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Tahmoor Coal Pty Ltd

BUILT FEATURES MANAGEMENT PLAN

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

July 2019

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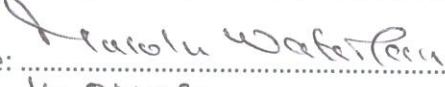
APPLICANT: Tahmoor Coal Pty Ltd
MINE: Tahmoor Coal Mine
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1 Introduction

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**) (refer to **Figure 1-1**). 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 bord and pillar mining methods, and via longwall mining methods since 1987. Tahmoor Coal, trading as Tahmoor Coking Coal Operations (**TCCO**), is a subsidiary within the SIMEC Mining Division (**SIMEC**) of the GFG Alliance (**GFG**).

Tahmoor Coal has previously mined 31 longwalls to the north and west of the Tahmoor Mine's current pit top location. Tahmoor Coal is currently 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 the Extraction Plan and this Built Features Management Plan (**BFMP**). The Western Domain is within Mining Lease (**ML**) 1376 and ML 1539, as illustrated in **Figure 1-2** of the Extraction Plan Main Document.

1.2 Purpose

This BFMP has been prepared to support an Extraction Plan for the secondary extraction of coal from LW W1-W2. This BFMP has been designed to provide the management strategies, controls and monitoring programs to be implemented for the management of potential subsidence impacts on built features affected by the secondary extraction of LW W1-W2.

1.3 Scope

The Study Area applicable to this BFMP consists of a combination of the Predicted 20 millimetres (**mm**) Total Subsidence Contour and the 35° Angle of Draw Line, as shown on **Figure 1-2**.

This BFMP:

- Addresses specific requirements set by DA 67/98 Condition 13H(vii)(b) (refer to **Section 2.1**);
- Addresses related regulatory requirements (refer to **Section 2**); and
- Addresses the monitoring and management of potential subsidence-related impacts to built features resulting (refer to **Section 3** and **Section 4**).

This BFMP has been prepared based on the contents of the Subsidence Predictions and Impact Assessment (MSEC, 2019) (**Volume 1**).

1.3.1 Built Features within the Study Area

The built features located within the Extraction Plan Study Area are managed by this BFMP and supporting individual infrastructure management plans.

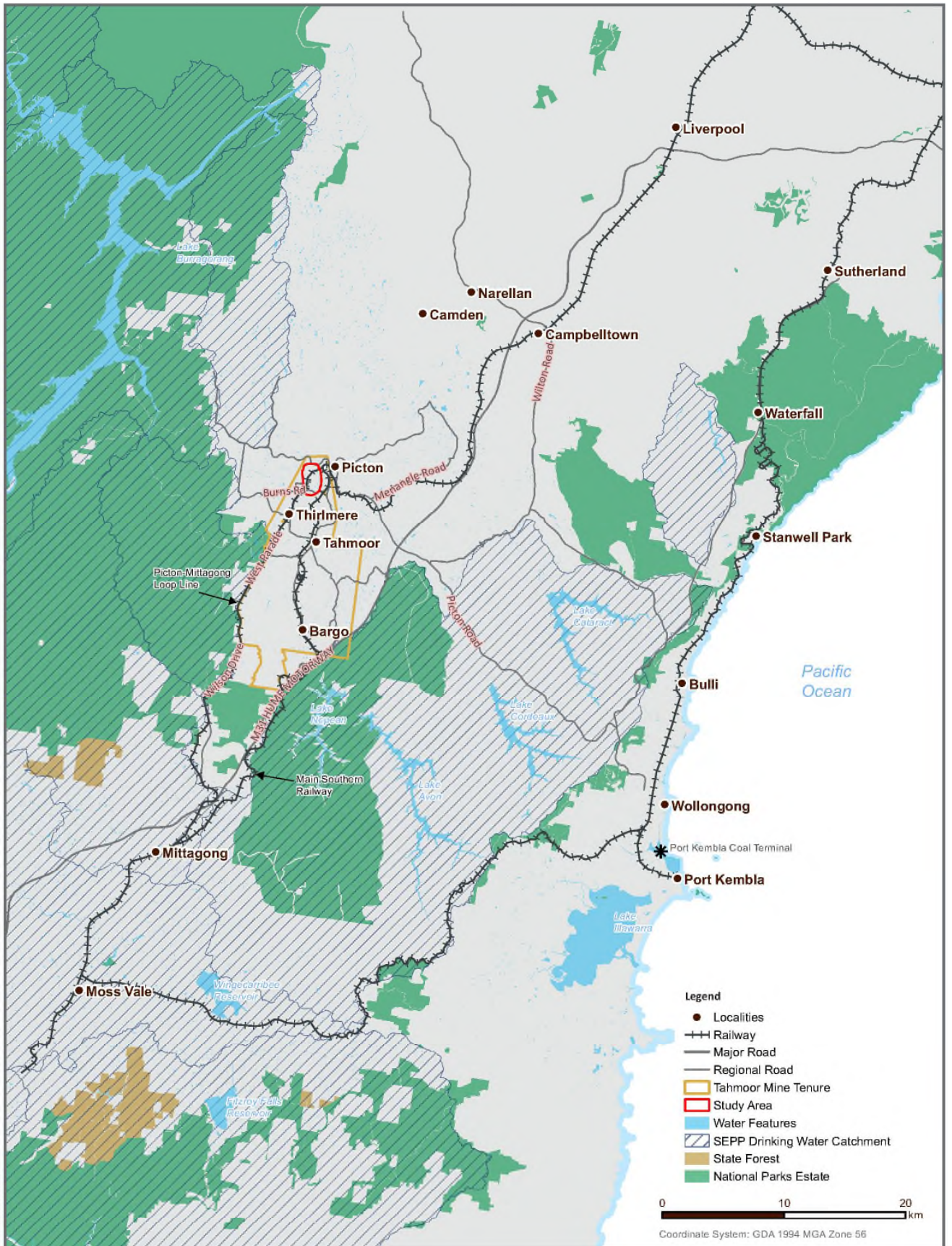
Separate infrastructure management plans will be developed in consultation with stakeholders prior to the influence of subsidence on each relevant feature. Stakeholders will include Endeavour Energy, Sydney Water, Jemena, Telstra, NBN Co., Wollondilly Shire Council, Australian Rail Track Corporation (**ARTC**), Railcorp, Transport Heritage NSW (**THNSW**), and property owners and managers of the Stonequarry Estate Wastewater Treatment Plant (**WTP**), Queen Victoria Memorial Home (**QVMH**), and Mill Hill.

Table 1-1 shows each built feature and the relevant assessment and management plans.

Table 1-1 Built features within the study area and associated management plans

Feature	Identification and Assessment	Management and Monitoring
Main Southern Railway	<ul style="list-style-type: none"> • Subsidence Prediction and Impact Assessment Report (MSEC, 2019). 	<ul style="list-style-type: none"> • Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Main Southern Railway, Report No. MSEC1058, 2019. • Built Features Management Plan. • Subsidence Monitoring Program.
Picton-Mittagong Loop Line	<ul style="list-style-type: none"> • Subsidence Prediction and Impact Assessment Report (MSEC, 2019). 	<ul style="list-style-type: none"> • Tahmoor Coal – LW W1-W2 Management Plan for extraction of LW W1-W2 beneath the Picton Mittagong Loop Line, Report No. MSEC1036, 2019. • Built Features Management Plan. • Subsidence Monitoring Program.
Public roads, bridges and culverts	<ul style="list-style-type: none"> • Subsidence Prediction and Impact Assessment Report (MSEC, 2019). 	<ul style="list-style-type: none"> • Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Wollondilly Shire Council Infrastructure, Report No. MSEC1045-02, 2019. • Built Features Management Plan. • Subsidence Monitoring Program.
Potable water infrastructure	<ul style="list-style-type: none"> • Subsidence Prediction and Impact Assessment Report (MSEC, 2019). 	<ul style="list-style-type: none"> • Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Sydney Water Potable Water Infrastructure, Report No. MSEC1045-03, 2019. • Built Features Management Plan. • Subsidence Monitoring Program.

Feature	Identification and Assessment	Management and Monitoring
Sewerage infrastructure	<ul style="list-style-type: none"> Subsidence Prediction and Impact Assessment Report (MSEC, 2019). 	<ul style="list-style-type: none"> Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Stonequarry Wastewater Treatment Plant, Report No. MSEC1045-04, 2019. Built Features Management Plan. Subsidence Monitoring Program.
Gas infrastructure	<ul style="list-style-type: none"> Subsidence Prediction and Impact Assessment Report (MSEC, 2019). 	<ul style="list-style-type: none"> Tahmoor Coal – LW W1-W2 for Potential Impacts to Jemena Gas Infrastructure, Report No. MSEC1045-05, 2019. Built Features Management Plan. Subsidence Monitoring Program.
Electrical infrastructure	<ul style="list-style-type: none"> Subsidence Prediction and Impact Assessment Report (MSEC, 2019). Endeavour Energy Network Results of On Site Audit Endeavour Energy Assets for SIMEC Mining – Tahmoor Colliery Longwalls West 1 and West 2. 	<ul style="list-style-type: none"> Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Endeavour Energy Infrastructure, Report No. MSEC1045-06, 2019. Built Features Management Plan. Subsidence Monitoring Program.
Telecommunications infrastructure	<ul style="list-style-type: none"> Subsidence Prediction and Impact Assessment Report (MSEC, 2019). Tahmoor Coal – LW W1-W2 Management Plan for Telstra and NBNCo Infrastructure, Comms Network Solutions, 2019. 	<ul style="list-style-type: none"> Tahmoor Coal – LW W1-W2 Management Plan for Telstra and NBNCo Infrastructure, Comms Network Solutions, 2019. Built Features Management Plan. Subsidence Monitoring Program.
Public amenities	<ul style="list-style-type: none"> Subsidence Prediction and Impact Assessment Report (MSEC, 2019). 	<ul style="list-style-type: none"> Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Built Structures, Report No. MSEC1045-12, 2019. Built Features Management Plan. Subsidence Monitoring Program.
Structures and Farm Dams	<ul style="list-style-type: none"> Subsidence Prediction and Impact Assessment Report (MSEC, 2019). Surface Water Technical Report (HEC, 2019). Land and Agricultural Resource Assessment (SLR, 2019). Geotechnical Assessment (Douglas Partners, 2019). 	<ul style="list-style-type: none"> Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Built Structures, Report No. MSEC1045-12, 2019. Water Management Plan. Built Features Management Plan. Subsidence Monitoring Program.
Heritage sites	<ul style="list-style-type: none"> Subsidence Prediction and Impact Assessment Report (MSEC, 2019). Historical Heritage Technical Report (EMM, 2019). 	<ul style="list-style-type: none"> Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to No. 675 Thirlmere Way (Mill Hill), Report No. MSEC1045-13-02, 2019. Tahmoor Coal – LW W1-W2 Property Subsidence Management Plan for potential mine subsidence impacts on Queen Victoria Memorial Home, Report No. MSEC1045-13-01, 2019. Heritage Management Plan. Built Features Management Plan. Subsidence Monitoring Program.



REGIONAL CONTEXT
Tahmoor North Western Domain Longwalls West 1 and West 2 Extraction Plan
FIGURE 1-1
 Date: 27/05/2019

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DOCUMENT FILE PATH



DOCUMENT FILE PATH



EXTRACTION PLAN STUDY AREA

Tahmoor North Western Domain Longwalls West 1 and West 2
Extraction Plan



FIGURE 1-2

Date: 28/05/2019

Data Sources:
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Aerial Imagery: © Photomapping Services (November 2018)

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2 Regulatory Requirements

2.1 Project Approval

2.1.1 Development Consent

Tahmoor Coal’s operations are conducted in accordance with applicable Commonwealth and State environmental, planning, mining safety, and natural resource legislation. A register of relevant environmental legislative and regulatory requirements is maintained by Tahmoor Coal in a compliance database.

The proposed LW W1-W2 will be operating in the Tahmoor North mining area under Development Consents DA 57/93 and DA 67/93, as discussed further in **Section 3.2.1** of the Extraction Plan Main Document.

DA 67/98 provides the conditional planning approval framework for mining activities in the Western Domain to be addressed within an Extraction Plan and supporting management plans. Conditions relevant to this BFMP from DA 67/98 are detailed in **Table 2-1**.

Table 2-1 Key Conditions from DA 67/98 regarding Built Features

Condition	Condition Requirement	Section Addressed
Performance Measures – Built Features		
13E	<p>The Applicant must ensure that extraction of Longwall 33 and subsequent longwalls does not cause any exceedances of the performance measures in Table 2.</p> <p>Notes</p> <ul style="list-style-type: none"> The Applicant will be required to define more detailed performance measures in the Built Features Management Plans or Public Safety Management Plan. Requirements regarding safety or serviceability do not prevent preventative or mitigatory actions being taken prior to or during mining in order to achieve or maintain these outcomes. Requirements under this condition may be met by measures undertaken in accordance with the <i>Coal Mine Subsidence Compensation Act 2017</i>. 	Section 3 Infrastructure Management Plans
Table 2	Feature	Performance Measure
	Key Public Infrastructure	
	<ul style="list-style-type: none"> Main Southern Railway; Picton-Mittagong Loop Line; and Electricity transmission lines and towers. 	<ul style="list-style-type: none"> Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.

Condition	Condition Requirement	Section Addressed
	<p>Other Infrastructure</p> <ul style="list-style-type: none"> Electricity distribution lines, poles and associated towers; Unsealed roads and road culverts, fire trails, fences and other built features; and Other public infrastructure. 	
	<ul style="list-style-type: none"> Privately-owned residences. 	
	<ul style="list-style-type: none"> Other privately-owned built features and improvements, including farm dams, swimming pools, tennis courts, roads, tracks and fences 	
	Public Safety	
	Public Safety	
	<p>Notes:</p> <ul style="list-style-type: none"> The Applicant will be required to define more detailed performance measures in the Built Features Management Plans or Public Safety Management Plan. Requirements regarding safety or serviceability do not prevent preventative or mitigatory actions being taken prior to or during mining in order to achieve or maintain these outcomes. Requirements under this condition may be met by measures undertaken in accordance with the Coal Mine Subsidence Compensation Act 2017. 	
13F	Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 2 is to be settled by the Secretary, following consultation with the Resources Regulator. Any decision by the Secretary shall be final	Noted.
Extraction Plan		
13H(vi)	describe in detail the performance indicators to be implemented to ensure compliance with the performance measures in Table 1 and Table 2, and manage or remediate any impacts and/or environmental consequences;	Section 3
13H(vii)(b)	Built Features Management Plan which has been prepared in consultation with the Resources Regulator, to manage the potential subsidence impacts of the proposed underground workings on built features, and which:	This document Section 2.4
	<ul style="list-style-type: none"> has been prepared in consultation with the owners of potentially affected features; 	Section 2.4 Infrastructure Management Plans
	<ul style="list-style-type: none"> addresses in appropriate detail all items of key public infrastructure (with particular consideration of transmission lines and towers (including angle towers), other public infrastructure and all classes of other built features; 	Section 3 Infrastructure Management Plans

Condition	Condition Requirement	Section Addressed
	<ul style="list-style-type: none"> recommends appropriate pre-mining mitigation measures to reduce subsidence impacts; 	Infrastructure Management Plans
	<ul style="list-style-type: none"> recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate predicted impacts on potentially affected built features in a timely manner; and 	Infrastructure Management Plans
	<ul style="list-style-type: none"> in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO 31000 (or alternative standard agreed with the infrastructure owner), and provides for annual auditing of compliance and effectiveness during extraction which may impact the infrastructure; 	Infrastructure Management Plans The Risk Management Framework utilised for risk assessment is the risk management process outlined in AS/NZS ISO 31000
13H(vii)(h)	<p>Trigger Action Response Plan/s addressing all features in Table 1 and Table 2, which contain:</p> <ul style="list-style-type: none"> appropriate triggers to warn of increased risk of exceedance of any performance measure; and specific actions to respond to high risk of exceedance of any performance measure to ensure that the measure is not exceeded; an assessment of remediation measures that may be required if exceedances occur and the capacity to implement the measures; and adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 1 or Table 2, or where any such exceedance appears likely; and 	Infrastructure Management Plans
13H(vii)(i)	<p>Contingency Plan that expressly provides for:</p> <ul style="list-style-type: none"> adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 1 and Table 2, or where any such exceedance appears likely; and an assessment of remediation measures that may be required if exceedances occur and the capacity to implement those measures; and includes a program to collect sufficient baseline data for future Extraction Plans. 	Infrastructure Management Plans

2.1.2 Extraction Plan Guidelines

The Extraction Plan and BFMP have been prepared in accordance with the *Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015), as illustrated in **Table 2-2**.

Table 2-2 Extraction Plan Guideline Requirements for Key Component Plans

Extraction Plan Guideline Content Requirements for Key Component Plans	Section(s) Addressed
An overview of all landscape features, heritage sites, environmental values, built features or other values to be managed under the component plan.	Section 1.3.1
Setting out all performance measures included in the development consent relevant to the features or values to be managed under the component plan.	Section 2.1.1, Section 4.1
Setting out clear objectives to ensure the delivery of the performance measures and all other relevant statutory requirements (including relevant safety legislation).	Section 2, Section 3 Infrastructure Management Plans
Proposing performance indicators to establish compliance with these performance measures and statutory requirements.	Section 5.1 Infrastructure Management Plans
Describe the landscape features, heritage sites and environmental values to be managed under the component plan, and their significance.	Section 3 Infrastructure Management Plans
Describe all currently-predicted subsidence impacts and environmental consequences relevant to the features, sites and values to be managed under the component plan.	Section 3 Infrastructure Management Plans
Describe all measures planned to remediate these impacts and/or consequences, including any measures proposed to ensure that impacts and/or consequences comply with performance measures and/or the Applicant's commitments.	Infrastructure Management Plans
Describe the existing baseline monitoring network and the current baseline monitoring results, including pre-subsidence photographic surveys of key landscape features and key heritage sites which may be subject to significant subsidence impacts (such as significant watercourses, swamps and Aboriginal heritage sites).	Section 3, Section 4.2 Infrastructure Management Plans
Fully describing the proposed monitoring of subsidence impacts and environmental consequences.	Section 4.2
Describe the proposed monitoring of the success of remediation measures following implementation.	Infrastructure Management Plans
Describe adaptive management proposed to avoid repetition of unpredicted subsidence impacts and/or environmental consequences.	Infrastructure Management Plans
Describe contingency plans proposed to prevent, mitigate or remediate subsidence impacts and/or environmental consequences which substantially exceed predictions or which exceed performance measures.	Infrastructure Management Plans
Listing responsibilities for implementation of the plan.	Section 6.3 Infrastructure Management Plans
An attached Trigger, Action, Response Plan (effectively a tabular summary of most of the above).	Infrastructure Management Plans

2.2 Relevant Legislation

2.2.1 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 the *Work Health and Safety Act 2011* and the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and associated *Regulations* (collectively referred to as the 'WHS laws').

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

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

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

- *complying with any specific requirements under the WHS laws;*
- *identifying reasonably foreseeable hazards that could give rise to health and safety risks;*
- *ensuring that a competent person assesses the risk;*
- *eliminating risks to health and safety so far as is reasonably practicable;*
- *minimising risks so far as is reasonably practicable by applying the hierarchy of control measures, any risks that are 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 (DPE, 2017).

The risk management process has been carried out in accordance with guidelines published by DPE (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.

The infrastructure management plans document the risk control measures that are planned to manage risks to health and safety associated with the mining of LW W1-W2 directly beneath or adjacent to built features in accordance with the WHS laws.

2.3 Risk Management

2.3.1 Risk Management Process

Tahmoor Coal has developed and acted in accordance with a risk management process to manage potential hazards due to mine subsidence on built features. The risk management strategy has been reviewed and updated based on experiences gained during the mining of Longwalls 22 to 32 and the strategy for LW W1-W2 includes the following process:

- Regular consultation with owners and operators of built infrastructure before, during and after mining;
- Site-specific investigations;
- Implementation of mitigation measures following engineering inspections and assessments;
- Surveys and inspections during mining within the active subsidence area:
 - Detailed visual inspections of built features;
 - Ground surveys; and
 - Specific ground surveys and visual inspections, where recommended by an engineer based on the inspections and assessments.

A flowchart illustrating the Subsidence Impact Management Process prior to, during and after mine subsidence movements is shown in **Figure 2-1**.

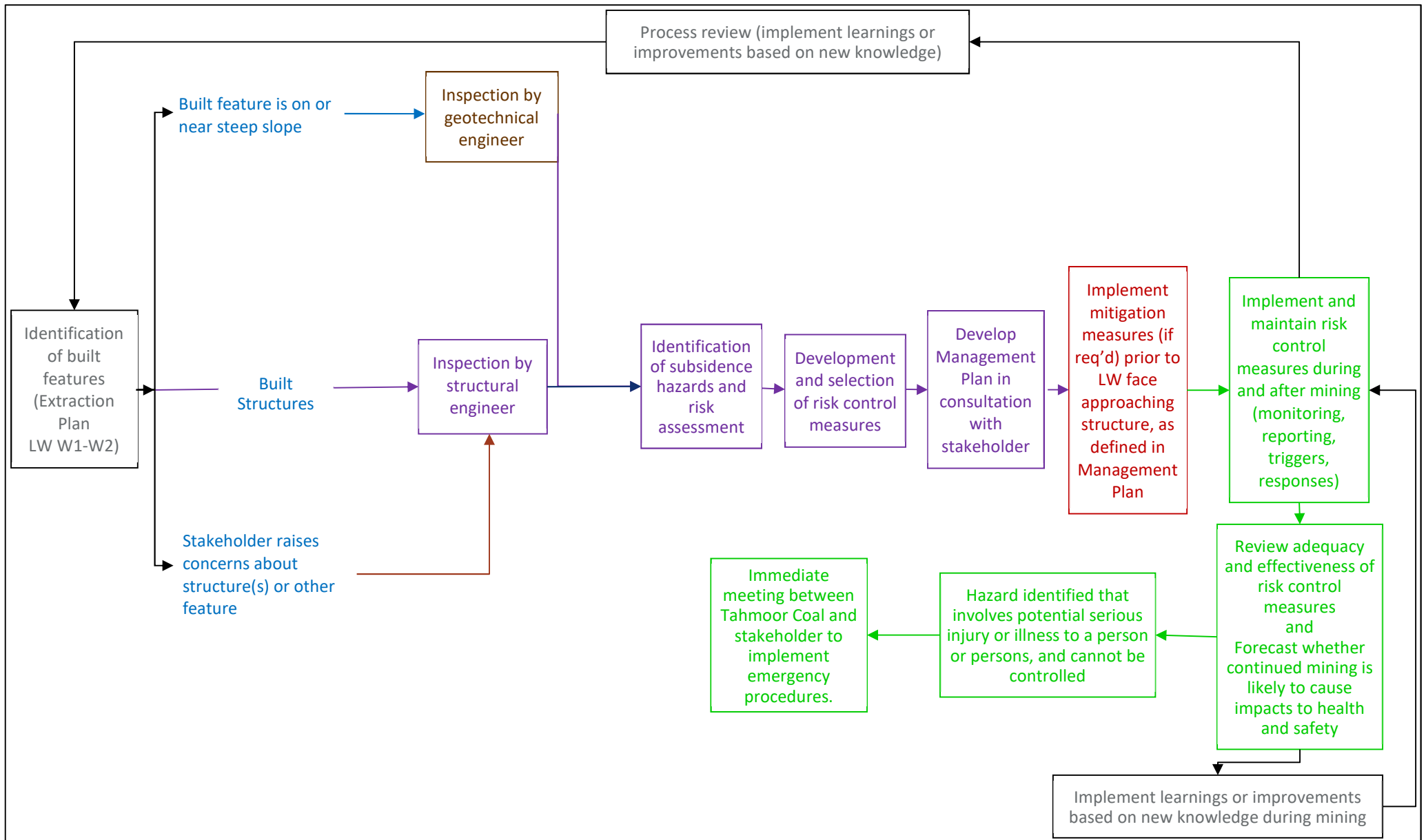


Figure 2-1 Flowchart for Subsidence Impact Management Process

2.3.2 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.

Mine subsidence hazards have been or will be identified, investigated and analysed in a systematic manner by examining each aspect of the built features. Each of the aspects below could potentially experience mine subsidence movements that give rise to risks to the health and safety of people:

- Railways;
- Local roads, bridges and culverts;
- Potable water infrastructure;
- Sewerage infrastructure;
- Gas infrastructure;
- Electrical infrastructure;
- Telecommunications infrastructure;
- Built heritage;
- Residential structures; and
- Farm dams.

A description of mine subsidence hazards identified that could give rise to risks to health and safety will be described in each of the individual infrastructure management plans.

Tahmoor Coal has completed a Risk Assessment for Built Features affected by subsidence from the extraction of LW W1-W2. A full copy of the risk assessment is included in the Public Safety Management Plan.

Tahmoor Coal, in consultation with infrastructure owners, will build upon the risk assessment to assess in detail the likelihood of the identified hazards affecting health and safety, and the severity of potential health and safety consequences during the risk assessment as a group. The results of the risk assessments will be included in each of the individual infrastructure management plans.

The identification and risk assessment process will take into account the location of infrastructure relative to LW W1-W2 and the associated timing and duration of the subsidence event.

Whilst mine subsidence predictions and extensive past experiences from previous mining at Tahmoor Coal will be taken into account, the identification and risk assessment process recognises that there are uncertainties in relation to predicting subsidence movements, and uncertainties in how mine subsidence movements may adversely impact built features. This includes the presence and influence of geological structures and valleys.

Tahmoor Coal will consider 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 built features in consultation with stakeholders.

A summary of built features and potential hazards identified in the Extraction Plan for LW W1-W2 are described in **Table 1-1**.

2.4 Consultation

Tahmoor Coal and utilities and infrastructure owners (including Wollondilly Shire Council, ARTC, Sydney Water, Endeavour Energy, Jemena and Telstra) have developed and acted in accordance with agreed subsidence management plans to manage potential impacts to services during the mining of Longwalls 22 to 32. These will be updated prior to the commencement of LW W1-W2. The management plans provide for ground and visual monitoring of infrastructure and are reviewed periodically.

Tahmoor Coal has commenced consultation with Railcorp, THNSW and the owner of Stonequarry WTP, which have not recently experienced mine subsidence impacts during the mining of Longwalls 22 to 32.

Separate infrastructure management plans will be developed in consultation with stakeholders prior to the influence of subsidence on each relevant feature.

The NSW Department of Planning and Environment – Resources Regulator (Resources Regulator) have been consulted with during the preparation of this Extraction Plan and Built Features Management Plan. A summary of consultation undertaken to date is provided in **Section 2.1.2** of the Extraction Plan Main Document, and a copy of the incoming correspondence is also provided in **Appendix C** of the Extraction Plan Main Document.

3 Summary of Built Features

This section provides a summary of Built Features, the identification of potential hazards, and the proposed risk controls.

3.1 Main Southern Railway

The Australian Rail Track Corporation (**ARTC**) is responsible for maintaining the Main Southern Railway. The location of the Main Southern Railway is shown in **Figure 3-1**.

The Main Southern Railway is located outside the Study Area. The railway is located 600 metres (m) east of the proposed LW W2 at its closest point to the proposed longwalls. At this distance, it is unlikely that the railway would experience adverse impacts, even if the predictions were exceeded by a factor of two times.

Tahmoor Coal will, however, continue to monitor movements at key items of railway infrastructure along the Main Southern Railway as part of the far field monitoring program for LW W1-W2.

3.2 Picton-Mittagong Loop Line

The Picton to Mittagong Loop Line is part of the former alignment of the Main South Line. It was built in 1867. The loop line was bypassed in 1919 following the construction of a new double track deviation, which is the current alignment of the Main Southern Railway.

THNSW, operating the Trainworks Railway Museum at Thirlmere, holds a licence to use the track. The majority of tourist trains run between Thirlmere and Buxton to the south of the Study Area. Approximately 4 to 5 trains typically travel through the Study Area per week as part of tours or arriving or leaving the Museum for maintenance.

The Picton-Mittagong Loop Line is a single line jointed track, which is defined by ARTC as rails that can move through the rail/sleeper fastenings and which have standard joints with a 6 mm gap installed at neutral temperature. The rails are generally fixed to steel or timber sleepers (but not concrete).

The location of the Picton-Mittagong Loop Line and the Study Area are shown in **Figure 3-1**.

The potential impacts on the Picton to Mittagong Loop Line comprise changes in track geometry and changes in rail stress., potential damage to culverts, embankment and cuttings.

Tahmoor Coal and THNSW, as the operator of the Trainworks Railway Museum at Thirlmere, have previously managed potential mine subsidence impacts on the Picton to Mittagong Loop Line during the extraction of LW21, when a corner of this longwall extracted directly beneath the loop line. A subsidence management plan was also developed in consultation and agreement with the then NSW Rail Transport Museum to manage the low likelihood risks associated with the mining of LW24 to LW26 at a remote distance from the loop line.

Tahmoor Coal and THNSW will develop a new plan to manage potential impacts during the mining of LW W1-W2. Risk controls will include maintaining the rail track to within operating standards prior to mining, surveys along the railway, visual inspections immediately prior to operation of trains, and repair of impacts as required to maintain the safe and serviceable operation of the railway during and after mining.

In the case of the loop line, there is ample time between trains, which generally run only on weekends. It is therefore possible to undertake monitoring and contingent response measures during weekdays prior to trains running.

With an appropriate management plan in place, it is considered that potential impacts on Picton-Mittagong Loop Line can be managed during the mining of LW W1-W2, even if actual subsidence movements are greater than the predictions or substantial non-conventional movements occur.

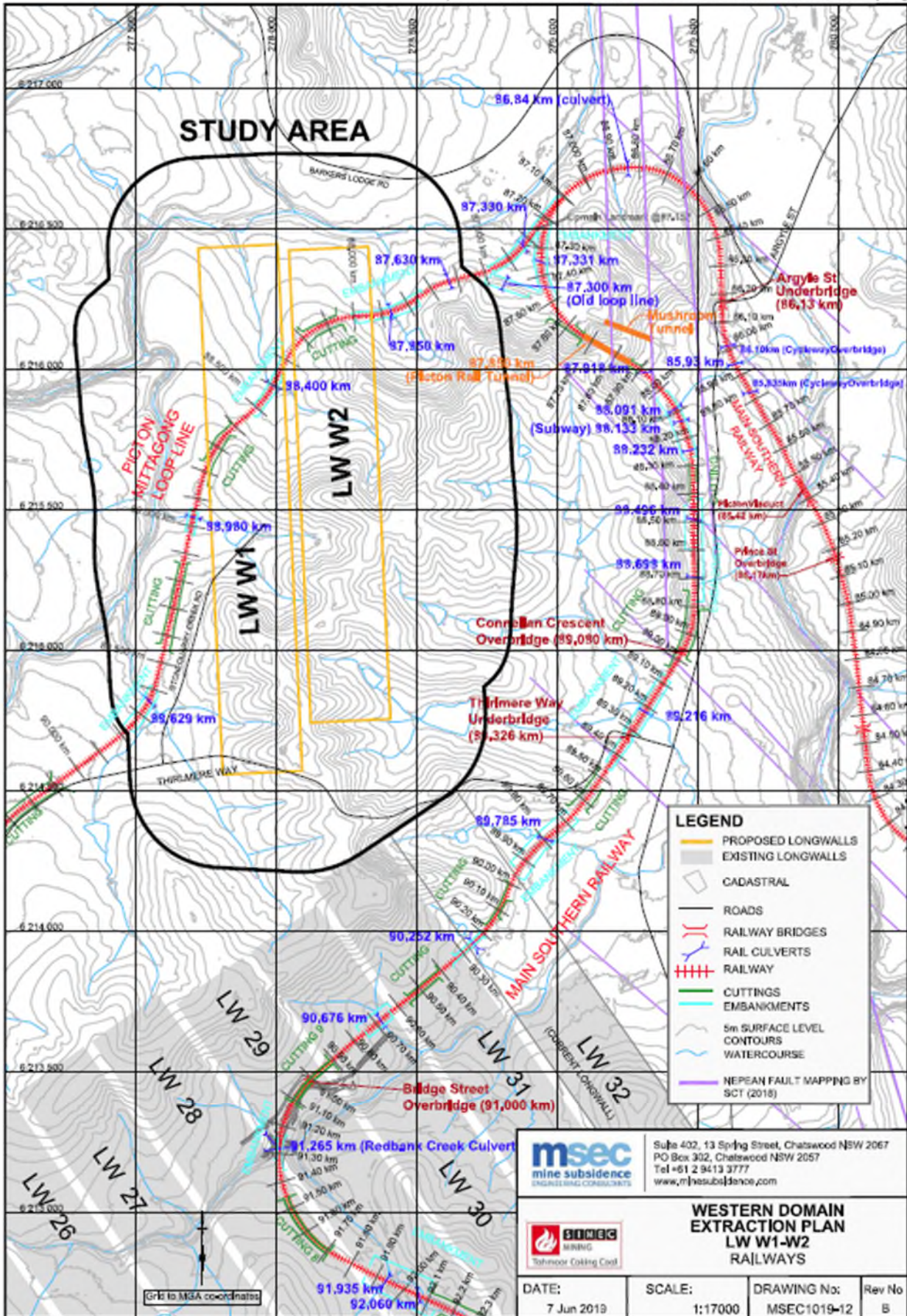


Figure 3-1 Railway Infrastructure and LW W1-W2 Extraction Plan Study Area (MSEC, 2019)

3.3 Local Roads

The main road within the Study Area is Thirlmere Way which connects Thirlmere and Picton. It crosses directly above the finishing (i.e. southern) end of LW W1.

The local roads within the Study Area include Stonequarry Creek Road, Carramar Close, Attunga Close and Booyong Close, which are partially located above the southern end of LW W1. Barkers Lodge Road is located outside the mining area to the north of the proposed longwalls.

The local roads are maintained by Wollondilly Shire Council. The locations of public roads within the Study Area are shown in **Figure 3-2**.

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

LW22 to LW31 at Tahmoor Coal have mined directly beneath more than 28 km of local roads and a total of 52 impact sites have been observed. The observed rate of impact on the local roads equates to an average of one impact for every 540 m of pavement. In most cases, the impacts were relatively minor and were remediated by locally resurfacing the pavements.

The most severe impacts were located where substantial non-conventional movements had developed. These impact sites were identified using visual and ground monitoring and remediation was undertaken during active subsidence to maintain these roads in safe and serviceable conditions.

Impacts have also been observed to concrete kerbs, gutters and drainage pits. The impacts are most commonly focussed around driveway laybacks and involve cracking, spalling or buckling.

Tahmoor Coal and Wollondilly Shire Council have developed and acted in accordance with an agreed risk management plan to manage potential impacts to local roads during the mining of LW22 to LW32. The management plan provides for ground and visual monitoring of road pavements. If impacts occur to the road network, Wollondilly Shire Council is able to quickly repair the pavement, if required.

Tahmoor Coal and Wollondilly Shire Council will review and develop a similar plan to manage potential impacts on local roads and associated infrastructure so that they remain safe and serviceable during and after mining.

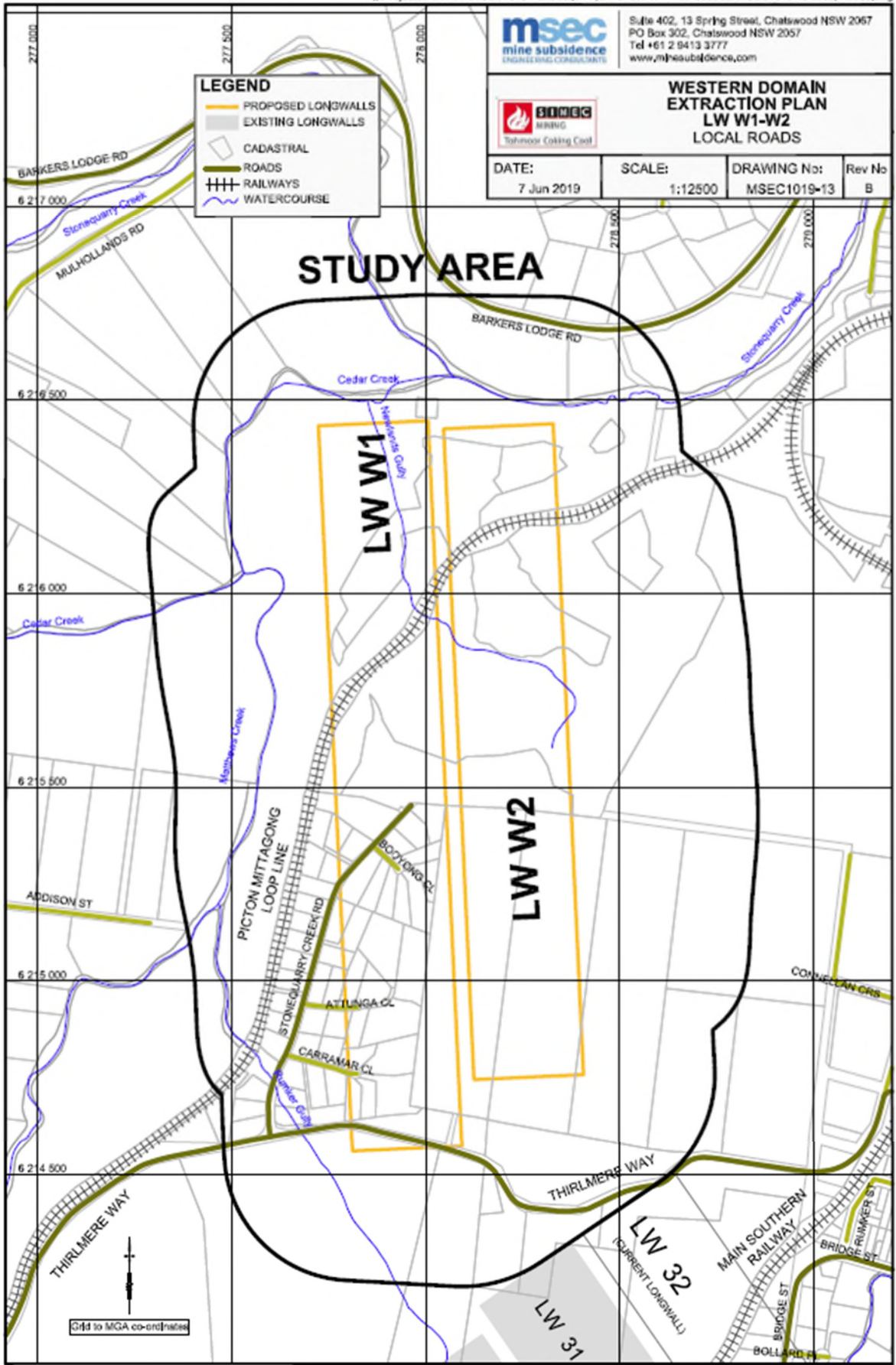


Figure 3-2 Public Roads and LW W1-W2 Extraction Plan Study Area (MSEC, 2019)

3.4 Potable Water Infrastructure

The potable water infrastructure comprises buried 100 mm and 180 mm uPVC pipelines along Thirlmere Way, Stonequarry Creek Road, Attunga Close, Booyong Close and Carramar Close. The pipelines are partly located above the southern end of LW W1. The total length of potable water pipelines located above the longwall is approximately 0.5 km. The total length of potable water pipelines within the Study Area is approximately 1.6 km.

The potable water infrastructure is owned by Sydney Water. The locations of the potable water infrastructure within the Study Area are shown in **Figure 3-3**.

Tahmoor Coal have directly mined beneath approximately 25 km of potable water pipelines during the mining of LW22 to LW31. These pipelines comprise older Ductile Iron Concrete Lined (**DICL**) and Cast Iron Concrete Lined (**CICL**) pipelines. The extraction of longwalls beneath these pipelines at Tahmoor has only resulted in minor impacts. Water leaks were repaired by Sydney Water using normal response procedures. The newer unplasticised polyvinyl chloride (**uPVC**) pipelines located within the Study Area are expected to be less susceptible to impacts from mine subsidence than the DICL and CICL pipelines located above the previously extracted longwalls.

Based on this experience, it is possible that some minor leakages of the potable water pipelines could occur, in isolated locations, due to the extraction of LW W1 W2. The incidence of these impacts is expected to be very low. Impacts are more likely to occur in the locations of non-conventional ground movements and at the tributary crossings due to the valley related effects. Any impacts are expected to be of a minor nature that could be readily repaired.

Tahmoor Coal and Sydney Water have developed and acted in accordance with an agreed risk management plan to manage potential impacts to local roads during the mining of LW22 to LW32. The management plan provides for ground and visual monitoring of local roads. If impacts occur to the potable water network, Sydney Water is able to quickly repair the pipework.

Tahmoor Coal and Sydney Water will review and develop a similar plan to manage potential impacts on potable water pipelines and associated infrastructure so that they remain safe and serviceable during and after mining.

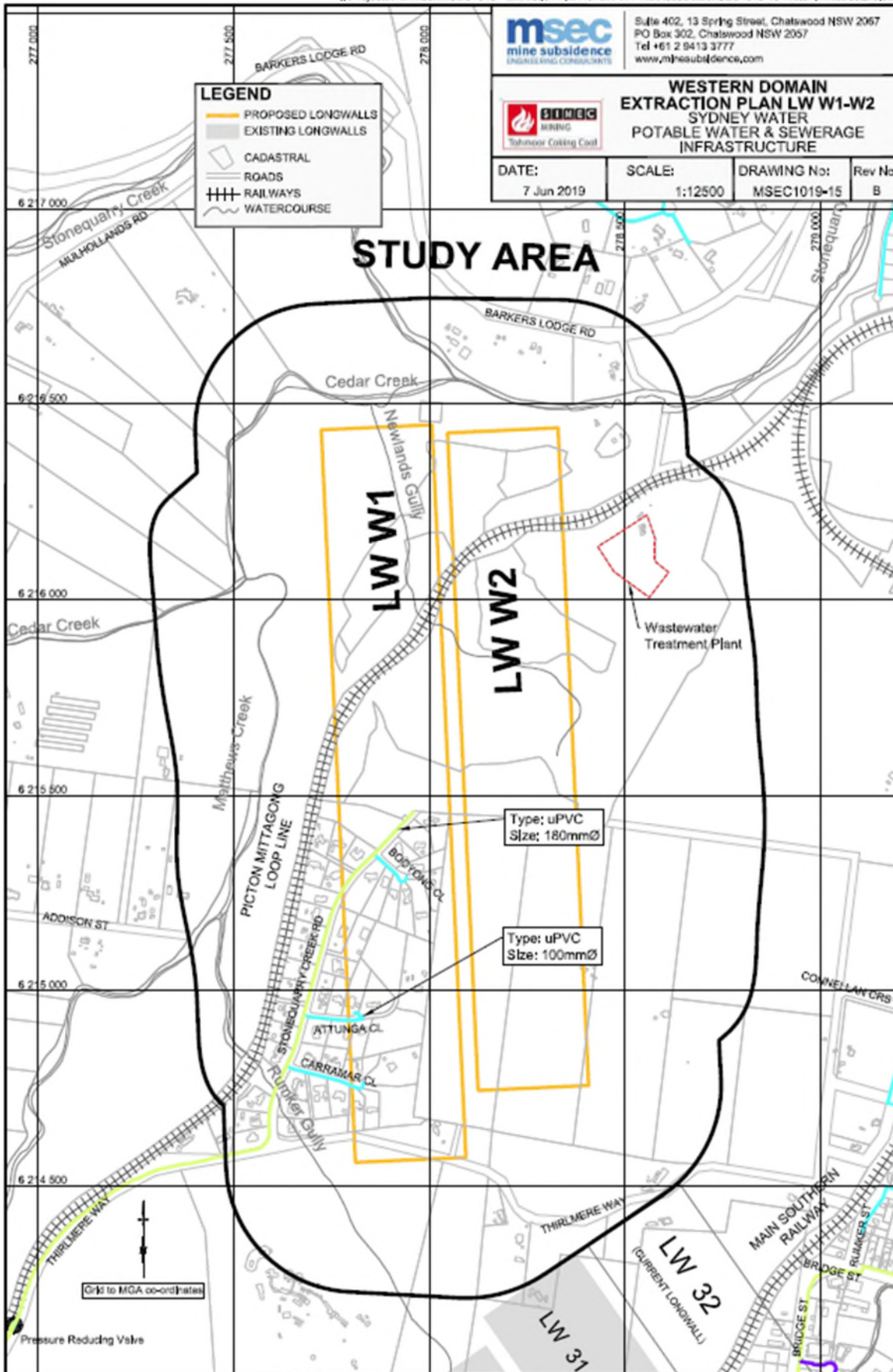


Figure 3-3 Potable Water Infrastructure and LW W1-W2 Extraction Plan Study Area (MSEC, 2019)

3.5 Sewerage Infrastructure

There are sewerage pipelines located within the Study Area, which are managed by Stonequarry Estate.

A WTP on the Stonequarry Estate is located within the Study Area, as shown in **Figure 3-3**. The property is located outside the proposed mining area at a minimum distance of 90 m east of LW W2.

As the design of the WTP has been approved by Subsidence Advisory NSW, it is expected that the structures, dam and connecting services pipes will be able to accommodate the predicted ground movements due to LW W1-W2. It is possible, however, that the WTP could experience non-conventional movements during the extraction of the proposed longwalls.

Tahmoor Coal and Stonequarry Estate will develop a subsidence management plan to manage potential impacts on the WTP and sewerage pipework during the extraction of LW W1-W2. Risk controls will include ground and visual monitoring of local roads. If impacts occur to the sewerage network or WTP, they will be able to be quickly repaired so that they remain safe and serviceable during and after mining.

3.6 Gas Infrastructure

The gas infrastructure comprises buried 32 mm, 50 mm and 75 mm nylon pipelines along Thirlmere Way, Stonequarry Creek Road, Attunga Close, Booyong Close and Carramar Close. These pipelines are partly located above the southern end of LW W1. The total length of gas pipelines located above the longwall is approximately 0.65 km. The total length of gas pipelines within the Study Area is approximately 1.9 km. The locations of the gas infrastructure within the Study Area are shown in **Figure 3-4**.

The gas infrastructure is owned by Jemena.

LW22 to LW31 at Tahmoor Coal have directly mined beneath approximately 18 km of gas pipelines and no adverse impacts have been recorded to date. The nylon pipelines are very flexible and have demonstrated that they are able to withstand the full range of subsidence experienced during longwall extraction at Tahmoor Coal. While no impacts have been experienced to date, it is acknowledged that the most vulnerable element of the system is the rigid copper pipe connections between the gas mains and the houses, which can be readily repaired.

Tahmoor Coal and Jemena have developed and acted in accordance with an agreed risk management plan to manage potential impacts to gas infrastructure during the mining of LW22 to LW32. The management plan includes ground and visual monitoring including the use of hand-held gas detection devices, and planned responses if triggered by observations of increased ground strains, ground curvature or localised surface deformations. Jemena inspectors have also conducted targeted regular inspections if triggered by monitoring results during the mining of LW24A, LW25, LW31 and LW32.

If the conditions are considered sufficient to potentially damage a section of pipe, Jemena is able to quickly uncover the pipe section, inspect the pipe for signs of stress and, if required, isolate the pipe section at short notice and repair.

Tahmoor Coal and Jemena will review and develop a similar plan to manage potential impacts on gas pipelines and associated infrastructure so that they remain safe and serviceable during and after mining.

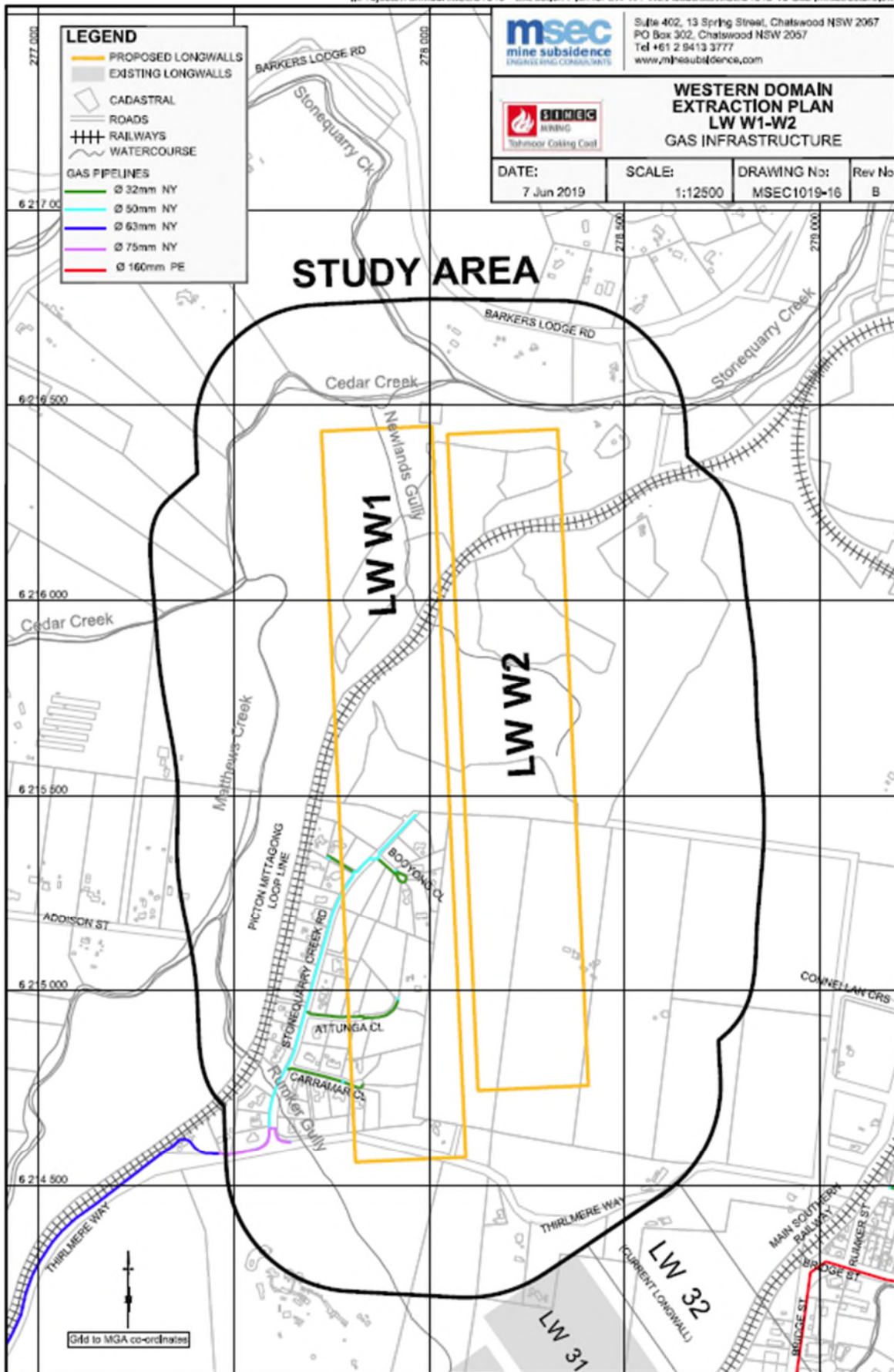


Figure 3-4 Gas Infrastructure and LW W1-W2 Extraction Plan Study Area (MSEC, 2019)

3.7 Electrical Infrastructure

The electrical infrastructure comprises 11 kilovolt (kV) and low voltage powerlines that generally follow the local roads. The powerlines are partly located above the southern ends of LW W1-W2. The total length of powerlines located above the longwalls is approximately 2.4 km. The total length of powerlines within the Study Area is approximately 10.3 km.

The 11 kV powerline along Thirlmere Way and the section of the low voltage powerline above the southern end of LW W2 comprise aerial conductors supported by timber poles. The powerlines along Stonequarry Creek Road, Attunga Close, Booyong Close and Carramar Close are buried.

The electrical infrastructure is owned by Endeavour Energy. The locations of the electrical infrastructure within the Study Area are shown in **Figure 3-5**.

LW22 to LW31 at Tahmoor Coal have directly mined beneath approximately 41 km of electrical cables and 1,060 power poles and no significant impacts have been recorded and there were no significant adverse impacts. However, tension adjustments have been made by Endeavour Energy to some aerial services connections to houses. This is understandable as the overhead cables are typically pulled tight between each house and power pole.

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

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

There is less experience of mining beneath buried powerlines in the Southern Coalfield. However, there is extensive experience of mining beneath buried copper telecommunications cables, as discussed in **Section 3.8**. This experience indicates that the likelihood of impacts on buried copper cables is also low.

Tahmoor Coal and Endeavour Energy have developed and acted in accordance with an agreed risk management plan to manage potential impacts to electrical infrastructure during the mining of LW22 to LW32. The management plan provides for ground and visual monitoring including specific surveys of critical power poles that have been identified within the network by Endeavour Energy.

The management plan also provides for planned responses if triggered by observations of impacts. If impacts occur to the network, Endeavour Energy is able to quickly make adjustments and restore power, where required.

Tahmoor Coal and Endeavour Energy will review and develop a similar plan to manage potential impacts on electrical infrastructure so that they remain safe and serviceable during and after mining.

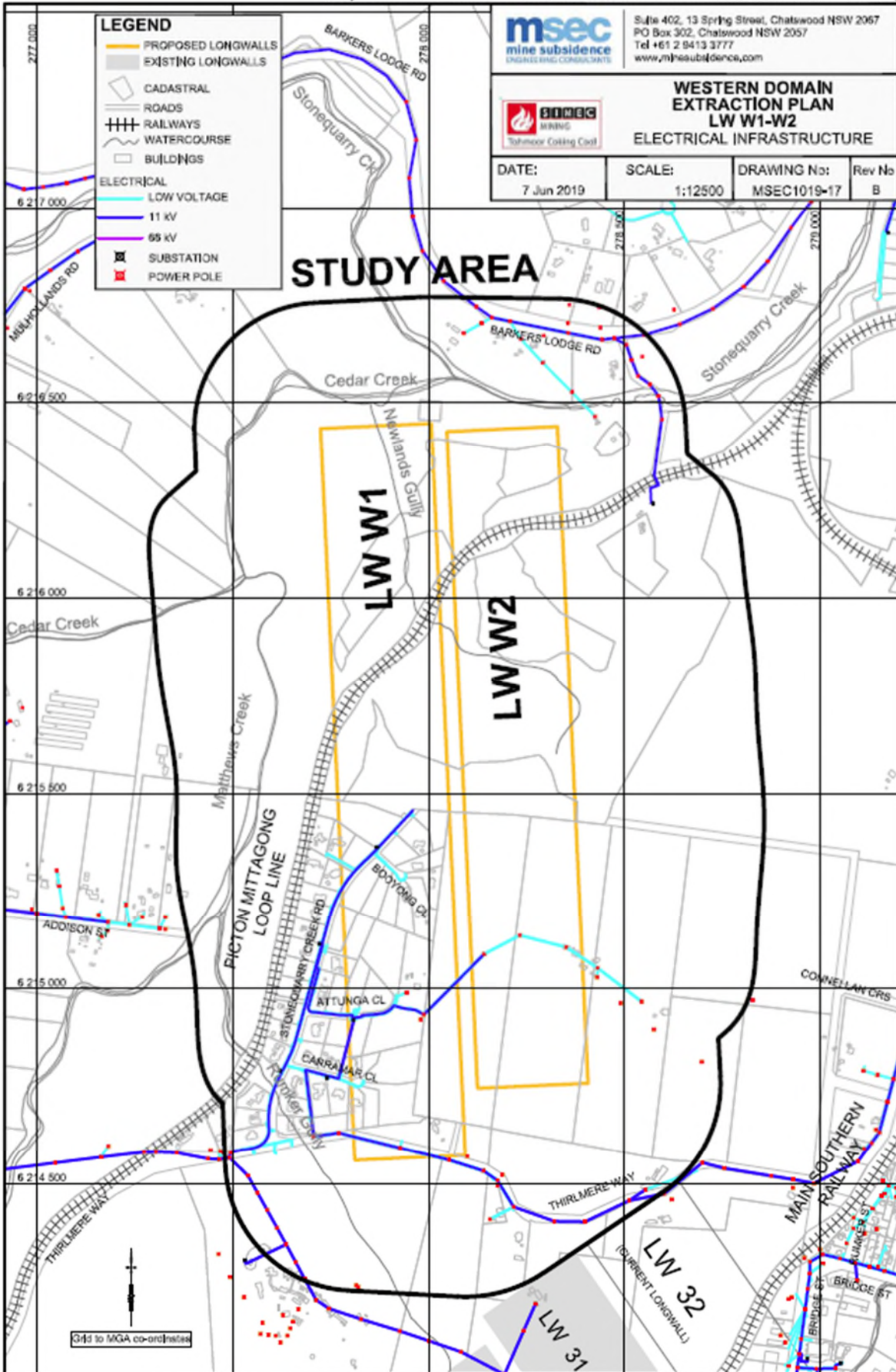


Figure 3-5 Electrical Infrastructure and LW W1-W2 Extraction Plan Study Area (MSEC, 2019)

3.8 Telecommunications Infrastructure

The telecommunications infrastructure comprises buried optical fibre cables and copper telecommunications cables that generally follow the local roads. The optical fibre cables are partly located above the southern ends of LW W1-W2. The copper telecommunications cables are located above the finishing (i.e. southern) end of LW W1.

The total length of cables located above the longwalls is approximately 2.2 km for the optical fibre cables and approximately 0.1 km for the copper cables. The optical fibre cables are owned by Telstra and NBN Co. and the copper telecommunications cables are owned by Telstra.

The optical fibre cables are owned by Telstra and NBN Co. and the copper telecommunications cables are owned by Telstra. The locations of the telecommunications infrastructure within the Study Area are shown in **Figure 3-6**.

Longwalls 22 to 31 at Tahmoor Coal have directly mined beneath approximately 43.1 km of buried copper cable and 3.2 km of buried optical fibre cable and 6.5 km of aerial cable and no impacts have been recorded to telecommunications services so far.

Adjustments to tension of aerial telecommunications cables were required during the mining of Longwall 26 on Tahmoor Road and Krista Place. Damage was also observed to a conduit on the north-western abutment of the Castlereagh St Bridge. No issues were detected during the mining of Longwalls 27 to 31.

Tahmoor Coal 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 LW22 to LW32. The management plan provides for ground and visual monitoring, which includes detailed inspections of pits and cables prior to, during and after mining, and Optical Time Domain Reflectometry (OTDR), which can be used to notify the infrastructure owners of strain concentrations due to non-conventional ground movements or valley related effects.

Tahmoor Coal, Telstra and NBN Co. will review and develop a similar plan to manage potential impacts on telecommunications infrastructure so that they remain safe and serviceable during and after mining.

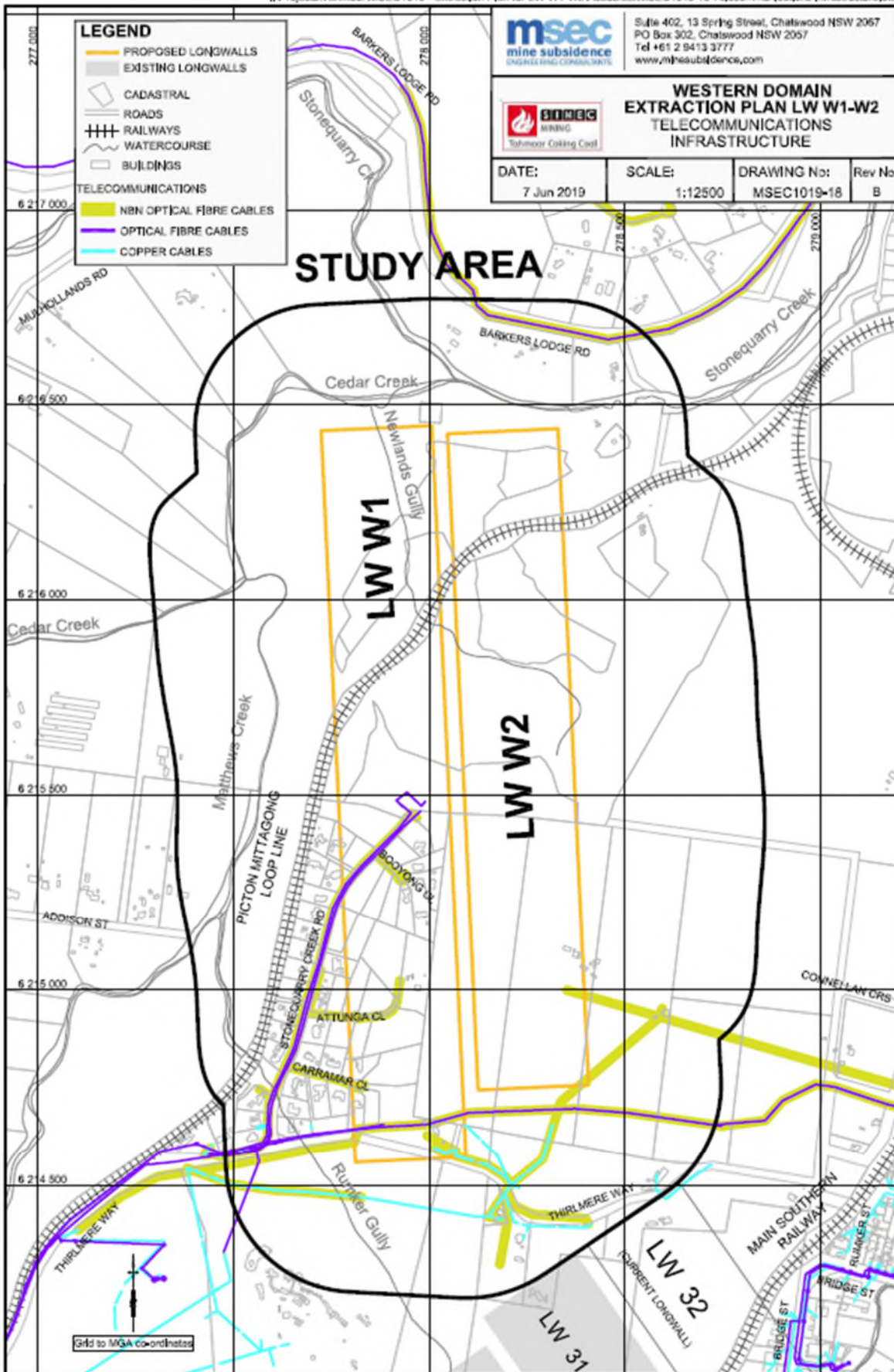


Figure 3-6 Telecommunications Infrastructure and LW W1-W2 Extraction Plan Study Area (MSEC, 2019)

3.9 Public Amenities

The QVMH property is located on Thirlmere Way above the southern boundary of the Study Area, to the south-west of LW W1. The location of the property within the Study Area are shown in **Figure 3-7**.

The main three-storey buildings, one heritage listed building constructed in 1886 and one modern building, are both located just inside the Study Area. The proposed longwalls are approximately 320 metre from the original old main building and 310 m from the new main building at their closest points. The old three-storey building is currently vacant.

Based on the experience at Tahmoor Mine, it is considered that there is a very low probability of adverse impacts to the structures associated with the QVMH as a result of the mining of the proposed longwalls. All structures are expected to remain in safe and serviceable condition at all times.

Tahmoor Coal and QVMH have developed and acted in accordance with an agreed risk management plan to manage potential impacts to the QVMH property during the mining of LW30 and LW31. The management plan provides for ground and visual monitoring, and asbestos air monitoring.

Tahmoor Coal and QVMH will review and develop a similar plan to manage potential impacts on the QVMH infrastructure so that it remains safe and serviceable during and after mining.

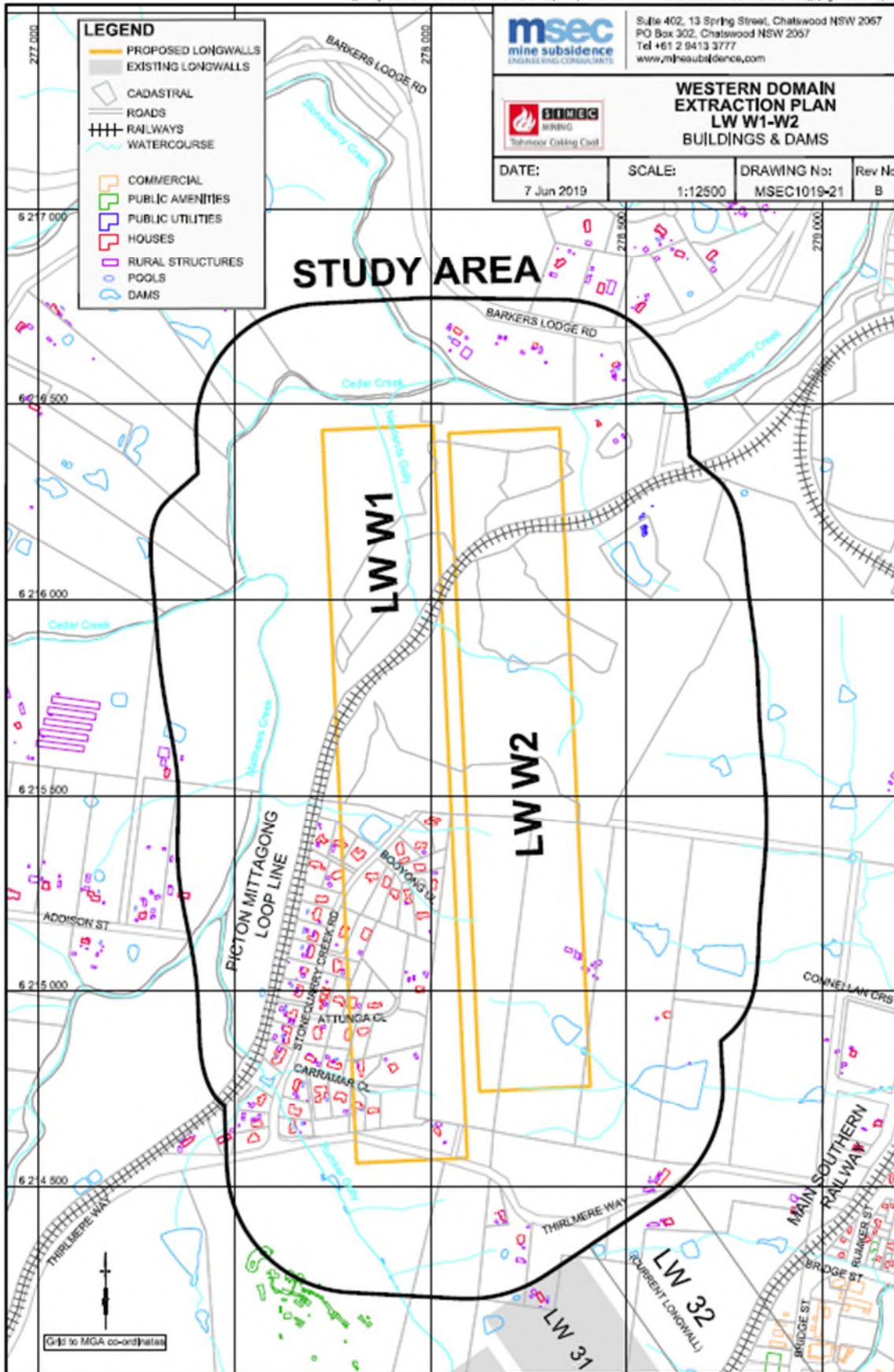


Figure 3-7 Public Amenities and LW W1-W2 Extraction Plan Study Area (MSEC, 2019)

3.10 Structures

A total of 62 houses, 16 swimming pools and 145 associated sheds and other rural and residential structures have been identified within the Study Area. The locations of the structures within the Study Area are shown in **Figure 3-7**.

Detailed predictions and a probabilistic assessment of potential impacts are provided in the Extraction Plan for LW W1-W2.

The primary risk associated with mining beneath structures is public safety. Historically, residents have not been exposed to immediate and sudden safety hazards as a result of impacts that occur due to mine subsidence movements in the NSW Coalfields, where the depths of cover were greater than 350 m, such as the case above the proposed longwalls. This includes the recent experience at Tahmoor during the mining of LWs 22 to 32, which has affected more than 2,000 houses and civil structures.

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

The existing condition of structures varies above LW W1-W2. This is a function of age, structural design, construction workmanship and maintenance. Pre-mining hazard identification inspections undertaken by Tahmoor Coal have identified elements of structures that did not appear to comply fully with Australian Standards, in regard to design and construction. In a small number of previous cases prior to the extraction of previous longwalls, the existing structural condition has been considered potentially unsafe and Tahmoor Coal has undertaken measures to repair the defect.

There is a remote possibility that the comparatively small additional contribution of mine subsidence movements could be sufficient to result in the structures that do not meet Australian Standards to become potentially unstable.

Tahmoor Coal will continue its current practice of ensuring that built structures remain safe and serviceable at all times during mining. In consultation with landowners, Tahmoor Coal will study the potential for impacts on the structures and other infrastructure and develop management measures. The study will require input from structural and subsidence engineers. The risk management process is implemented through a four-staged process, as described in **Section 3.10.1**.

3.10.1 Structures Risk Management Process

Stage One

Regular consultation, cooperation and coordination with the community before, during and after mining. This includes letters and door knocking to all residents of structures that will soon be affected by subsidence. The letters offer a free pre-mining inspection and hazard identification inspection by a structural engineer.

Stage Two

Site-specific investigations, where they are necessary and appropriate, into the conditions of buildings and associated structures and their surrounding environment (where access is allowed). The site-specific investigations have been and will continue to be undertaken early so that there is adequate time, if required, to arrange additional inspections and/or surveys and implement any mitigation measures before mining-induced impacts are experienced.

For properties located directly above the first 300 m of the commencing end of a longwall, the investigations are targeted to be undertaken prior to extraction or at the latest, they will be undertaken prior to the first 200 m of extraction of the longwall.

The site-specific investigations include the following:

- Identification of structures from aerial photographs and kerbside inspections;
- Front of house risk and visual screening inspections by Tahmoor Coal in company with a structural engineer for all properties that are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of each upcoming longwall. The purpose of the inspections is to identify hazards where access has not been granted by the landowner. In some cases, particularly in semi-rural and rural areas, it is difficult to inspect a structure that is remote from the street front. Where these cases involve properties that are located directly above a longwall, Tahmoor Coal has requested access to conduct a pre-mining inspection and hazard identification inspection by a structural engineer;
- Tahmoor Coal will request access to conduct pre-mining geotechnical inspections of structures located on or immediately adjacent to steep slopes that are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of each longwall;
- Tahmoor Coal will request access to conduct pre-mining hazard identification inspections by a structural engineer (where access is allowed by the landowner) to properties with structures that have been specifically targeted on the basis that may be more sensitive to mine subsidence movements. These include:
 - Commercial and business establishments, public amenities and public utilities;
 - Structures of heritage significance;
 - Structures that are located above hidden creeks;
 - Structures that are located above mapped geological structures;
 - Structures that are located on or adjacent to steep slopes or that have been recommended for structural inspection by the geotechnical engineer;
 - Structures that have been identified as being potentially unstable or unsafe by landowners (Stage One), or from the front of house inspections (Stage Two);
 - Houses and units located outside the declared Mine Subsidence Districts; and
 - Houses and units estimated to have been constructed prior to the declaration of the Picton Mine Subsidence District as originally declared in 1997 or if outside the original declared boundary, prior to the declaration of the current boundary in 2017.

Stage Three

Implementation of pre-mining mitigation measures following inspections by the geotechnical engineer and the structural engineer, in consultation and agreement with the landowner.

Stage Four

Surveys and inspections during mining within the active subsidence area:

- Detailed visual inspections and vehicle-based inspections along the streets;
- Ground surveys along the streets;
- Specific ground surveys for selected properties, where recommended by the geotechnical engineer or structural engineer due to their proximity to steep slopes or pre-existing condition;

- Visual inspections of residential structures that are either: located on or adjacent to steep slopes, are in poor existing condition (based on the hazard identification inspections), have previously reported impacts, or where recommended by the Structures Response Group;
- Visual inspections of pool fences and gates; and
- Visual inspections of commercial, industrial and business establishments, public amenities and public utilities.

3.10.2 Current Status

Front of house risk and visual screening inspections have been completed by Tahmoor Coal in company with a structural engineer for structures within the Study Area. One unoccupied house is in a dilapidated condition and it is proposed to erect bunting and warning signs around the structures to discourage access, subject to approval by the landowner.

The Built Structure Management Plan also provides for additional visual inspections and ground surveys in the event that increased subsidence is observed. This includes pre-mining checks of structures within the affected area, daily visual inspections during active subsidence and weekly ground surveys along streets. Tahmoor Coal also consults with Subsidence Advisory NSW to determine whether additional resources are required to assist with undertaking repairs to impacted structures.

Further details will be provided in the Built Structures Management Plan.

3.11 Built Heritage Sites

The heritage sites within the Study Area were identified by a specialist heritage consultant and the detailed descriptions are provided in the Extraction Plan for LW W1-W2. The structures identified as having heritage significance within the Study Area are shown in **Figure 3-8**. There are also some additional heritage relics and artefacts that are located within the Study Area which are also shown in **Figure 3-8**.

Potential impacts and planned risk controls for QVMH were discussed in **Section 3.9**.

Potential impacts and planned risk controls for railway culverts along the Picton-Mittagong Loop Line were discussed in **Section 3.2**.

A Property Subsidence Management Plan (**PSMP**) has previously been developed in consultation, co-operation and co-ordination with the owners of Mill Hill.

The PSMP includes the following monitoring and management measures in relation to the structures at Mill Hill:

- Monthly ground surveys around the perimeter of the house, and along the south-eastern property boundary, as shown in **Figure 3-8**;
- Monthly visual inspections of structures and dams; and
- Repair of impacts, if any, in consultation with a specialist heritage consultant.

Tahmoor Coal and the owners of Mill Hill will review and develop a similar plan to manage potential impacts on the property so that it remains safe and serviceable during and after mining.

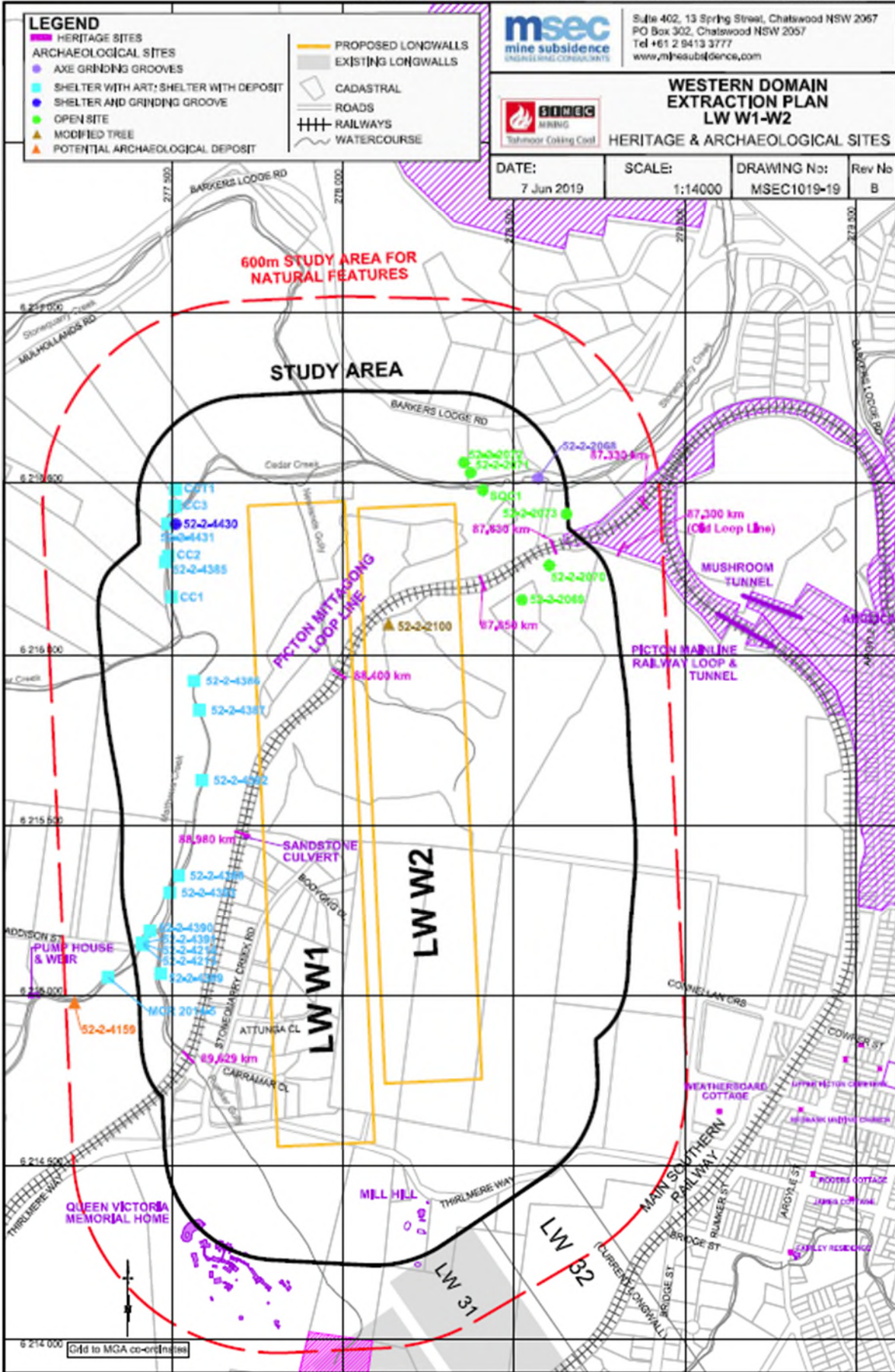


Figure 3-8 Heritage Sites and LW W1-W2 Extraction Plan Study Area (MSEC, 2019)

3.12 Permanent Survey Marks

This section provides detailed information about how the risks associated with mining beneath survey infrastructure will be managed by Tahmoor Coal and the Department of Finance, Service and Innovation, Spatial Services Division (**SS**).

Permanent Survey Marks are fundamental to spatial infrastructure. This includes Geographic Information Systems (**GIS**) and databases that are the primary spatial management tools for all levels of Government. The loss of Permanent Survey Marks can adversely affect future upgrades to physical infrastructure such as road, rail, ports and greenfield developments, as well as the planning and management of other development or resource management projects that require a spatial component, such as urban renewal, mapping and environmental management.

Cadastral Reference Marks are fundamental to the definition and re-establishment of the cadastre. The loss of these marks and Permanent Survey Marks can significantly degrade the integrity and accuracy of the cadastre, and add to the costs of subsequent surveys.

Within NSW there are two main types of survey infrastructure, which are:

- State Control Marks; and
- Cadastral Marks.

Survey marks are used as control for:

- Cadastral or Property Boundary;
- Mine Baselines;
- Engineering Construction;
- Stability Monitoring;
- Imagery and LiDAR control;
- Coordinate Services Utility Information; and
- Flood study.

Spatial Services Division within NSW maintain the Survey Control Information Management System (**SCIMS**) to provide the following functions:

- A database of Marks, their coordinates and other associated Metadata;
- The single point of truth for survey control in NSW; and
- Current datums are GDA94 & AHD71 moving to GDA2020 & AHD71.

Survey infrastructure is governed by *Surveying & Spatial Information Act 2002*. Under Section 24 of *Surveying & Spatial Information Act 2002* a person must not remove, damage, destroy, displace, obliterate or deface any survey mark unless authorised to do so by the Surveyor-General. An application is required under Clause 90 of the *Surveying and Spatial Information Regulation 2017* to remove survey marks under section 24 of the Act.

The Surveyor General Direction No. 11 (SGD11) – Preservation of Survey Infrastructure (**POSI**). In order to obtain authority from the Surveyor-General for the removal of any Permanent Survey Mark or Cadastral Reference Mark, SGD11 POSI process must be followed.

An application to remove, damage or replace Survey Marks affected by subsidence must be in accordance with the SGD11 POSI process.

Under SGD11 POSI process, Tahmoor Coal is responsible to ensure that all survey marks affected by subsidence are protected or that on completion of the works:

- The control survey should be of sufficient horizontal and vertical class to allow existing and/or replacement mark(s) to be coordinated to a similar standard as the mark(s) affected by the works; and
- Sufficient cadastral infrastructure is preserved or additional marks are placed with appropriate measurements to re-establish the cadastre at the accuracies specified in the *Surveying and Spatial Information Regulation 2017*.

The Clause 90 POSI application, generally consists of the following:

- A Report outlining the Strategy;
- A field audit of all survey marks;
- A Project Plan outlining the strategy and methodology for mark protection and reinstatement of survey infrastructure for the duration of the project, prior to commencement of any mining activity. The Plan is to include a diagram or drawing showing the extent of the proposed works.

Agreement on following process:

- Future active longwalls require a Clause 90 POSI application to be submitted using *Application to Remove or Replace Survey Marks* form and following the *SGD11 POSI Procedure for Mining Projects*. A quarterly report to be provided to indicate the general survey mark movement; and
- Rehabilitation of survey marks post long term subsidence period (after at least 4 years post longwall) a further Clause 90 POSI application to be submitted to outline strategy for rehabilitation of survey marks.

4 Subsidence Monitoring Program

4.1 Performance Measures

Performance measures for built features are provided in Table 2 of Condition 13E of DA 67/98 (refer to **Section 2.1.1**). It is anticipated that the performance measures will be achieved during and after mining of LW W1-W2 through the implementation of the various Infrastructure Management Plans (refer to **Table 1-1**).

4.2 Monitoring Program

Tahmoor Coal has developed a Subsidence Monitoring Program, which is included in the Extraction Plan for LW W1-W2. The Subsidence Monitoring Program describes the inspection regimes, layout of monitoring points, parameters to be measured, monitoring methods and accuracy, timing and frequencies of surveys and inspections, and recording and reporting of monitoring results.

The Subsidence Monitoring Program is consistent with the monitoring commitments as described in the following plans, which are submitted as part of Tahmoor Coal's Extraction Plan for LW W1-W2:

- Tahmoor Coal – Water Management Plan for LW W1-W2, 2019;
- Tahmoor Coal – Land Management Plan for LW W1-W2, 2019;
- Tahmoor Coal – Biodiversity Management Plan for LW W1-W2, 2019;
- Tahmoor Coal – Heritage Management Plan for LW W1-W2, 2019;
- Tahmoor Coal – Built Features Management Plan for LW W1-W2, 2019; and
- Tahmoor Coal – Public Safety Management Plan for LW W1-W2, 2019.

The Subsidence Monitoring Program will be consistent with detailed Subsidence Management Plans, which will be developed by Tahmoor Coal in consultation with stakeholders prior to the influence of subsidence on each relevant feature. Each of these management plans will describe measures that will be undertaken to monitor subsidence movements and physical changes and/or impacts that occur during mining. The management plans will include:

- Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Wollondilly Shire Council Infrastructure, Report No. MSEC1045-02, 2019;
- Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Sydney Water Potable Water Infrastructure, Report No. MSEC1045-03, 2019;
- Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Stonequarry Wastewater Treatment Plant, Report No. MSEC1045-04, 2019;
- Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Jemena Gas Infrastructure, Report No. MSEC1045-05, 2019;
- Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Endeavour Energy Infrastructure, Report No. MSEC1045-06, 2019;
- Tahmoor Coal – LW W1-W2 Management Plan for Telstra and NBNCo Infrastructure, Comms Network Solutions, 2019;
- Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to Built Structures, Report No. MSEC1045-12, 2019;

- Tahmoor Coal – LW W1-W2 Property Subsidence Management Plan for potential mine subsidence impacts on Queen Victoria Memorial Home, Report No. MSEC1045-13-01, 2019;
- Tahmoor Coal – LW W1-W2 Management Plan for Potential Impacts to No. 675 Thirlmere Way (Mill Hill), Report No. MSEC1045-13-02, 2019;
- Tahmoor Coal – LW W1-W2 Management Plan for extraction of LW W1-W2 beneath the Picton-Mittagong Loop Line, Report No. MSEC1036, 2019; and
- Tahmoor Coal – LW W1-W2 Management Plan for extraction of LW W1-W2 adjacent to the Main Southern Railway, Report No. MSEC1058, 2019.

4.3 Baseline Monitoring for Future Extraction Plans.

To assist in the preparation of future Extraction Plans, monitoring of built features as outlined in the Subsidence Monitoring Program would provide sufficient baseline data to assist the preparation of the Extraction Plan for LW W3-W4. Monitoring data collected during the mining of LW W1-W2 would be used in the review of observed subsidence impacts for future Extraction Plans.

5 Review and Improvement

This section of the BFMP describes the key elements of implementation relevant to built features. A description of general reporting requirements, reviews and key responsibilities that are applicable to extraction of LW W1-W2 are discussed in the Extraction Plan Main Document.

5.1 Reporting Requirements

Generic reporting requirements for the LW W1-W2 Extraction Plan are discussed in **Section 6.1** of the Extraction Plan Main Document. Specific reporting requirements will be described in the individual infrastructure management plans.

5.2 Review and Auditing

This BFMP 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 owner;
- 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.

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

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

5.3 Roles and Responsibilities

Generic roles and responsibilities applicable for the implementation of the LW W1-W2 Extraction Plan are discussed in **Section 6.3** of the Extraction Plan Main Document. There are no roles and responsibilities specific to the implementation of built features management measures identified for the extraction of LW W1-W2.

6 Document Information

This section provides a compiled list of references, terms, and abbreviations used in this document. In addition, this section provides the change information for this document.

6.1 References

Department of Planning and Environment (DPE) (2015), Guidelines for the Preparation of Extraction Plans V5.

Douglas Partners (2019), Report on Geotechnical Assessment, Extraction Plan Longwall West 1 and West 2, prepared for Tahmoor Coal.

EMM Consulting (2019), Tahmoor Mine Extraction Plan: Longwalls West 1 - West 2 - Historical Heritage Technical Report, report for Tahmoor Coal.

HydroSimulations (2019), Tahmoor Mine LW W1-W2 Extraction Plan: Groundwater Technical Report, prepared for Tahmoor Coal, document HS2019-14.

Mine Subsidence Engineering Consultants (2019), Tahmoor Coking Coal Operations – Longwalls W1 and W2 Subsidence Predictions and Impact Assessments, draft report for SIMEC Mining.

NSW Department of Planning & Environment (2017), Resources Regulator, Mine Safety Operations.

SLR (2019), Tahmoor Extraction Plan LW W1-W2 Land and Agricultural Resource Assessment, prepared for Tahmoor Coal, document 630.12732-R01-v0.1.

6.2 Glossary of Terms

The Extraction Plan Main Document provides a compiles Glossary of Terms in **Section 8.3**.

6.3 Abbreviations

Abbreviations used in this document are provided below in **Table 6-1**.

Table 6-1 Abbreviations

Abbreviation	Definition
ARTC	Australian Rail Track Corporation
BFMP	Built Features Management Plan
CICL	Cast Iron Concrete Lined
DICL	Ductile Iron Concrete Lined
DPE	NSW Department of Planning and Environment
GFG	GFG Alliance
km	Kilometre/s
LW	longwall
LW W1	Longwall West 1
LW W1-W2	Longwalls West 1 to West 2

Abbreviation	Definition
LW W2	Longwall West 2
LW W3-W4	Longwalls West 3 to West 4
LW W4	Longwall West 4
m	Metre/s
mm	Millimetre/s
ML	Mining Lease
NSW	New South Wales
PCBU	Persons conducting a business or undertaking
PSMP	Property Subsidence Management Plan
QVMH	Queen Victoria Memorial Home
ROM	run of mine
SIMEC	SIMEC Mining Division
SMP	Subsidence Management Plan
Tahmoor Mine	Tahmoor Coal Mine
TCCO	Tahmoor Coking Coal Operations
THNSW	Transport Heritage NSW
uPVC	Unplasticised polyvinyl chloride
WTP	Wastewater Treatment Plant

6.4 Change Information

Table 6-2 provides the details of document history of this BFMP.

Table 6-2 Document History

Version	Date Reviewed	Reviewed By	Change Summary
1.0	July 2019	Ron Bush	New document