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SIMEC Mining:

Tahmoor North Western Domain Longwalls West 3 and West 4

Management Plan for Potential Impacts to Built Structures

AUTHORISATION OF MANAGEMENT PLAN

Authorised on behalf of Tahmoor Coal:
Name: Zina Ainsworth
Signature: 
Position: Environment and Community Manager
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References:

AS/NZS 4360:2004	Risk Management
AS/NZS ISO 31000:2009	Risk Management – Principles and guidelines
MSO (2017)	Managing risks of subsidence – Guide | WHS (Mines and Petroleum Sites) Legislation, NSW Department of Planning & Environment, Resources Regulator, Mine Safety Operations, February 2017.
MSEC (2021)	Tahmoor Coal - Longwalls W3 and W4 - Subsidence Predictions and Impact Assessments for Natural and Built Features due to the extraction of the proposed Longwalls W3 and W4 in support of the Extraction Plan Application. (Report No. MSEC1112, Revision A, March 2021), prepared by Mine Subsidence Engineering Consultants.
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Douglas Partners (2019a)	Report on Geotechnical Assessment Longwalls W1 and W2, Picton, Douglas Partners, Report No. 89541.00, July 2019.
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Douglas Partners (2021a)	Report on Geotechnical Assessment Longwalls W3 and W4, Picton, Douglas Partners, Report No. 89541.06, March 2021.
Douglas Partners (2021b)	Detailed Assessment of Nominated Farm Dams Longwalls W3 and W4, Picton, Douglas Partners, Report No. 89541.07, August 2021.

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Drawing No.	***Description***	***Revision***
MSEC1173-00-01	Monitoring over LW W3-W4	02
MSEC1173-12-01	Structures	A

1.1. Background

Tahmoor Coal owns and operates Tahmoor Mine, an existing underground coal mine that is located approximately 80 km south-west of Sydney in the Southern Coalfield of NSW. Tahmoor Coal is a wholly owned entity within the SIMEC Mining Division of the GFG Alliance group. Tahmoor Coal has previously mined 34 longwalls to the north and west of the mine's current location.

Longwalls West 1 and West 2 (LW W1-W2) were the first two longwalls to be mined in the Western Domain, located northwest of the Main Southern Railway, and between the townships of Thirlmere and Picton. LW W1 and LW W2 have completed extraction.

Longwalls West 3 and West 4 (LW W3-W4) are the final two longwalls to be mined in the Western Domain and are shown in Fig. 1.1. A small number of structures are located directly above LW W3-W4.

A summary of the dimensions of LW W3-W4 is provided in Table 1.1. The longwalls will be extracted from the north towards the south.

Table 1.1 Longwall dimensions

Longwall	Overall void length including the installation heading (m)	Overall void width including the first workings (m)	Overall tailgate chain pillar width (m)
LW W3	1552	283	39
LW W4	1004	285	44

The depths of cover directly above LW W3-W4 vary between a minimum of 470 m above the commencing end of LW W3 and a maximum of 560 m on the eastern edge of LW W3 near the commencing end of LW W4. The longwalls will mine a constant height of 2.1 m.

This Management Plan provides detailed information about how the risks associated with the mining of LW W3-W4 beneath and adjacent to structures will be managed by Tahmoor Coal, taking into account the experiences gained during the mining of Longwalls 22 to 32 and LW W1-W2. The Management Plan is a live document that can be amended at any stage of mining.

Fig. 1.1 Orthophotograph showing proposed longwalls and the Study Area

1.2. Objectives

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

The objectives of the Management Plan have been developed to:

- ensure the safety and serviceability of all building structures and infrastructure. Public safety is paramount. Ensure that the health and safety of people who may be present in structures are not put at risk due to mine subsidence;
- avoid disruption and inconvenience, or, if unavoidable, keep to minimal levels;
- monitor ground movements and the conditions of building structures and associated infrastructure during mining;
- establish procedures to measure, monitor, control, mitigate and repair building structures and associated infrastructure;
- initiate and coordinate action to mitigate or remedy potential significant impacts that are expected to occur to the building structures;
- provide a plan of action in the event that the impacts of mine subsidence are greater than those that are predicted;
- 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 serious injury or illness to a person or persons at the properties that may require emergency evacuation, entry restriction or suspension of work activities;
- provide a forum to report, discuss and record impacts to the surface. This will involve Tahmoor Coal, the affected landowner and/or resident, relevant government agencies and consultants, as required; and
- establish lines of communication and emergency contacts.

1.3. Scope

The Management Plan is to be used to protect and monitor the condition of structures identified such that the health and safety of people who may be present at structures are not put at risk due to mine subsidence. The major items at risk are:

- residential establishments;
- non-residential structures; and
- commercial establishments.

There are no industrial establishments within the Study Area for LW W3-W4.

The locations of the structures near LW W3-W4 are shown in Drawing No. MSEC1173-12-01, in Appendix A.

This Management Plan describes measures that will be undertaken due to the mining LW W3-W4 only.

Separate management plans have been or will be developed for the following structures:

- structures owned by owners of services infrastructure, such as bridges, culverts and sewage pumping stations;
- structures associated with the Stonequarry Estate wastewater treatment plant; and
- heritage structures at 796 Thirlmere Way.

1.4. Limitations

This Management Plan is based on the predictions of the effects of mining on surface infrastructure as provided in Report No. MSEC1112 by Mine Subsidence Engineering Consultants (MSEC, 2021). Predictions are based on the planned configuration of LW W3-W4 at Tahmoor (as shown in Drawing No. MSEC1173-12-01), along with available geological information and data from numerous subsidence studies for longwalls previously mined in the area.

The structures and infrastructure considered in this Management Plan have been identified from aerial photographs, site visits and from discussions between Tahmoor Coal and property owners.

The impacts of mining on the building structures and associated infrastructure have been assessed in detail. It is recognised, however, that the prediction and assessment of subsidence can be relied upon only to a certain extent. The limitations of the prediction and assessment of mine subsidence are discussed in report MSEC1112 by Mine Subsidence Engineering Consultants.

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

1.5. Descriptions of the structures

The *Study Area* for the purpose of this management plan has been defined as the surface area that is located within the predicted limit of vertical subsidence, taken as the predicted 20 mm subsidence contour due to the extraction of LW W3-24 or the 35 degree angle of draw, whichever is the greatest. The *Study Area* for LW W3-W4 is shown in Drawing No. MSEC1173-12-01, in Appendix A.

The building structures and associated infrastructure that are located within the Study Area include: houses, rural structures, public utilities and commercial establishments. A summary of the structures located within the Study Area for LW W3-W4 is provided in Table 1.2.

Table 1.2 Structures located within the Study Area for LW W3-W4

Type	Number of structures		
	Above LW W3-W4	Outside LW W3-W4	Total within Study Area
Houses	1	68	69
Rural structures	4	192	196
Swimming pools	0	16	16
Public utilities	13	2	15
Commercial	0	4	4
All structures	**18**	**282**	**300**

A total of 300 structures are located within the Study Area, of which, 18 structures are located directly above LW W3-W4. There is one house located directly above LW W3 and no houses located directly above LW W4. The house above LW W3 is derelict and not habitable. The owner plans to demolish the house in the near future and has constructed fencing around it. The houses located within the Study Area and outside of the proposed longwalls are predominately located within the Stonequarry Estate, directly above the previously extracted LW W1, and between LW W1 and the Picton-Mittagong Loop Line.

1.6. Proposed mining schedule

It is planned that LW W3-W4 will extract coal working south from the northern ends. This Management Plan covers longwall mining until completion of mining in LW W4 and for sufficient time thereafter to allow for completion of subsidence effects. The current schedule of mining for this longwall is shown in Table 1.3.

Table 1.3 Schedule of mining

Longwall	Start Date	Completion Date
LW W3	September 2021	March 2022
LW W4	April 2022	August 2022

Please note the above schedule is subject to change due to unforeseen impacts on mining progress.

1.7. Definition of active subsidence zone

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

This is termed the “active subsidence zone” for the purposes of this Management Plan, where surface monitoring is generally conducted. The active subsidence zone for each longwall is defined by the area bounded by the predicted 20 mm subsidence contour for the active longwall and a distance of 150 m in front and 450 m behind the active longwall face, as shown by Fig. 1.2.

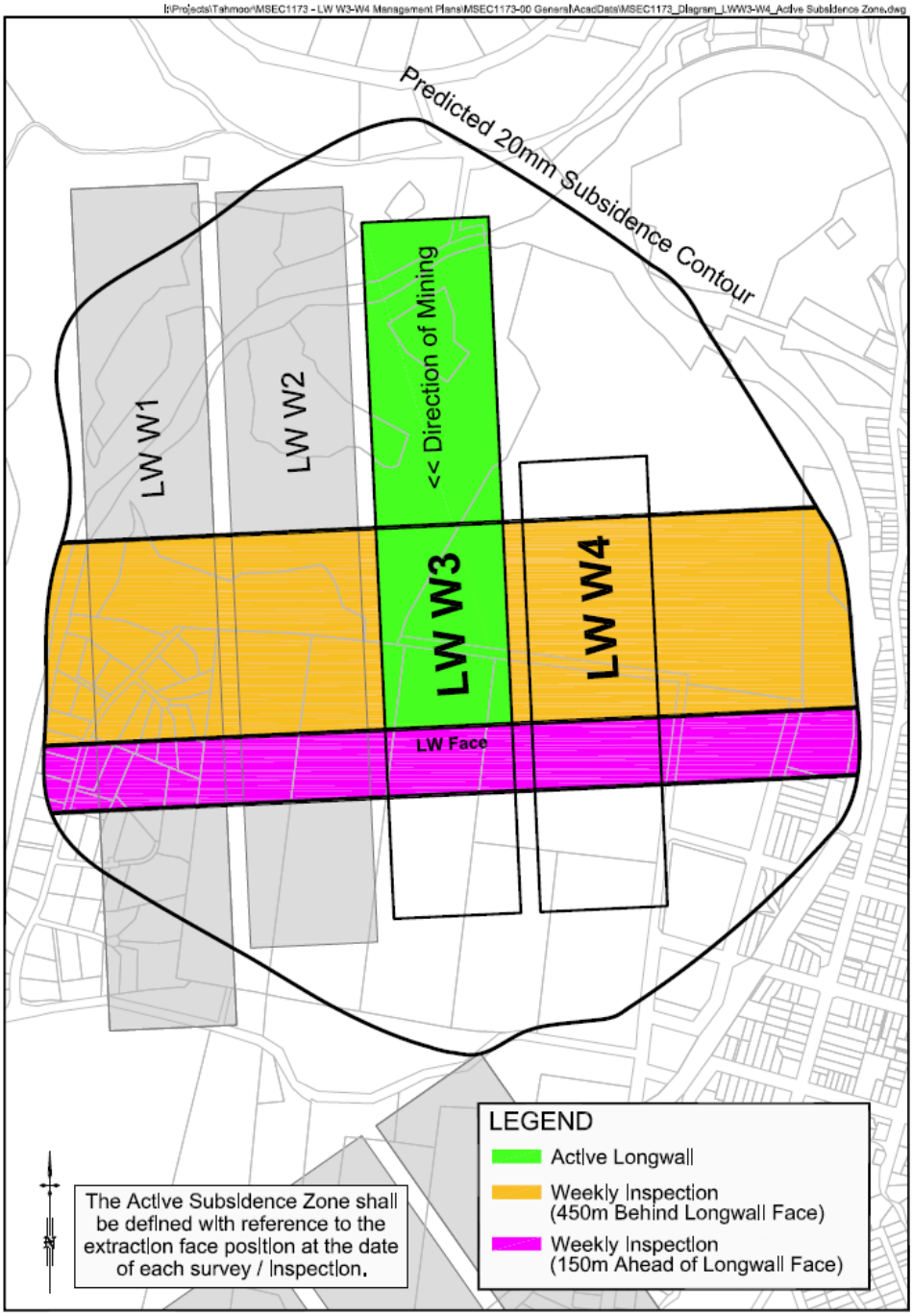


Fig. 1.2 Diagrammatic representation of the active subsidence zone

2.1. Maximum predicted conventional subsidence parameters

Predicted mining-induced conventional subsidence movements were provided in Report No. MSEC1112, which was prepared in support of Tahmoor Coal's Extraction Plan Application for LW W3-W4.

A summary of the maximum predicted incremental conventional subsidence parameters due to the extraction of LW W3-W4 is provided in Table 2.1. The incremental values represent the additional movements due to the extraction of each of the longwalls.

Table 2.1 Maximum predicted incremental conventional subsidence parameters for LW W3-W4

Longwall	Maximum predicted incremental vertical subsidence (mm)	Maximum predicted incremental tilt (mm/m)	Maximum predicted incremental hogging curvature (km^{-1})	Maximum predicted incremental sagging curvature (km^{-1})
LW W3	650	4.5	0.05	0.09
LW W4	600	4.5	0.05	0.09

A summary of the maximum predicted total conventional subsidence parameters due to the extraction of LW W3-W4 is provided in Table 2.2. The total values represent the accumulated movements due to the extraction of LW W3-W4.

Table 2.2 Maximum predicted total conventional subsidence parameters for LW W3-W4

Longwall	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km^{-1})	Maximum predicted total sagging curvature (km^{-1})
LW W3	950	5.0	0.06	0.10
LW W4	1025	5.0	0.06	0.10

2.2. Comparison of measured and predicted subsidence for LW W1-W2

Predictions using MSEC's Incremental Profile Method have been continually tested and refined during the mining of previous Longwalls 22 to 32, as described in Report No. MSEC1112.

In this case, LW W1-W2 have been extracted in a new longwall series, which is located to the north of the completed LW 32.

LW W1

Observed subsidence above single panels is typically more variable than above subsequent longwall panels in a series. The variations are due to different strengths of the overburden strata above the panel, which is supported on all four sides of the longwall.

A study on observed subsidence above previously extracted single panels at Tahmoor Mine was conducted by MSEC, with results provided in Report No. MSEC1112.

Ground surveys during the mining of LW W1 have found that subsidence has been substantially less than predicted (approximately 50%). The experience is new for Tahmoor Mine but it has been previously observed for nearby longwalls at Appin Colliery, including LW901 and the southern section of LW703.

A comparison between measured and predicted profiles of vertical subsidence along the Picton-Mittagong Loop Line are provided in Fig. 2.1 after the extraction of LW W1.

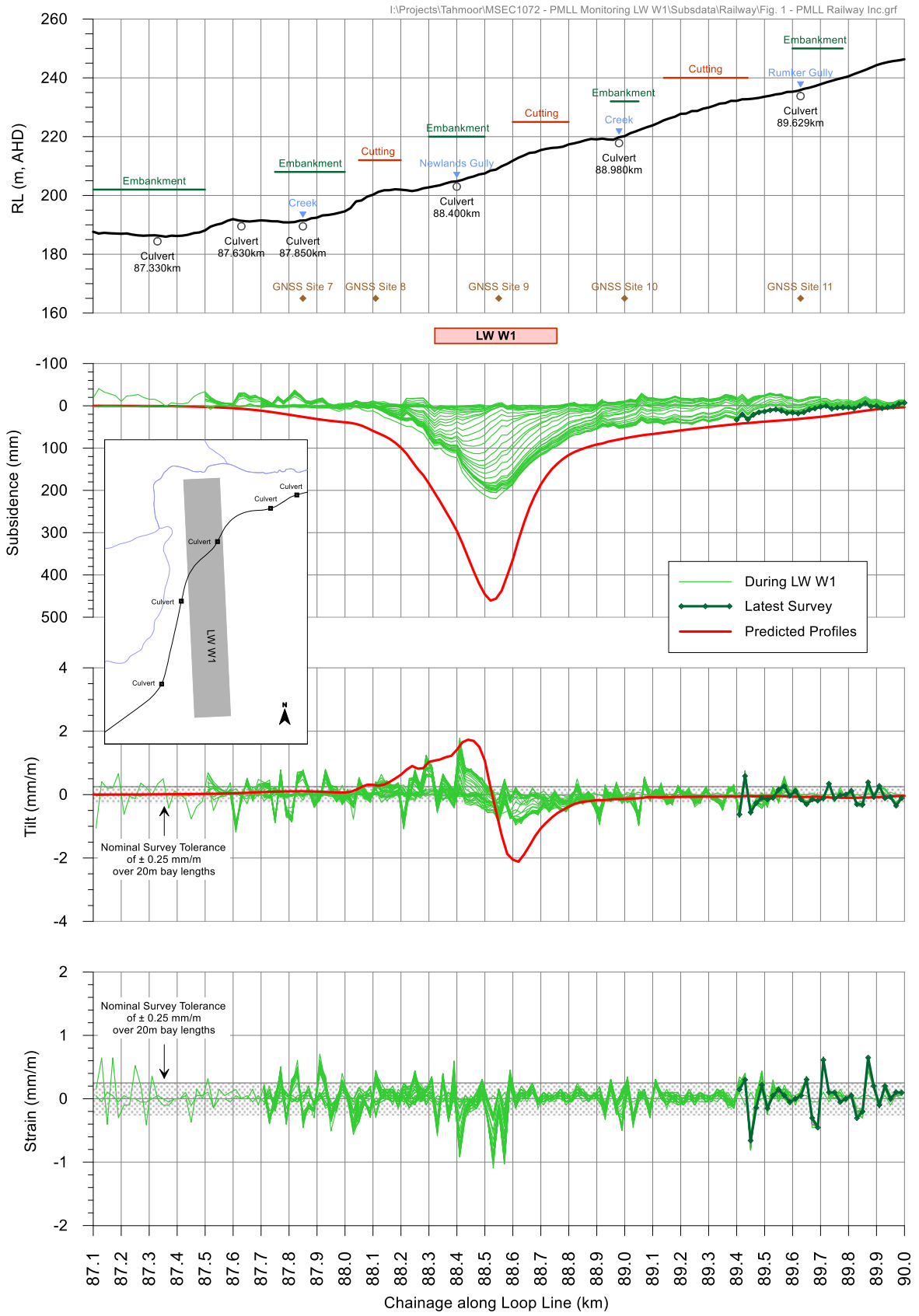


Fig. 2.1 Observed subsidence along Picton-Mittagong Loop Line during the mining of LW W1

LW W2

As of 1 June 2021, subsidence surveys above LW W2 have measured less subsidence than predicted. Observed subsidence along the Picton-Mittagong Loop Line after the extraction of LW W2 is shown in Fig. 2.2. Observed subsidence along the LW W1 W2 crossline after the extraction of LW W2 is shown in Fig. 2.3.

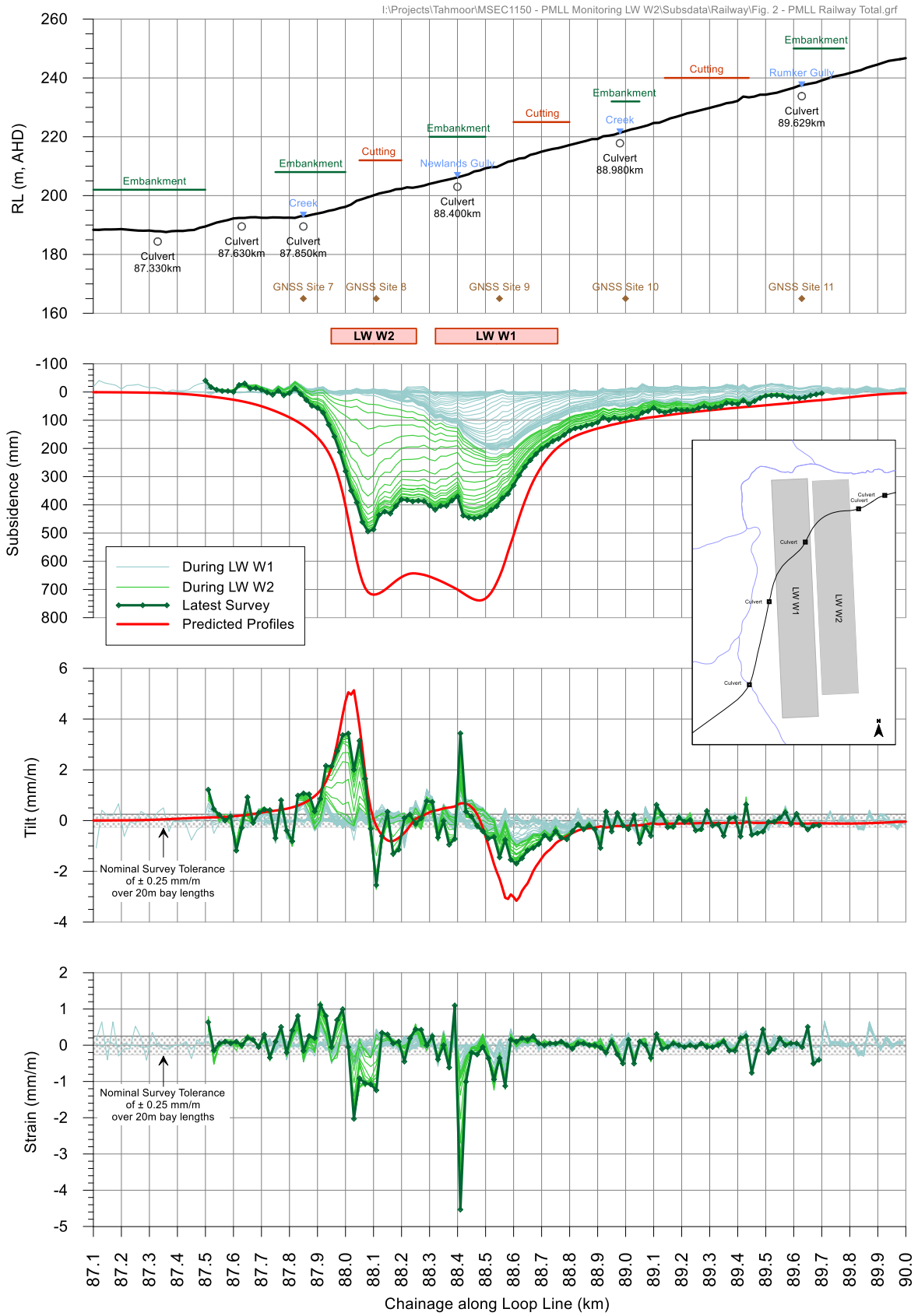


Fig. 2.2 Observed subsidence along Picton-Mittagong Loop Line during the mining of LW W1-W2

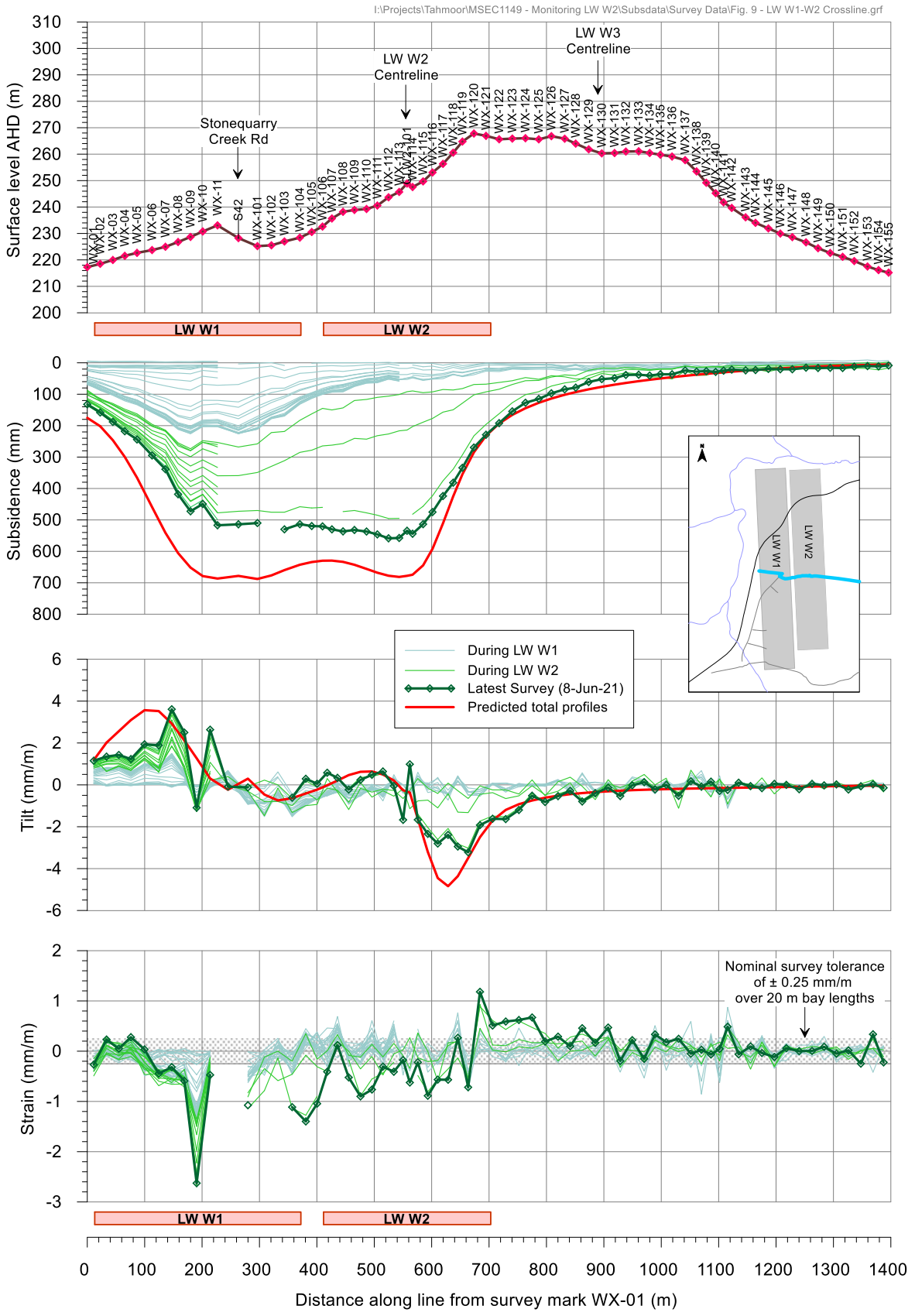


Fig. 2.3 Observed subsidence along LW W1-W2 crossline during the mining of LW W1-W2

Whilst observed subsidence above LW W1 and LW W2 was less than predicted, subsidence due to the extraction of LW W3-W4 may not follow the same pattern, and may return to normal levels. Subsidence may also be greater than predicted.

It is therefore planned to monitor the development of subsidence during the extraction of LW W3-W4 to compare observations with predictions. Measures have been developed in this Management Plan to manage potential impacts on structures, even when actual subsidence is substantially greater than the magnitudes that have been predicted above LW W3-W4.

2.3. Predicted strain

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

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

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

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

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

2.3.1. Predictions of strain above goaf

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

The survey database has been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of Longwalls 22 to 32 and LW W1 at Tahmoor Mine, for survey bays that were located directly above goaf or the chain pillars that are located between the extracted longwalls, which has been referred to as "*above goaf*".

A histogram of the maximum observed total tensile and compressive strains measured in survey bays above goaf at Tahmoor Mine is provided in Fig. 2.4. A number of probability distribution functions were fitted to the empirical data. It was found that a *Generalised Pareto Distribution (GPD)* provided a good fit to the raw strain data, and this is also shown in this figure.

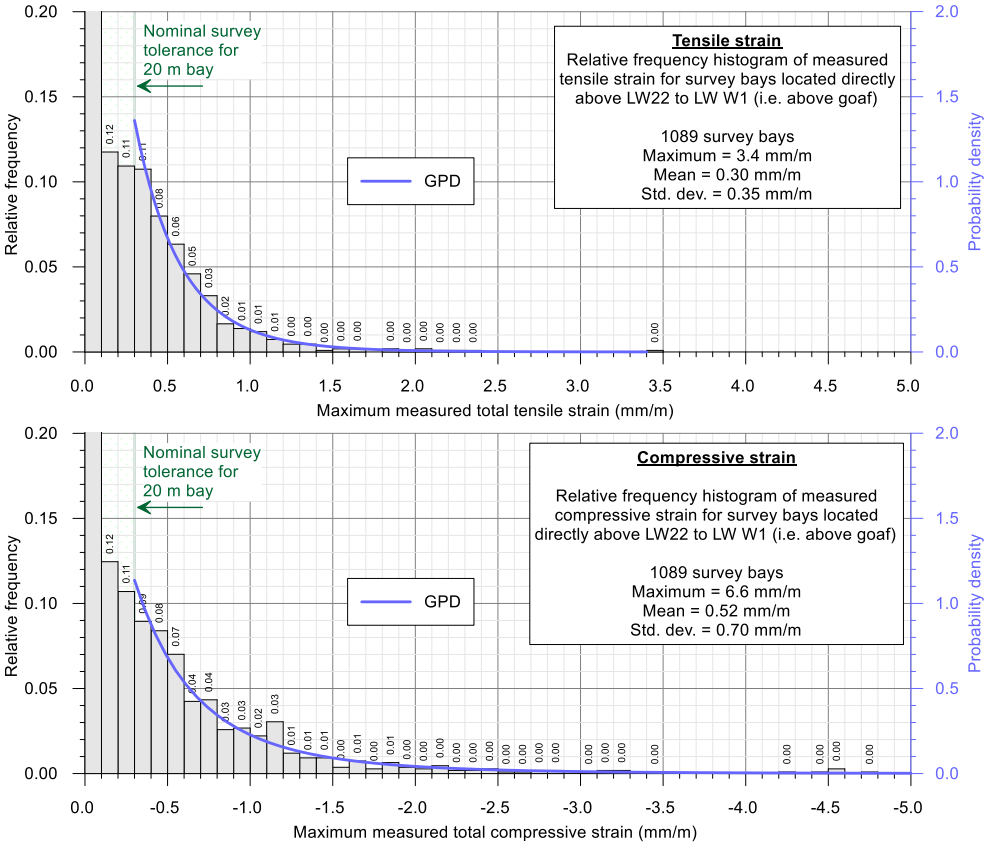


Fig. 2.4 Distributions of the maximum measured tensile and compressive strains during the extraction of previous longwalls for survey bays located above goaf

The 95 % confidence levels for the maximum total strains that the individual survey bays above goaf experienced at any time during mining were 1.0 mm/m tensile and 1.7 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays above goaf experienced at any time during mining were 1.5 mm/m tensile and 3.3 mm/m compressive.

2.3.2. Predictions of strain above solid coal

The survey database has also been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of Longwalls 22 to 32 and LW W1 at Tahmoor Mine, for survey bays that were located outside and within 250 metres of the nearest longwall goaf edge, which has been referred to as "*above solid coal*".

A histogram of the maximum observed tensile and compressive strains measured in survey bays above solid coal at Tahmoor Mine is provided in Fig. 2.5. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

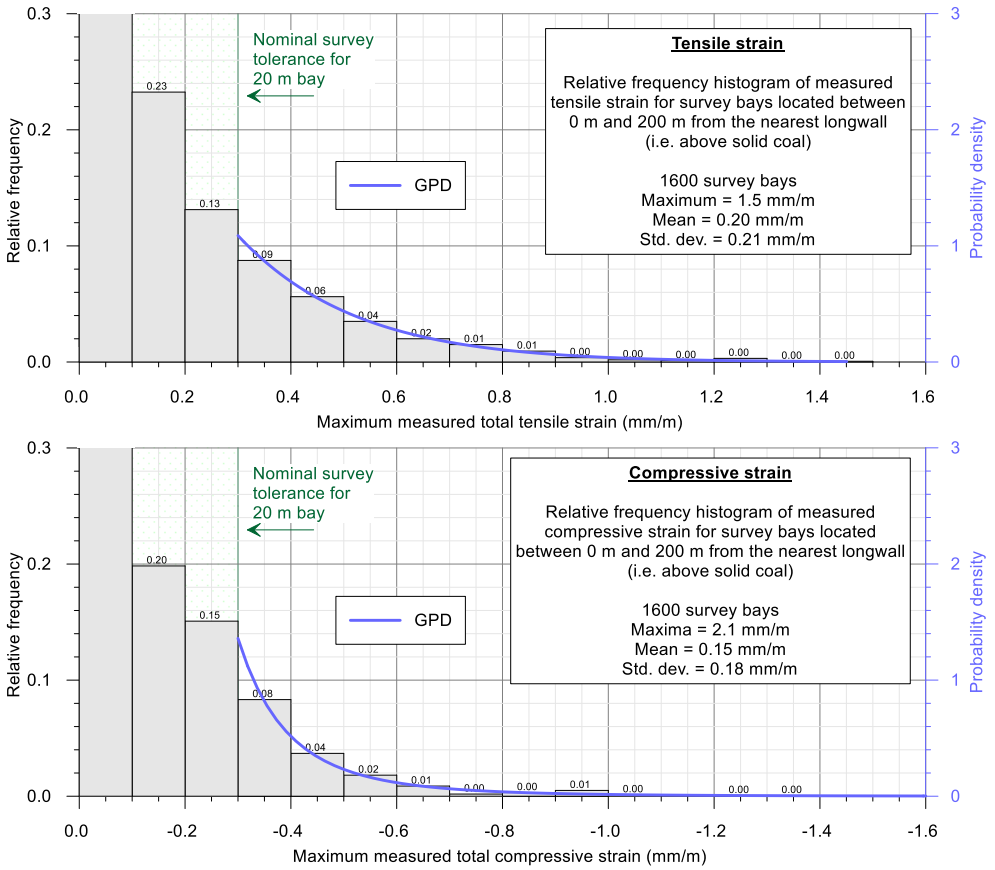


Fig. 2.5 Distributions of the maximum measured tensile and compressive strains during the extraction of previous longwalls for survey bays located above solid coal

The 95 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 0.6 mm/m tensile and 0.5 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 1.0 mm/m tensile and 0.8 mm/m compressive.

3.1. 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 & Investment Mine Safety:

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

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

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

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

Detailed guidelines have also been released by the NSW Department of Planning & 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 & 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:

1. identification and understanding of subsidence hazards;
2. assessment of risks of subsidence;
3. development and selection of risk control measures;
4. implementation and maintenance of risk control measures; and
5. continual improvement and change management.

Each of the above steps have been or will be conducted together with the following processes:

1. consultation, co-operation and co-ordination; and
2. 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 W3-W4 directly beneath and adjacent to structures in accordance with the WHS laws.

3.2. General

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

3.2.1. Consequence

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

3.2.2. Likelihood

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

3.2.3. Hazard

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

3.2.4. Method of assessment of potential mine subsidence impacts

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

[1] AS/NZS 4360:2004 – Risk Management pp2
[2] AS/NZS 4360:2004 – Risk Management pp2
[3] AS/NZS 4360:2004 – Risk Management pp2

4.1. Predicted subsidence effects for structures

Predicted mining-induced conventional subsidence movements were provided in Report No. MSEC1112, which was prepared in support of Tahmoor Coal's Extraction Plan for LW W3-W4.

A summary of the maximum predicted total subsidence parameters due to the extraction of LW W3-W4 are provided in Table 4.1.

Table 4.1 Maximum predicted conventional subsidence parameters due to the extraction of LW W3-W4 for the houses

Longwall	Maximum predicted total subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (1/km)	Maximum predicted total sagging curvature (1/km)
After LW W3	775	4.5	0.06	0.09
After LW W4	875	5.0	0.06	0.09

The maximum predicted total tilt is 5.0 mm/m (i.e. 0.5 %, or 1 in 200). The maximum predicted curvatures for these structures are 0.06 km^{-1} hogging and 0.09 km^{-1} sagging, which represent minimum radii of curvature of 17 km and 11 km, respectively.

Distributions of the predicted vertical subsidence, tilt and curvatures for the houses within the Study Area are illustrated in Fig. 4.1, Fig. 4.2 and Fig. 4.3.

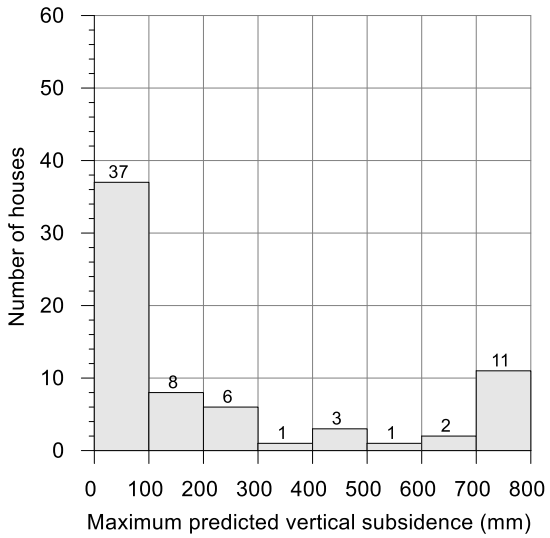


Fig. 4.1 Maximum predicted vertical subsidence for the houses

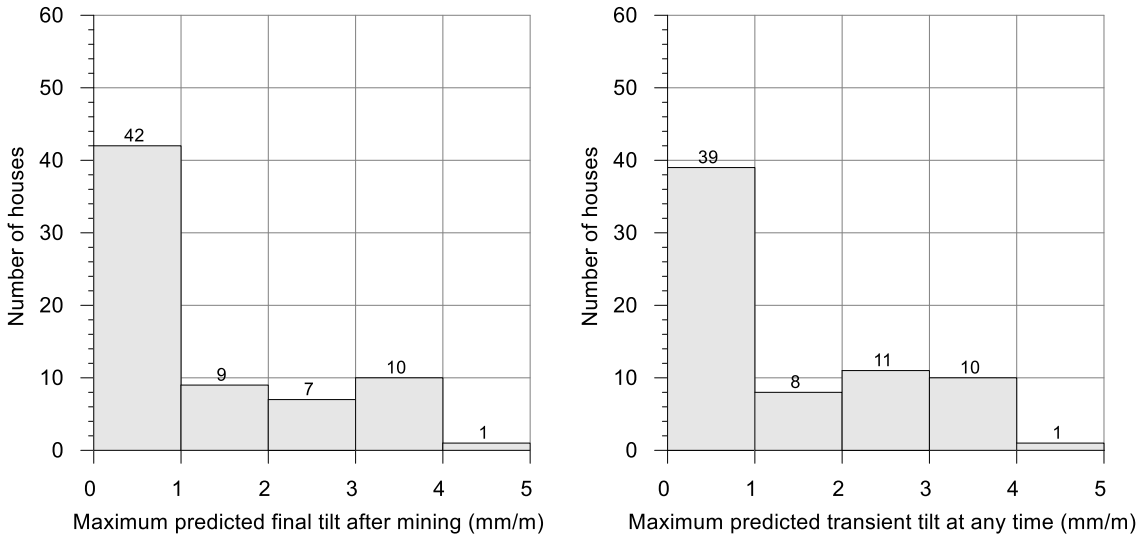


Fig. 4.2 Maximum predicted final tilt (left-side) and transient tilt (right-side) for the houses

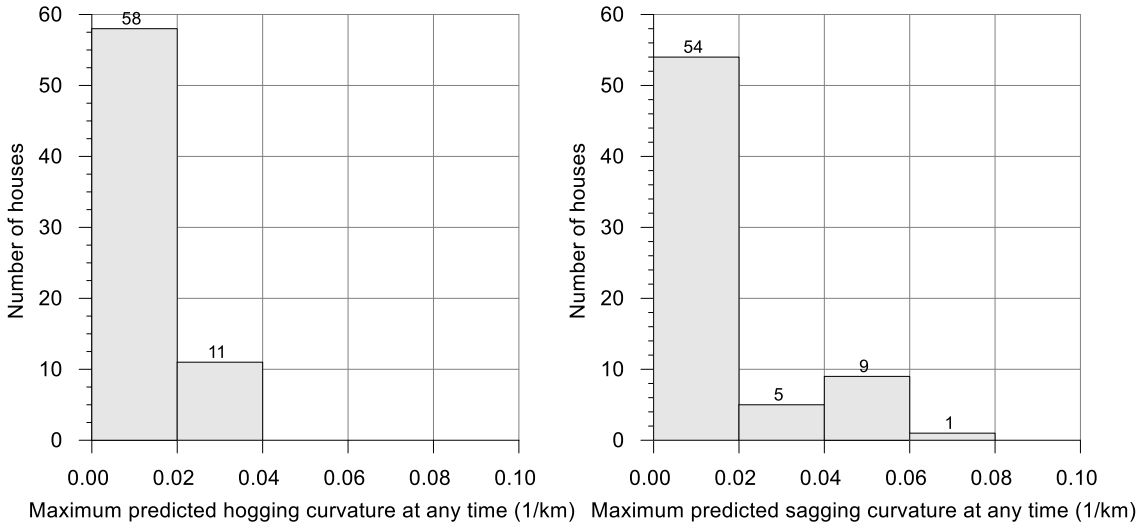


Fig. 4.3 Maximum predicted hogging curvature (left-side) and sagging curvature (right-side) at any time for the houses

The maximum predicted tilt for the houses within the Study Area is 4.8 mm/m (i.e. 0.48 %, or 1 in 210). The distribution of predicted final tilts for the houses within the Study Area is provided in Fig. 4.4. The greatest tilts occur at the uninhabitable house located directly above LW W3 and the houses located directly above previously extracted LW W1.

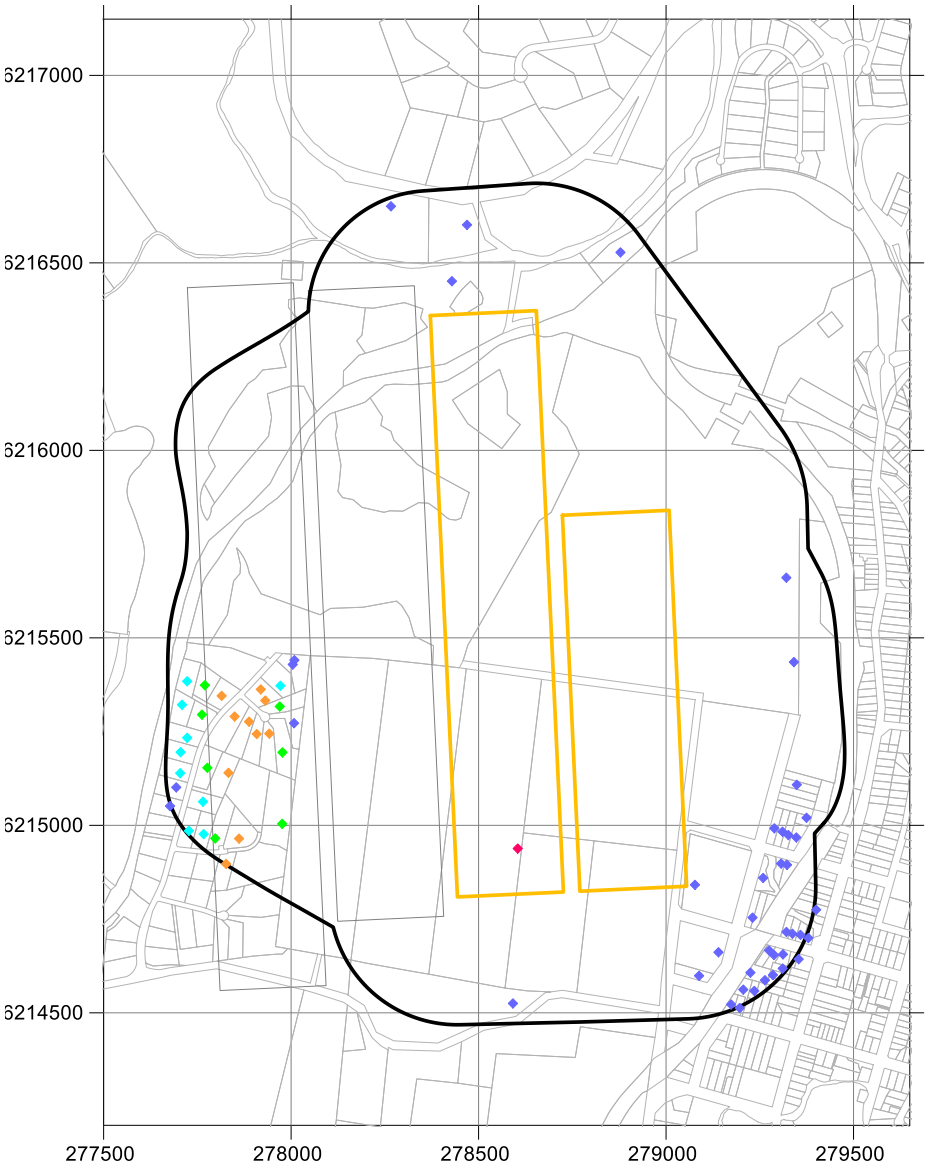


Fig. 4.4 Distribution of predicted final total tilts for the houses within the Study Area

The maximum predicted curvatures for the houses within the Study Area are 0.03 km^{-1} hogging and 0.06 km^{-1} sagging, which represent minimum radii of curvatures of 33 km and 17 km, respectively. The maximum predicted curvatures are predicted to occur at the uninhabitable house located directly above LW W3.

The distributions of the maximum predicted curvatures for the houses within the Study Area are provided in Fig. 4.5. It can be seen that the greatest predicted curvatures occur directly above LW W3 and the previously extracted LW W1.

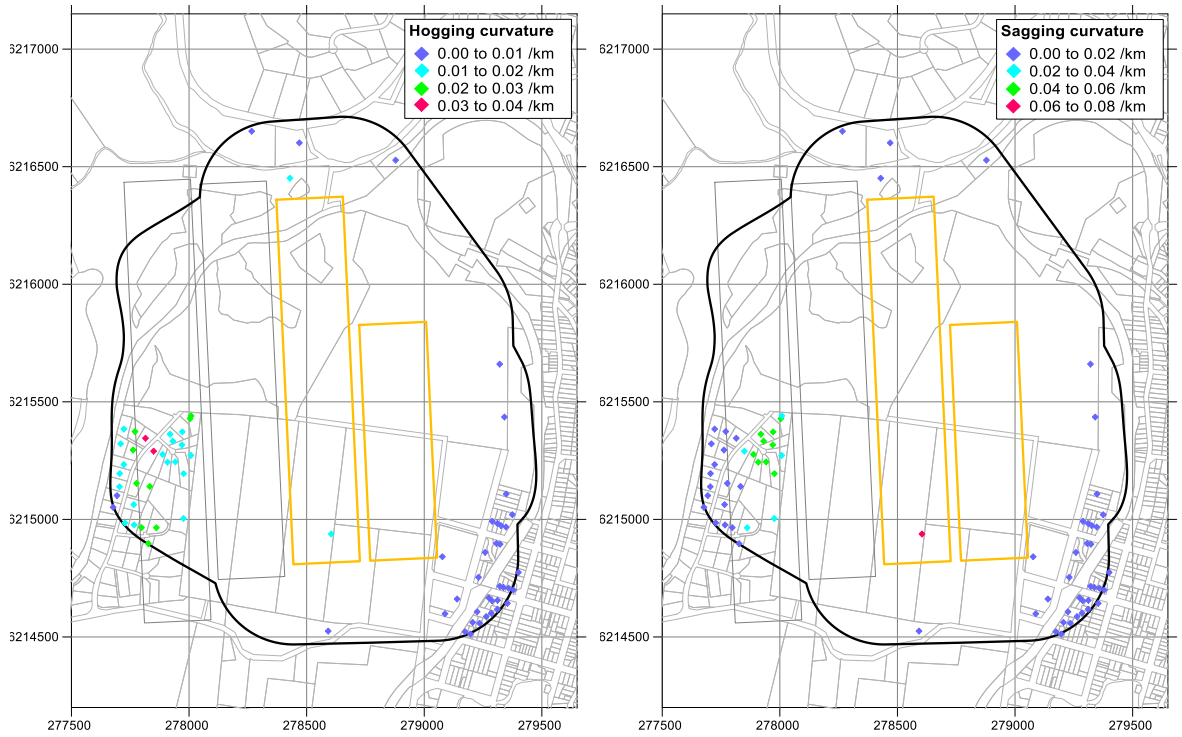


Fig. 4.5 Distributions of maximum predicted total hogging curvature (left-side) and sagging curvature (right-side) for the houses within the Study Area

The maximum predicted conventional strains for the houses, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 0.9 mm/m tensile and 1.5 mm/m compressive. Higher strains could develop at the houses due to irregular ground movements or topographic effects.

The predicted distributions of strain due to the extraction of LW W3-W4 are described in Report No. MSEC1112. The houses are at discrete locations and, therefore, the most relevant distribution of strain is the maximum strains measured in individual survey bays above previous longwall mining. The maximum predicted total strains directly above the proposed longwalls are 1.0 mm/m tensile and 1.7 mm/m compressive based on the 95 % confidence level.

The strains have been predicted for each of the houses using the method described by Barbato (2017). This method considers the position of each house relative to the longwalls, the surface slope, surface lithology and the potential for irregular anomalous movements.

The predicted total strains for each of the houses within the Study Area are provided in Report No. MSEC1112. Distributions of the predicted total strains based on the mean and on the 95 % confidence levels are provided in Fig. 4.6 and Fig. 4.7, respectively.

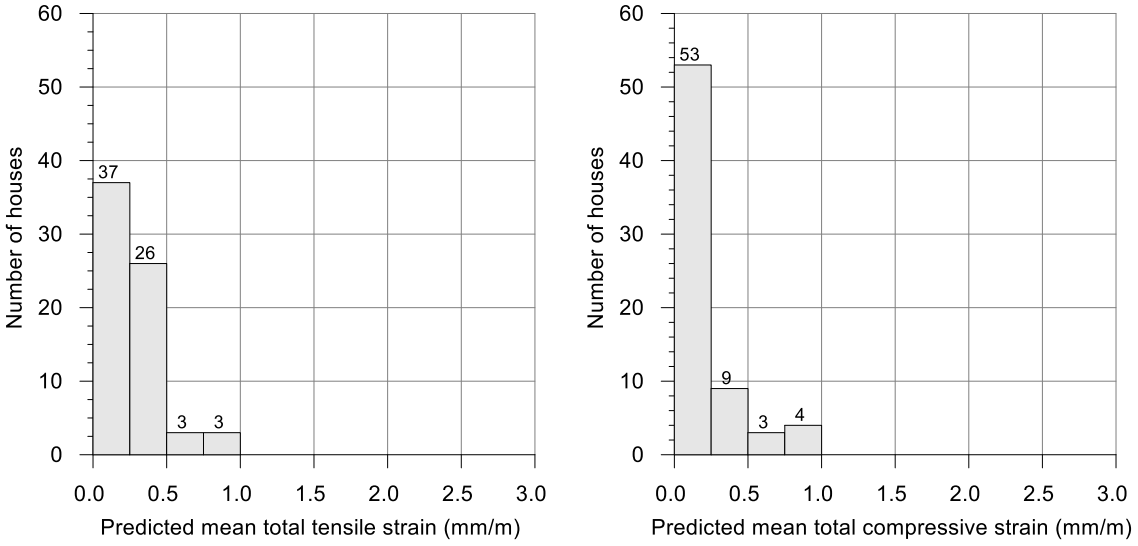


Fig. 4.6 Predicted total tensile strain (left-side) and total compressive strain (right-side) for the houses based on the mean

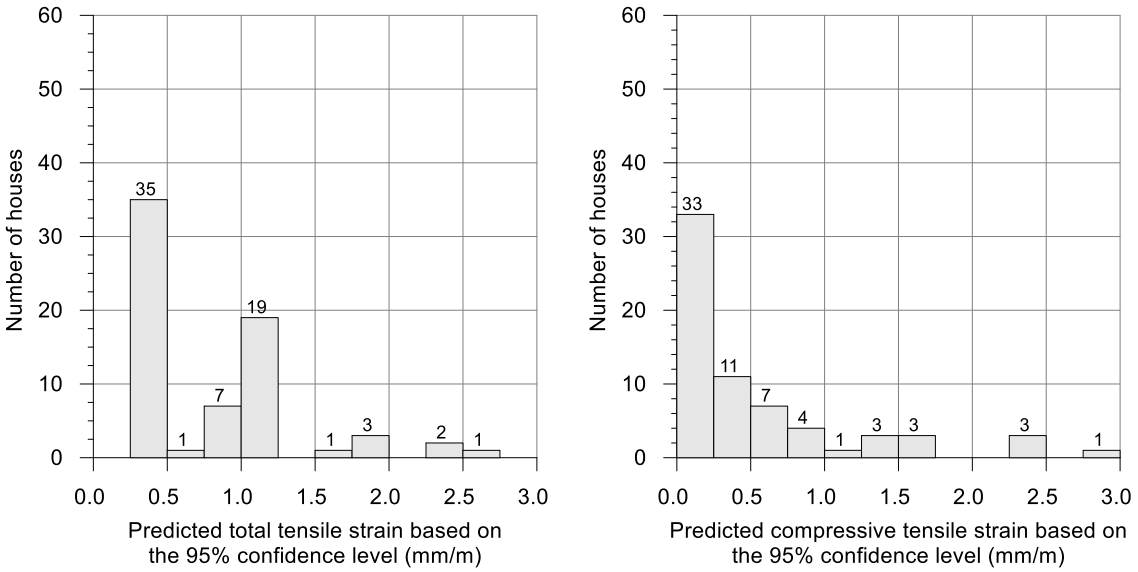


Fig. 4.7 Predicted total tensile strain (left-side) and total compressive strain (right-side) for the houses based on the 95 % confidence level

The houses within the Study Area are predicted to experience total tensile strains between 0.3 mm/m and 1.7 mm/m and total compressive strains between 0.2 mm/m and 2.4 mm/m based on the 95 % confidence levels. The predicted mean values range between 0.2 mm/m and 0.7 mm/m tensile and compressive.

5.1. Experience of mining beneath structures

There is extensive experience of mining beneath building structures at Tahmoor, as well as other mines elsewhere in the Southern Coalfield.

More than 2000 houses, public amenities and commercial and business establishments have experienced subsidence movements at Tahmoor, during the mining of Longwalls 22 to 32 and LW W1-W2. The following observations have been made based on the experiences of mining beneath building structures in the Southern Coalfield:

- Mine subsidence has not directly exposed residents to any immediate or sudden safety hazards;
- Subsidence Advisory NSW (SA NSW) had received 547 claims from individual properties (not including refused claims), at the completion of Longwall 30, of which, 489 claims included impacts to main structures. The remaining 58 claims related solely to damage to small improvements such as swimming pools, sheds and pavements;
- The overall claim rate at the completion of Longwall 30 is 489 out of 1955 main structures, or 25 %. In other words, no impacts have been reported for 75 % of the main structures;
- The rate of impact for structures located directly above the longwalls is greater than that based on all structures located within the predicted limit of vertical subsidence. There are 1190 houses, commercial and business establishments and public amenities located directly above Longwalls 22 to 27 (or the pillars between them). A total of 385 claims have been made from this subset, which represents a claim rate of 32 % for structures that are located above goaf;
- A similar rate of impact has been observed for houses that have been located directly above LW W1-W2. Of the 26 houses located directly above or immediately adjacent to LW W1-W2, 14 properties have reported impacts, of which 8 relate to damage to the house. This represents a claim rate of 27% for structures that are located above goaf. The impacts to the houses have been very slight to minor and all houses have remained safe and serviceable.

5.2. Managing public safety

The primary risk associated with mining beneath structures is public safety. Tahmoor Coal has previously directly mined beneath or adjacent to more than 2000 houses and civil structures, commercial and retail properties, the Main Southern Railway and local roads and bridges. Tahmoor Coal has implemented extensive measures prior to, during and after mining to ensure that the health and safety of people have not been put at risk due to mine subsidence. People have not been exposed to immediate and sudden safety hazards as a result of impacts that have occurred due to mine subsidence movements.

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 repair the structure.

The potential for impacts on public safety has been assessed on a case by case basis. The assessments include inspections by a structural engineer. The findings of the assessments are described in this Management Plan in the sections below.

5.2.1. Subsidence impact management process

Tahmoor Coal has developed a *risk management process* to manage potential impacts on structures due to the extraction of LW W3-W4. This plan has been developed based on the experience of mining beneath and adjacent to structures during the extraction of Longwalls 22 to 32 and LW W1-W2. This management process has been reviewed and updated based on continuing experiences gained from the mining of longwalls at Tahmoor Mine.

The risk management process for LW W3-W4 includes the following processes, which are illustrated in the flowchart in Fig. 5.1:

1. Regular consultation, cooperation and coordination with the community before, during and after mining as described in Section 6.3. 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;
2. 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). 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;

   In the case of LW W3-W4, site-specific investigations have been completed for all houses within the predicted limit of subsidence for LW W3 and most of the houses within the predicted limit of subsidence for LW W4.

   As a general rule, site-specific investigations are undertaken before the longwall face approaches to within 300 m of travel prior to directly mining beneath each property. 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.

   Site-specific investigations include the following:

   a) At the time of preparing Report No. MSEC1112 (2021) in support of Tahmoor Coal's Extraction Plan Application, structures were identified from aerial photographs, with structure types identified from kerbside inspections;

   b) 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 LW W3-W4. The purpose of the inspections was to identify hazards where access has not been granted by the landowner.

      In some cases, particularly in semi-rural and rural areas, it was difficult to inspect a structure that is remote from the street front. Where these cases involve properties that are located directly above LW W3-W4, Tahmoor Coal requested access to conduct a pre-mining inspection and hazard identification inspection by a structural engineer;

   c) Tahmoor Coal requested 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 LW W3-W4 (refer Section 5.3.1). ;

   d) Tahmoor Coal requested 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 they may be more sensitive to mine subsidence movements due to the extraction of LW W3-W4. These include:

      i) Commercial and business establishments, public amenities and public utilities that are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of LW W3-W4 (refer to Sections 5.11 and 5.12);

      ii) Structures of heritage significance that are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of LW W3-W4 (refer Section 5.3.3);

      iii) Structures that are located above hidden creeks that are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of LW W3-W4 (refer Section 5.3.4);

      iv) Structures that are located above mapped geological structures that are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of LW W3-W4;

      v) Structures that are located on or adjacent to steep slopes or that have been recommended for inspection by a geotechnical engineer;

      vi) Structures that have been identified as being potentially unstable or unsafe by landowners (Item 1), or from the front of house inspections (Item 2b);

      vii) 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 (refer Section 5.3.6).

3. Implementation of mitigation measures following inspections by the geotechnical engineer and the structural engineer, in consultation and agreement with the landowner. These will be implemented before the longwall face approaches to within 100 m of travel prior to directly mining beneath each property;
4. Surveys and inspections during mining within the active subsidence area (refer Table 6.1 for timing and frequencies):
    i) detailed visual inspections and vehicle-based inspections along the streets;
    ii) ground surveys along the streets;
    iii) baseline ground surveys of pegs installed around semi-rural and rural houses that are remote from local streets and located directly above LW W3-W4, or where requested by a landowner;
    iv) 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;
    v) 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;
    vi) visual inspections of pool fences and gates; and
    vii) visual inspections of commercial establishments and public utilities.

The *subsidence impact management process* has been developed in consideration of the following facts and observations:

1. Australian standards have been available for use in the design of structures since 1948. The majority of structures at Tahmoor and Thirlmere (approximately 80 %) have been constructed after the declaration of the Bargo Mine Subsidence District in November 1975;
2. There is sufficient redundancy in structural design such that ductile deformation will develop and be noticeable to residents before structural failure occurs;
3. Subsidence movements develop gradually over time at Tahmoor as they have above other previously extracted longwalls at similar depths of cover;
4. Experiences during the mining of Longwalls 22 to 32 and LW W1-W2 have found that the most effective method of managing potential impacts on the safety and serviceability of structures are by way of community consultation. Residents living within the active subsidence zone have often provided early feedback to Tahmoor Coal and/or SA NSW about impacts developing at their houses or along their local roads. Contact is made well before impacts develop to a level of severity sufficient to become a safety hazard;
5. On the basis of the above, there is sufficient time for residents to notify Tahmoor Coal or SA NSW of significant displacement or deflection well before structural failure will occur; and
6. The conclusions are supported by the observation that residents have not been exposed to immediate and sudden safety hazards as a result of impacts that occur due to mine subsidence movements at Tahmoor and above other previously extracted longwalls at similar depths of cover. This includes the recent experience at Tahmoor during the mining of Longwalls 22 to 32 and LW W1-W2, which have subsided more than 2000 houses and civil structures.

    While severe impacts have developed during the mining of Longwalls 22 to 32, there is sufficient redundancy in structural design such that when structures have experienced severe impacts, they have developed gradually with ample time for residents to notify Tahmoor Coal or SA NSW to repair the structure and/or relocate residents before structural failure occurs. This conclusion is supported by structural engineer John Matheson & Associates (JMA, 2014).

While the three most important factors in managing risks to public safety are redundancy in structural design, gradual development of subsidence movements and an effective community consultation program, a number of additional management measures have been or will be undertaken including: site-specific investigations, regular surveys and inspections during mining and triggered response measures as detailed in this Management Plan.

A flowchart illustrating the subsidence impact management process prior to, during and after each structure potentially experiencing mine subsidence movements is shown in Fig. 5.1.

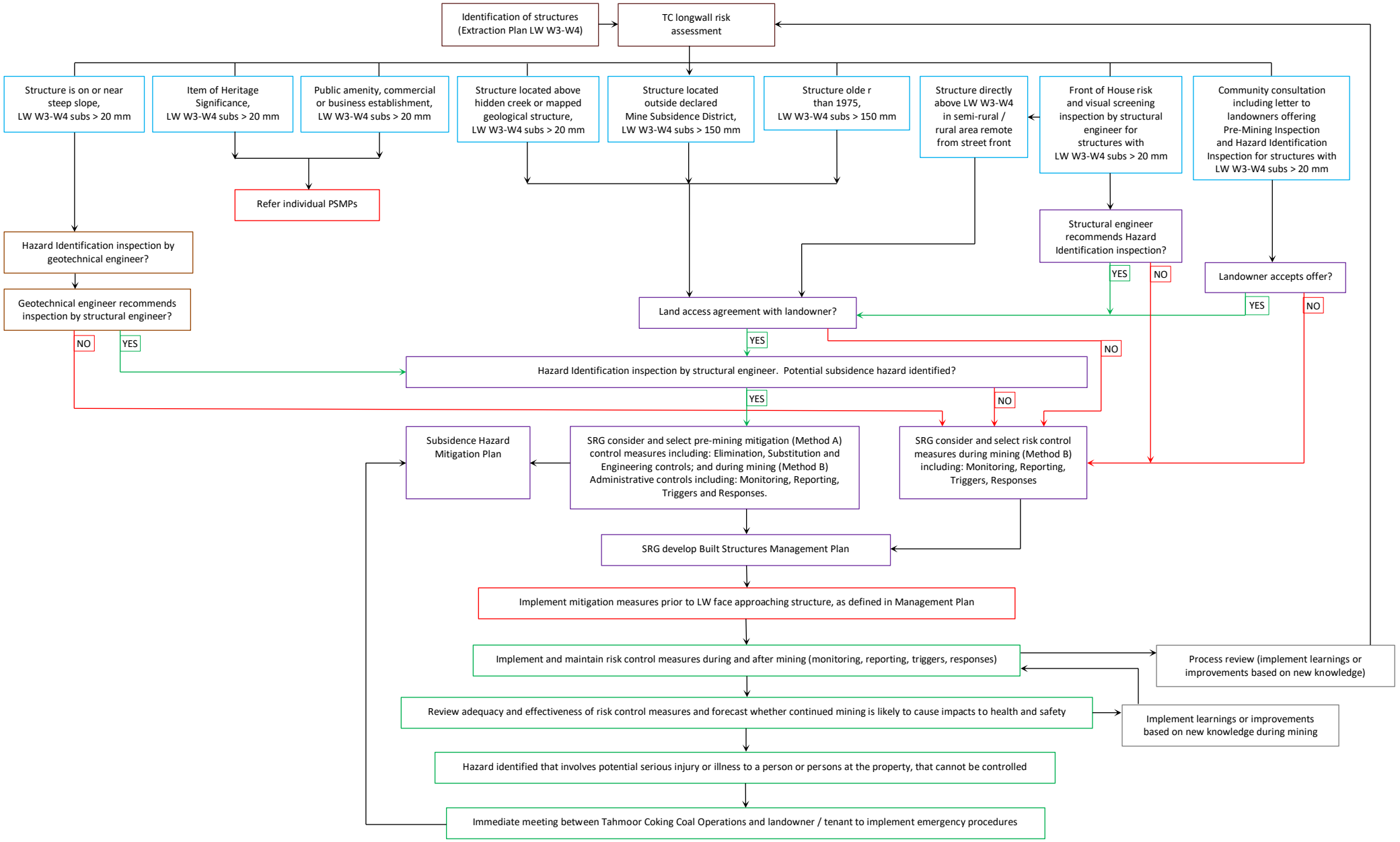


Fig. 5.1 Flowchart for subsidence impact management process for built structures

5.3. Residential structures

A total of 69 houses are located within the Study Area for LW W3-W4, of which one derelict, uninhabitable house is located directly above LW W3. No houses are located directly above LW W4.

Tahmoor Coal has and will continue to 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 they may be more sensitive to mine subsidence movements due to the extraction of LW W3-W4, including those outlined in the following sections.

5.3.1. Structures on steep slopes

A steep slope has been defined in this management plan as an area of land having a natural gradient greater than 1 in 3 (i.e. a grade of 33 %, or an angle to the horizontal of 18°). The areas with steep slopes were determined from 1 m surface level contours generated from an airborne laser scan of the area and are shown in Report No. MSEC1112 (MSEC, 2021).

Areas with natural steep slopes have been identified above LW W3-W4. The steep slopes are associated with small ridgelines and along the creaks and drainage lines. There are also artificial steep slopes along the alignments of the roads and railway.

An analysis of the LiDAR survey has also identified steep slopes that have been constructed, such as dam walls, embankments and cutting faces. In some cases, retaining walls have been cut into the side of a natural slope with a gradient that is less than 1 in 3 but the analysis has identified a “steep slope” due to the presence of the retaining walls. There are no structures located near cliffs.

A total of 30 structures within the Study Area have been built on or near steep slopes. A summary of these structures is provided in Table 5.1 and their locations are shown in Fig. 5.2.

Table 5.1 Structures and dams within the Study Area that are located on or near steep slopes

Structure Type	Description	No.
H	Houses	7
P	Pool	1
R	Rural structures	14
PU	Public Utilities	8
	Total	**30**

Hazard identification inspections have been conducted by geotechnical engineer Douglas Partners at the identified properties, where access has been provided by the landowner.

It is possible, though unlikely, that tension cracks may form at the top of the slope and these may coincide with some houses and cause additional impacts to them. It is considered extremely unlikely that the houses would be severely damaged due to large-scale slope failure. No impacts have been observed to steep slopes during the mining of Longwalls 22 to 32 and LW W1-W2, including steep slopes on the banks of Myrtle Creek and along the Redbank Range, and steep slopes within Stonequarry Estate.

5.3.2. Structures that are located above mapped geological structures

LW W3-W4 are located adjacent to the Nepean Fault Complex. Mapped geological structures associated with the Nepean Fault are shown in Drawing No. MSEC1173-12-01. As shown in the drawing, a small number of houses are located directly above and in between mapped geological structures.

It is possible, though unlikely, that houses will experience increased differential movements due to the response of the Nepean Fault Complex to the proposed extraction of LW W3-W4. It is considered extremely unlikely that the houses would be severely damaged due to their offset distances to the longwalls.

Hazard identification inspections have been conducted by geotechnical engineer Douglas Partners at the identified properties at the identified properties, where access has been provided by the landowner. Hazard identification inspections have been conducted by structural engineer JMA Solutions at the identified properties, with the exception of a small number near the corner of Rumker Street and Connellan Crescent. The inspections of these houses will be completed prior to the influence of LW W4, if access is provided by the landowners.

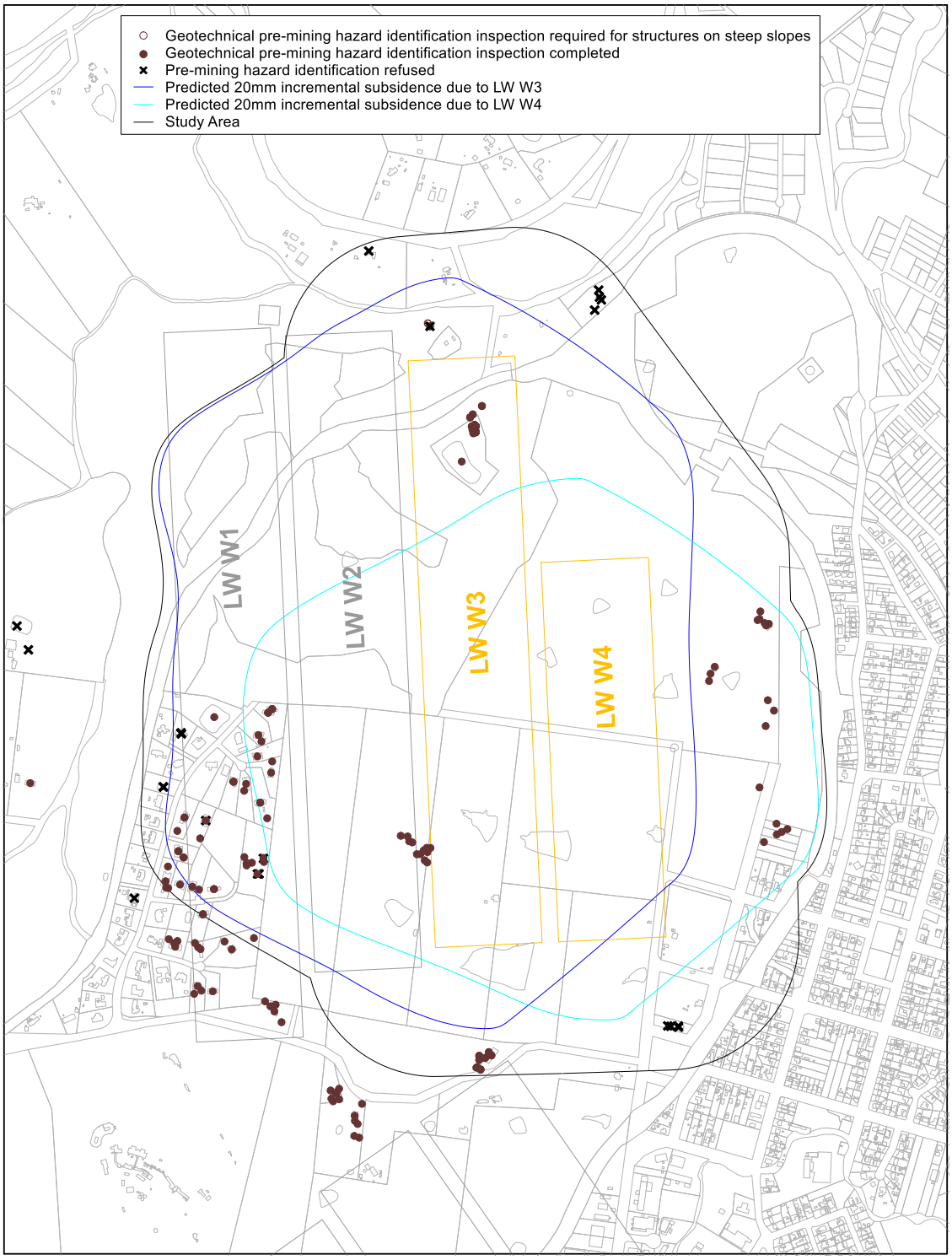


Fig. 5.2 Locations of structures on or near steep slopes

5.3.3. Structures of heritage significance

Structures within the Study Area of heritage significance are associated with a weatherboard cottage at 796 Thirlmere Way. A separate management plan will be developed for this property prior to the influence of LW W4 (the property will not be influenced by the extraction of LW W3).

5.3.4. Structures above 'hidden' creeks

No houses within the Study Area have been identified as being directly above a 'hidden' creek.

5.3.5. Houses prone to flooding or inundation

Flood modelling has been undertaken by WRM based on the existing topography as surveyed by LiDAR and predicted subsidence movements due to the extraction of the proposed longwalls WRM (2019).

The study found that flows are generally contained within the channels of Matthews Creek, Cedar Creek and Stonequarry Creek within the Study Area. The crest of Barkers Lodge Road may be overtopped during a Probable Maximum Flood (PMF) event. The subsidence resulting from the mining of the proposed LW W1-W2 results in a negligible change in flood levels, flow velocities and flood extent within the catchment area (WRM, 2019).

There are no houses located below the flood level for a 1% AEP event (1 in a 100 year).

5.3.6. Older houses and houses outside declared Mine Subsidence Districts

The Study Area is located entirely within the Picton MSD. The Picton MSD district was proclaimed in 1997 and originally encompassed properties on Stonequarry Creek Road, Carramar Close, Attunga Close and Booyong Close and parts of Thirlmere Way. The Picton MSD was expanded in 2017 and now covers all properties within the Study Area.

A total of 37 of the 69 houses (54%) within the Study Area are located within the original boundary of the Picton MSD and were constructed after the declaration of the Picton MSD in 1997. There are 30 houses within the Study Area that were constructed prior to 1997 (i.e. prior to the declaration of the Picton MSD). An additional two houses within the Study Area have been identified as having been constructed on or after the original declaration of the Picton MSD in 1997 but located outside the original boundary of the Picton MSD as declared in 1997.

28 of the houses constructed prior to the declaration of the Picton MSD are Type H1 (single storey houses with lengths of less than 30 m), three houses are Type H3 (double storey with length less than 30 m), and one house is Type H4 (double storey with length greater than 30 m). The wall construction of these houses comprise 19 brick or brick-veneer, 10 weatherboard and 3 are fibro. The footing types of these houses comprise 10 slab on ground, 8 piered footings, and 14 strip footings.

The hazard associated with these houses is that they may be less tolerant to mine subsidence movements as their designs have not been checked and approved by Subsidence Advisory NSW. Some old houses may also be in poor condition. Many of the houses are constructed with timber frames and weatherboard panels or fibro sheets.

Analysis of impacts to structures during the mining of Longwalls 22 to 25 in December 2008 did not find any significant trend between the rate of impacts and structure age.

Tahmoor Coal has conducted a hazard identification inspection for houses located outside a Mine Subsidence District or were constructed prior to declaration of the Mine Subsidence District and are predicted to experience more than 150 mm of subsidence during the mining of LW W3-W4.

5.3.7. Future house construction

New houses have been identified from aerial photographs captured in 2019. The houses have been mapped and included in Drawing No. MSEC1045-12-01.

LW W3-W4 will extract within a semi-rural area. It is possible that additional houses may be constructed that may be affected by the extraction of LW W3-W4. No large-scale developments are currently under construction in this area.

The hazard associated with new houses is considered to be generally low for the following reasons:

- The design for new houses will be approved by SA NSW; and
- The condition of the houses will generally be good as they are newly constructed.

As described in Section 6.3, Tahmoor Coal attempts to notify landowners at multiple stages during the mining process. New landowners may be contacted in this manner.

For newly constructed houses, Tahmoor Coal will offer a pre-mining hazard identification inspection by a structural engineer and provide an impact assessment and risk analysis to the landowner upon request.

Standard risk control procedures will be applied to new houses, which are provided in this Management Plan.

5.4. Flats or units

There are no flats or units affected by the extraction of LW W3-W4.

5.5. Pools

5.5.1. Pools

A total of 15 pools and one spa are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of LW W3-W4. The majority of the pools are inground. The majority of the pools are located to the side of LW W1, and no pools are located directly above the LW W3-W4.

A total of 157 pools experienced mine subsidence movements during the mining of Longwalls 22 to 30. Impacts have been reported for a total of 36 pools, which represents an impact rate of approximately 23 %. A higher proportion of impacts have been observed for in-ground pools, particularly fibreglass pools.

Impacts have been reported to one pool during the mining of LW W1-W2, with impacts also observed to tile surrounds.

The majority of the impacts related to tilt or cracking, though in a small number of cases the impacts are limited to damage to skimmer boxes or the edge coping.

Mining-induced tilts are more noticeable in pools than other structures due to the presence of the water line and small gap to the edge coping, particularly when the pool lining has been tiled. Skimmer boxes are also susceptible to being lifted above the water line due to mining tilt. The Australian Standard AS2783-1992 (Use of reinforced concrete for small swimming pools) requires that pools be constructed level within ± 15 mm. This represents a tilt of approximately 3.3 mm/m for pools that are 10 metres in length. Australian Standard AS/NZS 1839:1994 (Swimming pools – Pre-moulded fibre-reinforced plastics – Installation) also requires that pools be constructed with a tilt of 3 mm/m or less.

5.5.2. Pool gates

The hazard to pool gates is that they may not close due to mine subsidence impacts, even if they are spring-loaded. A number of pool gates have been impacted by mine subsidence due to mining in the Southern Coalfield. While the gates can be easily repaired, the consequence of breaching the pool fence integrity is considered to be severe.

Consultation with pool owners is considered to be the most effective method of managing potential impacts on pool gates. Tahmoor Coal will inspect pool fences and gates on a weekly basis during the active subsidence period, where access is permitted. Pool owners will monitor the pool gates where Tahmoor Coal has not been provided with access to the property. Any damage to pool fences and gates caused by mine subsidence will be repaired immediately.

5.6. Septic tanks

The risk to septic tanks is that they could be damaged and/or rendered unserviceable from mine subsidence impacts. There are two types of potential damage to septic tanks:

- compressive ground strains could cause cracking and leaking of the tanks; and
- shearing could also occur at joints connecting sewerage pipes to septic tanks, as sewerage pipes are generally able to slide as the ground moves horizontally beneath them, while the septic tanks are fixed and unable to slide relative to the sewerage pipes.

Given that tanks are quite small (usually less than 3 m in diameter), constructed of reinforced concrete and are usually bedded in sand and backfilled, the likelihood of cracking to septic tanks is assessed as low. It is noted that no impacts to septic tanks have been reported during the mining of Longwalls 22 to 32 and LW W1-W2.

Pipe joints are usually flexible and consist of relatively short lengths, due to the proximity of septic tanks to houses. However, given that both the house and septic tank are effective ground anchors, it is possible that pipe joints can pull out or shear as a result of subsidence. SA NSW reports that this has been observed in a small number of cases during the mining of Longwalls 22 to 32. This impact is relatively easy to repair.

SA NSW also report that on two occasions during the mining of Longwalls 22 to 26, the grade of the sewer pipe to the septic tank has reversed. The impacts are considered to have been partially due to very low pre-mining grades. In both cases, the repairs were straightforward, where the pipes were re-laid at an improved fall, entering the septic tank at a slightly lower level.

5.7. Sheds and other associated structures

A total of 196 sheds and associated structures are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of LW W3-W4. The risk to sheds and other associated structures is that they could be damaged and/or rendered unserviceable from mine subsidence impacts. The structures include garages, sheds, carports, shade structures and tanks.

These structures are able to withstand greater subsidence movements than houses as they are generally lighter, more flexible in construction, and smaller in size. The risk of damage to sheds and other domestic structures is therefore considerably less when compared to houses.

Impacts have been reported to a small number of sheds and other domestic structures during the mining of Longwalls 22 to 32 and LW W1-W2, all of which are considered to be relatively minor and easy to repair.

5.8. General services

There are many services on the properties within the Study Area for LW W3-W4. These services include potable water pipes, wastewater pipes, stormwater pipes, electrical services and communications services.

Pipes and ducts are generally flexible and will be able to withstand the mine subsidence movements that are predicted to occur. Water, wastewater, stormwater and gas pipes have been directly mined beneath in many locations in Tahmoor and other locations within the Southern Coalfield and very few impacts have been observed, all of which have been minor.

Cables are extremely flexible and will be able to withstand the mine subsidence movements that are predicted to occur. Very few impacts have been observed to cables as a result of previous mining.

5.9. Private roads and walking trails close to steep slopes

There are a small number of private driveways that are located on steep slopes.

It is possible that tension cracks may form at the tops or sides of the slopes and compression ridges may form at the bottoms of the slopes. These impacts may coincide with the private driveways. If the tension cracks are left untreated, these may cause erosion to occur, which may further damage driveways. It is unlikely that large-scale slope failure will occur.

Small ripples were observed along the private driveway of a house on Booyong Close during the mining of LW W1.

5.10. Access and mobility

It is possible that cracks or steps might form in the natural ground or external pavements that might affect access to properties. Any impacts that adversely affect access and mobility will be repaired immediately.

5.11. Commercial, industrial and business establishments.

There are no commercial, industrial and business establishments affected by the extraction of LW W3-W4.

5.12. Public amenities and utilities

No public amenities structures are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of LW W3-W4.

A total of 15 public utilities structures are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of LW W3-W4. The public utilities are described in Report No. MSEC1112 (MSEC, 2021).

The public utilities that are located within the Study Area for LW W3-W4 are:

- Stonequarry Estate water treatment plant (Ref. PSC_090_pu01 to PSC_090_pu13) is located directly above LW W3 near the commencing end, and approximately 275 metres to the northwest of LW W4; and
- Pumping station 2 and overflow storage tanks (Ref. Ref. PSC_019_pu01 and PSC_019_pu02) are located to the western side of previously extracted LW W1, and approximately 660 metres to the west of LW W3 and 985 metres to the west of LW W4.

A separate management plan has been developed for the Stonequarry Estate water treatment plant.

5.13. Risks associated with existing structural condition

The existing condition of structures varies within the general mining area. This is a function of age, structural design, construction workmanship and maintenance. Tahmoor Coal has undertaken pre-mining hazard identification inspections of structures during the mining of Longwalls 22 to 32, LW W1-W4. Pre-mining hazard identification inspections 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 cases, the existing structural condition has been considered unsafe and Tahmoor Coal has undertaken measures to repair the defect or has informed the landowner of the hazard.

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 unsafe. While the warnings appear dire, it should be noted that the likelihood of structural failure is still considered to be remote as no structures have collapsed as a result of mine subsidence movements in the Southern Coalfield.

The experience from the mining of Longwalls 22 to 32 and LW W1-W2, affecting more than 2000 structures shows that residents have not been exposed to immediate and sudden safety hazards as a result of impacts that occur due to mine subsidence movements. 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 management strategy described in Section 5.2 includes measures to identify potentially ‘unstable structures. The residential properties that are located within the predicted 20 mm subsidence contour due to LW W3-W4 have been offered a hazard identification inspection by a structural engineer. These inspections have specifically targeted the structures that could have increased risks due to their existing structural conditions, including the older structures and structures that are located outside of declared Mine Subsidence Districts.

The structural engineer has recommended additional management measures to be undertaken at 1 property, which was completed prior to the influence of LW W1-W2 as result of either pre-mining hazard identification inspections.

Mitigation measures have also been recommended for four properties that are located to the east of LW W4. The works will be completed prior to the influence of LW W4. Details are provided in Table A.1, which is included in the Appendix.

5.14. Farm dams

A total of 23 dams are located within the Study Area for LW W3-W4, of which 8 dams are located directly above the longwall panels. The locations of the dams are shown in Fig. 5.3.

There is extensive experience of mining directly beneath farm dams in the Southern Coalfield, which indicates that the incidence of impacts on these features is very low. Farm dams are commonly constructed with cohesive materials in the bases and walls which can absorb the conventional subsidence movements typically experienced in the Southern Coalfield without the development of substantial cracking. Non-conventional movements can result in localised cracking and deformations at the surface and, where coincident with farm dams, could result in adverse impacts.

Tahmoor Coal has mined LW22 to LW31 beneath a total of 103 dams. While a small number of landowners have advised of impacts, there has been one claim to Subsidence Advisory NSW for impacts on farm dams at the time of the report. The farm dam is located directly above previously extracted Longwall 27. This represents an impact rate of less than 1%. The dataset includes some large water treatment dams above Longwall 24A. A similar experience is found at dams located above other extracted longwalls at Appin and West Cliff Collieries, where the depth of cover is similar. While no impacts have been reported to dam walls, seepage was observed at the base of one dam wall that is located above Longwall 702 at Appin Colliery.

The dams are typically constructed from cohesive soils with reasonably high clay contents. The walls of the farm dams should be capable of withstanding tensile strains of up to 3 mm/m without significant impacts, because of their inherent plasticity.

As undertaken during the mining Longwalls 22 to 32 and LW W1-W2, Tahmoor Coal will visually inspect the dams immediately prior to and immediately after active subsidence. The dams do not show any signs of distress. The likelihood of leakage of a dam wall or floor due to subsidence is considered to be rare. If impacts occur, however, Tahmoor Coal will supply water to the landowner on a temporary basis until the dam is repaired.

From a public safety point of view, there are no structures located immediately downstream of the dams directly above LW W3-W4. The Picton-Mittagong Loop Line is located downstream of two dams and potential impacts on the railway culverts and embankments will be managed by Tahmoor Coal, Transport

Heritage NSW and the landowners. The two dams (Ref. PSC_090_d01 and PSC_019_d01, DP Dam Label FD7 and FD5, respectively) have been inspected by geotechnical engineer Douglas Partners (2019b), who advise that both dams are in good condition with relatively flat batter slopes and are performing in accordance with industry accepted expectations. No signs of instability were observed. These dams will be inspected regularly during the period of active subsidence.

Dam PTH_080_d01 (DP Label FD1) is located to the south of the finishing end of LW W3. Douglas Partners (2021b) has inspected the dam and conducted borehole investigations and laboratory testing of the dam materials. A stability analysis has confirmed that the minimum factor of safety is 1.35. Douglas Partners concluded that the dam is in an acceptable condition, performing in accordance with recommendations and has an effective spillway system.

Dam PTH_055_d01 (DP Label DP4) is located directly above LW W3 and Dam PTH_105_d01 (DP Label FD3) is located directly above LW W4 (the storage area is located above LW W3). Douglas Partners (2021b) has inspected the dams and conducted borehole investigations and laboratory testing of the dam materials. A stability analysis has confirmed that the minimum factors of safety are 1.32 and 1.30, respectively. Douglas Partners concluded that the dams are in an acceptable condition, performing in accordance with recommendations and both have an effective spillway system.

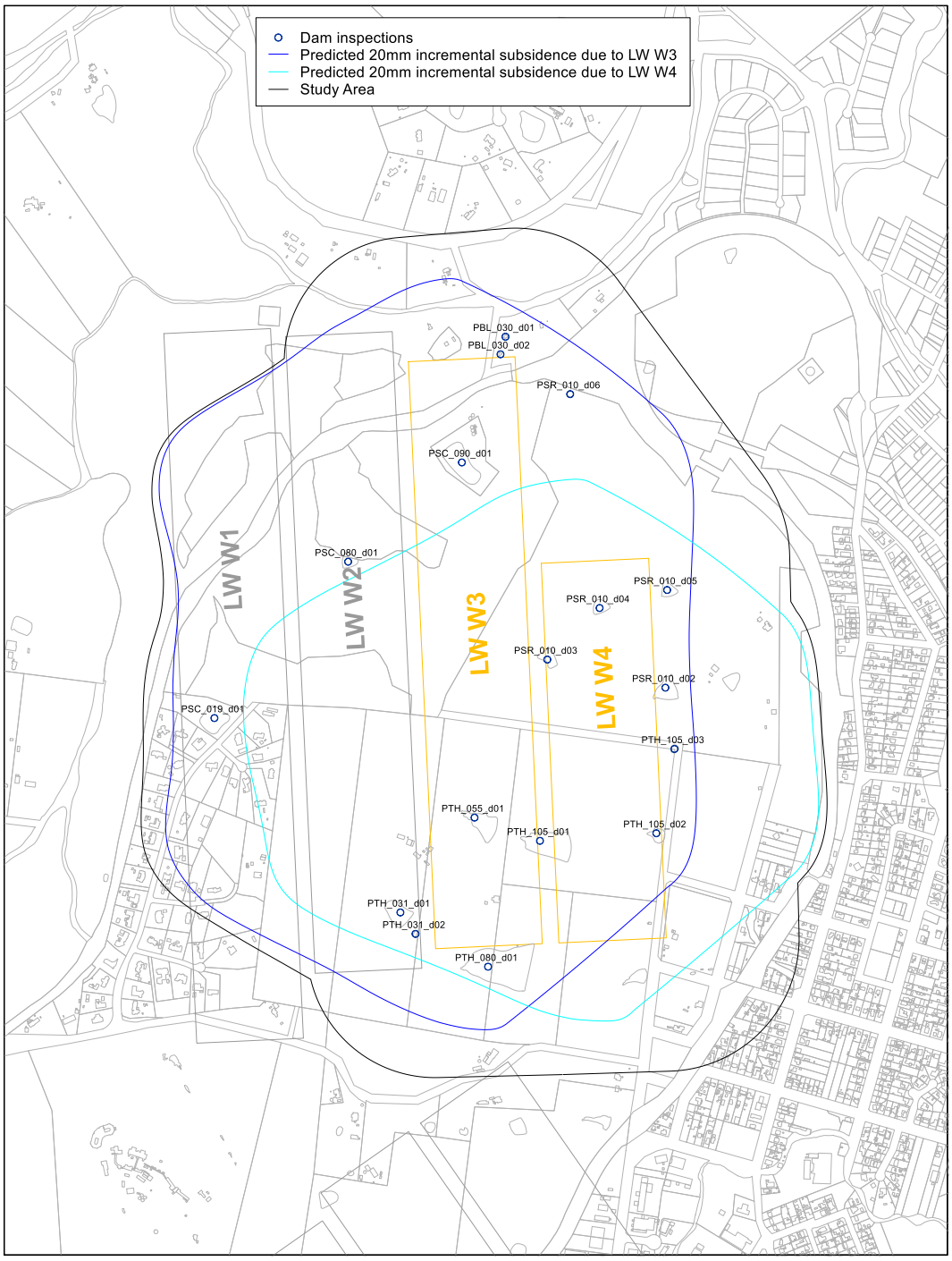


Fig. 5.3 Locations of dams

Douglas Partners also conducted a dam break analysis, which included a consideration of cascading failure of the small dams upstream of the dam on a Sunny Day, 1 in 100 year flood event and Probable Maximum Flood (PMF) event. In each event, the modelling found that dam break would result in flooding of houses that are located upslope and downslope of the Main Southern Railway culvert. Risk to life is considered to be less than 1 x 10^{-5}, and within an Acceptable level for existing development and the water levels will be more than 8 metres below the top of the railway embankment in a Sunny Day event. In a 1 in 100 year flood event, the contribution of a dam break is predicted to be approximately 100 mm in addition to the existing downstream flood level.

Douglas Partners (2021b) advises that based on the site investigations and geotechnical assessments conducted, the farm dams are of a reasonable level of construction and are performing in accordance with industry-accepted expectations for earth-fill embankments and have open-channel spillways. No hazard reduction works are recommended to protect the farm dams from mine subsidence impacts prior to the influence of LW W3 and LW W4.

Douglas Partners (2021b) recommends that the spillways and the Main Southern Railway culvert be kept clear of debris and obstructions. Tahmoor Coal will ensure this occurs during the mining of LW W3-W4. Douglas Partners recommends regular visual inspections during mining and after mining. Ground survey pegs have also been installed along the crest and base of Dam PTH_080_d01 (DP Label FD1) and PTH_105_d01 (DP Label FD3), which will be surveyed regularly during mining.

5.15. Summary of potential impacts

A summary of the assessed levels of potential impacts on building structures is provided in Table 5.2. The summary is consistent with the risk assessment undertaken by Tahmoor Coal (2020), which is included in Appendix A. The assessment has been based on the credible worst case, with the implementation of the proposed management strategies and preventive measures outlined in this plan.

Table 5.2 Summary of potential mine subsidence impacts on building structures

Risk	Likelihood	Consequence	Level of potential impact
Structures			
Impacts on health and safety	RARE	MODERATE	LOW
Damage to structures	UNLIKELY	MINOR	LOW
Pools			
Impacts on health and safety due to damage to pool gate	RARE	MAJOR	MEDIUM
Damage to pools	UNLIKELY	MINOR	LOW
Septic Tanks			
Damage to tanks	UNLIKELY	MINOR	LOW
Farm dams			
Leak of dam water	UNLIKELY	MINOR	LOW

5.16. Identification of subsidence hazards that could give rise to risks to health and safety

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 for structures which could give rise to risks to health and safety of people.

Using the processes described in Section 5.2 of this Management Plan, mine subsidence hazards have been identified, investigated and analysed in a systematic manner by examining each aspect of the property, as described in Sections 5.3 to 5.14 of this Management Plan. Each of the built features below could potentially experience mine subsidence movements that could give rise to risks to the health and safety of people:

- building structure(s);
- services to properties, including pipes, cables, fire protection, security, access and mobility;
- items noted during inspections by structural or geotechnical engineer;
- finishes; and
- external pavements, fences and gates.

The following mine subsidence hazards were identified that could give rise to risks to health and safety in respect to structures due to the extraction of LW W3-W4:

- potential mine subsidence damage to building structures (refer Sections 5.3 and 0);
- steep slopes (refer to Sections 5.3.1 and 5.9);
- potential damage to pools and pool gates (refer Section 5.5);
- potential damage or loss of services to properties (refer Section 5.8);
- potential development of trip hazards on internal floors and external pavements (refer Section 5.10); and
- potential flooding of properties in the event of dam break (refer Section 5.14),

As shown in Table 5.2 the Structures Response Group assessed the likelihood of the above hazards affecting health and safety, and the severity of potential health and safety consequences during the risk assessment as a group, based on the assessed worst-case consequence. The results of the risk assessment are included in Appendix A.

The identification and risk assessment process took into account the location of the structures relative to LW W3-W4 and the associated timing and duration of the subsidence events, as described in Section 1.7 of this Management Plan.

Whilst mine subsidence predictions and extensive past experiences from previous mining at Tahmoor Mine 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 properties, as discussed in Section 1.4 and Chapter 2 of this Management Plan.

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 properties in general. These are described in Chapter 6 of this Management Plan.

6.1. Structures Response Group (SRG)

The Structures Response Group (SRG) is responsible for taking the necessary actions required to manage the risks that are identified for structures. The SRG's key members are:

- Tahmoor Coal;
- JMA Solutions; and
- MSEC.

SA NSW may also participate in SRG meetings as observers when available. The SRG may invite other specialist consultants from time to time, including Douglas Partners where issues relate to slope stability.

6.2. Mitigation measures

Mitigation measures have been or will be undertaken where recommended by the structural engineer based on hazard identification inspections.

Mitigation measures were recommended at one property prior to the influence of LW W1-W2, where the base connections for verandah posts were recommended to be upgraded so that they bear on the centre of the foundations supporting them. The work was completed prior to the influence of LW W1.

Mitigation measures have also been recommended for four properties that are located to the east of LW W4. The works will be completed prior to the influence of LW W4. Details are provided in Table A.1, which is included in Appendix A of this Management Plan.

6.3. Community consultation, co-operation and co-ordination

Experiences during the mining of Longwalls 22 to 32 and LW W1-W2 have found that the most effective method of managing potential impacts on the safety and serviceability of structures are by way of community consultation. Residents living within the active subsidence zone have often provided early feedback about impacts developing at their houses or along their local roads. Contact is made well before impacts develop to a level of severity sufficient to become a safety hazard.

Community consultation commenced when the Tahmoor Coal applied for development consent to mine. A Commission of Inquiry was undertaken as part of this process. Tahmoor Coal continued to develop their mine plans after development approval was received. These plans were discussed with the Tahmoor Colliery Community Consultative Committee (TCCCC), which was set up in accordance with the conditions of development consent. Prior to mining the first longwall beneath Tahmoor, the Mine increased the level of communication with the community.

The approaches adopted by Tahmoor Coal are listed below:

- *Undertake conservative predictions and impact assessments*

  Tahmoor Coal and MSEC have adopted a conservative approach to predicting subsidence and assessing impacts. This reduces the likelihood of under-stating the predicted impacts. For example, predictions for each structure have been made by predicting the maximum subsidence, tilt and strain within a 20 m radius around each structure;

- *Undertake detailed predictions and impact assessments*

  By undertaking detailed subsidence predictions, Tahmoor Coal is able to provide residents with predictions for their own structures. Individual assessments provide some comfort to concerned residents. This is particularly helpful for residents that live beyond the extent of mining and are expected to experience only small movements;

- *Community information days*

  A number of advertised information days are held by Tahmoor Coal throughout the year. The information days allow members of the community to directly meet Tahmoor Coal representatives and its consultants. SA NSW is also present on information days to answer questions;

  The information exchanged at information days also assists Tahmoor Coal, as members of the community sometimes provide information about particular surface features or impacts that Tahmoor Coal might not have been aware of;

- *Tahmoor Colliery Community Consultative Committee*

  The committee meets at regular (quarterly) intervals. Meetings allow Tahmoor Coal to present information to the committee and receive feedback. The committee is committed to ensuring that the concerns of the community are well understood by Tahmoor Coal. Many of the members have been part of the committee for several years, and this facilitates informed discussion;

- *Letters to residents and door knocking*

  Tahmoor Coal sends letters to the community advising of imminent longwall mining in their area. By continuing to engage with residents at each stage of mining, Tahmoor Coal is able to find new residents who might not have been aware that mining was taking place. The letters include:

  - Notification of preparation of Extraction Plan application for LW W3-W4 and notification of lodgement of Extraction Plan application. The notification letter attached a Subsidence Information Pack, which included information on longwall mining and mine subsidence, the claims process with SA NSW, recommendations to undertake pre-mining hazard identification inspections, and a list of emergency contact numbers and point of contact at Tahmoor Coal;
  - Notification to all landowners within the application area of Extraction Plan approval for LW W3-W4;
  - Notification of imminent commencement of each longwall. The letter is sent to all landowners whose properties are located directly above the active longwall panel plus landowners whose properties are located directly above the next longwall panel. The letter encourages landowners to undertake pre-mining hazard identification inspections;
  - For properties where pre-mining hazard identification inspections have been or will be undertaken in accordance with this Management Plan, Tahmoor Coal have or will make direct contact to arrange access with the landowner by mail, letterbox drop, phone and/or door knocking;
  - Door knocking of houses located directly above the active longwall:
    - This exercise is an attempt to directly engage with residents and is undertaken in conjunction with front of house inspections;
    - This exercise will be undertaken before the longwall face approaches within 300 m of each property, so that there is adequate time, if required, to arrange additional inspections and/or surveys and implement any mitigation measures if required before mining-induced impacts are experienced.

- *Individual meetings with residents*

  Many members of the community prefer to meet with Tahmoor Coal representatives face to face. Tahmoor Coal has held many individual meetings with concerned residents to explain how mine subsidence develops and what the impacts might be. This is a time consuming but rewarding process for residents and Tahmoor Coal;

- *Newspaper advertisements*

  Tahmoor Coal places advertisements in the newspaper from time to time to advise the community at large about consultation opportunities, including community information days;

- *Regular reporting*

  Tahmoor Coal provides regular updates on the progress of mining in the area. This is conducted mainly by community newsletter by mail, email, website and notice boards for any member of the community who wishes to be regularly informed. The updates advise the current position of the longwall and any impacts that have been observed;

- *Prompt response to reported impacts*

  Tahmoor Coal responds quickly to impacts that are reported by the community. If a severe impact is reported, Tahmoor Coal checks neighbouring properties to see whether the incident is localised or part of a larger potential issue;

- *Ongoing monitoring if impacts occur*

  Where impacts have been reported, Tahmoor Coal offers to continue monitoring the property.

6.4. Development and selection of risk control measures

Tahmoor Coal has developed and selected risk control measures in consultation, co-ordination and co-operation with landowners 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:

1. Eliminate risks to health and safety so far as is reasonably practicable, and
2. 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:
   (a) substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk
   (b) isolating the hazard from any person exposed to it
   (c) implementing engineering controls
3. If a risk then remains, minimise the remaining risk, so far as is reasonably practicable, by implementing administrative controls.
4. 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).

Method A and B risk control measures are described in Sections 6.5 to 6.11. Prior to selecting Method B risk control measures, Tahmoor Coal has investigated and confirmed that the measures are feasible and effective for the site-specific conditions due to the extraction of LW W3-W4.

6.5. Avoidance and mitigation measures

Based on its own assessments, and the assessments by the structural engineer and geotechnical engineer, Tahmoor Coal considered Method A and B risk control measures, in accordance with the process described in Section 6.4.

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

Hazard identification inspections by structural engineer JMA Solutions have identified elements that are in poor existing condition or elements that could be susceptible to mine subsidence movements. The structural engineer has recommended engineering controls and monitoring to minimise risk.

A summary of the inspections, engineering controls and monitoring that have been recommended by the structural engineer, to date, are provided in Table A.1, in Appendix A. The engineering controls will be implemented prior to the structure experiencing active subsidence from LW W3-W4, i.e. before the longwall face approaches to within 100 m of travel of mining beneath the structure.

Additional engineering controls may be developed as further hazard identification inspections are completed by the structural engineer. In the case of LW W3-W4, hazard identification inspections have been completed for all houses within the predicted limit of subsidence for LW W3 and most of the houses within the predicted limit of subsidence for LW W4. The hazard identification inspections will be undertaken before the longwall face approaches to within 300 m of travel of mining beneath each property.

Administrative controls

The following administrative Controls were identified and selected that will put in place procedures to minimise the potential of impacts on health and safety:

- Implementation of a Monitoring Plan and Trigger Action Response Plan (TARP). As described in Table 6.1, the SRG has developed and implemented a management strategy of detecting early the development of potential adverse subsidence movements, so that contingency response measures can be implemented before impacts on safety and serviceability develop. The TARP includes the following:
  - ground monitoring and visual inspections along streets in the active subsidence zone;
  - baseline ground surveys of pegs installed around semi-rural and rural houses that are remote from local streets and located directly above LW W3-W4, or where requested by landowners;
  - 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;
  - visual inspections of public utilities;
  - visual inspection of commercial establishments;
  - additional surveys and inspections, if required, such as regular recording of widths of any new cracks that might appear;
  - repair of impacts that create a serious public safety hazard;
  - repair of impacts that impair any essential services;
  - repair of impacts that impair access and mobility to properties, even if further impacts are anticipated; and
  - in the worst case, as a last resort, advise landowners to restrict entry to part of the property or emergency evacuate the premises.

With the implementation of the above management strategies, Tahmoor Coal will ensure that the health and safety of people on properties will not be put at risk due to differential mine subsidence movements due to the extraction LW W3-W4.

6.6. Site-specific structure inspection plan

6.6.1. Identification of building structures

At the time of preparing Reports Nos. MSEC1019 (MSEC, 2019) and MSEC1112 (MSEC, 2020), in support of the Extraction Plan Applications, structures were identified from orthophotographs, with structure types identified from kerbside inspections. Additional structures have been identified from Nearmap images in July 2019 and from kerbside inspections as part of the preparation of this Management Plan.

Front of house risk and visual screening inspections have been carried out by a structural engineer for the properties that are predicted to experience more than 20 mm of incremental vertical subsidence due to the extraction of LW W3-W4, where they were visible from the street. The purpose of these inspections is to identify structures that are in poor existing condition or elements that could be sensitive to mine subsidence movements, where access was not granted by the owner for the hazard identification inspections.

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 LW W3-W4 Tahmoor Coal have requested access to conduct a pre-mining inspection and hazard identification inspection by a structural engineer.

The locations of residential structures where Front of House risk and visual screening inspections have been completed by a structural engineer prior to commencement of LW W3-W4 are shown in Fig. 6.1.

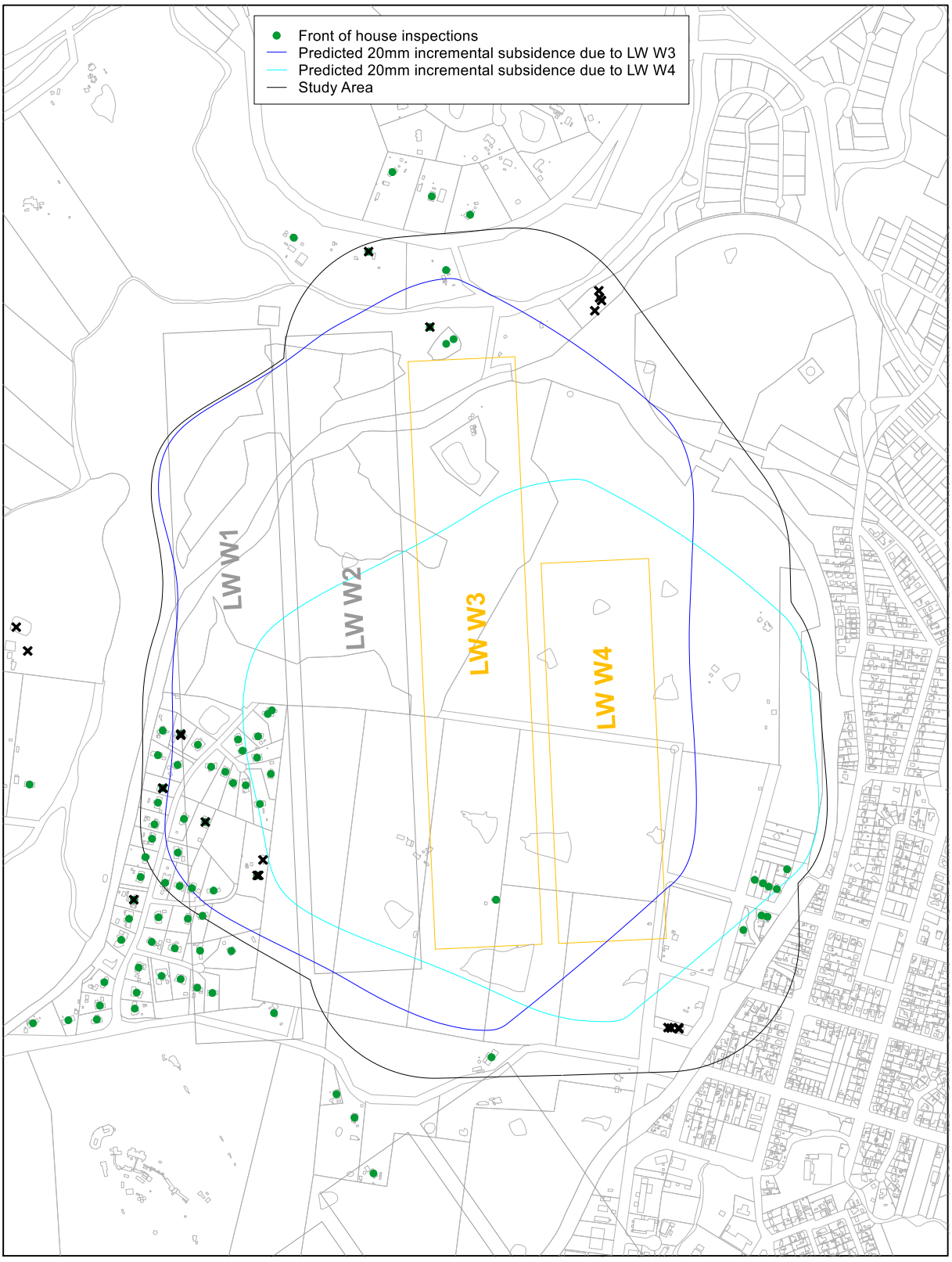


Fig. 6.1 Residential structures where front of house risk and visual screening inspections have been completed prior to commencement of LW W1-W2

6.6.2. Pre-mining hazard identification inspections by geotechnical engineer

A qualified geotechnical engineer (Douglas Partners) has inspected the steep slopes on which structures are located to determine whether there is any potential for slope instability prior to, during or after mining. The inspections confirmed the assumptions and assessments provided in the reports (Douglas Partners,2019a and 2021a), and have not identified additional geotechnical issues.

A map showing locations where geotechnical hazard identification inspections have been completed, and where geotechnical hazard identification inspections are required is shown in Fig. 6.2.

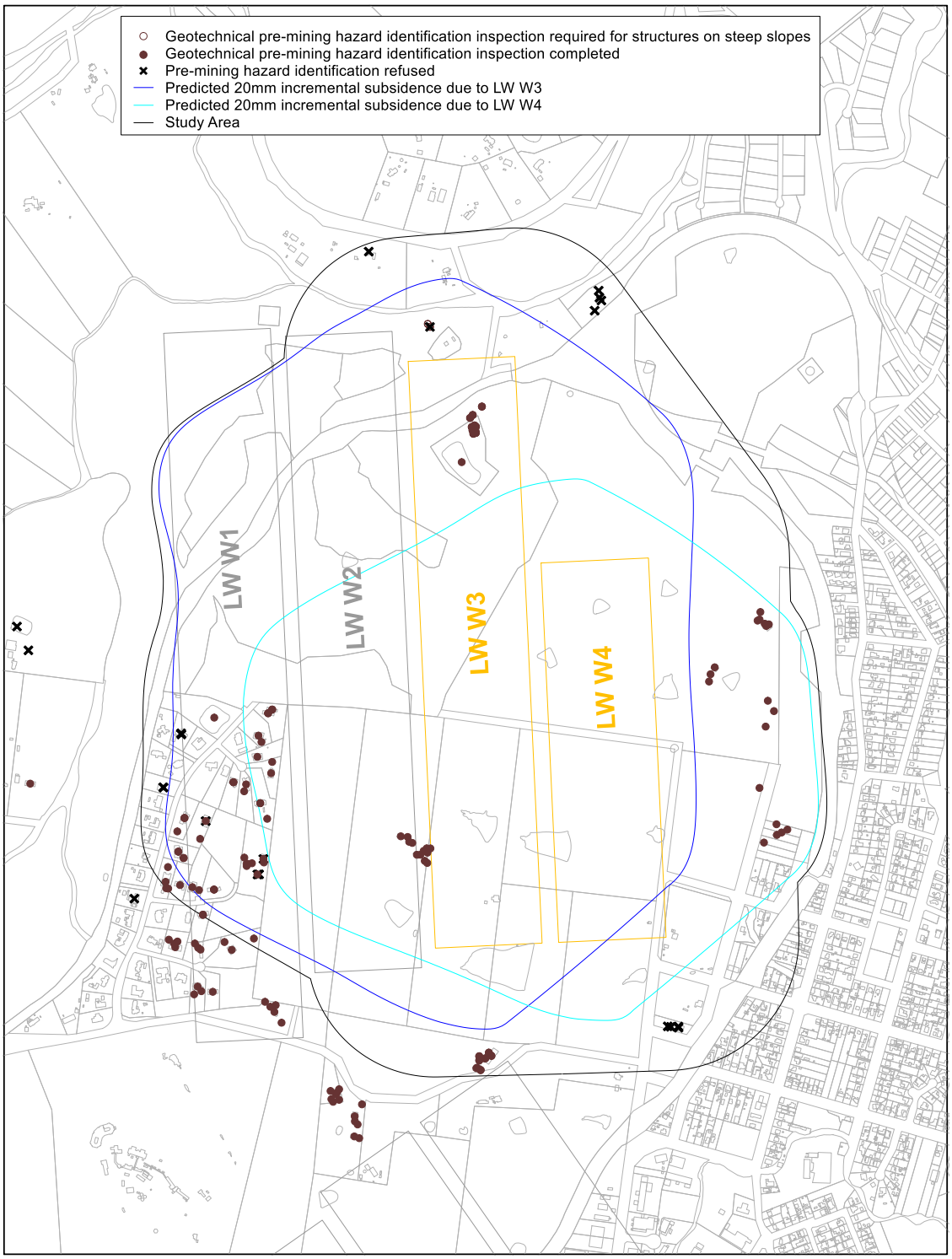


Fig. 6.2 Locations of structures near steep slopes that require pre-mining hazard inspection by geotechnical engineer for LW W3-W4

6.6.3. Pre-mining hazard identification inspections by structural engineer

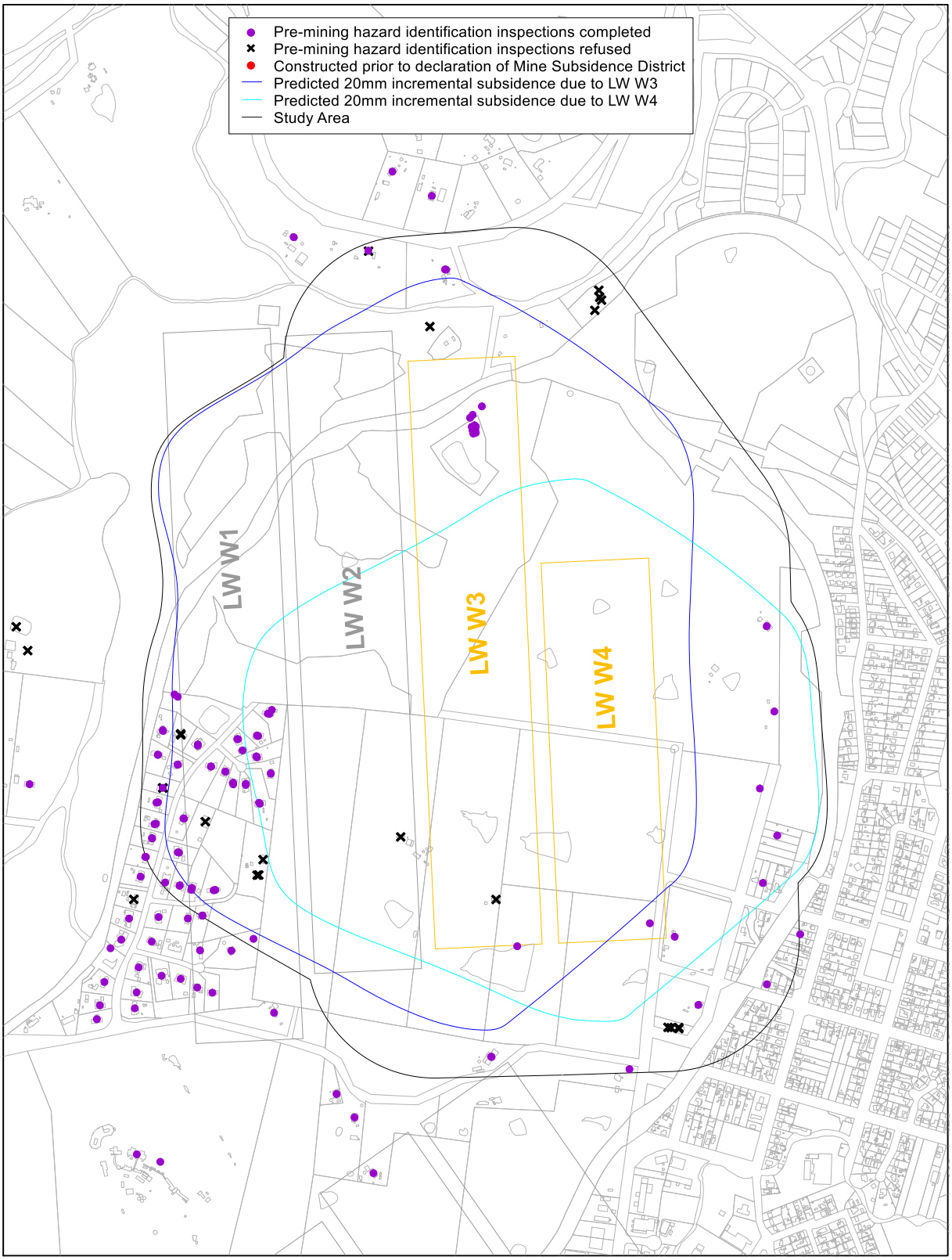
Tahmoor Coal has contacted residents of properties that are located within the predicted 20 mm subsidence contour due to LW W3-W4, offering a pre-mining hazard identification inspection by a structural engineer.

In addition, Tahmoor Coal has requested access to conduct pre-mining hazard identification inspections at properties with structures that have been specifically targeted on the basis that they may be more sensitive to mine subsidence movements due to the extraction of LW W3-W4, as outlined in Section 5.2.

The hazard identification inspections required to be completed will be undertaken before the longwall face approaches to within 300 m of travel prior to directly mining beneath each property. Where access is not granted by the landowner, inspections are limited to Front of House inspections where the structures are visible from the street.

Hazard identification inspections have been completed for all houses within the predicted limit of subsidence for LW W3 and most of the houses within the predicted limit of subsidence for LW W4. Some houses near the corner of Rumker Street and Connellan Crescent are planned to be conducted. The hazard identification inspections will be undertaken before the longwall face approaches to within 300 m of travel of mining beneath each property.

The locations of structures where pre-mining hazard identification inspections have been completed by structural engineer JMA Solution are shown in Fig. 6.3. It can be seen from Fig. 6.3 that hazard identifications inspection for structures within the predicted limit of incremental subsidence for LW W3 have been completed. Outstanding inspections will be undertaken prior to LW W4 approaching within 300 metres of each structure.



Note: all properties that are predicted to experience more than 20 mm of incremental subsidence have been offered a pre-mining hazard identification inspection.

Fig. 6.3 Locations of structures where pre-mining hazard inspections have been completed by structural engineer prior to commencement of LW W3-W4

6.6.4. Pre-mining inspections by SA NSW

SA NSW has undertaken a small number of pre-mining inspections above LW W3-W4. Further inspections may be conducted by SA NSW in the future, if requested by a landowner.

In order to reduce inconvenience to landowners, Tahmoor Coal will offer to conduct a pre-mining inspection for SA NSW to be conducted by the structural engineer at the same time as the hazard identification inspection. The landowner is not obliged to take up the offer when agreeing to the hazard identification inspection.

6.6.5. Visual kerbside inspections during mining

Detailed visual inspections will be undertaken along streets on a weekly basis within the active subsidence area from the commencement of LW W3-W4. Vehicle-based inspections will also be undertaken once a week within the active subsidence area during the mining of LW W3-W4, commencing after 200 m of extraction.

The frequency of inspections can be increased, if required, based on actual observations.

6.6.6. Visual inspections of structures during mining

Weekly visual inspections will be conducted for the following structures, when they are located within the active subsidence zone, where access is provided by the landowner:

- residential structures located on or adjacent to steep slopes, where recommended by the geotechnical or structural engineer;
- residential structures in poor existing condition, based on the hazard identification inspections by the structural engineer;
- residential structures that have experienced impacts as a result of mining previous longwalls, or where recommended by the SRG;
- pool fences and gates;
- commercial establishments; and
- public utilities.

Weekly visual inspections planned to be conducted during active subsidence are illustrated in Fig. 6.4. The active subsidence zone is described in Section 1.7, with the weekly inspections of the houses carried out from when they are 150 m in front of the longwall face to 450 m behind the longwall face.

Weekly inspections for the structures located near the longwall commencing end will start after the first 200 m of longwall extraction. Weekly inspections for the structures located beyond the longwall finishing end will be carried out for the last 300 m of extraction.

In addition to the above, farm dams will be inspected by a geotechnical engineer monthly during the period of active subsidence for each dam, and weekly by a building inspector using a checklist provided by the geotechnical engineer.

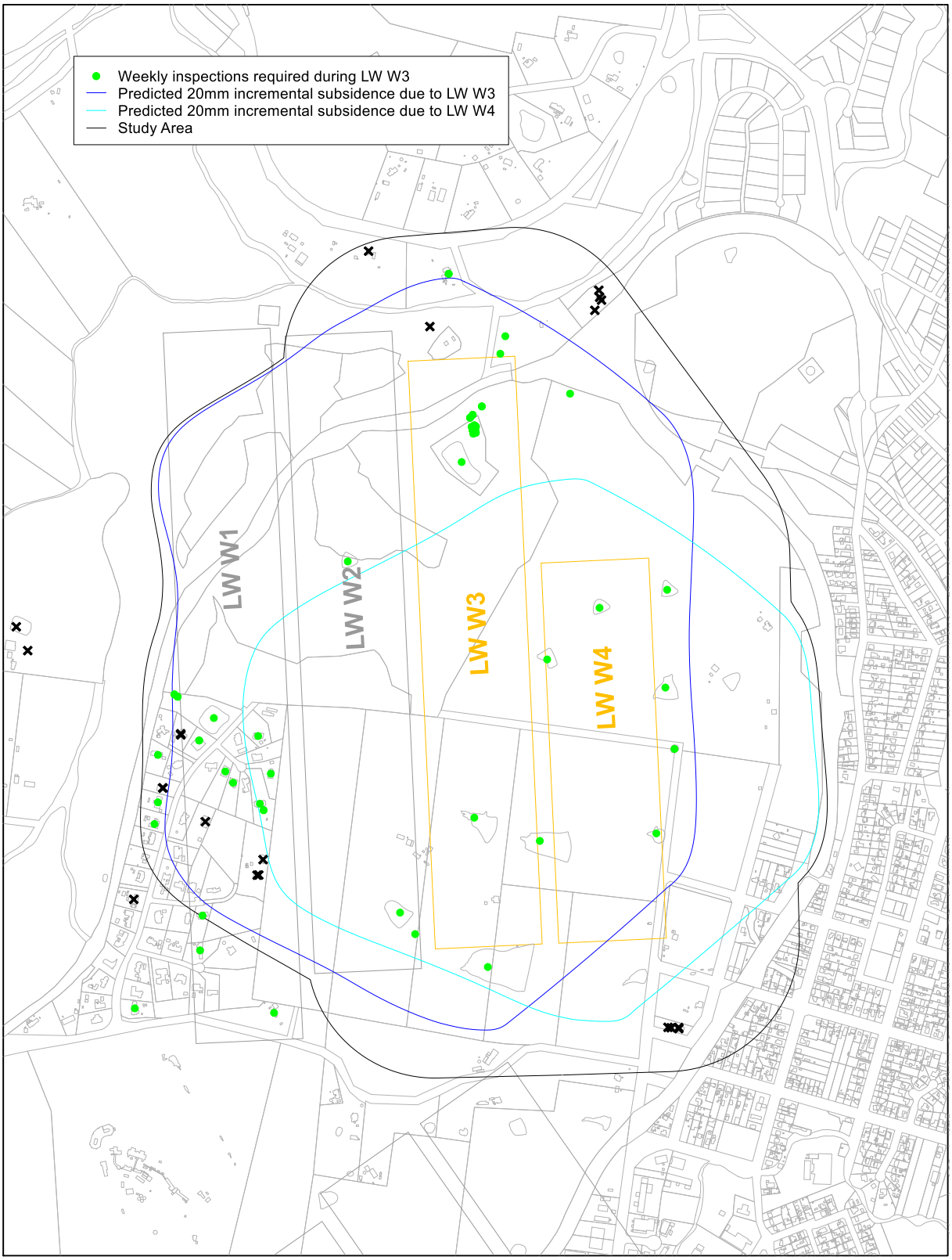


Fig. 6.4 Inspections during active subsidence of LW W3

6.7. Ground and structure monitoring plan

6.7.1. Ground surveys along the streets

Survey marks have been installed along streets above and adjacent to LW W3-W4, as shown in Drawing No. MSEC1173-00-01. The survey pegs will be surveyed during the period of active subsidence of these features during the extraction of LW W3-W4.

6.7.2. Specific structure surveys

Tahmoor Coal will undertake building surveys where recommended by the geotechnical or structural engineer, or where requested by the landowner. Tahmoor Coal will also install and baseline survey pegs around semi-rural and rural houses that are remote from local streets and located directly above LW W3-W4, where access is permitted.

Ground surveys around structures are used as a baseline monitoring tool. Surveys are undertaken following completion of each longwall unless impacts or high tilts are observed. Tahmoor Coal will place permanent ground survey marks around each subject building. Tahmoor Coal will endeavour to place marks at each external and internal corner of the building, and one mark at the centre of each external side of reasonable length (this will depend on the overall size of the building, but is approximately 10 m).

Tahmoor Coal will record the reduced levels of each mark, as well as the relative horizontal position between each mark around the perimeter of the building (local 3D survey). The survey information will provide subsidence, tilt, curvature and strain information on the ground around the building. This general surveying scheme is illustrated in Fig. 6.5. It is recognised that in some cases, it will not be possible to gain access and suitable lines of sight to the entire perimeter of the building, and in some cases, the number of survey pegs may be reduced. However, as a minimum, survey marks will be placed at every corner of the building.

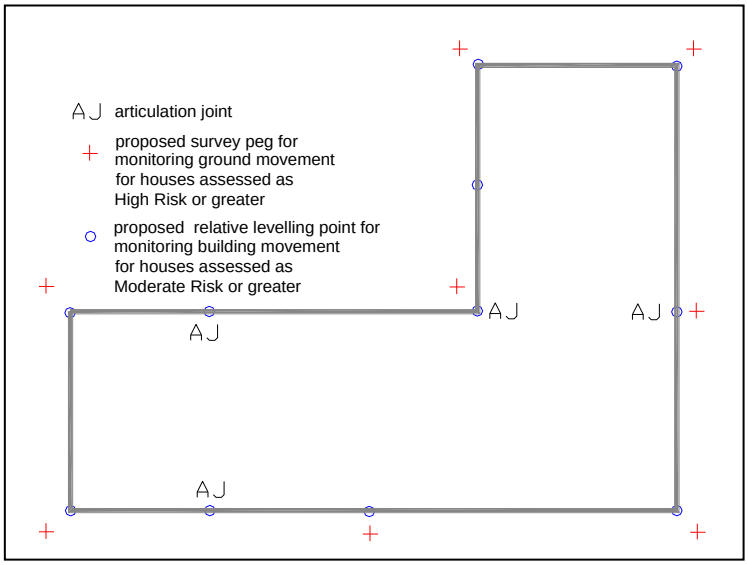


Fig. 6.5 Schematic layout for ground movement and building level surveys around a typical building

The properties where landowners have requested or agreed with Tahmoor Coal to install survey pegs are shown in Fig. 6.6. Survey marks have been installed at the majority of the properties prior to the commencement of LW W3.

Survey marks will be installed and baseline surveyed at the remaining properties prior to the longwall face approaching within 400 metres of each property.

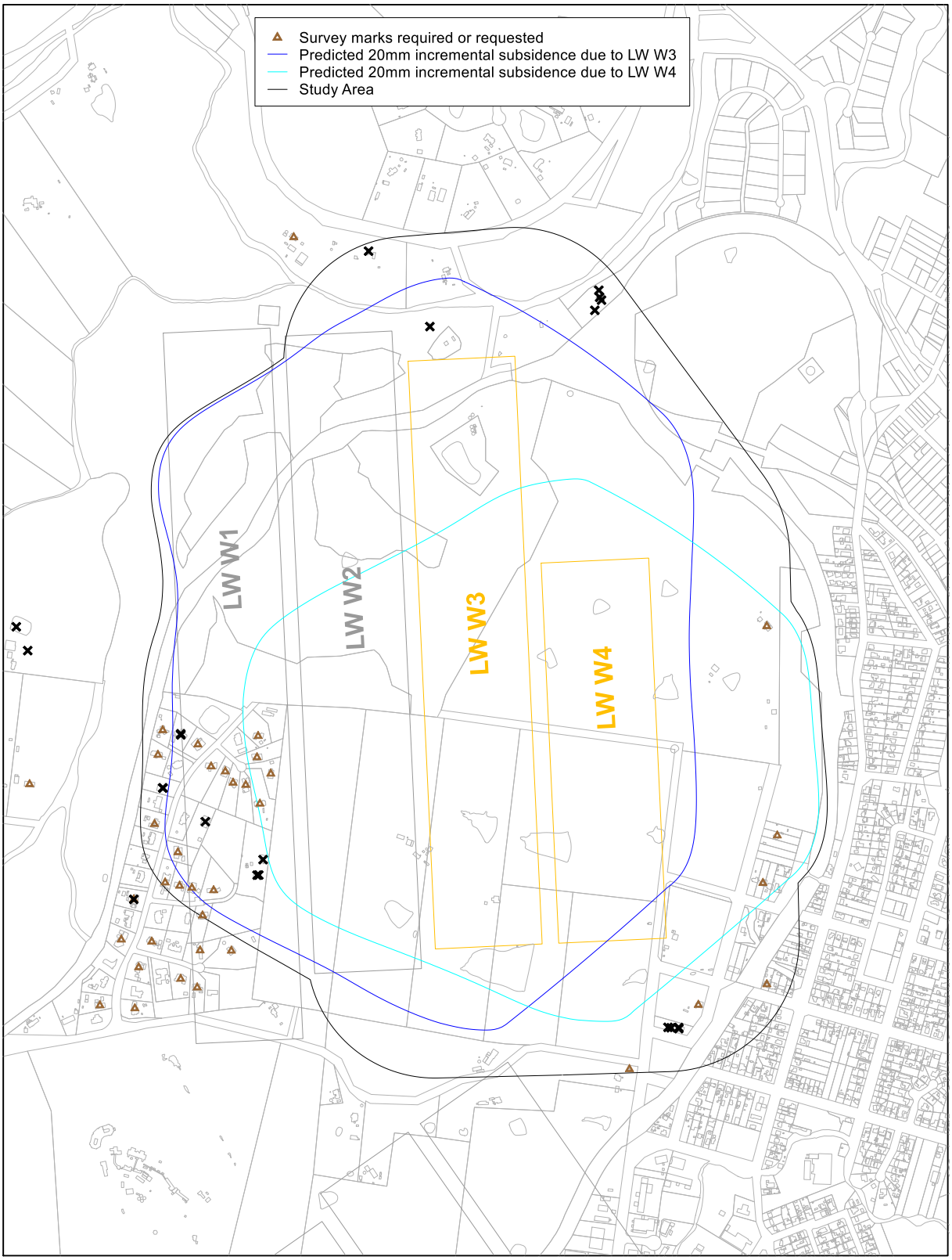


Fig. 6.6 Properties for which survey marks are required or have been requested

6.8. Schedule of inspections and surveys

A schedule of inspections and surveys is maintained by Tahmoor Coal.

6.9. Inspection and survey register

A register will be kept by Tahmoor Coal, recording when inspections and surveys are conducted. Tahmoor Coal can, at any time, provide a copy of the register to MSO.

6.10. Triggers and responses

Trigger levels have been developed by Tahmoor Coal based on observed ground movements or impacts. Trigger levels for each monitoring parameter are described in the risk control procedures in Table 6.1. Structural inspections will be undertaken for any structure where ground tilt is observed to exceed 7 mm/m or curvature is observed to exceed 0.2 km^{-1}.

Tahmoor Coal will coordinate and ensure that building contractors are on standby for immediate call out and service in the event of impacts occurring. Temporary alternative accommodation will also be arranged by Tahmoor Coal in the unlikely event that a residence becomes unsafe as a result of mine subsidence impacts.

Immediate responses will be undertaken by Tahmoor Coal for the following impacts:

- impacts that create a serious public safety hazard;
- impacts to all entry and exit doors, and all other doors that must remain operational for security and fire egress reasons, even if further impacts are anticipated;
- impacts that impair any essential services;
- impacts to sensitive equipment, even if further impacts are anticipated; and
- in the worst case, restriction on entry to part of the property and the provision of alternative accommodation for the resident.

The risk control measures described in this Management Plan have been developed to ensure that the health and safety of people who may be present at the properties are not put at risk due to mine subsidence. It is also an objective to avoid disruption and inconvenience to owner, or if unavoidable, keep disruption and inconvenience to minimal levels.

With respect to the extraction of LW W3-W4, no potential hazards have been identified that could reasonably give rise to the need for an emergency response for structures that will be affected by LW W3-W4. It is noted that pool gates can malfunction during the period of active subsidence and any impacts will be repaired immediately. It is possible that irregular ground movements could cause a severe impact on a building structure or farm dam; however, this will develop gradually allowing the risk to be managed.

Mine subsidence movements 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 landowners.

Tahmoor Coal and the SRG will review and assess monitoring reports and consider whether any additional management measures are required on a weekly basis. If irregular movements or adverse impacts are detected, it is anticipated that a focussed inspection will be undertaken for the affected property, 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 property, and that the landowner will be consulted on a more frequent basis.

Given the gradual development of subsidence movements, it is extremely unlikely that a situation will arise where observations change from a benign scenario to an emergency scenario within one week. Tahmoor Coal will also brief landowners on what signs to look for to detect the development of potential impacts.

Notwithstanding the above, if a hazard has been identified that involves potential serious injury or illness to a person or persons at a property, and it 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 at the property, Tahmoor Coal and the landowner will immediately meet and implement emergency procedures.

The implementation of emergency procedures may include any or a combination of the following:

- restriction of access to the hazardous area; and/or
- in the worst case, the relocation of residents to alternative accommodation until the hazard is rectified.

6.11. Risk control procedures for LW W3-W4

Risk control procedures for the management of potential impacts to residential, commercial and business establishments, and public utilities are provided in Table 6.1.

Table 6.1 Risk control procedures for built structures for LW W3-W4

Infrastructure	Hazard / impact	Risk	Trigger	Control procedure/s	Timing and frequency	By whom?
Items of heritage significance, public amenities, commercial, business and industrial establishments predicted to experience more than 20 mm of subsidence due to the extraction of LW W3-W4				Refer separate Property Subsidence Management Plans		
Residential structures that will experience mine subsidence effects due to the mining of LW W3-W4	Impacts occur	Low to Moderate	Prior to mining	Community consultation, including letters to landowners offering a Pre-Mining Inspection and Hazard Identification inspection for structures predicted to experience more than 20 mm of subsidence due to the extraction of LW W3-W4.	Complete	Tahmoor Coal
				Front of house screening inspection to identify any potentially unstable structures, for structures predicted to experience more than 20 mm of subsidence due to the extraction of LW W3-W4.	Complete	Tahmoor Coal (JMA)
				Conduct pre-mining hazard identification inspection and assessment by geotechnical engineer of structures on or near steep slopes to check whether there is any potential for slope instability prior to, during or after mining, for structures predicted to experience more than 20 mm of subsidence due to the extraction of LW W3-W4.	Complete	Tahmoor Coal (Douglas Partners)
				Conduct pre-mining hazard identification inspection and assessment by structural engineer, including: • structures requested for inspection by landowner during community consultation • structures directly above LW W3-W4 in semi-rural / rural areas remote from street front, where front of house screening is not practicable • structures that have been recommended for structural inspection by the geotechnical engineer • structures that have been recommended for structural inspection during front of house screening inspections • structures built outside Mine Subsidence District that are predicted to experience more than 150 mm of subsidence due to the extraction of LW W3-W4 • structures built prior to declaration of the Mine Subsidence District (1997) and predicted to experience more than 150 mm of subsidence due to the extraction of LW W3-W4 • structures above potential hidden creeks that are predicted to experience more than 20 mm of subsidence due to the extraction of LW W3-W4 • structures above mapped geological structures that are predicted to experience more than 20 mm of subsidence due to the extraction of LW W3-W4	Majority complete Complete remainder prior to LW W4 face approaching within 300 m of each property	Tahmoor Coal (JMA)
				Installation of additional monitoring measures or mitigation/strengthening measures as recommended by structural engineer.	Complete for LW W3 Prior to LW W4 face approaching within 100 m of each property	Tahmoor Coal
				Install ground monitoring lines on streets above LW W3-W4 and survey initial levels and strain distances (as shown in Drawing No. MSEC1173-00-01).	Complete	Tahmoor Coal (SMEC)
				Install ground pegs for structures as requested by or agreed with landowners	Majority complete Complete remainder to longwall face approaching within 400 m of each property	Tahmoor Coal (SMEC)
				Confirm arrangements for building contractors to remain on standby for immediate call out and service in the event of impacts affecting safety or serviceability.	Complete	Tahmoor Coal
			Discovery of potential structural issue prior to mining	Conduct structural hazard identification inspection and assessment and consider: - any mitigation / strengthening measures to improve the existing structural condition - any management measures that should be undertaken prior to or during mining - any monitoring and inspection measures, triggers and responses during mining	Within 1 week of discovery	Tahmoor Coal
				Advise property owner, SA NSW and MSO of findings of structural engineer.	Within 1 week of inspection	Tahmoor Coal
				Undertake mitigation / strengthening measures if decided by SRG.	Prior to LW W4 face approaching to within 100 m of structure	Tahmoor Coal

Infrastructure	Hazard / impact	Risk	Trigger	Control procedure/s	Timing and frequency	By whom?
Residential structures that will experience mine subsidence effects due to the mining of LW W3-W4	Impacts occur	Low to Moderate	During the mining of LW W3-W4	Surveys of street survey lines within active subsidence area, including Connellan Crescent, Thirlmere Way, Stonequarry Creek Road, Attunga Close, Booyong Close and Carramar Close	Weekly for pegs located within active subsidence zone	Tahmoor Coal (SMEC)
				Conduct kerbside visual inspection of streets and structures	Detailed inspection once a week Vehicle based inspection once a week within active subsidence area	Tahmoor Coal
				Conduct inspections during mining for following structures: a) Structures that have previously experienced mine subsidence impacts, where recommended by the SRG b) Pool gates c) Any other structures recommended for regular inspections and/or structure surveys by geotechnical or structural engineer following pre-mining hazard identification inspection and assessment	Weekly within active subsidence zone, or as required by geotechnical or structural engineer	Tahmoor Coal
				Analyse and report results of monitoring and inspections to SRG	Monthly from start of LW W1 and LW W2 Weekly after 800 m of extraction of LW W1 and LW W2 until one month after completion of each LW, unless ongoing adverse movements are observed.	Tahmoor Coal (MSEC)
				SRG discuss results and consider whether any additional management measures are required	Monthly from start of LW W1 and LW W2 Weekly after 800 m of extraction of LW W3 and after 500 m of extraction of LW W4 until one month after completion of each LW, unless ongoing adverse movements are observed.	SRG
			Observed tilts are greater than 7 mm/m or observed curvatures are greater than 0.2 km^{-1} near structure	Conduct inspection of building and provide photographic survey and impact report	Within one week	Tahmoor Coal
				Consider structural inspection/additional monitoring and/or mitigation/strengthening measures	Immediately after building inspection	Tahmoor Coal (JMA)
			Significant non-conventional movement occurs or Impacts observed to any surface infrastructure (not just structures) or Slope slippage observed	Consider whether any additional management measures are required in light of observations, including additional geotechnical or structural inspections, increase frequency of surveys and inspections, additional community consultation	As required by SRG	SRG
				Notify landowner, Tahmoor Coal, SA NSW and MSO	Within one week	Tahmoor Coal

Infrastructure	Hazard / Impact	Risk	Trigger	Control procedure/s	Timing and frequency	By whom?
Residential establishments that will experience mine subsidence movements due to the mining of LW W3-W4	Impacts occur	Low to Moderate	Any impact occurs to structure	As information can come from many possible sources: If not already done, notify landowner, Tahmoor Coal, SA NSW	Within 24 hours	Tahmoor Coal
				Inspect impact of subsidence on building	As soon as possible	Tahmoor Coal
				Inspect condition of building by structural engineer, where recommended by the SRG based on feedback from SA NSW	As recommended by SRG with active subsidence area or as agreed with owner	Tahmoor Coal
				Rectify any adverse impacts that impair upon: - the safety, access and mobility, security or fire egress - any essential services - sensitive equipment	As soon as possible at any stage during mining	Tahmoor Coal
				Repair damage to structure	When subsidence impacts cease	Tahmoor Coal
			Observed impacts are greater than predicted impacts	Investigate cause(s) for greater impacts, including possibility of non-conventional or anomalous movements, type of structure. Investigate spatial trends in data to identify any pattern.	Within one week of observation	Tahmoor Coal
			Structure has become or is likely to be become hazardous as a result of subsidence	Notify landowner, Tahmoor Coal, SA NSW and MSO	Within 24 hours	Tahmoor Coal
				Inspect structural condition of building.	Within two days and then as recommended by structural engineer	Tahmoor Coal (JMA)
				Reassess final level of damage based upon likelihood of further damage and structural condition.	Immediately after structural re-inspection.	SRG
				Consider additional monitoring and/or mitigation/strengthening measures	Immediately after structural re-inspection.	SRG
			A hazard has been identified that involves potential serious injury or illness to a person or persons at the property, and cannot be controlled	Provide temporary accommodation for residents in coordinate with SA NSW	Immediately	Tahmoor Coal
				Notify MSO	Within 24 hours	Tahmoor Coal
				Utilise acquisition and compensation procedure from DA67/98-1999 Development Consent Conditions 18-26 and SA NSW procedures	Immediately	Tahmoor Coal
			Property owner does not accept acquisition	Temporarily relocate residents until building is repaired	Immediately	Tahmoor Coal

Infrastructure	Hazard / impact	Risk	Trigger	Control procedure/s	Timing and frequency	By whom?
Houses	House subsides below 100 year ARI flood level	Moderate	Prior to Mining	Assess potential for houses to subside below 100 year ARI flood level	Complete	Tahmoor Coal
			Completion of Mining	Conduct survey of surface topography	End of LW W4	Tahmoor Coal (SMEC)
				Assess whether any houses has subsided below 100 year ARI flood level	End of LW W4	Tahmoor Coal
			House(s) subside below 100 year ARI flood level	Raise house so that floor level is above 100 year ARI flood level	As required	Tahmoor Coal
Houses	Impacts to future houses	Low to Moderate	Prior to mining	Contact residents to inform them of commencement of mine subsidence. Request owners for information on whether any new houses have been constructed in the last year.	Prior to subsidence occurring	Tahmoor Coal
			Owner notifies of new house	Conduct pre-mining hazard identification inspection, if access provided by landowner	Prior to subsidence occurring	Tahmoor Coal (JMA)
				Follow risk control procedures, as for other houses	Immediately	Tahmoor Coal (MSEC)
			New house has maximum plan dimension greater than 30 m	Conduct subsidence predictions, impact assessment and risk assessment	Prior to subsidence occurring	Tahmoor Coal (MSEC)
				Follow risk control procedures, as for other houses	Immediately	Tahmoor Coal
Swimming pools and pool gates	Damage to pool	Low	None	Notify owner of potential impacts to pool	Before mine subsidence impacts occur	Tahmoor Coal
	Pool gate – won't shut	High	None	Notify owner of potential impact to pool gate and fence	Before mine subsidence impacts occur	Tahmoor Coal
				Visually inspect pool gate to check that it is operating properly	Weekly when each pool is within active subsidence zone, and at completion of each longwall	Tahmoor Coal
			Pool gate won't close	Notify resident and/or landowner, contact Subsidence Advisory NSW to repair gate	Immediately	Tahmoor Coal
				Repair gate	As soon as possible	Tahmoor Coal
Farm dams	Loss of water storage due to leakage of dam wall or floor	Low	During mining	Survey along crest and base of Dam PTH_080_d01 (DP Label FD1) and Dam PTH_105_d01 (DP Label FD3)	Weekly during period of active subsidence at each dam	Tahmoor Coal
				Visual inspection of Dam PTH_080_d01 (DP Label FD1), Dam PTH_055_d01 and Dam PTH_105_d01 (DP Label FD3) by building inspector, based on checklist provided by geotechnical engineer	Weekly during period of active subsidence at each dam	Tahmoor Coal
				Visual inspection of dam by geotechnical engineer, including recording of water levels	Monthly during period of active subsidence at each dam Quarterly after completion of LW W4	Tahmoor Coal
			Cracks observed in dam	Repair cracks	As required	Tahmoor Coal
			Loss of water supply due to leakage of dam wall or floor	Supply water to landowner	As required	Tahmoor Coal

7.0 SRG REVIEW MEETINGS

The SRG undertakes reviews and, as necessary, revises and improves the risk control measures to manage risks to health and safety and potential impacts to building structures. The reviews are undertaken regularly during the period of active subsidence based on the results of surveys and visual inspections and summarised in regular monitoring reports, as described in Section 6.3.

The purpose of the reviews is to:

- detect changes, including the early detection of potential impacts on health and safety and impacts to building structures;
- verify the risk assessments previously conducted;
- ensure the effectiveness and reliability of risk control measures; and
- support continual improvement and change management.

SRG meetings will be held for discussion and resolution of issues raised in the operation of the Management Plan. The frequency of meetings shall be as agreed by the parties.

SRG meetings will discuss any incidents reported in relation to structures, the progress of mining, the extent of mine subsidence that has occurred, and comparisons between observed and predicted ground movements.

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

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

8.0 AUDIT AND REVIEW

This Management plan can be reviewed and updated to continually to 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 property and business 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:

- observation of greater impacts on surface features due to mine subsidence than was previously expected;
- observation of fewer impacts or no impacts on structures or 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 Management Plan be required during that period, an auditor shall be appointed by Tahmoor Coal to review the operation of the Management Plan and report at the next scheduled plan review meeting.

9.0 RECORD KEEPING

Tahmoor Coal will keep and distribute minutes of SRG meetings.

10.0 CONTACT LIST

Organisation	Contact	Phone	Email
NSW Department of Planning and Environment – Resources Regulator (RR)	Phil Steuart	(02) 4063 6484	phil.steuart@planning.nsw.gov.au
	Gang Li	(02) 4063 6429 0409 227 986	gang.li@planning.nsw.gov.au
	Ray Ramage	(02) 4063 6485 0442 551 293	ray.ramage@planning.nsw.gov.au
JMA Solutions (JMA)	John Matheson*	(02) 9979 6618	john@jmasolutions.com.au
Subsidence Advisory NSW	Matthew Montgomery	(02) 4677 1967 0425 275 564	Matthew.Montgomery@customerservice.nsw.gov.au
Mine Subsidence Engineering Consultants (MSEC)	Daryl Kay*	(02) 9413 3777 0416 191 304	daryl@minesubsidence.com
SIMEC Mining Tahmoor Coal Project Manager	Ross Barber*	(02) 4640 0028 0419 466 143	ross.barber@ simecgfg.com
SIMEC Mining Tahmoor Coal Approvals Specialist	April Hudson*	(02) 4640 0022 0466 380 992	April.Hudson@simecgfg.com
Tahmoor Coal	Tahmoor Coal Control 24 hour contact	1800 154 415	-

* denotes member of Structures Response Group

APPENDIX A. Drawings and Supporting Documentation

The following supporting documentation is provided in Appendix A.

Drawings

Drawing No.	*Description*	*Revision*
MSEC1173-00-01	Monitoring over Longwall W3-W4	02
MSEC1173-12-01	Structures	A

Supporting Documentation

Tahmoor Coal (2020)	Risk Assessment Report – Tahmoor North – Western Domain, Longwalls West 3 and West 4, October 2020.

Table A.1 - Hazard Identification and Engineering Controls for LW W3-W4

Structure Reference	Structure Type	Description	Hazard identification and recommendations by structural engineer	Hazard identification and recommendations by geotechnical engineer	Mine operator's management actions in response to engineers' recommendations	Requirement for a Subsidence Hazard Mitigation Plan	Expected active subsidence period affecting property
PAT_001_h01	H	House	No issues identified.	No issues identified.	No additional management actions required.	No	Feb-22 to May-22
PAT_002_h01	H	House	No issues identified.	No issues identified.	No additional management actions required.	No	Feb-22 to May-22
PAT_003_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Feb-22 to May-22
PAT_004_h01	H	House	No issues identified with structures. As this is a steeply sloping site, it is recommended that the property be inspected by the Geotechnical Engineer.	No issues identified.	No additional management actions required.	No	Feb-22 to May-22
PAT_008_h01	H	House	The base connections of the steel verandah posts are founded on the side of the supporting concrete piers rather than on the centre of the pier. It is recommended that the base connections of the steel verandah posts should be upgraded to transmit the post reaction towards the centre of the supporting concrete piers. A site inspection report JMA Solutions 20191101 has been prepared, which provides details for verandah post baseplate augmentation works to be carried out prior to subsidence impacting this site.	No issues identified.	Upgrade base connections of steel verandah posts as per recommendation by structural engineer (complete).	Yes	Mar-22 to May-22
PAT_009_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Mar-22 to May-22
PAT_010_h01	H	House	No issues identified.	No issues identified.	No additional management actions required.	No	Mar-22 to May-22
PBG_001_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Dec-21 to Mar-22
PBG_001_h02	H	House	No issues identified.	Not required.	No additional management actions required.	No	Jan-22 to Mar-22
PBG_002_h01	H	House	Not required.	No issues identified.	No additional management actions required.	No	Jan-22 to Mar-22
PBG_003_h01	H	House	The single-storey brick veneer residence has been constructed on a sloping site and brick piers in the sub-floor space are up to 3 metres high. A leaking water suply pipe has damaged the suspended timber floor in one area and had wet the ground surface and subsoil . There was evidence of ground surface cracking in the southwest corner of the subfloor space and the ground surface was damp around the footing along the downslope side of the dwelling. Vertical cracking was oberved in all "squint" corners of te external brick skin below ground floor level with some slight out-of-plane displacement being observed.	No issues identified.	Install baseline survey pegs around the perimeter of the main dwelling and garage (complete). Conduct monthly building inspections during active subsidence of LW W3.	No	Jan-22 to Apr-22
PBG_004_h01	H	House	Horizontal bed joint cracks in a load-bearing brick pier along southern wall of garage (split-level dwelling), behind which is located a concrete block retaining wall. This residence is located near an existing watrcourse and could be impacted by non-systematic ground movement, which could impact the reinforced concrete block retaining walls around the garage. As this is a steeply sloping site, it is recommended that the property be inspected by the Geotechnical Engineer.	No issues identified.	Install baseline survey pegs around the perimeter of the main dwelling and garage (complete). Conduct monthly inspections of the garage structure during active subsidence for LW W3. Monitor access stairs during active subsidence.	No	Jan-22 to May-22
PBG_005_h01	H	House	Timber access stair at front of residence was bouncy. Stairs replaced by owner in July 2020.	No issues identified.	Monitoring of stairs ceased in July 2020 when stairs were replaced.	No	Jan-22 to Apr-22
PBG_006_h01	H	House	Pad footings are located along the edge of the excavation that was carried out to form the undercroft garage. The footings are being undercut in some locations as shale is falling away from the excavated face. As this is a steeply sloping site, it is recommended that the property be inspected by the Geotechnical Engineer.	Inspection found pier foundations are susceptible to fretting and erosion during periods of heavy seepage. It is recommended that the sandstone face be supported with shortcrete of sandstone pitching to support the slope and foundations.	No additional management actions required. Inform owner of recommendations from geotechnical engineer (complete). Monthly inspections during active subsidence of LW W3.	No	Jan-22 to Apr-22
PBG_007_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Jan-22 to Apr-22
PBG_008_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Jan-22 to Apr-22
PBL_013_h01	H	House	Vehicle hoist has stabilising ground bars beneath the hoist posts.	Not required.	Baseline survey of tilt of vehicle hoist prior to start of LW W2 (complete).	No	Sep-21 to Dec-21
PCA_004_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Mar-22 to May-22
PSC_009_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Feb-22 to May-22
PSC_010_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Feb-22 to May-22
PSC_011_h01	H	House	Badly weathered unfinished particleboard deck was observed around the rear and northern elevations of the dwelling. It is recommended that access to the deck be restricted to the area immediately around the BBQ outside the family room during the period of active subsidence. It is recommended that the deck be visually inspected during active subsidence. Pre-existing damage was observed to the brick foundation wall below the garage floor level along the western elevation. It is recommended that crack gauges be installed and the gauges monitored for changes during active subsidence.	Not required.	Advise owner of existing condition of deck and request to restrict access during period of active subsidence (complete and owner currently rectifying deck). Install crack gauges as per structural engineer's recommendations (complete). Visually inspect deck and crack gauges as per structural engineer's recommendations, in addition to an inspection of the pool gates.	No	Jan-22 to May-22
PSC_012_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Jan-22 to May-22
PSC_014_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Jan-22 to Apr-22

Table A.1 - Hazard Identification and Engineering Controls for LW W3-W4

Structure Reference	Structure Type	Description	Hazard identification and recommendations by structural engineer	Hazard identification and recommendations by geotechnical engineer	Mine operator's management actions in response to engineers' recommendations	Requirement for a Subsidence Hazard Mitigation Plan	Expected active subsidence period affecting property
PSC_015_h01	H	House	It is recommended to visually inspect the brick retaining wall.	Not required.	Visually inspect the retaining wall during active subsidence monthly during active subsidence of LW W3.	No	Jan-22 to Mar-22
PSC_016_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Dec-21 to Mar-22
PSC_018_h01	H	House	No issues identified.	Not required.	Add weekly inspections of pool not previously identified (hidden fron	No	Dec-21 to Mar-22
PSC_020_h01	H	House	Not required.	No issues identified.	No additional management actions required.	No	Dec-21 to Mar-22
PSC_020_h02	H	House	Not required.	No issues identified.	No additional management actions required.	No	Dec-21 to Mar-22
PSC_021_h01	H	House	No issues identified.	Not required.	No additional management actions required.	No	Dec-21 to Mar-22
PSC_022_h01	H	House	Not required.	No issues identified.	No additional management actions required.	No	Jan-22 to May-22
PSC_024_h01	H	House	No issues identified.	No issues identified.	No additional management actions required.	No	Feb-22 to May-22
PSC_092_h01	H	House	The structures are in a visible dilapidated condition and would be unfit for human habitation based upon what can be observed in the aerial photogrpahs noting that the corrugated steel roof cladding is generally rusted roof. Recommend erect bunting around the structures and notices warning against unauthorised occupation of the structures.	Access initially denied but noted that structure is unoccupied.	Access available but noted that structure is unoccupied. Recommend erect bunting around the structures and notices warning against unauthorised occupation of the structures (complete).	No	Sep-21 to Dec-21
V15a	H	House	Completed prior to influence of LW32 with no issues noted.	No issues identified.	No additional management actions required.	No	May-22 to May-22
PTH_112_h01	H	House	* Trip hazards at cracks in the rear patio and garage slabs - unlikely to change due to mine subsidence - recommended that the owner place a fairing mortar against the stepped surface to provide a gradual transition in the slab surface. * External chimneys are present * Internal floor is bouncy due to inadequate support. Existing damage to internal wall linings has been identifed. * The timber-framed roof around the laundry should be connected to the supporting (in the sense of downwards gravity loading) steel post. This will not change due to mine subsidence.	No issues identified.	* Survey marks should be installed on both chimneys to monitor chimney tilt, weekly, during active subsidence. * Periodic building inspections during active subsidence to monitor the condition of the chimneys, the existing trip hazards on external pavements and existing internal floors and internal wall linings. * Tahmoor Coal will fasten the timber-framed roof around the laundry to the supporting steel post. Refer separate PSMP, which includes ground surveys and visual inspections.	Separate PSMP will be developed prior to influence of LW W3	During LW W4
PAR_104_h01	H	House	Slight pre-existing pier tilt at southern end of the dwelling, risk of bearer falling off the pier is low given the distance of this dwelling to LW-W4. Some movement could occur between the PVC pipework and supporting mass of concrete if dwelling is impacted by ground strain, which could cause a pipe leak. The corner cracking on the front verandah slab has reduced the effectiveness of the post brackets to tie the timber posts down to the front verandah slab in the event of wind uplift. Mine subsidence is unlikely to change the severity of the cracking nor the hazard level.	No issues identified.	Inform owner of existing hazards. Owner is elderly and frail. Tahmoor Coal will tie down the front corner verandah posts. Monitor during active subsidence of LW W4.	No	During LW W4
PCN_008_h01	H	House	* The plasterboard ceiling has delaminated and separated away from the supporting timber framing in several rooms, which has been noted in the PMI report. Remedial action should be undertaken by the owner as matter of priority. Mine subsidence will alter the condition of the ceiling. * No other pre-existing conditions or damage was observed that requires closer monitoring. * No other unusual structure or circumstances, such as adverse ground conditions, were observed (other than as described above), which appeared likely to impact the structure, requiring mitigation work to be carried out.	No issues identified.	Inform of existing defects. Visual monitoring by building inspector during active subsidence.	No	During LW W4

Table A.1 - Hazard Identification and Engineering Controls for LW W3-W4

Structure Reference	Structure Type	Description	Hazard identification and recommendations by structural engineer	Hazard identification and recommendations by geotechnical engineer	Mine operator's management actions in response to engineers' recommendations	Requirement for a Subsidence Hazard Mitigation Plan	Expected active subsidence period affecting property
PCN_021_h01	H	House	* Displaced ceiling in the enclosed verandah area. * Random sandstone masonry retaining wall is close to bearing on the timber posts along the western side of the rear patio. * Crack concrete block walls along the side of a steel-framed shed. * Broken branch has fallen on top of poultry enclosure. * No other pre-existing conditions or damage has been observed that requires closer monitoring. * No other unusual structure or circumstances, such as adverse ground conditions, were observed (other than as described above), which appeared likely to impact the structure, requiring mitigation work to be carried out.	No issues identified.	Inform owner of existing hazards. Owner is elderly and fail. Tahmoor Coal will secure the ceiling to the roof frame prior to infuence of LW W4. Monitor property for change during active subsidence of LW W4.	No	During LW W4
PRU_003_h01	H	House	Pre-existing pier tilt observed at 3 locations, which has most likely been caused by stormwater discharged into the soil or onto the ground surface adjoining the piers	No issues identified.	Periodic building inspections during active subsidence to monitor the tilt of piers where pre-existing tilt has been identified and the cracked path at rear of dwelling. No other mitigation work relating to subsidence has been identified.	No	During LW W4
PSR_010_h01	H	House	* No significant hazards were identified within or immediately surrounding the main dwelling or the adjacent machinery shed. * Vertical posts have been erected within the hay shed to support screens. The posts are tied to the roof trusses in an ad-hoc manner and do not appear to be connected to footings. Subsidence is not expected to impact the structure noticeably, however, wind load displacement of the hay shed could impact the connection between the posts and roof trusses and it is recommended that the ad-hoc structures be removed. * The small steel-framed paddock shed is small. The shed is infrequently used and is unlikely to be significantly impacted by subsidence. * The brick dairy shed is in a severely damaged condition and access should not be permitted. It is recommended that a temporary fence should be erected around the dairy to prevent unauthorised access. * The secondary dwelling is generally in serviceable condition except for the outwards leaning brick hearth along the southern elevation and the tilting brick piers that support a plastic rainwater tank off the southwest corner of the dwelling. It is recommended that the rainwater tank should be drained and removed from its current position and the tilting piers should be demolished as they are deemed unsafe. The outwards tilt of the hearth is unlikely to increase due to subsidence but monitor during LW-W4. * Equipment and materials are being stored on the truss bottom chord in the steel shed adjacent to the secondary dwelling. It is unlikely to have been designed for this loading. It is recommended that the materials should be removed and stored on the ground before mining of LW-W4.	No issues identified.	* Visual monitoring by building inspector during active subsidence. * Stabilise and secure the ad-hoc screen structure within the hay shed or dismantle and store materials on the ground. * Erect a min 1.8m high temporary fence around the dairy that should be located beyond where it is possible for a collapsing wall to impact the fence, to prevent unauthorised entry to the dairy. * Install two pairs of telltale marks into the side wall of the tilting hearth at the secondary residence, take baseline tilt measurements and monitor for change in tilt and crack width during mining of LW-W4. * Drain the plastic rainwater tank near the secondary residence and dismount it from the tank stand. Place tank on a prepared granular base on ground. * Recommend removal of the materials stored on the bottom chord of the roof trusses in the shed near the secondary residence to avoid possible overloading unrelated to subsidence.	No	During LW W4
PTH_126_h01	H	House	* The property is partly used in the care of children. * Some of the cubby roof-framing connections should be upgraded by way of galvanised metal straps to improve tied-down. * Some possible trip hazards at vertical steps at slab joints and cracks observed and identified in PMI report. * Rear pool gate latch at northern end of pool wobbles and should be secured. * Timber framed pergola in the pool enclosure is very flexible and additional knee-bracing should be considered. * Uncertain status of empty fuel drums at rear of shed. * No other pre-existing conditions or damage was observed that requires closer monitoring. * No other unusual structure or circumstances, such as adverse ground conditions, were observed (other than as described above), which appeared likely to impact the structure, requiring mitigation work to be carried out.	No issues identified.	Inform owner of existing defects to the property. Visual monitoring by building inspector during active subsidence.	No	During LW W4

Major Project Risk Assessment: Tahmoor Underground - Extraction Plan LW W3-W4

	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			
☑ Appendix B																		
Site	**Type of Risk Assessment**	**Key Element (CURA Context/Category)**	**Sub Key Element (If applicable)**	**Risk Description - Something happens……**	**Consequence - resulting in:**	**Causes - Caused by**	**Existing Control Description**	**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	Major Project	Built Infrastructure	Built Structures	Impact on health and safety of people	Injury to person	Subsidence resulting in failure of a structural element	* Management Plans prepared for previous longwalls (AC) * Previous ground survey and visual inspection as part of LW 22-W2 management (AC) * Previous consultation, coordination and cooperation with residents (AC) * Completion of Pre-mining and subsidence hazard inspections (EC)	2	Health & Safety	3	E	6	3	Health & Safety	Complete Built Structures Management Plan including TARP for emergency evacuation procedures	April Hudson	01-Sep-21	
Tahmoor Underground	Major Project	Built Infrastructure	Built Structures	Damage to structures	Repair of structures	Subsidence	* Management Plans prepared for previous longwalls (AC) * Previous ground survey and visual inspection as part of LW 22-W2 management (AC) * Previous consultation, coordination and cooperation with residents (AC) * Completion of Pre-mining and subsidence hazard inspections (EC)	2	Property Damage	2	D	5	2	Property Damage	Complete Built Structures Management Plan including TARP for emergency evacuation procedures	April Hudson	01-Sep-21	
	2	2		2	2	Subtotal CountA (ignoring hidden values)		2				2	2					
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						

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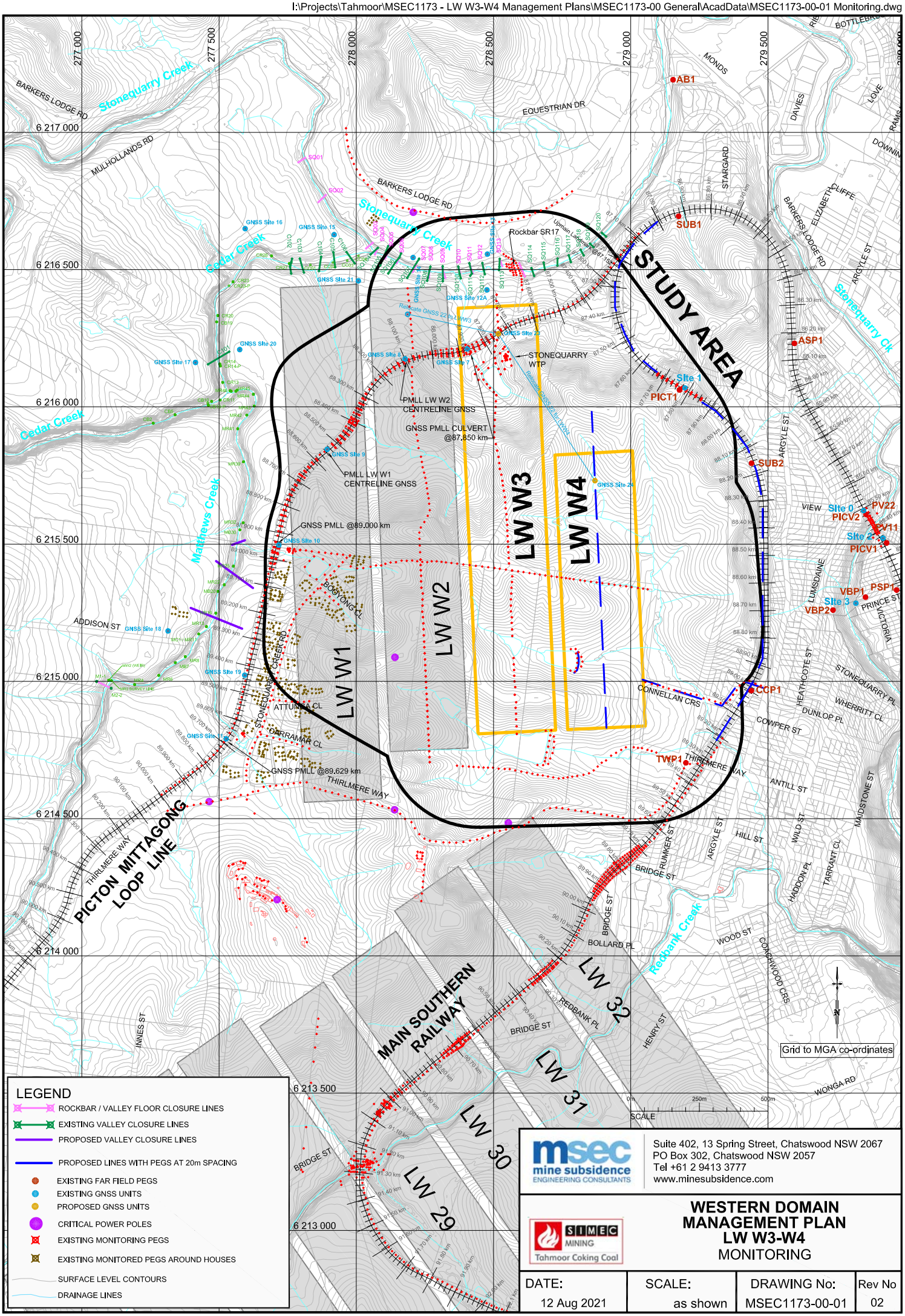

LEGEND

- ROCKBAR / VALLEY FLOOR CLOSURE LINES
- EXISTING VALLEY CLOSURE LINES
- PROPOSED VALLEY CLOSURE LINES
- PROPOSED LINES WITH PEGS AT 20m SPACING
- EXISTING FAR FIELD PEGS
- EXISTING GNSS UNITS
- PROPOSED GNSS UNITS
- CRITICAL POWER POLES
- EXISTING MONITORING PEGS
- EXISTING MONITORED PEGS AROUND HOUSES
- SURFACE LEVEL CONTOURS
- DRAINAGE LINES

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

SIMEC MINING
Tahmoor Coking Coal

WESTERN DOMAIN MANAGEMENT PLAN LW W3-W4 MONITORING

DATE:	SCALE:	DRAWING No:	Rev No
12 Aug 2021	as shown	MSEC1173-00-01	02

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