distances ranging from 50 m to 410 m. Existing ponded areas extend up to 270 m, indicating a potential lateral increase of up to 140 m.

3.2 Potential impacts to Aboriginal cultural heritage sites

Subsidence effects on Aboriginal cultural heritage sites within the Extraction Plan Area may include:

- vertical displacement;
- cracking;
- ponding;
- erosion; and
- subsidence remediation works.

3.2.1 Artefact sites

The majority of artefact scatters and isolated artefacts occur on actively degrading surfaces, and it is assumed that most of the artefacts have already been displaced by slope-wash, stock movement, land clearance, ploughing, harrowing and vehicular traffic. There will be few artefacts in their original depositional context or provenance, and the direct impact of subsidence (vertical or horizontal displacement) is likely to be minimal. As a result, subsidence impacts on these sites will be minimal and therefore negligible. Significant subsidence events (cracks larger than 50 mm in width) and subsequent site remediation works, such as the ripping of large surface cracks or channel earthworks, have the potential to impact artefact scatters. It is unlikely that cracking alone will impact surface artefacts, although they may be displaced through related surface erosional processes.

[3] The actual ponding depths, areas and volumes will also depend upon several other factors, such as rain duration, surface cracking and effective percolation rates of the surface soils along the creeks/drainage lines.

3.2.2 Mayfield GG1

One axe grinding grooves site, Mayfield GG1 (AHIMS 19-6-0191), has been identified as occurring above LW 205 (Figure 3-2). It appears that the 48 grinding grooves associated with this site are located on outcrops of sandstone bedrock.

The likelihood of damage occurring at Mayfield GG1 was assessed in the Mine Subsidence Assessment Report based on the impact parameter criteria detailed in Table 3-3. The criteria consider the theoretical cracking limits of rock of 0.3 mm/m to 0.5 mm/m and the 'system' slackness or strain 'absorbing' properties of a jointed, thinly bedded and highly weathered rock mass during subsidence deformation. The lack of measured observed impact (i.e. surface cracking) due to measured strains of up to 3 mm/m at several Newcastle Coalfield mines is an example of the difference between theoretical and in-situ rock mass cracking behaviour.

The Mine Subsidence Assessment Report predicted subsidence effects and impacts for Mayfield GG1 to be subject to transient tensile strains of up to 5 mm/m and final compressive strains of 5 mm/m indicating it is 'possible' (10 to 50% probability) to 'likely' (>50% probability) that the grooves may be impacted by cracking.

The Mayfield GG1 Technical Review revised these predictions in accordance with Table 3-3 based on the proposed slotting mitigation measure. The revised Mayfield GG1 subsidence effects and impact predictions are detailed in Attachment 3.

Table 3-3 Impact potential criteria for Mayfield GG1

Cracking damage potential - indicative probabilities of occurrence	Predicted 'smooth profile' horizontal strain (mm/m)	
	Tensile	Compressive
Very Unlikely (<5%)	< 1	< 2
Unlikely (5 - 10%)	1 - 3	2 - 4
Possible (10 - 50%)	3 - 5	4 - 6
Likely (>50%)	> 5	> 6
Erosion damage potential - indicative probabilities of occurrence	**Predicted surface gradient change or tilt increase**	
Very Unlikely (<5%)	<0.3% (<3 mm/m)	
Unlikely (5 - 10%)	0.3-1% (3 - 10 mm/m)	
Possible (10 - 50%)	1-3% (10 - 30 mm/m)	
Likely (>50%)	>3% (>30 mm/m)	

3.3 Site fencing

Fences around the Aboriginal cultural heritage sites may be damaged and require repair after mining. Impact to fences may include straining and possibly tensile failure of fencing wire strands in tensile strain zones and/or sagging of fencing wire strands and possibly loss of fence serviceability in compressive strain zones.

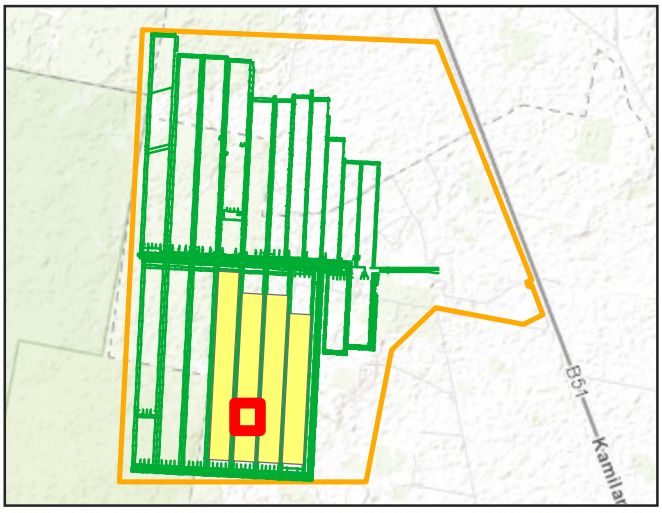

FIGURE 3-2: Context of Mayfield GG1

AHIMS Site
ACH Site Extent
LW Panel
Mine Plan
ML 1609

N

Drawn by: K. Whincop, 3 Nov 2022
Projection: GDA 1994 MGA Zone 55
Data sources: Heritage NSW, Whitehaven Coal Group, Whitehaven Aerial Image 28/4/2019

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4. Management measures

In accordance with Schedule 2 Condition 1 of the Project Approval, NCOPL will implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation activities at the Narrabri Mine.

The objectives, performance measures and management actions detailed in the following sections have been developed in consultation with the RAPs, in consideration of the scientific and cultural significance of sites identified within the Extraction Plan Area.

4.1 Objectives

The objectives for the management of Aboriginal cultural heritage sites within the Extraction Plan Area are to:

- identify, as far as practical, all Aboriginal cultural heritage sites and objects;
- consult and actively involve the RAPs in the management of Aboriginal cultural heritage sites and objects;
- advise mine staff and contractors of their personal responsibility in avoiding, managing and mitigating impacts on Aboriginal cultural heritage sites, objects and resources;
- provide a process for mine staff and contractors to follow in managing Aboriginal cultural heritage during the carrying out of their day-to-day operational activities at the Narrabri Mine;
- salvage archaeological and cultural values at sites where impacts are unavoidable;
- provide suitable conservation measures to ensure on-going protection to those Aboriginal sites and objects not impacted;
- ensure NCOPLs commitment to best practice in the management and mitigation of Aboriginal cultural heritage is reflected in its environmental management policies and protocols; and
- meet the conditions of the Project Approval.

These objectives will be achieved by:

- implementing the proposed monitoring and management measures to reduce the likelihood of impacts caused by subsidence; and
- implementing a review, reporting, and auditing process to provide feedback on the proposed monitoring and management measures and to allow for continual improvement.

4.2 Performance measures and indicators

Schedule 4 Condition 22 of the Project Approval states in respect of a Heritage Management Plan that:

The Proponent shall not destroy damage or deface any known Aboriginal objects (as defined in the National Parks and Wildlife Act 1974) without the written approval of the Secretary.

Site specific performance measures and indicators have been developed for the protection of Aboriginal cultural heritage sites and values at the Narrabri Mine and are presented in Table 4-1.

Table 4-1 Aboriginal cultural heritage performance measures

Performance measure	Controls	Performance indicators
Subsidence induced surface cracking, vertical displacement or erosion does not destroy, damage or deface Aboriginal objects or cultural heritage values	Existing sites and any new sites identified are assessed for impacts and management measures implemented consistent with the site Aboriginal Cultural Heritage Management Plan (**ACHMP**).	Mitigation measures and monitoring program are undertaken in accordance with the relevant management plan (ACHMP and/or EP-HMP) No Aboriginal objects or cultural heritage values are destroyed, damaged or defaced. All salvages are to contemporary standards.
Site remediation works do not destroy, damage or deface Aboriginal objects or cultural heritage values.	Works are undertaken in accordance with this EP-HMP, the EP 203-206 Land Management Plan, and the site ACHMP.	
Aboriginal cultural heritage objects have been salvaged to contemporary standards.	Salvage of Aboriginal objects undertaken prior to impact in accordance with the approved EP-HMP and with approval of the Secretary.	
Subsidence does not destroy, damage or deface Mayfield GG1	Management of the site is to be in accordance with the approved EP-HMP and the action plan (Attachment 3), developed in consultation with a suitably qualified expert. Mitigation measures will be implemented at Mayfield GG1 based on advice of the Mayfield GG1 Technical Review: • A slotting trial site will be implemented above LW204 • The slotting design for Mayfield GG1 will be implemented pending the outcomes of the trial site monitoring program • Longwall mining under Mayfield GG1 can only occur with the approval of the Steering Committee • Mayfield GG1 will be monitored before, during and after longwall mining • Post mining and upon cessation of subsidence, the protection slots will be backfilled and rehabilitated.	Mitigation measures are implemented and monitoring is conducted in accordance with the approved EP-HMP and action plan (Attachment 3). The trial site demonstrates that internal strains are <2mm/m tensile strain and <2mm/m compressive strain. Mitigation measures are implemented in accordance with technical recommendations prior to mining in LW205. Monitoring demonstrates that subsidence has not impacted Mayfield GG1.

Monitoring will be used to assess the impact of mining operations against the performance measures and indicators presented in Table 4-1. If monitoring and assessment indicates an actual or potential non-compliance against a performance measure, NCOPL will implement the contingency measures outlined in section 6.

4.3 General mitigation measures

The site ACHMP requires NCOPL to implement a range of management measures developed in consultation with the RAPs, in consideration of the cultural and scientific significance of Aboriginal cultural heritage sites identified across the Narrabri Mine. In summary, these measures cover the:

- management of potential impacts of surface disturbance;
- requirements for site protection;
- requirements for ongoing RAP consultation;
- requirements of the Permit to Work system; and
- protocols and procedures such as the:
  - Site Salvage Procedure;
  - Discovery of Possible Human Remains Procedure;
  - Salvage and Curation of Scarred Trees Procedure;
  - Accidental Damage to Known Sites Procedure;
  - Unidentified Aboriginal Cultural Heritage Sites Procedure; and
  - Consultation and Communication Protocol.

Any soil disturbance works within 100 m of a watercourse or drainage line, or in areas not previously inspected by RAPs for cultural heritage purposes, require the presence of the RAPs to monitor the works and minimise the risk of Aboriginal objects being disturbed by the activities (section 5).

In addition, both prior to and during mining, and if requested by the RAPs, those sites identified within 50 m of surface cracking larger than 50 mm width, or in the event that subsidence remediation works will result in impacts becoming unavoidable (subject to reasonable efforts to avoid such sites), the sites will be collected in accordance with the site salvage procedure detailed in section 4.6

4.4 Fencing of sites

All known Aboriginal cultural heritage sites will be fenced and appropriately signed to avoid accidental damage. Fencing will fully enclose the extent of each site, to be determined according to the Aboriginal Cultural Heritage Sites Database and in consultation with a qualified archaeologist and the RAPs.

Subsidence impacts to fencing will be determined via monitoring (refer to section 5). If impacts are observed, NCOPL or nominated contractor will rectify any damage as required.

4.5 Remediation of surface cracks and ponding

4.5.1 Surface cracking

NCOPL will conduct remediation of surface cracking where the crack width is more than 50 mm in accordance with the Extraction Plan – Land Management Plan. A preliminary assessment will be undertaken to minimise the environmental impact of remediation actions. Prior to any remediation, NCOPL will undertake a review of environmental impacts (including impacts to biodiversity values) that may result from the remediation at the specific location and consider whether remediation will create an increased impact (e.g. clearing native

vegetation to enable machinery access or major drainage works that will cause a greater impact from excavation). If the assessment concludes that there may be the potential to increase impacts on biodiversity, alternative methods of remediating the crack are warranted (e.g. without machinery).

After surface cracks have been remediated, NCOPL will conduct an inspection within three months to identify if further remediation is required, and then annually thereafter until no visible cracking is evident.

In addition to the above, a procedure for subsidence repair within a known Aboriginal cultural heritage site or, within 10 m of a site, the *Narrabri Mine Subsidence Repair in ACH sites* (WHC-PRO-NAR-SUBSIDENCE REPAIR IN ACH SITES) will be implemented. The procedure aims to enable remediation activities which avoid and/or minimise any potential adverse impacts to Aboriginal cultural heritage values.

4.5.2 Ponding

A set of criteria to determine the most suitable option for the management and remediation of ponding is presented in the EP-Water Management Plan (**EP-WMP**). Remediation of ponded areas will consider the following:

- ponding located in areas where vegetation is not affected, will be allowed to self-correct;
- ponding located in areas with affected vegetation, or if ponding significantly alters or affects flows, will be assessed and remedial actions (that present the lowest environmental impact) developed in consultation with a geomorphologist; and/or
- if downstream water quality analysis indicates a change in EC trends, the ponding will be assessed, and remediation options will be developed to afford the maximum practical protection to the affected feature.

4.6 Site salvage

The following describes the process for site salvage:

1. Seek the written approval from the Secretary prior to commencing any salvaging works and apply for a ‘Transfer of Aboriginal Objects’ permit required by section 85A of the NP&W Act.
2. Peg the location of the site to be salvaged.
3. Commission an archaeologist and invite representatives from the RAPs to salvage all visible artefacts by hand collection or excavation if warranted (e.g. undisturbed subsurface deposits are likely to exist).
4. The archaeologist will provide a Salvage Report outlining the results of the salvage activity, including a list and basic description of artefacts collected. The report will also provide recommendations for further detailed analysis, if warranted by the nature of the salvage activity (e.g., if artefacts were excavated from an undisturbed subsurface deposit associated with a rare or unusual cultural feature or object). When undertaken, artefact analysis will be completed within 6 months of the salvage program, and a short report outlining the results of the analysis prepared upon completion of the analysis.
5. Place the salvaged material in the care and control, requiring authorisation under a Care Agreement, of the Aboriginal organisation agreed by the RAPs. Narrabri Mine has agreed to provide a ‘Keeping Place’ within the Mining Leases.
6. Provide copies of the Salvage Report to DPHI, the RAPs and Heritage NSW within 12 months of completing the salvage.

4.7 Keeping place

Consultation with the RAPs to identify a culturally appropriate keeping place for all salvaged material from the Narrabri Mine has begun. Although a final Keeping Place has not yet been determined, a Care Agreement (as required under the NP&W Act), will be required for all salvaged artefacts. An Interim Keeping Place has been established for the storage of salvaged Aboriginal objects from the salvage program. This Interim Keeping Place consists of a locked cupboard within the NCOPL offices at the mine site.

Consultation regarding the final Keeping Place is ongoing and will be discussed with all RAPs at the biennial RAP consultation meetings.

Following closure of the mine, RAPs will be consulted to determine whether and, if so, where previously salvaged artefacts will be repatriated back to Country.

5. Subsidence impact monitoring

NCOPL will undertake monitoring of Aboriginal cultural heritage sites in accordance with Table 5-1. The monitoring program for Mayfield GG1 is detailed further in Attachment 3.

Table 5-1 Aboriginal cultural heritage subsidence monitoring program for LW 203 to LW 206

Aspect	Monitoring requirement	Timing
Aboriginal cultural heritage sites	Monitoring of Mayfield GG1 (AHIMS 19-6-0191) above LW 205 to assess crack development and potential for erosion.	As detailed in Appendix 3.
	Inspections (including photographs) of all sites above a given longwall panel to record condition of each site. These inspections will be undertaken by a qualified archaeologist in consultation with RAPs.	Prior to, and within six months of the cessation of mining.
	Audit of existing site fences to ensure fencing is maintained and in good condition.	Annually.
Subsidence	Visual subsidence inspections to determine surface cracking, ponding, and erosion. Monitoring to determine if remediation works and/or salvage is required and if repairs to Aboriginal cultural heritage site fencing is needed. Subsidence monitoring will be conducted in accordance with the Subsidence Monitoring Program (Appendix K to EP 203-206).	Monthly during mining, directly behind the longwall face. Following a significant rainfall event.*
	Inspection of remediated areas.	Within three months of remediation.
Surface disturbance	Any soil disturbance work within 100 m of a watercourse or drainage line is to be monitored by representatives of the RAPs (i.e. Cultural Heritage Monitors).	During disturbance activities within 100 m of watercourse or drainage line.

Note:
* defined as a rainfall event >38.4 mm over 5 consecutive days.

6. Contingency response

In the event that a non-compliance against a performance measure detailed in section 4.2 has occurred, or is likely to occur, NCOPL will:

1. Report the non-compliance as soon as practicable to the relevant agencies as required under the Project Approval and relevant legislation in accordance with section 7.
2. Identify and implement an appropriate course of action with respect to the non-compliance in consultation with a suitably qualified person/s, relevant agencies and the RAPs.
3. Review the effectiveness of the EP-HMP management measures in accordance with section 8.3.

A Trigger Action Response Plan (Table 6-1) has been developed to identify, assess, and respond to triggers and manage risks associated with meeting the Aboriginal cultural heritage performance measures. A site-specific TARP has been developed for Mayfield GG1 and is detailed in Attachment 3.

Table 6-1 Trigger Action Response Plan

Performance measure	Status	Trigger	Action	Response
Surface cracking, vertical displacement, or erosion				
Surface cracking, vertical displacement or erosion does not destroy, damage or deface Aboriginal objects or cultural heritage values.	**Normal**	• Surface cracks <50 mm present within 50 m of an Aboriginal cultural heritage site, and no erosion identified.	• Document occurrence of surface cracks.	• Continue monitoring in accordance with the EP-HMP.
	Level 1	• Surface cracks >50 mm present within 50 m of an Aboriginal cultural heritage site. and/or • Erosion as a result of cracking identified.	• Document occurrence of surface cracks. • Provide safety fencing and signage if required. • Advise relevant stakeholders.	As for Level 1 AND • Implement remediation measures as appropriate. These may include site salvage (section 4.6) and surface crack remediation as detailed in section 4.5.1. • Remediation will be conducted in accordance with the *Narrabri Mine Subsidence Repair in ACH sites*. For sites of a medium or high scientific significance: • Site to be inspected by representatives of the RAPs and an appropriately qualified specialist (e.g. archaeologist, geologist, geomorphologist) to determine the nature and extent of impacts, and to provide advice on whether mitigation is required or feasible. • Mitigation measures may include further monitoring, site salvage or open area salvage excavation (if warranted).
Ponding				
Ponding does not destroy, damage or deface Aboriginal objects or cultural heritage values.	**Normal**	No ponding occurs at Aboriginal cultural heritage site.	Nil	• Continue monitoring in accordance with the EP-HMP.
	Level 1	Ponding identified within proximity of an Aboriginal cultural heritage site.	• Advise relevant stakeholders.	As for Level 1 AND Implement remediation measures as appropriate. These may include salvage of cultural heritage (section 4.6) or remediation of ponding (section 4.5.2). For sites of a medium or high scientific significance: • Site to be inspected by representatives of the RAPs and an appropriately qualified specialist (e.g. archaeologist, geologist, geomorphologist) to determine the nature and extent of impacts, and to provide advice on whether mitigation is required or feasible. • Mitigation measures include further monitoring, surface site salvage, or open area salvage excavation (if warranted).

7. Incidents and non-compliance

7.1 Incident notification

An incident is defined under the Project Approval as *a set of circumstances that causes or threatens to cause material harm, and/or breaches or exceeds the limits of performance measures/criteria*. Material harm to the environment is defined under the Project Approval as *involving actual or potential harm to the health or safety of human beings or to the environment that is not trivial.* This definition excludes "harm" that is authorised under the Project Approval or any other statutory approval (e.g., the Environmental Protection License).

In the event of any exceedance of the performance criteria, NCOPL will advise the Secretary and any other relevant agencies as soon as practicable after becoming aware of the incident, in accordance with Schedule 6 Condition 4. Within 7 days of the event, NCOPL will also provide the Secretary and any relevant agencies a detailed report which will:

- describe the date, time and nature of the exceedance/incident;
- identify the cause (or likely cause) of the exceedance/incident;
- describe what action has been taken to date; and
- describe the proposed measures to address the exceedance/incident.

Notifications to the NSW Environment Protection Authority will be made by contacting the Environment Line on 131 555 and written details of the notification will be provided within 7 days of the date on which the incident occurred.

Incident reporting and emergency response is further described in NCOPLs Environmental Management Strategy.

7.2 Non-compliance

In accordance with Schedule 6 Condition 2, where a non-compliance with a statutory requirement/s or an exceedance of the relevant criteria or performance measures has occurred, NCOPL will, at the earliest opportunity, take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur. Once this has been achieved, all reasonable and feasible options for remediation (where relevant) will be considered.

In accordance with Schedule 6 Condition 4, within seven days of becoming aware of a non-compliance, NCOPL will notify DPHI of the non-compliance[4]. The notification will be made in writing via the Major Projects website and identify the development (including the development application number and name), set out the condition or requirement that the development is non-compliant with, why it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.

NCOPL will implement any reasonable remediation measures as directed by the Secretary, to the satisfaction of the Secretary.

[4] A non-compliance which has been notified as an incident under section 7.1 does not need to also be notified as a non-compliance under section 7.2.

8. Reporting, evaluation and review

8.1 Annual review

In accordance with Schedule 6 Condition 6, NCOPL will review the performance of its environmental management for the previous calendar year and report the relevant results within the Annual Review, to the satisfaction of the Secretary. The Annual Review will at minimum provide information regarding the effectiveness of the management measures to prevent, and if prevention is not reasonable and feasible, to minimise any impact on Aboriginal cultural heritage values.

Further, the Annual Review requires a number of items to be reviewed or assessed. In summary these are:

- monitoring results and complaints;
- non-compliances and incidents;
- compliance with performance measures;
- discrepancies between predicted and actual impacts; and
- measures to be implemented to improve environmental performance.

The Annual Review may also make recommendations for any additions, changes, or improvements to NCOPLs environmental management procedures.

The Annual Review will be made available on the WHC website.

8.2 Independent environmental audits

Prior to 13 September 2010, and every 3 years thereafter, unless the Secretary directs otherwise, NCOPL will commission and pay the full cost of an Independent Environmental Audit (**IEA**) of the development (Stages 1 and 2), to be conducted in accordance with the requirements of Schedule 6 Condition 7.

The audit team will be led by a suitably qualified auditor and the IEA will be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary.

8.3 Management plan review and evaluation

As required by Schedule 6 Condition 3 of the Project Approval, within three months of any of the following:

- completion of an IEA (as required by Schedule 6 Condition 7);
- submission of an Incident Report (as required by Schedule 6 Condition 4);
- submission of an Annual Review (as required by Schedule 6 Condition 6); and
- any modification to the conditions of the Project Approval (unless the conditions require otherwise).

NCOPL will then review, and if necessary, revise this EP-HMP. This is to ensure that the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the Narrabri Mine operations.

Condition 3 of Schedule 6 further states that if the review determines that this EP-HMP requires revision, then this will be completed to the satisfaction of the Secretary. A dedicated review register will be maintained which will provide the details of the review of all relevant strategies, plans and programs that need to be reviewed as

required by Schedule 6 Condition 3 of the Project Approval. The revision status of this EP-HMP is indicated in section 13.

8.4 Improvement measures

Project Approval Schedule 6 Condition 2(f) requires this Plan to include a program to investigate and implement ways to improve the environmental performance of the development over time. Improvement measures may be investigated through review of the following:

- monitoring data, and any assessment of trends;
- audit outcomes, including audits of Aboriginal cultural heritage management measures; and
- incident reports, including any community complaints.

Reasonable and feasible improvement measures will be implemented and documented as a management measure in a revision to the Plan as described in section 8.3.

In accordance with Schedule 6 Condition 2(g) a protocol for periodic review of this Plan has been addressed under section 8.3.

9. Complaints management

Any complaints received in relation to aboriginal heritage will be managed in accordance with the complaints management protocol as follows:

- Publicly advertised telephone complaints line, 1800WHAVEN, will be in place to receive complaints.
- Each complaint received will be recorded in a Complaints Register, which will include the following details:
  - date and time of complaint;
  - method by which a complaint was made;
  - personal details the complainant wishes to provide or, if no such details are provided, a note to that effect;
  - nature of the incident that led to the complaint;
  - action taken by NCOPL in relation to the complaint (i.e., any required remedial actions), including any follow-up contact with the complainant; and
  - if no action was taken, the reason why no action was taken.
- The Environmental Manager will be responsible for ensuring that an initial response is provided within 24 hours of receipt of a complaint (except in the event of complaints recorded when the mine is not operational or outside of usual business hours).
- Once the identified measures are undertaken, the Environmental Superintendent will sign off on the relevant complaint within the Complaints Register.
- If necessary, follow-up monitoring will take place to confirm the source of the complaint is adequately mitigated.
- A summary of the complaints will be maintained by NCOPL and made available to the Community Consultative Committee, the complainant (on request) and on the WHC website. A summary of complaints received every 12 months will be provided in the Annual Review.

In the event that any complainant considers that NCOPL has not adequately addressed their concerns, the NCOPL representative will convene additional meetings with the complainant.

10. Plan implementation

10.1 Roles and responsibilities

During the operational phases of the development, the Narrabri Mine will be managed by the General Manager who will have overall responsibility for ensuring contractors, employees and service providers comply with all laws, regulations, licences, and approvals. Table 10-1 outlines the roles and responsibilities applicable to this EP-HMP.

Table 10-1 Roles and responsibilities

Roles	Responsibilities
General Manager	• Ensure that adequate resources are available to NCOPL personnel to facilitate the completion of their responsibilities under this EP 203-206.
Mining Engineering Manager	• Ensure all contractors, sub-contractors and service-personnel are appropriately qualified, competent, and licensed to undertake the required work under this EP 203-206.
Environmental Manager	• Review and authorisation of changes to this EP 203-206 • Responsible for decision making in relation to the activation of TARP responses and/or contingency planning. • Manage incident, non-compliance and other reporting requirements. • Communicate with statutory agencies and departments, public authorities, and the community.
Environmental Superintendent	• Ensure that all environmental monitoring and reporting is undertaken in accordance with this EP 203-206 and various approval requirements, and is checked, processed, and filed appropriately. • Advise on matters identified in all approval, permit, licence, and consent documents and ensure all operations are conducted in compliance with those conditions, and all other environmental obligations.
Surface Operations Manager	• Provides notification to all mine personnel advising of potential subsidence hazards and impacts. • Maintains access to critical surface infrastructure and facilitates inspections and remedial works.
Civil Services Coordinator	• Inspect and monitor the condition and safety of roads and tracks around the mine site. • Remediates subsidence impacts to maintain trafficability of access roads and tracks.
Technical Services Manager	• Provide technical advice to support decision making in relation to the activation of TARP responses and/or contingency planning. • Liaise with stakeholders regarding subsidence impact management. • Decommission mining infrastructure prior to subsidence impacts.
Registered Mine Surveyor	• Ensure the subsidence monitoring program is implemented and adhered to.

10.2 Inductions and training

NCOPL seeks to minimise the risk of inadvertent damage to Aboriginal cultural heritage sites by promoting an awareness of heritage conservation via the induction process. All NCOPL personnel have a duty of care to protect and manage Aboriginal cultural heritage sites from adverse impacts.

All personnel undertaking work at the Narrabri Mine are required to complete an induction package, which includes a training module focusing on Aboriginal cultural heritage awareness. The module provides information in relation to the presence, identification, reporting and protection of Aboriginal cultural heritage sites within and surrounding the mine site.

The induction package was developed in consultation with the RAPs and is delivered through an NCOPL on-line portal.

NCOPL retains records of all completed inductions.

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12. Glossary

Term	Definition
Aboriginal cultural heritage site	Location of evidence of Aboriginal occupation (typically, Aboriginal objects, but also places of traditional or historical cultural value for which no Aboriginal objects exist).
Aboriginal object	As defined under section 5 of the NP&W Act.
Aboriginal place	As defined under section 5 of the NP&W Act.
Aboriginal remains	As defined under section 5 of the NP&W Act.
Active subsidence	The period of time that movement of the ground can occur after underground mining.
Angle of Draw	The angle with the vertical, made by a straight line extending away from the limits of extraction at seam level to the ground surface, spanning the horizontal distance in which subsidence may occur.
Artefact	An object made by human agency (e.g. stone artefacts).
Assessment	Refer to an environmental assessment of the environmental consequences of a project prior to the decision to move forward with the proposed action.
Compressive strain	A decrease in the distance between two points on the surface. This can cause shear cracking or steps at the surface if > 3 millimetres per metre (mm/m).
Cover depth	The depth of coal seam from the ground surface (metres).
Department	Planning and Assessment Group formerly within the NSW DPE, now within DPHI
Development	The Stage 2 development described in the EA as modified by the Project Approval.
Environmental consequences	The environmental consequences of subsidence impacts including: damage to built features; loss of surface flows to the sub-surface; loss of standing pools; adverse water quality impacts; development of iron bacterial mats; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts to aquatic ecology; ponding.
Extraction Plan Area	The area predicted to be affected by the proposed secondary extraction of the approved longwall panels LW 203 to LW 206.
First workings	Development of the main headings and gate roads to establish access to the coal in the mining area.
Incident	A set of circumstances that causes or threatens to cause material harm to the environment, and/or breaches or exceeds the limits of performance measures/criteria in the Project Approval.
In-situ	Situated in the original place.
Material harm	Material harm to the environment is defined in section 147 of the *Protection of the Environment Operations Act 1997*.
Minimise	Implement all reasonable and feasible mitigation measures to reduce the impacts of the Narrabri Mine.
Mining operations	The extraction, processing and transportation of coal on the site, including the formation of mine access drifts and associated surface infrastructure such as gas and water drainage facilities.
Mitigation	Activities associated with reducing the impacts of the development.
MOD 5	Reduced the number of longwall panels from 26 to 20; increased the longwall panel widths for LW 107 to LW 120 from approximately 295 m to approximately 400 m; extended the western footprint approximately 60 m; and increased the maximum ROM coal processing rate from 8 Mtpa to 11 Mtpa.

Term	Definition
MOD 7	Describes the change in mining method within the extent of the previously approved LW 201 and LW 202 and allows for up to 0.7 Mtpa via bord and pillar extraction at pillar reduction panels CF 201 to CF 205.
Narrabri Mine	The development approved under the Project Approval 05_0102 and Project Approval 08_0144.
Negligible	Small and unimportant, such as not worth considering.
Non-compliance	An occurrence, set of circumstances or development that is a breach of the conditions of the statutory approvals.
Project	The Stage 2 Narrabri Coal Project described in the EA.
Project Approval	Development consent (PA 08_0144) issued on 26th July 2010 under Section 75J of the Environmental Planning and Assessment Act 1979 by the Department of Planning & Infrastructure (as modified).
Registered Aboriginal Parties	As described in the National Parks and Wildlife Regulation 2019.
Rehabilitation	The treatment or management of land disturbed by the project for the purpose of establishing a safe, stable and non-polluting environment including the remediation of impacts.
Remediation	Activities associated with partially or fully repairing or rehabilitating the impacts of the project or controlling the environmental consequences of this impact.
Second workings	Extraction of coal from longwall panels, mini-wall panels, or pillar extraction.
Secretary	Planning Secretary under the EP&A Act, or nominee.
Site	Has the same meaning as Aboriginal cultural heritage site.
Stage 1	The project approval granted by the Minister Planning for the Narrabri Coal Project, dated 14 November 2007.
Stage 2	Narrabri Mine Stage 2 approved under Project Approval 08_0144.
Statement of Commitments	The Proponent's revised commitments in Appendix 3 of the Project Approval, dated May 2010.
Subsidence	The totality of subsidence effects, subsidence impacts and environmental consequences of subsidence impacts.
Subsidence effects	Deformation of the ground mass due to mining, including all mining-induced ground movements, such as vertical and horizontal displacement, tilt, strain and curvature.
Subsidence impacts	Physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs.
Tensile strain	An increase in the distance between two points on the surface. This is likely to cause cracking at the surface if it exceeds 2 mm/m. Tensile strains are usually associated with convex (hogging) curvatures near the sides (or ends) of the panels.
the Proponent	Narrabri Coal Operations Pty Ltd
Tilt	The rate of change of subsidence between two points (A and B), measured at set distances apart (usually 10m). Tilt is plotted at the mid-point between the points and is a measure of the amount of differential subsidence
Watercourse	A river, creek or other stream, including a stream in the form of an anabranch or tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events: In a natural channel, whether artificially modified or not, or in an artificial channel that has changed the course of the stream. It also includes weirs, lakes and dams.

13. Review history

Revision	Comments	Author	Authorised by	Date
0B	Issued for approval	Matt Whincop (Whincop Archaeology) Onward Consulting	B. Baker	22 August 2024

Attachment 1 Compliance conditions relevant to this Plan

Table A1-1 Project Approval conditions relevant to this Plan

Project Approval 08_0144 conditions		Document reference
Condition	**Requirement**	
Schedule 2 Condition 1	The Proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project.	Section 4
Schedule 2 Condition 11	With the approval of the Secretary, the Proponent may submit any management plan or monitoring program required by this approval on a progressive basis. ***Note**: The conditions of this approval require certain strategies, plans, and programs to be prepared for the project. They also require these documents to be reviewed and audited on a regular basis to ensure they remain effective. However, in some instances, it will not be necessary or practicable to prepare these documents for the whole project at any one time, particularly as these documents are intended to be dynamic and improved over time. Consequently, the documents may be prepared and implemented on a progressive basis, subject to the conditions of this approval. In doing this however, the Proponent will need to demonstrate that it has suitable documents in place to manage the existing operations of the project.*	There is no staging of the EP-HMP
Schedule 3, Condition 4 (h)	The Proponent shall prepare and implement Extraction Plans for any second workings to be mined to the satisfaction of the Secretary. Each Extraction Plan must: include a: **Heritage Management Plan**, which has been prepared in consultation with BCS and relevant stakeholders for Aboriginal heritage, to manage the potential environmental consequences of the proposed second workings on heritage sites or values; and;	Section 1.6 Section 1.4.2
	***Notes**:* *Management plans prepared under condition 4(h) should address all potential impacts of proposed underground coal extraction on the relevant features. Other similar management plans required under this approval (eg under conditions 13 and 23 of schedule 4 or condition 3 of schedule 5) are not required to duplicate these plans or to otherwise address the impacts associated with underground coal extraction.*	
Schedule 3, Condition 5	The Proponent shall ensure that the management plans required under Schedule 3 Condition 4(h) include:	
	a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval;	Section 3
	b) a detailed description of the measures that would be implemented to remediate predicted impacts; and	Section 4
	c) a contingency plan that expressly provides for adaptive management.;	Section 6
Schedule 6, Condition 2	The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
	a) detailed baseline data;	Section 2

Project Approval 08_0144 conditions		Document reference
Condition	**Requirement**	
	b) a description of:	
	• the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 1.4
	• any relevant limits or performance measures/criteria;	Section 4.2
	• the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures	Section 4.2
	c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria:	Section 4 Section 5
	d) a program to monitor and report on the:	
	• impacts and environmental performance of the project;	Section 5
	• effectiveness of any management measures (see (c) above);	
	e) a contingency plan to manage any unpredicted impacts and their consequences;	Section 6
	f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Section 8.4
	g) a protocol for managing and reporting any:	
	• incidents;	Section 7.1
	• complaints;	Section 9
	• non-compliances with statutory requirements; and	Section 7.2
	• exceedances of the impact assessment criteria and/or performance criteria; and	
	h) a protocol for periodic review of the plan.	Section 8.3
Schedule 6 Condition 3	Within 3 months of the submission of an:	Section 8.3
	a) audit under condition 7 of Schedule 6;	
	b) incident report under condition 4 of Schedule 6; and	
	c) annual review under condition 5 of Schedule 6; and	
	d) any modification to the conditions of this approval (unless the conditions require otherwise),	
	the Proponent shall review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Secretary.	

Project Approval 08_0144 conditions		Document reference
Condition	**Requirement**	
Schedule 6 Condition 4	The Proponent shall notify the Secretary in writing via the Major Projects website and any other relevant agencies of any incident associated with the project as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of the date of the incident, the Proponent shall provide the Secretary and any relevant agencies with a detailed report on the incident.	Section 7
Schedule 6 Condition 5	The Proponent shall provide regular reporting on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval, and to the satisfaction of the Secretary.	Section 1.7 Section 8.1
Schedule 6 Condition 6	By the end of March each year, the Proponent must submit a review of the environmental performance of the project for the previous calendar year to the satisfaction of the Secretary.	Section 8.1
Schedule 6 Condition 7	Prior to 13 September 2010, and every 3 years thereafter, unless the Secretary directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project (Stages 1 and 2).	Section 8.2
Schedule 6 Condition 10	The Proponent shall: (a) make copies of the following publicly available on its website: • the documents referred to in Condition 2 of Schedule 2; • all current statutory approvals for the project; • all approved strategies, plans and programs required under the conditions of this approval; • a comprehensive summary of the monitoring results of the project, reported in accordance with the specifications in any conditions of this approval, or any approved plans and programs; • a complaints register, updated on a monthly basis; • minutes of Community Consultative Committee meetings; • the annual reviews of the project; • any independent environmental audit of the project, and the Proponent's response to the recommendations in any audit; • any other matter required by the Secretary; and	Section 1.7
	(b) keep this information up-to-date, to the satisfaction of the Secretary.	Section 1.7

Table A1-2 Statement of Commitments

SoC requirements		EP-HMP reference
SoC	**Summary of the requirement**	
1.5	Advise relevant personnel on restrictions placed on activities by identification of sites of ecological or heritage significance and management requirements.	Section 10.2
5.7	Note the effects of any ponding and commission a hydrologist or ecologist to recommend remedial actions should the area of ponding encroach upon sites of conservation or heritage significance.	Section 4.5.2
5.16	For ponding where there is little or no vegetation of conservation significance) monitor the location and extent of ponding. If ponded area continues to increase in area, encroaches on vegetation of conservation significance or there is an increase in water salinity, excavate a channel to reduce the gradient change over the retained chain pillars. The excavation will be undertaken in accordance with an Aboriginal Cultural Heritage Management Plan and vegetation clearing procedures.	Section 4.5.2
9.1	Involve all site employees and contractors in an awareness program re: Aboriginal heritage issues.	Section 10.2
9.3	Erect a sign on the fencing identifying an “Environmental Protection Zone”.	Section 4.4
9.8	In the event that one of the Aboriginal sites (other than Aboriginal Sites 10, 19, 38 and 39) cannot be avoided, commission an archaeologist and invite representatives of registered Aboriginal stakeholders (Gomeroi and Narrabri LALC) to salvage the artefacts identified at the affected site (“the Salvage Area”).	Section 4.6
9.9	Undertake a full analysis of the material salvaged from within the Salvage Area by allowing the archaeologist to take the artefacts for further analysis.	Section 4.6
9.10	Return the salvaged artefacts to the authorised Aboriginal organisation.	Section 4.7
9.11	Place the salvaged artefacts in the care and control of the Aboriginal organisation agreed to by Narrabri LALC and Gomeroi. (The Proponent (if required) has agreed to provide an interim ‘keeping place’ in a designated storage facility within the Pit Top Area until such time as a suitable location is identified and agreed to by Narrabri LALC and Gomeroi).	Section 4.7
9.12	Commission the preparation of a report (“Salvage Report”) including full descriptions of the salvaged material, and an interpretation of the archaeological record within the Salvage Area.	Section 4.6
9.13	Provide copies of the Salvage Report to Narrabri LALC, Gomeroi and the DECCW	Section 4.6
9.15	Identify and protect through fencing and signage, those sites determined to be of high scientific significance as agreed and determined in consultation between the Proponent, the registered Aboriginal stakeholders and the archaeologist.	Section 4.4 Section 4.5
9.16	In the event that an identified site cannot be avoided, commission an archaeologist and invite representatives of registered Aboriginal stakeholders (Gomeroi and Narrabri LALC) to salvage the identified artefacts. All salvage is to be undertaken as per Commitments 9.9 to 9.13 above.	Section 4.6

SoC requirements		EP-HMP reference
SoC	**Summary of the requirement**	
9.18	Ensure that if any further Aboriginal artefacts are uncovered at any time during the life of the mine, work in the vicinity of the subject area ceases and the Proponent follows the procedures recorded in the ACHMP.	Section 4.3
9.19	Wherever possible, if a tree is identified as having culturally made scars, it is retained in situ and protected.	Section 4.3
9.20	Ensure that, where it is not possible to retain a scarred tree in-situ, the tree is cut down to preserve the scar, and relocated into a designated protected area. All activity associated with cutting of the tree and preservation of the scar is to be conducted in consultation with the Aboriginal stakeholders and the archaeologist.	Section 4.3

Attachment 2 Consultation records

Narrabri Local Aboriginal Land Council

96 Barwan Street
NARRABRI NSW 2390
Email: ceo@narrabrilalc.com.au

ABN: 76 035 946 562

Phone: (02) 6792 4228
Mobile: 0439 924222
E-mail: admin@narrabrilalc.com.au

Brent Baker
Manager -Environment
Whitehaven Coal
10 Kurrajong Creek Road
Baan Baa NSW 2390

27th September 2024

Dear Brent

RE: EXTRACTION PLAN LW203-206- HERITAGE MANAGEMENT PLAN

Narrabri Local Aboriginal Land Council (NLALC) has undertaken consultation with Narrabri Coal Operations (NCO) with regards to the Extraction Plan LW203-206 Heritage Management Plan (the Plan):

- Narrabri LALC first provided comments on the plan in a letter to NCO dated 19th October 2022. In this letter we advised the significance of the Mayfield grinding groove site and expressed our desire to have this site protected from mining impacts.
- Narrabri Coal Operations developed a methodology for protection of the grinding groove site and consulted with us. We provided further comments to NCO in a letter dated 04 November 2023, where we made a number of recommendations for investigation and protection of the grinding groove site.
- We are aware that NCO has updated the Extraction Plan Heritage Management Plan to include an Action Plan for the Mayfield Grinding Groove site. NCO has provided us with a copy of the Action Plan on 13 August 2024 and further explained the details of the plan in a meeting held at our office on 02 September 2024.

Following this consultation with myself and Edward Trindall (Senior CHO) we would like to confirm that they are satisfied that the Action Plan has addressed our earlier comments and recommendations, and that the proposed slotting protection measures are an appropriate control measure to protect the site from mining subsidence impacts.

NLALC are satisfied with the Action Plan monitoring program:

- Trial site established above LW204;
- Archival recording of the grinding groove site with NARRABRI LALC representatives prior to undermining.
- Visual inspections with Narrabri LALC representatives during undermining of the grinding groove site; and
- NCO to provide Narrabri LALC routine updates on the subsidence monitoring results, as per the Action Plan.

It is recommended by Narrabri LALC that if the Grinding Grooves are or will be damaged significantly STOP WORK Immediately for another option of protection.

If further information is required, please contact me on the above number

Yours in Unity,

Lynn Trindall
Chief Executive Officer
Narrabri Local Aboriginal Land Council

Narrabri
Local Aboriginal Land Council

96 Barwan Street
NARRABRI NSW 2390
Email [redacted]

ABN: 76 035 946 562

[redacted]
E-mail: [redacted]

Brent Baker
Manage HSE Narrabri Coal Operations
10 Kurrajong Road
Baan Baa NSW 2390

19th October 2022

Dear Brent

Re: NARRABRI UNDERGROUND MINE EXTRACTION PLAN LW 203 TO LW 206 – AHMP

As a representative of the RAP Narrabri LALC would like to make the following comments in relation to the extraction plan for longwall 203 to longwall 206.

We would like to think that all necessary precautions will be to extract the scattered artefacts and place them into the unit that was to be set up as a keeping place.

With the grinding groves they are very significant as it shows where people would use areas of significance, this area should be protected as due to the rarity of the site. Once it is fully assessed a decision will be made by all RAPS.

If you require any further information, please contact me on the above numbers

Thanking you

Lynn Trindall
Chief Executive Officer
Narrabri Local Aboriginal Land Council

From:	Nicole Davis
To:	Brent Baker
Cc:	Narrabri Environmental Approvals
Subject:	Heritage NSW - ACH - Narrabri Coal Mine - Stage 2 - Extraction Plan LW203-206 (MP08_0144-PA-39) (Narrabri Shire)
Date:	Sunday, 20 November 2022 4:04:00 PM
Attachments:	image001.png image002.png

Dear Brent,

Thank you for your referral to the MPP ion relation to the Narrabri Mine Extraction Plan - Heritage Management Plan (LW 203 – LW 206), Whitehaven Coal, 8 November 2022.

I understand that Narrabri Coal Operations Pty Ltd (NCOPL) have prepared a draft Extraction Plan for Longwall Panels (LW) 203 to LW 206 to comply with the conditions of the State approved Narrabri Mine Stage 3 Extension Project (SSD 10269). However, due to an unexpected delay in receiving Commonwealth approval for the Stage 3 Project, NCOPL are revising the secondary approval strategy to ensure the continuation of mining operations under the current Stage 2 Project Approval (PA 08_0144). This will require the draft Extraction Plan for LW 203 to LW 206 to be prepared to comply with the conditions under PA 08_0144 (Stage 2). In accordance with Schedule 3 Condition 4(h) of the Stage 2 Project Approval (PA 08_0144), you are seeking any comments that Heritage NSW may have in relation to the draft (Revision A) Extraction Plan - Heritage Management Plan, prior to finalisation. I can advise that I have the draft (Revision A) Extraction Plan - Heritage Management Plan, and have no additional comments. Please contact me directly should you require any additional information. I shall upload to the MPP this afternoon.

Kind Regards
Nicole Davis

Nicole Davis
Manager Assessments
Heritage NSW
Department of Planning and Environment

[redacted]

NSW GOVERNMENT

[redacted]

Sent: Wednesday, 9 November 2022 9:44 AM

[redacted]

Subject: Major Projects – Proponent Request for Advice - Narrabri Coal Mine - Stage 2 - Extraction Plan LW203-206 (MP08_0144-PA-39) (Narrabri Shire)

A proponent is requesting advice in relation to a post approval matter for the Narrabri Coal Mine - Stage 2.

Please sign in to your account to view the details of this request and to upload your advice.

If you have any enquiries about this request, you can contact Brent Baker at [redacted]

To sign in to your account click here or visit the Major Projects Website.

Please do not reply to this email.

Kind regards

The Department of Planning and Environment

Subscribe to our newsletter

WHITEHAVEN COAL

26 October 2022

Jim Trindall
Gomeroi Narrabri Aboriginal Corporation
[redacted]

Dear Jim,

Re: NARRABRI UNDERGROUND MINE – EXTRACTION PLAN HERITAGE MANAGEMENT PLAN FOR LONGWALLS 203 - 206

I am writing to you in relation to our recent correspondence regarding the Narrabri Coal Operations Pty Ltd (NCOPL) draft Extraction Plan – Aboriginal Heritage Management Plan for Longwalls 203-206. The draft plan was initially developed to comply with the conditions of the recently approved Narrabri Mine Stage 3 Extension Project (SSD 10269). However, due to a delay in receiving Federal approval for the Stage 3 Project, NCOPL are required to continue mining operations under the current Stage 2 Project Approval (PA 08_0144).

Therefore, NCOPL have revised the Extraction Plan – Aboriginal Heritage Management Plan for Longwalls 203-206 to comply with the conditions under Stage 2 Project Approval 08_0144. The revised plan has been amended with administrative changes only, no material changes have occurred. The changes are summarised as follows:

- Title updated to Extraction Plan – Heritage Management Plan (EP-HMP) in accordance with Stage 2 Proect Approval 08_0144 Schedule 3, Condition 4(h);
- Removal of all references to the Stage 3 development (i.e. Conditions of Consent, SSD 10269, Stage 3 etc.) and replaced with reference to the Stage 2 development under PA 08_0144; and
- No changes have been made in relation to the subsidence predictions, environmental impacts and/or management measures.

Please find enclosed for your review a copy of the draft EP-HMP. Your comments on the EP-HMP will be taken into consideration as the plan is finalised. If you do not have any comments, we would still very much appreciate written confirmation of this via letter or email.

I look forward to further consultation with you as mining progresses.

Yours sincerely,

Brent Baker
Manager HSE - Narrabri Coal Operations
[redacted]

Brent Baker

From: Brent Baker
Sent: Wednesday, 26 October 2022 12:33 PM
To: 'CEO | Narrabri LALC'
Subject: LW203-206 Extraction Plan- Heritage Management Plan- Stage 2 Project Approval
Attachments: Heritage Management Plan LW 203-206 - Rev A clean.pdf

Dear Lynn

I am writing to you in relation to our recent correspondence regarding the Narrabri Coal Operations Pty Ltd (NCOPL) draft Extraction Plan – Aboriginal Heritage Management Plan for Longwalls 203-206. The draft plan was initially developed to comply with the conditions of the recently approved Narrabri Mine Stage 3 Extension Project (SSD 10269). However, due to a delay in receiving Federal approval for the Stage 3 Project, NCOPL are required to continue mining operations under the current Stage 2 Project Approval (PA 08_0144). Therefore, NCOPL have revised the Extraction Plan – Aboriginal Heritage Management Plan for Longwalls 203-206 to comply with the conditions under PA 08_0144 (Stage 2). The revised plan has been amended with administrative changes only, no material changes have occurred. The changes are summarised as follows:

- Title updated to Extraction Plan – Heritage Management Plan (EP-HMP) in accordance with Stage 2 Project Approval 08_0144, Schedule 3, Condition 4(h)
- Removal of all references to the Stage 3 development (i.e. Conditions of Consent, SSD 10269, Stage 3 etc.) and replaced with reference to the Stage 2 development under PA 08_0144
- No changes have been made in relation to the subsidence predictions, environmental impacts and/or management measures.

Please find a copy of the revised EP-HMP for Longwalls 203-206 attached.
If you could kindly review the pan, and provide a response letter confirming receipt and advising of any comments.

In response to your letter provided to NCOPL on 19 October 2022 in relation to the initial draft Stage 3 LW203-206 Extraction Plan-Aboriginal Heritage Management Plan I provide the below responses:

- NLALC comment regarding Mayfield Grinding Groove– "*Once it is fully assessed (i.e. Mayfield GG1) a decision will be made by all RAPs"*.
    - NCO response – Absolutely; all RAPs will be included in investigations and decision making process. Section 4.5 of the EP-HMP includes the following text: "*NCOPL will undertake further investigation prior to mining to determine the potential connection to bedrock with an appropriately qualified specialist (e.g. archaeologist, geologist, geomorphologist) and the RAPs. If the investigations determine that the site is connected to bedrock, additional management measures will be determined in consultation with the appropriately qualified specialist and the RAPs."*
    Whilst undermining of the area where Mayfield Grinding Groove is located will not occur for several years, the management plan includes a requirement to develop an Action Plan for the management of the site within 6 months of approval of the plan.
- NLALC comment "*We would like to think that all necessary precautions will be to extract the scattered artefacts and place them into the unit that was to be set up as a keeping place*".
    - NCO response – "It is best practice to only salvage those sites under threat of impact. As per the current management measures employed for previous longwall mining areas, NCO will only salvage those sites predicted to have an impact in accordance with section 4.7 of the EP-HMP. All other artefact sites will be protected from surface disturbance activities, fenced as per section 4.4 of EP-HMP, and subject to regular monitoring for any potential subsidence impacts. If assessment determines an impact is likely (for example from subsidence cracking) any salvaged artefacts will be stored in the allocated Keeping Place (section 4.8 of EP-HMP).

Regards,

Brent Baker
Manager HSE - Narrabri Coal Operations

Whitehaven Coal Limited
10 Kurrajong Creek Rd, Baan Baa NSW 2390 Australia

[redacted]

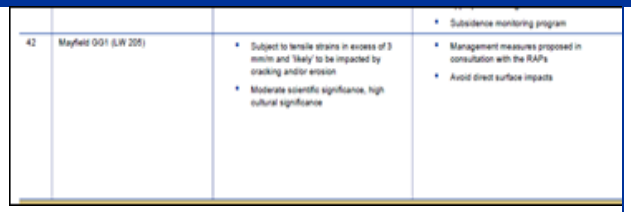
Table A2-1 Consultation response - NLALC

Consultation feedback	Outcome	Document reference
EP-HMP Revision A		
1. We would like to think that all necessary precautions will be to extract the scattered artefacts and place them into the unit that was to be set up as a keeping place.	It is best practice to only salvage those sites under threat of impact. As per the current management measures employed for previous longwall mining areas, NCO will only salvage those sites predicted to have an impact in accordance with section 4.7 of the EP-HMP. All other artefact sites will be fenced and appropriately signed as per section 4.4 of EP-HMP to protect the sites from surface disturbance activities. These sites will be subject to regular monitoring for any potential subsidence impacts as per section 5 of EP-HMP. If assessment determines an impact is likely (for example from subsidence cracking) any salvaged artefacts will be stored in the allocated Keeping Place (section 4.8 of EP-HMP).	Section 4.4 Section 4.6 Section 4.7 Section 5
2. With the grinding grooves they are very significant as it shows where people would use areas of significance, this area should be protected as due to the rarity of the site. Once it is fully assessed a decision will be made by all RAPS.	All RAPs will be included in investigations and decision-making process. Section 4.5 of the EP-HMP includes the following text: “NCOPL will undertake further investigation within 6 months of approval of this EP-HMP (and prior to the commencement of secondary workings) to determine the potential connection to bedrock with an appropriately qualified specialist (e.g. archaeologist, geologist, geomorphologist) and the RAPs. If the investigations determine that the site is connected to bedrock, additional management measures will be determined in consultation with the appropriately qualified specialist and the RAPs.” “An action plan will be developed for the management of this site within 6 months of approval of this EP-HMP which will include the outcomes of the investigation and will outline the mitigation options determined in consultation with the RAPs.”	**Response updated since Rev 0 – refer to Attachment 3**
EP-HMP Revision 0B		
“..we would like to confirm that they are satisfied that the Action Plan has addressed our earlier comments and recommendations, and that the proposed slotting protection measures are an appropriate control measure to protect the site from mining subsidence impacts.”	The NLALC were provided with a copy of the revised EP-HMP and Mayfield GG1 Action Plan and are satisfied with the proposed management measures.	This plan and Attachment 3

Table A2-2 Technical response - IEAPM

Consultation feedback	Outcome	Document Reference
Preliminary RFI – dated 16 December 2022		
1. Can NCOPL please provide the Panel with photographs of Aboriginal cultural heritage site Mayfield GG1 (AHIMS 19-6-0192 - the site of 48 grinding grooves)?	Current photographs of Mayfield GG1 have been provided to IAPUM as part of the request for documentation.	-
2. What performance measures have been endorsed and by whom for Mayfield GG1?	NCOPL received endorsement from DPE (letter dated 7 November 2022) for the Extraction Plan - Heritage Management Plan (EP-HMP) (p.g. i) to be prepared by Dr Matthew Whincop of Whincop Archaeology. The EP-HMP developed by Matthew Whincop includes the specific performance measure 'Surface cracking, vertical displacement or erosion does not compromise Aboriginal objects or cultural heritage values' as presented in the TARP (Table 6-1 of the EP-HMP). This performance measure has also been included in Table 4-1 of the EP-HMP. The EP-HMP also includes management measures for protecting Mayfield GG1 from the impacts of subsidence as stated in section 4.5 of the plan. These measures include: undertaking further investigation prior to mining to determine the potential connection to bedrock with an appropriately qualified specialist (e.g. archaeologist, geologist, geomorphologist) and the RAPs. If the investigations determine that the site is connected to bedrock, additional management measures will be determined in consultation with the appropriately qualified specialist and the RAPs. Measures may include: use of electronic monitoring equipment regular inspections by the RAPs, and/or potential relocation of the grinding grooves to a suitable location. The *Mine Subsidence Assessment for Longwalls LW203 to LW206 at the Narrabri Underground Mine* (DGS, 2022) (Appendix J of EP 203-206) suggests that partial soil excavation around each slab with hand tools may reduce strain transfer into the slabs during subsidence and reduce the potential for cracking. This measure has been added to section 4.5 of the EP-HMP.	**Response updated since Rev 0 – refer to Attachment 3**

Consultation feedback	Outcome	Document Reference
	In addition, an action plan will be developed for the management of this site within 6 months of approval of the EP-HMP which will include the outcomes of the investigation as stated above and will outline the mitigation options determined in consultation with the RAPs (section 4.5 of EP-HMP). NCOPL will monitor Mayfield GG1 on a monthly basis to assess potential cracking and subsidence impacts. The measures stated above have been reviewed by the RAPs via the formal consultation process as stated in section 1.6 of the EP-HMP. One comment was received in relation to the grinding grooves as follows: "With the grinding grooves they are very significant as it shows where people would use areas of significance, this area should be protected as due to the rarity of the site. Once it is fully assessed a decision will be made by all RAPS." As previously stated, this has been addressed in section 4.5 of the plan which reads "NCOPL will undertake further investigation prior to mining to determine the potential connection to bedrock with an appropriately qualified specialist (e.g. archaeologist, geologist, geomorphologist) and the RAPs. If the investigations determine that the site is connected to bedrock, additional management measures will be determined in consultation with the appropriately qualified specialist and the RAPs." "An action plan will be developed for the management of this site within 6 months of approval of this EP-HMP which will include the outcomes of the investigation and will outline the mitigation options determined in consultation with the RAPs."	
3. When will it be established if the grinding grooves are located in bedrock or on 'loose' boulders?	As stated in section 4.5 of the EP-HMP, NCOPL will undertake further investigation within 6 months of approval of the EP-HMP (and prior to the commencement of secondary workings) to determine the potential connection to bedrock with an appropriately qualified specialist (e.g. archaeologist, geologist, geomorphologist) and the RAPs.	**Response updated since Rev 0 – refer to Attachment 3**
4. Re the following extract from Appendix I – Risk Assessment.	The Mine Subsidence Assessment Report (DGS, 2022) (Appendix J of EP 203-206) assessed Mayfield GG1 as being located on sandstone bedrock or possibly partially buried 'loose' boulders which could be prone to cracking. The predicted mean and worst-case final subsidence, tilt and horizontal strain (U95%CL values) were derived from the predicted	Section 1.5

Consultation feedback	Outcome	Document Reference
 a. What specific additional controls cause the likelihood rating of cracking of the grinding grooves to decrease from 'B (likely)' to 'D (unlikely)'? b. How are these ratings influenced by whether the grinding grooves are located in bedrock or on 'loose' boulders?	subsidence effect contours. It was assessed that Mayfield GG1 is expected to be subject to transient tensile strains of up to 5 mm/m and final compressive strains of 5 mm/m. It is 'possible' to 'likely' that the grooves may be impacted by cracking in their current location. Based on the above assessment, and the existing and additional controls, the residual risk for Mayfield GG1 has been amended to a likelihood rating of 'B' making this a 'high' risk item (section 4 of the Risk Assessment [Appendix I to EP 203-206]). Section 1.5 of the EP-HMP has been updated to reflect the amendment.	
RFI dated March 2023		
IEAPM concluded that there is a credible likelihood that subsidence-induced cracking will impact the physical state and heritage values of the Mayfield GG1 site. IEAPM concludes that if subsidence-induced cracking is to be prevented, then the EP-HMP should; • propose preventative measures (e.g. including slotting around the site) to interrupt the transmission of ground strains; and • include an action plan for the management of GG1 based on clearly articulated and measurable performance measures. Additionally, IEAPM recommends: If cracking of Mayfield GG1 is unacceptable then prior to further assessment, the EP for LW203-LW206 should: a) include clear, unambiguous and measurable performance measures for Mayfield GG1. b) include all management plans relevant to complying with the performance measures for Mayfield GG1.	NCOPL has undertaken further geotechnical characterisation of Mayfield GG1 and consulted with the NLALC in relation to the proposed plan of management for the Mayfield GG1 site. Details of the management measures and monitoring program are included in this plan.	Section 4.7 Section 5.1 Section 6 **Response updated since Rev 0 – refer to Attachment 3**

Attachment 3 – Mayfield GG1 Action Plan

NARRABRI MINE

EXTRACTION PLAN LW 203 – LW 206

Heritage Management Plan – Attachment 3

Mayfield Grinding Groove Action Plan

LW 205

	NARRABRI MINE ENVIRONMENTAL MANAGEMENT SYSTEM	Document owner:	Environmental Superintendent
		Document approver:	Environmental Manager
		Revision period:	5 years
		Revision:	0B
		Last revision date:	12 August 2024

WHC_PLN_NAR_MAYFIELD GRINDING GROOVE ACTION PLAN LW 205

Prepared by:

Title	Name	Signature	Date
Director	Matthew Whincop Whincop Archaeology		22 August 2024
Executive Manager – Operations	Mike Gale Onward Consulting		12 August 2024

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1. Mayfield GG1 investigations and revised subsidence predictions

1.1 Mayfield GG1 investigations

NCOPL engaged SCT Operations Pty Ltd (**SCT**), a specialist geotechnical consultancy, to further investigate Mayfield GG1 and develop control measures that can reduce the risks of cracking to the site. Findings from the investigation, which includes the proposed control measures for protection of Mayfield GG1 during subsidence, are documented in the *Geotechnical Characterisation of Investigation of Grinding Groove Site at Narrabri Mine* (**Mayfield GG1 Characterisation Investigation Report** [SCT, 2023b]).

Following SCTs investigation, NCOPL engaged Ditton Geotechnical Services Pty Ltd (**DGS**) to provide a technical review of the Mayfield GG1 Characterisation Investigation Report (*Review of the proposed strain relieving slots at the 'Mayfield' grinding groove site due to LW203 to 206 at the Narrabri Mine* [DGS, 2024]) (**Mayfield GG1 Technical Review**).

1.2 Revised subsidence predictions

The initial EP 203-206 Mine Subsidence Assessment Report assessed Mayfield GG1 as 'possible' (10 to 50% probability) to 'likely' (>50% probability) to be impacted by cracking in their current location (DGS, 2022).

The revised subsidence effects and impact predictions for Mayfield GG1 post installation of the proposed slotting design is predicted to be tensile strains to < 1 mm/m and compressive strain to < 2 mm/m. This would then allow the likelihood of cracking to be decreased from 'likely' to 'very unlikely' or probability of occurrence of < 5%. The site is not predicted to be significantly affected by the retreat of LW 204 (DGS, 2024).

1.3 Performance measures and indicators.

Schedule 4 Condition 22 of the Project Approval states in respect of a Heritage Management Plan that:

The Proponent shall not destroy damage or deface any known Aboriginal objects (as defined in the National Parks and Wildlife Act 1974) without the written approval of the Secretary.

Performance measures and indicators have been developed for the Mayfield GG1 site as presented in Table 4-1 of the EP-HMP. An extract of the Mayfield GG1 performance measures and indicators are presented in Table 1-1 below.

Table 1-1 Mayfield GG1 performance measures

Performance measure	Controls	Performance indicators
Subsidence does not destroy, damage or deface Mayfield GG1.	Management of the site is to be in accordance with the approved EP-HMP and this action plan, developed in consultation with a suitably qualified expert. Mitigation measures will be implemented at Mayfield GG1 based	Mitigation measures are implemented, and monitoring is conducted in accordance with the approved EP-HMP and Action plan. The trial site demonstrates that internal strains are <2mm/m tensile strain and <2mm/m compressive strain.

Performance measure	Controls	Performance indicators
	on advice of the Mayfield GG1 Technical Review: • A slotting trial site will be implemented above LW204 • The slotting design for Mayfield GG1 will be implemented pending the outcomes of the trial site monitoring program • Longwall mining under Mayfield GG1 can only occur with the approval of the Steering Committee (section 2.4). • Mayfield GG1 will be monitored before, during and after longwall mining (section 3) • Post mining and upon cessation of subsidence, the protection slots will be backfilled and rehabilitated.	Mitigation measures are implemented in accordance with technical recommendations prior to mining in LW 205. Monitoring demonstrates that subsidence has not impacted Mayfield GG1.

Monitoring will be used to assess the impact of the mining operations against the performance measures and indicators presented in Table 1-1. If monitoring and assessment indicates an actual or potential non-compliance against a performance measure, NCOPL will implement the contingency measures outlined in section 6 of the EP-HMP.

2. Management of Mayfield GG1

Management measures have been developed on the advice of DGS (2024), SCT (2023) and Whincop Archaeology, and in consultation with NLALC and DCCEEW.

Mayfield GG1 Characterisation Investigation Report (SCT 2023b) recommends the design and installation of 5-6 m deep protection slots around each individual grinding groove site.

A technical review of the Investigation Report (DGS 2024) concurs that the protection slots will protect Mayfield GG1 from tensile and compressive strains and recommends demonstrating the effectiveness of the design through a geometrically similar trial site above LW 204.

Overall, management measures for Mayfield GG1 include:

1. Establishment of a Steering Committee and decision-making protocol.
2. Establishment of a trial site above LW 204 to provide data that is geologically comparative to the Mayfield GG1 site.
3. Monitoring of the trial site above LW 204 to confirm modelled subsidence and demonstrate effectiveness of the slotting mitigation measure.
4. The Steering Committee will review the outcomes of the trial site monitoring program, including a revised assessment of risk to Mayfield GG1.
5. The Steering Committee must determine that mining of LW205 can proceed and ensure protection slots around each rock outcrop of Mayfield GG1 are installed as per a detailed design report.
6. Monitoring of Mayfield GG1 during mining of LW205.
7. Rehabilitation of protection slots.
8. Site evaluation post-mining.

The monitoring program in section 3 and the TARP in section 4 provide further detail on the monitoring and adaptive measures for Mayfield GG1.

2.1 LW 204 trial site

A trial site will be established above LW204 (as recommended by DGS 2024) at a location of geometrically similar location from the tailgate pillars, approximately 873 m outbye of LW204 starting position and 37 m west of LW204 tailgate ribs as shown in Figure 2-1.

The objective of the trial site is to provide subsidence data for a block isolated using trenches. The trial site will consist of the following:

- trenches are to be excavated to 3 m depth and spaced at 10 m with a 600 mm bucket;
- trenches to be temporarily covered with sandbagged, ~1 m wide form-ply sheets (or equivalent) with a width at least 0.4 m wider than the trench;
- spoil from the excavation will be stockpiled away from the site and survey monitoring lines for backfilling of the trenches after the monitoring program is complete;
- survey pegs are to be installed at 4 m spacing inside the trenches with one row parallel to the longwall face (i.e. cross line) and one row normal to the face (i.e. centreline);
- the pegs will follow the same lines outside of the trenches at a 5 m spacing and continue for a distance

of 16 m (i.e. from both sides of the trenches);

- 1.6 m long steel star pickets (or equivalent) are to be driven to 1.0 m into stiff clay; and
- monitoring is to be conducted as specified in section 3.

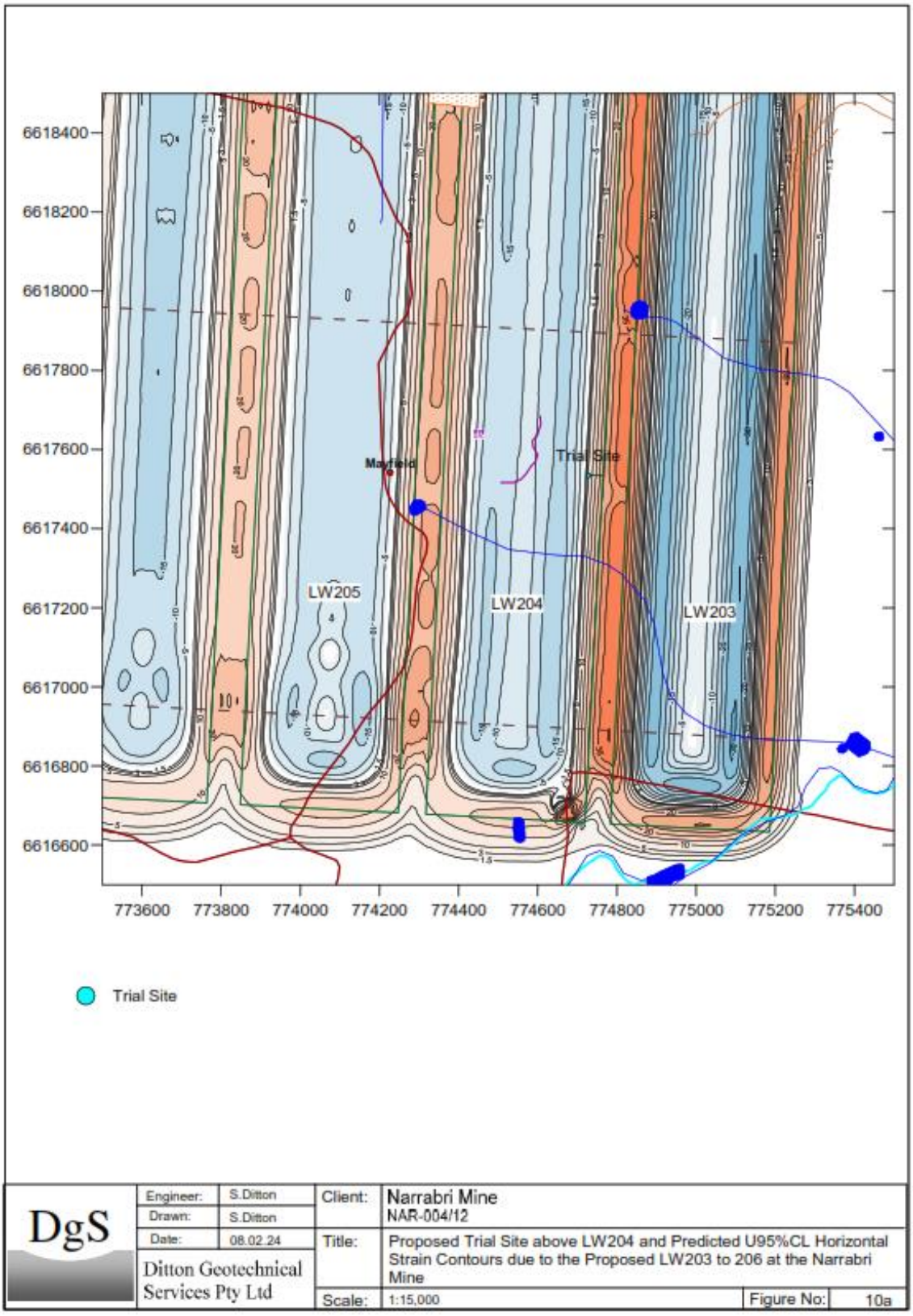

Figure 2-1 Location of trial site (DGS, 2024)

2.2 Mayfield GG1 protection slots

Slots will be cut around each of the three grinding groove rock outcrops. The objective of the slots is to reduce the likelihood of cracking to <5% as defined in DGS (2022).

NCOPL will engage a third-party specialist driller, under supervision of a subsidence specialist, to drill a series of 6 m deep, overlapping boreholes to create a continuous 100mm wide trench around the sites as shown in Figure 2-2. The protection slot detailed design will be informed by the outcomes of the LW204 trial site.

The works will be supervised by suitably qualified archaeologists and RAP representatives and be subject to permit to work procedures. Approximately six months after mining under Mayfield GG1, the protection slots will be backfilled and rehabilitated in accordance with technical advice and site procedures.

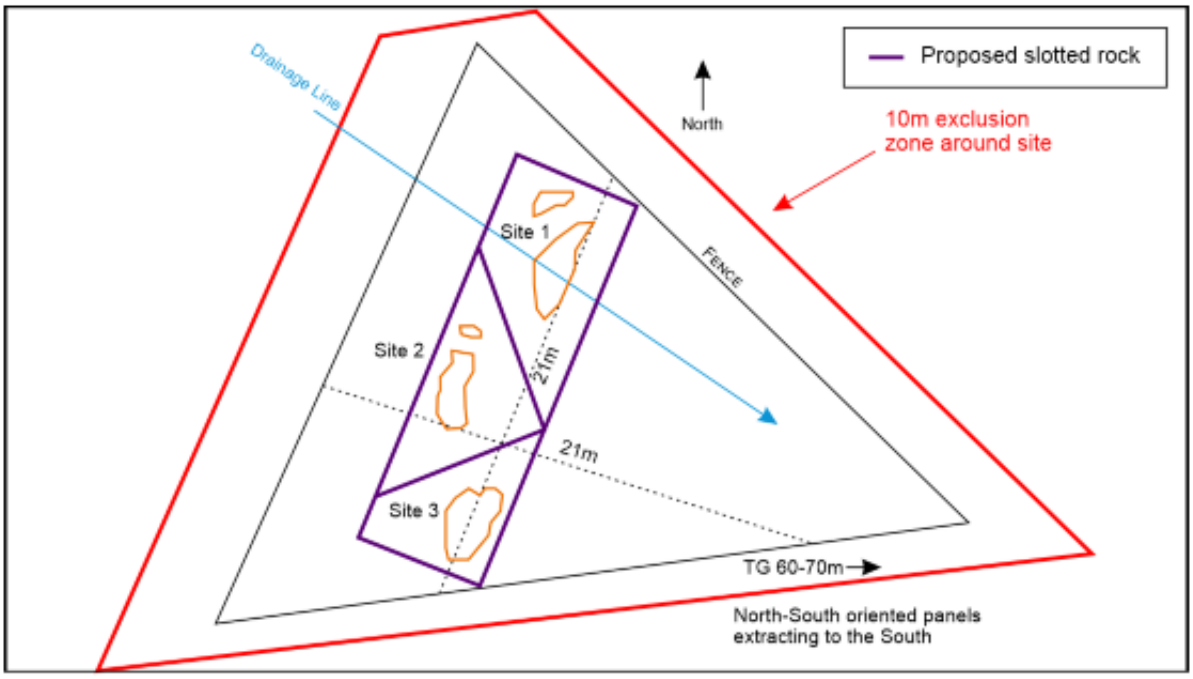

Figure 2-2 Proposed preliminary protection slots (SCT, 2023)[1]

[1] Final design to be revised after results of trial site and technical review

2.3 Technical review and Steering Committee

A Steering Committee will be formed onsite at the commencement of LW 204 and meet regularly in accordance with this plan to ensure its implementation, including;

- Monitoring data is collected and reviewed by suitable technical expertise in accordance with established processes.
- The risk assessment is reviewed and updated after trial site results are assessed.
- Mitigation measures are implemented in accordance with specifications and technical advice.

Relevant roles are identified in Table 2-1.

Table 2-1 Nominated personnel

Role	Organisation	Position
Technical Specialists	SCT Operations Pty Ltd (SCT)	Geotechnical Engineer
	Ditton Geotechnical Services Pty Ltd (DGS)	Mine Subsidence Engineer
	Whincop Archaeology	Archaeologist
Steering Committee	Narrabri Coal (NCOPL)	General Manager – Chair
		Registered Surveyor
		Environmental Manager
		Technical Services Manager
Consultation	Narrabri Local Aboriginal Land Council (NLALC)	CEO

2.4 Decision protocol

The Steering Committee will follow the below decision protocol:

Milestone	Action	Timing	Responsible
Approval of HMP	1. Steering Committee established with terms of reference.	On approval of this plan	Steering Committee
	2. Design trial site and monitoring procedures – finalised through technical report.	Prior to commencement of longwall 204	Technical Specialist
	3. Approval of trial site and site-specific monitoring procedures.	Prior to commencement of longwall 204	Steering Committee
Establish trial site LW 204	4. Installation of trial site/s.	Prior to commencement of longwall 204	Steering Committee Technical Specialist
	5. Archival recording of Mayfield GG1 site.	Prior to commencement of longwall 205	Steering Committee Technical Specialist
Commencement of LW204 Mining	6. Monitoring of trial site in accordance with EP-HMP and site-specific procedures.	During mining, 50m inbye to 250m outbye of the trial site	Steering Committee
Mining under trial site	7. Technical specialists will analyse the results of the trial site (monitoring against predictions), including incorporation of the data in the subsidence model, to confirm the likelihood of subsidence impacts to Mayfield GG1 and whether the proposed slotting measures are sufficient (validation of design). Finalised through report on detailed design for Mayfield GG1 slotting measures, including a detailed site-specific monitoring program (**Final design report**).	Once mining 250m outbye of trial site	Technical Specialist
Prior to mining in LW205	8. Decision to proceed with mining beneath Mayfield GG1 based on the outcomes of the trial site monitoring program in consultation with NLALC	On receipt of final design report	Steering Committee
	9. Review of final Mayfield GG1 slotting design report.	Prior to commencement of longwall 205 (Sept 2026)	Steering Committee
	10. Survey of Mayfield GG1 site and site fencing works.	Prior to commencement of longwall 205 (Sept 2026)	Steering Committee
	11. Steering Committee to approve Mayfield GG1 site specific monitoring procedures.	Prior to commencement of longwall 205 (Sept 2026)	Steering Committee
Slotting installed at Mayfield GG1site	12. Slotting measures installed at Mayfield GG1 in accordance with final design report.	Prior to commencement of longwall 205 (Sept 2026)	Steering Committee Technical Specialist
Mining of LW205	13. Monitoring of Mayfield GG1 in accordance with the EP-HMP and site-specific procedures.	During mining of LW205 in accordance with Final Design report	Steering Committee
	14. Management in accordance with EP-HMP and TARP.	During mining of LW205 in accordance with Final Design report	Steering Committee
Post mining	15. Rehabilitation of site including backfilling of slots.	Within 6 months of longwall progressing beyond 400m outbye of the GG1 site	Steering Committee
	16. Review of monitoring data and preparation of final report to include: ▪ Subsidence measured at the Mayfield GG1 site ▪ Details of any site changes or impacts ▪ Learnings identified	Within 6 months of longwall progressing beyond 400m outbye of the GG1 site	Steering Committee Technical Specialist

3. Mayfield GG1 monitoring

NCOPL will undertake a specific monitoring program for the Mayfield GG1 site to evaluate if subsidence is consistent with predictions and to ensure the effectiveness of the protection slots.

3.1 Trial site monitoring program

A trial site will be established above LW 204 to enable NCOPL to assess subsidence effects and impacts at the trial site prior to mining within proximity to Mayfield GG1. This monitoring will provide actual ground movement relative to predictions to inform detailed design of the Mayfield GG1 slotting. The monitoring will be established as followed:

- survey pegs will be located in MGA94 (and MGA2020) coordinates;
- peg top levels and distances between pegs will be surveyed to an accuracy of +/- 2mm (i.e. spirit levelling and standard steel tape);
- the survey pegs will have two baseline readings before the longwall encroaches to within 300 m of the site;
- active subsidence monitoring is to commence along the centreline and crossline when the longwall face is 50 m inbye of the site with re-surveys in 50 m longwall face retreat increments until the face is 250 m past the site (approximately 7 surveys in total on a weekly to fortnightly frequency based on a longwall retreat rate of 30 m to 50 m per week);
- any surface cracking within the survey monitoring area to be located with a gps and plotted on a plan (crack width, length and depth to be recorded); and
- monitoring data will be provided to the subsidence specialist approximately one week after collection.

The monitoring schedule is provided in Table 3-1 and indicative layout of the trial site is provided in Figure 3-1.

The monitoring results will be reviewed and will inform management recommendations in accordance with the decision protocol in section 2.4.

Table 3-1 Trial site monitoring program

Component	Parameters	Frequency
LW 204 centreline and crossline	Monitoring parameters • Easting • Northing • Vertical Subsidence • Tilt • Strain	• Two baseline surveys – before longwall encroaches within 300m of the site • When mining in LW 204 is within 50m inbye and 250m outbye of the trial site centre point, on the dayshift immediately following the LW face position: ▪ 50m inbye the centre point ▪ At the centre point ▪ 50m outbye the centre point ▪ 100m outbye the centre point ▪ 150m outbye the centre point ▪ 200m outbye the centre point ▪ 250m outbye the centre point
Cracking / subsidence evidence / impact monitoring	• GPS recording of crack width, length and depth. • Photographs	

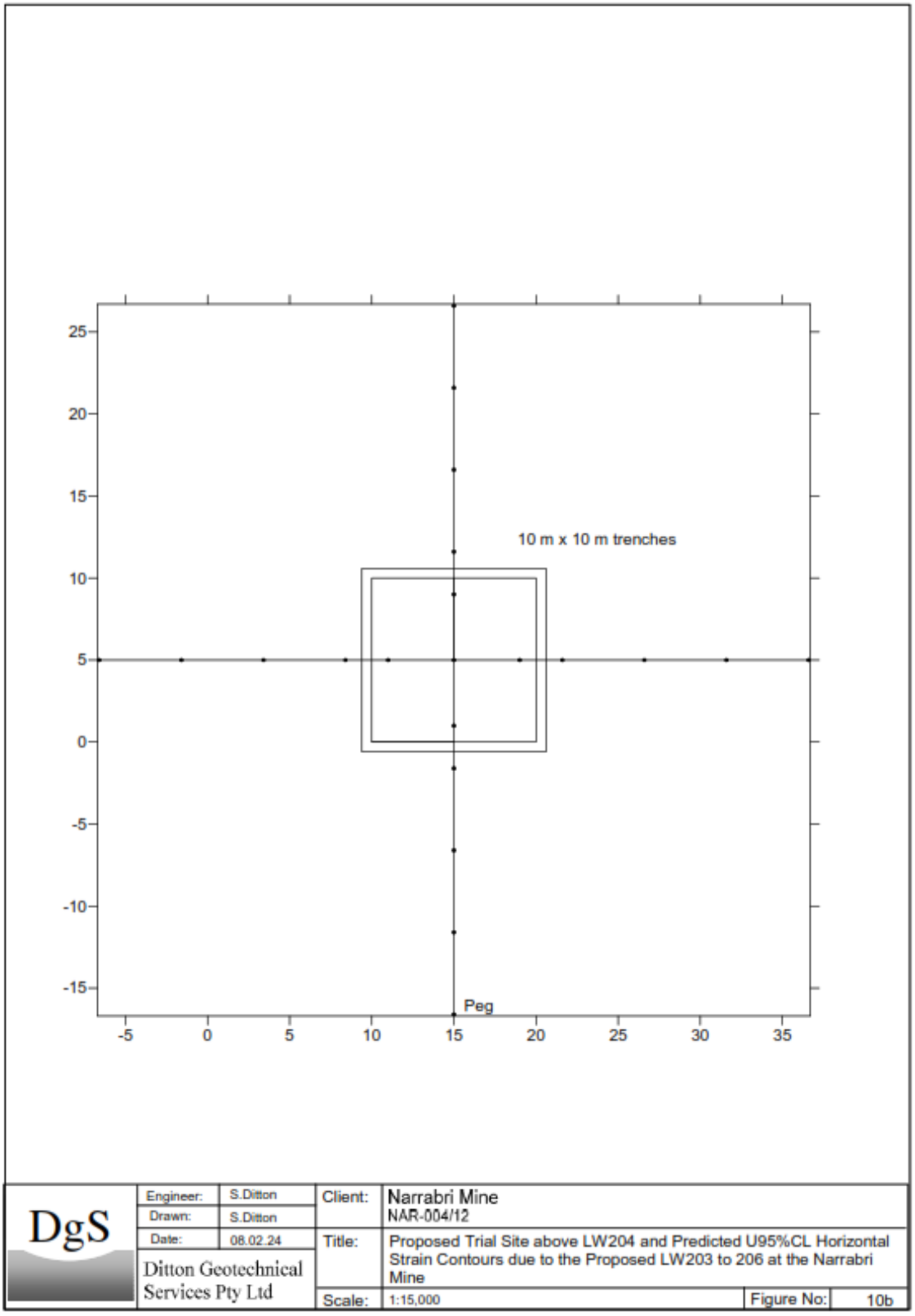

Figure 3-1 Proposed LW204 trial site layout (DGS, 2024)

3.2 Mayfield GG1 subsidence monitoring

Monitoring of the Mayfield GG1 site will comprise several different methods to be confirmed in the Final design report. The records will be actively reviewed by the Steering Committee and inform any TARP response (section 4).

3.2.1 Archival recording

Prior to installation of slotting measures, Mayfield GG1 will be subject to a detailed archival recording including detailed photo and measure drawings and consultation with NLALC.

3.2.2 Visual inspections

During mining of LW 205, photographic records of the site will be taken to identify and record any visual signs of subsidence impacts as per the site-specific monitoring procedures approved by the Steering Committee.

3.2.3 Subsidence monitoring

A subsidence monitoring site will be established on the surface inbye of and adjacent to Mayfield GG1 as close as reasonably practicable. It will comprise of a minimum of two transect lines with survey marks set in rock or star pickets driven to refusal. This monitoring site will be installed and surveyed prior to commencement of LW 205.

NCO survey team to install pegs, undertake monitoring including crack observations.

The longwall retreat rate is nominally in the range of 30-50 m per week. The monitoring of the survey lines is specified to occur on the first dayshift following nominated longwall chainage positions. Consequently, the surveys will be undertaken following nominally 50m (or weekly) of longwall retreat through the monitored zone.

Table 3-2 provides the indicative monitoring program at Mayfield GG1. The review of the trial site results and detailed design may result in changes to the program. Changes will be captured in the final design report as per the decision protocol.

Table 3-2 Mayfield GG1 monitoring site program

Component	Parameters	Frequency
Visual inspections	Completion of approved proforma with cultural heritage representation in attendance.	• Baseline – prior to commencement of LW 205 • When mining in LW 205 is within 50m inbye and 250m outbye of the monitoring site centre point, on the dayshift immediately following the LW face position ▪ 50m inbye the centre point ▪ At the centre point ▪ 50m outbye the centre point ▪ 100m outbye the centre point
Cracking / subsidence evidence / impact monitoring	GPS recording, photographs	

Component	Parameters	Frequency
LW 205 Mayfield GG1 centreline and crossline	Monitoring parameters • Easting • Northing • Vertical Subsidence • Tilt • Strain	▪ 150m outbye the centre point ▪ 200m outbye the centre point ▪ 250m outbye the centre point

4. Contingency response

In the event that a non-compliance against a performance measure detailed in section 1.3 has occurred, or is likely to occur, NCOPL will:

1. Report the non-compliance as soon as practicable to the relevant agencies as required under the Project Approval and relevant legislation in accordance with EP-HMP section 7.
2. Identify and implement an appropriate course of action with respect to the non-compliance in consultation with a suitably qualified person/s, relevant agencies and the RAPs.
3. Review the effectiveness of the EP-HMP and Action plan management measures in accordance with EP-HMP section 8.3.

A Trigger Action Response Plan (Table 4-1) has been developed to identify, assess, and respond to triggers and manage risks associated with meeting the Aboriginal cultural heritage performance measures.

Table 4-1 Trigger Action Response Plan

Performance measure	Status	Trigger	Action	Response
Mayfield GG1 Monitoring				
Surface cracking or displacement does not destroy, damage or deface Mayfield GG1	**Normal**	No subsidence impacts are identified.	Nil	Continue monitoring in accordance with the EP-HMP and Action plan.
	Level 2	Surface cracking at the Mayfield GG1 site is identified during monitoring (as detailed in section 3).	• Notification provided to the DPHI. • Increase visual monitoring to daily. • Provide safety fencing and signage if required. • Advise relevant stakeholders.	• Site to be inspected by representatives of the RAPs and an appropriately qualified specialist to determine the nature and extent of impacts, and to provide advice on whether mitigation is required or feasible. • Detailed final report, as per decision protocol, to include all monitoring results and investigation into cracking. • Proceed with management of the site in consultation with DPHI and the RAPs.

Appendix 1 – Technical report - Review of the Proposed Strain Relieving Slots at Mayfield Grinding Groove Site

Ditton Geotechnical Services Pty Ltd
80 Roslyn Avenue Charlestown NSW 2290
PO Box 5100 Kahibah NSW 2290

DgS
Ditton Geotechnical Services

7 August 2024

Mr Brent Baker
Environmental Manager
Narrabri Mine
Whitehaven Coal Ltd
10 Kurrajong Creek Road
Baan Baa NSW 2390

Report No. NAR-004/12

Subject: Review of the Proposed Strain Relieving Slots at the 'Mayfield' Grinding Groove Site due to LW203 to 206 at the Narrabri Mine

1.0 Introduction

This report has reviewed the proposed Management Plan (MP) for the strain relieving slot options recommended in the SCT Report No. WCL5566a (13/03/23) and WCL5566b (5/09/23) at the 'Mayfield' Grinding Groove Site (GG1) above LW205. The slots are required to 'absorb' tensile and compressive strains of up to 5 mm/m and 10 mm/mm respectively without cracking occurring in the surface sandstone rock exposures between the slots.

The proposed Management Plan for Mayfield GG1 was submitted by Narrabri Mine in a letter to the Department of Planning and Environment (DPE) dated 30/11/2023 in response to Condition 3 of the Progressive Approval of Extraction Plan LW203 - LW206 dated 7 May 2023:

Within 6 months of this approval, Narrabri Coal must provide a detailed response to the Panel's recommendations in relation to Aboriginal heritage.

DPE subsequently requested that the MP include the following additional information:

(i) revised subsidence predictions that confirm the estimated tensile and compressive strains with the implementation of proposed mitigation measures; and

(ii) all management plans relevant to complying with the performance measures for Mayfield GG1, in the form of an updated Extraction Plan Heritage Management Plan LW 203-206.

This report has addressed item (i) and also provides the results of a numerical model (FLAC3D) of the proposed 'strain relieving' slotting technique in sandstone at the Mayfield Site and a proposed trial trench site in stiff clay above LW204.

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2.0 Review of Subsidence Effects and Proposed Management Plan Options

2.1 Subsidence Effects and Predicted Impacts

The location of the 'Mayfield' Grinding Groove Site above the proposed LW205 is shown in **Figure 1**.

The predicted subsidence effects at the Mayfield site were presented in the DgS Report No. NAR-004/9 (25/10/22) and based on proposed mining geometry and measured subsidence effects for the extracted longwalls at Narrabri (see **Figures 2a** to **2c**). To-date, Narrabri Mine has completed LW101 to 110 in the northern area of Stage 2 and commenced the extraction of LW203 in the south.

The site is located 69 m west of LW205 Tailgate +/- 10 m at a depth of cover of 265 m. LW203 to 206 will each have a void width of ~ 400 m and expected to cause the following subsidence effects (see **Table 1**) and impacts (see **Table 2**) at Mayfield.

Table 1 - Predicted Subsidence Effects at the Mayfield Grinding Groove Site

Aboriginal Heritage Site Name	Site Type (No.)	Panel	Final Subsidence (m)	Final Tilt (mm/m)	Transient & Final Horizontal Ground Strain (mm/m)^	
					Transient	Final
Mayfield GG1	Grinding Grooves (48)	LW205	1.16	37	2 (3)	-3 (-5)

^ - Tensile strain is positive; (brackets) - Discontinuous strains due to tensile cracking or compressive shearing.

Table 2 - Predicted Subsidence Impact at Mayfield Grinding Groove Site

Site Name.	Site Type (No. of grooves)	Location	Horizontal Strain (mm/m)^	Cracking Damage Potential*	Tilt (mm/m)	Erosion Damage Potential
Mayfield GG1	Grinding Grooves (43)	Sandstone Bedrock	-5 (+5)	'possible' to 'likely'	37	'possible'

^ - Tensile strain is positive; (brackets) - discontinuous strain due to cracking and shearing.
# - grinding grooves are located on separate sandstone 'slabs' which may mitigate strain transfer. Partial excavation around the 'slabs' may reduce strain and cracking potential.

It was assessed in **DgS, 2022** that the Mayfield GG1 grinding grooves are expected to be subject to transient tensile strains of 2 mm/m to 3 mm/m and final compressive strains of 3 mm/m to 5 mm/m.

It was determined that it is 'possible' to 'likely' that the grooves will be impacted by tensile or shear cracking in their current location above LW205.

Impact management strategies for the site included investigative soil excavation around the grinding groove 'slabs' to determine the degree of connectivity of the surface outcrops to underlying bedrock and ascertain whether there may be a mechanism to reduce strain and mitigate the cracking potential due to mine subsidence.

2.2 Review of SCT Investigation and Strain Control Option Reports

Narrabri Mine subsequently commissioned SCT to conduct geotechnical investigations at the site and to provide further advice on possible strain management options to avoid significant mining impact. Two SCT reports (**SCT, 2023a and SCT, 2023b**) have been completed to date and have established the following:

- That there are three separate groove sites on medium strength sandstone outcrops that extend to a depth of 5 m to 6 m over very low strength claystone.

- The sites exist within an area that may be enclosed by a circle with a radius of 10 m.

- Measured strains were reviewed above LW102 (survey cross line A) and indicated tensile strain of up to 5 mm/m and compressive strain of up to 10 mm/m at the equivalent location from the tailgate rib side (albeit at a shallower depth of 160 m and narrower longwall width of 306 m).

- SCT also reviewed the patterns of surface cracking above the completed longwall panel LW110, which was 400 m wide and located at a depth of 300 m to 340 m. They observed that typical crack widths ranged from 10 mm to 25 mm, were continuous and sub-parallel to the sides and ends of the panels. Occasional transitional diagonal cracks at 40^{o} to the retreating longwall face were also noted. Cracks were spaced between 1 m to 5 m and occurred between 40 m to 70 m inside the tailgate pillars or behind the longwall face.

- It was concluded that the grinding grooves at Mayfield were vulnerable to cracking or shearing from both tensile and compressive strains due to longwall 205 and that strain reduction controls would be necessary.

- SCT proposed to reduce the tensile and compressive strains at the groove sites by either (i) leaving a barrier of coal below the sites or (ii) drilling a series of contiguous (HQ-size) boreholes with a diameter of 100 mm to the claystone interface at 5 m to 6 m depth.

- It was assessed for Option (i) that a barrier of coal would need to be at least 0.3H to 0.7H wide (i.e. 80 m to 190 m) in all directions to provide an angle of draw set-back of between 17^{o} to 35^{o}. It is noted that the smaller barrier option (0.3H radius) could still see strain relief cracking occur at the groove sites if strains exceeded 2 to 3 mm/m.

- For Option (ii), the slots would need to extend around each of the sites to isolate the grooves from potentially damaging strain. It was recommended that they have an effective spacing of 10 m to 15 m to allow the alleviation of predicted transient and final closure movements of between 20 mm to 50 mm for the range of principal strain direction anticipated.

- A deeper (25 m) and wider (200 mm) slot option was also suggested if the smaller slots were considered to be too close to the groove sites. However, it was considered the resulting spacing would probably be too wide and allow some uncontrolled cracking to develop regardless.

DgS considers the SCT reports provide a conservative assessment of the surface and subsurface conditions at the Grinding Groove Sites.

However, it is noted that the strains reviewed along the A-Line above LW102 were for a cover depth of ~180 m instead of ~260 m at the grinding groove site. Based on a review of the strains along the H-Line above the wider longwalls LW107 to 109 at a depth range of 255 m to 275 m, it is apparent that the strain magnitudes are similar to LW102 measurements regardless (see **Figures 3a - 3d**).

The measured strains are therefore likely to be conservative for the design of the two strain control options for the groove sites. The predicted strains for each Strain Control option is assessed in the following sub-sections.

2.3 Strain Predictions for Proposed Barrier Pillars (Option (i))

The three proposed barrier pillar options will all require the full face of LW205 to be relocated as shown in **Figure 4a**. The barrier widths have been determined by adding 10 m to twice the set-back distance required for each option to ensure the grinding groove sites are just out-side the design set-back distance. The predicted subsidence effects have been determined based on the measured survey data along the LW108 end of panel centreline (see **Figure 4b** and **4c**). The results are summarised in **Table 3**.

Table 3 - Predicted Subsidence Effects at Grinding Groove Sites based on Measured Survey Data above LW108 Centreline

Barrier Set-Back/Cover Depth (x/H)	Cover Depth below Mayfield H (m)	Barrier Width* W_b (m)	Predicted Subsidence at Grinding Grooves (m)	Predicted Tilt at Grinding Grooves (m)	Predicted Horizontal Strain at Grinding Grooves (m)	Cracking Likelihood
0.3	265	179	0.10	0.5	1.9 (3.8)	Unlikely (Possible)
0.5	265	285	0.08	0.2	0.4 (0.8)	Very Unlikely
0.7	265	391	0.06	0.1	0.1 (0.2)	Very Unlikely

^ - Tensile strain is positive; (brackets) - Discontinuous strains due to tensile cracking or compressive shearing. shaded - preferred design.

It is assessed that the optimum barrier width will be the 0.5H setback option with a total width of 312 m. The 0.3H setback option will have a total width of 195 m and may still result in cracking, whereas the 0.7H setback option (419 m wide) provides little additional benefit in regard to cracking likelihood reduction for LW205 and provides the same level of protection as the 0.5H setback option (unless a barrier is also left in LW204 at the same location).

It is assessed that the Mayfield site will not be significantly affected by the retreat of LW204 as demonstrated in **Figures 5a** to **5c**. The predicted systematic subsidence at the Mayfield Site is 0.1 m with a strain of 0.4 to 0.8 mm/m as the longwall passes within 135 m from the groove site (an angle of draw of 26.5^o or setback distance of ~ 0.5H).

The adoption of a 312 m wide barrier below the Mayfield grinding groove site for the 0.5H set-back option, however, will have the following operational and cost implications for the Narrabri Mine:

- If the mine opted not extract the initial 1001.9 m of the LW205 Block and start LW205 a distance of 142.5 m outbye of the Mayfield Site (Option1 - see **Figure 6a/b**), there would be an ~**$459 Million (AUD)** loss in coal revenue alone.

- Alternatively, if the mine opted to 'step-around' the Mayfield site by extracting LW205A, it would be necessary to leave a full-face width coal barrier below Mayfield, it would be and relocating the longwall equipment to mine the LW205B block (Option 2 - see **Figure 6a/b**). This option would also incur a significant cost to the mine of ~ **$174 Million (AUD)** due to:
  - Additional installation and roadway drivage ~ $16.4 Million (AUD)
  - Longwall relocation cost ~$14 Million (AUD)
  - Lost coal revenue ~ $143 Million (AUD)
  - Additional Goaf Seals and Labour ~$300,000 (AUD)

Accepting the above two options, it would also not be considered feasible to mine the LW205A block, which would only be ~690 m long. Specific reasons for this would include:

- The requirement to drive 2 x installation roadways to facilitate the step-around,
- Cost of the LW205A roadway drivage,
- Initial production costs to ramp-up and commission equipment at the start of the block,
- Associated geotechnical and safety concerns i.e. windblast and periodic weighting at the start-up position and recovery position,
- Spontaneous combustion concerns associated with forming two goafs in the same block,
- Associated business risks of not being able to supply contract labour and machinery to relocate the longwall equipment twice in the same financial year.

It has therefore been considered necessary to design strain relieving slots or trenches around the Mayfield Site in order to significantly reduce the predicted surface strains from +/-5 mm/m to < 2 mm/m between the slots / trenches; see **Section 2.4**. The use of a numerical model (FLAC3D) and trial or simulation site above LW204 to calibrate the model is further discussed in **Section 3.0**.

2.4 Strain Predictions for Proposed Slots (Option (ii))

The concept of reducing the strain around the groove sites is based on previous experience at two locations in the NSW Coalfield as well as other published cases from the UK on the use of trench technology to protect masonry structures.

The excavation of a compressive stress (or strain) relieving slot was successfully trialled at Marhnyes Hole in the Southern Coalfield on the Georges River (**Mills *et al*, 2002**) and at an site in the Western Coalfield (Moolarben).

The cost of the 28.5 m long by 150 mm wide by 20 m deep slot construction at Marhnyes Hole was 3% of the estimated cost of stepping around feature and leaving a coal barrier as described in **Section 2.3**.

The predicted closure at the site was 180 mm after the completion of a 230 m wide longwalls with a mining height of 2.8 m at a depth of 500 m. Movements into the slot included 20 mm (after construction) due to natural stress relief and a further 50 mm to 60 mm after mine subsidence of ~ 600 mm and a compressive strain of 1.5 mm/m occurred. It was assessed that the slot protected a section of rock behind the 28.5 m long slot of between 30 m and 40 m with only minor impact occurring. It was considered that further slots would have enhanced the level of protection.

It is considered by SCT that the proposed 100 mm wide slots to a depth of 6 m and spacing of 10 m to 15 m will be required to be installed around each groove site to reduce the predicted tensile strains to < 1 mm/m and compressive strain to < 2 mm/m. This would then allow the likelihood of cracking to be decreased from 'likely' to 'very unlikely' or probability of occurrence of < 5% as defined in **DgS, 2022**.

The alternative deeper and wider slot option has significantly higher uncertainty because it must isolate a much larger block of rock. It is considered that the isolated block may still be subject to bending curvatures > 0.1 km^{-1} and tensile strains > 2 mm/m that will cause cracking if natural jointing and bedding are not orientated favourably.

3.0 Design of Strain Relieving Slots or Trenches

3.1 FLAC3D

The proposed strain relieving slots or trench works have been assessed using the explicit Finite Difference modelling program (FLAC3D V. 5.01). The FLAC-3D model allows the estimates of curvature and horizontal strain to be applied directly to an elastic surface block model comprising either stiff clay or rock and a range of trench depth and spacing configurations.

The 50 m x 50 m x 20 m model has been generated using $1m^3$ blocks with a 10 m x 10 m area of rock being isolated from the rest of the model by excavating 1 m wide trenches to a depth of 2 m and 3 m at the test site above LW204 (stiff clay) and 6 m at the Mayfield Site above LW205 (6 m of sandstone over claystone).

The program applies equations of motion to the model elements to firstly establish pre-mining stress and displacement fields by time-stepping to equilibrium.

The models were then subject to a spherical up or down velocity field over 2000-time steps to generate a hogging or sagging curvature profile of 10 km radius in x and y directions (to simulate longwall subsidence 'wave' development). A uniform tensile strain field of 5 mm/m was also applied to the sides of the model; see **Figures 6c** and **6d**.

It was considered that a conservative approach to assessing the effectiveness of the trenches to relief horizontal strain required the adoption of elastic model properties to avoid underestimating strain reduction that will also occur at natural joints and due to slip along bedding planes.

The material properties for the elastic model require elastic deformation parameters only (density, Young's Modulus (E), Poisson's Ratio (v)) to be assigned to each lithological unit.

The volumetric elastic properties for each of the soil and rock mass units were then derived from the Young's Modulus (E) and Poisson's Ratio (v) as follows:

K = bulk modulus (normal stress) = E/(3(1-2v))

G = shear modulus (shear stress) = E/(2(1+v))

A mohr-coulomb model was applied to the interface at the sandstone and claystone to demonstrate the effects of bedding slip at the sandstone and claystone horizon at 6 m depth below the surface.

Assuming weathering has relieved near surface tectonic or pre-consolidation stresses, horizontal stress for the models were derived based on the following rock-mechanics formula for a block of rock (or stiff clay) in a gravity field and confined in all directions:

$\sigma_h = (v/1+v)\sigma_v$

3.2 Trial Site

A Youngs modulus of 15 MPa and Poisson's ratio of 0.25 was assumed for the stiff clay to give a K value of 10 MPa and G value of 6 MPa. The above parameters also indicate a clay UCS of 0.15 to 0.25 MPa based on a modulus to UCS ratio of 60 to 100 for over-consolidated clay. The pre-mining horizontal stress in the model was determined based on $0.333\sigma_v$.

The subsidence and strain contours after application of the mine subsidence deformations of the 2 m deep trenches are shown in **Figures 6e** and **6f**. The figures demonstrate that the tensile strain of 5 mm/m is reduced to 2.0 mm/m ~ 2.5 mm/m, with strains of up to 10 mm/m concentrating at the base of the trenches due to the stress notching affect.

Figures 6g and **6h** show the subsidence and strain contours for the 3 m deep trenches. The figures demonstrate that the tensile strain of 5 mm/m is reduced to < 1.0 mm/m with strains of

up to 11 mm/m concentrating at the base of the trenches. It is noted that the strains increase to 2.0 mm/m at a depth of ~ 1 m below the surface. Increasing the trench depth or reducing the trench spacing will expand the strain isolated volume even further below the surface.

Figure 6i demonstrates a similar reduction in compressive strain and sagging curvature due to the trenches.

The subsidence and strain profiles for the 2 m deep trench case (at 10 m spacing) are shown in **Figures 7a** and **7b** and demonstrate that the trenches will decrease the applied strains by ~ 50%. It is considered that surface cracking could still develop at the surface for this configuration (i.e. a 'possible' event).

The subsidence and strain profiles for the 3 m deep trench case (at 10 m spacing) are shown in **Figures 7c** and **7d** and demonstrate that the trenches will decrease the applied strains by ~ 80%. It is considered that surface cracking is 'unlikely' to develop at the surface for this configuration.

The above analysis will be simulated in the field above LW204 to provide verification or allow further refinement to the model to re-assess the predicted strains at the Mayfield site.

3.3 Mayfield Site

The proposed 6 m deep slots at Mayfield site have been assessed assuming a 6 m thick sandstone unit overlying claystone; see **Figure 8a**.

A Youngs modulus of 1500 MPa and Poisson's ratio of 0.25 was assumed for the sandstone to give a K value of 1000 MPa and G value of 600 MPa. The above parameters also indicate a UCS of 10 to 15 MPa based on a modulus to UCS ratio of 100 to 150 for weathered and jointed rock.

The properties for the claystone were based on a UCS of 5 to 10 MPa to give a Youngs modulus of 750 MPa and Poisson's ratio of 0.25 for a K value of 500 MPa and G value of 300 MPa.

The pre-mining horizontal stress in the model was also determined based on $0.333\sigma_v$.

Figures 8a and **8b** show the subsidence and strain contours for the 6 m deep slots at a 10 m spacing. The figures demonstrate that the tensile strain of 5 mm/m is reduced to < 0.5 mm/m with strains of up to 11 mm/m concentrating at the base of the trenches. It is noted that the strains increase to 1.0 mm/m at a depth of ~ 3 m below the surface; see **Figure 8d**.

The slots will therefore decrease the applied strains by 80% ~ 90% within 3 m of the surface. It is considered that surface cracking is 'unlikely' to develop at the surface for this configuration (i.e. < 5% probability).

If it is assumed that the interface or bedding parting between the sandstone an claystone can only develop a cohesion of 20 kPa and friction angle of 20^o, then the FLAC3D model predicts

that the sandstone will slip and further reduce the strains between the slots after mine subsidence; see **Figures 9a** to **9c**.

The above analysis will be further refined once field data is obtained at the simulation site above LW204.

4.0 Proposed Monitoring Program at the Trial Site

The monitoring of the trial site above LW204 will require the following:

4.1 Installation

The proposed trench location and monitoring plan is shown in **Figures 10a** and **10b**. The site will require the following works:

- The centre of the proposed trench site is at MGA94 E774727, N6617534 or approximately 873 m outbye of LW204 starting position and 37 m west of LW204 Tailgate ribs (see **Figure 10a**). Note: The proposed site has a predicted tensile strain of 5 mm/m.

- 3 m deep x 10 m spaced trenches are to be excavated as shown in **Figure 10b** with a 600 mm bucket.

- Trenches are to excavated to 3 m depth and temporary covered with sandbagged, ~1 m wide form-ply sheets (or equivalent) with a width at least 0.4 m wider than the trench.

- Spoil from the excavation should be stockpiled away from the site and survey monitoring lines for backfilling of the trenches after the monitoring program is complete.

- Survey pegs are to be installed at 4 m spacing inside the trenches with one row parallel to the longwall face (i.e. cross line) and one row normal to the face (i.e. centreline).

- The pegs should follow the same lines outside of the trenches at a 5 m spacing also and continue for a distance of 16 m (i.e. from both sides of the trenches).

- 1.6 m long steel star pickets (or equivalent) are to be driven to 1.0 m into stiff clay.

- Monitoring is to be conducted as specified in **Section 4.2**.

After the completion of the monitoring program due to LW204, the trenches should be backfilled with spoil and monitoring pegs removed.

4.2 Monitoring Schedule

- The survey pegs should be located in MGA94 (and MGA2020) coordinates.
- Peg top levels and distances between pegs should be surveyed to an accuracy of +/- 2 mm (i.e. spirit levelling and standard steel tape).
- The survey pegs should have two baseline readings before the longwall encroaches to within 300 m of the site.
- Active subsidence monitoring is to commence along the centreline and crossline when the longwall face is 50 m inbye of the site with re-surveys in 50 m longwall face retreat increments until the face is 250 m past the site (approximately 7 surveys in total on a weekly to fortnightly frequency based on a longwall retreat rate of 30 m to 50 m/week).
- Any surface cracking within the survey monitoring area to be located with a gps and plotted on a plan (crack width, length and depth to be recorded).
- Monitoring data to be sent to DgS approximately 1 week after each survey completed.

5.0 Conclusions and Recommendations

It is not considered economically feasible to sterilise the coal below the Mayfield site above LW205 by 'stepping' the longwall face around it. There are also safety concerns with adopting this approach.

The preferred option will be to install strain relieving slots around the site to a depth of 6 m with the spacing limited to 5 m and 10 m (pending the outcome of the trial site monitoring above LW204).

However, it is noted that the effectiveness of the design should be demonstrated by an early warning monitoring program at a geometrically similar location from the tailgate pillars above LW204. It is also considered that the site could be located in clay soil to avoid the need to mobilise drilling equipment and allow the slots to be excavated with a backhoe instead.

A monitoring and management plan should be incorporated into a TARP for the Mayfield Site that would require the implementation of the strain relieving slot option. Details of the trench arrangement and survey peg locations are shown in **Figure 10b**.

The slot design at Mayfield and the effectiveness of the trenches will be demonstrated by comparison of external and internal strain measurements at the Trial Site. At this stage, internal strains would need to be < cracking strain thresholds of < 2 mm/m tensile strain and < 2 mm/m compressive strain.

If the effectiveness of the trench design is not considered adequate for the Trial Site, it will be necessary to reduce the spacing of the slots as necessary.

Monitoring frequency would need to capture subsidence and strain development before, during and after undermining on a weekly basis or every 50 m of retreat until subsidence has practically ceased. Based on the LW108 centreline data, monitoring would need to commence when the longwall face was 50 m ahead of the site and continue until the longwall was a least 250 m past the site.

The trenches should be backfilled with spoil after completion of the monitoring program.

For and on behalf of
Ditton Geotechnical Services Pty Ltd

Steven Ditton
Principal Engineer

Attachments:

Figures 1a to 10b

References

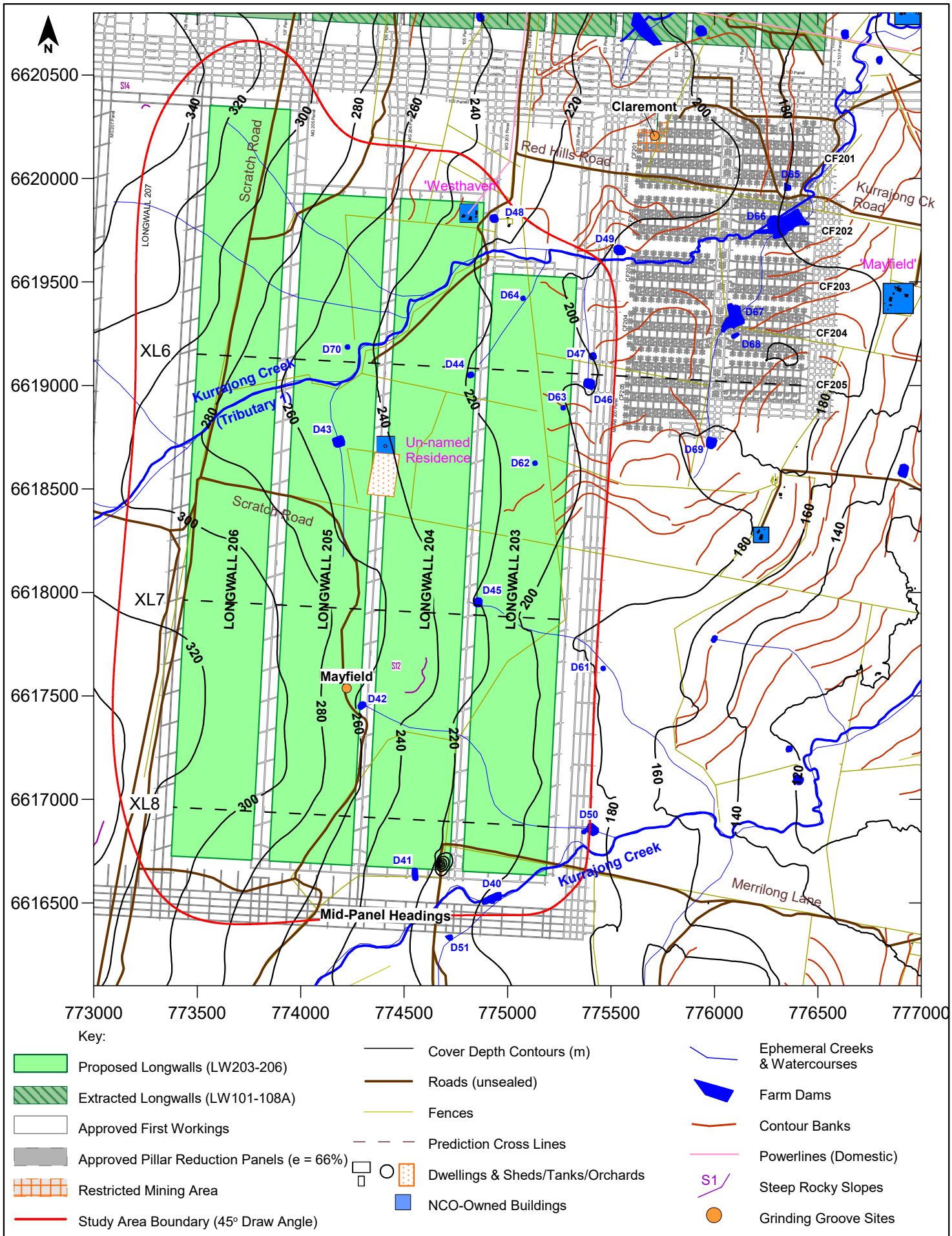
DgS, 2022. **Mine Subsidence Assessment for the Proposed Longwalls LW203 to LW206 at the Narrabri Underground Mine**. Ditton Geotechnical Services Pty Ltd. Report No. NAR-004/9 (25 October).

Mills K.W., Poole, G.R. and Fredericks, L.D., 2002. **Mitigation of Subsidence Impacts at Marhynes Hole Rock Bar**. Published Proceedings of Sydney Basin Geologists Symposium. Wollongong University.

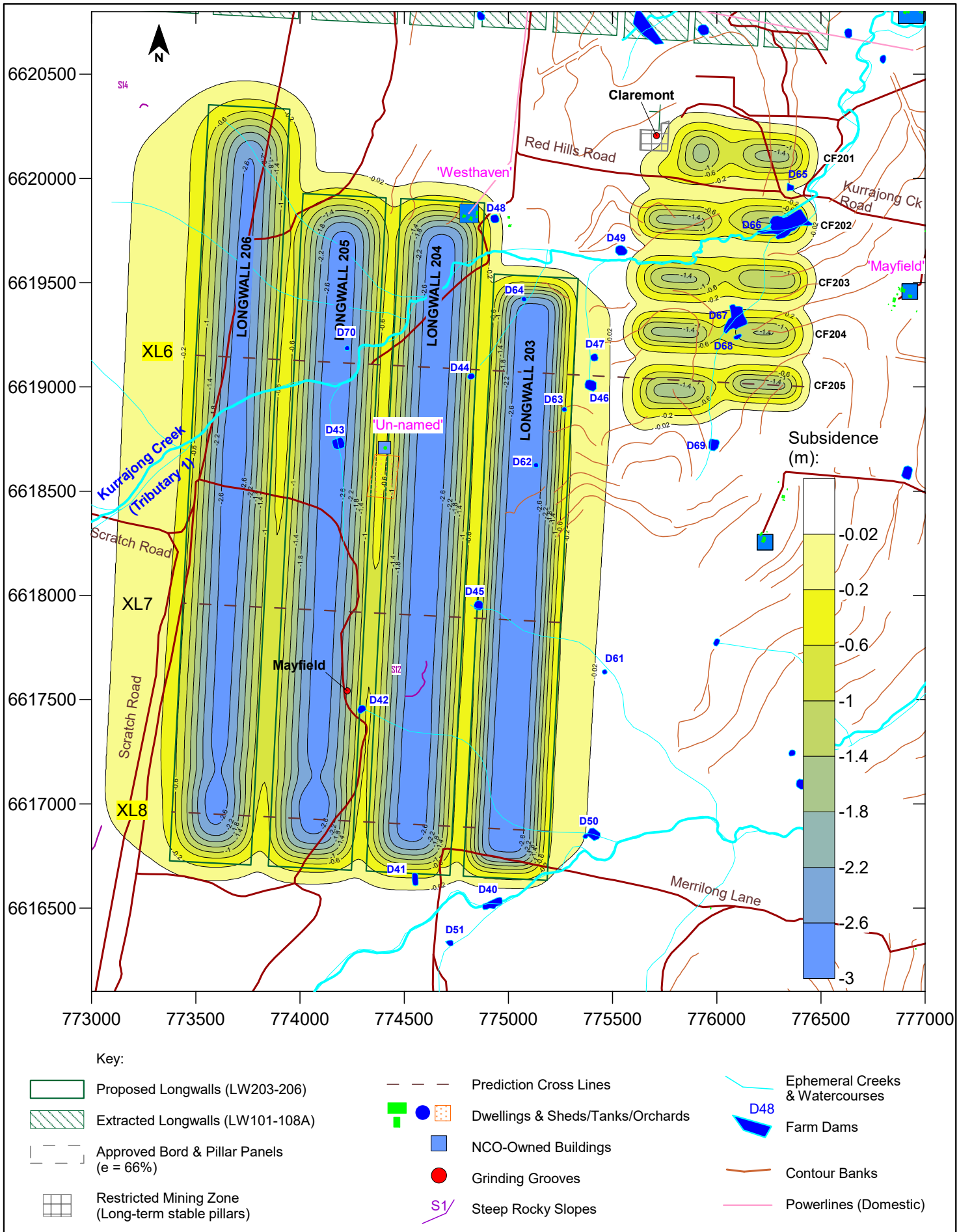
Peng, S.S. & Chiang, H.S, 1984. **Longwall Mining**. Wiley.

SCT, 2023a. **Investigation of Grinding Groove Site at Narrabri Mine**. SCT Report No. WCL5566a (13/03/23).

SCT, 2023b. **Geotechnical Characterisation of Grinding Groove Site at Narrabri Mine**. SCT Report No. WCL5566b (5/09/23).



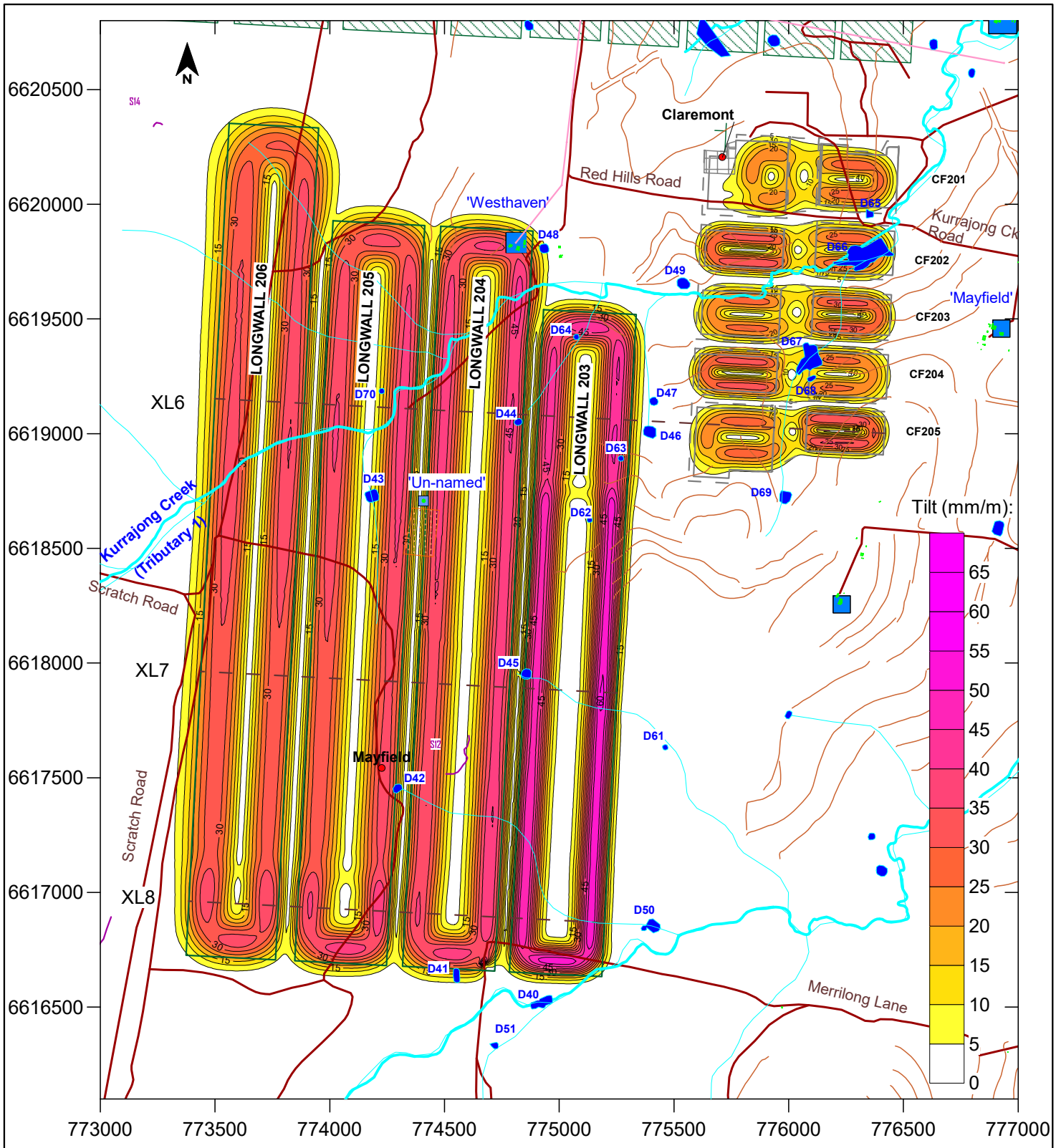
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	08.02.24	Title:	Surface Features & Cover Depth Contours to the Mine Workings Roof with the Proposed Longwalls 203 to 206	
	Ditton Geotechnical Services Pty Ltd		Scale:	1:30,000	Figure No: 1



Key:

- Proposed Longwalls (LW203-206)
- Extracted Longwalls (LW101-108A)
- Approved Bord & Pillar Panels (e = 66%)
- Restricted Mining Zone (Long-term stable pillars)
- Prediction Cross Lines
- Dwellings & Sheds/Tanks/Orchards
- NCO-Owned Buildings
- Grinding Grooves
- S1 Steep Rocky Slopes
- Ephemeral Creeks & Watercourses
- D48 Farm Dams
- Contour Banks
- Powerlines (Domestic)

DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	08.02.24	Title:	Predicted U95%CL Subsidence Contours due to the Proposed LW203 to 206 at the Narrabri Mine	
Ditton Geotechnical Services Pty Ltd			Scale:	1:30,000	Figure No: 2a



Key:

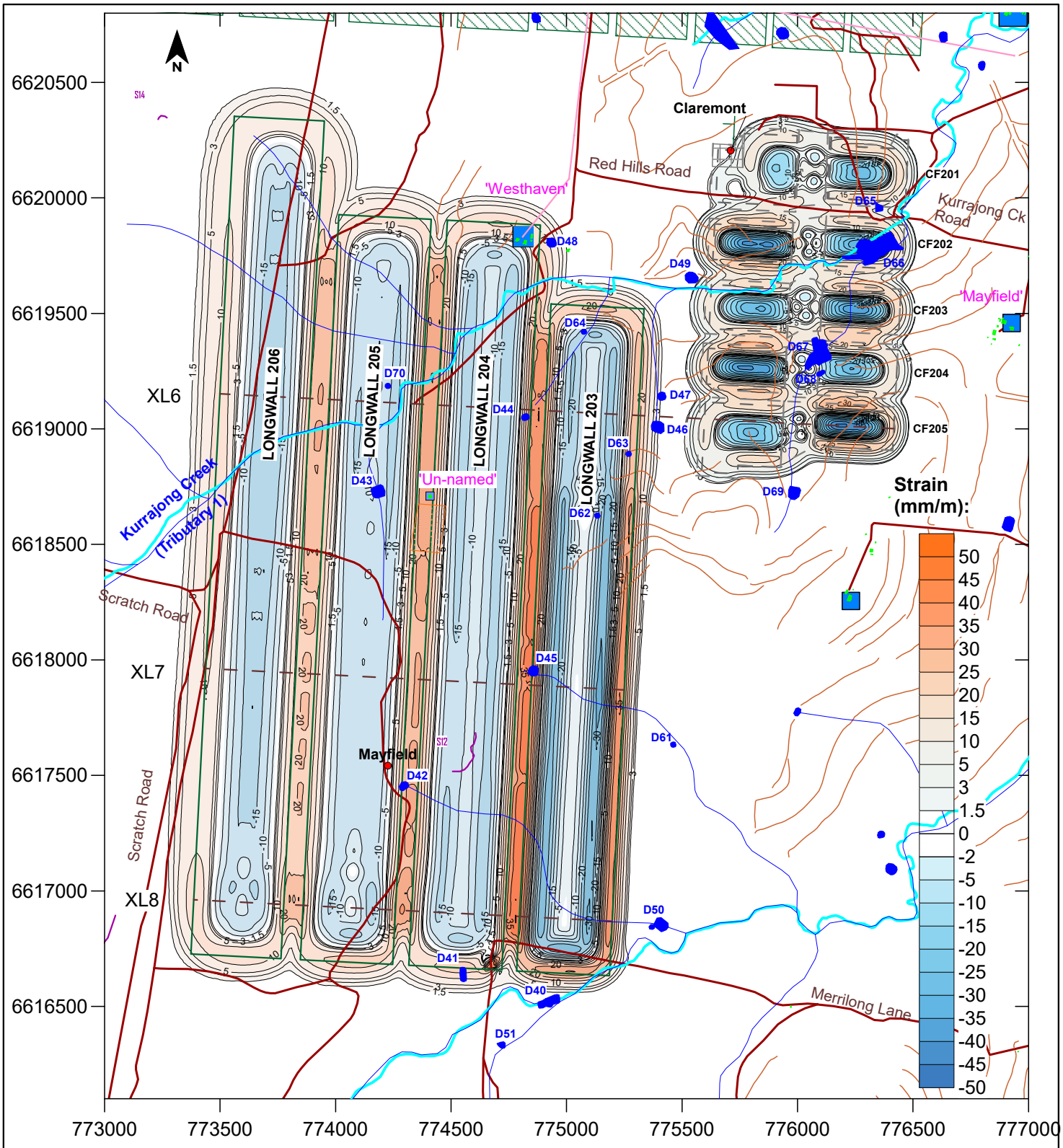
- Proposed Longwalls (LW203-206)
- Extracted Longwalls (LW101-108A)
- Approved Bord & Pillar Panels (e = 66%)
- Restricted Mining Zone (Long-term stable pillars)
- Prediction Cross Lines
- Dwellings & Sheds/Tanks/Orchards
- NCO-Owned Buildings
- Grinding Grooves
- S1 Steep Rocky Slopes
- Ephemeral Creeks & Watercourses
- D48 Farm Dams
- Contour Banks
- Powerlines (Domestic)

DgS

Ditton Geotechnical Services Pty Ltd

Engineer:	S.Ditton
Drawn:	S.Ditton
Date:	08.02.24

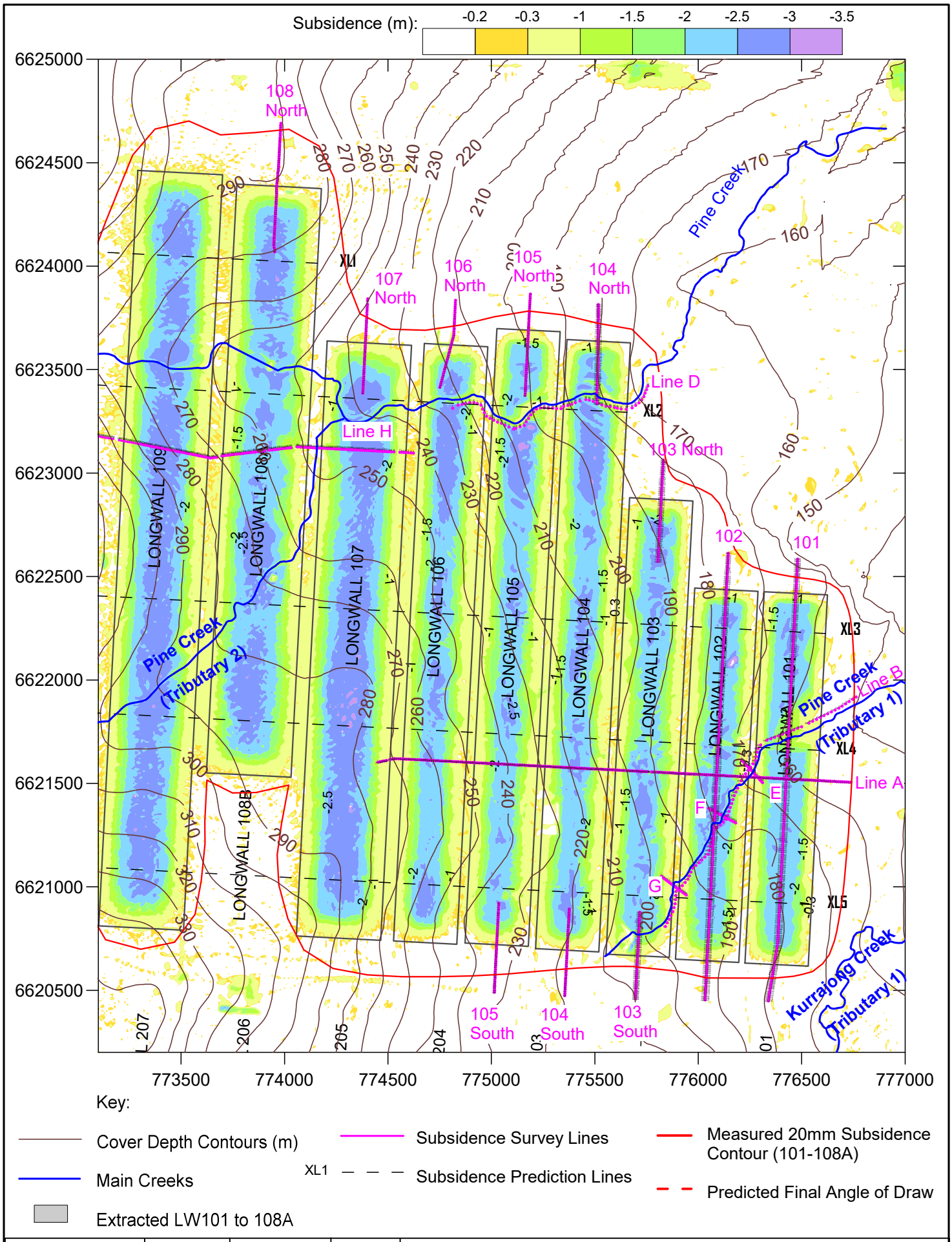
Client:	Narrabri Mine NAR-004/12
Title:	Predicted U95%CL Tilt Contours due to the Proposed LW203 to 206 at the Narrabri Mine
Scale:	1:30,000
Figure No:	2b



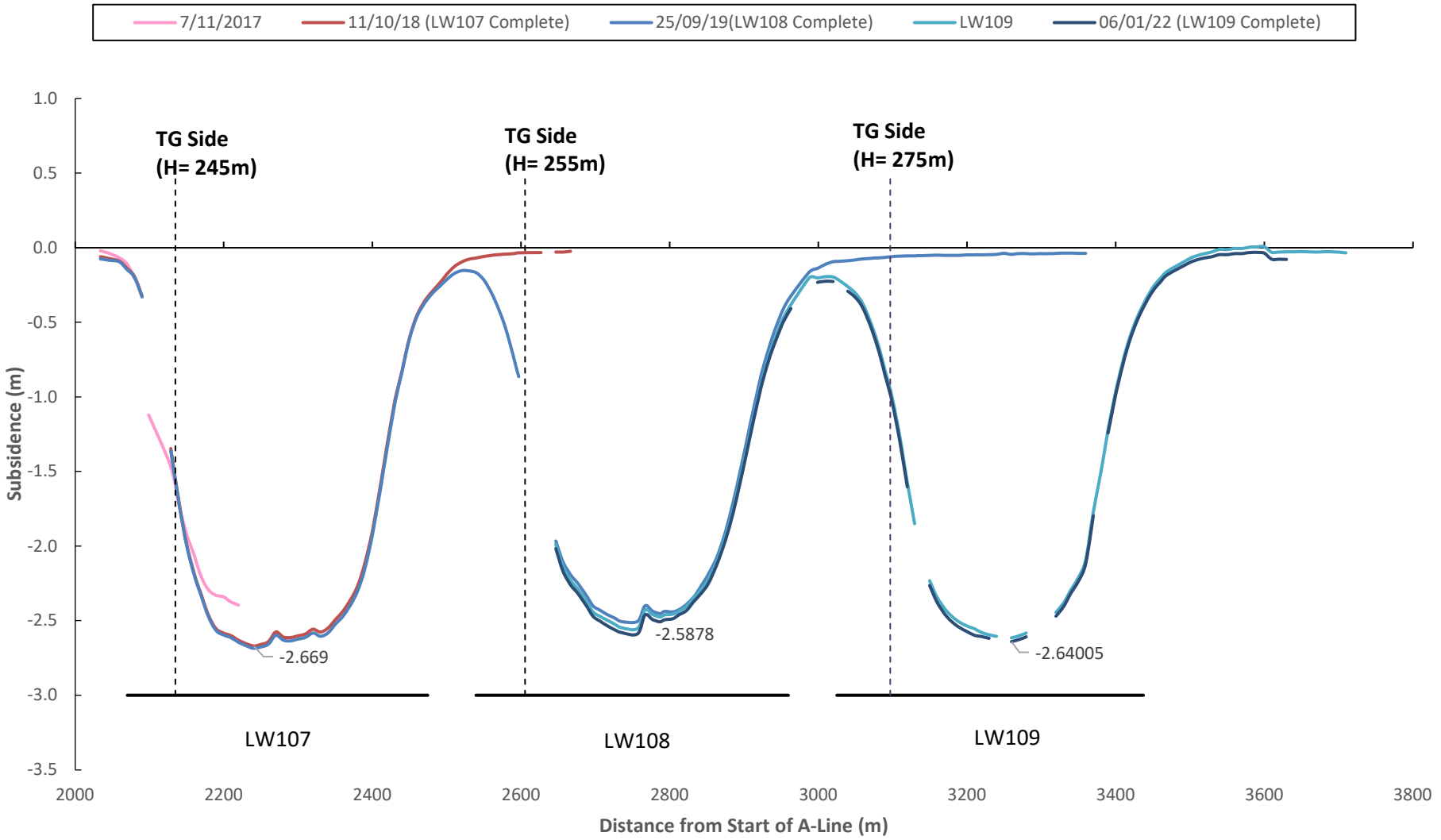
Key:

- Proposed Longwalls (LW203-206)
- Extracted Longwalls (LW101-108A)
- Approved Bord & Pillar Panels (e = 66%)
- Restricted Mining Zone (Long-term stable pillars)
- Prediction Cross Lines
- Dwellings & Sheds/Tanks/Orchards
- NCO-Owned Buildings
- Grinding Grooves
- S1 Steep Rocky Slopes
- Ephemeral Creeks & Watercourses
- D48 Farm Dams
- Contour Banks
- Powerlines (Domestic)

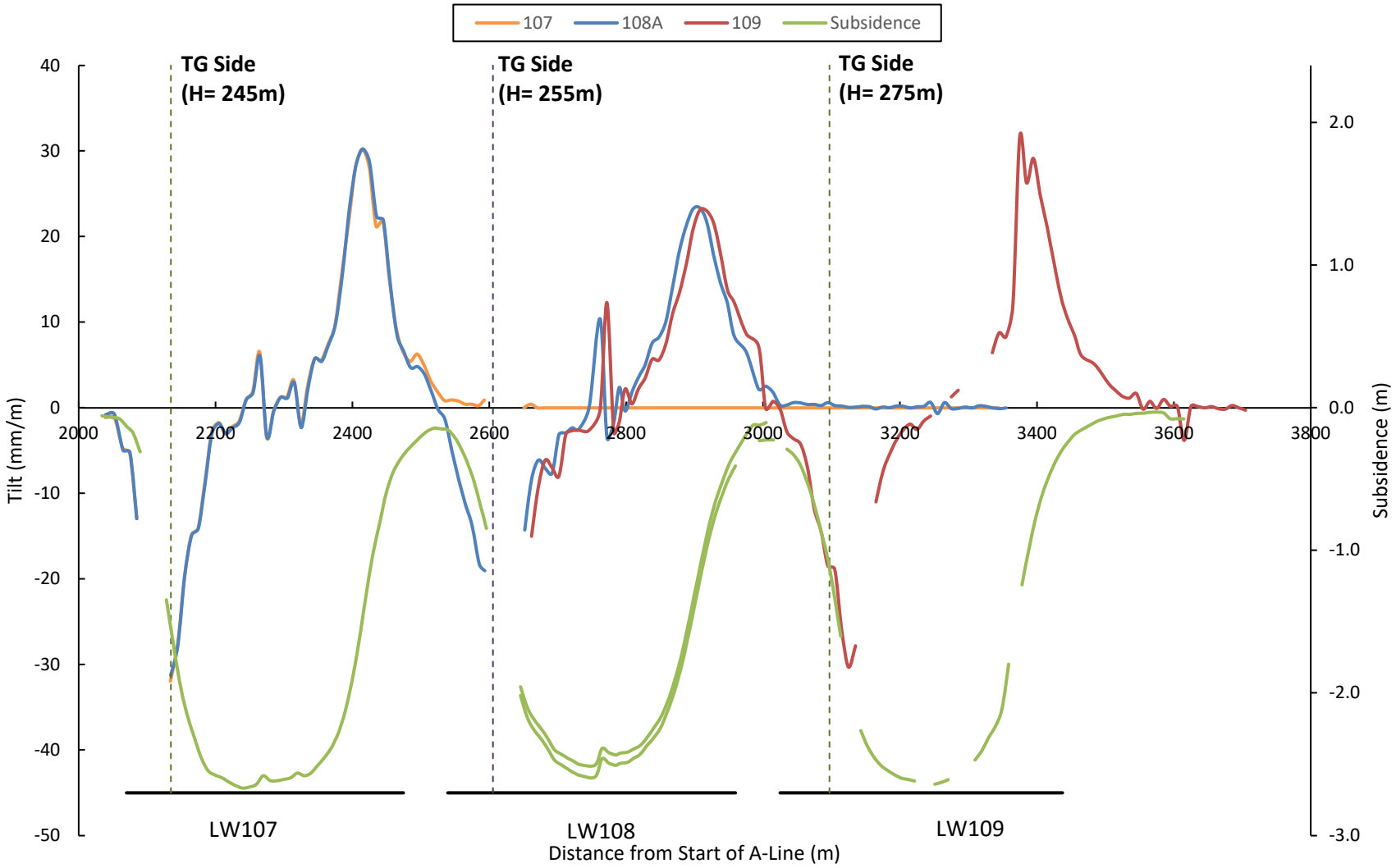
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	08.02.24	Title:	Predicted U95%CL Horizontal Strain Contours due to the Proposed LW203 to 206 at the Narrabri Mine	
	Ditton Geotechnical Services Pty Ltd		Scale:	1:30,000	Figure No: 2c



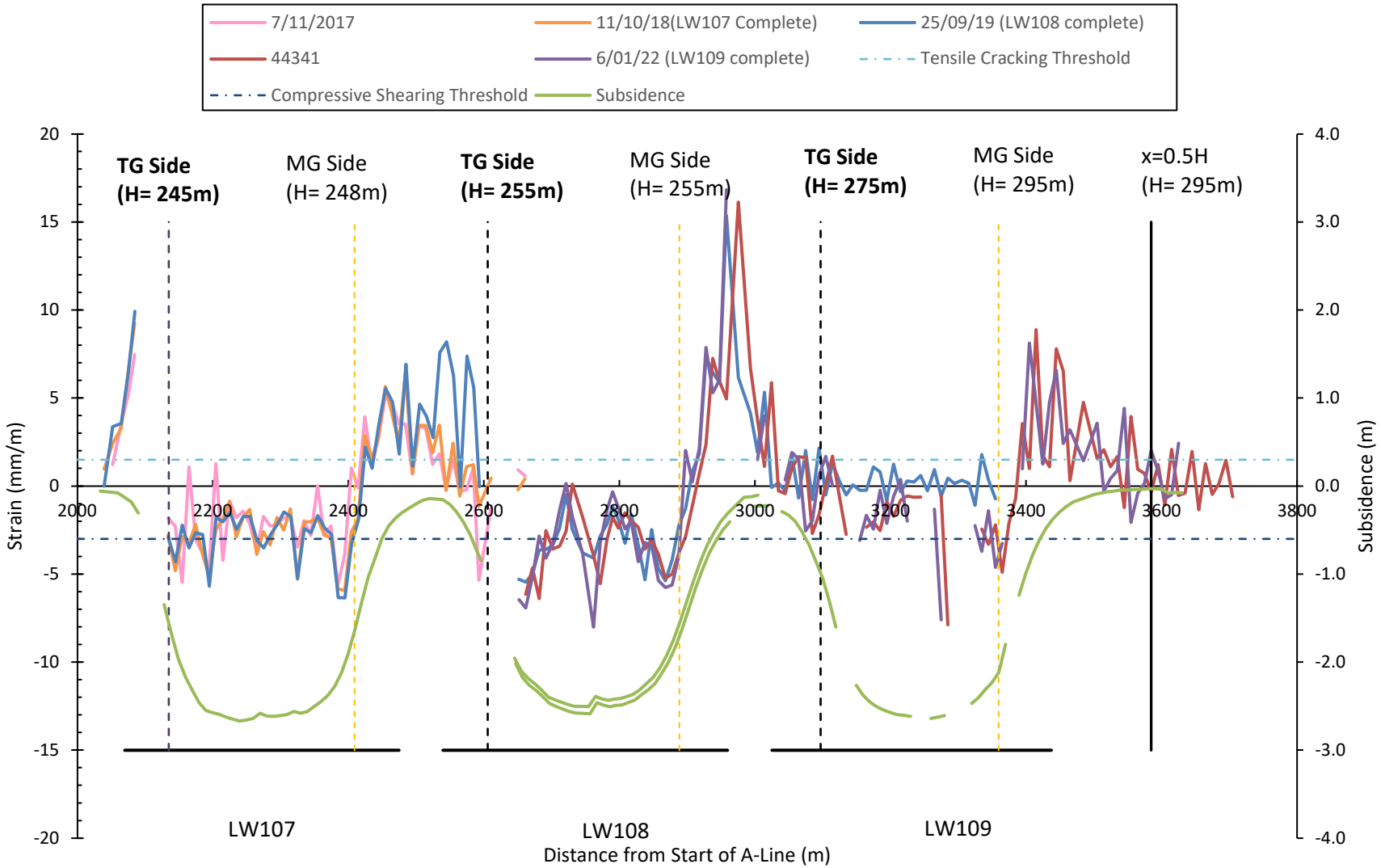
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.02.24	Title:	Subsidence Survey Lines with LiDAR Subsidence Contours Above the Extracted LW101 to 109 at the Narrabri Mine (Dec 2021 - Dec 2008 Surveys)	
Ditton Geotechnical Services Pty Ltd			Scale:	1:25,000	Figure No: 3a



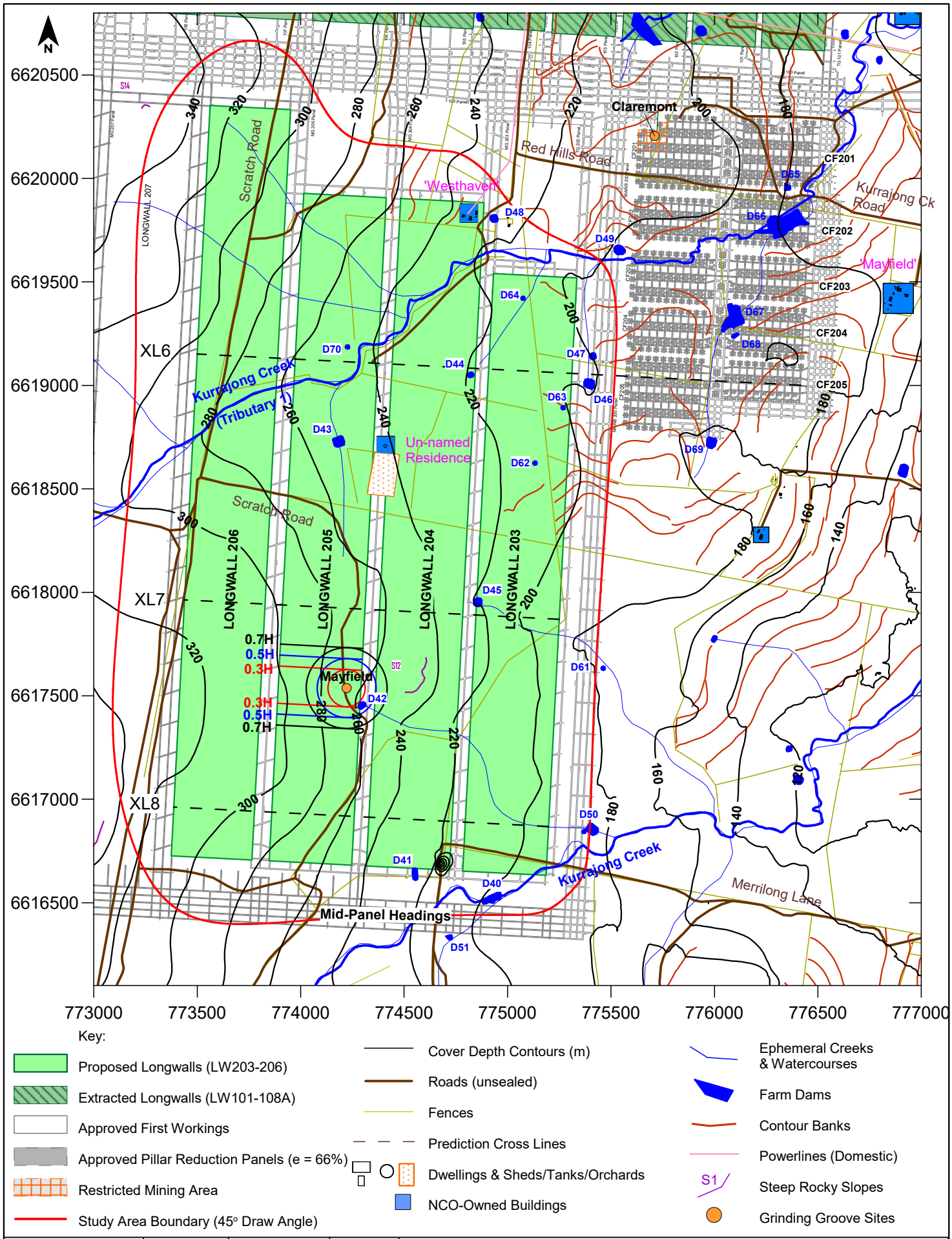
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.02.24	Title:	Measured Subsidence along H CrossLine (LW107-109) at Geometrically Equivalent Locations for the Mayfield Grinding Groove Sites	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 3b



DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.02.24	Title:	Measured Tilt along H CrossLine (LW107-109) at Geometrically Equivalent Locations for the Mayfield Grinding Groove Sites	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 3c



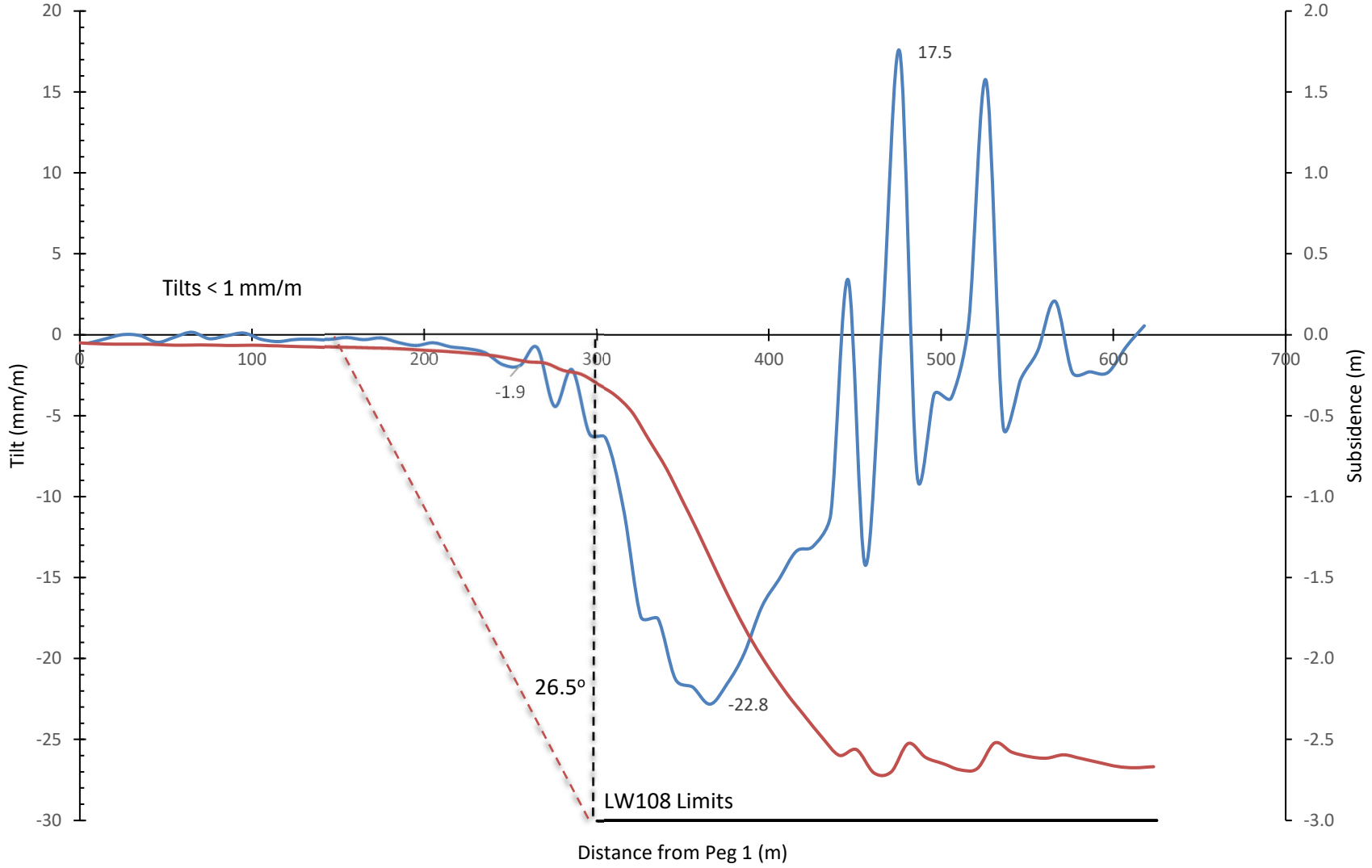
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.02.24	Title:	Measured Strain along H CrossLine (LW107-109) at Geometrically Equivalent Locations for the Mayfield Grinding Groove Sites	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 3d



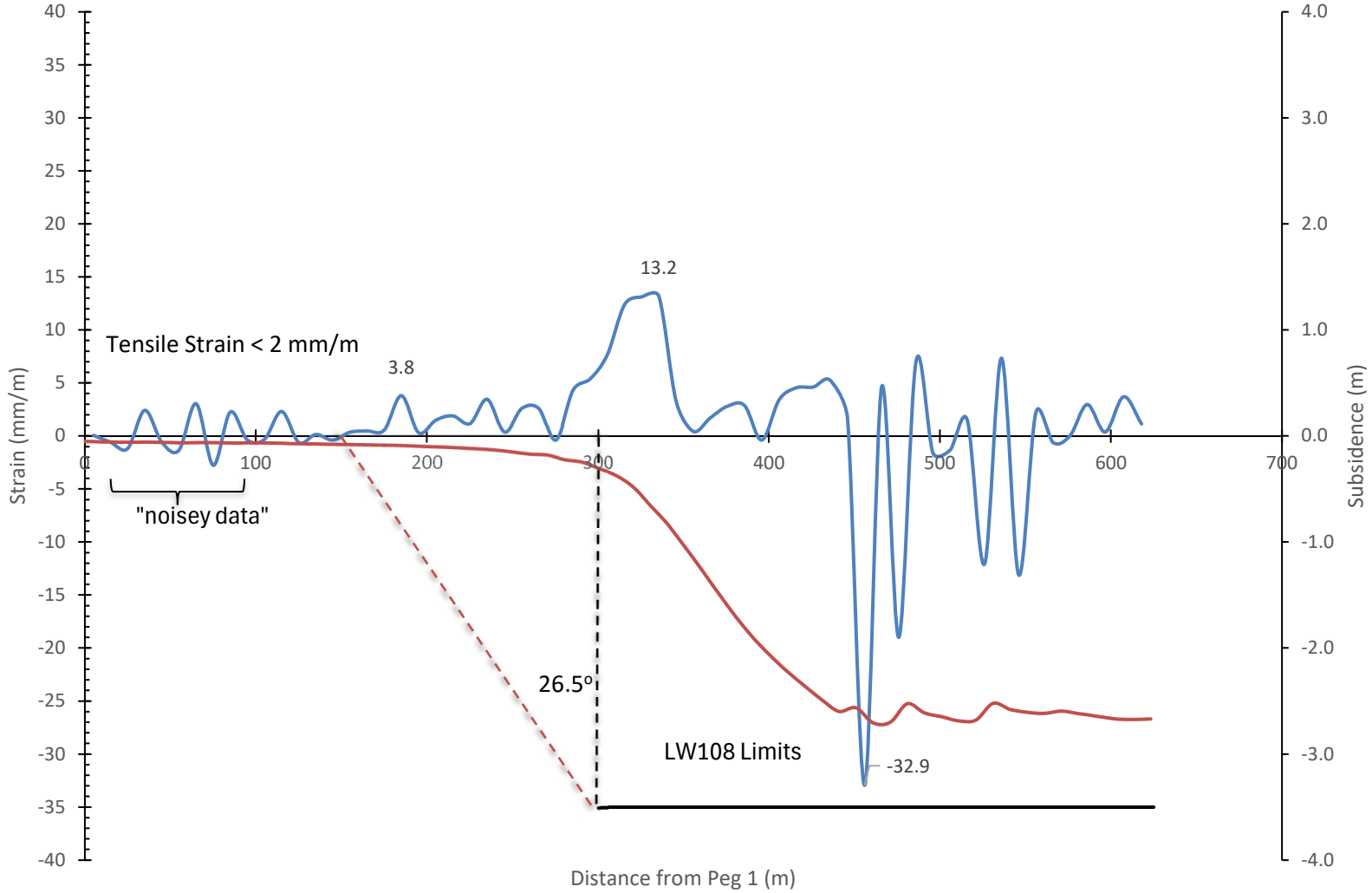
Key:

- Proposed Longwalls (LW203-206)
- Extracted Longwalls (LW101-108A)
- Approved First Workings
- Approved Pillar Reduction Panels (e = 66%)
- Restricted Mining Area
- Study Area Boundary (45° Draw Angle)
- Cover Depth Contours (m)
- Roads (unsealed)
- Fences
- Prediction Cross Lines
- Dwellings & Sheds/Tanks/Orchards
- NCO-Owned Buildings
- Ephemeral Creeks & Watercourses
- Farm Dams
- Contour Banks
- Powerlines (Domestic)
- S1 Steep Rocky Slopes
- Grinding Groove Sites

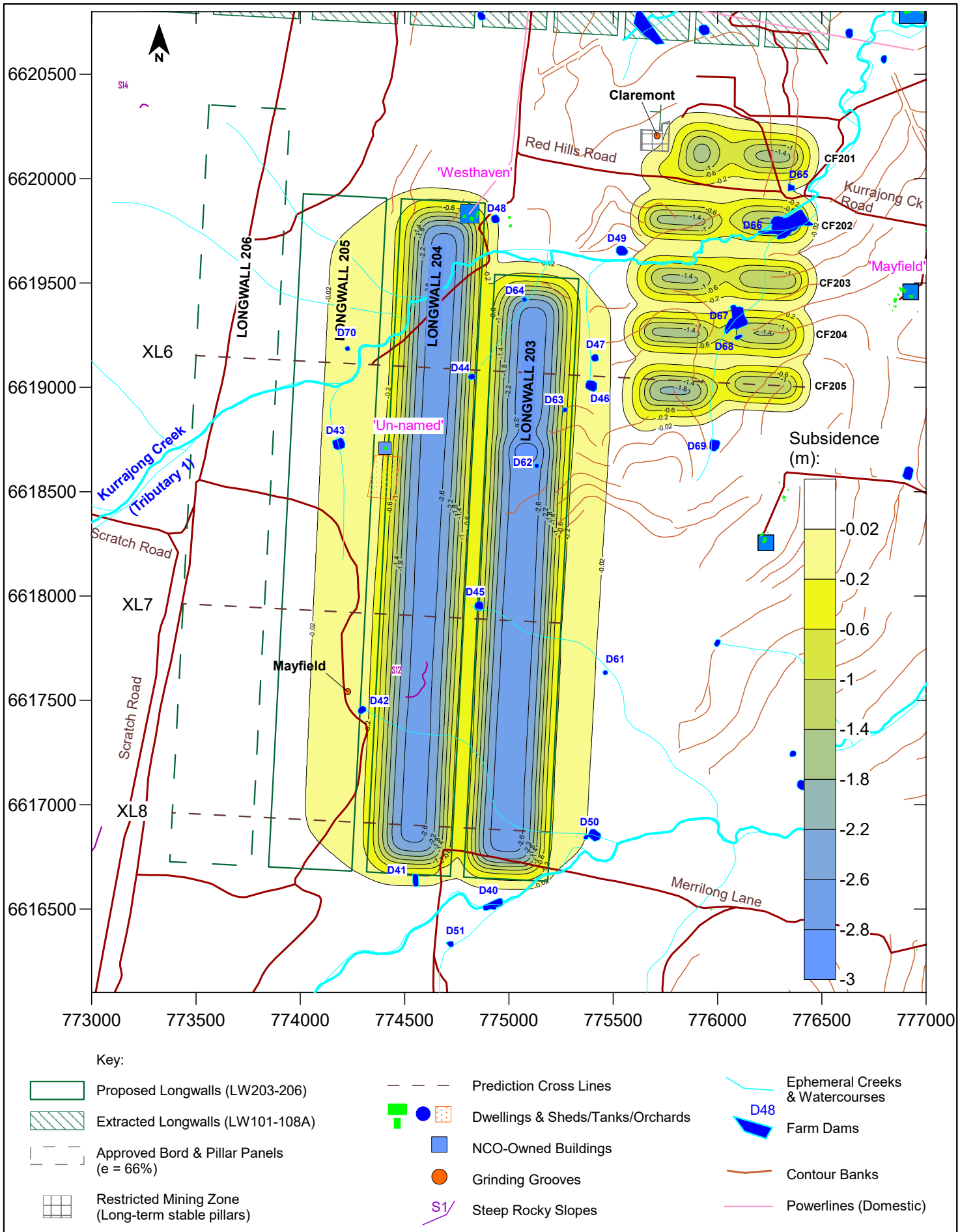
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	08.02.24	Title:	Strain Control Barrier Pillar Options for Mayfield and the Proposed Longwalls 203 to 206	
	Ditton Geotechnical Services Pty Ltd		Scale:	1:30,000	Figure No: 4a



DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	Measured Subsidence & Tilt along North Centreline (LW108A) : Tilt Development ahead of Longwall Face	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 4b



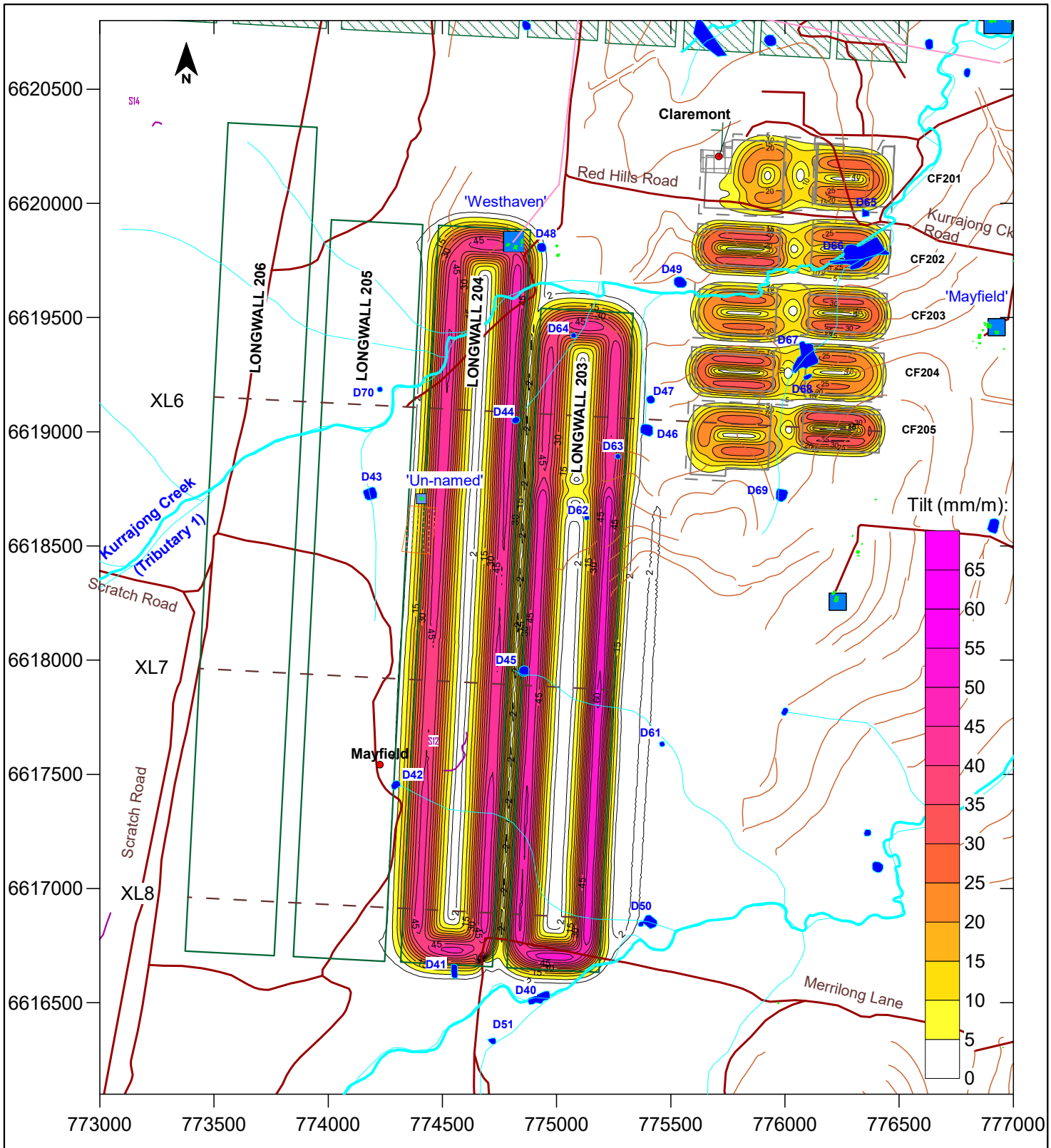
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	Measured Subsidence & Strain along North Centreline (LW108A): Strain Development Ahead of Longwall Face	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 4c



Key:

- Proposed Longwalls (LW203-206)
- Extracted Longwalls (LW101-108A)
- Approved Bord & Pillar Panels (e = 66%)
- Restricted Mining Zone (Long-term stable pillars)
- Prediction Cross Lines
- Dwellings & Sheds/Tanks/Orchards
- NCO-Owned Buildings
- Grinding Grooves
- S1 Steep Rocky Slopes
- Ephemeral Creeks & Watercourses
- D48 Farm Dams
- Contour Banks
- Powerlines (Domestic)

DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	08.04.24	Title:	Predicted U95%CL Subsidence Contours due to the Proposed LW203 to 204 at the Narrabri Mine	
Ditton Geotechnical Services Pty Ltd			Scale:	1:30,000	Figure No: 5a



Key:

- Proposed Longwalls (LW203-206)
- Extracted Longwalls (LW101-108A)
- Approved Bord & Pillar Panels (e = 66%)
- Restricted Mining Zone (Long-term stable pillars)
- Prediction Cross Lines
- Dwellings & Sheds/Tanks/Orchards
- NCO-Owned Buildings
- Grinding Grooves
- Steep Rocky Slopes
- Ephemeral Creeks & Watercourses
- D48 Farm Dams
- Contour Banks
- Powerlines (Domestic)

DgS

Ditton Geotechnical Services Pty Ltd

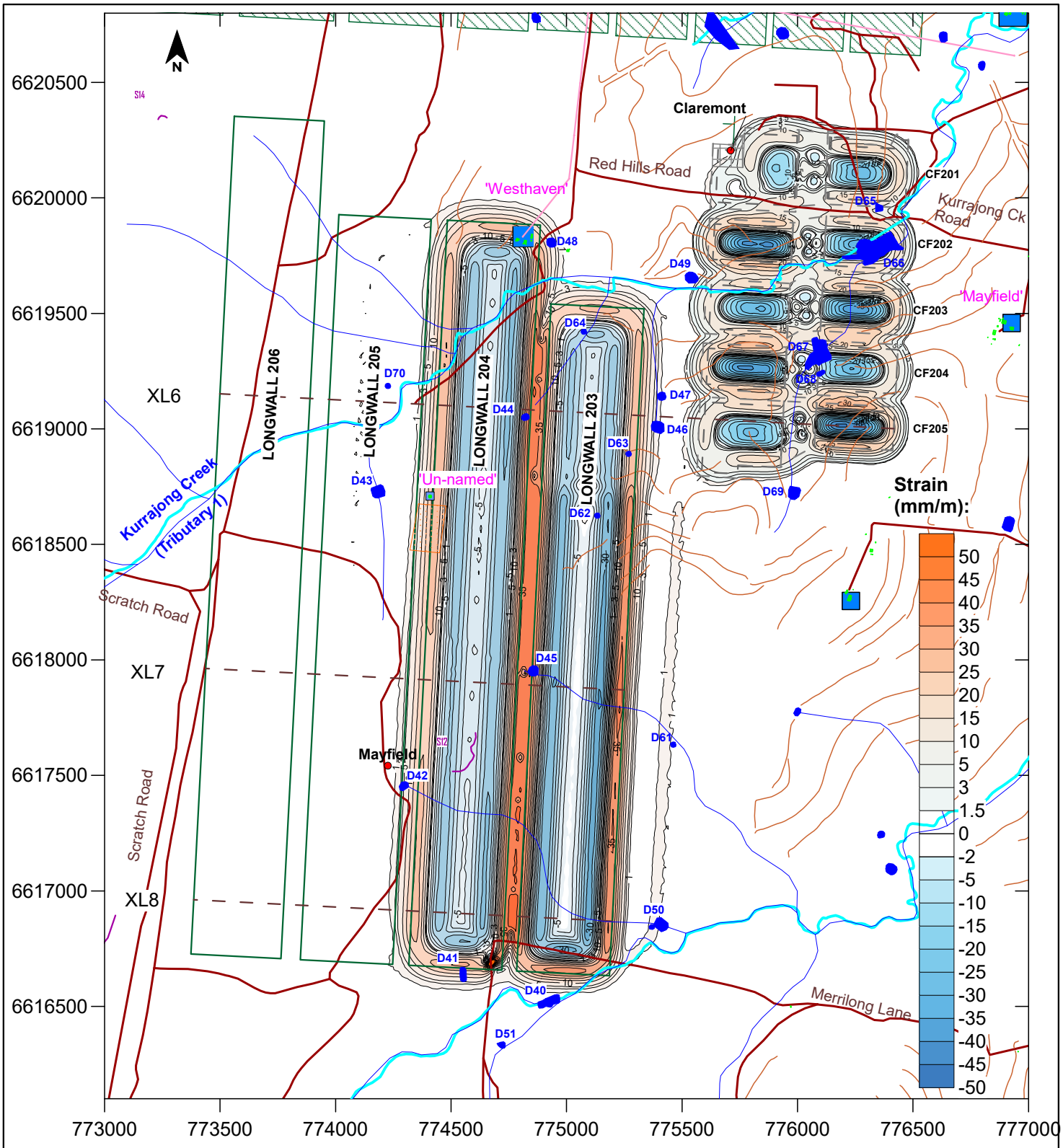
Engineer:	S.Ditton
Drawn:	S.Ditton
Date:	23.04.24

Client: Narrabri Mine
NAR-004/12

Title: Predicted U95%CL Tilt Contours due to the Proposed LW203 to 204 at the Narrabri Mine

Scale: 1:30,000

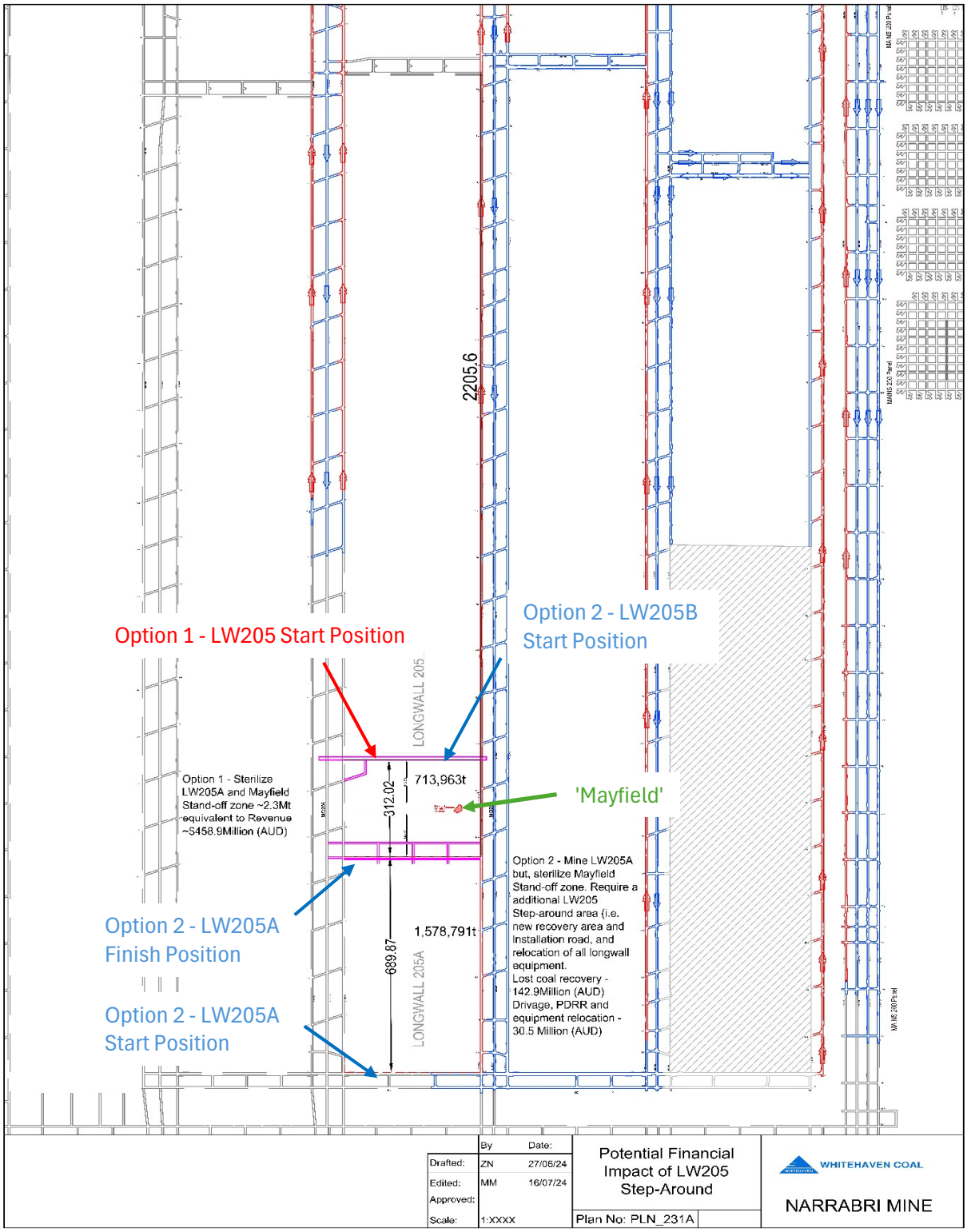
Figure No: 5b



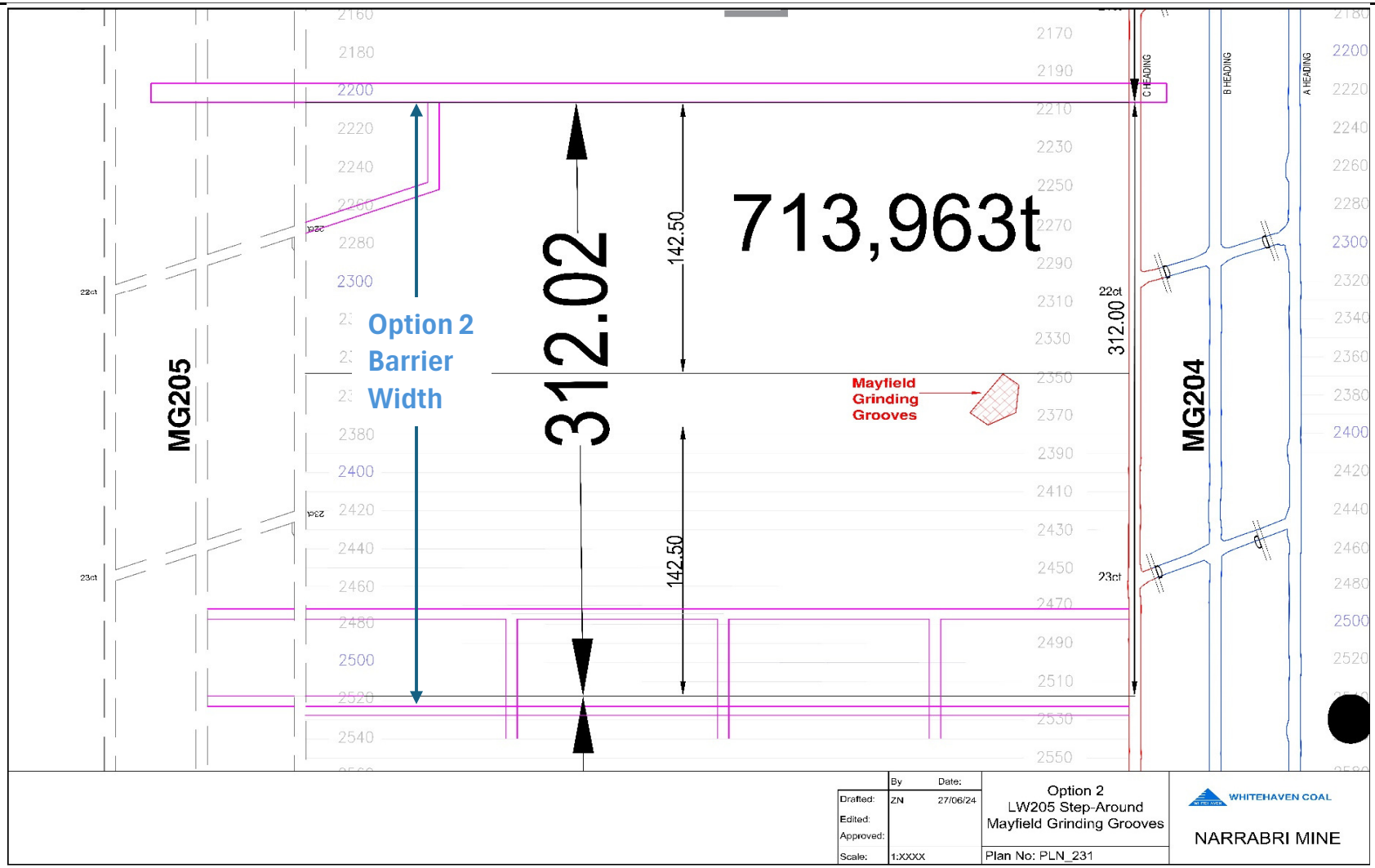
Key:

- Proposed Longwalls (LW203-206)
- Extracted Longwalls (LW101-108A)
- Approved Bord & Pillar Panels (e = 66%)
- Restricted Mining Zone (Long-term stable pillars)
- Prediction Cross Lines
- Dwellings & Sheds/Tanks/Orchards
- NCO-Owned Buildings
- Grinding Grooves
- S1 Steep Rocky Slopes
- Ephemeral Creeks & Watercourses
- D48 Farm Dams
- Contour Banks
- Powerlines (Domestic)

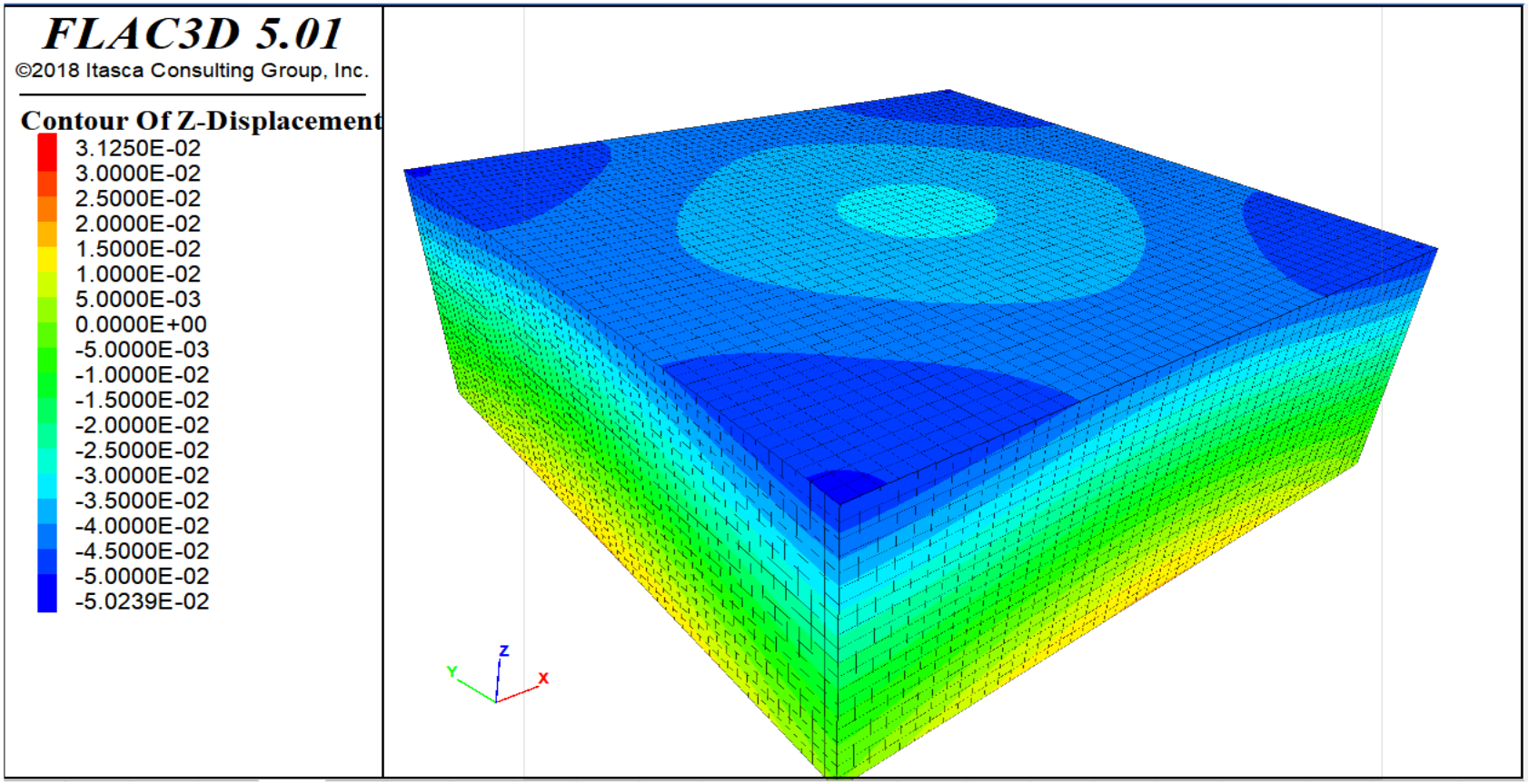
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	08.02.24	Title:	Predicted U95%CL Horizontal Strain Contours due to the Proposed LW203 to 204 at the Narrabri Mine	
	Ditton Geotechnical Services Pty Ltd		Scale:	1:30,000	Figure No: 5c



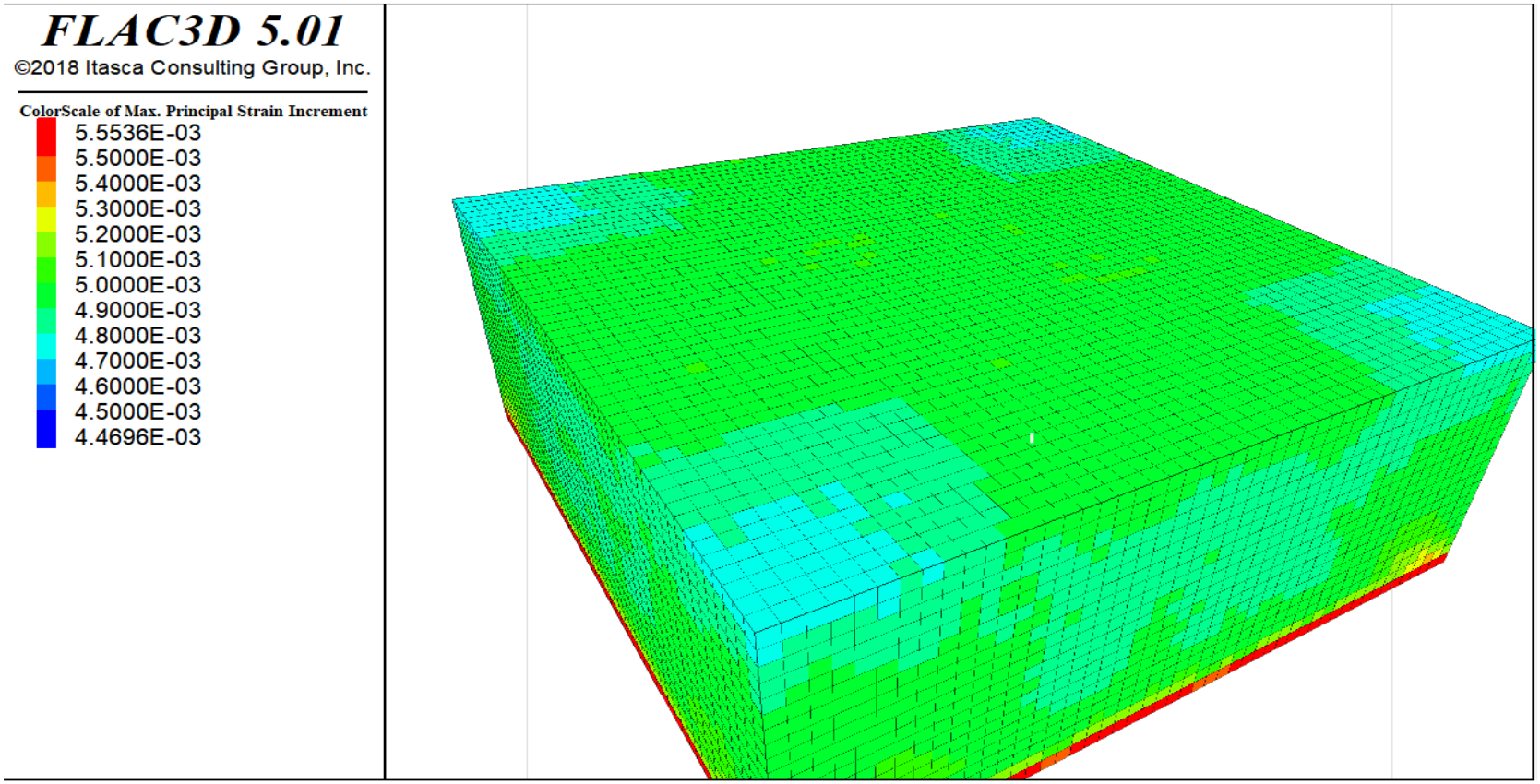
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine	
	Drawn:	S.Ditton		NAR-004/12	
	Date:	02.08.24	Title:	Barrier Options 1 and 2 to protect Mayfield grinding Groove Sites	
	Ditton Geotechnical Services Pty Ltd		Scale:		Figure No: 6a



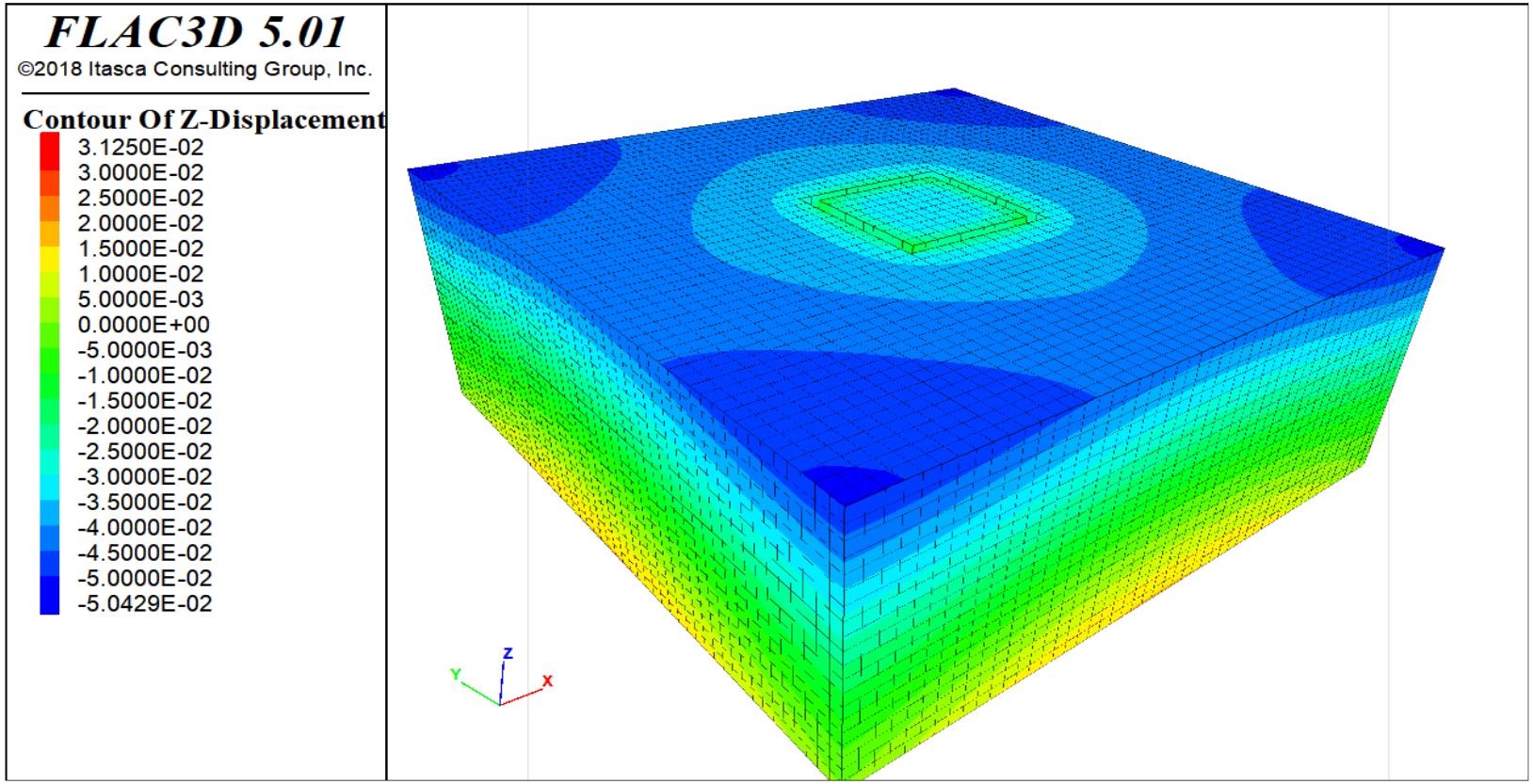
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	Option 1 and 2 Mayfield Site Protection Barrier (based on 0.5H setback distance to site)	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 6b



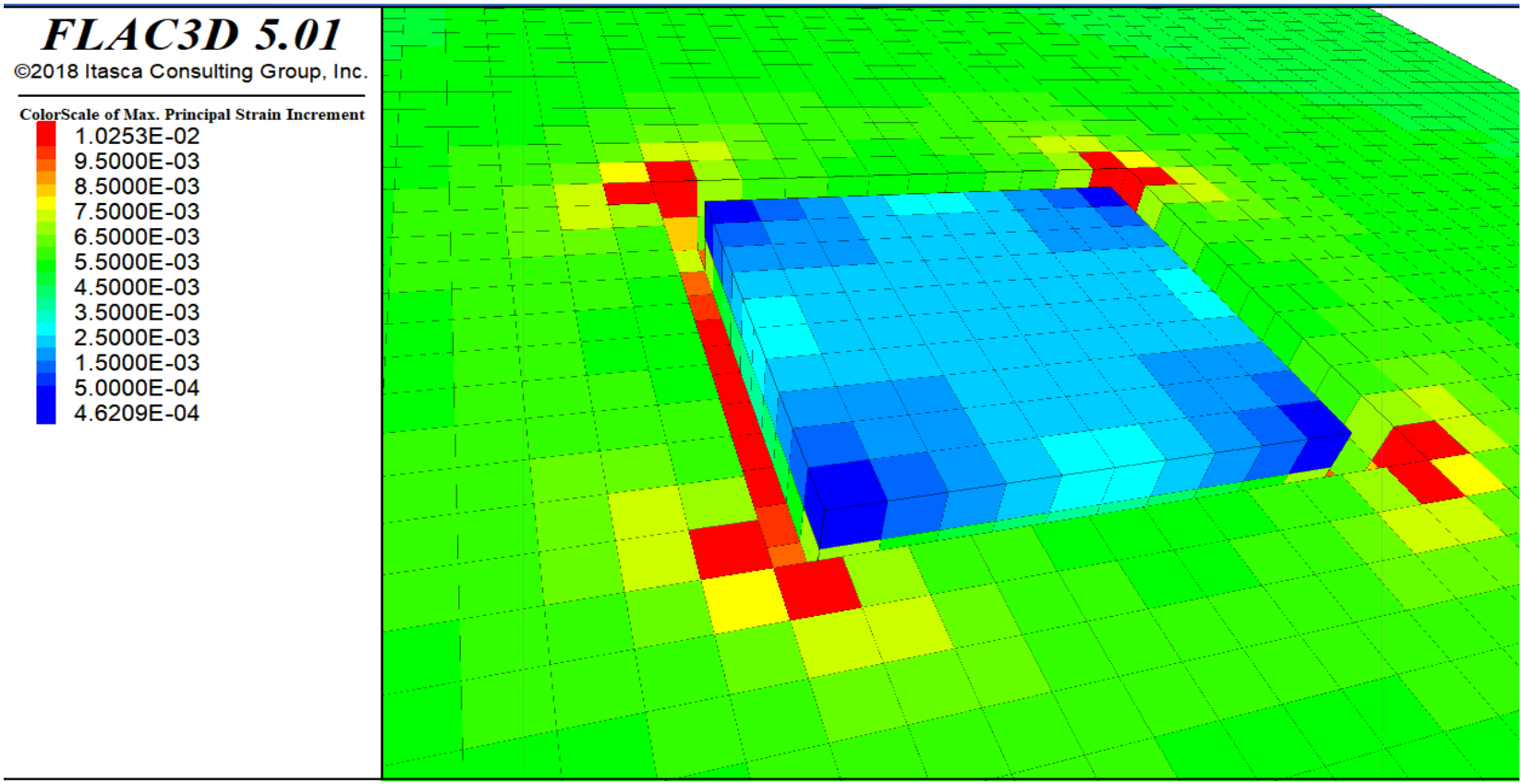
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	02.08.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - No trenches in Elastic Material and 5mm/m Tensile Strain Zone: Vertical Displacement Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 6c



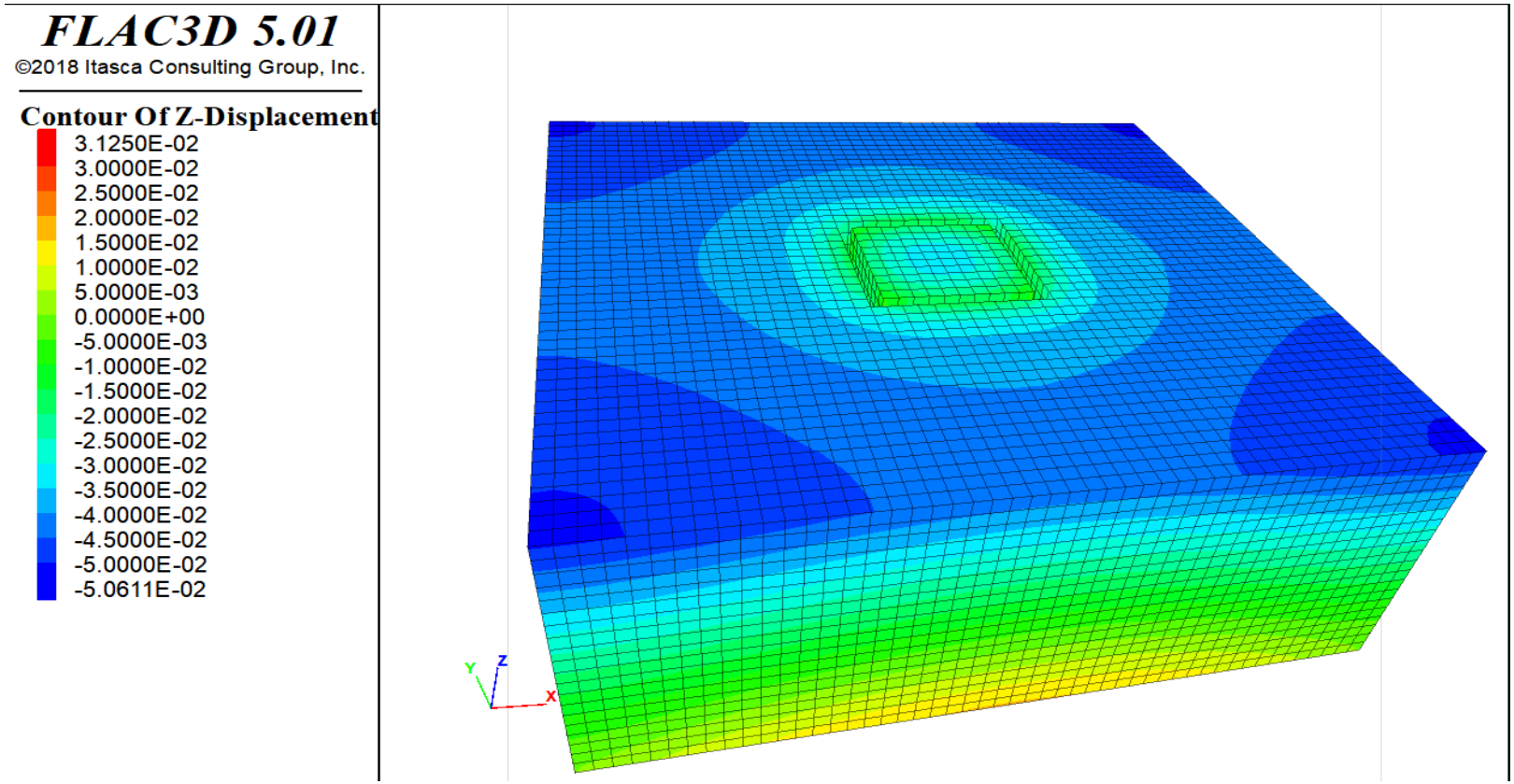
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	02.08.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - No trenches in Elastic Material and 5mm/m Tensile Strain Zone: Maximum Principal Strain Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 6d



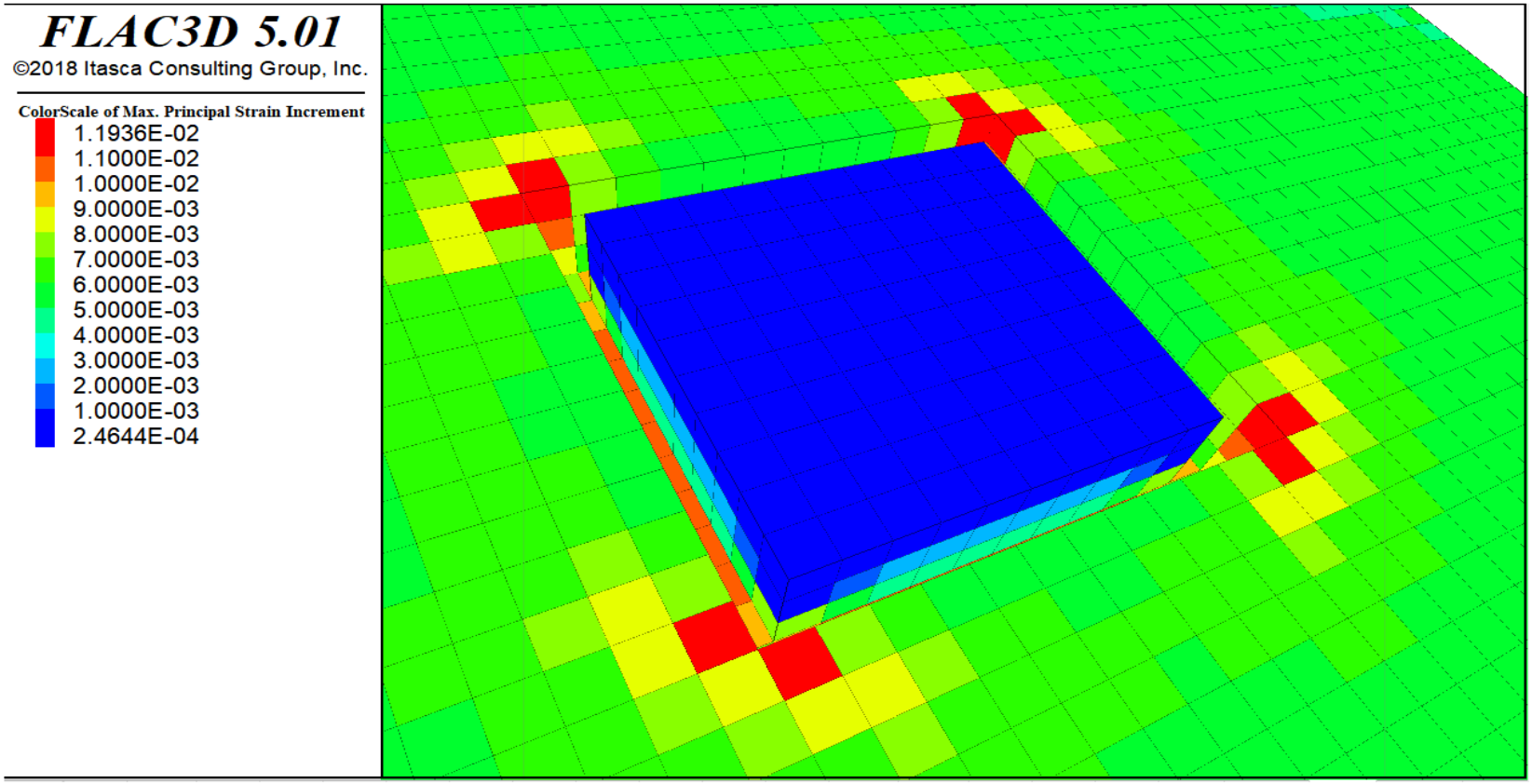
DgS	Engineer: S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn: S.Ditton			
	Date: 10.04.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - 2m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Vertical Displacement Contours	
	Ditton Geotechnical Services Pty Ltd	Scale:	NTS	Figure No: 6e



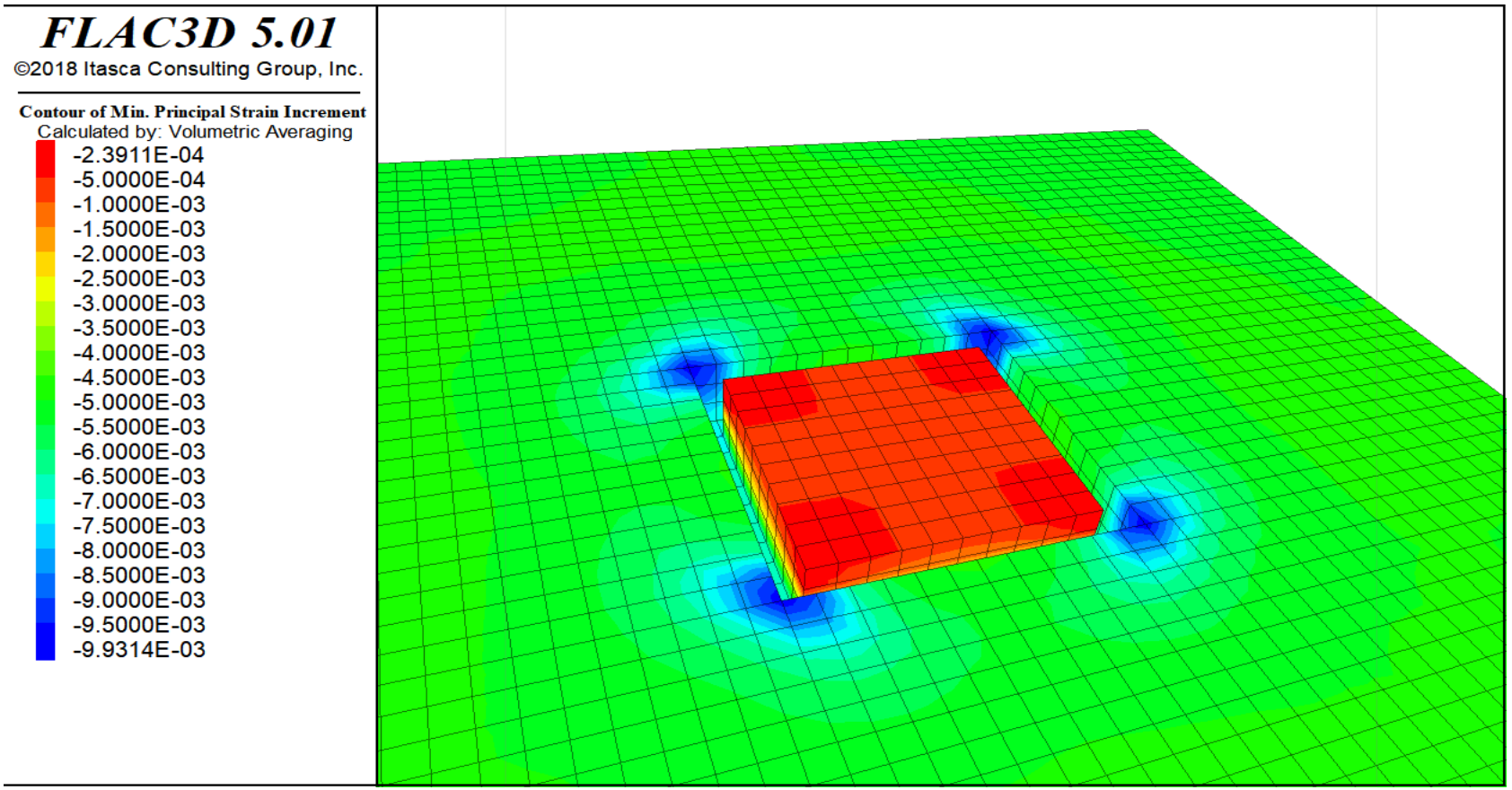
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - 2m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Maximum Principal Strain Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 6f



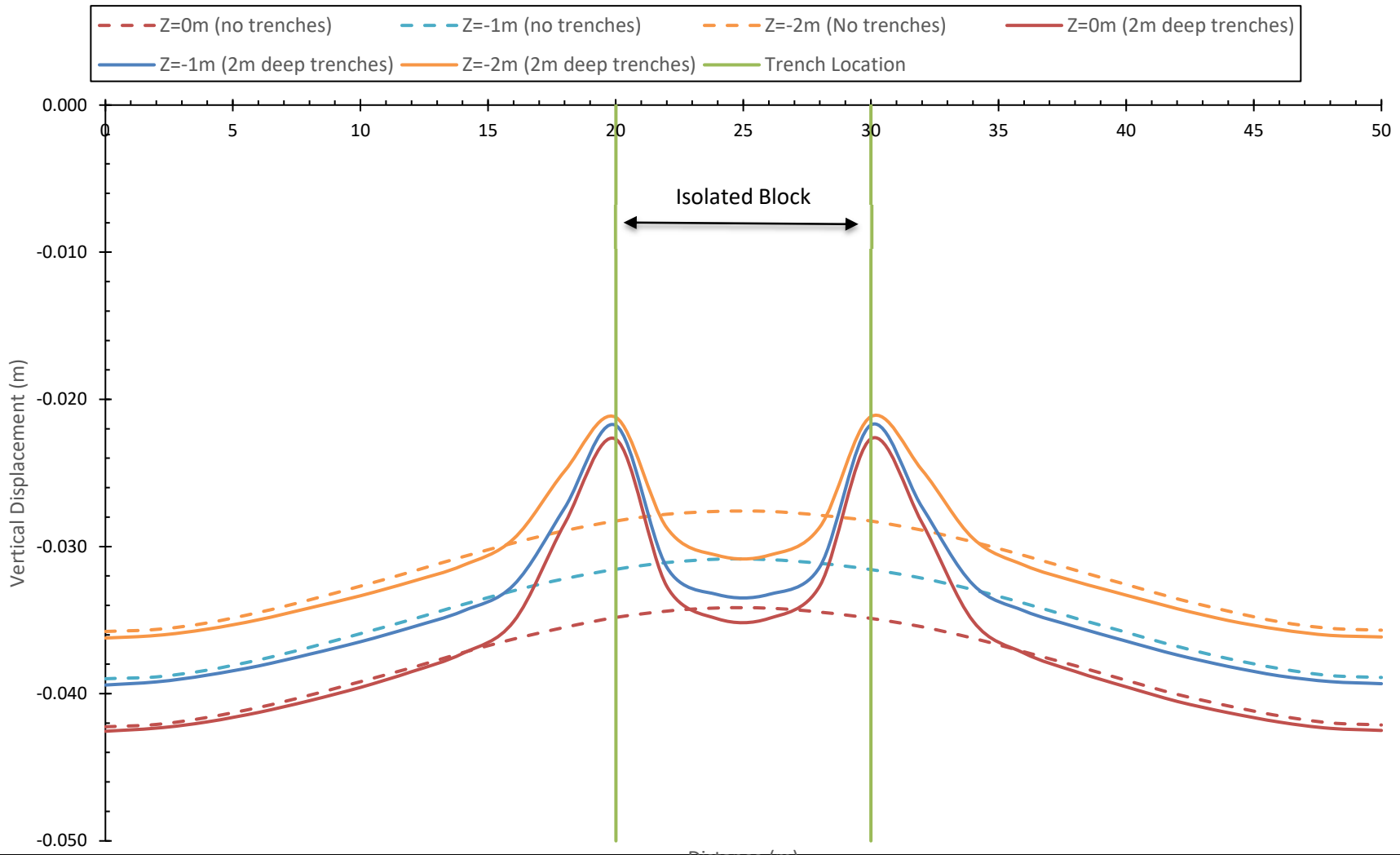
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - 3m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Vertical Displacement Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 6g



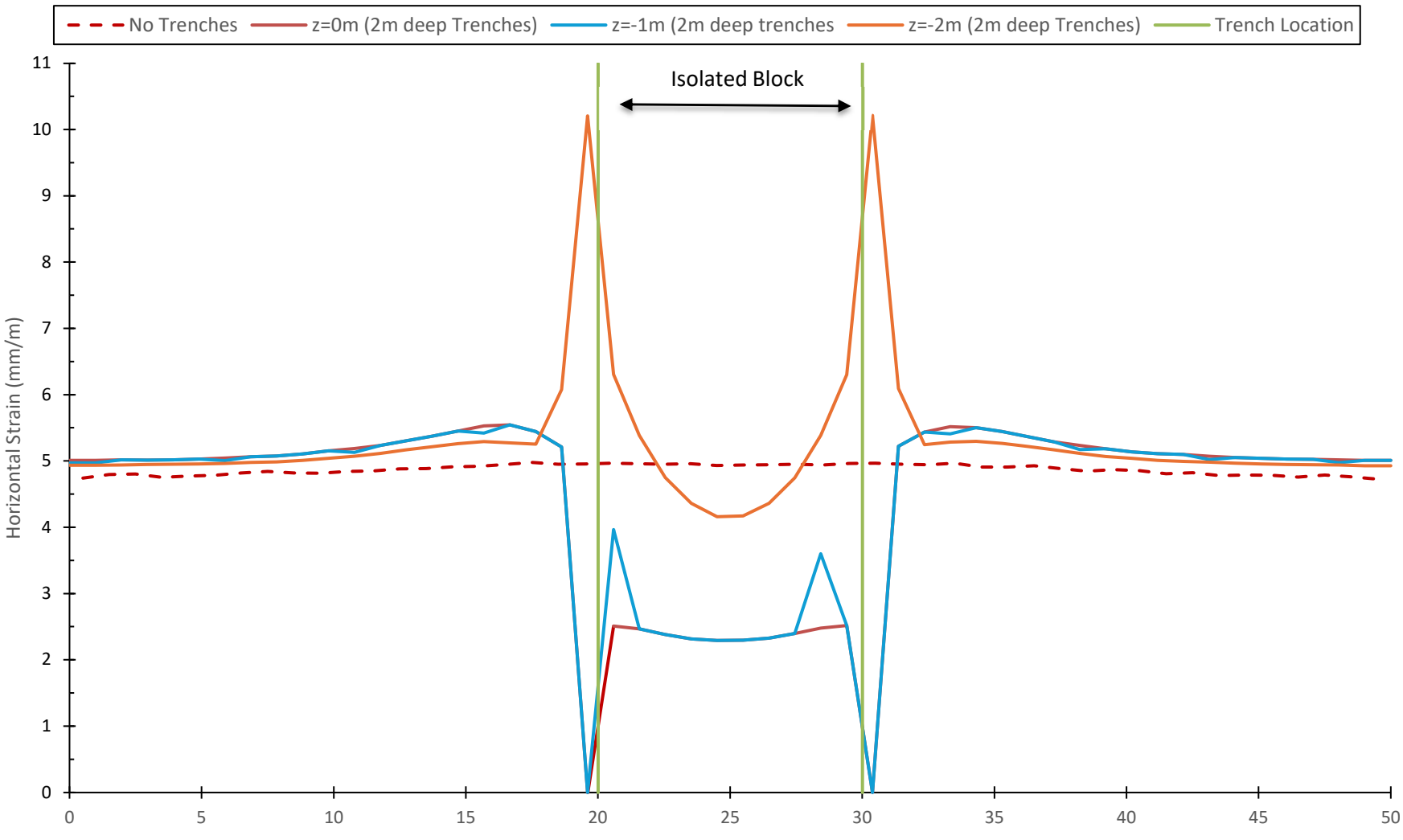
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - 3m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Maximum Principal Strain Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 6h



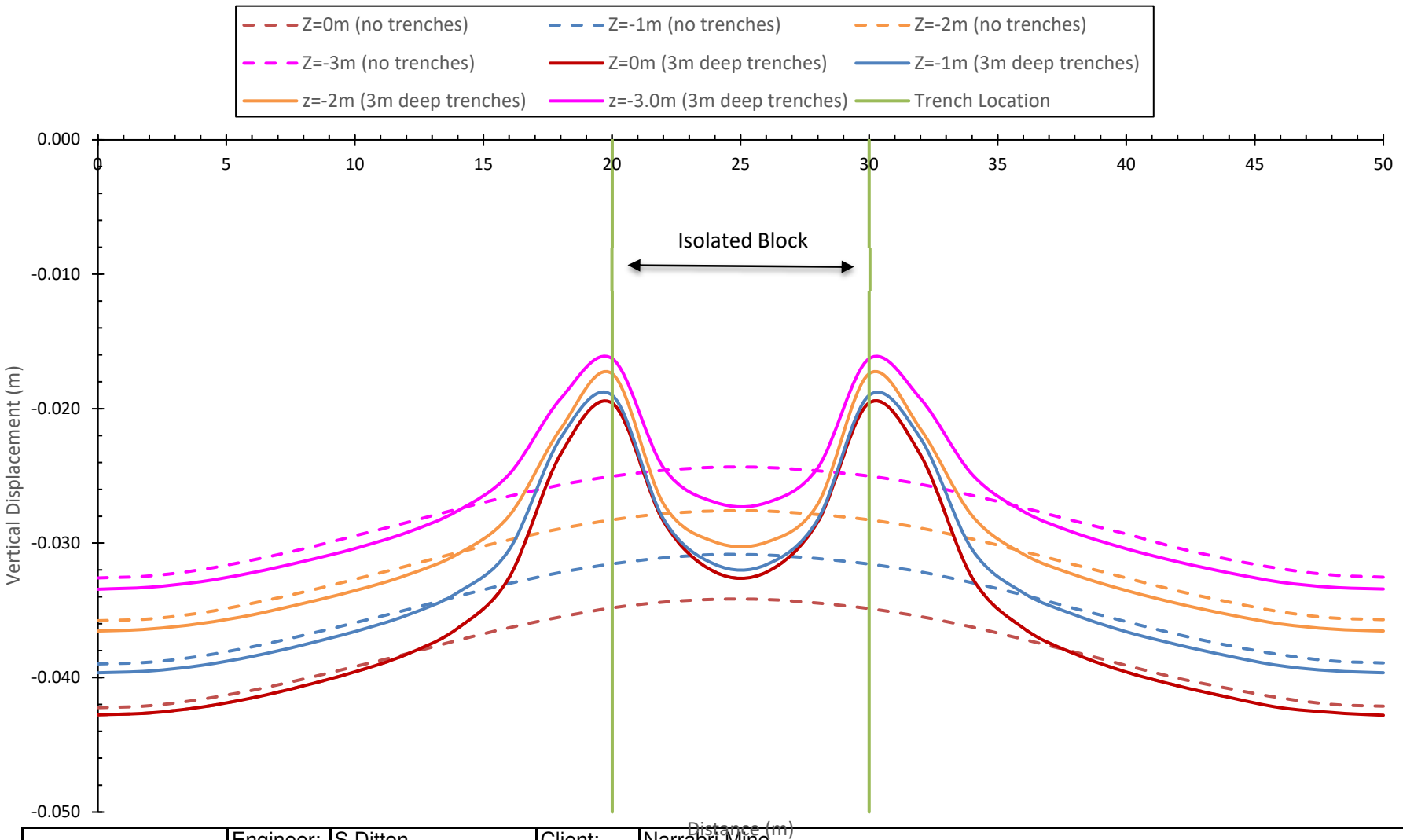
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - 3m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Compressive Strain Zone: Minimum Principal Strain Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 6i



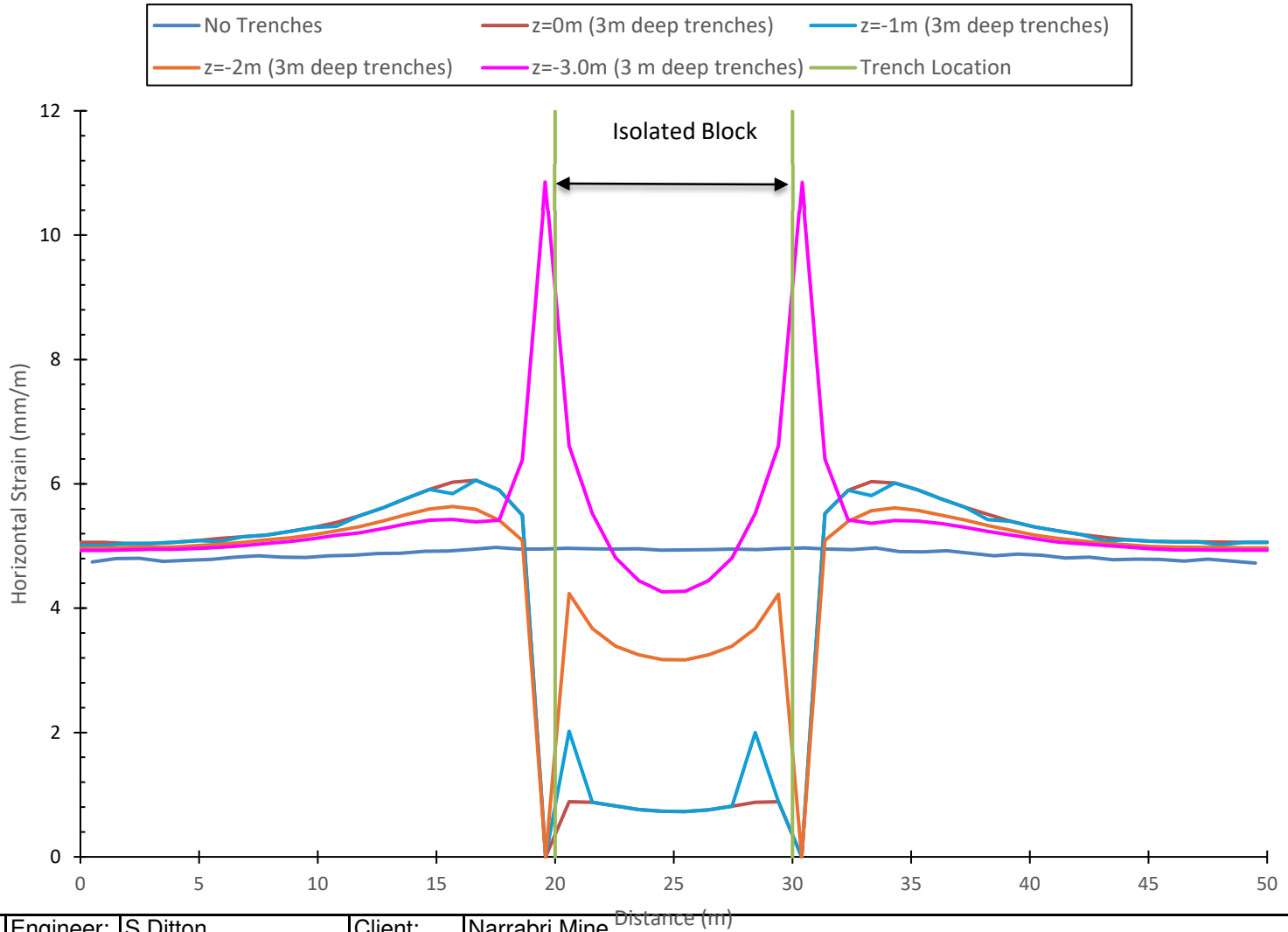
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine	
	Drawn:	S.Ditton		NAR-004/12	
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - 2m deep trenches @ 10 m spacing in Mohr-Coulomb Material and 5mm/m Tensile Strain Zone: Subsidence Profiles	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 7a



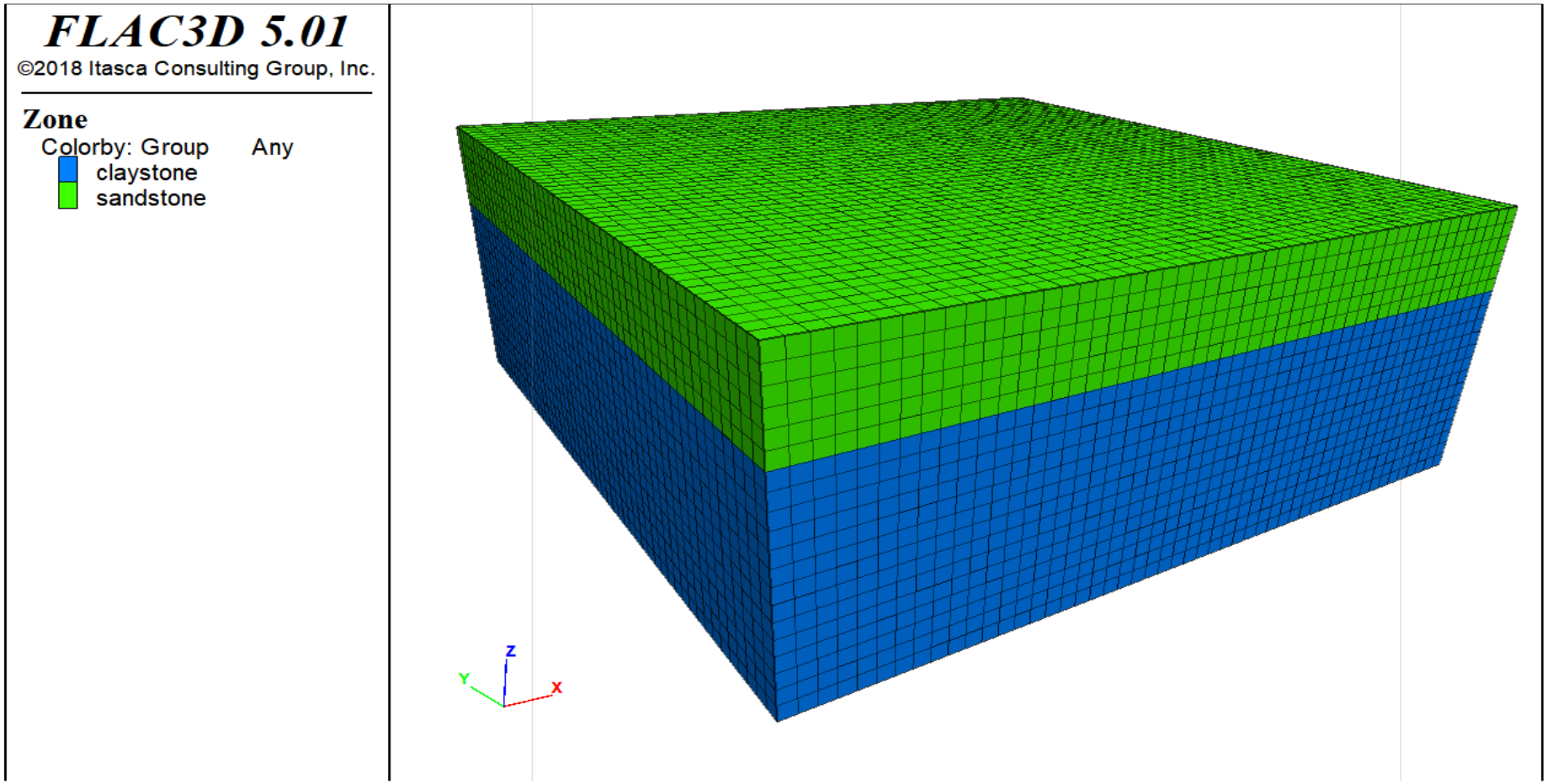
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine	
	Drawn:	S.Ditton		NAR-004/12	
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - 3 m deep trenches @ 10 m spacing in Mohr-Coulomb Material and 5mm/m Tensile Strain Zone: Maximum Principal Strain Profiles	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 7b



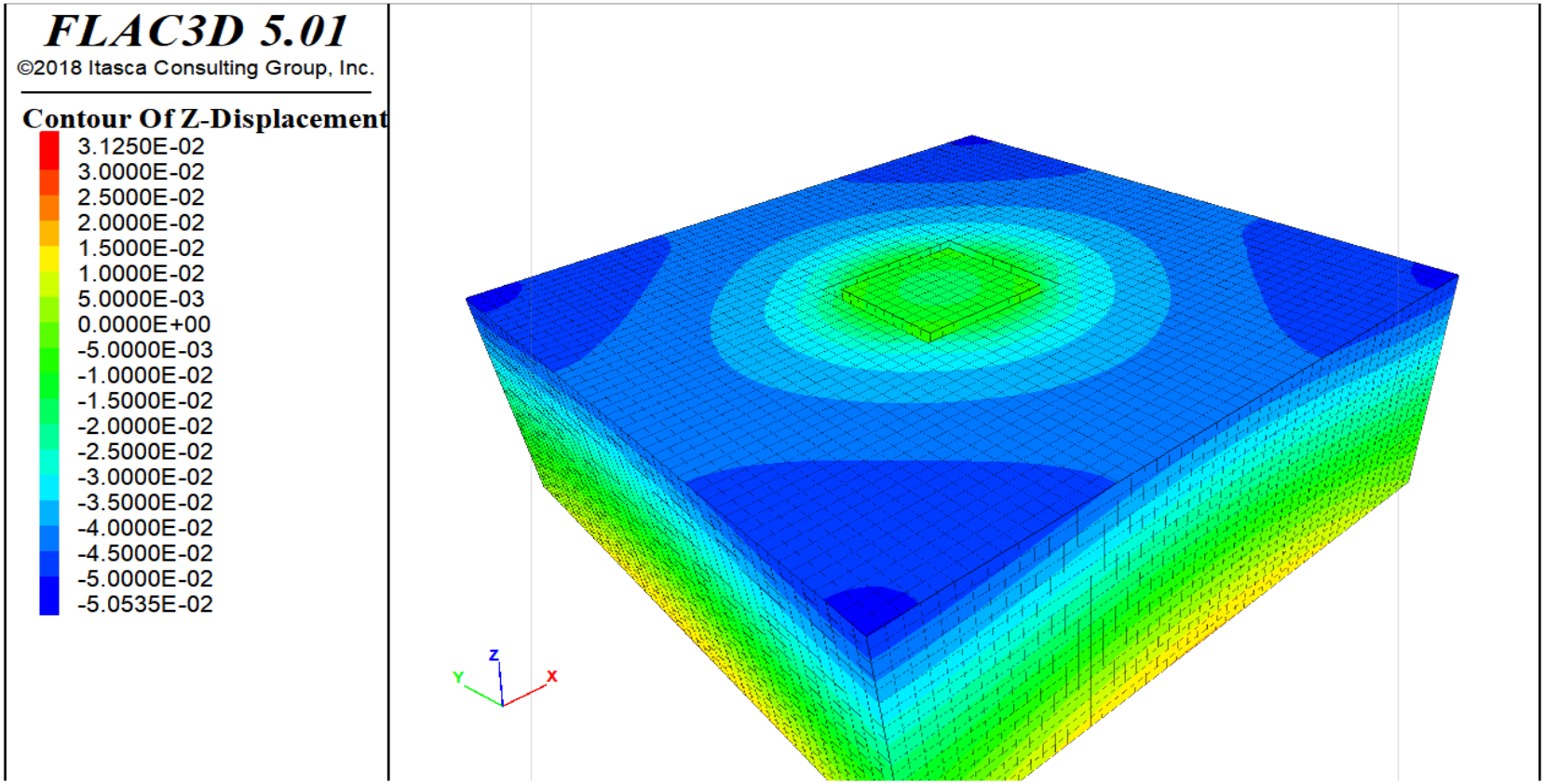
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine	
	Drawn:	S.Ditton		NAR-004/12	
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - 3m deep trenches @ 10 m spacing in Mohr-Coulomb Material and 5mm/m Tensile Strain Zone: Subsidence Profiles	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 7c



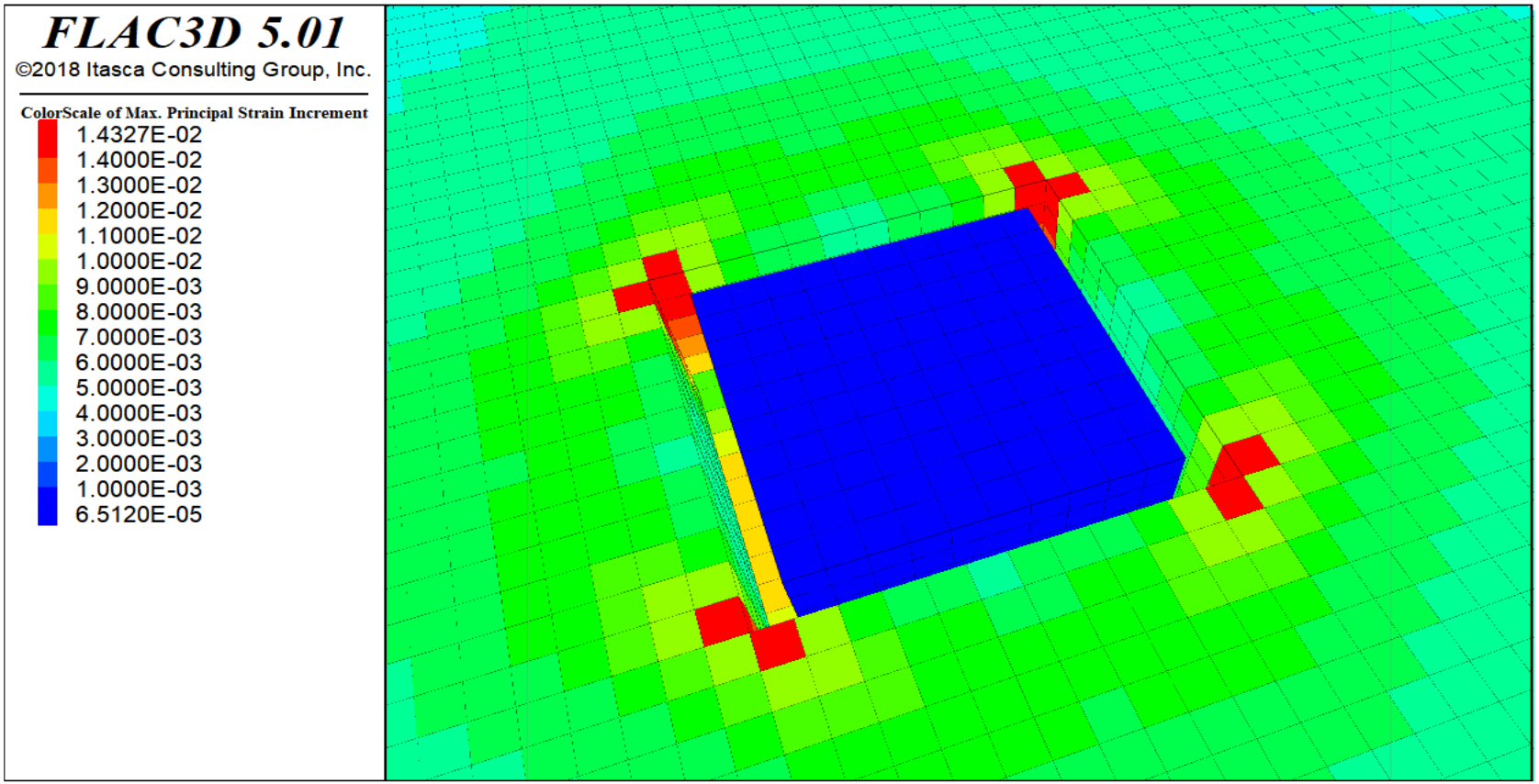
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine	
	Drawn:	S.Ditton		NAR-004/12	
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Stiff Clay - 3m deep trenches @ 10 m spacing in Mohr-Coulomb Material and 5mm/m Tensile Strain Zone: Maximum Principal Strain Profiles	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 7d



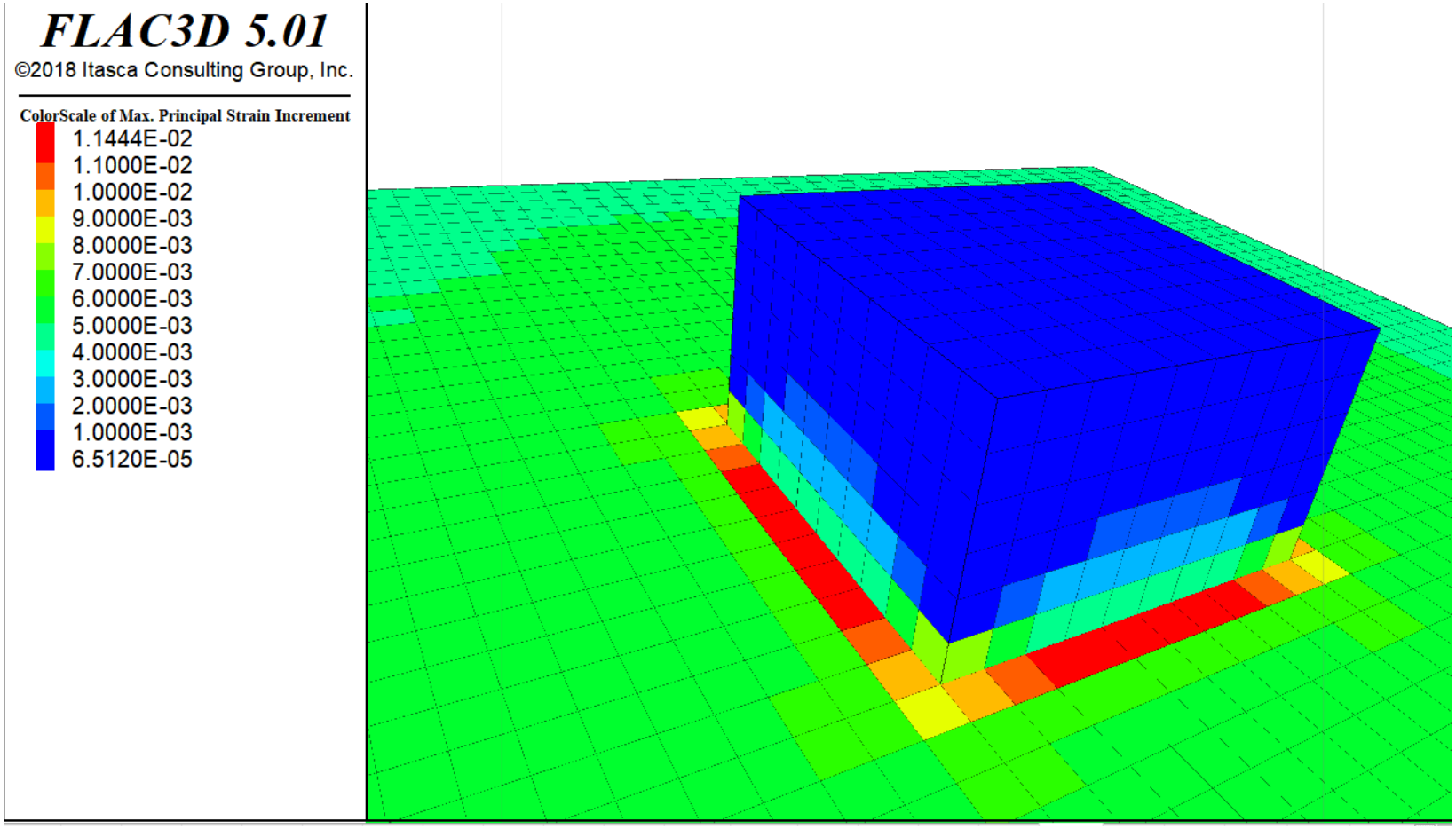
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Rock - 6m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Maximum Principal Strain Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 8a



DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Rock - 6m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Subsidence Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 8b

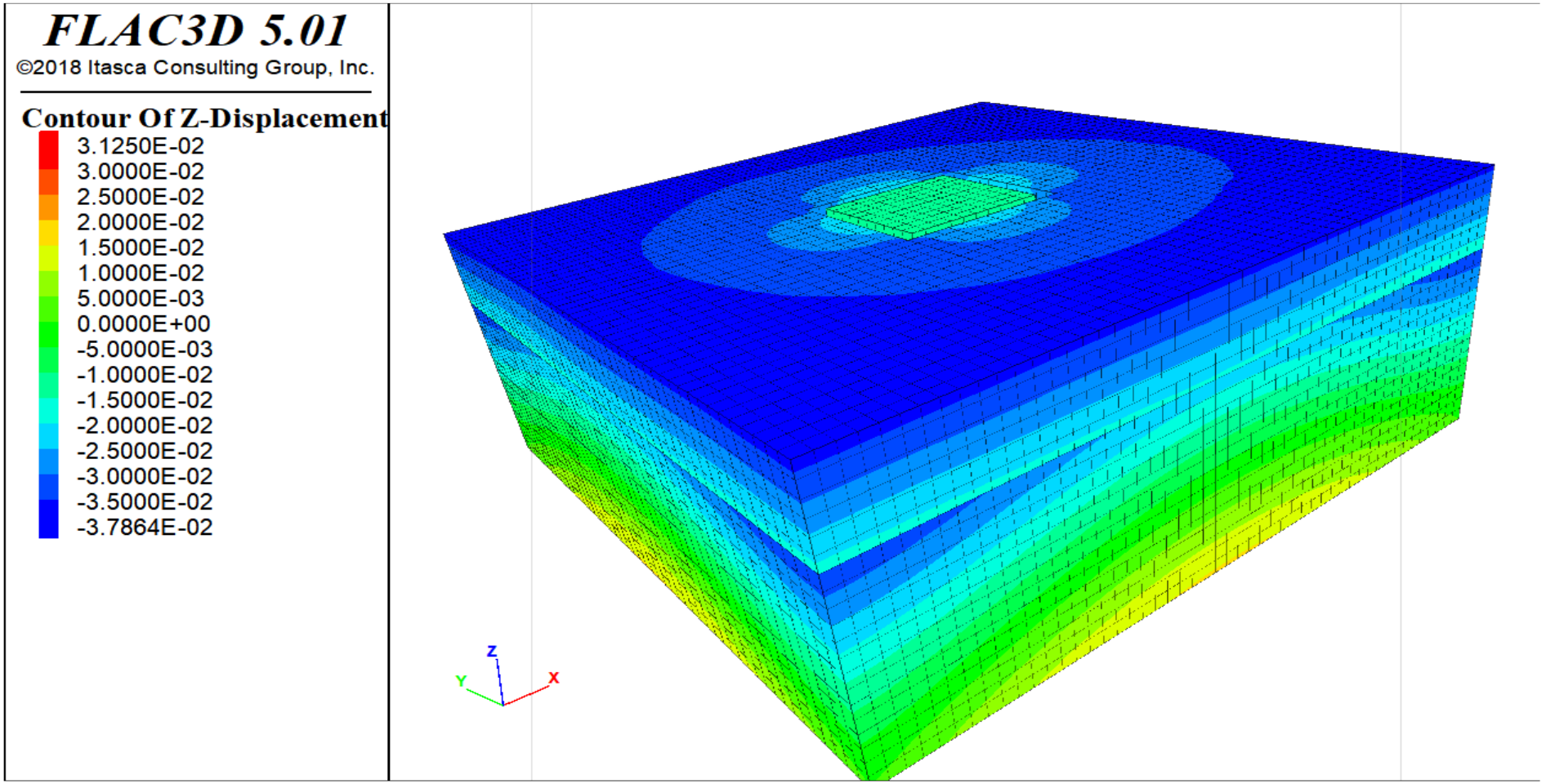


DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Rock - 6m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Maximum Principal Strain Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 8c

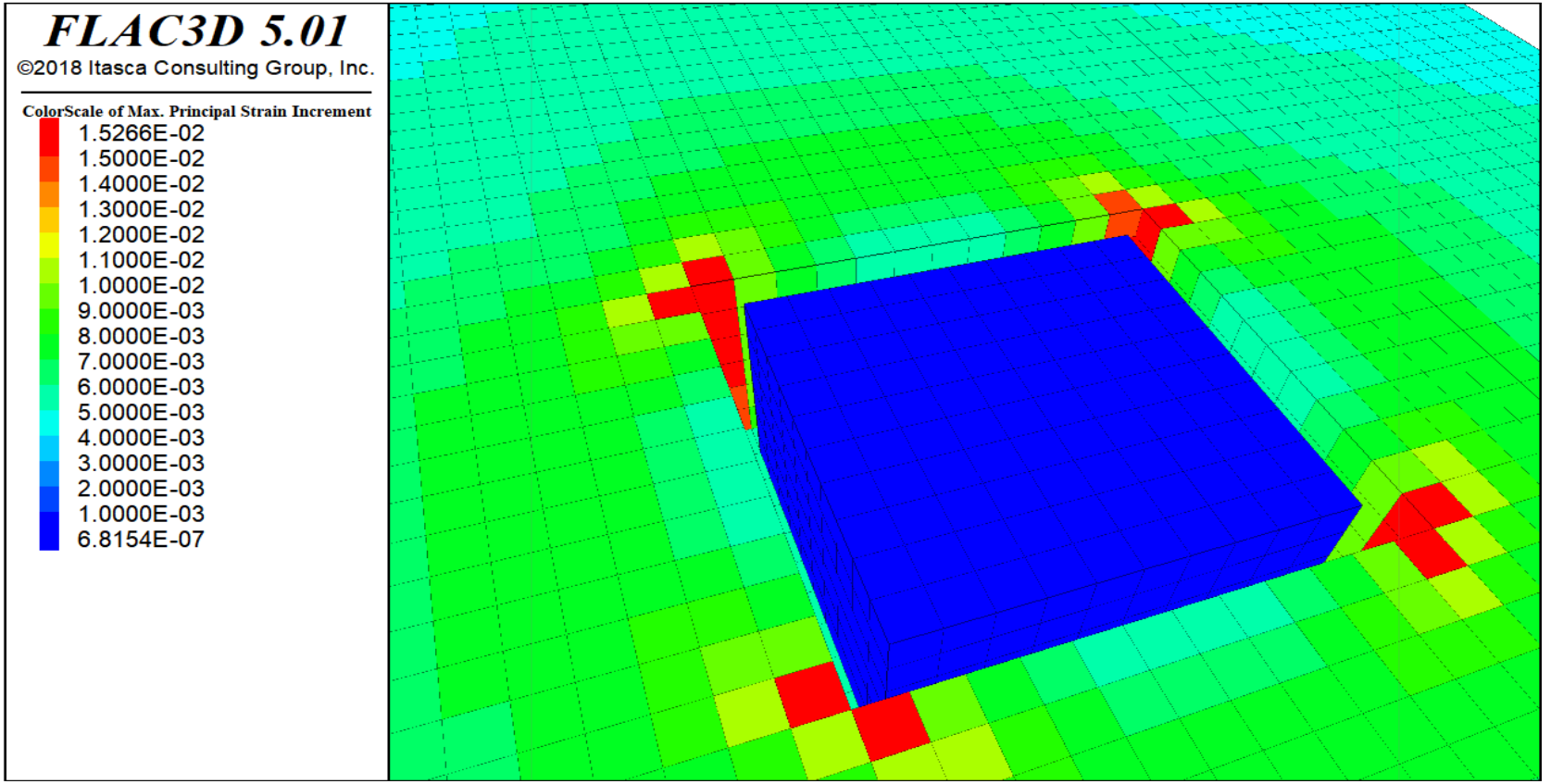


Note: Sandstone outside of slots not shown

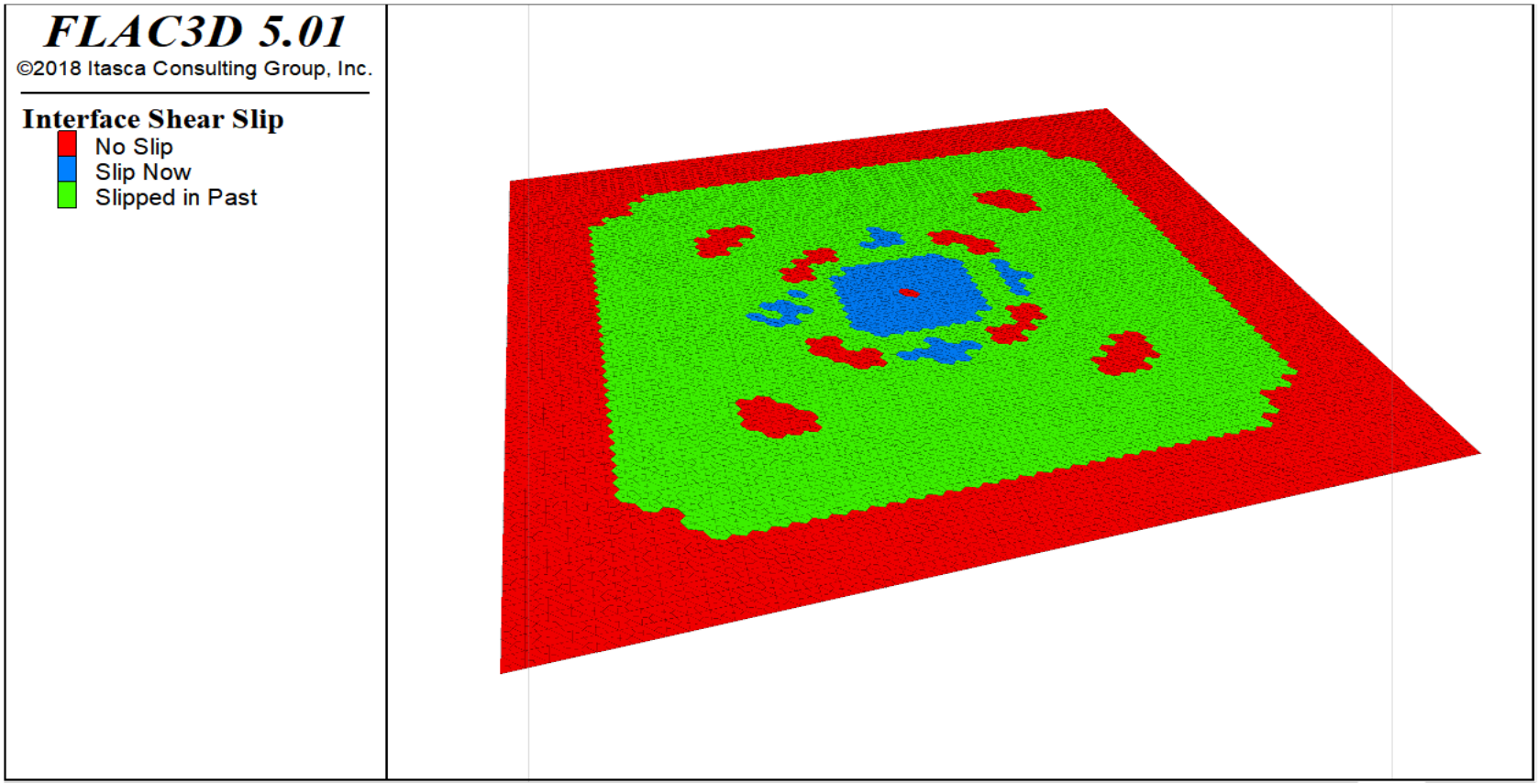
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Trial Trench Site in Rock - 6m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Maximum Principal Strain Contours	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 8d



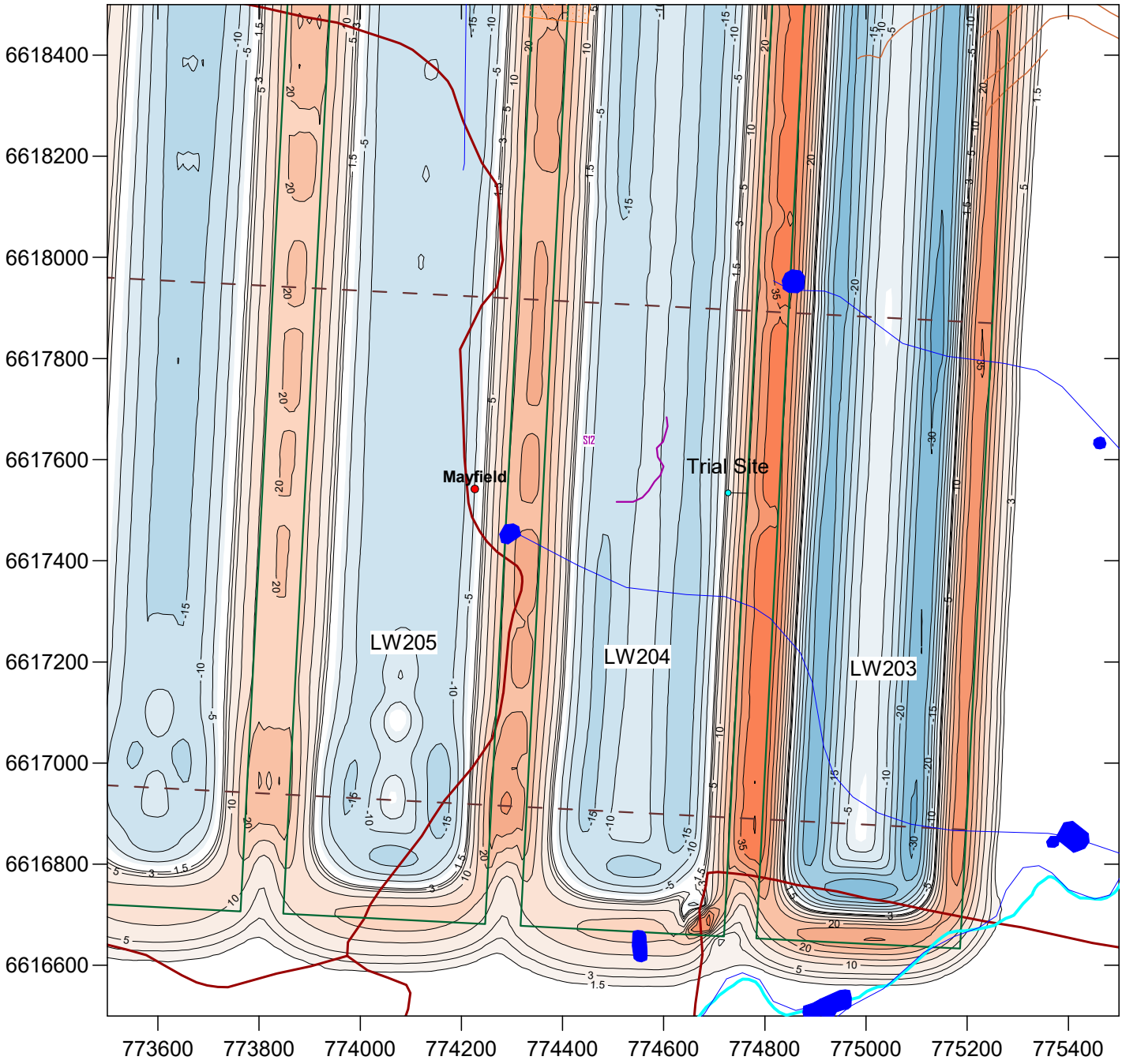
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Mayfield Site in Rock - 6m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Subsidence Contours for Bedding Slip Model	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 9a



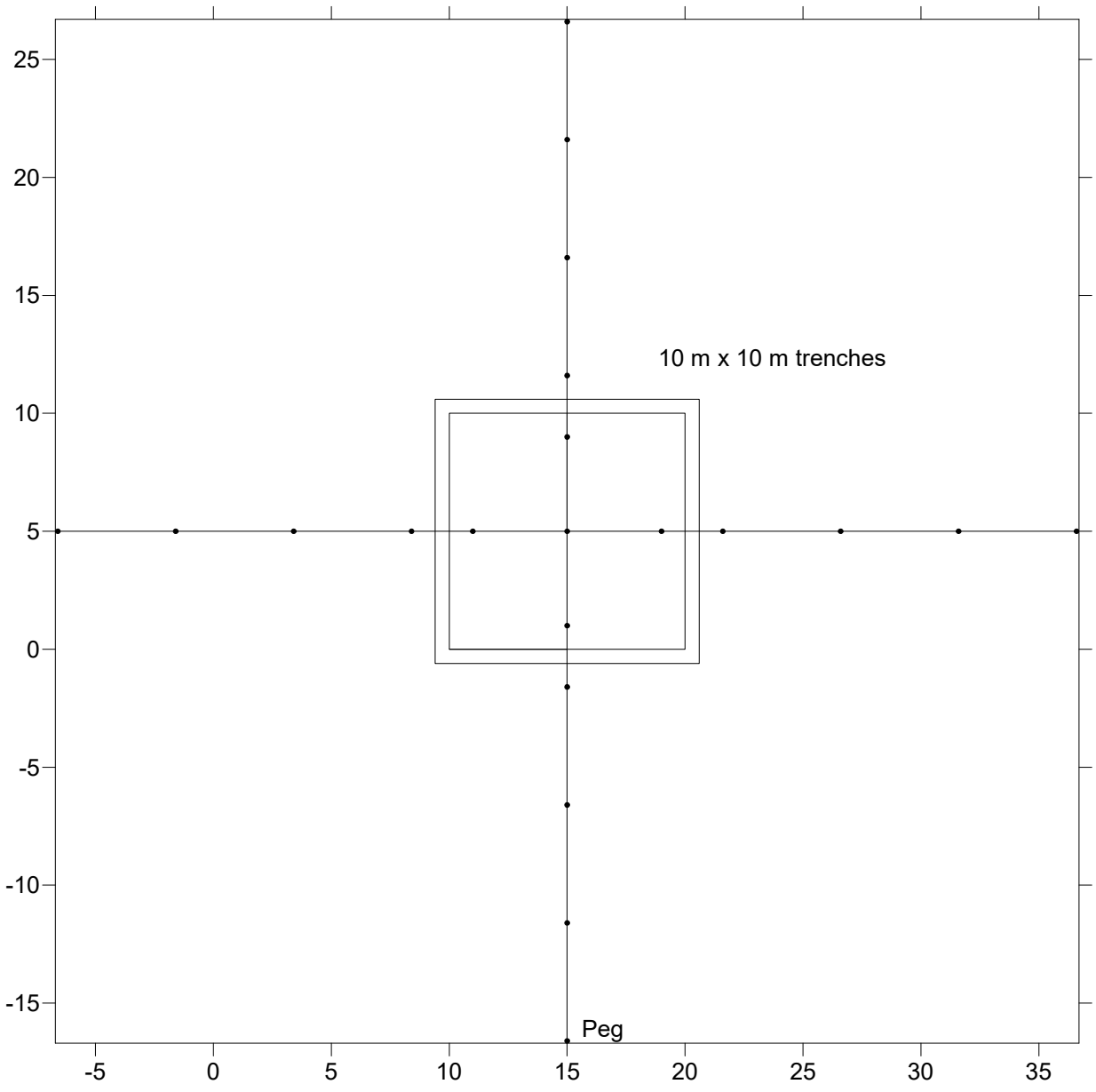
DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Mayfield Site in Rock - 6m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Principal Strain Contours for Slip model	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 9b



DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	10.04.24	Title:	FLAC3D Mayfield Site in Rock - 6m deep trenches @ 10 m spacing in Elastic Material and 5mm/m Tensile Strain Zone: Bedding Slip at Sandstone/Claystone Horizon	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 9c



DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	08.02.24	Title:	Proposed Trial Site above LW204 and Predicted U95%CL Horizontal Strain Contours due to the Proposed LW203 to 206 at the Narrabri Mine	
	Ditton Geotechnical Services Pty Ltd		Scale:	1:15,000	Figure No: 10a



DgS	Engineer:	S.Ditton	Client:	Narrabri Mine NAR-004/12	
	Drawn:	S.Ditton			
	Date:	08.02.24	Title:	Proposed Trial Site above LW204 and Predicted U95%CL Horizontal Strain Contours due to the Proposed LW203 to 206 at the Narrabri Mine	
	Ditton Geotechnical Services Pty Ltd		Scale:	1:15,000	Figure No: 10b