Tahmoor Colliery
Longwalls 24 to 26

RAIL TRANSPORT MUSEUM PICTON-MITTAGONG LOOP LINE

SURFACE SAFETY AND SERVICEABILITY MANAGEMENT PLAN

REVISION A

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GENERAL

AUTHORISATION OF SURFACE SAFETY AND SERVICEABILITY MANAGEMENT PLAN

Authorised on behalf of Tahmoor Colliery:	
Name:	MITCHELL GEDDES
Signature:	
Position:	TECHNICAL SERVICES MANAGER
Date:	21 AUGUST 2006.

Authorised on behalf of Rail Transport Museum:	
Name:	PETER BERRIMAN
Signature:	
Position:	PRESIDENT
Date:	21 AUGUST 2006

REVIEW

Date	Rev	Comments
18-Aug-06	A	Submission to Rail Transport Museum
21-Aug-06	A	OK by NSW Rail Transport Museum.

REFERENCES

1	*AS/NZS 4360:1999 Risk Management.*
2	*Tahmoor Colliery Longwalls 24 to 26 - The Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts on Surface and Sub-Surface Features due to mining Longwalls 24 To 26 at Tahmoor Colliery in support of an SMP Application.* (Report MSEC157), prepared by Mine Subsidence Engineering Consultants.

TABLE OF CONTENTS

Drawings

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

Drawing No.	*Description*	*Rev*
MSEC286-040801	Picton-Mittagong Loop Line	A

CHAPTER 1. INTRODUCTION

1.1. Background

Tahmoor Colliery is managed and operated by Tahmoor Coal Pty Limited, a fully owned subsidiary of Austral Coal Limited. Recently, Centennial Coal successfully secured an 85% interest in Austral Coal and as such, management of Tahmoor Colliery. Tahmoor Coal holds coal leases CCL 716, ML 1539 and ML 1376. The Picton-Mittagong Loop Line is located within these lease areas.

1.2. Current and Proposed Operations

Tahmoor Colliery has begun extending its underground coal mining into an area designated "Tahmoor North", which is located in the Southern Coalfields of NSW.

From 2002, the equipment in use at the mine has been steadily updated, including a new underground longwall mining unit. This longwall has a production capacity of 3,500 tonnes per hour. New high capacity belt conveyors are transferring coal to the surface for treatment at the upgraded Coal Preparation Plant.

Roadway development is carried out using five continuous miner development units. With the introduction of this new equipment and upgraded facilities, the Colliery has increased its productive capacity from 2 million to 3.6 million tonnes per annum.

1.2.1. Longwall Panels 24 to 26

Longwalls 24 to 26 are a continuation of a series of longwalls that extend into the Tahmoor North Lease area, which began with Longwall 22. The longwall panels are located between the Bargo River in the south-east, the township of Thirlmere in the west and Picton in the north. A portion of each longwall is located beneath the urban area of Tahmoor.

A number of surface and sub-surface features have been identified within the vicinity of the longwalls, including the Picton – Mittagong Loop Line, which lies outside the predicted limit subsidence, but within an angle of draw of 35 degrees from the longwalls.

1.3. Predicted Subsidence Movements over whole subsided area (not Loop Line)

The predicted movements in this section do not refer to predicted subsidence at the Picton-Mittagong Loop Line. They refer only to maximum predicted subsidence over Longwalls 24 to 26 and are provided for general background information.

A summary of the predicted maximum incremental parameters over the whole subsided area, due to the extraction of each longwall, is shown in Table 1.1.

Table 1.1 Maximum Predicted Incremental Subsidence Parameters over whole area (not Loop Line)

Subsidence Parameter	LW 22	LW 23	LW 24	LW 25	LW 26
Vertical Subsidence (mm)	503	613	596	631	636
Transverse Tilt (mm/m)	3.5	4.9	4.7	5.0	5.1
Longitudinal Tilt (mm/m)	3.0	3.8	3.5	3.7	3.7
Transverse Tensile Strain (mm/m)	0.4	0.7	0.7	0.8	0.8
Longitudinal Tensile Strain (mm/m)	0.6	0.7	0.8	0.8	0.8
Transverse Compressive Strain (mm/m)	0.9	1.6	1.5	1.7	1.7
Longitudinal Compressive Strain (mm/m)	0.6	0.8	0.6	0.6	0.8
Transverse Hogging Curvature (km^{-1})	0.03	0.05	0.05	0.05	0.05
Longitudinal Hogging Curvature (km^{-1})	0.04	0.05	0.05	0.05	0.05
Transverse Sagging Curvature (km^{-1})	0.06	0.11	0.10	0.11	0.11
Longitudinal Sagging Curvature (km^{-1})	0.04	0.05	0.04	0.04	0.05

The maximum predicted cumulative subsidence parameters, after the extraction of each longwall, are shown in Table 1.2.

Table 1.2 Maximum Predicted Cumulative Subsidence Parameters over whole area (not Loop Line)

Subsidence Parameter	LW 22	LW 23	LW 24	LW 25	LW 26
Vertical Subsidence (mm)	503	756	850	892	934
Transverse Tilt (mm/m)	3.5	5.0	4.8	5.2	5.2
Longitudinal Tilt (mm/m)	3.0	4.4	4.9	5.1	5.2
Transverse Tensile Strain (mm/m)	0.4	0.7	0.7	1.0	1.3
Longitudinal Tensile Strain (mm/m)	0.6	0.7	0.8	0.9	0.9
Transverse Compressive Strain (mm/m)	0.9	1.6	1.7	1.7	1.8
Longitudinal Compressive Strain (mm/m)	0.6	0.8	0.8	0.8	0.8
Transverse Hogging Curvature (km^{-1})	0.03	0.05	0.05	0.07	0.09
Longitudinal Hogging Curvature (km^{-1})	0.04	0.05	0.05	0.06	0.06
Transverse Sagging Curvature (km^{-1})	0.06	0.11	0.11	0.11	0.12
Longitudinal Sagging Curvature (km^{-1})	0.04	0.05	0.05	0.05	0.05

1.4. Limitations

This Management Plan is based on the predictions of the effects of mining on surface infrastructure as provided in Report No. MSEC157 by Mine Subsidence Engineering Consultants. Predictions are based on the planned configuration of longwalls at Tahmoor Colliery (as shown in Drawing No. MSEC286-040801), along with available geological information and data from numerous subsidence studies for longwalls previously mined in the area.

Infrastructure considered in this Plan has been identified from aerial photographs and regional maps.

The impacts of mining on surface and sub-surface features have been assessed in detail. However, it is recognised that the prediction and assessment of subsidence can be relied upon only to a certain extent. The limitations of the prediction and assessment of mine subsidence are discussed in report MSEC157 by Mine Subsidence Engineering Consultants.

As discussed in the report, there is a low probability that ground movements and their impacts could exceed the predictions and assessments. However, if these potentially higher impacts are considered prior to mining, they can be managed. This Surface Safety and Serviceability Management Plan will not necessarily prevent impacts from longwall mining, but will limit the impacts by establishing appropriate procedures that can be followed should evidence of increased impacts emerge.

1.5. Objectives

The objectives of this Surface Safety and Serviceability Management Plan (SSSMP) are to establish procedures to measure, control, mitigate and repair potential impacts that might occur to the Picton – Mittagong Loop Line.

The objectives of the SSSMP have been developed to:-

- Ensure the safe and serviceable operation of all surface infrastructure. Public and workplace safety is paramount. Disruption and inconvenience should be kept to minimal levels.
- Monitor ground movements and the condition of surface infrastructure during mining.
- Initiate action to mitigate or remedy potential significant impacts that are expected to occur on the surface.
- Provide a plan of action in the event that the impacts of mine subsidence are greater than those that are predicted.
- Provide a forum to report, discuss and record impacts to the surface. This will involve Tahmoor Colliery, Rail Transport Museum, Mine Subsidence Board, Department of Mineral Resources, and consultants as required.
- Establish lines of communication and emergency contacts.

1.6. Scope

The SSSMP is to be used to protect and monitor the condition of the items of infrastructure identified to be at risk due to mine subsidence. The major items at risk are:-

- Railway Tracks and Ballast
- Culverts

The SSSMP only covers infrastructure that is located within the general application area, which defines the extent of land that may be affected by mine subsidence as a result of mining Longwalls 24 to 26. The management plan does not include other sections of the Picton – Mittagong Loop Line which lies outside the extent of the general application area.

The Plan also applies to persons employed or engaged by Tahmoor Colliery requiring them to carry out activities described by this Plan.

Impacts are considered in terms of mining directly affecting infrastructure, rather than the effects from loss of services.

1.7. Proposed Mining Schedule

It is planned that each longwall will extract coal working northwest from the southeastern ends. This SSSMP covers longwall mining until completion of mining in Longwall 26 and for sufficient time thereafter to allow for completion of subsidence effects. It is proposed that the SSSMP will be in operation until end of 2010.

The current schedule of mining is shown in Table 1.3.

Table 1.3 Schedule of Mining

Longwall	Start Date	Completion Date
Longwall 24B	September 2006	June 2007
Longwall 24A	July 2007	November 2007
Longwall 25	January 2008	January - March 2009
Longwall 26	January - March 2009	April - June 2010

CHAPTER 2. RISK MANAGEMENT METHOD

2.1. General

The Australian/New Zealand standard for Risk Management defines the terms used in the risk management process, which includes the identification, analysis, assessment, treatment and monitoring of risk. In this context:-

2.1.1. Consequence

'The outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event.'[1] The consequences of a hazard are rated from very slight to very severe.

2.1.2. Likelihood

'Used as a qualitative description of probability or frequency.'[2] The likelihood can range from very rare to almost certain.

2.1.3. Hazard

'A source of potential harm or a situation with a potential to cause loss.'[3]

2.1.4. Risk

'The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood.'[4] The risk combines the likelihood of an impact occurring with the consequence of the impact occurring. The risk is rated from very low to extreme. In this study, the likelihood and consequence are combined via the qualitative risk analysis matrix shown in Table 2.1, to determine an estimated level of risk for particular events or situations.

The Risk Analysis Matrix is similar to the example provided in AS/NZS 4360:1995, Appendix D, p.25.

Table 2.1 Qualitative Risk Analysis Matrix

LIKELIHOOD	CONSEQUENCES				
	Very Slight	**Slight**	**Moderate**	**Severe**	**Very Severe**
Almost Certain	Low	Moderate	High	Extreme	Extreme
Likely	Low	Moderate	High	Very High	Extreme
Moderate	Low	Low	Moderate	High	Very High
Unlikely	Very Low	Low	Moderate	High	High
Rare	Very Low	Very Low	Low	Moderate	High
Very Rare	Very Low	Very Low	Low	Moderate	Moderate

This SSSMP adopts a common system of nomenclature to summarise each risk analysis, which is **"LIKELIHOOD / CONSEQUENCE → LEVEL OF RISK".**

For example, if the likelihood of a risk is assessed as "**UNLIKELY**", and the consequence of a risk is assessed as "**SEVERE**", the risk analysis would be summarised as **"UNLIKELY / SEVERE → HIGH"**.

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[1] AS/NZS 4360:1999 – Risk Management pp2
[2] AS/NZS 4360:1999 – Risk Management pp2
[3] AS/NZS 4360:1999 – Risk Management pp2
[4] AS/NZS 4360:1999 – Risk Management pp3

CHAPTER 3. RISK ASSESSMENT

3.1. Picton – Mittagong Loop Line

The Picton-Mittagong Loop Line is located to the north west of the proposed longwalls and comprises a single set of rails generally supported by steel sleepers with some timber sleepers.

While the railway is located within the SMP Area, no section of the railway is located within the predicted limit of subsidence. However, there is one masonry railway culvert, numbered C05 that lies within the SMP Area that might experience some small upsidence and closure movements.

The track predates the Main Southern Railway and is constructed in short lengths connected by fishplates. The Loop Line is no longer used by commercial passenger or freight services. However, the New South Wales Rail Transport Museum at Thirlmere holds a licence to use the track, and runs tourist trains between Thirlmere and Picton on the first and third Sundays of each month from March to November inclusive. Trains also run on other days in school holidays.

The Rail Transport Museum conducts routine visual track inspections as part of its licence conditions. It inspects the track on a fortnightly basis and also on an 'as needs' basis if another train movement is scheduled between the regular fortnightly movements. The inspections are carried out a couple of days before each scheduled train movement by traversing the line.

3.2. Hazard Identification

Two hazards have been identified that are associated with mine subsidence impacts on the Picton – Mittagong Loop Line:-

1. The hazard that railway tracks may become unsafe or unserviceable as a result of mine subsidence movements.
2. The hazard that culverts may crack.
3. The hazard that culverts may not drain.

The likelihood and consequence of each hazard and the associated level of risk are discussed in the following sections.

3.3. Hazard 1 – Railway Tracks and Ballast

The Picton-Mittagong Loop Line is located outside the predicted limit of subsidence. The railway tracks are therefore not expected to experience any adverse impacts as a result of the proposed mining. It is noted that previous longwall mining, which occurred close to (Longwalls 15 to 20) or directly beneath the Loop Line (Longwall 21), with no observed impacts.

The likelihood of any impacts occurring on the railway tracks and ballast is therefore considered **VERY RARE**.

If any impact occurs, it is likely that the impact will be minor in nature, particularly given that the track consists of short lengths connected by fish plates. This impact will be noticed during scheduled track inspections that are conducted by the Rail Transport Museum. The consequence of any minor impact is therefore considered **SLIGHT.**

The level of risk can therefore be considered **RARE / SLIGHT → VERY LOW**.

3.4. Hazard 2 – Cracking to Culverts

All culverts are located outside the predicted limit of subsidence. Culverts located in watercourses can also experience closure and upsidence movements, which can be observed beyond the limit of subsidence. Predictions of closure and upsidence have been conducted for Culvert C05, and it is expected that the culvert will experience very small closure and upsidence movements (less than 5 mm).

The likelihood of any cracking occurring on Culvert C05, as a result of mine subsidence, is therefore considered **VERY RARE**.

If any cracking occurs, it is likely that the impact will be minor in nature, which could be easily repaired. The consequence of any impact is therefore considered **SLIGHT**.

The level of risk can therefore be considered **VERY RARE / SLIGHT → VERY LOW**.

3.5. Hazard 3 – Loss of Drainage to Culverts

All culverts are located outside the predicted limit of subsidence. It is therefore extremely unlikely that the culverts will experience any changes in gradient. The likelihood of loss of drainage to the culverts as a result of mining is therefore considered **LESS THAN VERY RARE**. Further risk analysis has therefore not been completed.

3.6. Summary of Risk Analysis for Picton-Mittagong Loop Line

A summary of the levels of risk for the Picton-Mittagong Loop Line is provided in Table 3.1.

Table 3.1 Summary of Risk Analysis for Sewer Mains

Risk	Likelihood	Consequence	Level of Risk
Impacts to Railway Tracks and Ballast	VERY RARE	SLIGHT	VERY LOW
Cracking to culverts	VERY RARE	SLIGHT	VERY LOW
Loss of drainage to culverts	LESS THAN VERY RARE		

HAZARD	IMPACT	LIKELI HOOD	CONSEQ	OVERALL RISK	TRIGGER	CONTROL PROCEDURES	TIMING & FREQ	BY WHOM?
Picton Mittagong Loop Line								
Impacts to Railway Tracks and Ballast	Damage to tracks	Very Rare	Slight	VERY LOW	None	Inspect condition of track and ballast prior to operating trains	As per current Rail Transport Museum procedures (Refer Section 3.1)	RTM
					Impact occurs	Notify Tahmoor Colliery, Mine Subsidence Board and Department of Primary Industries – Minerals	As soon as possible	RTM
Damage to Culverts	Cracked brickwork / rock spalling	Very Rare	Slight	VERY LOW	None	Inspect condition of track and ballast prior to operating trains	As per current Rail Transport Museum procedures (Refer Section 3.1)	RTM
					Impact occurs	Notify Tahmoor Colliery, Mine Subsidence Board and Department of Primary Industries – Minerals	As soon as possible	RTM

CHAPTER 5. GEOLOGICAL STRUCTURES AND ANOMALIES

Should any geological structures be discovered or unexpected movement occur on the surface during mining operations, this information should immediately be reported to stakeholders to consider the implications on the Picton – Mittagong Loop Line.

CHAPTER 6. RESOURCES

The Risk Control Procedures indicate which party is responsible for each risk control procedure. A contact list is provided in Chapter 10.

CHAPTER 7. MANAGEMENT PLAN REVIEW MEETINGS

The monitoring of natural surface features and surface infrastructure which forms an integral part of this Management Plan will be carried out by Tahmoor Colliery. Management Plan Review Meetings will be held between Tahmoor Colliery, Rail Transport Museum, the Mine Subsidence Board and / or the Department of Mineral Resources for discussion and resolution of issues raised in the operation of the Management Plan. The frequency of the Plan Review Meetings will be monthly unless agreed otherwise between representatives of each Plan Review Meeting.

A secretary will be appointed at the Plan Review Meeting. All documentation, distribution of meeting minutes and organising of meeting times will be undertaken by the secretary.

Plan Review Meetings will discuss any incidents reported in relation to the relevant surface feature, the progress of mining, the degree of mine subsidence that has occurred, and comparisons between observed and predicted ground movements.

It will be the responsibility of the meeting representatives to determine whether the incidents reported are due to the impacts of mine subsidence, and what action will be taken in response.

In the event that a significant risk is identified for a particular surface feature, any party may call an emergency Plan Review Meeting, with one day's notice, to discuss proposed actions and to keep other parties informed of developments in the monitoring of the surface feature.

CHAPTER 8. AUDIT AND REVIEW

All Management Plans within this document have been agreed between parties. The Management Plan will be reviewed following extraction of each longwall.

Should an audit of the Management Plan be required during that period, an auditor shall be appointed by the Tahmoor Colliery to review the operation of the Management Plan and report at the next scheduled Plan Review Meeting.

Other factors that may require a review of the Management Plan are:-

- Observation of greater impacts on surface features due to mine subsidence than was previously expected.
- Observation of fewer impacts or no impacts on surface features due to mine subsidence than was previously expected.
- Observation of significant variation between observed and predicted subsidence.

CHAPTER 9. RECORD KEEPING

The secretary will keep and distribute regular minutes of each Plan Review Meeting for each surface feature. The minutes will include reports on the condition of the relevant surface feature, the progress of mining, the degree of mine subsidence that has occurred, comparisons between observed and predicted ground movements, agreements reached between parties, and a log of incidents that have occurred on the surface feature.

CHAPTER 10. CONTACT LIST

Organisation	Contact	Phone	Email / Mail	Fax
Department Primary Industries (Mineral Resources Division)	Phil Steuart	(02) 4931 6648	phil.steuart@dpi.nsw.gov.au	(02) 4931 6790
Department Primary Industries (Mineral Resources Division)	Gang Li	(02) 4931 6644 0409 227 986	gang.li@dpi.nsw.gov.au	(02) 4931 6790
Department Primary Industries (Mineral Resources Division)	Ray Ramage	(02) 4931 6645 0402 477 620	ray.ramage@dpi.nsw.gov.au	(02) 4931 6790
Mine Subsidence Board	Darren Bullock	(02) 4577 1967	d.bullock@minesub.nsw.gov.au	(02) 4677 2040
Mine Subsidence Engineering Consultants (MSEC)	Arthur Waddington Daryl Kay	(02) 9979 1723	enquiries@minesubsidence.com	(02) 9979 1726
Rail Transport Museum (Thirlmere) – President	Peter Berriman	(02) 4681 8001 0412 610 024	thirlmere@nswrtm.org	(02) 4681 8410
Rail Transport Museum (Thirlmere) – Rail Inspections	Col Wilmot	(02) 4681 8001 0401 571 790	thirlmere@nswrtm.org	(02) 4681 8410
Tahmoor Colliery	David Clarkson	(02) 4640 0133	david.clarkson@centennialcoal.com.au	(02) 4640 0140
Tahmoor Colliery (Senior Mine Surveyor)	Mark Rundle	(02) 4640 0155	mark.rundle@centennialcoal.com.au	(02) 4640 0140

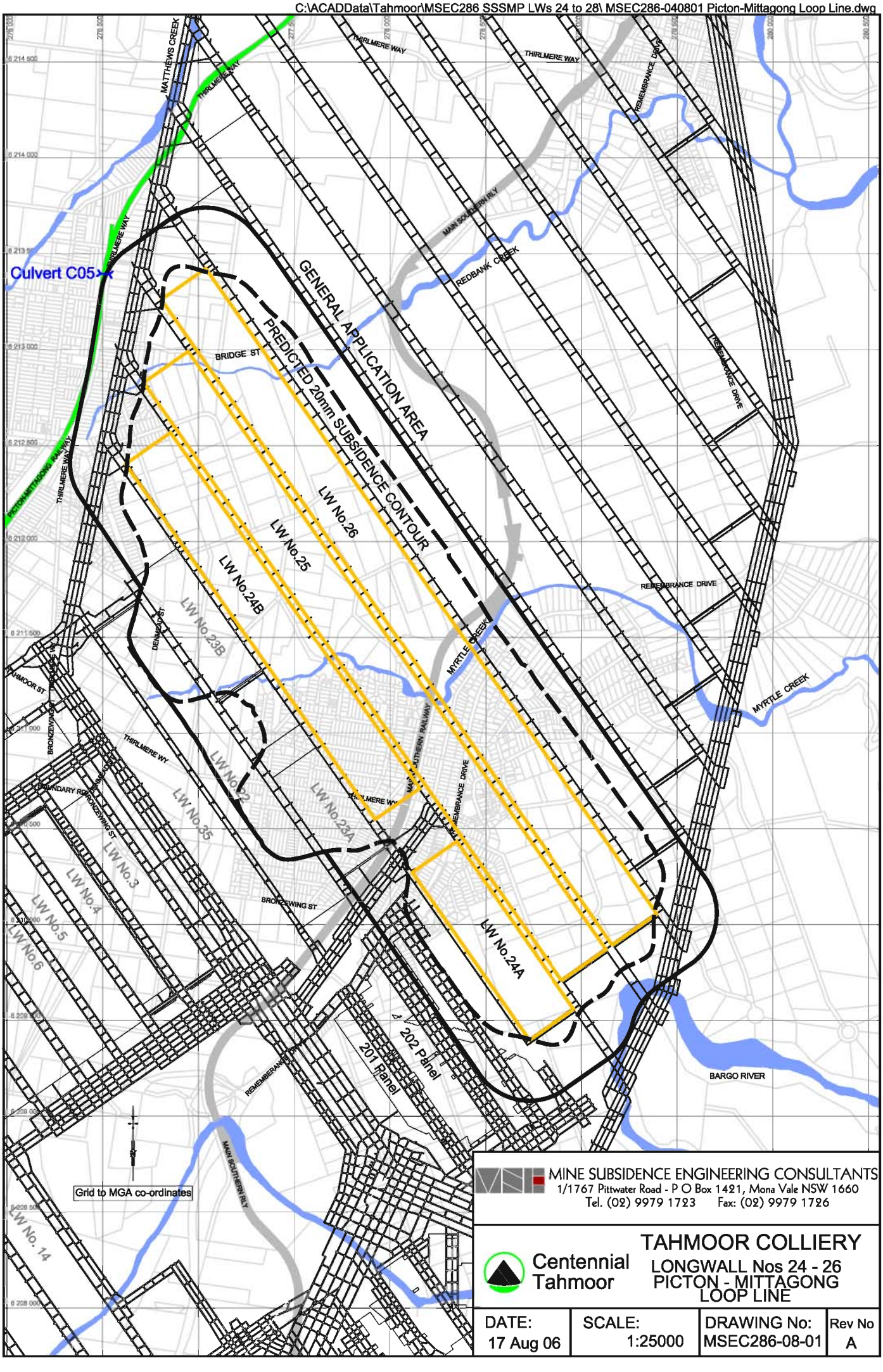
Appendix A - Glossary of Terms and Definitions

Glossary of Terms and Definitions

Angle of draw	The angle of inclination from the vertical of the line connecting the goaf edge of the workings.
Chain pillar	A block of coal left unmined between the longwall extraction panels.
Cover depth (H)	The depth from the surface to the top of the seam. Cover depth is normally provided as an average over the area of the panel.
Critical area	The area of extraction at which the maximum possible subsidence of one point on the surface occurs.
Curvature	The change in tilt between two adjacent sections of the tilt profile divided by the average horizontal length of those sections.
Extracted seam	The thickness of coal that is extracted. The extracted seam thickness is thickness normally given as an average over the area of the panel.
Effective extracted seam thickness (T)	The extracted seam thickness modified to account for the percentage of coal left as pillars within the panel.
Face length	The width of the coalface measured across the longwall panel.
Goaf	The void created by the extraction of the coal into which the immediate roof layers collapse.
Goaf end factor	A factor applied to reduce the predicted incremental subsidence at points lying close to the commencing or finishing ribs of a panel.
Horizontal displacement	The horizontal movement of a point on the surface of the ground as it settles above an extracted panel.
Inflection point	The point on the subsidence profile where the profile changes from a convex curvature to a concave curvature. At this point the strain changes sign and subsidence is approximately one half of S max.
Incremental subsidence	The difference between the subsidence at a point before and after a panel is mined. It is therefore the additional subsidence at a point resulting from the excavation of a panel.
Overlap adjustment factor	A factor that defines the ratio between the maximum incremental subsidence of a panel and the maximum incremental subsidence of that panel if it were the first panel in a series.
Panel	The plan area of coal extraction.
Panel length (L)	The longitudinal distance along a panel measured in the direction of (mining from the commencing rib to the finishing rib.
Panel width (Wv)	The transverse distance across a panel, usually equal to the face length plus the widths of the roadways on each side.
Panel centre line	An imaginary line drawn down the middle of the panel.
Pillar	A block of coal left unmined.
Pillar width (Wpi)	The shortest dimension of a pillar measured from the vertical edges of the coal pillar, i.e. from rib to rib.
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points.
Sub-critical area	An area of panel smaller than the critical area.
Subsidence	The vertical movement of a point on the surface of the ground as it settles above an extracted panel.
Super-critical area	An area of panel greater than the critical area.
Tilt	The difference in subsidence between two points divided by the horizontal distance between the points.
Uplift	An increase in the level of a point relative to its original position.
Upsidence	A reduction in the expected subsidence at a point, being the difference between the predicted subsidence and the subsidence actually measured.

Appendix B – Drawings and Illustrations

C:\ACADData\Tahmoor\MSEC286 SSSMP LWs 24 to 28\ MSEC286-040801 Picton-Mittagong Loop Line.dwg



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Centennial Tahmoor

TAHMOOR COLLIERY

LONGWALL Nos 24 - 26 PICTON - MITTAGONG LOOP LINE

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