TAHMOOR UNDERGROUND
GLENCORE

GLENCORE:

Tahmoor Colliery – Longwall 31

Management Plan for Potential Impacts to Endeavour Energy Infrastructure

AUTHORISATION OF MANAGEMENT PLAN

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Date	Report No.	Rev	Comments
Mar-06	MSEC286-0406	A	Draft for Submission to Endeavour Energy (formerly Integral Energy)
May-06	MSEC286-0406	B	Agreed plan
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Sep-08	MSEC286-0406	D	Updated for Longwall 25
May-10	MSEC446-06	A	Updated for Longwall 26
Sep-12	MSEC567-06	A	Updated for Longwalls 27 to 30
Oct-12	MSEC567-06	B	Updated after consultation with Endeavour Energy
Jun-17	MSEC862-06	A	Updated for Longwall 31

REFERENCES

AS/NZS 4360:1999 Risk Management

MSEC (2014) Tahmoor Colliery Longwalls 31 to 37 - Subsidence Predictions and Impact Assessments for Natural and Built Features in support of the SMP Application. (Report MSEC647, Revision A, December 2014), prepared by Mine Subsidence Engineering Consultants.

Endeavour Energy (2017). *Endeavour Energy Network: Result of On Site Audit Endeavour Energy Asset Audit for Tahmoor Coal – Tahmoor Colliery Longwall 31*, Endeavour Energy, April 2017.

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Tables

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

Figures

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

Drawings

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

1.1. Background

Tahmoor Colliery is located approximately 80 km south-west of Sydney in the township of Tahmoor NSW. It is managed and operated by Glencore. Tahmoor Colliery has previously mined 29 longwalls to the north and west of the mine's current location. It is currently mining Longwall 30.

Longwall 31 is 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. Longwall 31 is located beneath the rural area of Tahmoor and part of the South Picton industrial area, and infrastructure owned by Endeavour Energy is located within this area.

A summary of the dimensions of Longwall 31 is provided in Table 1.1.

Table 1.1 Longwall dimensions

Longwall	Overall void length including the installation heading (m)	Overall void width including the first workings (m)	Overall tailgate chain pillar width (m)
Longwall 31	2448	283	39

This Management Plan provides detailed information about how the risks associated with mining beneath Council infrastructure will be managed by Tahmoor Colliery and Endeavour Energy.

The Management Plan is a live document that can be amended at any stage of mining, to meet the changing needs of Tahmoor Colliery and Endeavour Energy.

1.2. Objectives

The objectives of this Management Plan are to establish procedures to measure, control, mitigate and repair potential impacts that might occur to powerlines and associated infrastructure.

The objectives of the Plan have been developed to:

- Ensure the safe and serviceable operation of all surface infrastructure. Public and workplace safety is paramount. Ensure that the health and safety of people who may be in the vicinity of electrical infrastructure that may experience mine subsidence are not put at risk due to mine subsidence.
- 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, Endeavour Energy, relevant government agencies and consultants as required; and
- Establish lines of communication and emergency contacts.

1.3. Scope

The Management Plan is to be used to protect and monitor the condition of the Endeavour Energy infrastructure identified to be at risk due to mine subsidence and to ensure that the health and safety of people who may be in the vicinity of electrical infrastructure that may experience mine subsidence are not put at risk due to mine subsidence. The Management Plan only covers infrastructure that is located within the limit of subsidence, which defines the extent of land that may be affected by mine subsidence as a result of mining Longwall 31 only. The management plan does not include other infrastructure owned by Endeavour Energy which lie outside the extent of this area.

A separate Property Subsidence Management Plan has been developed between Endeavour Energy and Tahmoor Colliery in relation to the depot at 94 Bridge Street, Picton.

1.4. Description of the Endeavor Energy infrastructure

Endeavour Energy has an extensive electrical infrastructure network above the longwalls at Tahmoor Colliery. Information on the network has been provided by Endeavour Energy. The electrical infrastructure above and adjacent to Longwall 31 are shown in Drawing No. MSEC862-06-01. It can be seen from this drawing that the conductors include 66 kV, 11 kV and Low Voltage (LV) cables. The majority of the conductors are 11 kV or LV cables, which provide power to individual properties. The 66 kV powerline is located outside the extents of Longwall 31.

The conductors consist of overhead cables supported by power poles, which are shown in Drawing No. MSEC862-06-01. The critical poles have been identified by Endeavor Energy and these are shown in Drawing No. MSEC862-06-02.

1.5. Consultation

Tahmoor Colliery has consulted with Endeavour Energy in relation to potential mine subsidence effects from the extraction of Longwall 31.

Endeavour Energy has assessed the electrical infrastructure that may be affected by the extraction of Longwall 31, and has identified critical poles that will be surveyed by Tahmoor Colliery. Endeavour Energy has also undertaken a risk assessment.

Tahmoor Colliery will continue to consult regularly with Endeavour Energy during the extraction of Longwall 31.

1.6. Proposed mining schedule

It is planned that Longwall 31 will extract coal working north-west from the south-eastern end. This Management Plan covers longwall mining until completion of mining in Longwall 31 and for sufficient time thereafter to allow for completion of subsidence effects. The current schedule of mining is shown in Table 1.2.

Table 1.2 Schedule of mining

Longwall	Start date	Completion date
Longwall 31	July 2017	July 2018

The above schedule is subject to change due to unforeseen impacts on mining progress. Tahmoor Colliery will keep Endeavour Energy informed of changes.

1.7. Definition of active subsidence zone

As a longwall progresses, subsidence begins to develop at a point in front of the longwall face and continues to develop after the longwall passes. The majority of subsidence movement typically occurs within a distance of 150 m in front of the longwall face to a distance of 450 m behind the longwall face.

This is termed the “active subsidence zone” for the purposes of this Management Plan, where surface monitoring is generally conducted. The active subsidence zone for each longwall is defined by the area bounded by the predicted 20 mm subsidence contour for the active longwall and a distance of 150 m in front and 450 m behind the active longwall face, as shown by Fig. 1.1.

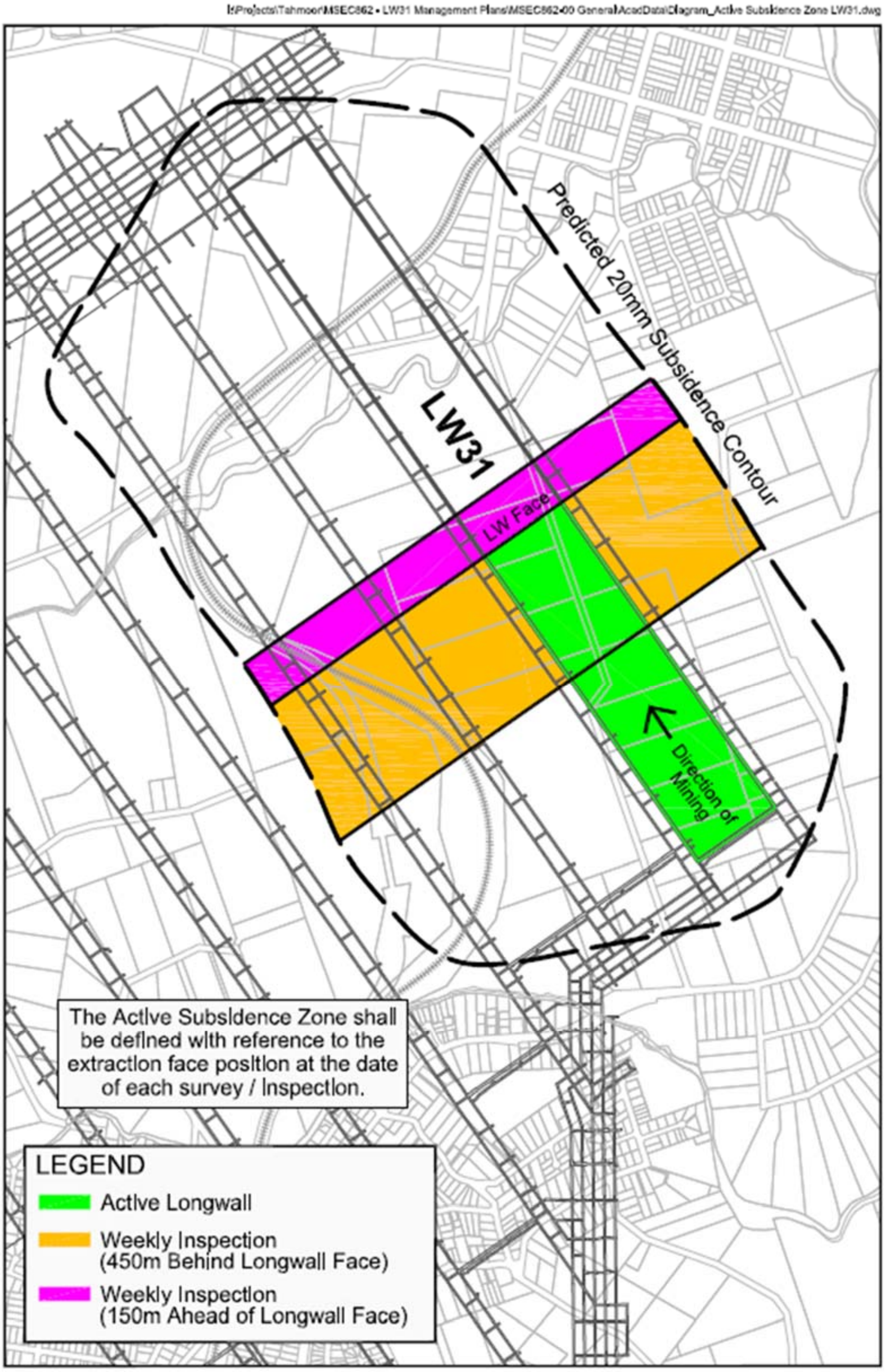


Fig. 1.1 Diagrammatic representation of the active subsidence zone

1.8. Compensation

The Mine Subsidence Compensation Act 1961 (MSC Act) is administered by Subsidence Advisory NSW (Mine Subsidence Board). Currently, under the Mine Subsidence Compensation Act 1961, any claim for mine subsidence damage needs to be lodged with Subsidence Advisory NSW. Subsidence Advisory NSW staff will then assess the damage to determine the cause. If the damage is determined to be attributable to mine subsidence, a scope will be prepared and compensation will be assessed.

2.1. Maximum predicted conventional parameters

Predicted mining-induced conventional subsidence movements were provided in Report No. MSEC647, which was prepared in support of Tahmoor Colliery's SMP Application for Longwalls 31 to 37, and includes prediction due to the extraction of Longwall 31.

A summary of the maximum predicted incremental conventional subsidence parameters, due to the extraction of Longwall 31 only, is provided in Table 2.1. A summary of the maximum predicted total conventional subsidence parameters, after the extraction of Longwall 31, is provided in Table 2.2.

Table 2.1 Maximum predicted incremental conventional subsidence parameters due to the extraction of Longwall 31

Longwall	Maximum predicted incremental subsidence (mm)	maximum predicted incremental tilt (mm/m)	Maximum predicted incremental hogging curvature (1/km)	Maximum predicted incremental sagging curvature (1/km)
Due to LW31	725	5.5	0.06	0.12

Table 2.2 Maximum predicted total conventional subsidence parameters after the extraction of Longwall 31

Longwall	Maximum predicted total subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (1/km)	Maximum predicted total sagging curvature (1/km)
After LW31	1225	6.0	0.09	0.13

The values provided in the above table are the maximum predicted cumulative conventional subsidence parameters which occur within the general longwall mining area, including the predicted movements resulting from the extraction of Longwalls 22 to 31.

2.2. Observed subsidence during the mining of Longwalls 22 to 30

The extraction of longwalls at Tahmoor Colliery has generally resulted in mine subsidence movements that were typical of those observed above other collieries in the Southern Coalfield of NSW at comparable depths of cover.

However, observed subsidence was greater than the predicted values over Longwalls 24A and the southern parts of Longwalls 25 to 27. Monitoring during the mining of Longwalls 28 to 30 has found that subsidence behaviour has returned to normal levels.

Ground surveys will continue to be undertaken above Longwall 31. The survey results will be checked against predictions to confirm whether subsidence continues to develop in a normal manner during the mining of Longwall 31.

2.3. Predicted strain

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

In previous MSEC subsidence reports, predictions of conventional strain were provided based on the best estimate of the average relationship between curvature and strain. Similar relationships have been proposed by other authors. The reliability of the strain predictions was highlighted in these reports, where it was stated that measured strains can vary considerably from the predicted conventional values.

Adopting a linear relationship between curvature and strain provides a reasonable prediction for the conventional tensile and compressive strains. The locations that are predicted to experience hogging or convex curvature are expected to be net tensile strain zones and locations that are predicted to experience sagging or concave curvature are expected to be net compressive strain zones. In the Southern Coalfield, it has been found that a factor of 15 provides a reasonable relationship between the maximum predicted curvatures and the maximum predicted conventional strains.

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

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

A number of probability distribution functions were fitted to the empirical data. It was found that a *Generalised Pareto Distribution (GPD)* provided a good fit to the raw strain data. Confidence levels have been determined from the empirical strain data using the fitted GPDs. In the cases where survey bays were measured multiple times during a longwall extraction, the maximum tensile strain and the maximum compressive strain were used in the analysis (i.e. single tensile strain and single compressive strain measurement per survey bay).

2.3.1. Analysis of strains measured in survey bays

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

Predictions of strain above goaf

The survey database has been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of Longwalls 22 to 28 at Tahmoor Colliery, for survey bays that were located directly above goaf or the chain pillars that are located between the extracted longwalls, which has been referred to as "*above goaf*".

The histogram of the maximum observed total tensile and compressive strains measured in survey bays above goaf at Tahmoor Colliery is provided in Fig. 2.1. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

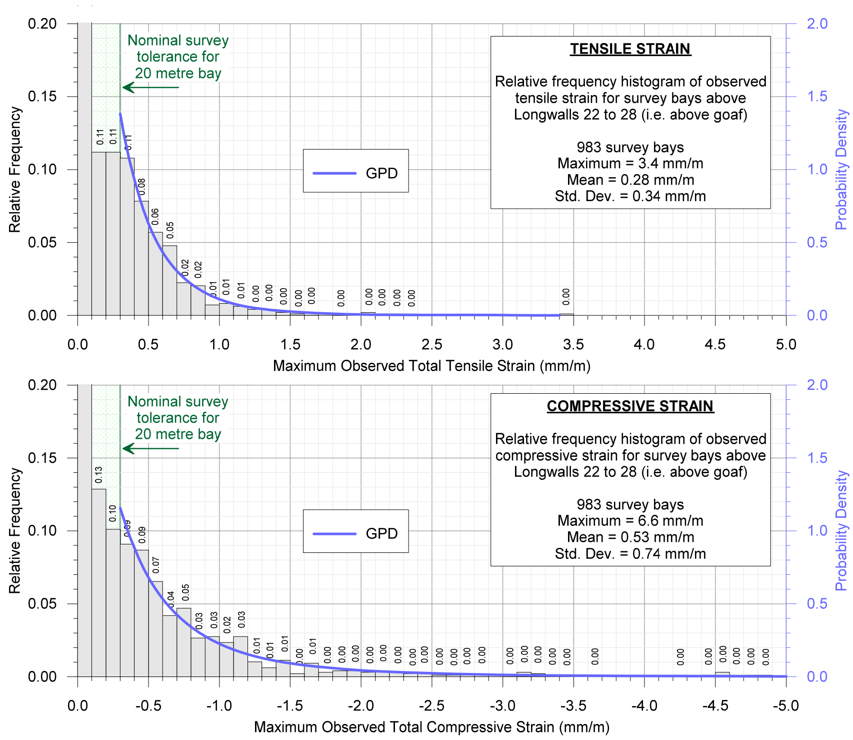


Fig. 2.1 Distributions of the measured maximum tensile and compressive strains for surveys bays located above goaf

The 95 % confidence levels for the maximum total strains that the individual survey bays *above goaf* experienced at any time during mining are 0.9 mm/m tensile and 1.8 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays *above goaf* experienced at any time during mining are 1.5 mm/m tensile and 3.5 mm/m compressive.

Predictions of strain above solid coal

The survey database has also been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of Longwalls 22 to 28 at Tahmoor Colliery, for survey bays that were located outside and within 200 metres of the nearest longwall goaf edge, which has been referred to as "*above solid coal*".

The histogram of the maximum observed tensile and compressive strains measured in survey bays above solid coal at Tahmoor Colliery is provided in Fig. 2.2. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

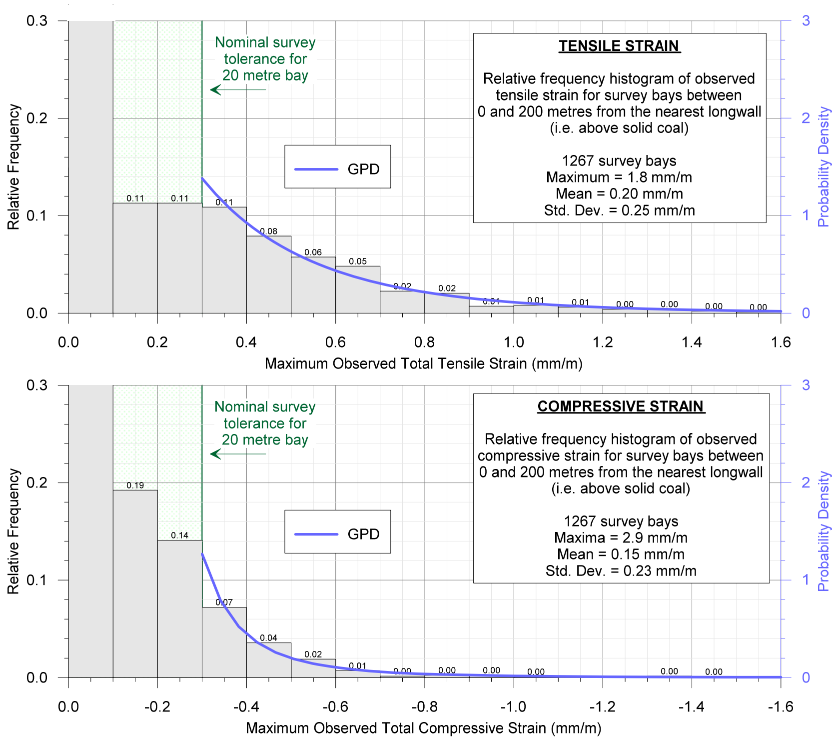


Fig. 2.2 Distributions of the measured maximum tensile and compressive strains for survey bays located above solid coal

The 95 % confidence levels for the maximum total strains that the individual survey bays *above solid coal* experienced at any time during mining are 0.6 mm/m tensile and 0.5 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays *above solid coal* experienced at any time during mining are 1.1 mm/m tensile and 0.9 mm/m compressive.

2.3.2. Analysis of strains measured along whole monitoring lines

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

The histogram of maximum observed total tensile and compressive strains measured anywhere along the monitoring lines, at any time during or after the extraction of Longwalls 22 to 28 at Tahmoor Colliery, is provided in Fig. 2.3.

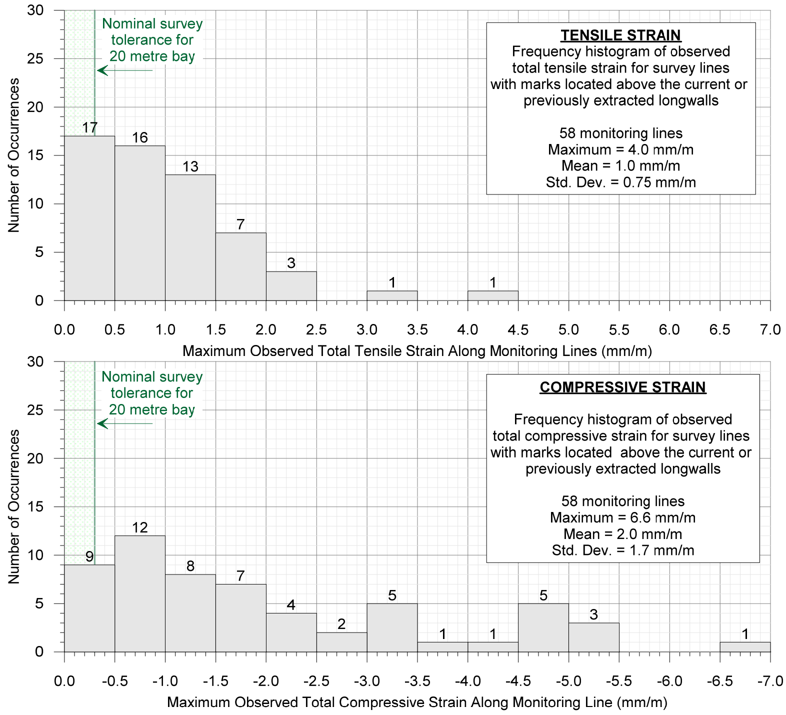


Fig. 2.3 Distributions of measured maximum tensile and compressive strains anywhere along the monitoring lines

It can be seen from Fig. 2.3, that 33 of the 58 monitoring lines (i.e. 57 %) had recorded maximum total tensile strains of 1.0 mm/m, or less, and that 53 monitoring lines (i.e. 91 %) had recorded maximum total tensile strains of 2.0 mm/m, or less. It can also be seen from this figure, that 36 of the 58 monitoring lines (i.e. 62 %) had recorded maximum compressive strains of 2.0 mm/m, or less, and that 48 of the monitoring lines (i.e. 83 %) had recorded maximum compressive strains of 4.0 mm/m, or less.

3.1. NSW Work Health & Safety Legislation

All persons conducting a business or undertaking (PCBUs), including mine operators and contractors, have a primary duty of care to ensure the health and safety of workers they engage, or whose work activities they influence or direct. The responsibilities are legislated in *Work Health and Safety Act 2011* and the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and associated Regulations (collectively referred to as the 'WHS laws').

The *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* commenced on 1 February 2015 and contains specific regulations in relation to mine subsidence.

As outlined in the Guide by the NSW Department of Trade & Investment Mine Safety:

"a PCBU must manage risks to health and safety associated with mining operations at the mine by:

- *complying with any specific requirements under the WHS laws*
- *identifying reasonably foreseeable hazards that could give rise to health and safety risks*
- *ensuring that a competent person assesses the risk*
- *eliminating risks to health and safety so far as is reasonably practicable*
- *minimising risks so far as is reasonably practicable by applying the hierarchy of control measures, any risks that it is are not reasonably practical to eliminate*
- *maintaining control measures*
- *reviewing control measures.*

The mine operator's responsibilities include developing and implementing a safety management system that is used as the primary means of ensuring, so far as is reasonably practicable:

- *the health and safety of workers at the mine, and*
- *that the health and safety of other people is not put at risk from the mine or work carried out as part of mining operations."*

This Management Plan documents the risk control measures that are planned to manage risks to health and safety associated with the mining of Longwall 31 beneath the Endeavour Energy infrastructure in accordance with the WHS laws.

3.2. General

The method of assessing potential mine subsidence impacts in the Management Plan is consistent with the Australian/New Zealand Standard for Risk Management. The Standard defines the terms used in the risk management process, which includes the identification, analysis, assessment, treatment and monitoring of potential mine subsidence impacts. In this context:

3.2.1. 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.

3.2.2. Likelihood

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

3.2.3. Hazard

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

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

3.2.4. Method of assessment of potential mine subsidence impacts

The method of assessing potential mine subsidence impacts combines the likelihood of an impact occurring with the consequence of the impact occurring. In this Management Plan, the likelihood and consequence are combined via the Glencore Coal Assets Australia Risk Matrix to determine an estimated level of risk for particular events or situations. A copy of the Risk Matrix is included in the Appendix of this Management Plan.

The 66 kV, 11 kV and LV powerlines located above and adjacent to Longwall 31 generally follow the alignments of the local roads. The maximum predicted subsidence parameters for these powerlines, therefore, are similar to those predicted for the roads.

The predicted profiles of conventional subsidence, tilt and curvature for the powerline along Bridge Street are shown in Fig. 4.1. The predicted total profiles after the completion of Longwall 30 are shown as the solid cyan lines. The predicted incremental profiles due to the extraction of Longwall 31 only are shown by the black dashed lines. The predicted total profiles after the completion of Longwall 31 are shown as the solid blue lines.

A summary of the maximum predicted conventional subsidence, tilt and curvature for the powerlines located adjacent to the local roads, after the extraction of Longwall 31, is provided in Table 4.1. The values are the maximum predicted parameters anywhere along the sections of powerlines located within the predicted limit of vertical subsidence for Longwall 31.

Table 4.1 Maximum predicted total conventional subsidence, tilt and curvature for the powerlines

Powerline located adjacent to local road	Longwall	Maximum predicted total subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (1/km)	Maximum predicted total sagging curvature (1/km)
Bridge Street	After LW31	1225	5.5	0.09	0.13
Stilton Lane	After LW31	725	3.5	0.06	0.10
Remembrance Drive (between Wonga and Koorana Roads)	After LW31	50	< 0.5	0.01	< 0.01
Thirlmere Way (at South Picton)	After LW31	80	0.5	0.01	< 0.01

The consumer powerlines service the properties above and adjacent to Longwall 31. These consumer powerlines are located across the mining area and, therefore, could experience the full range of predicted movements summarised in Chapter 3.

The maximum predicted subsidence parameters for the powerlines are similar to the maxima predicted for the powerlines above the previously extracted longwalls at Tahmoor Colliery. Longwalls 22 to 30 have directly mined beneath approximately 37 km of electrical cables and 987 power poles and no adverse impacts have been reported to date. However, tension adjustments have been made by Endeavour Energy to some consumer cable connections to the houses. This is understandable as the overhead cables are typically pulled tight between each house and power pole.

While the experience at Tahmoor Colliery has been relatively benign, Endeavour Energy has been required to adjust power pole tilts and catenaries as a result of mine subsidence at other locations within the Southern Coalfield. This repair work is more substantial but the frequency of such impacts is very low.

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

Visual monitoring of the powerlines will be undertaken within the active subsidence zone to identify high pole tilts, increased cable tensions and changes in cable catenaries. The cables will be adjusted, as required, where adverse impacts are identified.

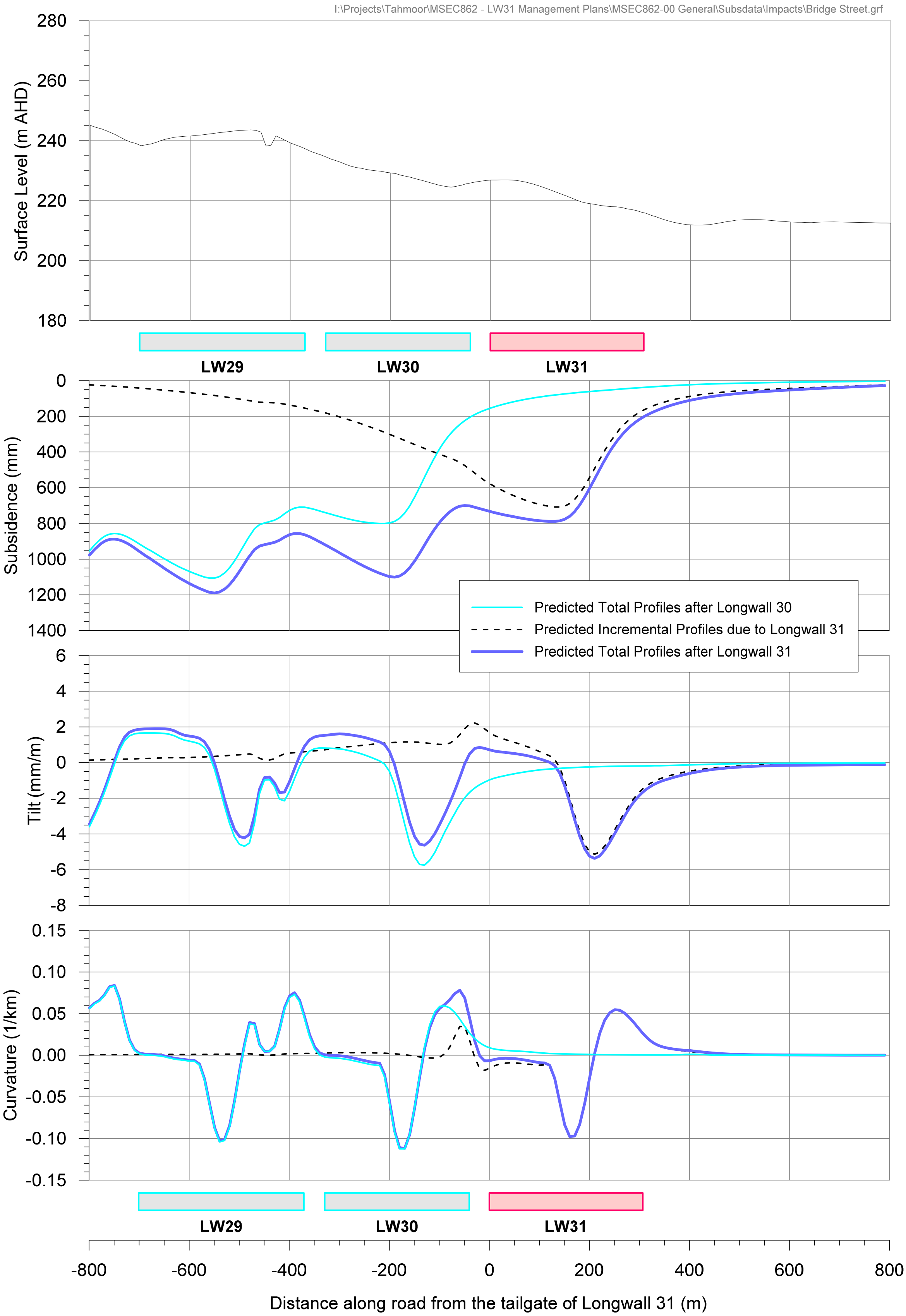


Fig. 4.1 Predicted profiles of total subsidence, tilt and curvature for the powerline along Bridge Street due to the mining of Longwalls 22 to 31

5.0 RISK ASSESSMENT

A risk assessment was conducted by Endeavour Energy and the results are described in a letter by Endeavour Energy, dated 5 April 2017, which is included in the Appendix.

Endeavour Energy and Tahmoor Colliery have developed and acted in accordance with an agreed management plan during the mining of Longwalls 22 to 30.

Given that no significant impacts have been experienced to date, Endeavour Energy and Tahmoor Colliery consider that there is no need to amend the management measures that have been developed in previously agreed management plans.

The risk to the powerlines is the mining-induced change in cable catenaries that result in adverse impact on the cable tensions and the loads on the supporting power poles.

A summary of the assessed levels of potential impacts on the Endeavour Energy infrastructure is provided in Table 5.1. The summary is consistent with the risk assessment undertaken by Tahmoor Colliery (Glencore, 2017), which is included in the Appendix.

Table 5.1 Summary of the risk assessment

Risk	Likelihood	Consequence	Level of potential impact
Powerlines			
Adverse impacts on the 66 kV, 11 kV and LV powerlines	Rare	Minor	Low
Adverse impacts on the consumer cables to houses	Unlikely	Negligible	Low

5.1. Power Poles recommended for monitoring

An inspection of power poles located within the mining area for Longwall 31 was conducted by Endeavour Energy on 5 April 2017. The accompanying report concluded that the electricity infrastructure is generally in a good state of repair and in serviceable order. Experience has shown that power poles have remained safe and serviceable during and after mining.

The poles recommended for monitoring during Longwall 31 are listed in Table 5.2, and are shown in Drawing No. MSEC862-06-02.

Table 5.2 Summary of poles recommended for monitoring during Longwall 31

Sub No.	Pole No.	Street Name	Type	Position relative to LWs
Poles selected by Endeavour Energy for monitoring during the mining of Longwall 31				
12016	628485	Stilton Lane	Pole Sub	Above LW30
-	628482	Stilton Lane	HV Pole	Near side of LW31
-	628623	Stilton Lane	HV Pole	Above LW31
10209	798027	Stilton Lane	Pole Sub	Above LW31
-	805777	Stilton Lane	HV Pole	Near side of LW31
-	628573	Stilton Lane	ABS Pole	Near side of LW31
-	805778	Henry Street	HV Pole	Near side of LW31
12089	628632	Henry Street	Pole Sub	Near side of LW31
-	628565	Bridge Street	HV Pole	Near side of LW31
3915	623338	Bridge Street	Pole Sub	Near side of LW31
20823	230469	Bridge Street	Pole Sub	Above LW31
-	623346	Bridge Street	HV Pole	Near side of LW31
11338	623341	Bridge Street	Pole Sub	Above LW31
18638	623348	Redbank Place	Pole Sub	Near side of LW31

6.1. Infrastructure Management Group

The Infrastructure Management Group (IMG) is responsible for taking the necessary actions required to manage the risks that are identified from monitoring the infrastructure. The IMG's key members are Tahmoor Colliery, Endeavour Energy and Mine Subsidence Engineering Consultants. Subsidence Advisory NSW (Mine Subsidence Board) acts as an observer.

6.2. Mitigation measures

There are no recommended mitigation measures for the Endeavour Energy infrastructure prior to active subsidence.

6.3. Monitoring measures

Tahmoor Colliery will survey power poles that have been recommended for monitoring by Endeavour Energy. The surveys will measure:

- Vertical subsidence at the base of each identified pole
- Coordinates at the base and top of each identified pole
- Report of any visual change in the tension or sag of the power lines within the area affected by the extraction of Longwall 31

Monitoring lines have been installed along all streets within the urban area above and adjacent to Longwall 31, as shown in Drawing No. MSEC862-00-01. The monitoring lines have been initially surveyed to provide a baseline reference. Monitoring of street survey lines will be conducted for every 200 metres of longwall travel as a minimum for marks located within the active subsidence zone. Visual inspections of the powerlines located within the active subsidence zone will also be carried out.

A monitoring report will be provided after the surveys have been carried out.

6.4. Risk control procedures

The risk control procedures are provided in Chapter 7.0 . The procedures include responses if triggered by the monitoring results.

Infrastructure	Hazard / Impact	Risk	Trigger	Control Procedure/s	Frequency	By Whom?
Electrical Infrastructure	Impacts to infrastructure	Refer Letter from Endeavour Energy in Appendix A	None	Conduct visual inspection for surface deformation along streets	Twice a week when the roads are within active subsidence area	Tahmoor Colliery
				Conduct surveys along survey lines to provide some early warning for potentially damaging subsidence events	Every 200 metres of longwall face movement	Tahmoor Colliery (SMEC / MSEC)
				Conduct pole surveys that measure subsidence at base and vertical offset or tilt of selected poles.	Monthly for each pole within active subsidence zone and for next 3 months after leaving active subsidence zone End of Longwall for all poles within limit of subsidence for panels	Tahmoor Colliery (SMEC / MSEC)
				Advise of position of longwall by email	Weekly	Tahmoor Colliery
				Keep Subsidence Advisory NSW (formerly Mine Subsidence Board) informed of events – Tahmoor Colliery / Endeavour Energy.	As required	Tahmoor Colliery / Endeavour Energy
				Communicate regularly	Ongoing	Tahmoor Colliery / Endeavour Energy
			Impacts observed	Notify all stakeholders, including Endeavour Energy, Tahmoor Colliery, Subsidence Advisory NSW (Mine Subsidence Board) and DTIRIS	Within 24 hours	Endeavour Energy or Tahmoor Colliery
				Repair impact.	As per Endeavour Energy procedures	Endeavour Energy
				Increase the frequency of survey and visual inspections in vicinity of impact, if appropriate.	As agreed between Tahmoor Colliery and Endeavour Energy	Tahmoor Colliery

8.0 CONSULTATION, CO-OPERATION AND CO-ORDINATION

Substantial consultation, co-operation and co-ordination has taken place between Tahmoor Colliery and Endeavour Energy prior to and during the development of this Management Plan, as detailed in Section 1.5.

The following procedures will be implemented during and after active subsidence of the property to ensure the continued effective consultation, co-operation and co-ordination of action with respect to subsidence between Tahmoor Colliery and Endeavour Energy:

- Arrangements to facilitate surveys and inspections during active subsidence.
- Reporting observed impacts to Tahmoor Colliery either during the weekly visual inspection or at any time directly to Tahmoor Colliery.
- Distribution of monitoring reports, which will provide the following information whilst surveys are being conducted on local roads during active subsidence:
    - Position of longwall relative to the local area;
    - Summary of management actions since last report;
    - Summary of consultation with Endeavour Energy since last report;
    - Summary of observed or reported impacts, incidents, service difficulties, complaints;
    - Summary of subsidence development;
    - Summary of adequacy, quality and effectiveness of management process;
    - Any additional and/or outstanding management actions; and
    - Forecast whether there will be any subsidence impacts to the health and safety of people who may be present at the property due to the continued extraction of Longwall 31.
- Convening of meetings between Tahmoor Colliery and Endeavour Energy at any time as required.
- Arrangements to facilitate timely repairs, if required, to avoid business interruption.

Immediate contact between Tahmoor Colliery and Endeavour Energy if a mine subsidence induced hazard has been identified that involves potential serious injury or illness to a person or persons due to mine subsidence impacts on Endeavour Energy infrastructure and may require emergency evacuation, entry restriction or suspension of work activities.

9.0 AUDIT AND REVIEW

All Management Plans within this document have been agreed between parties. The Management Plan will be reviewed following extraction of the 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; and
- Observation of significant variation between observed and predicted subsidence.

10.0 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.

11.0 CONTACT LIST

Organisation	Contact	Phone	Email / Mail	Fax
NSW Department of Planning and Environment – Resources Regulator, Mine Safety Operations	Phil Steuart	(02) 4931 6648	phil.steuart@industry.nsw.gov.au	(02) 4931 6790
	Gang Li	(02) 4931 6644 0409 227 986	gang.li@industry.nsw.gov.au	(02) 4931 6790
	Ray Ramage	(02) 4931 6645 0402 477 620	ray.ramage@ industry.nsw.gov.au	(02) 4931 6790
Subsidence Advisory NSW (Mine Subsidence Board)	Matthew Montgomery	(02) 4677 1967 0425 275 564	matthew.montgomery@finance.nsw.gov.au	(02) 4677 2040
Mine Subsidence Engineering Consultants (MSEC)	Daryl Kay*	(02) 9413 3777 0416 191 304	daryl@minesubsidence.com	(02) 8412 0222
Glencore Tahmoor Coal – Approvals and Community Coordinator	Belinda Treverrow*	(02) 4640 0133 0458 627 752	Belinda.L.Treverrow@glencore.com.au	(02) 4640 0140
Endeavour Energy	Emergency Contact	131 003		
Endeavour Energy	David Olley (Project Officer, Regional Services - Central)	(02) 4252 2476	david.olley@endeavourenergy.com.au	-

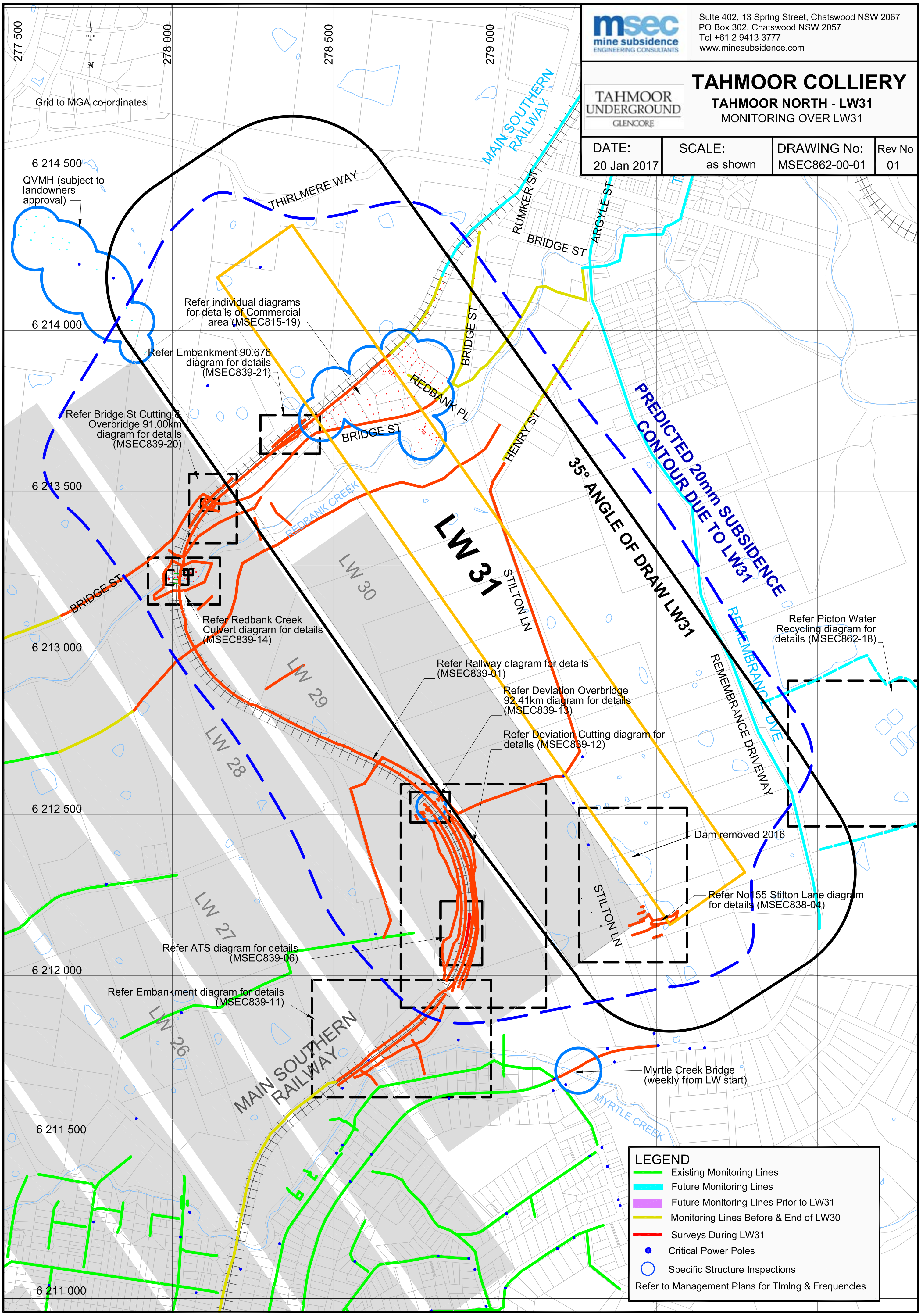
APPENDIX A.

Please refer to the following documents:

- Drawing No. MSEC862-00-01 Monitoring over Longwall 31
- Drawing No. MSEC862-06-01 Endeavour Energy infrastructure
- Drawing No. MSEC862-06-02 Critical power poles

- Endeavour Energy (2017). *Endeavour Energy Network: Result of On Site Audit Endeavour Energy Asset Audit for Tahmoor Coal – Tahmoor Colliery Longwall 31,* Endeavour Energy, April 2017.

I:\Projects\Tahmoor\MSEC862 - LW31 Management Plans\MSEC862-00 General\AcadData\MSEC862-00-01 Monitoring LW31.dwg



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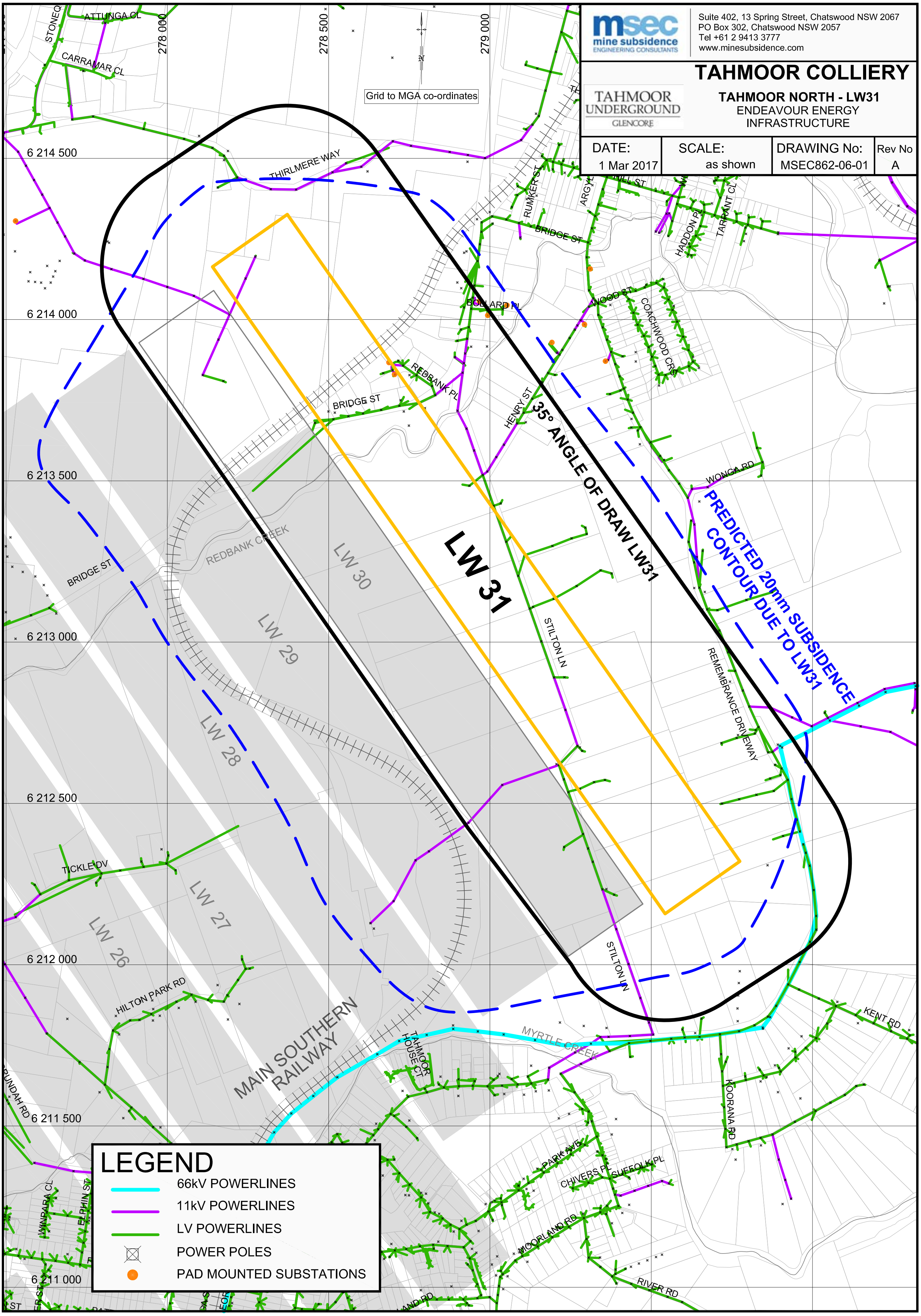

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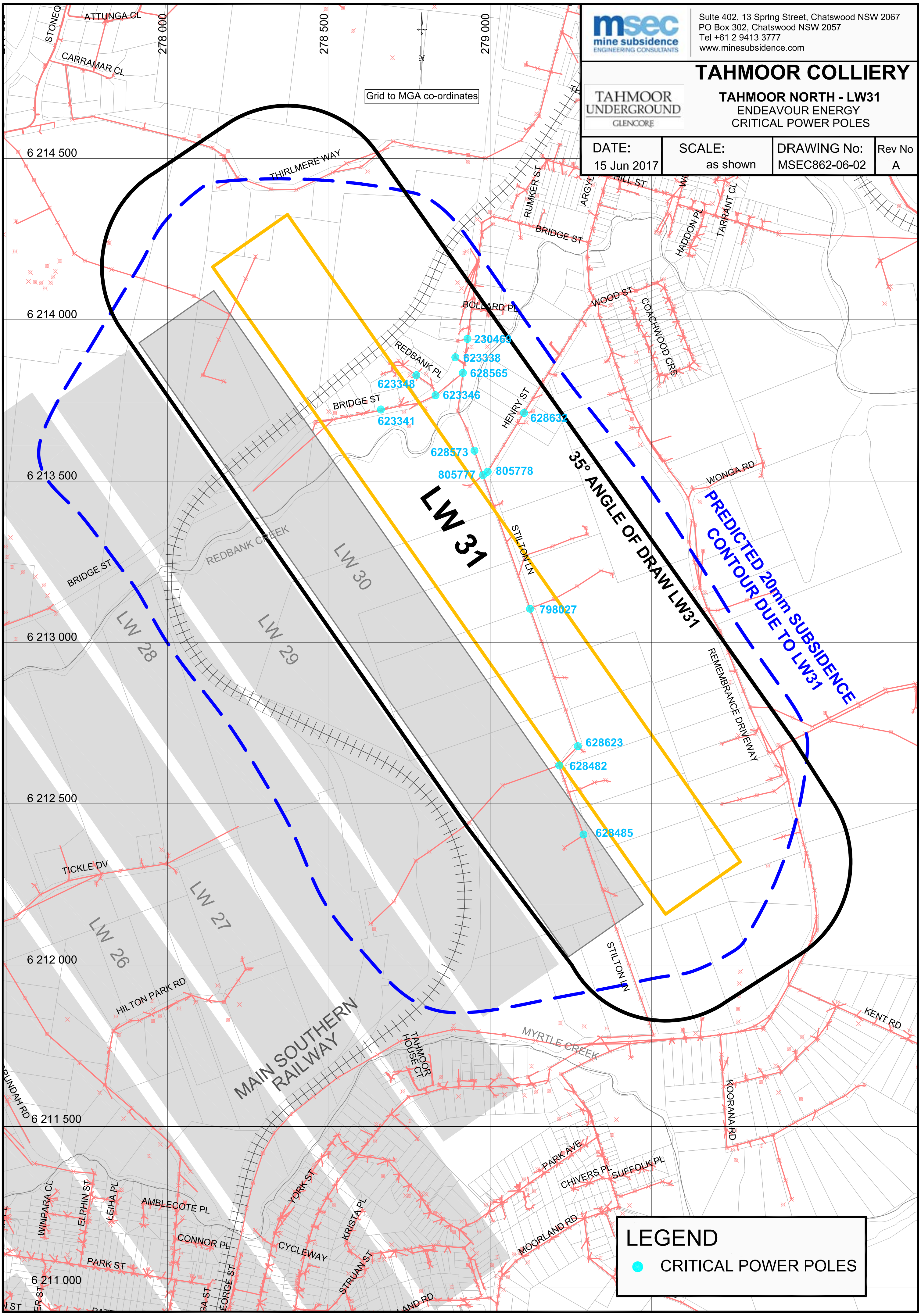


msec mine subsidence ENGINEERING CONSULTANTS

Suite 402, 13 Spring Street, Chatswood NSW 2067
PO Box 302, Chatswood NSW 2057
Tel +61 2 9413 3777
www.minesubsidence.com

TAHMOOR UNDERGROUND GLENCORE

TAHMOOR COLLIERY

TAHMOOR NORTH - LW31

ENDEAVOUR ENERGY
CRITICAL POWER POLES

DATE:	SCALE:	DRAWING No:	Rev No
15 Jun 2017	as shown	MSEC862-06-02	A

Endeavour Energy

5th April, 2017

Tahmoor Coal – Tahmoor Colliery
PO Box 100
Tahmoor, NSW 2573

Attention: Ms Belinda Treverrow

Dear Madam,

TAHMOOR COAL, PROPOSED LONGWALL 31, TAHMOOR COLLIERY.

In order to assist Tahmoor Coal in their application to the Department of Mineral Resources, for approval to mine Longwall 31 Tahmoor Colliery, Endeavour Energy has conducted an on-site audit in this location with the following results.

Our on-site audit indicates Endeavour Energy's existing assets to be in a good state of repair and in serviceable order. History has also shown that similar projects in other locations have resulted in no significant unduly influence on Endeavour's assets due to subsidence.
Given the above, and the "prediction of subsidence parameters" from Tahmoor Coal – Tahmoor Colliery (by Mine Subsidence Engineering Consultants Pty Ltd), it is considered unlikely that Tahmoor Coal's proposal will result in any significant or unmanageable adverse effect on Endeavour Energy's assets in the Picton (Longwall 31) area.

However, as a means of assisting with Endeavour Energy's ongoing risk management, it is important that should subsidence impact our assets we have some quantitative information to assist with our evaluations. We believe that it is appropriate that a number of our assets, which have been identified as "critical poles", should be monitored to assess any impact of the proposed mining.

It is requested, at a minimum, that Tahmoor Coal – Tahmoor Colliery arrange for the following:

- Monitoring of subsidence at the base of the identified Endeavour Energy "critical poles"
- Monitoring of the coordinates at the base and top of each of the identified Endeavour Energy "critical poles" to detect any movement.
- Report of any visual change in the tension or sag of the power lines within the subsidence region.

Endeavour Energy would require the monitoring identified above to be undertaken on the following "critical poles" listed over page.

Contact name: David Olley - Direct phone: (02) 4252 2476 - Email: david.olley@endeavourenergy.com.au
51 Huntingwood Drive Huntingwood NSW 2148. PO Box 811 Seven Hills NSW 1730.
Endeavour Energy ABN 59 253 130 878 www.Endeavourenergy.com.au

Endeavour Energy Identified Critical Poles				
	Pole No	Asset	Location	Photo Number
1	628485	Pole Sub 12016	Stilton Lane (Map 1)	1
2	628482	HV Pole	Stilton Lane (Map 1)	2
3	628623	HV Pole	Stilton Lane (Map 1)	3
4	798027	Pole Sub 10209	Stilton Lane (Map 1)	4
5	805777	HV POLE	Stilton Lane (Map 2)	5
6	628573	ABS Pole	Stilton Lane (Map 2)	6
7	805778	HV Pole	Henry Street (Map 2)	7
8	628632	Pole Sub 12089	Henry Street (Map 2)	8
9	628565	HV Pole	Bridge Street (Map 2)	9
10	623338	Pole Sub 3915	Bridge Street (Map 2)	10
11	230469	Pole Sub 20823	Bridge Street (Map 2)	11
12	623346	HV Pole	Bridge Street (Map 2)	12
13	623341	Pole Sub 11338	Bridge Street (Map 2)	13
14	623348	Pole Sub 18638	Bridge Street (Map 2)	14

Please send the results of these observations in report format by email to:

Mr David Olley
Regional Services – Central
Endeavour Energy

Email address: david.olley@endeavourenergyl.com.au

The initial report should be sent prior to commencement of works and updated reports submitted on a monthly basis over a period up to 3 months after extraction has been completed.

Subject to your agreement with the requested monitoring, reporting regime and the responsibility for any proven damage to Endeavour Energy assets in the forecast subsidence period, we endorse your application to proceed as planned.

If you have any queries or wish to further discuss this matter further, please contact David Olley, Project Officer Network Asset Operations at Moss Vale, on phone (02) 4869 6276.

Yours faithfully,

David Olley
Project Officer
Regional Services – Central
Endeavour Energy

Recommendation

To approve Endeavour Energy's attached Audit of Assets, Risk Assessment, and Conditions, to be incorporated into Tahmoor Coal Tahmoor Colliery's Subsidence Management Plan for proposed Longwall 31 at Picton.

Submitted for Endeavour Energy approval.

Recommended	*Endorsed*
David Olley ***Project Officer*** ***Regional Services - Central*** ***Endeavour Energy***	*Sanja Milosavljevic* ***Regional Services Manager*** ***Network - Central Region*** ***Endeavour Energy***
Approved	
David Campbell ***Manager*** ***Network - Central Region*** ***Endeavour Energy***	

RISK REGISTER - DAMAGE TO ENDEAVOUR ENERGY ASSETS

Mining: Longwall 31

Location: Picton

Mining Company: Tahmoor Coal, Tahmoor Colliery

Risk	Hazardous event	Prevention Controls	Control Effectiveness (1-5)	Mitigation Controls	Control Effectiveness (1-5)	Residual Risk Assessment (E, H, M, L)	Control Accountability
Damage to Endeavour Energy Assets	Damage to Endeavour Energy assets caused by ground subsidence	Complete Worksite Hazard and Risk Assessment as per Company Procedure (Health and Safety) GSY 1066. Reference: Hazard Alert No. 25/07	4	Working in a Mine Subsidence Area 1. When Performing a Worksite Hazard and Risk Assessment, pay particular attention to ground conditions. 2. If in any doubt, walk access tracks to check for cracking prior to driving into subsidence areas. 3. If in a remote area, ensure people know where staff are working, and an expected time of arriving home. 4. If in a remote area, it may be preferable that staff are not in a mine subsidence area alone.	4	**LOW - D2 Unlikely / Minor ALARP**	**Endeavour Energy**
		Endeavour Energy's Network within the defined ground subsidence area, has been audited to verify the condition and integrity of the network, and record made for future referene. Critical assets (most susceptible to impact by subsidence) have been identified, photographed, and condition recorded. Oil containing assets (Transformer tanks etc..) are considerred as "critical assets".	3	Assets to be patrolled regularly for visual inspection. Critical assets are monitored monthly by survey to detect signs of movement. (Tahmoor Coal and contracted agencies). Monthly reports are forwarded to Endeavour Energy (survey results). Endeavour Energy is notified immediately on irregularities noted during visual inspection.	4		**Tahmoor Coal Mine Subsidence Engineering Consultants Pty Ltd**
				Incident Management	3		

KNOWN HAZARDS REGISTER - DAMAGE TO ENDEAVOUR ENERGY ASSETS

Risk	Hazardous event	Causes	Consequences
Damage to Endeavour Energy Assets	Damage to Endeavour Energy assets caused by ground subsidence	Ground subsidence as a result of long wall mining	Loss of life or injury Loss of property Damage to property Increased customer dissatisfaction Loss of supply Loss of network assets Environmental impact Reputation media damage Legal liability (including financial loss)

Endeavour Energy

5th April, 2017

Tahmoor Coal – Tahmoor Colliery
PO Box 100
Tahmoor, NSW 2573

Attention: Ms Belinda Treverrow

Endeavour Energy Network

Result of On Site Audit Endeavour Energy Assets

For

Tahmoor Coal - Tahmoor Colliery

Longwall 31

(On Site Audit conducted on Wednesday 5th April, 2017)

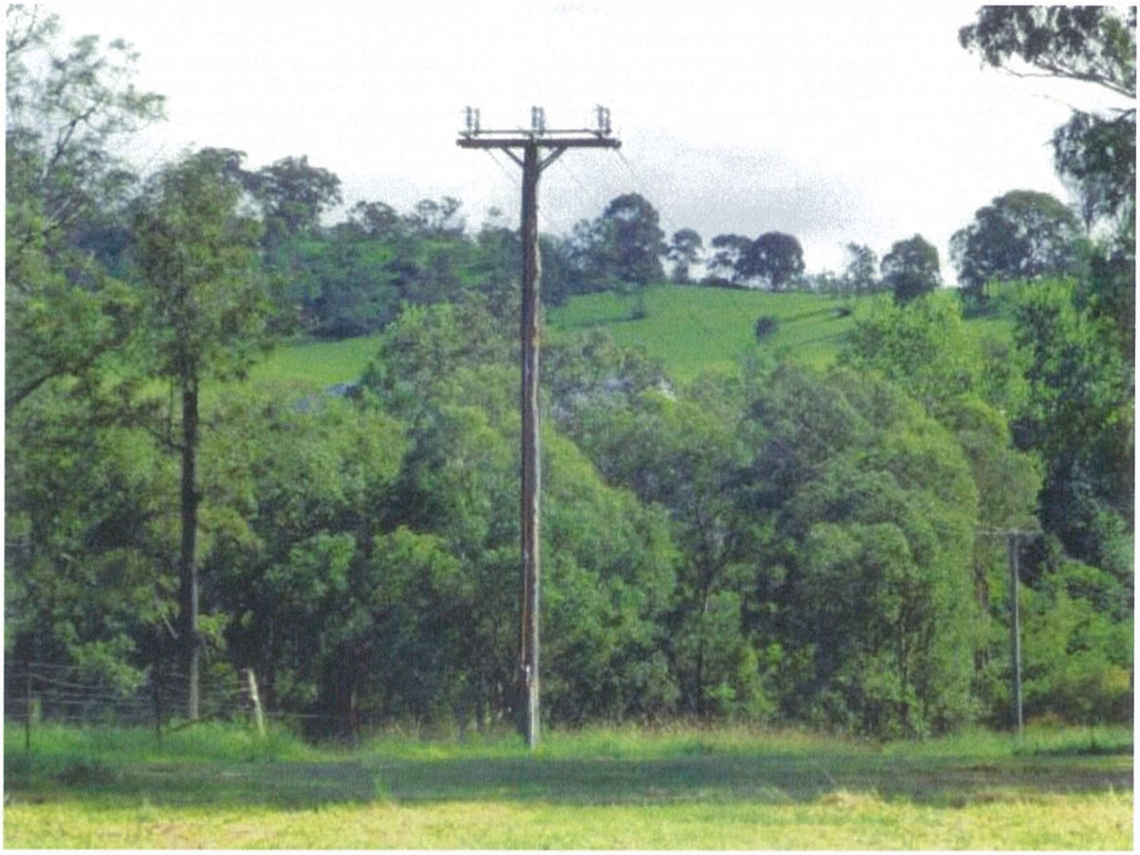
Pole No	Asset	Location	Photo Number	Description
628485	Pole Sub 12016	Stilton Lane (Map 1)	1	12.5/12 Sub Pole - Ground Stayed HV Pin Construction LV Strain Construction Separate Earth Configuration 1 x Service Mains Pole stands vertical and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
628482	HV Pole	Stilton Lane (Map 1)	2	12.5/12 HV Angle Pole - Stayed to Bollard HV Term Construction HV Strain Construction LV ABC Strain Construction Pole stands vertical and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
628623	HV Pole	Stilton Lane (Map 1)	3	12.5/12 HV Angle Pole - Stayed to Bollard 2 x HV Term Constructions LV ABC Strain Construction 1 x LV HU Service Mains Pole stands vertical with the top of the pole being slightly bent toward the angle, and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
798027	Pole Sub 10209	Stilton Lane (Map 1)	4	12.5/12 Sub Pole - Ground Stayed HV Pin Construction LV Strain Construction Separate Earth Configuration 1 x Service Mains Pole stands vertical and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
805777	HV POLE	Stilton Lane (Map 2)	5	12.5/8 HV Take-off Pole - Ground Stayed HV Strain Construction HV Term Construction LV Term Construction 1 x LV Service Mains Pole stands vertical and is in good serviceable condition.



Pole No	Asset	Location	Photo Number	Description
628573	ABS Pole	Stilton Lane (Map 2)	6	12.5/8 ABS Pole ABS No P083 Pole stands vertical but with a slight bend about 2m below the pole top, and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
805778	HV Pole	Henry Street (Map 2)	7	12.5/8 HV Angle Pole HV Strain Construction LV ABC Service Mains Pole stands vertical and is in good serviceable condition.

]

Pole No	Asset	Location	Photo Number	Description
628632	Pole Sub 12089	Henry Street (Map 2)	8	12.5/12 Sub Pole HV Pin Construction LV Strain Construction Separate Earth Configuration 4 x Service Mains Pole stands vertical and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
230469	Pole Sub 20823	Bridge Street (Map 2)	9	12.5/12 Sub Pole - Ground Stayed HV Pin Construction LV Strain Construction Separate Earth Configuration 1 x Service Mains Pole stands vertical and is in good serviceable condition.

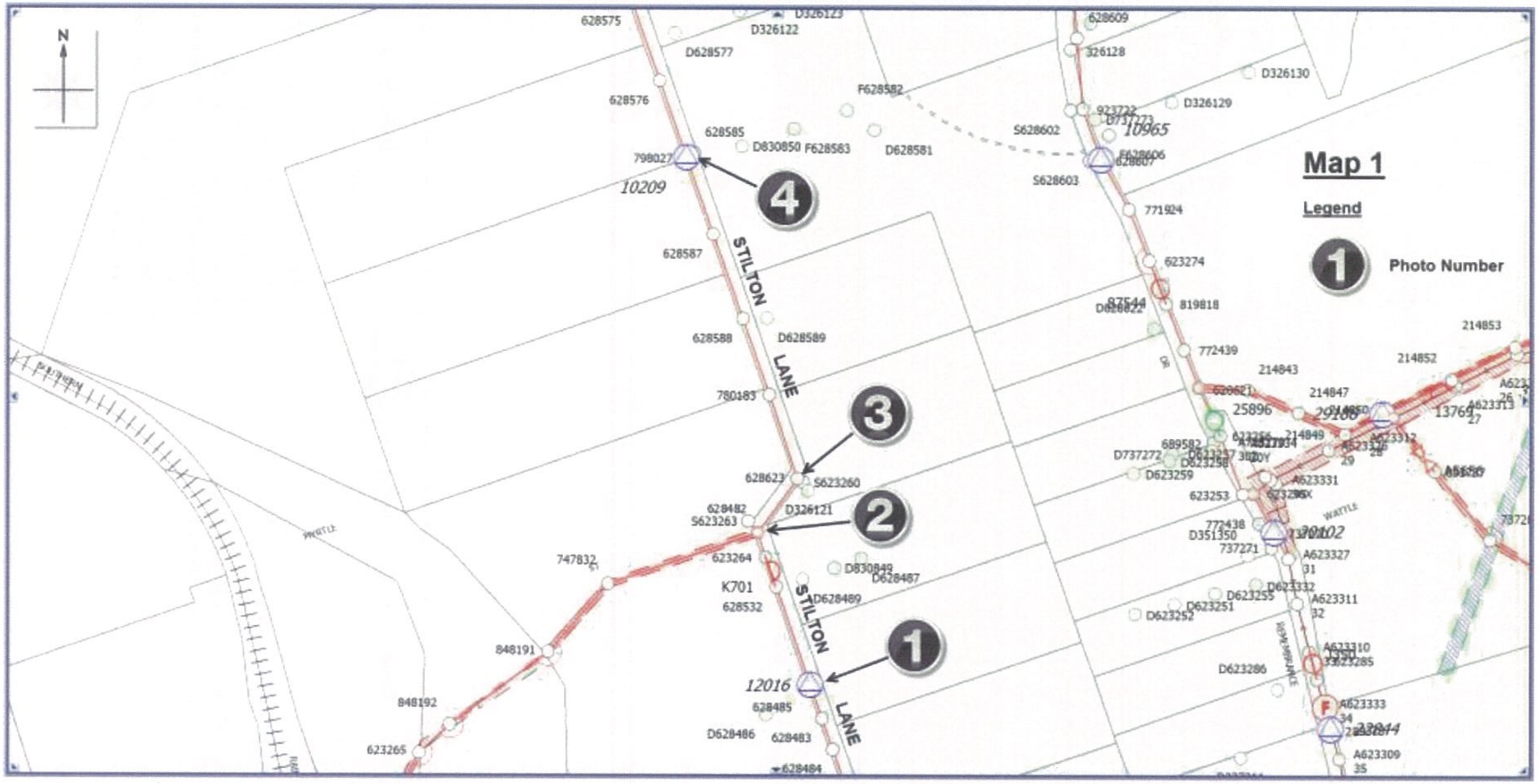
Pole No	Asset	Location	Photo Number	Description
623338	Pole Sub 3915	Bridge Street (Map 2)	10	12.5/12 Sub Pole - Ground Stayed HV Term Construction 1 x SL Conductor crossing road Separate Earth Configuration Pole stands vertical and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
628565	HV Pole	Bridge Street (Map 2)	11	12.5/8 HV Take-off Pole - Ground Stayed HV Strain Construction HV Term Construction – Links 17282 Joint Use Telstra Pole Pole stands vertical and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
623348	Pole Sub 18638	Bridge Street (Map 2)	12	12.5/12 Sub Pole HV Strain Construction LV ABC Strain Construction Separate Earth Configuration 3 x Service Mains Pole stands vertical and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
623346	HV Pole	Bridge Street (Map 2)	13	12.5/12 HV Take-off Pole HV Pin Construction HV Term Construction 2 x LV ABC Term Constructions Joint Use Telstra Pole Pole stands vertical and is in good serviceable condition.

Pole No	Asset	Location	Photo Number	Description
623341	Pole Sub 11338	Bridge Street (Map 2)	14	12.5/12 Sub Pole - Ground Stayed HV Term Construction LV Term Construction LV ABC Term Construction Separate Earth Configuration 1 x Service Mains Pole stands vertical and is in good serviceable condition.



Map 1
Legend
1 Photo Number
N
STILTON LANE
1
2
3
4
12016
10209
10965
798027
628575
628576
628585
628587
628588
780183
628623
S623260
D326121
628482
S623263
623264
K701
628532
628485
628483
D628486
747832
848191
848192
623265
D628577
D326122
D830850
F628583
D628581
F628582
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S628602
S628603
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819818
772439
214843
214847
214852
214853
25896
D737272
D623259
623253
A623331
772438
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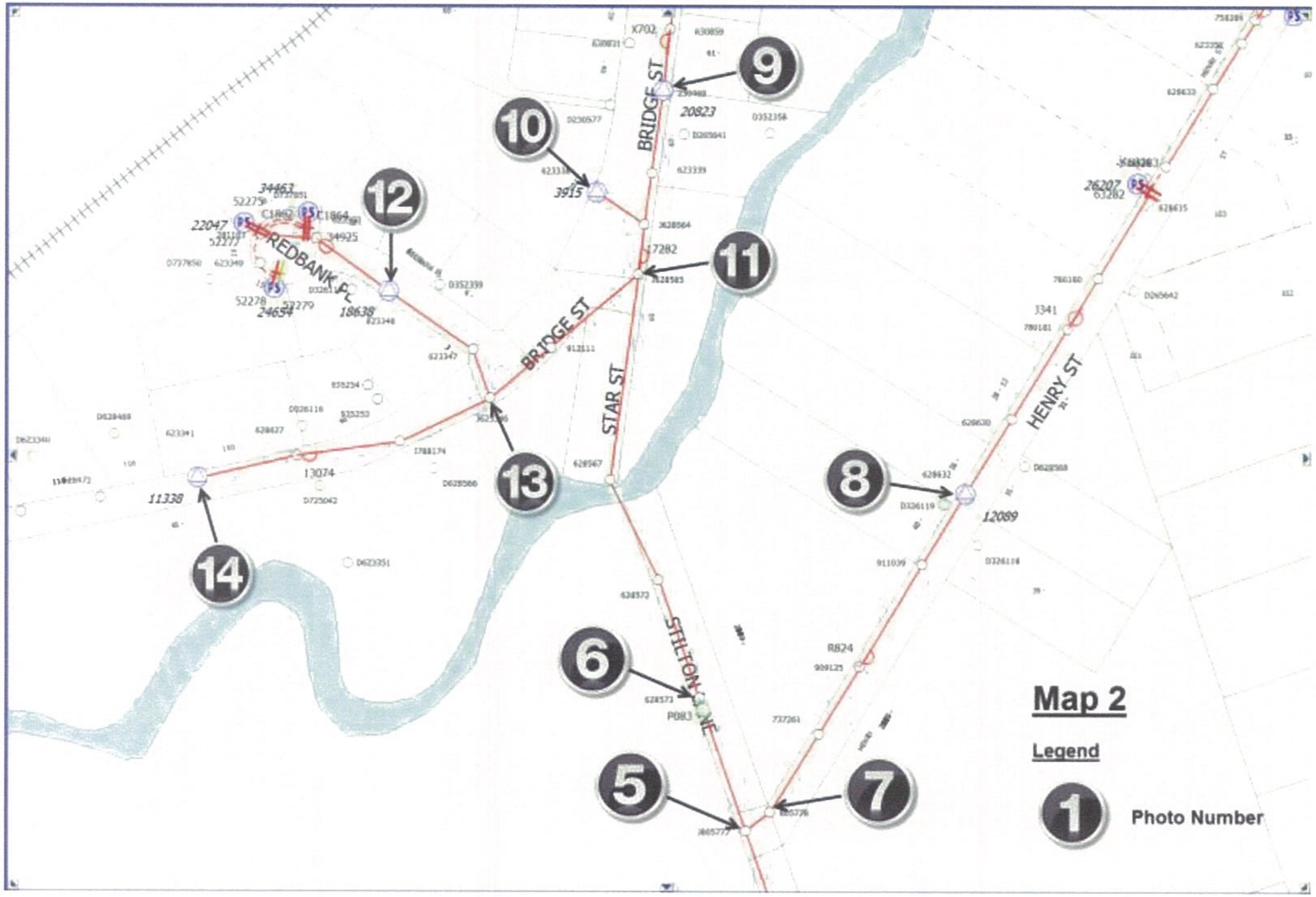
WATTLE


Map 2
Legend
1 Photo Number
HENRY ST
BRIDGE ST
STAR ST
STILTON LANE
REDBANK PL
5
6
7
8
9
10
11
12
13
14
20823
3915
17282
34463
22047
18638
24654
11338
13074
12089
26207
R824
3341
X702

Asset Status / Condition Audit For Tahmoor Coal
Tahmoor Colliery, Longwall 31

(On Site Audit conducted on Wednesday 5th April, 2017)

Scope:

The inspection was carried out to determine the condition of existing Endeavour Energy Assets which may potentially be adversely impacted by works carried out at the above mentioned sites, prior to commencement of those works.

Areas considered during the inspection process included:-

- Stability of pole foundations
- Ground clearance
- Alignment of poles
- Electrical clearances to structures
- Identification of "critical poles" for the purpose of regular monitoring.

Conditions:

The inspection was carried out om Wednesday 5th April, 2017.

The prevailing weather conditions were:

- Quiet to slight breeze only
- Overcast to Sunny
- Ambient temperature – approximately 19°C.

Observations:

Endeavour Energy's assets constructed over the above sites were visually inspected. The attached photographs show that the poles are generally in good order above ground and that they are vertical in both the traverse and longitudinal directions to the lines.

The inspection has indicated that there is no compromising of clearances to ground or structures evident, and insulator swing angles were also minimal, indicating very little, if any, relative movement of structures since installation.

The attached photographs confirm the observations made above.

Conclusion:

Site inspection has indicated no evidence to suggest any compromise of the integrity of the inspected distribution lines in the effected mining zone. The lines were found to be in a good state of repair and in serviceable order.

We note that our site audit, whilst extensive, was not exhaustive and therefore we reserve the right to identify other critical structures or issues in the future.