

Comms Network Solutions


TAHMOOR COAL - LONGWALL WEST 1 AND WEST 2

**MANAGEMENT PLAN FOR POTENTIAL IMPACTS TO
NBNCO INFRASTRUCTURE**

Prepared for Tahmoor Coal Pty Ltd

Issued 1st November 2019

AUTHORISATION OF TELECOMMUNICATIONS MANAGEMENT PLAN

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1. Introduction

1.1. Background

The Tahmoor Coal Mine (Tahmoor Mine) is an underground coal mine located approximately 80 kilometres (km) south-west of Sydney between the towns of Tahmoor and Bargo, New South Wales (NSW). Tahmoor Mine produces up to three million tonnes of Run of Mine (ROM) coal per annum from the Bulli Coal Seam. Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Product coal is transported via rail to Port Kembla and Newcastle for Australian domestic customers and export customers.

The Tahmoor Mine has been operated by Tahmoor Coal Pty Ltd (Tahmoor Coal) since Tahmoor Mine commenced in 1979 using board and pillar mining methods and via longwall mining methods since 1987. Tahmoor Coal, trading as Tahmoor Coking Coal Operations (TCCO), is a wholly owned subsidiary within the SIMEC Mining Division (SIMEC) of the GFG Alliance (GFG).

Tahmoor Coal has previously mined 32 longwalls to the north and west of the Tahmoor Mine's current pit top location. Tahmoor Coal has recently completed mining Longwall 32 in accordance with Development Consents and Subsidence Management Plan Approval.

Tahmoor Coal proposes to extend underground coal mining to the north-west of the Main Southern Railway (referred to as the 'Western Domain') which will include Longwalls West 1 (LW W1) to West 4 (LW W4) at Picton and Thirlmere. The first two longwalls to be mined are LW W1 and Longwall West 2 (LW W2) (collectively referred to as LW W1-W2), which are the focus of this Extraction Plan. The location of these areas is shown in Plate 1.

As part of the planning for mining LW W1-W2, Tahmoor Coal has identified surface assets which may be affected by the mining operation in the Picton west area. Some of these telecommunications assets belong to NBNC Co and Telstra and are part of NBNC Co's infrastructure in the area.

There are current changes underway to transfer ownership of Telstra's external cable network progressively to NBNC Co and some of the existing communications infrastructure in this area, has been or is, progressively being transferred to NBNC Co, as they establish their new network throughout the area. Telstra will maintain ownership of their existing main cable and conduit network while NBNC Co will have ownership over their newly installed cable network to the Node or Pillar and then to the customer's premises. Additionally, NBNC Co have installed their own Inter Exchange Network (IEN) optical fibre cable network. Hence ownership of the telecommunications network throughout this area, is a composite arrangement, essentially with NBNC Co owning cables from the Node to the customer as well as their IEN optical fibre cable network and with Telstra owning their existing conduit network plus their main copper and optical fibre cables. This dual ownership provides challenges to implementing telecommunications management plans, due in part to overlapping ownership details such as NBNC Co cable within Telstra's conduit and pit network.

Tahmoor Coal has represented this longwall mining application for LW W1-W2 to both Telstra and NBNC Co, and each company have independently determined that they will present their own preferred management plan and monitoring regime for their own networks to Tahmoor Coal for implementation. This management plan is to consider the monitoring actions determined by NBNC Co for their network, allowing for some minor overlap and feedback being provided from the Telstra monitoring exercise since this has been established over the past 20 years.

1.2. Purpose and Objectives

This NBNC Co Management Plan (NBN MP) will consider the impact of the ground surface movements, contributed by LW W1-W2 on the assets owned by NBNC Co. Additionally, there is some comment in this management plan regarding potential impacts on the adjacent Telstra network. The comments relate to planned monitoring of the Telstra network by Comms Network Solutions Pty Ltd (CNS) which has been part of previous longwall monitoring where the entire communications network was owned by Telstra. The commitment by CNS to NBNC Co in regard to existing monitoring regimes, as previously adopted and now applied to LW W1-W2, is to immediately provide any relevant

information gained by monitoring the performance of the Telstra network to NBNC Co. This provides the advantage to NBNC Co that CNS field staff engaged by Tahmoor Coal can immediately advise NBNC Co of current ground surface impacts, potentially affecting the co-located Telstra network which may have implications for the adjacent NBNC Co network.

It is recognised that NBNC Co will be responsible for managing potential impacts on their network but this can be augmented by CNS providing current mining status, potential anomalous ground movements and any changes noted in the Telstra network which may prove to be of assistance to the monitoring regime established for NBNC Co.

The objectives of this NBN MP in relation to NBNC Co plant are to put in place procedures to be followed:

- 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 present in the vicinity are not put at risk due to mine subsidence;
- To avoid disruption and inconvenience or, if unavoidable, kept to minimal levels;
- To audit and assess the relative risk, for each section of the NBNC Co networks exposed to mine subsidence;
- To monitor the impact of mine subsidence and initiate action to mitigate potential damage to the network infrastructure by recording visible changes or changes in transmission characteristics which may affect plant performance;
- To provide a plan of action, should subsidence effects impact on the serviceability or performance of plant;
- To establish a clearly defined decision-making process to ensure timely implementation of risk control measures for high consequence but low likelihood mine subsidence induced hazards that involve potential for serious injury or illness to a person or persons that may require emergency evacuation, entry restriction or suspension of work activities; and
- To establish an NBN Response Group (NBN RG) to report, discuss and record impacts on NBNC Co plant and transmission performance (refer to Section 6.0).

1.3. Scope

Tahmoor Coal commissioned a report by Mine Subsidence Engineering Consultants Pty Ltd (MSEC) in support of the Extraction Plan for LW W1-W2. The Report by MSEC 1019, Revision A, Reference No 1, is titled *SIMEC Mining-Tahmoor Coking Coal Operations - Longwalls W1 and W2- Subsidence Predictions and Impact Assessments for Natural and Built Features due to the Extraction of Proposed Longwalls W1 and W2 in Support of the Extraction Plan Application*. This report identifies a Study Area for LW W1-W2 that considers mine subsidence impacts bounded by the 20 mm subsidence contour line and 35° Angle of Draw for LW W1-W2. This Study Area has been identified for LW W1-W2 in MSEC Drawing MSEC1019-18, which is attached as Appendix A, Sheet 1 and shows the layout of the telecommunications infrastructure including Telstra and NBNC Co optical fibre and copper cable networks. (Note this drawing is being updated to more accurately reflect the installed NBNC Co network.)

As mentioned, the Study Area under consideration is to the west of Picton and include the following NBNC Co major assets or shared assets:

- NBNC Co Nodes in Stonequarry Creek Road providing interconnection from NBNC Co optical fibre cable to copper distribution cable network in this area;
- NBNC Co main optical fibre cable network between Picton and Tahmoor telephone exchanges along Thirlmere Way, (Telstra IEN cable also adjacent);
- NBNC Co main optical fibre cable installed west from Picton along Barkers Lodge Road, (Telstra IEN cable also adjacent); and
- Telstra Pit and Pipe networks supporting some of the above cable networks throughout the mining area.

During the extraction of previous longwalls LW22 to LW32, the mining impacts from mine subsidence on the Telstra owned network that have occurred have been managed satisfactorily from Telstra's perspective. As mining continues in LW W1-W2 the potential for impacts on the major network cable infrastructure will vary with regards to the different types of telecommunications infrastructure exposed to mining. With this new mining area LW W1-W2, the

southern section of the Study Area will be associated with network in the Thirlmere Way and Stonequarry Creek Road area and the northern section of the Study Area will be associated with Barkers Lodge Road.

The two areas present very similar telecommunications infrastructure for subsidence and ground movement considerations. Main IEN optical fibre cables are present in the south and north. In the south however, there is also NBNC Co optical fibre cable to the Nodes and the local cable distribution is also present in the south to customers along Stonequarry Creek Road. The Telstra manhole, pit and conduit installations support both the Telstra and NBNC Co cable networks and also cover both south and north sections of the Study Area. Therefore, the NBNC Co cable networks potentially impacted by LW W1-W2 are located in the north along Barkers Lodge Road and in the south along Thirlmere Way and Stonequarry Creek Road.

This NBN MP is to be used to assess and protect the performance of the items in the NBNC Co network identified to be most at risk, due to mine subsidence impacts and to ensure that the health and safety of people who may be present on public property or around NBNC Co property, are not put at risk due to mine subsidence. The major items of NBNC Co plant are considered, relative to their location and risk assessed from subsidence impacts from LW W1-W2 (See Section 4.2 -4.3).



Plate 1: Google Earth aerial view of two longwalls LW W1-W2 showing Thirlmere Way in the south and Barkers Lodge Road in the north. The green lines indicate NBNCo optical fibre cables, south between Picton and Tahmoor exchanges and along Stonequarry Creek Road and north along Barkers Lodge Road between from Picton and west. The blue lines are the NBNCo local copper customer cables and the yellow lines are the Telstra IEN optical fibre cables.

1.4. Timeframe

Extraction from longwall LW32 was completed in October 2019 and LW W1 is anticipated to commence in November 2019. The longwall will then take approximately 10 months to mine, working from the north to south towards Thirlmere Way. It is anticipated that LW W2 will then commence extraction around 11 months later in October 2020. Therefore, this NBN MP covering the longwall mining under NBNCo & Telstra plant will continue in

operation until completion of mining of LW W2, anticipated towards late 2021 and for sufficient period of time thereafter to allow for completion of subsidence effects.

1.5. Limitations

The mechanism of mine subsidence and its impact on the telecommunications networks have been considered over a large number of longwall mining events in different geographic locations with different types of telecommunications networks similar to those identified above. Previous longwalls have undermined direct buried major interstate optical fibre cables through to undermining two pair copper cables servicing one customer. It is known that longwall mining can impact on the transmission characteristics of optical fibre cables, older more brittle lead sheathed cables and aerial cables. In this case, as the optical fibre cables are located across LW W1, maximum exposure of these cables is associated with some accompanying risk to the Inter Exchange Network.

Also, as mentioned above there are both, local copper direct buried cables and cables in conduit which are potentially vulnerable to sheath damage or high tensile loads respectively. Since monitoring has been performed on the network during LW24 through to LW32 subsidence events, there is now some basis for assessing the performance of these networks from past experience. Generally, as mentioned it has been found that the older lead sheathed main, junction, and local copper cables and local aerial copper cable distribution networks are vulnerable to ground movement, particularly the latter during exposure to ground tilting. However, within the subsidence zone for LW W1-W2 there are no older lead sheathed copper cables or aerial customer distribution cables.

Once the mine subsidence is initiated there is no method of halting the subsidence event and hence, if the degree of ground movement begins to damage communications plant, then the impact is irreversible and repair work is required. This has been done in the past where, through continuous fibre monitoring, vulnerable plant has been identified to be at risk during the event and action has been taken to minimise the risk of any continuing damage to the network. An NBN MP will not necessarily prevent damage but will limit subsidence impact and put in place suggested actions to be taken should evidence of significant ground movement indicate the potential for damage to occur.

1.6. Definitions

CAN - Customer Access Network, the cable distribution network which provides communications services direct to customers premises.

Main Cable – Main copper cable providing pairs of copper conductors between the exchange and the distribution point or cross connect point generally a pillar location. This cable network is being superseded as NBNC Co roll out FTTN.

NBNC Co FTTN - System of providing telecommunications services to the customer. NBNC Co install above ground Micro Node or VDSL (Very High Bit Rate Subscriber Line) Cabinets at the Pillar with optical fibre cable feeds to the Node location. Copper services are then generally used customer's side of the Node to provide data, phone and internet services to customer's premises. The Node will be fed by optical fibre cable from the exchange and the distribution from the node to the customer will be by NBNC Co Local copper cable network.

Local Cable – NBNC Co customer local copper cable providing pairs of copper conductors between the Node distribution point and the customer's premises. This cable may be directly buried or installed in conduit or use aerial distribution to the individual premises.

OTDR :- Optical Time Domain Reflectometer, used to determine loss characteristics for transmission systems on optical fibre cables. Generally used for testing transmission quality of individual optical fibres with testing at 1625nm, at higher frequency than transmission systems, to provide early warning of possible transmission loss on the system.

Pillar – Is the Telstra interconnection point between the local cable leading to the customer's premises and the Main cable from the exchange. It provides flexibility within the Customer Access Network to connect new and disconnect cancelled services. The main telephone exchange distribution area is broken up into smaller distribution areas where the individual pillar provides the connection between the exchange and the customer. Note that with the rollout of

NBNCo this section of the Telstra cable network will be divested from Telstra to NBNCo as NBNCo establish Nodes as in Stonequarry Creek Road.

NBN Response Group: (NBN RG) Forum proposed to be convened as necessary (teleconference preferred) to facilitate the implementation and discussions around the operation of this NBN MP. Participants to be from NBNCo, Tahmoor Coal, MSEC, Comms Network Solutions and other Tahmoor Coal technical consultants as required. The NBN RG will arrange discussions and meetings as required and where necessary involve Subsidence Advisory NSW and the NSW Resources Regulator.

NBN Node – This is an external cabinet located generally in the road reserve as a stand-alone cross connect unit which allows improved transmission systems in telephone, internet and data traffic to be provided to locations remote from a telephone exchange. The transmission system into the Node is provided by optical fibre cable and the customer feed from the Node is then generally by traditional local copper cable distribution to the customer’s premises.

2. Consultation

2.1. Consultation with NBNC Co

Colin Dove from CNS attended a meeting with NBNC Co Network Deployment NSW / ACT at their Pennant Hills Office in August 2019 to discuss the planned longwalls LW W1-W2 to be commenced by Tahmoor Coal and to consider the implications on the NBNC Co Network.

There has been follow up phone and email contact with NBNC Co Technology Group where the Network Operations and Service Delivery Sections of NBNC Co are to introduce Remote OTDR monitoring on their two optical fibre cables:

- a) The 144f SMOF cable, 2OAK 00 00 TSS 010 crossing LW W1 in the southern zone
- b) The 144f SMOF cable, 2OAK-00-00-TSS-007 installed just within the northern Study Area for LW W1 & W2.

Tahmoor Coal will regularly consult with NBNC Co in relation to mine subsidence effects from mining as required and contact can also be supplemented through CNS who are in the field monitoring the Telstra network. This will include regular consultation and reporting of subsidence movements and potential impact areas.

Tahmoor Coal and/or CNS will continue to consult regularly with NBNC Co during the extraction of LW W1-W2 in relation to progress of longwalls, presentation of survey data and potential mine subsidence impacts.

3. Subsidence Predictions

3.1 Subsidence Predictions (Reference No 1)

The Mine Subsidence Engineering Consultants Pty Ltd Report MSEC1019 Revision A, Reference 1, Section 6.11.4 Telecommunications Services makes the statement that:

“TCCO and Telstra have developed and acted in accordance with an agreed risk management plan to manage potential impacts to telecommunications infrastructure during the mining of Longwalls 22 to 31. It is recommended that this management plan is reviewed and updated to incorporate LW W1-W2.”

The NBN MP will take into consideration the subsidence predictions for LW W1-W2, as well as drawing on the experience gained from the management of the Telstra infrastructure from previous subsidence events due to LW29 to LW32 at Tahmoor Mine.

It is recognised from past experience gained at Tahmoor Mine in monitoring the Telstra network that optical fibre cable is more vulnerable to ground movement predominantly due to the nature of the cable in that it is only able to sustain relatively low ground compressive and tensile strains before the external sheath transfers the strain to the individual fibres within the cable. When this occurs, the individual fibres have limited capacity to tolerate tensile or compressive strains before they cause interruption to or failure of transmission systems. The other concern with optical fibre cables is that they have much larger capacity to carry telephone, data and internet services such that any minor interruption to traffic, can cause serious impacts on the overall telecommunications network.

Generally the more extensive local copper cable network is more robust and able to tolerate reasonable levels of mining induced ground strain. The interaction is complex since the network comprises of very small copper cable of 5 mm diameter up to larger and generally more fragile 12-20 mm diameter optical fibre cables, spread diversly in the northern and southern sections of the Study Area. As a result the cable types will be considered within their general groupings of cable type:

- a NBNC Co Local copper cable distribution in Stonequarry Creek Road;
- b NBNC Co optical fibre cables: (including consideration of Telstra optical fibre cables co-located)
 - i NBNC Co and Telstra direct buried IEN optical fibre cables crossing the southern end of LW W1 and crossing to the south of LW W2;
 - ii NBNC Co and Telstra CAN optical fibre cable along Stonequarry Creek Road. Note, NBNC Co cable stops short of western goaf edge of LW W1 while the Telstra cable crosses into the western extraction area of LW W1;
 - iii NBNC Co and Telstra optical fibre cables in conduit to the north of LW W1-W2 along Barkers Lodge Road just inside the Study Area; and
- c Cable distribution network consisting of manholes, pits and conduit over the Extraction Plan Study Area supporting both the Telstra and NBNC Co cable networks.

The total subsidence predictions for these various cable types is as shown below in Table 1 extracted from Reference No 1 as included in Appendix A Sheets 2, 3 and 4.

Table 1 Maximum Predicted Cumulative Subsidence Parameters for LW W1-W2 on optical fibre and copper telecommunications cables

Location of Network	Subsidence mm	Tilt mm/m	Curvature (1/km)	Transverse Strain (Applying a factor of 10 to curvature)
NBNCo & Telstra Optical Fibre Cable & direct buried copper cable crossing LW W1 and south of LW W2	750	5.5	+0.06, -0.11	0.6mm/m tension 1.1mm/m compression
NBNCo & Telstra Optical Fibre and local copper cable Stonequarry Creek Road LW W1	720	2.7	+0.025, -0.05	0.25mm/m tension 0.5mm/m compression
NBNCo Optical Fibre in conduit & Telstra direct buried Optical Fibre and local copper cable along Barkers Lodge Rd	20	0.0	0.0	0.0mm/m tension 0.0mm/m compression

It is proposed that this NBN MP will initiate a broad agreement between CNS, NBNCo and Tahmoor Coal to assist in effectively managing and addressing the monitoring issues, related to the degree of risk, assessed during mining, for the various elements of the NBNCo network exposed to mine subsidence from LW W1-W2 extraction.

3.2 Geological Structures

There have been extensive drilling investigations to identify geological structures at coal seam level. Tahmoor Coal commissioned an engineering geologist from Strata Control Technologies in 2018 (SCT) to undertake site inspections and mapping of the Nepean Fault. This work has provided detailed information on the nature and location of Nepean Fault, and second order geological structures associated with the fault. These structures are located to the east of LW W1-W2, and it was stated by SCO (2018) that “...no significant geological structures have been identified within the Western Domain from underground workings by TCCO”.

Tahmoor Coal has surveyed subsidence along many streets during the mining of previous Longwalls 24A to 32. Some of these monitoring lines are located over solid, unmined coal, between the extracted longwalls and the Nepean Fault. None of the survey lines cross first order faults, though two survey lines (Stilton Dam Line and Remembrance Drive East Line) cross mapped second order conjugate faults. A study has been completed to ascertain whether irregular subsidence have occurred along the survey lines. The information provides an indication of the likelihood of irregular movements during the extraction of Longwall 32. The study found no increased subsidence, tilt or strains were measured along the survey lines that were located over unmined, solid coal areas between the extracted longwalls and the Nepean Fault.

Should any evidence of unpredicted movement or location of geological structures become apparent during mining operations for LW W1-W2 this should be reported immediately to NBNCo. Also, during future mining development works or should ‘Regional or Far Field Horizontal Ground Movements’ be recorded, this information should also be immediately reported to the NBN RG for NBNCo to consider the impact on their network.

4. Risk Assessment

4.1 NSW Work Health and 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 and 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 not reasonably practical to eliminate;*
- *Maintaining control measures; and*
- *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.”*

Detailed guidelines have also been released by the NSW Department of Planning and Environment, Resources Regulator, Mine Safety Operations (MSO, 2017).

The risk management process has been carried out in accordance with guidelines published by the NSW Department of Planning and Environment, Resources Regulator, Mine Safety Operations (MSO, 2017). The following main steps of subsidence risk management have been and will be undertaken, in accordance with the guidelines:

- Identification and understanding of subsidence hazards;
- Assessment of risks of subsidence;
- Development and selection of risk control measures;
- Implementation and maintenance of risk control measures, and
- Continual improvement and change management.
- Each of the above steps have been or will be conducted together with the following processes.
- Consultation, co-operation and co-ordination; and
- Monitoring and review.

This management plan documents the risk control measures that are planned to manage risks to health and safety associated with the mining of LW W1-W2 in accordance with the WHS laws.

4.2 Risk Assessment Methodology

The following are the assessed relative risks associated with existing NBNC Co plant within the Study Area as shown in Appendix A Sheet 1. The items of plant have been assessed according to the probability of damage and the consequences resulting from that damage, associated with that general category of plant. The Risk Factors (from low to high) are shown in the attached Table 2. A summary of all risks are detailed in Table 3.

Table 2 Relative Risk Factor for NBNC Co Plant

Risk Assessment Matrix		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost Certain	Significant	Significant	High	High	High
	Likely	Moderate	Significant	Significant	High	High
	Moderate	Low	Moderate	Significant	High	High
	Unlikely	Low	Low	Moderate	Significant	High
	Rare	Low	Low	Moderate	Significant	Significant

4.3 Risk Assessments for each Infrastructure Group

4.3.1 NBNC Co Local Copper Customer Distribution Cable

This cable provides connection to each customer's premises along Thirlmere Way & Stonequarry Creek Road. The section of cable in Stonequarry Creek Road and intersecting roads of Carramar Close, Attunga Close and Booyong Close are all in conduit and potentially are exposed to limited subsidence impact since the conduit isolates the cable from the ground movement. Hence the risk factor for these cables is assessed to be associated with an unlikely likelihood, minor consequence, and overall **low** risk.



Plate 2.1 View into typical Telstra plastic pit showing P100 conduit and NBNCable cables along Stonequarry Creek Road.

However, the direct buried local cables near the southern end of LW W1 are much more exposed to ground movement than the cables in the conduit network. Hence accepting that these cables are not crossing but just entering into the goaf areas of LW W1 the risk factor is assessed to be associated with a moderate likelihood, minor consequence, and an overall **moderate** risk.



Plate 2.1 View of Telstra No5 Pit in private property on north side of Thirlmere Way showing line of NBNCable cable towards the south east corner of LW W1. Cable is grease filled hard jacket 10/0.64 cable

4.3.2 NBNC Co Optical Fibre Cables (Telstra direct buried cable also present)

i) NBNC Co Cable in Conduit crossing LW W1 and to the south of LW W2 (Telstra Direct Buried IEN optical fibre cable)

The Telstra cable F PCTN 103 12f SMOF cable is a small diameter standard construction direct buried cable crossing LW W1 alongside the NBNC Co cable. The NBNC Co cable is a 144f SMOF cable, 2 OAK 00 00 TSS 010 which is of more robust construction that is installed in conduit alongside the Telstra cable hence being less vulnerable to ground strain than the Telstra cable. Therefore, since the cables are installed within 3-5m of each other it is considered that the Telstra cable being the more vulnerable of the two cables present across LW W1-W2, can be monitored to provide early advice of potential impacts to NBNC Co. The risk factor for the NBNC Co cable installed in conduit is assessed as an unlikely event with major consequence, and an overall **significant** risk.

ii) NBNC Co Cable in Conduit crossing the northern end of LW W1-W2 (Barkers Lodge Road) – (Telstra direct buried IEN cable also present)

The NBNC Co cable is installed in Telstra conduit while the Telstra IEN cable is direct buried along the southern side of Barkers Lodge Road, just with the LW W1-W2 Study Area. However, since there is no predicted ground strain in this area, the only concern is far field movement and the remote possibility of potential damage to the cables. It is assumed that since the NBNC Co cable is installed in conduit it is at a much lower risk than the Telstra standard construction direct buried cable adjacent to the conduit route. The risk factor for the NBNC Co cable is assessed to be a rare likelihood with a major consequence due to the importance of the cable and an overall **significant** risk. See Plate 3 below.

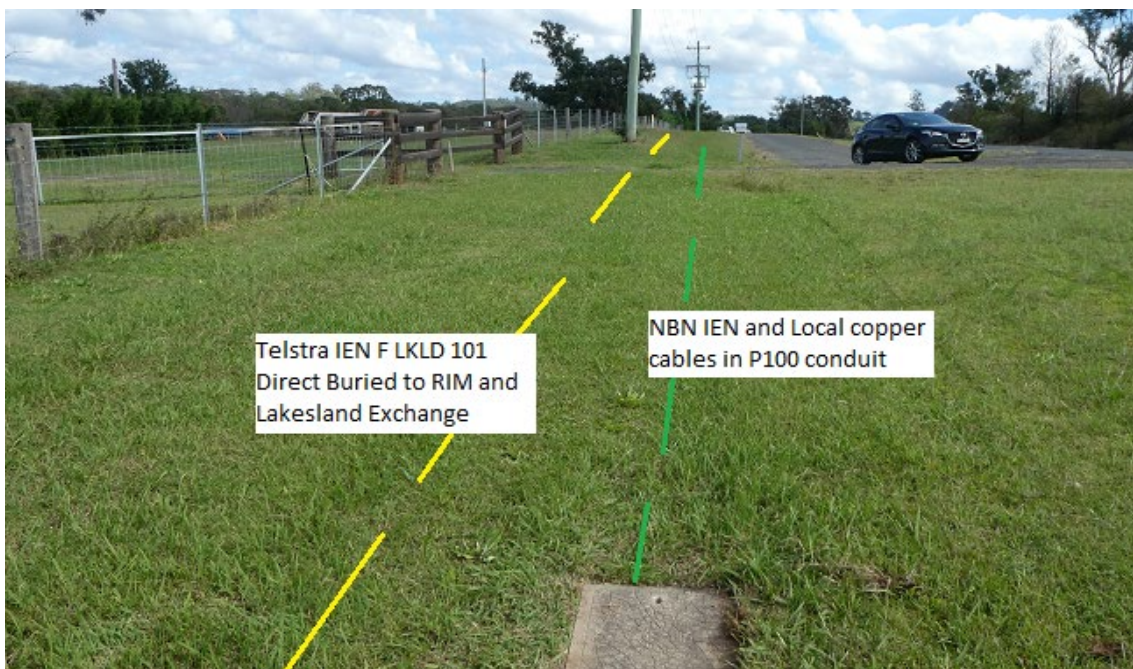


Plate 3 View of No 6 Pit in Barkers Lodge Road looking west towards Telstra's RIM showing alignment of direct buried Telstra optical fibre cable F LKLD 101 18f installed parallel with NBNC Co IEN optical fibre and Telstra local copper cables both installed in conduit.

4.3.3 NBNC Co Cable in Conduit along Stonequarry Creek Road (Telstra CAN cable also present in same conduit)

These cables are installed along the western footpath alignment of Stonequarry Creek Road to the NBNC Co Nodes and to the Telstra RIM located at the northern end of Stonequarry Creek Road. The Telstra cable crosses into LW W1 diagonally from west to east. The NBNC Co cable however, only extends north to the northern side of Attunga Close and doesn't actually enter the longwall goaf edge on the western side of LW W1. Both optical fibre cables are installed for the full length in conduit and both cables carry the main fibre connections to the respective Nodes, NBNC Co near Attunga Close and Telstra at the northern end of Stonequarry Creek Road within LW W1.

Since the NBNC Co cable is in conduit and stops approximately 100m west of LW W1 the risk factor is assessed as a rare likelihood, with moderate consequence, and an overall **moderate** risk.

The Telstra cable however since it crosses for around 300m into the western goaf area of LW W1, leads to a relatively higher risk factor than the NBNC Co cable and CNS monitoring of this cable will provide feedback on the NBNC Co cable.

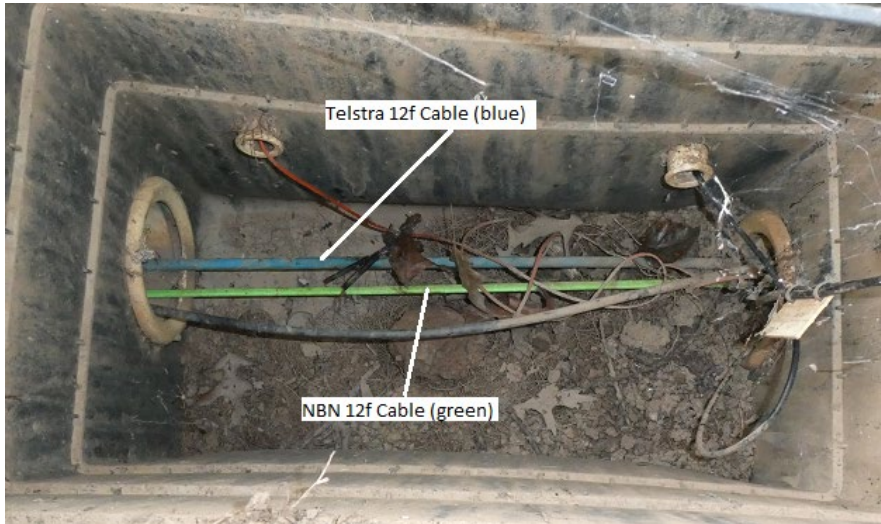


Plate 4 View of No5 Pit in Stonequarry Creek Road showing NBNC Co (green) and Telstra optical fibre (blue) cables to Nodes in Stonequarry Road and Telstra RIM at the northern end of the road.

4.3.4 NBNC Co Nodes in Stonequarry Creek Road



Plate 5 View of NBNC Co Node '2TAH02-07-FNO-001' located at No 13 Stonequarry Creek Road showing NBNC Co (green) and Telstra (yellow) conduit from Telstra No6 Pit to Node and along western side of Stonequarry Creek Road. Note NBNC Co Nodes are not located over LW W1

The two NBNC Co Nodes installed along Stonequarry Creek Road are not considered to be at risk due to longwall mining. They are relatively small light weight above ground HDPE housings mounted on a No5 Pit with P100 conduit

feeding into the pit from the adjacent Telstra pit. Additionally, the Nodes are located up to 100m from the western goaf edge of LW W1. Therefore, the risk factor is assessed to be Rare likelihood with Minor consequences, risk factor for NBNC Co Node is **Low**.

4.3.5 Manhole, Conduit and Pit Network

The conduit, manhole and pit network are a critical factor in the performance of the cable network during mine subsidence. Although the possibility of differential movement between the components of this network, due to mine subsidence is low, due to the large geographical extent of the network, its lack of homogeneity and its differing age, it is considered to be an important factor in the performance of the entire cable network. The conduit, manholes and pits provide the primary isolation of the cable network from ground movement and strain. In addition, because of the variation in the components of this network it is also the most difficult item of plant to assess for potential risk of damage.

The main concern in this network is the performance of the older larger asbestos and cellulose fibre pits, however these are only present outside of the direct mining areas along Thirlmere Way and Barkers Lodge Road. The large pits along Stonequarry Creek Road are all HDPE (polyethylene) construction making them far less vulnerable to ground movement impacts than the heavier asbestos or concrete pits located in adjacent areas. All of the conduit network utilises varying sized PVC conduit (20-100 mm dia.) which is considered to be at a low level of risk of damage from ground movement or strain. The risk assessment for the manhole, conduit and pit network is considered to be associated with an unlikely likelihood, minor consequence, and an overall **low** risk.

4.4 Identification of subsidence hazards

Clause 34 of the *Work Health and Safety Regulation (2017)* requires that the duty holder (in this case Tahmoor Coal), in managing risks to health and safety, must identify reasonably foreseeable hazards that could give rise to risks to health and safety.

This section of the management plan summarises hazards that have been identified in the mining operation which could raise risks to health and safety of people in the vicinity of NBNC Co and Telstra infrastructure.

Mine subsidence hazards have been identified, investigated and analysed in a systematic manner by examining each aspect of the infrastructure, as described in Section 4.3.1 to 4.3.5 above of this management plan. Each of the infrastructure groups discussed above could potentially experience mine subsidence movements that give rise to risks to the health and safety of people.

The following mine subsidence hazards were identified that could give rise to risks to health and safety due to the extraction of LW W1-W2:

- Temporary loss of telecommunication IEN or CAN services;
- Tensile or compressive ground strain acting on direct buried cables; and
- Disruption of telecommunication services into or out of Nodes.

The identification and risk assessment process took into account the location of infrastructure relative to LW W1-W2 and the associated timing and duration of the subsidence event, as described in this management plan.

Whilst mine subsidence predictions and extensive past experiences from previous mining at Tahmoor Coal were taken into account, the identification and risk assessment process recognised that there are uncertainties in relation to predicting subsidence movements, and uncertainties in how mine subsidence movements may adversely impact NBNC Co and also Telstra infrastructure. In this case, creeks and geological structures have been mapped that intersect both the NBNC Co and Telstra infrastructure where higher ground strains may occur.

Tahmoor Coal has considered the outcomes of the hazard identification and risk assessment process when developing measures to manage potential impacts on the health and safety of people, and potential impacts on NBNC Co and Telstra infrastructure in general. These details are described in Section 5 of this management plan.

In addition to the risk assessment process outlined in this NBN MP, a Risk Assessment was completed by Tahmoor Coal for LW W1-W2 Infrastructure on 26 March 2019, which included the identification of potential risks to NBNC's infrastructure (refer to Appendix B and Appendix C).

5. Control Procedure

5.1 Overview of Control Procedures

Tahmoor Coal has developed and selected risk control measures in consultation, co-ordination and co-operation with the infrastructure owner in accordance with WHS legislation. In accordance with Clauses 35 and 36 in Part 3.1 of the *Work Health and Safety Regulation 2017* and the guidelines (MSO, 2017), a hierarchy of control measures has been considered and selected where reasonably practicable, using the following process:

- Eliminate risks to health and safety so far as is reasonably practicable;
- If it is not reasonably practicable to eliminate risks to health and safety – minimise those risks so far as is reasonably practicable, by doing one or more of the following:
 - Substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk;
 - Isolating the hazard from any person exposed to it;
 - Implementing engineering controls;
- If a risk then remains, minimise the remaining risk, so far as is reasonably practicable, by implementing administrative controls; and
- If a risk then remains, the duty holder must minimise the remaining risk, so far as is reasonably practicable, by ensuring the provision and use of suitable personal protective equipment.
- A combination of the controls set out in this clause may be used to minimise risks, so far as is reasonably practicable, if a single control is not sufficient for the purpose.

There are primarily two different methods to control the risks of subsidence, namely:

- Method A – Selection of risk control measures to be implemented prior to the development of subsidence, (Items 1 and 2 above), and
- Method B – Selection of risk control measures to be implemented during the development of subsidence (Items 3 and 4 above).

Tahmoor Coal considered Method A and Method B risk control measures in relation to managing potential impacts on NBNC Co infrastructure due to the extraction of LW W1-W2.

The following considerations have been made by Tahmoor Coal with regards to impact to telecommunication infrastructure:

- Elimination - In this instance, no reasonably practicable controls could be identified that would eliminate the identified risks;
- Substitution - In this instance, no reasonably practicable controls could be identified that will change the environment so the hazards could be substituted for hazards with a lesser risk;
- Isolation - In this instance, no reasonably practicable controls could be identified to isolate a hazard from any person exposed to it;
- Engineering Controls - In this instance, no reasonably practicable controls could be identified to put in place a structure or item that prevents or minimises risks; and
- Administrative Controls - Tahmoor Coal and NBNC Co have developed and implemented Administrative Controls that will put in place procedures to minimise the potential of impacts on the health and safety of people associated with damage to NBNC Co infrastructure.

Tahmoor Coal and NBNC Co have developed a management strategy of detecting early the development of potential adverse subsidence movements in the ground, so that contingency response measures can be implemented before impacts on the safety and serviceability develop. See Table 3 of this NBN MP.

The risk control measures described in this NBN MP have been developed to ensure that the health and safety of people on NBNCo infrastructure are not put at risk due to mine subsidence. It is also an objective to avoid disruption to services, or if unavoidable, keep disruption and inconvenience to minimal levels.

With respect to the extraction of LW W1-W2, no potential hazards have been identified that could reasonably give rise to the need for an emergency response. Of the potential hazards identified, only a complete loss of mobile and fixed line services could possibly give rise to the need for an emergency response. The likelihood is considered remote and would require substantial differential subsidence movements at multiple locations to develop before such an event occurs.

Mine subsidence movements will develop gradually and there will be ample time to identify the development of potentially adverse differential subsidence movements early, consider whether any additional management measures are required and repair or adjust affected surface features, in close consultation with NBNCo.

Tahmoor Coal and NBNCo will review and assess monitoring reports and consider whether any additional management measures are required on a weekly basis. If potentially adverse differential subsidence movements are detected, it is anticipated that a focussed inspection will be undertaken in the affected area, and a decision will likely be made to increase the frequency of surveys and/or inspections. Additional management measures may also be implemented. It is therefore expected that, as a potential adverse situation escalates, Tahmoor Coal will be present on site on a more frequent basis to survey or inspect the affected site, and that NBNCo will be consulted on a more frequent basis.

Notwithstanding the above, if a hazard has been identified that involves potential serious injury or illness to a person or persons on public property or in the vicinity of NBNCo infrastructure, and cannot be controlled, the immediate response is to remove people from the hazard. If such a situation is observed or is forecast to occur by either Tahmoor Coal or by people on public property, Tahmoor Coal NBNCo will immediately meet and implement emergency procedures through the NBN RG.

5.2 Control for each Infrastructure Groups

There is now information available on the general performance of Telstra telecommunications plant due to ground subsidence caused by longwall mining operations in the past. The current information available is from experience gained at Appin, Tahmoor / Thirlmere, Appin, Helensburgh, West Wallsend, Camberwell and Broke in NSW. The longwall mining operation at Thirlmere / Tahmoor provides a continuing opportunity to gather information on the performance of the network, needed to understand the interaction between ground movement and the Telstra or NBNCo networks, comprising both robust and also relatively sensitive elements of the network. This information is provided in this NBN MP for the benefit of NBNCo through the experience gained by CNS over 20 years of ‘in the field’ monitoring of Telstra’s extensive telecommunications network throughout the large geographic areas identified above

The general control procedure considered in this NBN MP is to look at each item of plant described in Section 4.3.1 to 4.3.5 and determine the practical level of monitoring that can be performed according to the assessed risk factor applied. The monitoring described for the plant identified should be completed during the ground subsidence events occurring at the particular location as the longwall progresses. In addition, Table 3 is a summary of recommendations for monitoring procedures and basic actions to be taken during mining, should the potential for damage be indicated by surface impacts, cable testing or from survey data.

Since there are similar types of cable involved and the proposed monitoring methods for each cable type are similar, they have been grouped together below and in Table 3 to simplify the discussion and proposed management of the network during ground subsidence.

5.2.1 NBNC Co Local Copper Customer Distribution Cable

(Risk Factor. Unlikely/ Minor, low risk in a conduit; Moderate / Minor, moderate risk directly buried)

The NBNC Co local copper customer cables located in Thirlmere Way, Stonequarry Creek Road and intersecting roads of Carramar Close, Attunga Close and Booyong Close are all in conduit and are exposed to limited subsidence impacts since the conduit isolates the cable from the ground movement and it is only at the northern end of Stonequarry Creek Road that the network enters LW W1.

The maximum predicted subsidence at the northern end of Stonequarry Creek Road is 700 mm with Tilt of +/- 2 mm/m and Ground Strain 0.5 mm/m compression to 0.2 mm/m tension. From previous experience with the performance of cables, pits and conduit network during subsidence events the risk of damage is very low in this situation. The control method is to inspect the relevant sections of the network concurrent with analysing survey data which will indicate anomalous ground movement behaviour, to specifically target inspection areas at specific stages of extraction of the longwalls.

The local NBNC Co copper cable into the eastern edge of LW W2 was not able to be inspected at the time of preparation of this NBN MP. It is suggested by Tahmoor Coal that the rural property over LW W2 that this cable feeds is to an unoccupied property that may be developed in the future. This cable needs to be surveyed to identify the type of cable and the location of the cable relative to the edge of extraction of LW W2 and if indeed the cable is in use. Should this cable enter the eastern extraction edge of LW W2 then specific monitoring action may be required to monitor impacts on this cable. This may involve survey of the cable line and or liaison with the property owner to monitor any change in the operation of their service, As identified above the risk factor of this particular cable is associated with a moderate likelihood, minor consequence, and an overall **moderate** risk and detail of the cable type and specific location is required to be positively established prior to mining of LW W2 in October 2012.

5.2.2 NBNC Co & Telstra Optical Fibre Cables

i) NBNC Co (2 OAK 00 00 TSS 010) optical fibre cables crossing the southern end of LW W1 and crossing to the south of LW W2 (Telstra (F PCTN 103) direct buried IEN co-located)

(Risk Factor, Moderate / Major - **high** risk).

The two cables NBNC Co 144f SMOF cable, 2 OAK 00 00 TSS 010 is believed to be installed in conduit alongside the direct buried Telstra cable F PCTN 103 12f SMOF both located approximately 80m to the south of LW W2 and across the southern end of LW W1 approximately 160 m inside the longwall from the finishing end. The two cables for the majority of this section of the route are installed within three to five metres of each other. The NBNC Co cable at 144f is a more robust hard jacketed cable at more than twice the size of the standard construction Telstra optical fibre cable. The route of both cables across the longwalls is to the north by an average of around 150 m from Thirlmere Way through undulating rural land as shown in Plate 1 and Plate 6 below.



Plate 6 View of NBNCo and Telstra IEN cables to the south of LW W2 running east west around 150m north of Thirlmere Way through farmland.

In this case there is little value in physical inspection of the cable lines during mining with the exception that over LW W1 The NBNCo cable leaves the Telstra alignment and crosses to the south of Thirlmere Way where inspection can be carried out. Therefore, it is proposed by both NBNCo and Telstra to Remotely OTDR monitor their cables using their own Network Operations Centres for their cables across LW W1 W2.

Due to the importance of these two IEN cables an additional monitoring regime will be maintained on these cables consisting of:

- Physical inspection along Thirlmere Way along the accessible section of the NBNCo cable line;
- Analysis of survey data by Tahmoor Coal surveyors for Thirlmere Way; and
- Close in 1625nm OTDR testing on spare fibres in the Telstra cable F PCTN 103 from Tahmoor exchange, to closely monitor any minor loss that may develop on this more vulnerable of the two optical fibre cables. Any minor loss detected at 0.1dB trigger level will be immediately advised to NBNCo so that a close in test can be arranged on their cable.

This OTDR fibre testing on the Telstra cable across the longwalls will be carried out by CNS from Picton or Tahmoor exchange 'looking' through the mining area. This specialized individual fibre testing can confirm that there are no or very low levels of transmission loss present on the cable. The trigger levels and actions for the cable monitoring which will be at 1625nm on individual fibres will be set as follows:

- Loss of 0.1dB - The point loss or area of loss should be recorded and an investigation carried out of the direct buried cable line at that location to determine if any ground movement is evident, i.e. ground compression tension over the cable line and analysis of any relevant survey data;
- Loss of 0.5dB -The loss event identified should continue to be continuously monitored and should the loss progress to (+/-) 0.5 dB then the cable should be exposed at the recorded location to attempt to relieve pressure or tension/compression on the cable due to ground strain; and
- Loss on 1dB - In the event of the loss on the cable continuing, excepting that cable exposure has not relieved or reduced the transmission loss and that loss continues and exceeds 1 dB an interruption cable should be laid and pits installed in preparation for cable cutover of the cable as considered necessary.

With interruption cable installed and secured discussions with Tahmoor Coal and Subsidence Advisory NSW will be initiated through the NBN RG for the permanent reinstatement of the cable -Like for Like replacement.

Survey data for the centre line of the longwalls should also be provided to NBNCo and Telstra at regular intervals to determine the degree of anomalous ground movement.

ii) NBNC Co Cable in Conduit crossing the northern end of LW W1-W2 (Barkers Lodge Road) – (Telstra direct buried IEN cable also present)

(Risk Factor -Rare / Major -significant risk.)

As in Part i) above the two cables are installed along the same route. The NBNC Co 144f SMOF cable, 2 OAK 00 00 TSS 007 is installed in Telstra conduit and pits and is alongside the direct buried standard construction Telstra cable F LKLD 18f. Both cables are installed along the southern side of Barkers Lodge Road, just with the Study Area. Since this location is on the edge of the Study Area it is reasonably assumed that this is the 20 mm subsidence contour from LW W1 and W2. As a result, the maximum ground subsidence is around 20 mm and ground strains will be less than survey accuracy below + or – 0.25mm/m. Since 2 OAK 00 00 TSS 0007 is in conduit and ground movement will be minimal there is in fact very little risk to the NBNC Co cable while the Telstra cable remains more vulnerable since it is direct buried.

Also as described in Part i) above the NBNC Co cable will be Remotely OTDR monitored by NBNC Co Network Operations Centre while the Telstra cable will be close-in monitored along Barkers Lodge Road for the initial 350m of mine extraction on LW W1 and W2 from Picton exchange by CNS. As above the Telstra fibre monitoring will be at 1625nm across LW W1 W2 utilising the same trigger levels as above 0.1dB to 1.0dB, as above, with any minor loss detected at 0.1dB trigger level to be immediately advised to NBNC Co so that a close in test can be arranged on their cable.

5.2.3 NBNC Co Cable in Conduit along Stonequarry Creek Road (Telstra CAN cable also present in same conduit)

(Risk factor -Rare / Moderate -Moderate risk.)

These cables are installed along the western footpath alignment of Stonequarry Creek Road to the NBNC Co Nodes outside LW W1 and to the Telstra RIM located inside LW W1, at the northern end of Stonequarry Creek Road.

Since the NBNC Co optical fibre cable 2TAH 02-07-FNO-001 only extends to the northern side of Attunga Close, the cable does not enter the extraction edge on the western side of LW W1, it is therefore assessed that cable testing is not required, see in Plates 4 & 5. However, the Telstra optical fibre F PCTN 103 AZ-BG is installed along with the NBNC Co cable in the same conduit but carries the main connections for the Telstra RIM at the northern end of Stonequarry Creek Road and also makes a diagonal crossing of LW W1. This exposure as outlined places the co-located Telstra cable at higher risk.

The Telstra cable will be monitored on spare fibres along the full length of Stonequarry Creek Road by CNS using close in OTDR monitoring at 1625 nm with cable testing at regular intervals while extraction is occurring in LW W1 at the southern finishing end. Again, as in 5.2.1 & 2 above, any minor loss of 0.1dB that is identified on the Telstra cable will be immediately notified to NBNC Co for their consideration, accepting that the NBNC Co optical fibre cable does not enter the western edge of the longwall but the local copper cable distribution does enter this area. Survey data from Tahmoor Coal surveyors will also be reviewed to determine if more regular cable testing is required or which areas should be specifically investigated along the cable route on Stonequarry Creek Road.

5.2.4 Manhole, Conduit and Pit Network

(Risk Factor Unlikely / Minor - low risk).

The cable distribution network is obviously subject to a degree of risk of damage in the areas of maximum subsidence, however in this case for LW W1-W2, there is a relatively small amount of the network exposed to subsidence impacts along the northern end of Stonequarry Creek Road and this network consists of plastic jointing pits and relatively newer uPVC conduit installation. The remainder of the network to the north of Thirlmere Way into the south-eastern side of LW W1 is a combination of pit and conduit and direct buried cable.

During critical times of extraction of LW W1-W2 it is proposed, in association with cable testing outlined above, to carry out regular physical inspections of the network. The inspection regime will be supplemented by an examination of the survey data provided by Tahmoor Coal, so that inspections can be targeted to areas of any abnormal ground movement identified in the survey data.

5.3 Surface Subsidence Survey

The control procedure for the NBNC Co & Telstra plant identified above will be supplemented by ground surveys carried out by Tahmoor Coal at agreed time intervals along agreed base lines of Stonequarry Creek Road, Thirlmere Way and Barkers Lodge Road recording:

Initial RL of the surface prior to mining commencing:

- Incremental subsidence over the agreed period;
- Incremental ground strain over the agreed period; and
- Incremental ground tilt over the agreed period.

The frequency of the survey and the reporting of the results, to the NBN RG are to be agreed by the members of the Group as the longwalls commence and advance into the different areas. The NBN RG should consult and agree on the limits of the survey lines and set the frequency of the survey work.

Refer to the following table – Table 3, which presents a Summary of the NBNC Co, Risk Factors, Monitoring and Actions required for items of plant, which may be impacted by mine subsidence. Note that in Table 3 items of plant have been grouped as discussed in the four groupings identified above. i.e. Local Copper Cables, Main Optical Fibre Cables, Local (CAN) Optical Fibre Cables and Manholes, Conduit and Pits.

Table 3 Monitoring for Telecommunications Infrastructure

Location of Network	Risk Factor	Method Levels	Monitoring Details	Frequency	Trigger	Actions and Responsibilities
1) i) NBNC Co Local copper cables installed in Conduit	Low	Physically Monitor.	CNS to complete Physical inspections along cable lines during LW W1 and W2 extraction. Tahmoor Coal to provide regular survey data for current survey lines.	Weekly during critical subsidence events. Dependant also on anomalous survey data recorded along survey lines.	Ground Strain > + or -1mm/m, Observed ground tension or compression over cable line	Tahmoor Coal or CNS to report ground strains approaching + or – 1mm/m to NBN RG for decision on action to be taken as considered necessary by NBNC Co representatives to check condition of local cable
1) ii) NBNC Co Local copper cable Direct buried cable	Moderate	Type and cable location unable to be verified at time of preparation of NBN MP.	CNS to locate cable with Tahmoor Coal surveyors to establish cable type and exact location of direct buried cable relative to the eastern goaf edge of LW W2.	Establish cable details prior to commencement of LW W2 in Oct 2021.	Customer advice of loss or degradation of service advised to Tahmoor Coal	Dependant on cable identified from field inspection. Tahmoor Coal to immediately report any change identified by customer in their Local service to NBNC Co for investigation
2) NBNC Co OF Cables i) 2 OAK 00 00 TSS 010 ii) 2 OAK 00 00 TSS 007	High Significant	Base line OTDR Testing.	Remote OTDR Testing by NBNC Co Network Operations on both cables over LW W1 & W2	Continuous OTDR testing with alarms	Minor transmission loss sustained in the area of LW W1 & W2 mining	NBNC Co Service Delivery to investigate and advise Tahmoor Coal of proposed action. Additional localised OTDR testing of Telstra cables alongside both cables. Any loss detected by CNS immediately referred to NBNC Co for consideration

Location of Network	Risk Factor	Method Levels	Monitoring Details	Frequency	Trigger	Actions and Responsibilities
3) NBNC Co Local optical fibre cable along Stonequarry Creek Road 2TAH 02-07-FNO-001	Moderate	Survey cable line Physical Inspection OTDR test of adjacent Telstra cable.	Tahmoor Coal to survey cable line along Stonequarry Creek Rd. CNS to inspect cable line OTDR Testing @ 1625nm of F PCTN 103 AZ-BG by CNS along Stonequarry Creek Rd	Initial survey and follow up weekly surveys & physical route inspections by CNS during final stage of LW W1. OTDR test then fortnightly / weekly during LW W1 impacts.	Ground Strain > + or -1mm/m, Ground movement around pits or along conduit route Recorded loss from CNS OTDR tests on F PCTN 103 AZ-BG	Tahmoor Coal to Report ground strains approaching + or -1mm/m Any abnormal evidence of ground movement around pits or along cable route to be reported to NBN RG Additional localised OTDR testing of Telstra cable alongside NBNC Co cable. Any loss detected by CNS immediately referred to NBN Co for consideration
c) Conduit, Manhole Pit & Pole Network	Low	Monitor conduit & cable movement in pits and manholes concurrent with cable testing as outlined in 3) above.	Monitor conduit & cable movement in Stonequarry Creek Rd, Carramar, Attunga & Booyong Close during LW W1 progress under the southern area of LW W1	Prior to mining then as determined by Longwall progress under southern area of LW W1	Visual check of active section being monitored. If significant surface movement impacting on network check distribution cables in conduit network.	Should surface damage occur or survey data indicate anomalous movement CNS to check conduit pit and manhole network in this area. CNS to advise NBNC Co of any observation or damage evident and maintenance or repair work considered necessary on conduit, pits or manholes.
Survey Line	Not Applicable	Establish permanent marks at approx. 20 metre intervals along roads & cable lines where network is installed.	Tahmoor Coal to carry out detail survey, (subsidence, strain and tilt recorded) along Stonequarry Creek Road for LW W1. Provide survey results to NBNC Co representatives.	To be determined by NBN RG dependant on degree of subsidence occurring and potential hazard to NBNC Co plant	Ground Strain > + or -1mm/m, to be reported immediately to NBN RG	Tahmoor Coal to make survey results available to NBNC Co and CNS following each regular survey of active mining area for LW W1 and W2.

6. Implementation

6.1. NBN Response Group – Roles and Responsibility

Technical resources required to carry out the monitoring as identified In Table 3 are to be provided by Tahmoor Coal or their consultants as required. Tahmoor Coal will provide the survey resources required for the line surveys established on the roads around and over LW W1-W2 to determine incremental and total subsidence, strain and tilt during mine subsidence from the longwalls. The initial survey is to follow on from LW32 survey and the frequency of the survey work is to be reviewed as required by the NBN Response Group (NBN RG).

Prior to commencing any proposed rectification work the NBNCο representatives will detail the extent of the work and the associated costs to the NBN RG. At that meeting agreement will be reached between Tahmoor Coal, NBNCο and Subsidence Advisory NSW as to the responsibility for the costs of the proposed work. For emergency work involving work to immediately secure NBNCο’s network, where loss of service to customers or line systems outage is involved, the work will be carried out by NBNCο as necessary and the discussions regarding costs associated with the emergency repair work resolved at a special meeting of the NBN RG.

The following procedures will be implemented during and after active subsidence of the NBNCο infrastructure to ensure the continued effective consultation, co-operation and co-ordination of action with respect to subsidence between Tahmoor Coal and NBNCο and Subsidence Advisory NSW.

The monitoring of the NBNCο’s network in accordance with this management plan is to be carried out by Tahmoor Coal, NBNCο or their representatives and CNS for ‘in field’ monitoring. The NBN RG is to be the forum for discussion and resolution of issues raised in the operation of the management plan and discussions on impacts on the telecommunication network. Meetings or teleconferences to be arranged as necessary and the NBN RG need only be convened in the event of trigger levels being reached as set out in Table 3, unpredicted ground movement detected by survey or cable faults or damage being recorded within the NBNCο or Telstra network. Any anomalous ground movement resulting from subsidence over LW W1-W2 and any risk perceived by Tahmoor Coal to the network, due to mining is to be used as a trigger for an initial meeting of the NBN RG.

The representatives proposed to be involved in the NBN Response Group are (contact details are provided in Section 8):

- **David Talbert** – Environment and Community Manager, Tahmoor Coal.
- **April Hudson** – Approvals Coordinator, Tahmoor Coal.
- **Amanda Fitzgerald** – Environment & Community Officer, Tahmoor Coal
- **Daryl Kay** – Mine Subsidence Engineering Consultants Pty Ltd.
- **Colin Dove** – Consultant Telecommunications Engineer.

Matthew Montgomery – Infrastructure Manager Subsidence Advisory NSW. The NBNCο stakeholders are (contact details are provided in Section 8):

- **Todd Williams** – NBNCο Deployment Manager – Augmentation Network.
- **Senthil Manikandan** – NBNCο Technology Manager.
- **Chinmay Kumar** – NBNCο Networks Operations Manager.
- **Colin Chapman** – NBNCο Service Delivery Manager.

When required the NBN RG is to appoint a minutes secretary responsible for maintaining all documentation presented to the meeting and responsible for circulating minutes and advising participants of future meetings. The purpose of the NBN Response Group reviews is to:

- Assess monitoring data, including the early detection of potential impacts on health and safety and impacts to NBNCο infrastructure;
- Verify the risk assessments previously conducted;

- Ensuring the effectiveness and reliability of risk control measures; and
- Supporting continual improvement and change management.

At the NBN RG meetings, NBNCos are to report incidents recorded in relation to the performance of their network plant and a detailed log is to be maintained of each incident reported to the NBN RG. Full details are to be reported of significant events observed or events which have an impact on the communications networks or the provision of telecommunication services in the area. Tahmoor Coal are to report on the degree of subsidence that has occurred at that time and how closely subsidence is following the predictions made in Reference No 1.

It is the responsibility of this meeting to determine if the events recorded are due to the impact of mine subsidence and then determine the degree of responsibility each party has for those events.

Should significant risk be identified then either party may call an emergency NBN RG meeting, with one day's notice, to discuss proposed action and to keep other parties informed of developments in the monitoring or maintenance of the NBN and/or Telstra network.

6.2. Communication Plan

The communications plan outlines the feedback to be provided between Tahmoor Coal and NBNCos during the operation of this management plan:

Tahmoor Coal will provide to NBN details of:

- Regular ground surveys along monitoring lines as identified in Appendix A Sheet 4
- Exception reporting of impacts observed from visual inspections of telecommunications plant which has relevance to NBNCos, i.e. inspection of Telstra conduit and pit network carrying NBNCos cables
- OTDR reports of any transmission loss identified on adjacent Telstra cables
- Status of mining, progress of longwall
- Monitoring reports of what has been monitored (as above)
- Direct notification to NBN if we observe potential adverse changes on surrounding infrastructure such as roads, drainage structures, buildings or on other underground or above ground services

NBN will communicate to Tahmoor Coal:

- Any impact identified on NBN assets during mining.
- Planned new NBN infrastructure to be constructed within the Study Area.

6.3. Audit and Review

This management plan as agreed between parties and can be reviewed and updated to continually improve the risk management systems based on audit, review and learnings from the development of subsidence during mining and manage changes in the nature, likelihood and consequence of subsidence hazards.

The review process will be conducted to achieve the following outcomes:

- Gain an improved understanding of subsidence hazards based on ongoing subsidence monitoring and reviews, additional investigations and assessments as necessary, ongoing verification of risk assessments previously conducted, ongoing verification of assumptions used during the subsidence hazard identification and risk assessment process, ongoing understanding of subsidence movements and identified geological structures at the mine;
- Revise risk control measures in response to an improved understanding of subsidence hazards;
- Gain feedback from stakeholders in relation to managing risks, including regular input from business or property owners;

- Ensure on-going detection of early warnings of changes from the results of risk assessments to facilitate corrective or proactive management actions or the commencement of emergency procedures in a timely manner; and
- Ensure timely implementation of a contingency plan in the event that the implemented risk control measures are not effective.

Some examples where review may be applied include:

- Poor performance of the NBNC Co plant in regard to mine subsidence, such as interruption or loss of services;
- Any trigger levels being reached or exceeded;
- Favourable performance of the NBNC Co plant in regard to mine subsidence, no observe red or recorded impacts;
- Significant variations between actual and predicted subsidence occurring including variations in ground strain observed from survey data; and
- Evidence of significant geological faults or evidence suggesting major “Far field effects” may develop.

Should an audit of the NBNC Co Management Plan be required during that period then a representative is to be appointed by NBNC Co, Tahmoor Coal and Subsidence Advisory NSW to review the operation of the plan and report amendments to the next scheduled meeting of the NBN RG.

6.4. Record Keeping

As and when required, if a meeting is initiated of the NBN RG, a minutes secretary shall be appointed to keep minutes from the meetings called and advise participants of any future or emergency meetings to be held. The minutes are to include details as reported on the condition of the individual items of NBNC Co plant, the assessment of the degree of ground subsidence that has occurred, any agreements reached and a log of any incidents/damage reported to the meeting involving the telecommunications network.

The review process will be conducted to achieve the following outcomes:

- Gain an improved understanding of subsidence hazards based on ongoing subsidence monitoring and reviews, additional investigations and assessments as necessary, ongoing verification of risk assessments previously conducted, ongoing verification of assumptions used during the subsidence hazard identification and risk assessment process, ongoing understanding of subsidence movements and identified geological structures at the mine;
- Revise risk control measures in response to an improved understanding of subsidence hazards;
- Gain feedback from stakeholders in relation to managing risks, including regular input from business or property owners;
- Ensure on-going detection of early warnings of changes from the results of risk assessments to facilitate corrective or proactive management actions or the commencement of emergency procedures in a timely manner; and
- Ensure timely implementation of a contingency plan in the event that the implemented risk control measures are not effective.

Some examples where review may be applied include:

- Poor performance of the Telstra plant in regard to mine subsidence, such as interruption or loss of services;
- Any trigger levels being reached or exceeded;
- Favourable performance of the Telstra plant in regard to mine subsidence, no observe red or recorded impacts;
- Significant variations between actual and predicted subsidence occurring including variations in ground strain observed from survey data; and
- Evidence of significant geological faults or evidence suggesting major “Far field effects” may develop.

It is anticipated that the NBN RG will remain active as required until late 2021. Should an audit of the NBN MP be required during that period then a representative is to be appointed by Telstra, NBNC Co, Tahmoor Coal and Subsidence Advisory NSW to review the operation of the plan and report amendments to the NBN RG to initiate amendment of the NBN MP.

7. Associated Documents and References

7.1. Appendices

Appendix A (Drawings Extracted from Reference No1)

Western Domain Extraction Plan LW W1-W2,
Telecommunications Infrastructure
MSEC Drawing MSEC1019-18. Sheet 1 of 4

MSEC Fig. C.09
Predicted Profiles of Vertical Subsidence, Tilt and Curvature
Along Thirlmere Way, Due to LW W1-W2 Sheet 2 of 4

Tahmoor Coal,
Western Domain, Extraction Plan LWW1-W2, MSEC Fig. E.20
Predicted Total Subsidence Contours After LW W2
Drawing No MSEC 1019-29 Sheet 3 of 4

Tahmoor Coal,
Western Domain, Extraction Plan LWW1-W2, Monitoring,
MSEC Drawing MSEC 1019-30 Sheet 4 of 4

Appendix B

Environmental Risk Assessment, Tahmoor Underground,
Extraction Plan LW W1-W2, Infrastructure Sheet 1 of 1

Appendix C

Tahmoor Coal Pty Ltd, Risk Assessment Report,
Infrastructure, Tahmoor North, Western Domain
Longwalls West 1 & West 2. 26th March 2019 Pages 1 to 20

7.2. References

Reference No 1

The Report MSEC 1019, Revision A, is titled “SIMEC Mining- Tahmoor Coking Coal Operations - Longwalls W1 and W2- Subsidence Predictions and Impact Assessments for Natural and Built Features due to the Extraction of Proposed Longwalls W1 and W2 in Support of the Extraction Plan Application”

8. Contact List

Contacts of participants involved in the NBN Response Group:

Organisation	Contact Name	Title	Postal Address	Telephone / Mobile	Email
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Tahmoor Coal	April Hudson	Approvals Coordinator	PO Box 100 Tahmoor NSW	4640 0022, 0466 380 992	April.Hudson@simecgfg.com
Tahmoor Coal	Amanda Fitzgerald	Environment and Community Coordinator	PO Box 100 Tahmoor NSW	4640 0133, 0436 331 630	Amanda.Fitzgerald@simecgfg.com
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NBNCo	Senthil Manikandan	Technology Manager	Melbourne		SenthilManikandan@nbnco.com.au
NBNCo	Chinmay Kumar	Networks Operations Manager			chinmaykumar@nbnco.com.au
NBNCo	Colin Chapman	Services Delivery Manager			ColinChapman@nbnco.com.au
Comms Network Solutions Pty Ltd	Colin Dove	Telecomms Consultant	20 Bowden Cresc Connells Point, 2221	0428 970 826	cdove@commsnet.net.au
Subsidence Advisory NSW	Matthew Montgomery	Infrastructure Manager, Southern Coalfields	PO Box 40 Picton NSW, 2571	4677 1967, 0425 275 567	matthew.montgomery@finance.nsw.gov.au



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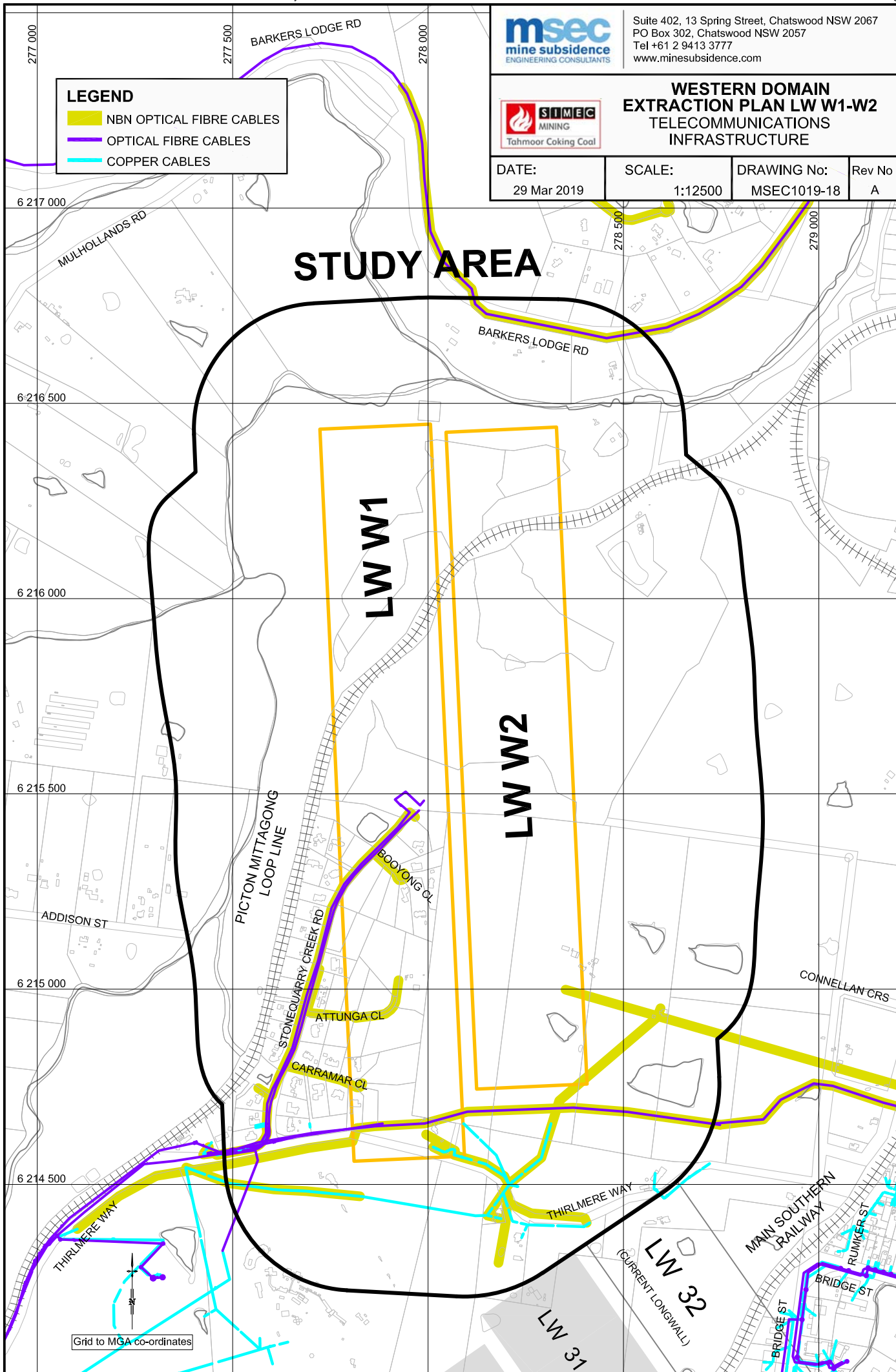
**WESTERN DOMAIN
 EXTRACTION PLAN LW W1-W2
 TELECOMMUNICATIONS
 INFRASTRUCTURE**

DATE: 29 Mar 2019	SCALE: 1:12500	DRAWING No: MSEC1019-18	Rev No A
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LEGEND

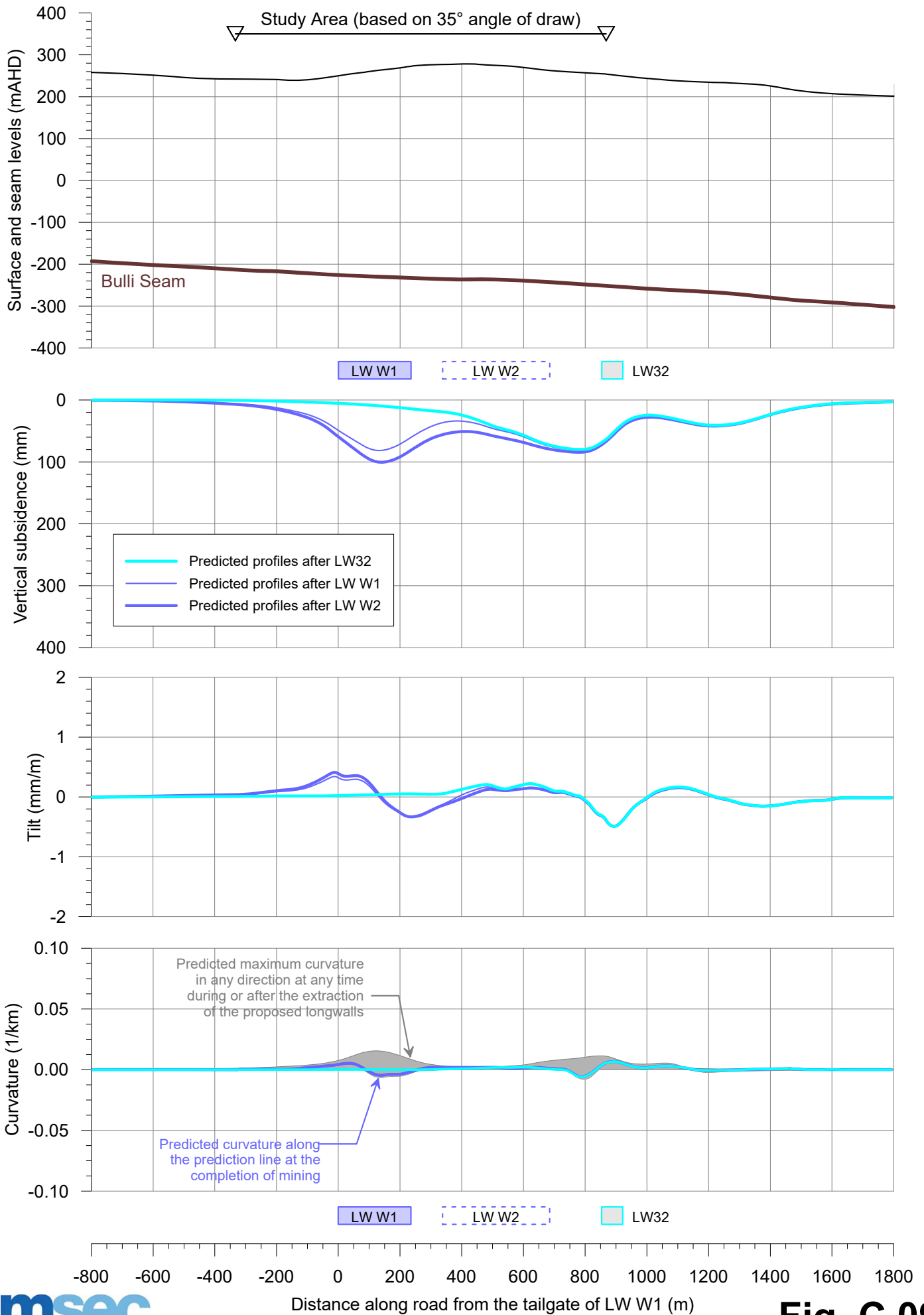
- NBN OPTICAL FIBRE CABLES
- OPTICAL FIBRE CABLES
- COPPER CABLES

STUDY AREA



Grid to MGA co-ordinates

Predicted profiles of vertical subsidence, tilt and curvature along Thirlmere Way due to LW W1-W2





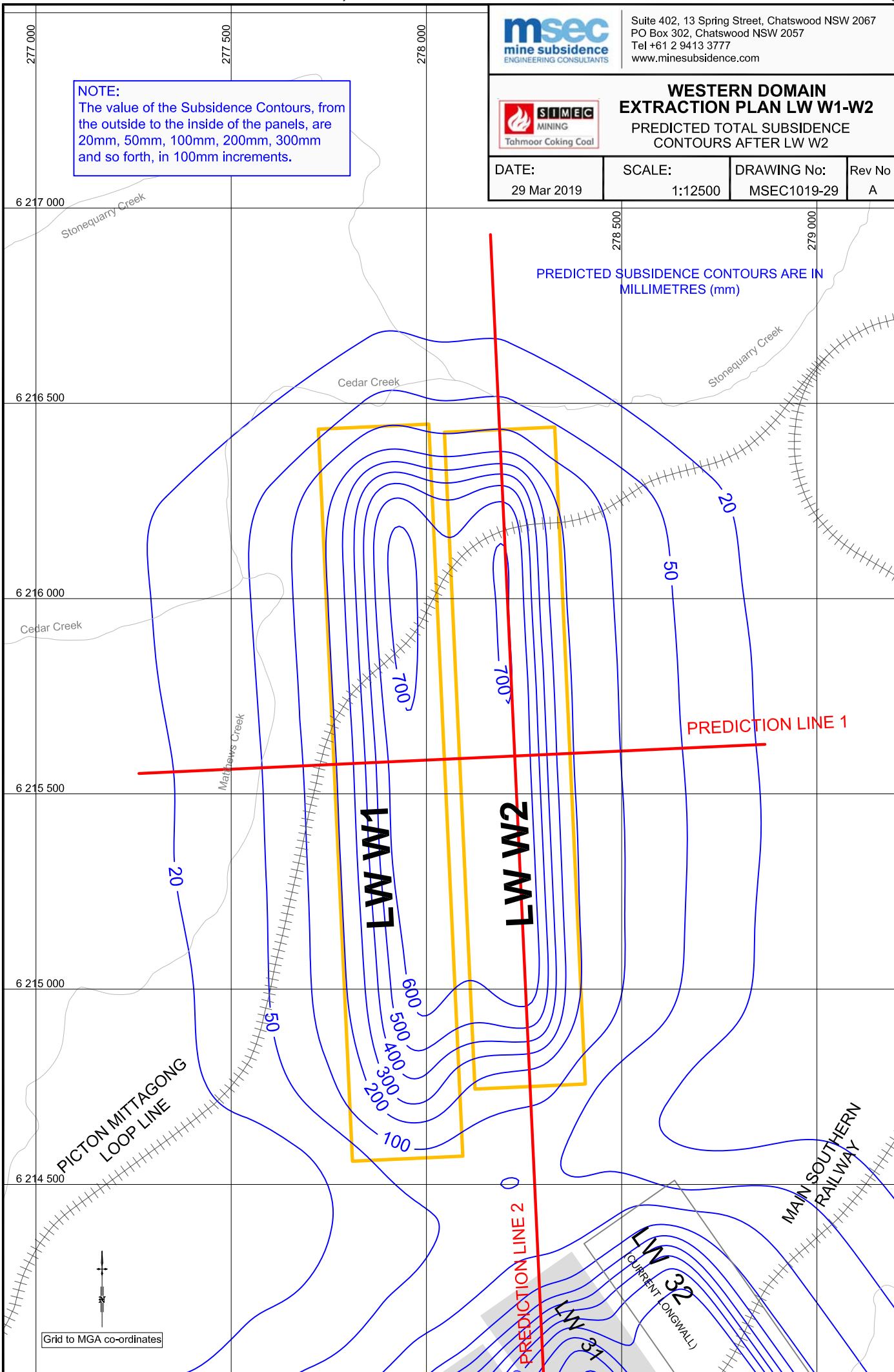
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 Tel +61 2 9413 3777
 www.minesubsidence.com



**WESTERN DOMAIN
 EXTRACTION PLAN LW W1-W2
 PREDICTED TOTAL SUBSIDENCE
 CONTOURS AFTER LW W2**

DATE: 29 Mar 2019	SCALE: 1:12500	DRAWING No: MSEC1019-29	Rev No A
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NOTE:
 The value of the Subsidence Contours, from the outside to the inside of the panels, are 20mm, 50mm, 100mm, 200mm, 300mm and so forth, in 100mm increments.

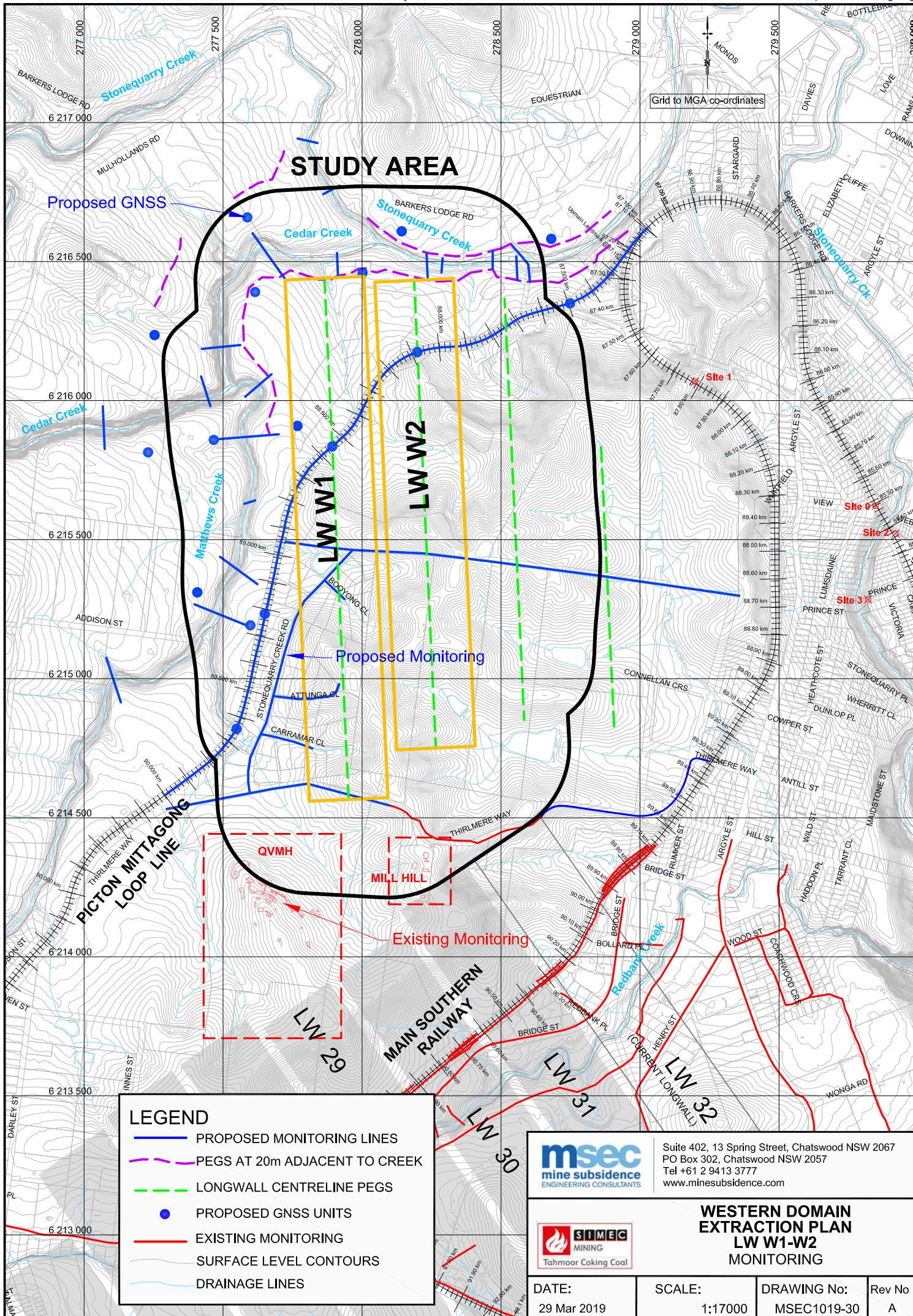


PREDICTED SUBSIDENCE CONTOURS ARE IN MILLIMETRES (mm)

PREDICTION LINE 1

PREDICTION LINE 2

Grid to MGA co-ordinates



STUDY AREA

Grid to MGA co-ordinates

Proposed GNSS

Proposed Monitoring

Existing Monitoring

LEGEND

- PROPOSED MONITORING LINES
- - - PEGS AT 20m ADJACENT TO CREEK
- - - LONGWALL CENTRELINE PEGS
- PROPOSED GNSS UNITS
- EXISTING MONITORING
- SURFACE LEVEL CONTOURS
- DRAINAGE LINES

msec
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**WESTERN DOMAIN
EXTRACTION PLAN
LW W1-W2
MONITORING**

DATE: 29 Mar 2019	SCALE: 1:17000	DRAWING No: MSEC1019-30	Rev No: A
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Environmental Risk Assessment: Tahmoor Underground - Extraction Plan LW W1-W2 - Infrastructure

Step 2: Assess Type; Key Elements-These change depending on TYPE of Risk Assessment		Step 3: Identify the risks, causes and potential consequences						Step 4: Identify the existing controls to manage the identified risks			Step 5: Determine RCE		Steps 6, 7 & 8: Determine the Expected Consequence / Likelihood applicable to the Expected Consequence / Current level of risk			Step 10: PMC		Step 11: Treat the Risks			
Site	Type of Risk Assessment	Key Element (CURA Context/Catagory)	Sub Key Element (if applicable)	Risk Description - Something happens.....	Consequence - resulting in:	Causes - Caused by	Risk Owner	Existing Control Description	Control Owner (Contact)	Fatal Hazard Protocol (as applicable)	Risk Control Effectiveness	Expected Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Potential Maximum Consequence	Potential Maximum Category	Treatment plans/tasks (Description)	Task Owner	Due Date	Comments
Tahmoor Underground	Environmental		Telstra / NBN infrastructure	Damage to copper local cable	Loss of serviceability, emergency repair or replacement of cable	Subsidence		Telecommunications Management Plan for LW W1-W2 to be prepared and will contain the following controls to manage subsidence (as per previous Management Plans for LW32) (AC): * Ground surveys to be conducted along streets * Visual inspections - weekly * TARP including repair of cable, relocation if required * Analysis and reporting * Consultation, coordination and cooperation with Telstra / NBN			2	Property Damage	1	D	2	1	Property Damage	Develop Telecommunications Management Plan including TARP	April Hudson	10-Oct-19	
Tahmoor Underground	Environmental		Telstra / NBN infrastructure	Damage to conduit, manhole, pit and pole network	Loss of serviceability, emergency repair or replacement of cable	Subsidence		Telecommunications Management Plan for LW W1-W2 to be prepared and will contain the following controls to manage subsidence (as per previous Management Plans for LW32) (AC): * Ground surveys to be conducted along streets * Visual inspections - weekly * TARP including repair of cable, relocation if required * Analysis and reporting * Consultation, coordination and cooperation with Telstra / NBN			2	Property Damage	1	E	1	1	Property Damage	Develop Telecommunications Management Plan including TARP	April Hudson	10-Oct-19	
Tahmoor Underground	Environmental		Telstra / NBN infrastructure	Damage to optical fibre cables	Loss of serviceability, emergency repair or replacement of cable	Subsidence		Telecommunications Management Plan for LW W1-W2 to be prepared and will contain the following controls to manage subsidence (as per previous Management Plans for LW32) (AC): * Ground surveys to be conducted along streets * Visual inspections - weekly * TARP including repair of cable, relocation if required * Analysis and reporting * Consultation, coordination and cooperation with Telstra / NBN			2	Property Damage	2	D	5	2	Property Damage	Develop Telecommunications Management Plan including TARP	April Hudson	10-Oct-19	
3		3			3			Subtotal CountA (ignoring hidden values)				3		3		3					

Tahmoor Underground	Broad Brush														#N/A						
Tahmoor Underground	Life of Mine														#N/A						
Tahmoor Underground	Business																				
Tahmoor Underground	Major Project														#N/A						
Tahmoor Underground	Environmental/Health/Process														#N/A						
Tahmoor Underground	Equipment														#N/A						



SIMEC

MEMBER OF



Tahmoor Coal Pty Ltd

RISK ASSESSMENT REPORT -

INFRASTRUCTURE

**Tahmoor North – Western Domain
Longwalls West 1 and West 2**

Date Held: 26 March 2019

April 2019

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Document Control

DOCUMENT TITLE:	Tahmoor North – Western Domain LW W1-W2 – Infrastructure Risk Assessment
PUBLICATION DATE:	April 2019
DOCUMENT STATUS:	Final (Version 1)
PREPARED BY:	April Hudson Approvals Coordinator Tahmoor Coking Coal Operations – SIMEC Mining
APPROVED BY:	Ron Bush Environment and Community Manager Tahmoor Coking Coal Operations – SIMEC Mining

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1 Introduction

1.1 Background

Tahmoor Coal is located approximately 80 kilometres south-west of Sydney in the township of Tahmoor NSW. It is managed and operated by SIMEC Mining. Tahmoor Coal has previously mined 31 longwalls to the north and west of the mine's current pit top location. It is currently mining Longwall 32, in accordance with current Development Consent (DA 67/98) and Subsidence Management Plan Approval for the extraction of Longwall 32.

Tahmoor Coal proposes to extend underground coal mining to the north-west of the Main Southern Railway, which will include Longwalls West 1 to West 4 (**LW W1-W4**) at Picton (refer to **Figure 1-1**). Mining of Longwalls West 1 and West 2 (**LW W1-W2**) is expected to commence in November 2019, and first workings of development headings for LW W1 have commenced.

Under Condition 13H of the Development Consent (DA 67/980, as modified), an Extraction Plan is required for all second workings from LW W1 and subsequent longwalls. The first Extraction Plan to be prepared will cover LW W1-W1, which are located in the Tahmoor North Lease area. The Extraction Plans will be required to be approved by the NSW Department of Planning and Environment (**DPE**), and relevant Infrastructure Management Plans are required to be approved by the relevant infrastructure owners.

The Extraction Plan shall address the Study Area for LW W1-W2, which is comprised of both the predicted 20 mm Total Subsidence Contour and the 35° Angle of Draw Line (refer to **Figure 1-1**).

The Extraction Plan will provide detailed information on how the risks associated with mining under the Study Area will be managed by Tahmoor Coal during and following the extraction of LW W1-W2.

A Risk Assessment Workshop was held at the Administration Building at the Tahmoor Coking Coal Operations (**TCCO**) site on 26 March 2019 to determine the major infrastructure risks associated with LW W1-W2 that may impact on achieving timely approval for the commencement of LW W1-W2 extraction, as well as the completion of extraction of LW W1-W2.

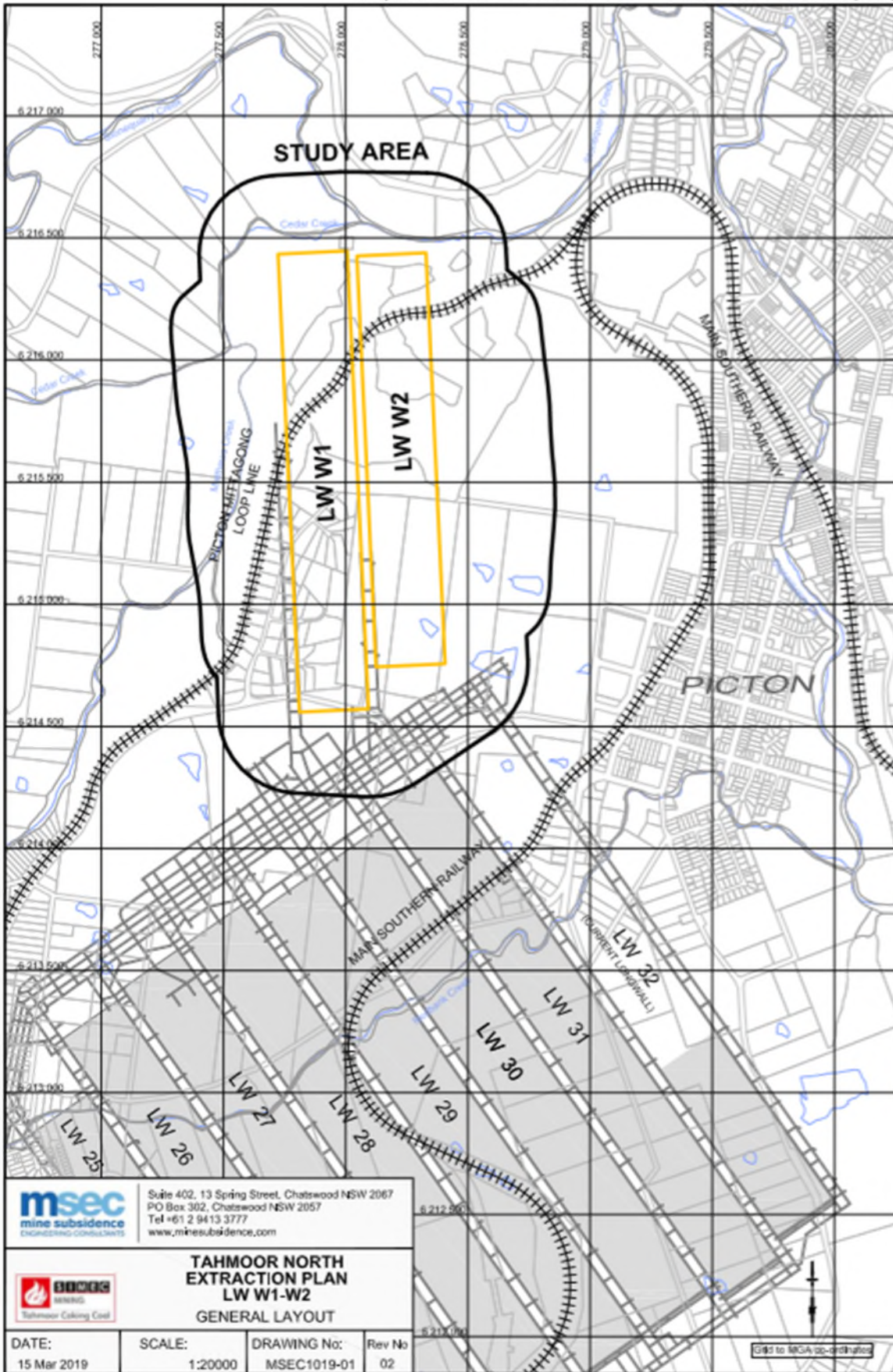


Figure 1-1 Study Area for LW W1-W2

1.2 Methodology

This risk assessment was completed using the Workplace Risk Assessment and Control methodology (**WRAC**).

It was compiled by a team of specialist personnel including:

- Compliance Officer and Risk Assessment Facilitator, Tahmoor Coal: Diana Harris;
- Environment and Community Manager, Tahmoor Coal: Ron Bush;
- Approvals Coordinator, Tahmoor Coal: April Hudson;
- Subsidence Engineer, MSEC: Daryl Kay;
- Structural Engineer, JMA Solutions: John Matheson; and
- Building Inspector, Building Inspection Services: Adam Walker.

The 12 step Risk Management process which forms part of the Tahmoor Coking Coal Operations Risk Management Standard has been adhered to in this risk assessment.

The risk matrix has been used to prioritise risk treatments.

Prior to this risk assessment any previous risk assessments, safety alerts and High Potential Risk incidents have been sourced and put forward for consideration within the risk assessment workshop.

1.3 Outcome

This risk assessment identified a total of 29 risks / hazards (refer to **Figure 1-2**), which included:

- 13 medium risks and 16 low risks;
- One risk that was satisfactory and did not require any further risk control, and 28 risks that required further improvement;
- Risk consequences included:
 - Two risks with environmental impact consequences;
 - Seven risks with health and safety consequences; and
 - 20 risks with property damage consequences.

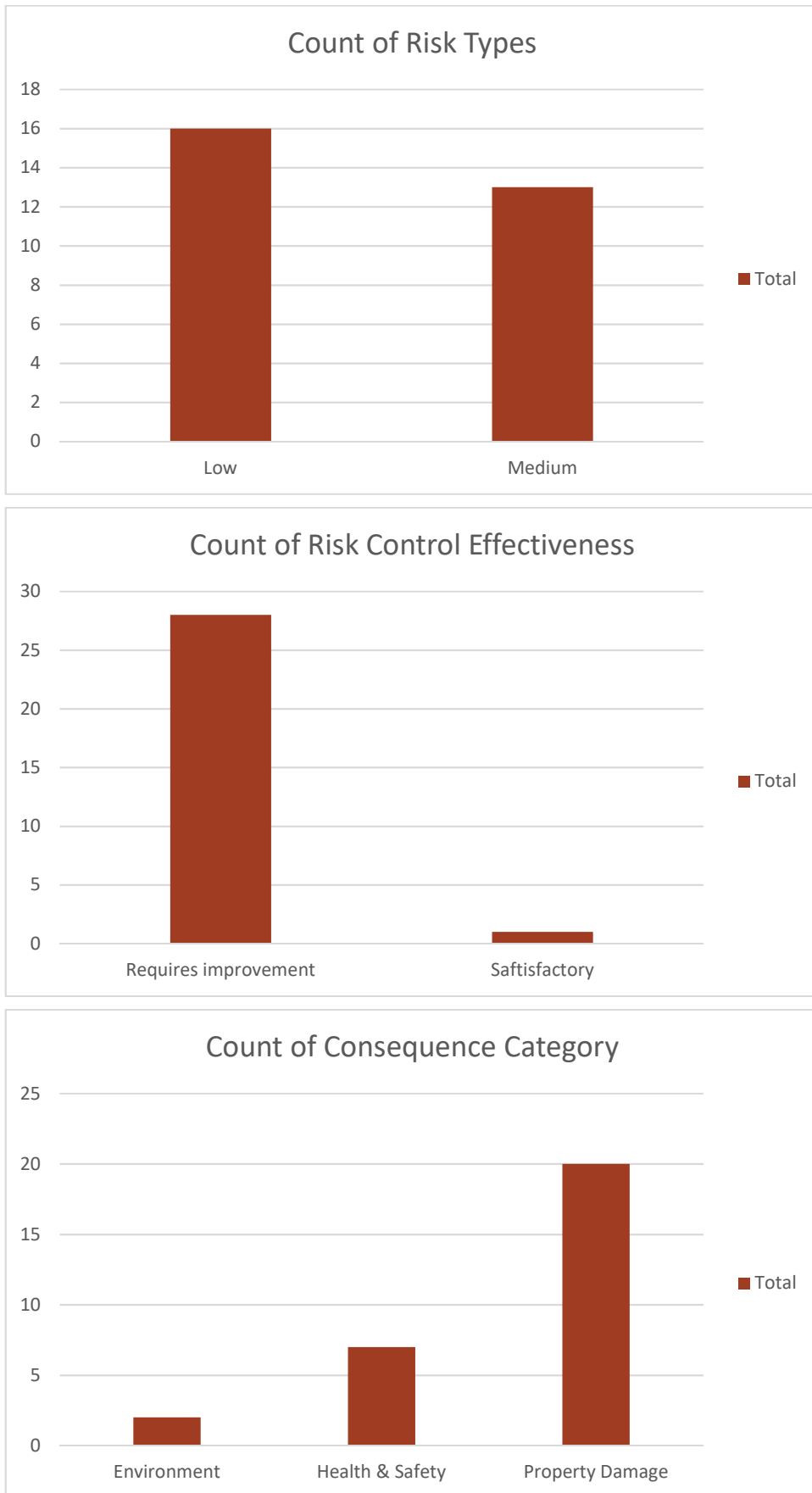


Figure 1-2 Graphs of Risk Type, Risk Control Effectiveness and Consequence Category

1.4 Further Actions

Further actions as identified in the Risk Assessment are identified in **Table 1-1**.

Table 1-1 Table of Further Actions

Treatment plans/tasks	Task Owner	Due Date
Develop Endeavour Energy Management Plan including TARP	April Hudson	14-Nov-2019
Endeavour Energy to complete Critical Poles Audit	April Hudson	14-Nov-2019
SMEC to complete survey of critical poles	April Hudson	14-Nov-2019
Building Inspection Services to complete baseline tilt measurement of poles	April Hudson	14-Nov-2019
Develop Sydney Water Potable Water Management Plan including TARP	April Hudson	14-Nov-2019
Develop Stonequarry Creek Estate Water Management Plan including TARP	April Hudson	14-Nov-2019
Develop Jemena Management Plan including TARP and contact details for Jemena	April Hudson	14-Nov-2019
Complete baseline gas detection survey (Macarthur Gas)	April Hudson	14-Nov-2019
Develop Telecommunications Management Plan including TARP	April Hudson	14-Nov-2019
Develop Wollondilly Shire Council Management Plan including TARP	April Hudson	14-Nov-2019
Develop traffic control plan for emergency repairs	April Hudson	14-Nov-2019
Develop Spatial Services Management Plan including TARP	April Hudson	14-Nov-2019
Notify Spatial Services via POSI application of predicted subsidence movements of the permanent survey control marks	April Hudson	14-Nov-2019
Ongoing monitoring and review of far field monitoring network, including GNSS network	April Hudson	14-Nov-2019
Develop Built Structures Management Plan including TARP for emergency evacuation procedures	April Hudson	14-Nov-2019
Prepare QVMH Management Plan including TARP	April Hudson	14-Nov-2019
Consultation plan to be developed	Samantha Beresford	14-Nov-2019
Prepare Mill Hill Management Plan including TARP	April Hudson	14-Nov-2019

2 Objective

The purpose of the Risk Assessment was to:

- Ensure the required infrastructure management plans for the proposed longwalls are approved and in place in a timely manner to manage infrastructure impacts during mining;
- Ensure the safe and serviceable operation of all surface infrastructure and structures in the Study Area;
- Ensure that the health and safety of people who may be present in the Study Area are not put at risk due to mine subsidence; and
- Assist in the establishment of procedures to measure, monitor, control, mitigate and repair infrastructure in the Study Area.

The Risk Assessment will also be used to:

- Develop, review and improve the treatment plans / tasks identified as a result of the identified risks;
- Provide a basis to determine whether the identified risk management measures are sufficient to address the identified risks;
- Meet the statutory requirements of legislation and regulation that relate to impacts to infrastructure; and
- Identify those processes requiring a more detailed level of risk assessment due to the Potential Maximum Consequence (**PMC**) level of risk.

3 Context

3.1 Scope

The risk assessment considered the areas below:

- Management of infrastructure owned by Endeavour Energy (electrical), Sydney Water (potable water only), Stonequarry Creek Estate Sewerage Plant (sewer), Jemena (gas), Telstra (telecommunications), NBN (telecommunications), Wollondilly Shire Council (roads, culverts and bridges), Spatial Services (survey control marks);
- Impacts to rural properties and structures such as built structures, pools, septic tanks, and farm dams; and
- Historical heritage buildings including Queen Victoria Memorial Home and Mill Hill.

3.2 Internal Context

This risk assessment was conducted for the Environment and Community Department of Tahmoor Coal to help identify the risks to infrastructure associated with LW W1-W2.

The risk assessment was conducted in accordance with the Risk Management Standard, utilising a cross-section of site personnel, relevant civil works experts, and an internal facilitator.

3.3 External Context

The risk assessment process is completed to satisfy Tahmoor Coking Coals requirements in relation to WHS and in compliance to Mining regulations and conditions and is completed in consultation with key stakeholders.

Key Stakeholders include:

- Tahmoor Coking Coal management;
- NSW Department of Planning and Environment (Planning, Resources and Geoscience);
- Resources Regulator (Subsidence, Environment);
- NSW Office of Environment and Heritage;
- Subsidence Advisory NSW;
- NSW Environment Protection Authority;
- NSW Department of Primary Industries (Agriculture);
- Dam Safety Committee;
- Crown Lands Division;
- NSW Roads and Maritime Services;
- WaterNSW;
- NSW State Emergency Services;
- Wollondilly Shire Council;
- Other utility providers including Endeavour Energy (electrical), Sydney Water (potable water only), Stonequarry Creek Estate Sewerage Plant (sewer), Jemena (gas), Telstra (telecommunications), NBN (telecommunications), Wollondilly Shire Council (roads, culverts and bridges), Spatial Service (survey control marks);
- Heritage stakeholders; and
- Landowners.

The external context for this Risk Management Process included consideration of:

- NSW Department of Planning and Environment as the approver of the Extraction Plan;
- NSW *Work Health and Safety (Mines and Petroleum Sites) Regulations 2014*;
- AS/NZS ISO 31000:2009 Risk Management - Principles and Guidelines; and
- Risk Management Handbook for the Mining Industry (MDG1010).

3.4 Exclusions / Assumptions

The participants in the risk assessment agreed to the following exclusions:

- Community effects will be managed as per Tahmoor Coal procedures and EMS (dust, lighting and noise);
- A detailed risk assessment for rail operational risks associated with LW W1-W2 will be conducted separately; and
- A broad risk assessment focusing on approvals, environmental and general infrastructure risks has been completed for LW W1-W2 on 12 February 2019 (CMO ID 201902202). Consideration of infrastructure risks addressed in this previously completed risk assessment were excluded.

These considerations included:

- Infrastructure Owner do not approve Infrastructure Management Plan;
- Failure to implement Infrastructure Management Plan actions;
- Greater than predicted subsidence in Study Area;
- Stress to landowner/business owner;
- Formation of Community Action Group; and
- Land owners do not sign Land Access Agreements.

The participants in the risk assessment agreed to the following assumptions:

- All plant and equipment is fit for purpose;
- Personnel are competent and authorised;
- Inspection systems are in place and effective;
- People (employees, contractors) do present themselves fit for work;
- The appropriate PPE is utilised where required; and
- Observations and learnings from Longwall 32.

4 Issue / Reason for Review

The risk assessment was completed to identify significant implications relating to approval, environmental and infrastructure risks, and to identify the controls necessary to effectively manage these risks.

5 Risk Analysis Method

5.1 Risk Management Standard

All risk assessments are conducted in accordance with Tahmoor Coking Coal Operations Risk Management Standard.

The Tahmoor Coking Coal Operations Risk Management Standard is based on the *ISO31000:2009 Risk Management – Principles and Guidelines International Standard*.

5.2 Risk Management Process

The risk management process is set out in the 12 Steps Risk Management Process (refer to **Figure 5-1**).

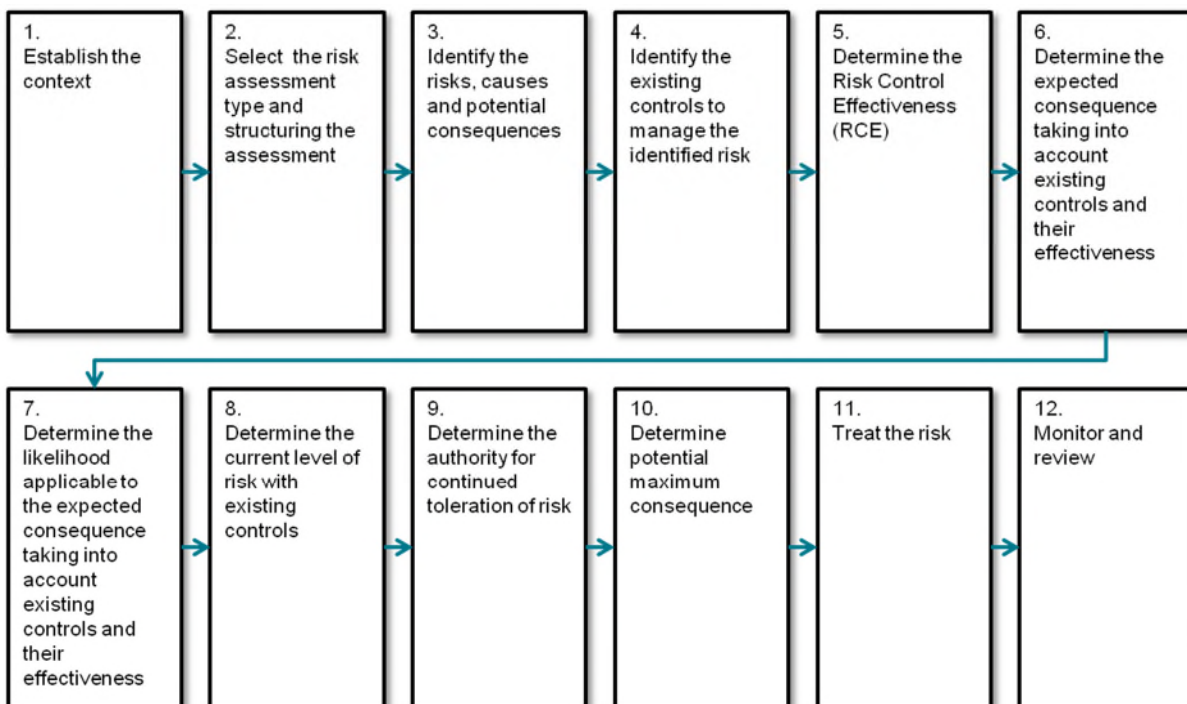


Figure 5-1 The 12 Steps Risk Management Process

5.3 Risk Matrix

The analyses of the risks identified in the workshop have undergone categorisation by the use of the risk matrix outlined within the Tahmoor Coking Coal Operations Risk Management Standard.

A copy of the risk matrix from Tahmoor Coking Coal Operations Risk Management Standard is provided in **Appendix A**.

5.4 Hierarchy of Controls

During the risk management process additional treatments and controls have been categorised using the hierarchy of controls table (refer to **Figure 5-2**).

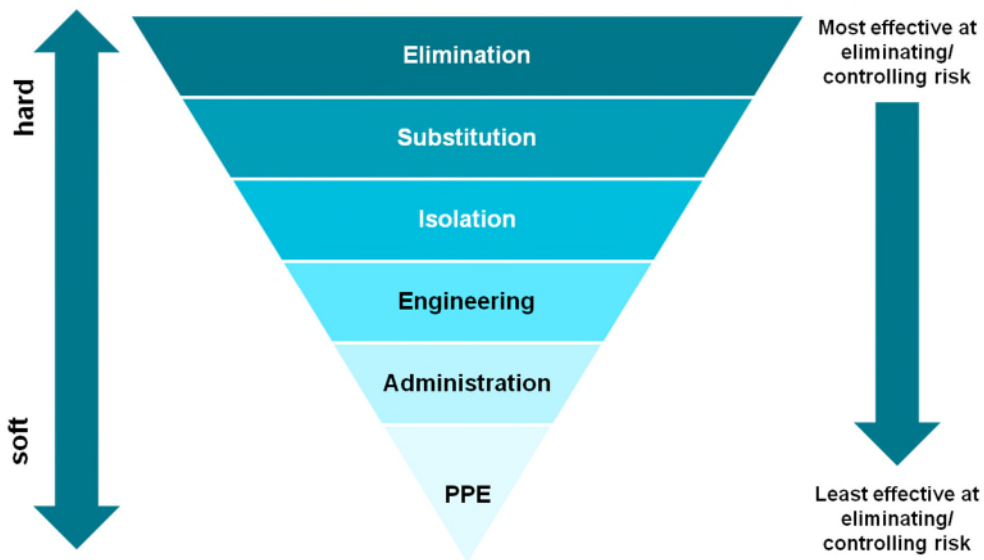


Figure 5-2 Hierarchy of Controls

5.5 Risk Assessment Team Members

Participating risk assessment team members are listed in **Table 5-1**.

Table 5-1 Participating Risk Assessment Team Members

Name	Position	Organisation	Qualifications	Related Experience
Ron Bush	Environment & Community Manager	SIMEC	BSc (Geol), GCEng, GD GW, MPlan, MProDev, MEng	30yrs
Diana Harris	Facilitator – Compliance Officer	SIMEC	Cert IV OH&S, G3 Risk Management	4yrs
April Hudson	Approvals Coordinator	SIMEC	B Env Sci (Hons)	9yrs
John Matheson	Structural Engineer	JMA Solutions	BE Struct (Hons)	20yrs
Daryl Kay	Subsidence Engineer	MSEC	BE, LLB	16yrs
Adam Walker	Building Inspector	Building Inspection Services	Cert IV Building	30yrs

A copy of the signed attendance sheet is attached in **Appendix B**.

6 Risk Assessment Register

The Risk Assessment Register is attached within **Appendix C**.

7 Treatment Plan

A treatment plan is provided in **Section 1.4.1**.

8 Risk Assessment Review Period

A review period for the risk assessment has not been identified.

Appendix A – Risk Matrix

RISK MATRIX

CONSEQUENCE [potential foreseeable outcome of the event]

	Health & Safety	Environment	Financial Impact	Image & Reputation / Community	Legal & Compliance
5 Catastrophic	<ul style="list-style-type: none"> Multiple fatalities (5 or more fatalities in a single incident) Multiple cases (5 or more) of Permanent Damage Injuries or Diseases that result in permanent disabilities in a single incident 	<ul style="list-style-type: none"> Unconfined and widespread Environmental damage or effect (permanent; >10 years) Requires major remediation 	<ul style="list-style-type: none"> >\$600M investment return >\$100M operating profit >\$20M property damage 	<ul style="list-style-type: none"> Loss of multiple major customers or large proportion of sales contracts Sustained campaign by one or more international NGOs resulting in physical impact on the assets or loss of ability to operate Security incident resulting in multiple fatalities or major equipment damage Formal expression of significant dissatisfaction by government Grievance from internal or external stakeholder alleging human rights violation resulting in multiple fatalities 	<ul style="list-style-type: none"> Major litigation / prosecution at SIMEC corporate level Nationalisation / loss of licence to operate
4 Major	<ul style="list-style-type: none"> Single incident resulting in: Less than 5 Fatalities Permanent Damage Injury or Disease that results in a permanent disability- less than 5 cases in a single incident 	<ul style="list-style-type: none"> Long-term (2 to 10 years) impact Requires significant remediation 	<ul style="list-style-type: none"> \$60-600M investment return \$20-100M operating profit \$2-20M property damage 	<ul style="list-style-type: none"> Security/ stakeholder incident resulting in single loss of life or equipment damage Grievance from internal or external stakeholder alleging human rights violation resulting in single fatality or serious injuries Topic of broad societal concern and criticism Negative media coverage at international level resulting in a Corporate statement within 24 hours Investigation from government and/ or international (or high-profile) NGOs Complaints from multiple "final" customers Loss of major customer Negative impact on share price 	<ul style="list-style-type: none"> Major litigation / prosecution at Department level
3 Moderate	<ul style="list-style-type: none"> Lost Time Injury (LTI) Lost Time Disease (LTD) Permanent Disabling Injury (PDI) Permanent Disabling Disease (PDD) Single incident that results in multiple medical treatments 	<ul style="list-style-type: none"> Medium-term (<2 years) impact (typically within a year) Requires moderate remediation 	<ul style="list-style-type: none"> \$6-60M investment return \$2-20M operating profit \$200K-2M property damage 	<ul style="list-style-type: none"> Negative media coverage at national level over more than one day Complaint from a "final" customer Off-spec product Local Stakeholder action resulting in national societal scrutiny 	<ul style="list-style-type: none"> Major litigation / prosecution at Operation level
2 Minor	<ul style="list-style-type: none"> Medical Treatment Injury (MTI) Medical Treatment Disease (MTD) Restricted Work Injury (RWI) Restricted Work Disease (RWD) 	<ul style="list-style-type: none"> Near source Short-term impact (typically <week) Requires minor remediation 	<ul style="list-style-type: none"> \$600K-6M investment return \$200K-2M operating profit \$10-200K property damage 	<ul style="list-style-type: none"> Negative local/ regional media coverage Complaint received from an internal or external stakeholder 	<ul style="list-style-type: none"> Regulation breaches resulting in fine or litigation
1 Negligible	<ul style="list-style-type: none"> First Aid Injury (FAI) or illness (not considered disease or disorder) 	<ul style="list-style-type: none"> Near source and confined No lasting environmental damage or effect (typically <day) Requires minor or no remediation 	<ul style="list-style-type: none"> <\$600K investment return <\$200K operating profit <\$10K property damage 	<ul style="list-style-type: none"> Negligible media interest 	<ul style="list-style-type: none"> Regulation breaches without fine or litigation

LIKELIHOOD [of the event occurring with that consequence]

Basis of Rating	E - Rare	D - Unlikely	C - Possible	B - Likely	A – Almost Certain
LIFETIME OR PROJECT OR TRIAL OR FIXED TIME PERIOD OR NEW PROCESS / PLANT / R&D	Unlikely to occur during a lifetime OR Very unlikely to occur OR No known occurrences in broader worldwide industry	Could occur about once during a lifetime OR More likely <u>NOT</u> to occur than to occur OR Has occurred at least once in broader worldwide industry	Could occur more than once during a lifetime OR As likely to occur as not to occur OR Has occurred at least once in the mining / commodities trading industries	May occur about once per year OR More likely to occur than not occur OR Has occurred at least once within Tahmoor Mine	May occur several times per year OR Expected to occur OR Has occurred several times within Tahmoor Mine
5 Catastrophic	15 (M)	19 (H)	22 (H)	24 (H)	25 (H)
4 Major	10 (M)	14 (M)	18 (H)	21 (H)	23 (H)
3 Moderate	6 (L)	9 (M)	13 (M)	17 (H)	20 (H)
2 Minor	3 (L)	5 (L)	8 (M)	12 (M)	16 (M)
1 Negligible	1 (L)	2 (L)	4 (L)	7 (M)	11 (M)

Consequence Category	Consequence Type	Ownership	Action
Cat. 5	Catastrophic Hazard	Department / Functional / Operational / Asset Leadership	<ul style="list-style-type: none"> Quantitative or semi-quantitative risk assessment required. Capital expenditure will be justified to achieve ALARP ('As Low As Reasonably Practicable'). Catastrophic Hazard Management Plans (CHMP) must be implemented where practical, Crisis Management Plans (CMP) tested and Catastrophic Event Recovery Plans (CERP) developed.
Cat. 4 (Health & Safety consequence)	Fatal Hazard	Department / Functional / Operational / Asset Leadership	<ul style="list-style-type: none"> Fatal Hazard Protocols or appropriate management plans must be applied. Capital expenditure will be justified to achieve ALARP.
Risk Rank	Risk Rating	Ownership	Action
17 to 25	High Risk	Department / Functional / Operational / Asset Leadership	<ul style="list-style-type: none"> Install additional HARD and SOFT controls to achieve ALARP. Capital expenditure will be justified to achieve ALARP.
7 to 16	Medium Risk	Operational / Asset Leadership	<ul style="list-style-type: none"> install additional HARD and SOFT controls if necessary to achieve ALARP. Capital expenditure may be justified.
1 to 6	Low Risk	Operational / Asset Leadership	<ul style="list-style-type: none"> Install additional controls if necessary to achieve ALARP. Capital expenditure is not usually justified.

Appendix B – Risk Assessment Attendance Sheet

Team Members and Qualifications:					Tahmoor Underground - Process	
Name (Print & Sign)	Position	Company/Site	Years in Industry	Related Qualifications	Related Experience	4/09/2018
Facilitator Details						
Diana Harris	Compliance Officer	Tahmoor	29	Cert IV OHS, G3 risk mgmt		
DARIL KAN	MINE SUBSIDENCE ENGINEER	MSEC	17	CIVIL ENG/LAW	Subsidence	
JOHN MATHESON	DIRECTOR JMA SOLUTIONS	JMA SOLUTIONS	37	BE (MINS)	STRUCTURAL	
Adam Walker	Director BIS	Building Inspection Services	30	Cert IV Building	Building Consultant	
Ron Bush	Environment + Community Manager	Tahmoor	30	BSc (Geol), MPlan, MProDev, MEng	Approvals	<i>Ron Bush</i>
April Hudson	Approvals coordinator	Tahmoor	9	B. Env Sci (Hons)	Approvals.	<i>April Hudson</i>

Appendix C – Risk Assessment Register

Environmental Risk Assessment: Tahmoor Underground - Extraction Plan LW W1-W2 - Infrastructure

Step 2: Assess Type; Key Elements-These change depending on TYPE of Risk Assessment		Step 3: Identify the risks, causes and potential consequences						Step 4: Identify the existing controls to manage the identified risks			Step 5: Determine RCE			Steps 6, 7 & 8: Determine the Expected Consequence / Likelihood applicable to the Expected Consequence / Current level of risk			Step 10: PMC		Step 11: Treat the Risks		
Site	Type of Risk Assessment	Key Element (CURA Context/Catagory)	Sub Key Element (if applicable)	Risk Description - Something happens.....	Consequence - resulting in:	Causes - Caused by	Risk Owner	Existing Control Description	Control Owner (Contact)	Fatal Hazard Protocol (as applicable)	Risk Control Effectiveness	Expected Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Potential Maximum Consequence	Potential Maximum Category	Treatment plans/tasks (Description)	Task Owner	Due Date	Comments
Tahmoor Underground	Environmental		Telstra / NBN infrastructure	Damage to copper local cable	Loss of serviceability, emergency repair or replacement of cable	Subsidence		Telecommunications Management Plan for LW W1-W2 to be prepared and will contain the following controls to manage subsidence (as per previous Management Plans for LW32) (AC): * Ground surveys to be conducted along streets * Visual inspections - weekly * TARP including repair of cable, relocation if required * Analysis and reporting * Consultation, coordination and cooperation with Telstra / NBN			2	Property Damage	1	D	2	1	Property Damage	Develop Telecommunications Management Plan including TARP	April Hudson	14-Nov-19	
Tahmoor Underground	Environmental		Telstra / NBN infrastructure	Damage to conduit, manhole, pit and pole network	Loss of serviceability, emergency repair or replacement of cable	Subsidence		Telecommunications Management Plan for LW W1-W2 to be prepared and will contain the following controls to manage subsidence (as per previous Management Plans for LW32) (AC): * Ground surveys to be conducted along streets * Visual inspections - weekly * TARP including repair of cable, relocation if required * Analysis and reporting * Consultation, coordination and cooperation with Telstra / NBN			2	Property Damage	1	E	1	1	Property Damage	Develop Telecommunications Management Plan including TARP	April Hudson	14-Nov-19	
Tahmoor Underground	Environmental		Telstra / NBN infrastructure	Damage to optical fibre cables	Loss of serviceability, emergency repair or replacement of cable	Subsidence		Telecommunications Management Plan for LW W1-W2 to be prepared and will contain the following controls to manage subsidence (as per previous Management Plans for LW32) (AC): * Ground surveys to be conducted along streets * Visual inspections - weekly * TARP including repair of cable, relocation if required * Analysis and reporting * Consultation, coordination and cooperation with Telstra / NBN			2	Property Damage	2	D	5	2	Property Damage	Develop Telecommunications Management Plan including TARP	April Hudson	14-Nov-19	
3		3			3			Subtotal CountA (ignoring hidden values)				3		3		3					

Tahmoor Underground	Broad Brush														#N/A						
Tahmoor Underground	Life of Mine														#N/A						
Tahmoor Underground	Business																				
Tahmoor Underground	Major Project														#N/A						
Tahmoor Underground	Environmental/Health/Process														#N/A						
Tahmoor Underground	Equipment														#N/A						