mine subsidence ENGINEERING CONSULTANTS

TAHMOOR UNDERGROUND GLENCORE

GLENCORE:

Tahmoor Colliery - Longwalls 28 to 30

Management Plan for Potential Impacts to Built Heritage

AUTHORISATION OF MANAGEMENT PLAN

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Feb-14	MSEC646-13	A	Updated for Longwalls 28 to 30

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References:-

Biosis, (2009). *Tahmoor Colliery – Longwalls 27-30, Impacts of Subsidence on Cultural Heritage.* Biosis Research, May 2009. .

JMA, (2012). *27 Remembrance Drive, Tahmoor Structural Inspection Report*, John Matheson & Associates, Report No. 0194, Rev. 1, July 2012.

MSEC, (2009). *Tahmoor Colliery Longwalls 27 to 30 - The Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts on Natural Features and Items of Surface Infrastructure due to mining Longwalls 27 to 30 at Tahmoor Colliery in support of the SMP Application.* Mine Subsidence Engineering Consultants, Report No. MSEC355, Revision B, July 2009.

MSEC, (2013). *Tahmoor Colliery Longwalls 29 and 30 – The Effects of the Proposed Modified Commencing Ends of Longwalls 29 and 30 at Tahmoor Colliery on the Subsidence Predictions and Impact Assessments.* Mine Subsidence Engineering Consultants, Report No. MSEC645, 2013.

MSEC, (2013b). *Tahmoor House Monitoring Reports during the mining of Longwall 27*, Report Series MSEC620.

Niche, (2012). *Heritage Assessment of Tahmoor House*, Niche Environment and Heritage, Project No. 1346, Final v.4, December 2012.

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

1.1. Background

Tahmoor Colliery is located approximately 80 kilometres south west of Sydney in the township of Tahmoor NSW. It is managed and operated by Glencore. Tahmoor Colliery has previously mined 26 longwalls to the north and west of the mine's current location and is currently mining Longwall 27.

Longwalls 28 to 30 are a continuation of a series of longwalls that extend into the Tahmoor North Lease area, which began with Longwall 22. The longwall panels are located between the Bargo River in the south-east, the township of Thirlmere in the west and Picton in the north. A portion of each longwall is located beneath the urban area of Tahmoor. Items of heritage significance are located within these areas. A summary of the dimensions of these longwalls is provided in Table 1.1.

Table 1.1 Longwall Dimensions

Longwall	Overall Void Length Including Installation Heading (m)	Overall Void Width Including First Workings (m)	Overall Tailgate Chain Pillar Width (m)
Longwall 28	2630	283	39
Longwall 29	2321	283	39
Longwall 30	2321	283	39

This Management Plan provides detailed information about how the risks associated with mining beneath items of heritage significance will be managed by Tahmoor Colliery.

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

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 items of heritage significance.

The objectives of the Management Plan have been developed to:-

- Ensure the safety and serviceability of all structures. Public safety is paramount. Disruption and inconvenience should be kept to minimal levels.
- Maintain the heritage value of the structures.
- Monitor ground movements and the condition of structures during mining.
- Initiate or coordinate action with the Mine Subsidence Board to mitigate or remedy potential significant impacts that are expected to occur to structures.
- Provide a plan of action in the event that the impacts of mine subsidence are greater than those that are predicted.
- Provide a forum to report, discuss and record impacts to the surface. This will involve Tahmoor Colliery, Mine Subsidence Board, NSW Department of Trade and Investment, Regional Infrastructure and Services, Division of Resources and Energy (DTIRIS), and consultants as required.
- Establish lines of communication and emergency contacts.

1.3. Scope

The Management Plan is to be used to protect and monitor the condition of the items of heritage significance identified to be at risk due to mine subsidence. The major items at risk are:-

- Residential establishments
- Significant heritage elements of the structure

The Plan only covers items of heritage significance that may be affected by mine subsidence as a result of mining Longwalls 28 to 30. The management plan does not include other properties that lie outside the extent of these areas.

1.4. Proposed Mining Schedule

It is planned that each longwall will extract coal working northwest from the southeastern ends. This Management Plan covers longwall mining until completion of mining in Longwall 30 and for sufficient time thereafter to allow for completion of subsidence effects.

The current schedule of mining is shown in Table 1.2.

Table 1.2 Schedule of Mining

Longwall	Start Date	Completion Date
Longwall 28	April 2014	August 2015
Longwall 29	September 2015	October 2016
Longwall 30	November 2016	December 2017

1.5. 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 metres in front of the longwall face to an area 450 metres 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 metres in front and 450 metres behind the active longwall face, as shown by Fig. 1.1.

Fig. 1.1 Diagrammatic Representation of Active Subsidence Zone

1.6. Maximum Predicted Subsidence Parameters

Predicted mining-induced systematic subsidence movements were provided in Report No. MSEC355, which was prepared in support of Tahmoor Colliery's SMP Application for Longwalls 27 to 30. Revised predictions have been provided in Report No.MSEC645, which was prepared in support of Tahmoor Colliery's modification to the commencing ends of Longwalls 29 and 30.

A summary of the maximum predicted incremental systematic subsidence parameters, due to the extraction of each of the proposed longwalls, is provided in Table 1.3. A summary of the maximum predicted total systematic subsidence parameters, after the extraction of each of the longwalls, is provided in Table 1.4.

Table 1.3 Maximum Predicted Incremental Systematic Subsidence Parameters due to the Extraction of Longwalls 28 to 30

Longwall	Maximum Predicted Incremental Subsidence (mm)	Maximum Predicted Incremental Tilt (mm/m)	Maximum Predicted Incremental Hogging Curvature (1/km)	Maximum Predicted Incremental Sagging Curvature (1/km)
Due to LW28	730	5.8	0.06	0.13
Due to LW29	720	5.8	0.06	0.12
Due to LW30	720	5.7	0.06	0.12

Table 1.4 Maximum Predicted Total Systematic Subsidence Parameters after the Extraction of Longwalls 28 to 30

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 LW28	1250	6.0	0.11	0.14
After LW29	1250	6.0	0.11	0.14
After LW30	1250	6.0	0.11	0.14

The values provided in the above table are the maximum predicted cumulative systematic subsidence parameters which occur within the general longwall mining area, including the predicted movements resulting from the extraction of Longwalls 22 to 30.

1.7. Observed Subsidence during the mining of Longwalls 22 to 27

Extensive ground monitoring within the urban areas of Tahmoor has allowed detailed comparisons to be made between predicted and observed subsidence, tilt, strain and curvature during the mining of Longwalls 22 to 27.

In summary, there is generally a good correlation between observed and predicted subsidence, tilt and curvature. Observed subsidence was generally slightly greater than predicted in areas that were located directly above previously extracted areas and areas of low level subsidence (typically less than 100 mm) was generally observed to extend further than predicted.

While there is generally a good correlation between observed and predicted subsidence, substantially increased subsidence has been observed above most of Longwall 24A and the southern end of Longwall 25, with slightly increased subsidence above the commencing ends of Longwalls 26 and 27. This was a very unusual event for the Southern Coalfield.

The cause for the increased subsidence has been investigated by Strata Control Technologies on behalf of Tahmoor Colliery (Gale and Sheppard, 2011). The investigations concluded that the increased subsidence is consistent with localised weathering of joint and bedding planes above a depressed water table adjacent to an incised gorge.

In light of the above observations, the region above the extracted longwalls at Tahmoor has been partitioned into three zones:

1. Normal subsidence zone – where the observed vertical subsidence is within the normal range and correlates well with predictions
2. Maximum increased subsidence zone – where the observed vertical subsidence is substantially greater than predictions but has reached it upper limit. Maximum subsidence above the centreline of the longwalls appears to be approximately 1.2 metres above Longwalls 24A and 25, 900 mm above Longwall 26 and 800 mm above Longwall 27.
3. Transition zone – where the subsidence behaviour appears to have transitioned between areas of maximum increased subsidence and normal subsidence.

When the locations of the three zones are plotted on a map, as shown in Drawing No. MSEC646-00-01 (refer Appendix), it can be seen that the transition zone is roughly consistent in width above Longwall 24A, Longwall 25 and Longwall 26. This orientation is roughly parallel to the Nepean Fault. The transition zone then appears to change direction above Longwall 27. This may suggest a relationship to the proximity of Longwall 27 to the Bargo River and a curved transition zone has been drawn to illustrate this. .

The observations above Longwalls 24A to 27 suggest that the location of the zone of increased subsidence is linked to both the alignment of the Nepean Fault and the proximity to the Bargo River. It correlates with the findings of Gale and Sheppard that the increased subsidence is linked to localised weathering of joint and bedding planes above a depressed water table adjacent to the incised gorge of the Bargo River.

The experiences of reduced maximum subsidence above Longwalls 26 and 27 suggest that the magnitude of maximum subsidence above the commencing ends of Longwalls 28 to 30 will be less than previously observed and may return close to normal levels of subsidence elsewhere at Tahmoor.

The zones of increased subsidence and transition to normal subsidence have been conservatively projected above Longwalls 28 to 30 in Drawing No. MSEC646-00-02 (refer Appendix). The projection is conservative as it is based on the orientation of the Nepean Fault rather than its proximity to the Bargo River. A curved dashed line is also shown in in Drawing No. MSEC646-00-02 above Longwall 28, which is an alternative projection based on the observations above Longwall 27 and its proximity to the Bargo River. This alternative projection appears reasonable based on the observations above Longwall 27. Despite the above observations and projections, it is recognised that substantially increased subsidence could develop above the commencing ends of Longwalls 28 to 30 and this Management Plan has been developed to manage potential impacts if substantial additional subsidence were to occur.

With respect to heritage structures, none are located directly within a potential zone of increased subsidence above Longwalls 28 to 30.

1.7.1. Predicted Strain

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

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

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

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

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

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

1.7.2. Analysis of Strains Measured in Survey Bays

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

Predictions of Strain Above Goaf

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

The histogram of the maximum observed total tensile and compressive strains measured in survey bays above goaf, for monitoring lines at Tahmoor, Appin Area and West Cliff Collieries, is provided in Fig. 1.2. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

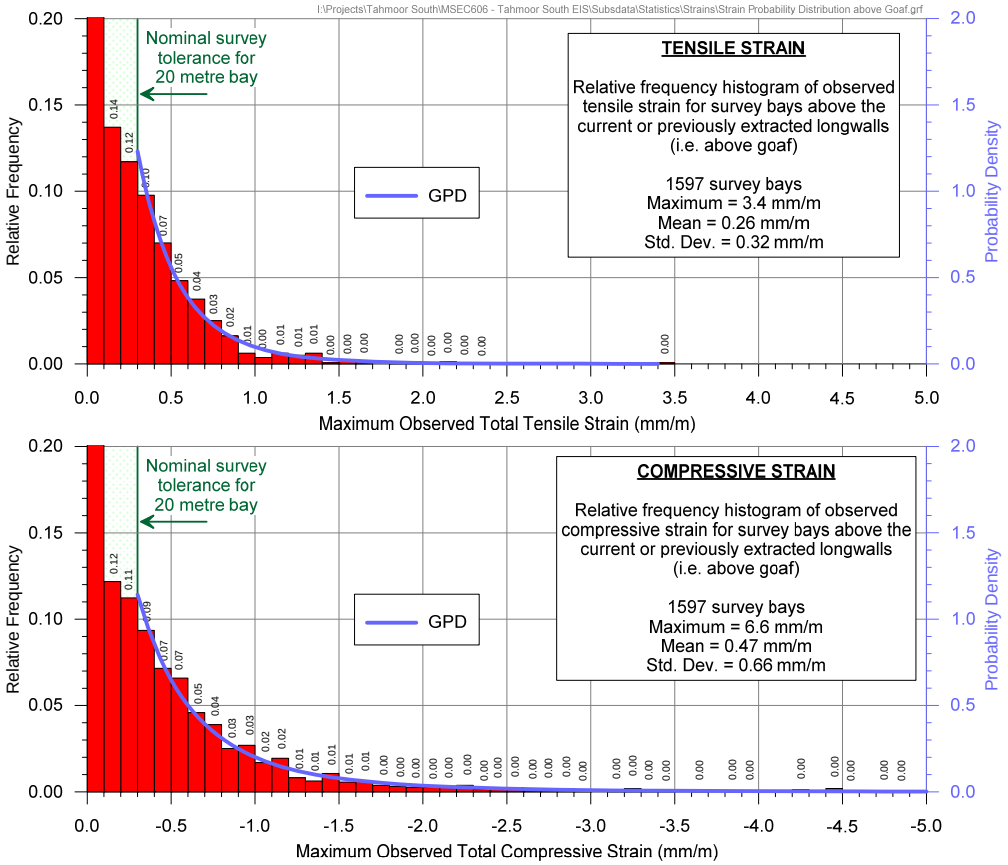


Fig. 1.2 Distributions of the Measured Maximum Tensile and Compressive Strains for Surveys Bays Located Above Goaf at Tahmoor, Appin and West Cliff Collieries

The 95 % confidence levels for the maximum total strains that the individual survey bays *above goaf* experienced at any time during mining at Tahmoor, Appin and West Cliff Collieries were 0.9 mm/m tensile and 1.6 mm/m compressive. The strains for the proposed longwalls are predicted to be 30 % to 50 % greater than those previously observed at these collieries and, therefore, it is expected that 95 % of the strains measured *above goaf* would be less than 1.5 mm/m tensile and 2.5 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 at Tahmoor, Appin and West Cliff Collieries were 1.4 mm/m tensile and 3.1 mm/m compressive. Similarly, it is expected that 99 % of the strains measured *above goaf* for the proposed longwalls would be less than 2.0 mm/m tensile and 4.5 mm/m compressive.

Predictions of Strain Above Solid Coal

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

The histogram of the maximum observed tensile and compressive strains measured in survey bays above solid coal, for monitoring lines at Tahmoor, Appin and West Cliff Collieries, is provided in Fig. 1.3. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

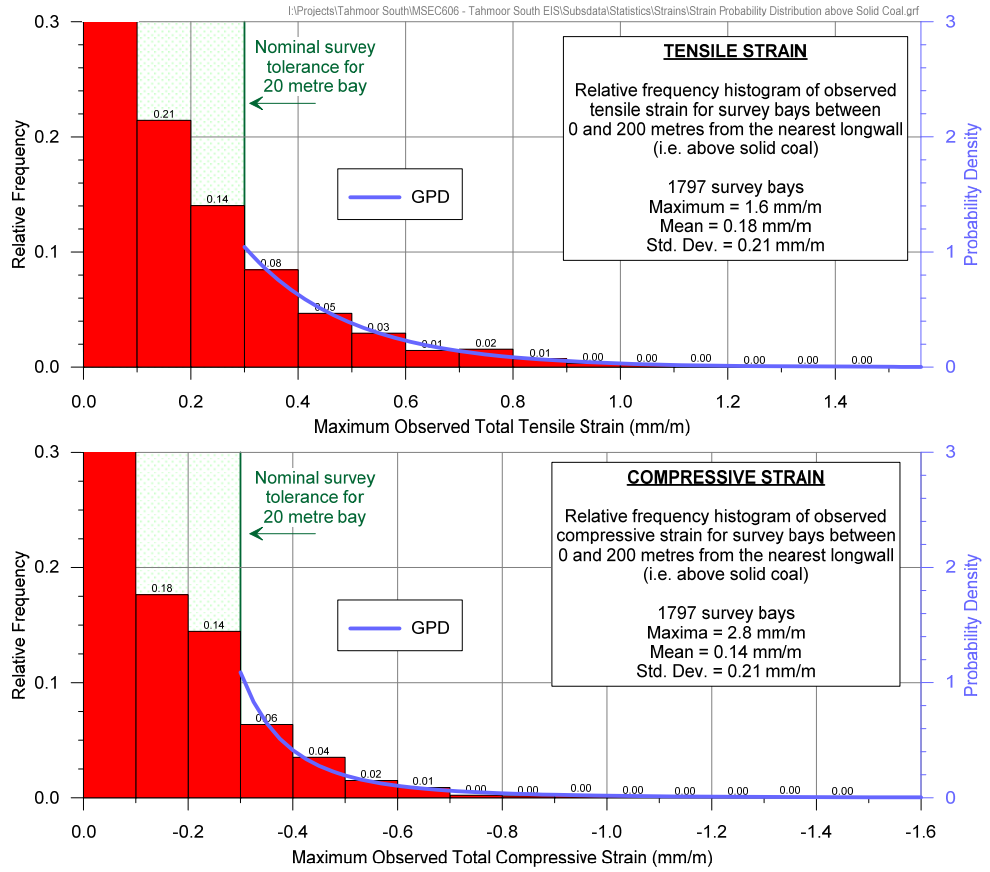


Fig. 1.3 Distributions of the Measured Maximum Tensile and Compressive Strains for Survey Bays Located Above Solid Coal at Tahmoor, Appin and West Cliff Collieries

The 95 % confidence levels for the maximum total strains that the individual survey bays *above solid coal* experienced at any time during mining at Tahmoor, Appin and West Cliff Collieries were 0.6 mm/m tensile and 0.5 mm/m compressive. The strains for the proposed longwalls are predicted to be 30 % to 50 % greater than those previously observed at these collieries and, therefore, it is expected that 95 % of the strains measured *above solid coal* would be less than 1.0 mm/m tensile and compressive.

The 99 % confidence levels for the maximum total strains that the individual survey bays *above solid coal* experienced at any time during mining at Tahmoor, Appin and West Cliff Collieries were 0.9 mm/m tensile and compressive. Similarly, it is expected that 99 % of the strains measured *above solid coal* adjacent to the proposed longwalls would be less than 1.5 mm/m tensile and compressive.

2.1. Overview

A number of items of heritage significance were identified in the SMP Application for Longwalls 27 to 30 (MSEC, 2009). The locations of the heritage items are shown in Drawing No. MSEC646-13-01. A summary is provided below.

- Tahmoor House

  Tahmoor House is located directly above the chain pillar between Longwalls 27 and 28. This Management Plan describes the measures that will be undertaken to manage potential impacts on this property.

- RSL LifeCare Queen Victoria Gardens

  Structures at RSL LifeCare Queen Victoria Gardens may experience small mining-induced movements during the mining of Longwalls 28 to 30. A separate management plan will be developed by Tahmoor Colliery and Queen Victoria Gardens.

- Remembrance Drive Pedestrian Bridge over Myrtle Creek

  The Remembrance Drive Pedestrian Bridge over Myrtle Creek is a single-lane bridge, which is located on the northern edge of the Tahmoor urban area. The location of the Remembrance Drive Road Bridge relative to Longwalls 28 to 30 is shown in Drawing No. MSEC646-13-01. The bridge is located approximately 170 metres east of the commencing end of Longwall 28 and approximately 250 metres south of the modified commencing end of Longwall 29.

  The effect of shortening the commencing ends of Longwalls 29 and 30 by approximately 250 metres is to substantially reduce the magnitude of subsidence at the bridges.

  The bridge has been inspected by structural engineer John Matheson & Associates.

  Given the offset distance of the Bridge from Longwalls 28 to 30 and the anticipated very small amount of movement that is expected to occur, the likelihood of the bridge being damaged and requiring repairs during the mining of Longwalls 28 to 30 is assessed as rare. A separate management plan has been developed by Tahmoor Colliery and Wollondilly Shire Council.

  In the unlikely event of impacts on the Bridge, repairs will be undertaken in consultation with a heritage consultant and Wollondilly Shire Council.

- 55-59 Remembrance Drive, Tahmoor

  The house is located above previously extracted Longwall 26 and no impacts have been reported during the mining of Longwalls 22 to 27. Very little additional subsidence is expected to develop during the mining of Longwalls 28 to 30 and no site specific management measures are planned for this structure.

  In the unlikely event of impacts on the house, repairs will be undertaken in consultation with a heritage consultant and Wollondilly Shire Council.

- 10 Hilton Park Road, Tahmoor

  The house is located above the chain pillar between Longwalls 25 and 26 and no impacts have been reported during the mining of Longwalls 22 to 27. Very little additional subsidence is expected to develop during the mining of Longwalls 28 to 30 and no further site specific management measures are planned for this structure.

  In the unlikely event of impacts on the house, repairs will be undertaken in consultation with a heritage consultant and Wollondilly Shire Council.

- 2425 Remembrance Drive, Tahmoor

  The item of heritage significance, a sawmill, is an open-sided timber and corrugated iron shed. The sawmill appears to have been abandoned after it was taken out of use, though the machinery appears largely intact (Biosis, 2009c). The machinery on the site consists of loose equipment, some of which is suspended from the roof trusses.

  The sawmill is located beyond the ends of Longwalls 29 and 30 by a distance of more than 400 metres. It is therefore assessed that the probability of impact on the sawmill is extremely low. No impacts are expected to occur to the machinery.

  No management measures are recommended for the sawmill or machinery.

- 675 Thirlmere Way, Picton (Miller's House)

  Miller's House is located beyond the end of Longwall 30. The items of heritage significance consist of a single-storey weatherboard house and archaeological relics.

  The house is located approximately 270 metres from Longwall 30 and is predicted less than 20 mm of subsidence during the extraction of the proposed longwalls.

  The likelihood of impact at this house is considered remote.

  No management measures are recommended for this structure during the mining of Longwalls 28 to 30.

- 220 Bridge Street, Thirlmere

  The property is located directly above the ends of Longwalls 29 and 30. The items of heritage significance consist of archaeological relics with no standing structures.

  The likelihood of impacts to the relics is considered remote.

  No management measures are recommended for this item.

2.2. Tahmoor House

2.2.1. Building Structures

Tahmoor House (MSEC Structure Ref. CC92a) is located directly above the chain pillar between Longwalls 27 and 28, as shown in Fig. 2.1. The items of heritage significance consist of a house and remnants of former outbuildings.

Fig. 2.1 Location of Tahmoor House in relation to Longwalls 28, 29 and 30

Tahmoor House is a single-storey weatherboard house constructed on sandstone foundations with a part basement. It has a maximum plan dimension of approximately 24 metres. The pitched timber framed roof is covered by corrugated iron. There is evidence of some past termite damage in the roof and JMA (2012) recommends that the owner replace a small number of rafters. There are four brick chimneys within the house. While the main building fabric is constructed with weatherboard panels, the lower levels of the house are constructed with sandstone and sandstock brick. While the sandstock brick appears to have been more recently built, the bricks themselves may have heritage value. Some of the masonry walls have been exposed following the construction of a lower floor and new brick piers have been inserted through walls, replacing the original sandstone. The internal walls are generally lined with plasterboard or more recently constructed sandstock brick.

Extensive restoration works have been undertaken at Tahmoor House and further restoration works are planned. The house and shed were inspected by structural engineer John Matheson & Associates, who considers that they appear to be in serviceable condition with no visible evidence from which to infer that the building was unstable (JMA, 2012).

Fig. 2.2 Front of Tahmoor House

Photo courtesy Niche (2012)

Fig. 2.3 Rear of Tahmoor House

2.2.2. Heritage Significance

A heritage assessment has been conducted by Biosis Research (2009 and 2011) and by Niche (2012). Background research indicates that the main building was constructed c1822.

Niche (2009) has provided the following statement of significance:

> *"Tahmoor House is one of the earliest surviving houses in the Tahmoor area and is an important example of an early Colonial Georgian Inn. Built c1822 by Edward Doyle, Tahmoor House was designed as an accommodation house, and later Inn, for travellers on the Great Southern Road. The Inn was one of a few that serviced the main roads of the colony. Such establishments were crucial to its expansion and the growth of settlements along early routes. The house is associated with a number of figures important to the cultural history of Tahmoor including: Edward Boyle, William Klensendorlffe, James Crispe and George Bradbury. Despite significant modification to its fabric, the house features notable elements that possess representative and aesthetic value, including: the rear staircase, the front (west) door and the sandstone flagging on the front verandah. The rear of the property also has considerable research potential, with remnants of former outbuildings, wells and cesspits likely to be present in less disturbed areas. Tahmoor House is currently listed as a locally significant heritage item; however further assessment indicates that it has values that would meet the threshold for state heritage significance."*

Photographs of the notable elements of heritage significance are shown below.

Photo courtesy Niche (2012)

Fig. 2.4 Rear staircase

Photo courtesy Niche (2012)

Fig. 2.5 Sandstone flagging on front verandah

Photo courtesy Niche (2012)

Fig. 2.6 Original (west) entrance

2.2.3. Experience during the mining of Longwall 27

Surveys and visual inspections were undertaken during the mining of Longwall 27 in accordance with the Longwall 27 Management Plan, and the results were provided in regular monitoring reports (MSEC, 2013b)

Vertical subsidence

The first survey pegs installed near Tahmoor House were pegs that are located along Remembrance Drive. Survey pegs RE51 and RE52 are located directly in front of Tahmoor House and these were installed prior to the extraction of Longwall 25 in August 2008. As at 22 May 2013, when the Longwall 27 face had passed Tahmoor House by a distance of 495 metres, a total of 208 mm and 172 mm of vertical subsidence had been measured at survey pegs RE51 and RE52, respectively. This compares well with and is slightly less than the prediction of 250 mm for the House after the mining of Longwall 27.

Prior to the influence of Longwall 27, survey pegs were installed in the ground around Tahmoor House and on the roof and fascia boards. A plot of subsidence at each survey peg is shown in Fig. 2.7. It can be seen that a maximum of 171 mm of subsidence has been observed around the perimeter of Tahmoor House since the commencement of Longwall 27. This compares well with and is slightly less than the prediction of 200 mm for the House due to the mining of Longwall 27.

Ground tilt

It can be seen from Fig. 2.7 that the house has tilted along its long axis, with slightly more subsidence (approximately 40 mm) observed at the western side of the house compared to the eastern side. This is within expectations as the western side of the house is closest to the longwall face.

After the effects of Longwall 27 had passed, very little tilt was observed along the short axis, as expected.

The measured changes in height represent a mining-induced tilt of 1.7 mm/m, which compares well with and is slightly less than the prediction of 2.3 mm/m for the House after the mining of Longwall 27.

Changes in horizontal distances and Ground strains

Ground strain is a measure of change in horizontal distance between adjacent survey pegs, divided by their original length. Observed changes in horizontal distance around the house are shown in Fig. 2.7. It can be seen that measured changes in horizontal distances are generally within survey tolerance but generally tensile in nature. The measured changes in horizontal distance represent maximum tensile strains of approximately 0.5 mm/m. This is also within expectations.

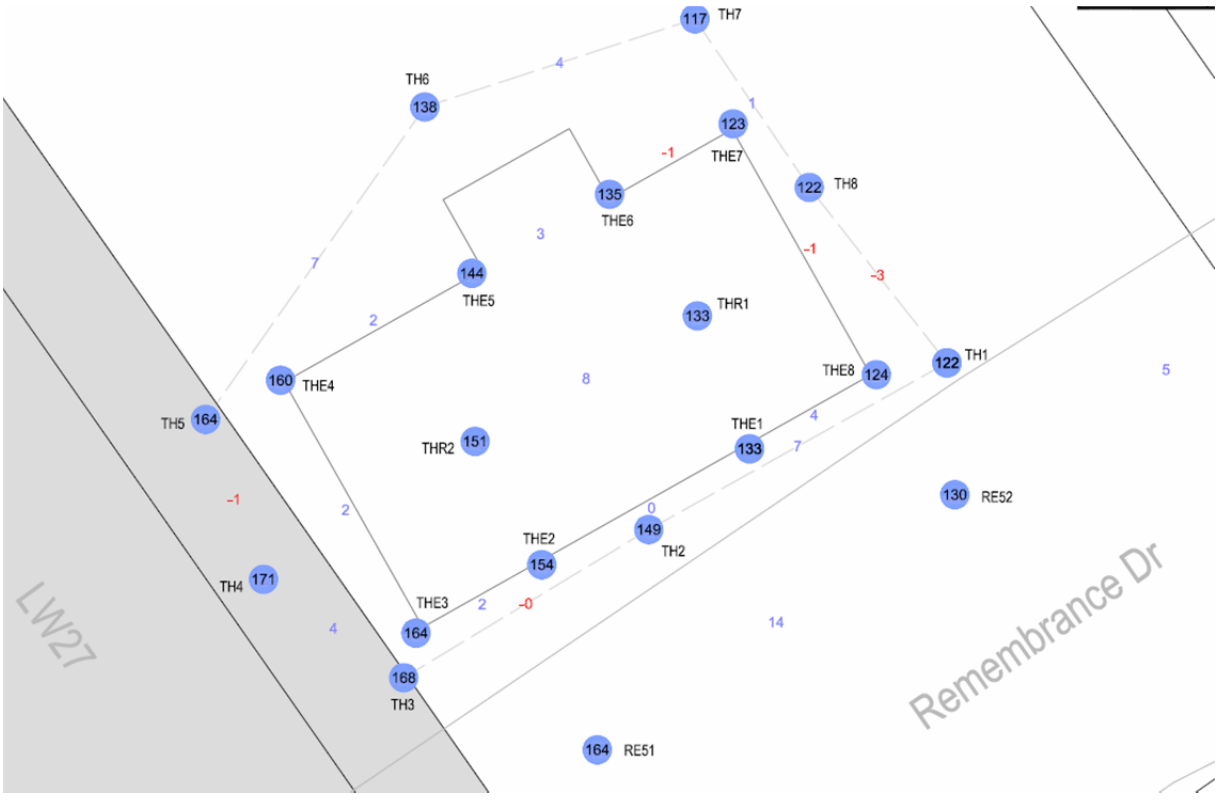


Fig. 2.7 Observed subsidence at Tahmoor House during the mining of Longwall 27

Very minor impacts were reported at the property during the mining of Longwall 27, including:

- Very minor differential movement in mortar bedding material at the base of the front steps. On the eastern side of the entry steps from Remembrance Drive, minor movement (approximately 20 mm) of the new retaining wall away from the sandstone blocks was observed.
- Red brick dust was found on the paving area at the north east corner of the house. A possible source for the dust may have been from the chimneys where they extend above the roof level. There did not appear to be any fretting from the external chimney on the eastern wall near the northern corner. Some mortar appeared to have been lost between brickwork of the northern internal chimney, though the bricks appeared to be in good condition. Some fretting was visible in the brickwork on the southern chimney but it is unlikely that any brick dust from the southern chimney would be visible on the paving.
- Some very minor cracking of mortar joint lines was observed on the eastern side of the rear steps. A small wedge of mortar (50 mm long by 20-25 mm high) was found at the base of the first tread.
- A gap developed between a brick internal partition wall and a timber internal partition wall on the ground floor of the house, east of the rear stairs. The gap tapered from zero at the ground, to about 5 mm at the ceiling. No impacts were observed to the sandstone wall. The crack may have been present prior to the mining of Longwall 27.
- A single board on the eastern side of the house had moved away from its frame beneath the window. After a period of no change, an additional board and a weather strip were observed to have moved off the frame.

2.2.4. Predicted Subsidence Movements

The subsidence predictions for this structure were provided in Report No. MSEC355 (2009, Rev. B), which was provided in support of Tahmoor Colliery's SMP application for Longwalls 27 to 30. The main structure was referenced CC92a and the shed was referenced CC92b in this report.

The commencing ends of Longwalls 29 and 30 have been shortened by approximately 250 metres, since the predictions were provided in Report No. MSEC355. Revised predictions have been provided in Report No. MSEC645, which was prepared in support of Tahmoor Colliery's modification to the commencing ends of Longwalls 29 and 30. The effect of the revised predictions is to slightly reduce the amount of subsidence at Tahmoor House.

Predictions of systematic subsidence, tilt and curvature for the main structure are provided in Table 2.1. The predictions are based on the revised layout, which are slightly less than those provided in the SMP application. The predicted movements for the shed are similar to those for the house.

Table 2.1 Subsidence Predictions for Tahmoor House

Stage of Mining	Maximum Predicted Subsidence (mm)	Maximum Predicted Total Tilt (mm/m)	Maximum Predicted Hogging Curvature (1/km)	Maximum Predicted Sagging Curvature (1/km)
After LW27	250	2.3	0.01	< 0.01
After LW28	670	2.0	0.08	0.02
After LW29	700	2.3	0.07	0.02
After LW30	710	2.3	0.07	0.02

It can be seen that the majority of mine subsidence movements are predicted to occur during the mining of Longwall 28.

The maximum predicted incremental tilt due to the mining of Longwall 28 is approximately 2.6 mm/m. The predicted direction of tilt due to Longwall 28 includes a significant component in the longitudinal direction of the longwall panel. This explains why the predicted total tilt after the mining of Longwall 28 is similar in magnitude to the predicted tilt after the mining of Longwall 27.

The House is predicted to experience at increase in hogging curvature due to the mining of Longwall 28. While compressive ground strains could develop around the House, it is expected that tensile ground strains will continue to develop during the mining of Longwall 28.

Very little change is predicted to occur at Tahmoor House during the mining of Longwalls 29 and 30.

2.2.5. Potential Impacts during the mining of Longwalls 28 to 30

A method of assessment has been provided in Report No. MSEC355. The assessed probability of impact for the main house (CC92a), based on its type of construction and predicted systematic curvature is provided in Table 2.2.

Table 2.2 Assessed Probability of Impacts for Tahmoor House

Structure	Repair Category			
	No Claim or R0	R1 or R2	R3 or R4	R5
Tahmoor House	84%	12%	4%	< 0.5%

The repair categories have been defined as shown in Table 2.3. The Repair Category R5 is reserved for instances where the Mine Subsidence Board has agreed with the owner to rebuild the structure as the cost of repair exceeds the cost of replacement. In the case of items of heritage significance like Tahmoor House, such a commercial decision would not apply and all attempts would be undertaken to minimise subsidence induced impacts to the structure progressively during active subsidence. This is the focus of this Management Plan.

Moderate to severe impacts typically occur as a result of localised non-systematic high ground strains and curvatures. Damaging high ground strains are usually compressive in nature and surveys during the mining of Longwall 27 did not indicate detect the early development of such movements. While the potential for moderate to severe impacts to occur during the mining of Longwall 28 cannot be dismissed, the experiences during the mining of Longwall 27 are encouraging.

A separate structural assessment has been undertaken by John Matheson & Associates (2012). If the predicted tensile and compressive ground strains occur and directly transfer into the structure, some cracking could occur in the sandstone rubble or brick lower ground floor walls but the public risk is considered to be low.

The experience from the mining of Longwalls 22 to 27 at Tahmoor Colliery, affecting over 1500 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, or introduce measures to provide additional support to the house.

Table 2.3 Classification Based on the Extent of Repairs

Repair Category	Extent of Repairs
Nil	No repairs required
R0 Adjustment	One or more of the following, where the damage does not require the removal or replacement of any external or internal claddings or linings:- • Door or window jams or swings, or • Movement of cornices, or • Movement at external or internal expansion joints.
R1 Very Minor Repair	One or more of the following, where the damage can be repaired by filling, patching or painting without the removal or replacement of any external or internal brickwork, claddings or linings:- • Cracks in brick mortar only, or isolated cracked, broken, or loose bricks in the external façade, or • Cracks or movement < 5 mm in width in any external or internal wall claddings, linings, or finish, or • Isolated cracked, loose, or drummy floor or wall tiles, or • Minor repairs to any services or gutters.
R2 Minor Repair	One or more of the following, where the damage affects a small proportion of external or internal claddings or linings, but does not affect the integrity of external brickwork or structural elements:- • Continuous cracking in bricks < 5 mm in width in one or more locations in the total external façade, or • Slippage along the damp proof course of 2 to 5 mm anywhere in the total external façade, or • Cracks or movement ≥ 5 mm in width in any external or internal wall claddings, linings, finish, or • Several cracked, loose or drummy floor or wall tiles, or • Replacement of any services.
R3 Substantial Repair	One or more of the following, where the damage requires the removal or replacement of a large proportion of external brickwork, or affects the stability of isolated structural elements:- • Continuous cracking in bricks of 5 to 15 mm in width in one or more locations in the total external façade, or • Slippage along the damp proof course of 5 to 15 mm anywhere in the total external façade, or • Loss of bearing to isolated walls, piers, columns, or other load-bearing elements, or • Loss of stability of isolated structural elements.
R4 Extensive Repair	One or more of the following, where the damage requires the removal or replacement of a large proportion of external brickwork, or the replacement or repair of several structural elements:- • Continuous cracking in bricks > 15 mm in width in one or more locations in the total external façade, or • Slippage along the damp proof course of 15 mm or greater anywhere in the total external façade, or • Relevelling of building, or • Loss of stability of several structural elements.
R5 Re-build	Extensive damage to house where the MSB and the owner have agreed to rebuild as the cost of repair is greater than the cost of replacement.

2.2.6. Potential Impacts on Heritage Significance of the Structures during the mining of Longwalls 28 to 30

The heritage assessment (2012) recommended that monitoring "*focus on significant heritage elements including: the sandstone house footings, sandstone flagging on the front verandah and the rear staircase*".

While the most likely outcome from mining is that no or minor impacts occur during the mining of Longwalls 28 to 30, it is possible that Tahmoor House may experience severe differential vertical or horizontal movements. This may result in noticeable distortion to the structural floor and building frame. In this case, the floor is supported by sandstone rubble walls. JMA (2012) has advised that it will be possible to temporarily strengthen the walls by confining the walls with sheets of Tensar Geogrid reinforcement and 100x50 F7 vertical timber soldiers at regular spacing along both faces of the affected sections of rubble wall. The soldiers on both sides of the wall will need to be connected with bolts that will need to run through the rubble wall.

It will also be possible to relevel the floor and building frame by jacking the floor and inserting packers between the footings and the floor beam supports. In the unlikely event of severe differential vertical or horizontal movements occurring, the wall strengthening and floor relevelling works will be undertaken in consultation with the owners of the building and a heritage consultant.

Exposed, untreated sandstone walls can be difficult to restore to their original condition in the event of cracks forming. While repairs can be carefully undertaken, there is a potential that impacts to the sandstone walls may not completely restore the appearance of the wall to its pre-mining condition. It is noted that minor differential movement was observed in mortar bedding material at the base of the front steps during the mining of Longwall 27.

It is possible that the sandstone flagging on the front verandah may move independently to the main house in response to subsidence movements. This may result in the opening of a gap between the house and the flagging, or the existing gap may close. The flagging itself may experience tensile or compressive strains during mining. The sandstone flagging can be reset if tension cracks develop in the grout. If the front verandah experiences compressive ground strains, the existing grout between the flagging could be raked out to allow the stones to move together.

The rear staircase appears to be separated from the main house and may, therefore, move independently to the main house in response to subsidence movements. This may result in the opening of a gap between the house and the stairs, or the existing gap may close. The staircase itself may experience tensile or compressive strains during mining, as well as mining-induced tilts and curvature. Given the relatively small footprint of the rear staircase, the likelihood of it experiencing significant differential vertical or horizontal movements is considered to be very low. The stair trends appear to be independent of each other and may slide relative to each other in response to tensile or compressive movements. It is noted that some very minor cracking of mortar joint lines was observed on the eastern side of the rear steps during the mining of Longwall 27. A small wedge of mortar (50 mm long by 20-25 mm high) was found at the base of the first tread. As described for the sandstone rubble walls, a similar method of confinement can be applied to the rear staircase if required, except that the ties can run along the base of stair risers to minimise impact.

While unlikely, the original (west) front door may experience differential movements. This may be in the form of mining-induced tilt, which would lead to self-swinging of the door, which can be reset by adjusting the hinges. In the unlikely event of severe differential movements, the door frame itself may experiencing racking, resulting in door jams. This would require careful repair in consultation with the owners of the building and a heritage consultant.

The finish of the external walls is painted weatherboard. While there is potential for the weatherboard walls to develop cracks or gaps during mining, these impacts can be repaired in a sensitive manner without impacting on the heritage significance of the house. It is noted that two boards and a weather strip on the eastern side of the house had moved away from its frame beneath the window during the mining of Longwall 27.

Subsidence impacts on roofs are historically very rare and impacts to the pitched timber framed roof with galvanised corrugated steel roof sheeting can be repaired in a sensitive manner without impacting on the heritage significance of the house.

Experience from extensive ground survey monitoring in the Southern Coalfield shows that subsidence develops gradually. If severe differential movements develop, they can be detected either by ground surveys or visual inspections at an early stage before they become severe. This allows time for measures such as jacking to be introduced before the structure experiences significant deformation.

2.2.7. Risk Assessment

The following risk analysis matrix has been used by Tahmoor Colliery to assess the risks to Tahmoor House.

Table 2.4 Qualitative Risk Analysis Matrix

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

The following risks have been identified and assessed by Tahmoor Colliery.

Table 2.5 Risk Analysis for Tahmoor House

Risk	Planned Controls	Consequence	Likelihood	Risk Analysis
Impacts to structure	Ground survey along Remembrance Drive Ground survey around house Visual inspections around house and surrounding streets Landowner consultation Repairs to structure if req'd Structural inspection if req'd	Very Slight	Likely (84%)	Low
		Slight	Unlikely (12%)	Low
		Severe	Rare (4%)	Moderate
		Very Severe	Very Rare	Moderate
Severe impacts to building structure, affecting overall heritage significance of house	Ground survey along Remembrance Drive Ground survey around house Visual inspections around house and surrounding streets Landowner consultation Confine sandstone rubble walls or rear staircase in consultation with Heritage Consultant if req'd Reset sandstone flagging if req'd Re-level and adjust floor if required Repair, repaint as per advice from Heritage Consultant if req'd Structural inspection if req'd	Severe	Very Rare (on account of likelihood of substantial differential movements developing at house and ability to relevel / adjust structure without affecting heritage significance)	Moderate

Risk	Planned Controls	Consequence	Likelihood	Risk Analysis
Impacts to exposed sandstone foundation blockwork affecting overall heritage significance of house	Ground survey along Remembrance Drive Ground survey around house Visual inspections around house and surrounding streets Landowner consultation Confine sandstone rubble walls in consultation with Heritage Consultant if req'd Excavate trench around structure if req'd Repair, re-point sandstone as per advice from Heritage Consultant if req'd Structural inspection if req'd	Moderate	Moderate (on account of building footprint)	Moderate
Impacts to exposed sandstone flagging on front verandah affecting overall heritage significance of house	Ground survey along Remembrance Drive Ground survey around house Visual inspections of house and surrounding streets Landowner consultation Confine sandstone rubble walls in consultation with Heritage Consultant if req'd Excavate trench around structure if req'd Repair, re-set flagging as per advice from Heritage Consultant if req'd Structural inspection if req'd	Moderate	Rare (on account of footprint of verandah and ability to reset flagging if required)	Low
Impacts to rear staircase affecting overall heritage significance of house	Ground survey along Remembrance Drive Ground survey around house Survey of staircase Visual inspections of house and surrounding streets Landowner consultation Confine sandstone rubble walls in consultation with Heritage Consultant if req'd Repair, re-point blockwork and stair treads as per advice from Heritage Consultant if req'd Structural inspection if req'd	Moderate	Rare (on account of small footprint of staircase, structural independence from house, flexibility of stair treads and ability to reset stair treads if required)	Low
Impact to heritage significance of weatherboard walls	Ground survey along Remembrance Drive Ground survey around house Visual inspections around house and surrounding streets Landowner consultation Repair, repaint as per advice from Heritage Consultant if req'd Structural inspection if req'd	Moderate	Very Rare (on account of being relatively easy to repair without affecting heritage significance)	Low

3.1. Heritage Management Group (HMG)

The HMG is responsible for taking the necessary actions required to manage the risks that are identified from monitoring of structures. The HMG's key members are:

- Tahmoor Colliery
- John Matheson and Associates (Structural Engineer)
- Niche Environment and Heritage (Heritage Consultants)
- Mine Subsidence Engineering Consultants

Wollondilly Shire Council, DTIRIS and the Mine Subsidence Board may participate in HMG meetings as observers. The HMG may invite other specialist consultants from time to time.

3.2. Mitigation Measures

3.2.1. Tahmoor House

Tahmoor House has been inspected by structural engineer John Matheson & Associates and no strengthening measures are recommended prior to mining.

3.3. Monitoring Measures

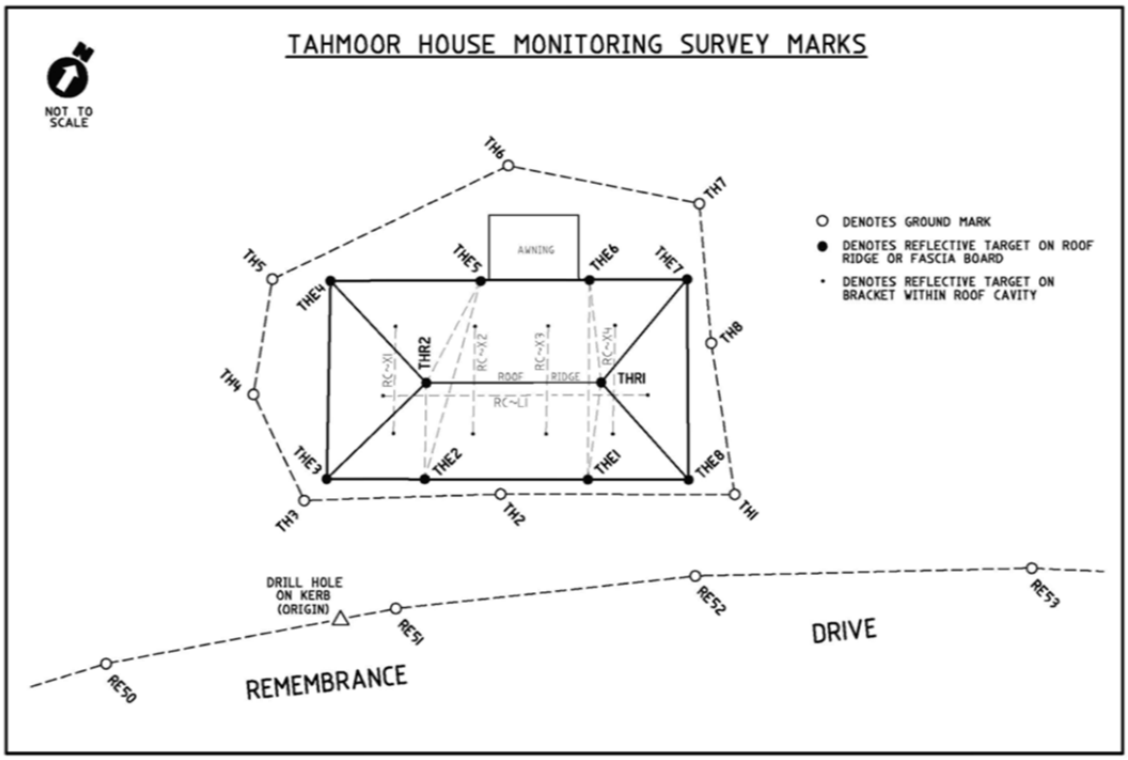
3.3.1. Tahmoor House

The following monitoring measures will be undertaken during active subsidence:

- Ground surveys along Remembrance Drive in front of the property
- Ground surveys of pegs around the perimeter of the property
- Survey of rear staircase (subject to landowner approval)
- Visual inspections of the main building including, as recommended by JMA (2012):
    - Baseline photographic survey of key elements of heritage significance, including sandstone found walls, rear staircase, sandstone flagging on front verandah and original (west) front door. (this has been completed)
    - Tilt measurements of each chimney and panel of sandstone rubble wall;
    - Close inspection of the interface between the sandstone rubble wall and timber framed ground floor structure; and
    - Measurements of horizontal distance across the roof, which will be monitored regularly by external survey with backup internal baseline measurements.

Tahmoor Colliery will inform the landowner and Wollondilly Shire Council of the progress of mining and request the owner to contact either the Colliery or the Mine Subsidence Board if impacts are observed.

Survey pegs have been installed around the perimeter of the house and initially surveyed. A diagram showing the approximate positions of survey pegs is shown in Fig. 3.1.



Layout courtesy SMEC Urban

Fig. 3.1 Layout of survey marks at Tahmoor House

3.4. Triggers and Responses

3.4.1. Tahmoor House

Triggers in this Management Plan are described in Section 3.5 and are based on ground survey and visual inspections near the property.

No specific trigger levels have been recommended from the results of the ground survey around the house, or tilt and horizontal measurements of building elements. The observations will be examined as a whole and responses will be considered if it is apparent from the monitoring data that significant impacts could occur at the House.

In the event of impacts being observed or identification of possible future impacts based on monitoring data, the HMG may consider the following responses, if required. These may include:

- Additional inspections and/or surveys during active subsidence
- Confining the sandstone walls or rear staircase
- Resetting sandstone flagging or stair treads
- Filling or removing grout between flagging stones or between flagging and the main house
- Adjusting doors and windows
- Relevelling of the main house structure
- Excavation of trench around the perimeter of the House (extreme case)

3.5. Risk Control Procedures for Longwalls 28 to 30

The risk control procedures for the management of potential impacts to Tahmoor House are provided in Table 3.1.

Table 3.1 Risk Control Procedures for Longwalls 28 to 30

Infrastructure	Hazard / Impact	Risk	Trigger	Control Procedure/s	Frequency	By Whom?
Tahmoor House	Impacts occur to structures or heritage significance of property	Low to Moderate	Baseline monitoring	Kerbside inspection to identify any potentially unstable structures	Complete	Tahmoor Colliery (MSEC)
				Baseline heritage assessment	Complete	Tahmoor Colliery (Niche)
				Baseline structural assessment	Complete	Tahmoor Colliery (JMA)
			Prior to mining	Contact landowner to inform of commencement of mine subsidence. Request landowner to provide information on any potential issues with existing structures.	Complete for LW27 Contact landowner prior to start of LW28	Tahmoor Colliery
				Inform Wollondilly Council of commencement of mine subsidence and seek endorsement of Heritage Management Plan.	Prior to subsidence occurring	Tahmoor Colliery
				Install and baseline survey ground pegs around perimeter of property and baseline tilt and horizontal distance measurements	Complete	Tahmoor Colliery (SMEC Urban)
				Install and baseline survey rear staircase, subject to approval of landowner	Complete	Tahmoor Colliery (SMEC Urban)
				Baseline photographic survey of identified significant heritage significance	Complete	Tahmoor Colliery (CNS)
			During mining of Longwalls 28 to 30	Conduct ground surveys of Remembrance Drive	Weekly after start of LW28 until 800m of extraction, unless by exception, based on actual monitoring data End of LW28 One survey after 800m of extraction of LW29 and LW30 End of LW29 and LW30	Tahmoor Colliery (SMEC Urban)
				Conduct ground survey of pegs around perimeter of property, plus horizontal distance measurements of roof	Weekly after start of LW28 until 800m of extraction, unless by exception, based on actual monitoring data End of LW28 One survey after 800m of extraction of LW29 and LW30 End of LW29 and LW30	Tahmoor Colliery (SMEC Urban)
				Conduct detailed visual inspections including tilt measurements	Weekly after start of LW28 until 800m of extraction	Tahmoor Colliery (CNS)
				Confirm arrangements through MSB for building contractors to remain on standby for immediate call out and service in the event of impacts affecting safety or serviceability.	Prior to subsidence occurring	Tahmoor Colliery
				Contact landowner to advise of LW progress and check for impacts to property	Monthly after start of LW28 until 800m of extraction, unless by exception, based on actual monitoring data	Tahmoor Colliery
				Analyse monitoring results and report findings	Weekly during active subsidence	Tahmoor Colliery (MSEC)
			For survey pegs around Tahmoor House: Tilt exceeds 7 mm/m or Significant non-systematic movement occurs or Impacts observed to surface outside property	Contact and inform landowner. Request inspection by structural engineer and heritage consultant	Within two days and then as recommended by structural engineer	Tahmoor Colliery
				If consent given by landowner, conduct structural inspection and/or re-inspection by heritage consultant	Within two days and then as recommended by structural engineer	Tahmoor Colliery (JMA / Niche)
				If consent given by landowner, consider additional monitoring and/or mitigation/strengthening measures or any other management measures in consultation with the heritage consultant.	Immediately after structural re-inspection.	HMG

Infrastructure	Hazard / Impact	Risk	Trigger	Control Procedure/s	Frequency	By Whom?
Tahmoor House	Impacts occur to structures or heritage significance of property	Low to Moderate	Any impact occurs to structure	Notify Mine Subsidence Board, Industry and Investment, Wollondilly Council	Within 24 hours	Tahmoor Colliery
				Inspect building	As soon as possible	MSB / Tahmoor Colliery
				If landowner consents, inspect condition of building	Once a week with active subsidence area or as agreed with landowner	Tahmoor Colliery (CNS)
				Rectify any adverse impacts that impair upon: - the safety, access and mobility, security or fire egress - any essential services in consultation with the heritage consultant and/or structural engineer.	As soon as possible at any stage during mining	Tahmoor Colliery and/or MSB
				If consent given by landowner, conduct structural inspection and/or re-inspection by heritage consultant	Within two days and then as recommended by structural engineer	Tahmoor Colliery (JMA / Niche)
				Assess available monitoring information and forecast potential future impacts to structure and impacts on heritage significance	Within two days	HMG
				If consent given by landowner, consider additional monitoring and/or mitigation/strengthening measures, including confinement of sandstone rubble walls or staircase, jacking of floor and excavation of trench around building or any other management measures	Within two days	HMG
				Repair damage to structure, with input from heritage consultant if impacts are related to heritage significance of property	When subsidence movements cease	MSB
			Property is likely to be safe during and after mining	Monitor impacts on building (e.g. extent of cracking, level of tilt)	As advised by subsidence engineer and structural engineer	Tahmoor Colliery (MSEC)
				Re-inspect condition of building	Weekly within active subsidence area	Tahmoor Colliery (CNS)
			Property is likely to be unsafe during or after mining	Coordinate with MSB and provide temporary accommodation for residents.	Immediately	MSB & Tahmoor Colliery
				Utilise acquisition and compensation procedure from DA67/98-1999 Development Consent Conditions 18-26 and MSB procedures	Immediately	MSB & Tahmoor Colliery
			Property owner does not accept acquisition	Temporarily relocate residents until building is repaired	Immediately	MSB & Tahmoor Colliery

4.0 HMG REVIEW MEETINGS

HMG meetings will be held between Tahmoor Colliery and the Mine Subsidence Board for discussion and resolution of issues raised in the operation of the Management Plan. The frequency of the Plan Review Meetings will be as requested by any party.

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

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

In the event that a significant risk is identified for a particular surface feature, any member of the HMG may call an emergency HMG 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.

5.0 AUDIT AND REVIEW

The Management Plans has been agreed between parties. The Management Plan will be reviewed following extraction of each longwall.

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

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

- Observation of greater impacts on surface features due to mine subsidence than was previously expected.
- Observation of fewer impacts or no impacts on surface features due to mine subsidence than was previously expected.

6.0 RECORD KEEPING

Tahmoor Colliery will keep and distribute minutes of any HMG Meeting.

7.0 CONTACT LIST

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* Denotes HMG member

APPENDIX A.

Please refer to the following documents:

- Drawings
- Niche, (2012). *Heritage Assessment of Tahmoor House*, Niche Environment and Heritage, Project No. 1346, Final v.4, December 2012.
- JMA, (2012). *27 Remembrance Drive, Tahmoor Structural Inspection Report*, John Matheson & Associates, Report No. 0194, Rev. 1, July 2012.

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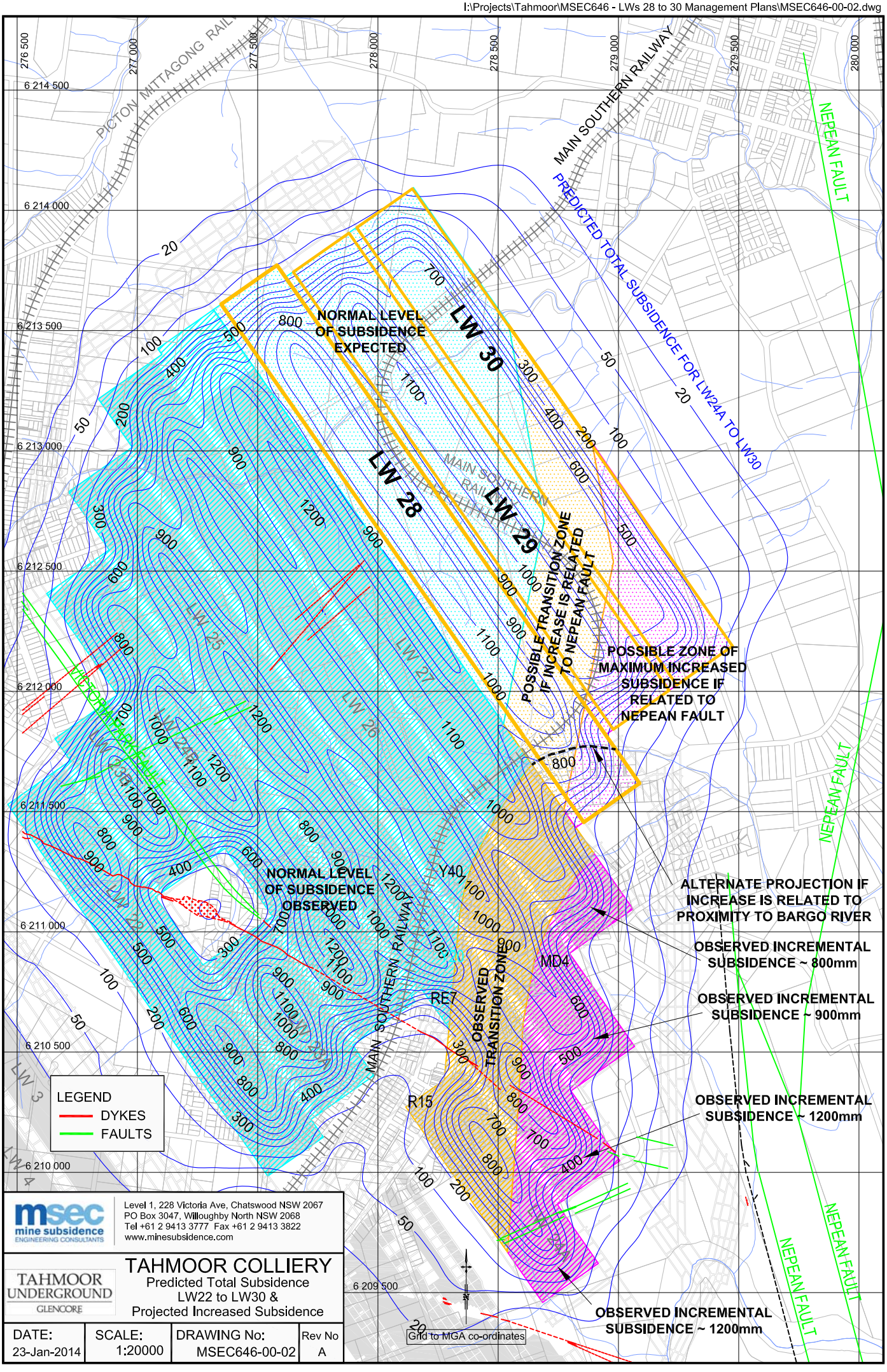

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TAHMOOR UNDERGROUND GLENCORE

TAHMOOR COLLIERY

Predicted Total Subsidence
LW22 to LW30 &
Projected Increased Subsidence

DATE:	SCALE:	DRAWING No:	Rev No
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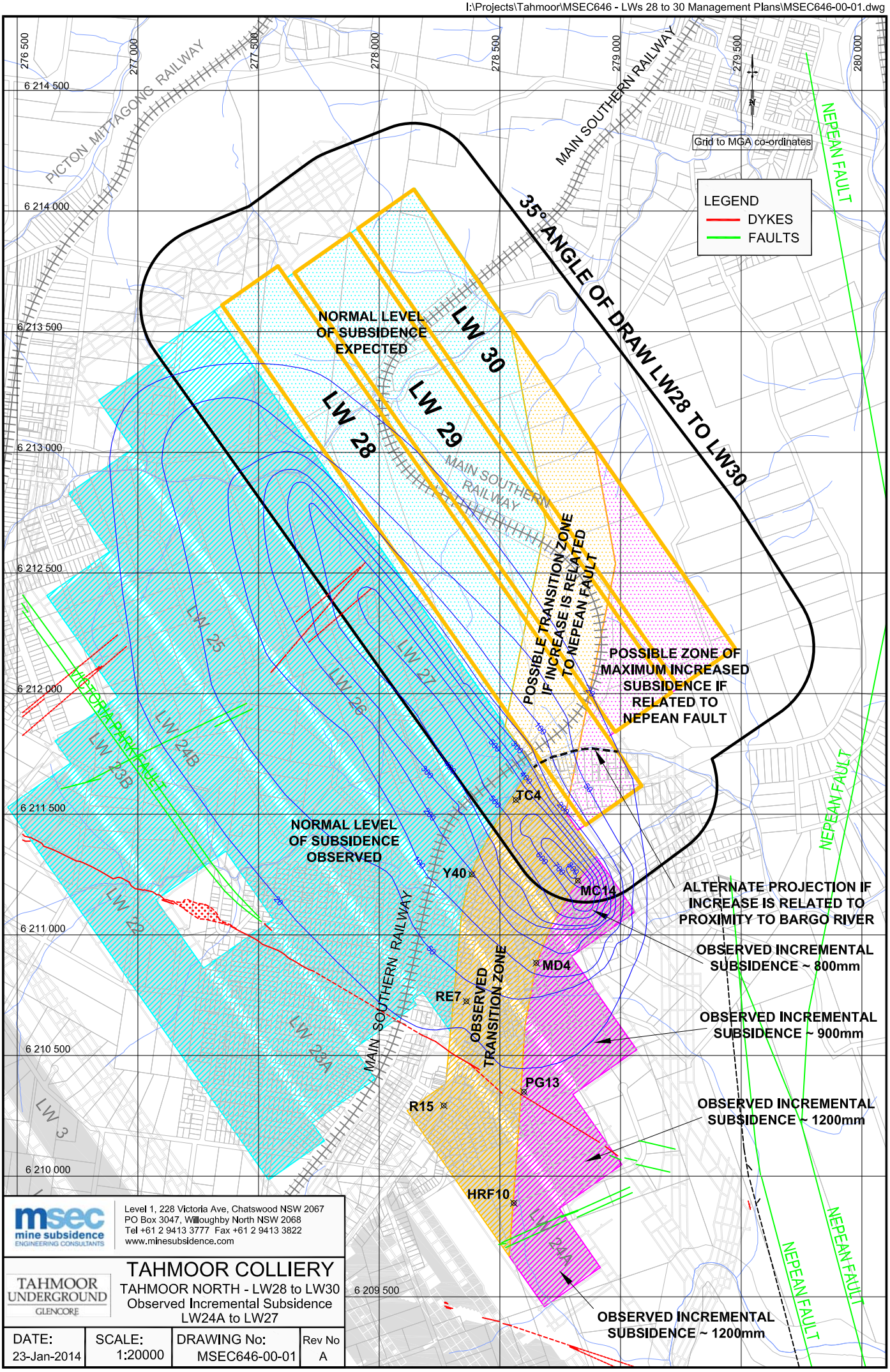

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TAHMOOR UNDERGROUND GLENCORE

TAHMOOR COLLIERY

TAHMOOR NORTH - LW28 to LW30
Observed Incremental Subsidence
LW24A to LW27

DATE:	SCALE:	DRAWING No:	Rev No
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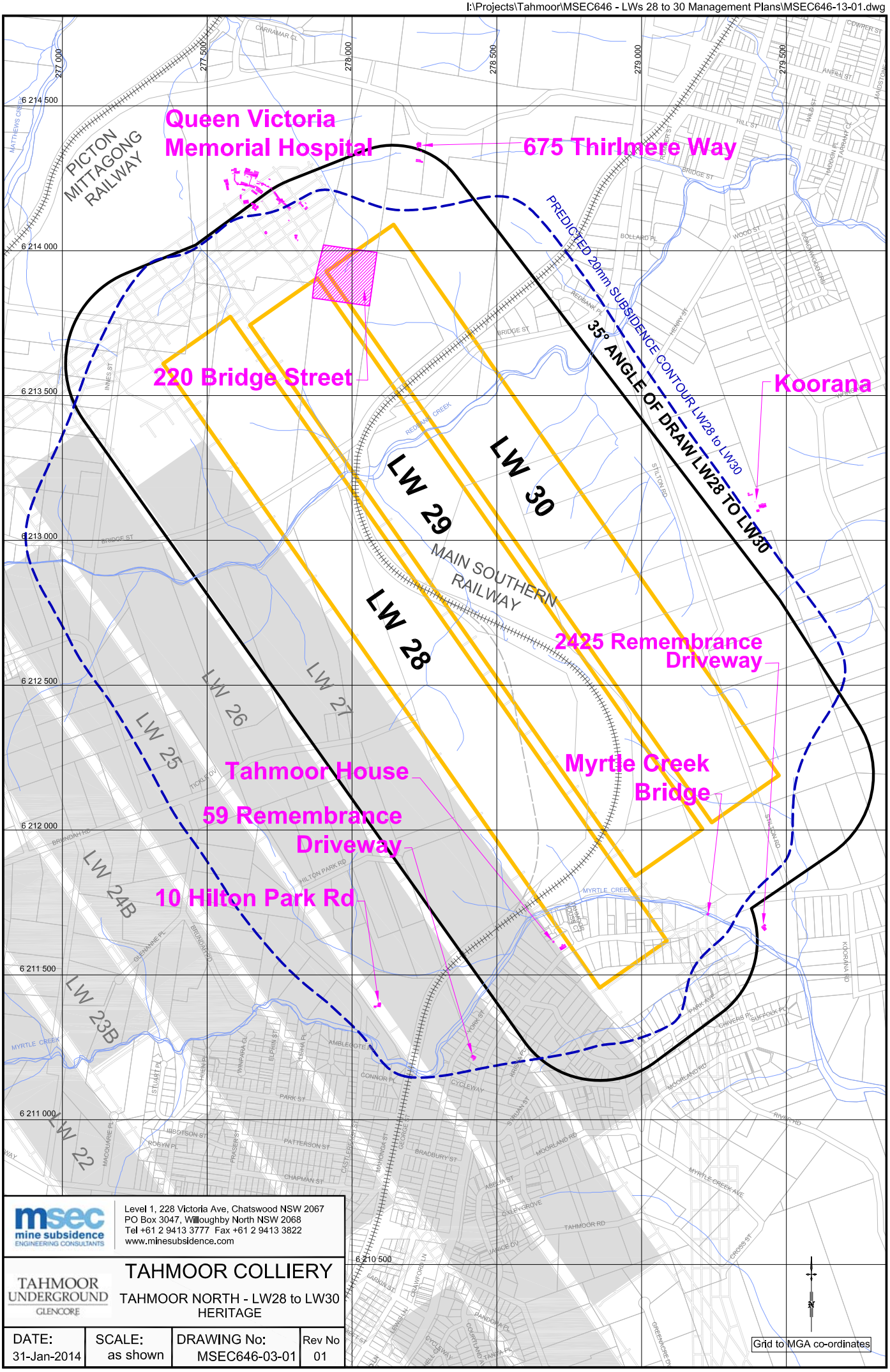

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TAHMOOR UNDERGROUND GLENCORE

TAHMOOR COLLIERY

TAHMOOR NORTH - LW28 to LW30 HERITAGE

DATE:	SCALE:	DRAWING No:	Rev No
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niche
Environment and Heritage

Heritage Assessment of Tahmoor House

Tahmoor Colliery, NSW

Tahmoor Colliery

December 2012

Document Controls

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Cover Photo: Tahmoor House from Remembrance Drive (Source: Niche, 2012)

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Figures

Plates

Summary

This report presents the results of a heritage assessment of Tahmoor House, located at 27 Remembrance Driveway, Tahmoor, NSW. It has been prepared in accordance with the Heritage Council of NSW's *Heritage Manual* (1996) to satisfy the requirements of DA67-98 issued to Tahmoor Colliery for the mining of Longwalls 27-30. This report will form part of a broader Subsidence Management Plan (SMP) prepared by Tahmoor Colliery for the endorsement of Wollondilly Shire Council.

The purpose of this document is to provide a report documenting the heritage significance of the property. This will assist Tahmoor Colliery with the management of potential impacts on the house from Longwall mining. The assessment presents a detailed site history, the results of a visual inspection of Tahmoor House and its environs, a predictive model for archaeological relics, a significance assessment and recommendations for the appropriate management of likely impacts.

The assessment concluded that while Tahmoor House is not currently listed on the NSW State Heritage Register, it has heritage values that would meet the threshold for state heritage significance. Given this assessment, it is recommended that Tahmoor Colliery consider future management of Tahmoor House during proposed Longwall mining with respect to these values. Mitigation strategies should include preparation of a pre-mining structural inspection by a qualified structural engineer and regular monitoring of fabric, focussing on significant heritage elements. If Tahmoor Colliery becomes aware of any impact on heritage fabric it is recommended that a qualified heritage practitioner and structural engineer be engaged to assess the impact and prevent further damage.

1 Introduction

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Tahmoor Colliery to provide a report documenting the significance of Tahmoor House located at 27 Remembrance Driveway, Tahmoor, NSW. The house is listed as an item of local heritage significance in Schedule 5 of the Wollondilly Local Environmental Plan (LEP). A more recent heritage assessment of the house, however, found it to be state significant for its historical heritage values, associations, research potential and rarity (Biosis 2009).

Tahmoor Colliery was issued consent for the mining of Longwalls 27-30 in the Tahmoor area in 1999 (DA 67-98). Condition 27 of the approval states that:

> *The Applicant shall not cause damage to any building or structure which is a Heritage Item without the prior approval of Council. The application for such approval shall include a detailed report assessing:*
>
> *i. likely subsidence and the potential damage to the item arising from subsidence;*
> *ii. impacts of expected damage on the historical significance of the Item (prepared by a qualified heritage expert endorsed by Council); and*
> *iii. appropriate mitigation, management or restoration measures.*

As such, further heritage assessment of Tahmoor House and the potential impact of Longwall mining is required for the endorsement of Wollondilly Shire Council.

This report aims to partially satisfy this consent condition. It has been prepared in accordance with the Heritage Council of NSW's *Heritage Manual* (1996) and presents:

1. the results of background research, including heritage register searches, a review of primary and secondary historical documentation and previous heritage reports associated with Tahmoor House;
2. a survey of the house and environs;
3. a significance assessment; and
4. recommendations for managing impacts associated with the mining of Longwalls 27-30.

The other components required to satisfy the consent condition will be prepared by John Matheson & Associates and Mine Subsidence Engineering Consultants.

This report has been prepared by Fiona Leslie (Senior Archaeologist, Niche) and Lydia Sivaraman (subconsultant) and has been reviewed by Cameron Harvey (Heritage Team Leader, Niche).

2 Scope

The scope of our assessment included the following tasks:

- A desktop review of previous studies and reports relevant to Tahmoor House and a search of state and local heritage registers;
- Historical research on Tahmoor House, its development and former occupants. Research involved a review of primary and secondary sources, lands and title records and historical maps and plans. The aim of the research was to understand its construction history, occupation and use of the house and environs;
- Physical inspection of the house and grounds and documentation of existing structures, ruins and areas of archaeological potential;
- Synthesis of historical research, physical remains and mapping of known or potential archaeological sites or features;
- Significance assessment of the house and environs using the criteria outlined as in the NSW *Heritage Manual (1996)*; and
- Recommendations to ensure potential impacts to the house by Longwall mining are managed appropriately.

3 Location

Tahmoor House is located at 27 Remembrance Driveway, Tahmoor, NSW. The subject area is within the Tahmoor Colliery site, situated within property description Lot 12 DP10669. The location and extent of the subject area is shown in Figures 1 and 2.

4 Proposed Works

Tahmoor Colliery is located approximately 80 kilometres south west of Sydney in the township of Tahmoor NSW. It is managed and operated by Tahmoor Colliery. Tahmoor Colliery has previously mined 26 longwalls to the north and west of the mine's current location.

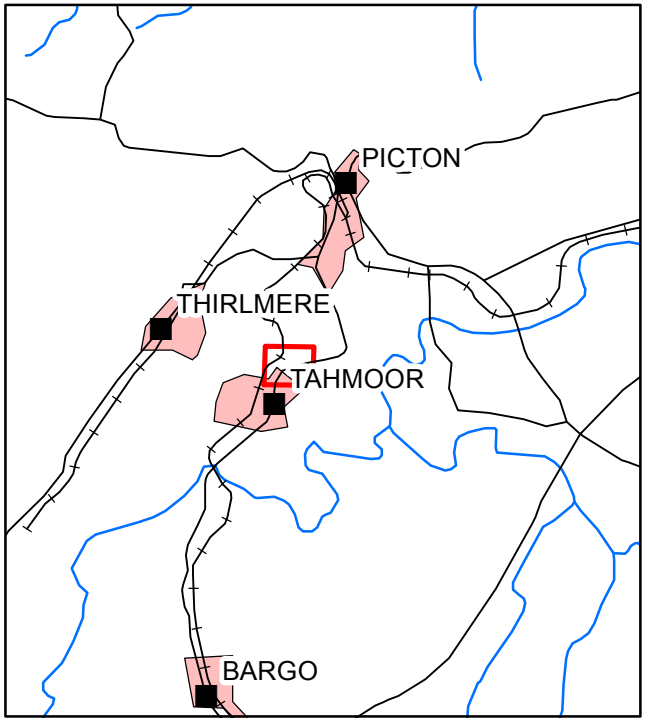
Longwall 27 is a continuation of a series of longwalls that extend into the Tahmoor North Lease area which began with Longwall 22. It is located between the Bargo River in the south-east, the township of Thirlmere in the west and Picton in the north. Longwall 27 is located beneath the urban area of Tahmoor.

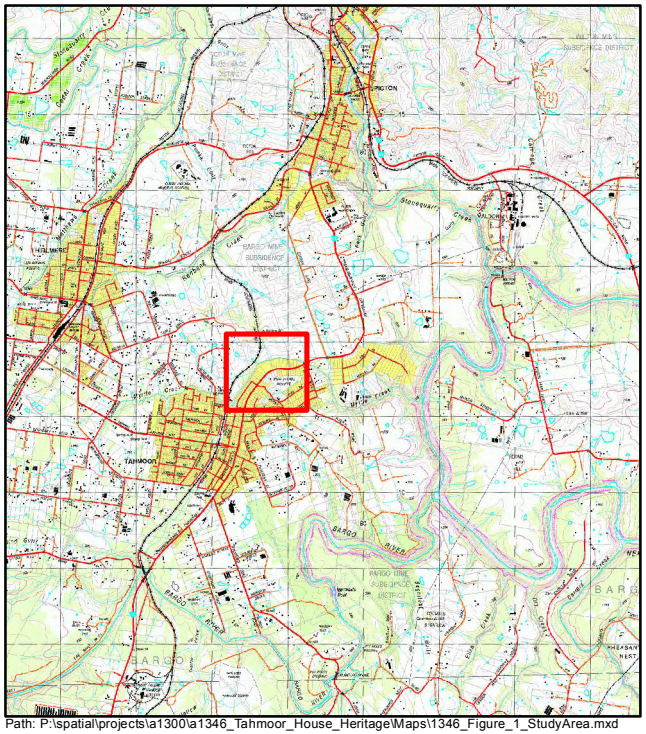
A detailed drawing of the proposed Longwalls at Tahmoor Colliery and their proximity to Tahmoor House is shown in Figure 3.

5 Aims

The aims of this assessment were to:

- Assess the house and ground of Tahmoor House and document existing structures, ruins and areas of archaeological potential;
- Assess the significance of the property; and
- provide recommendations for the management of Tahmoor House and its environs prior to and during proposed Longwall mining.





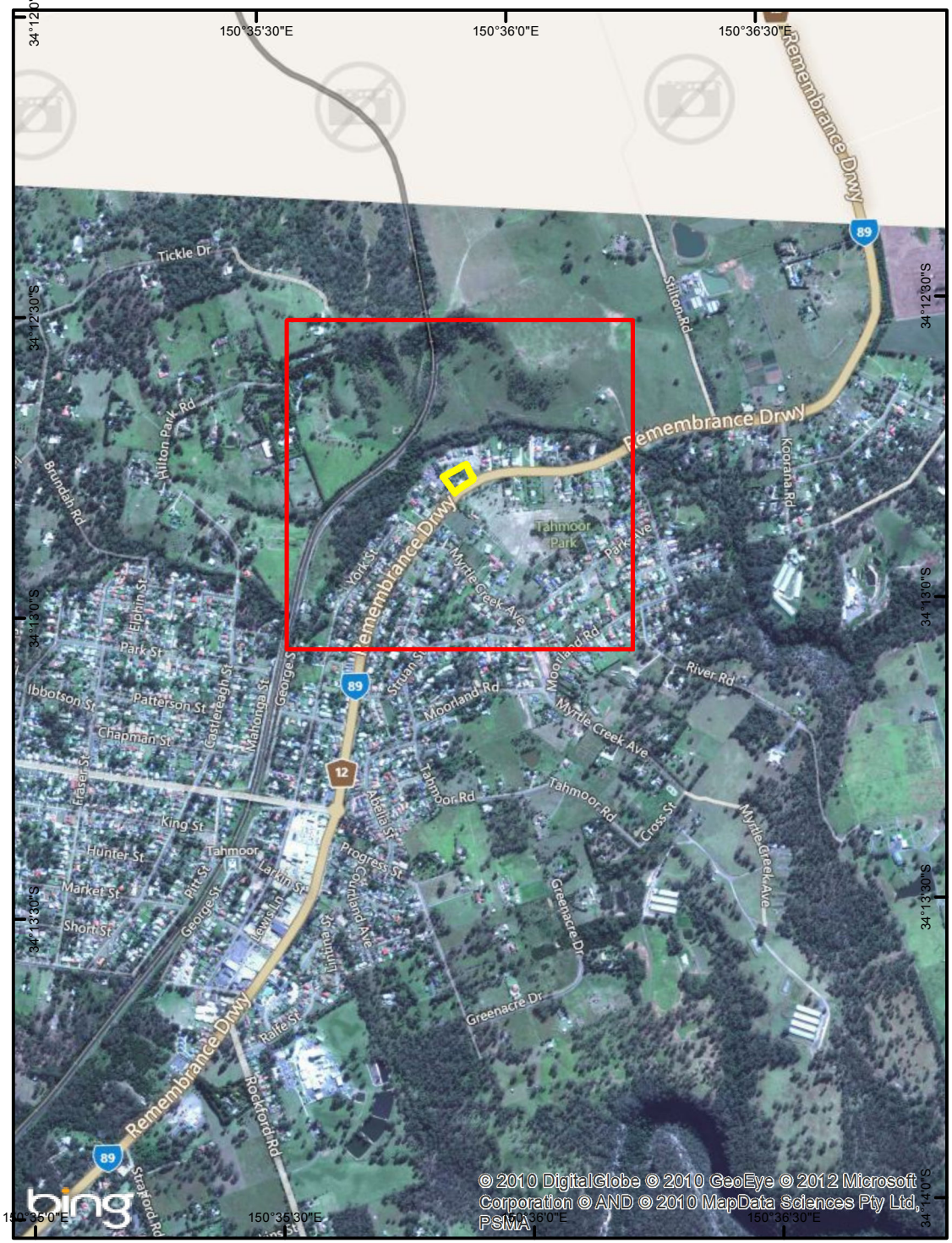


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Figure 1: Location Map

1346 Tahmoor House Heritage Assessment

Drawn by: EM
Project Mgr: FL

Date: 16/11/2012

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Imagery:
(c) 2010 Microsoft Corporation and its data suppliers

Figure 2: Site Map

1346 Tahmoor House Heritage Assessment

Drawn by: EM
Project Mgr: FL

Date: 16/11/2012

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Imagery:
(c) 2010 Microsoft Corporation
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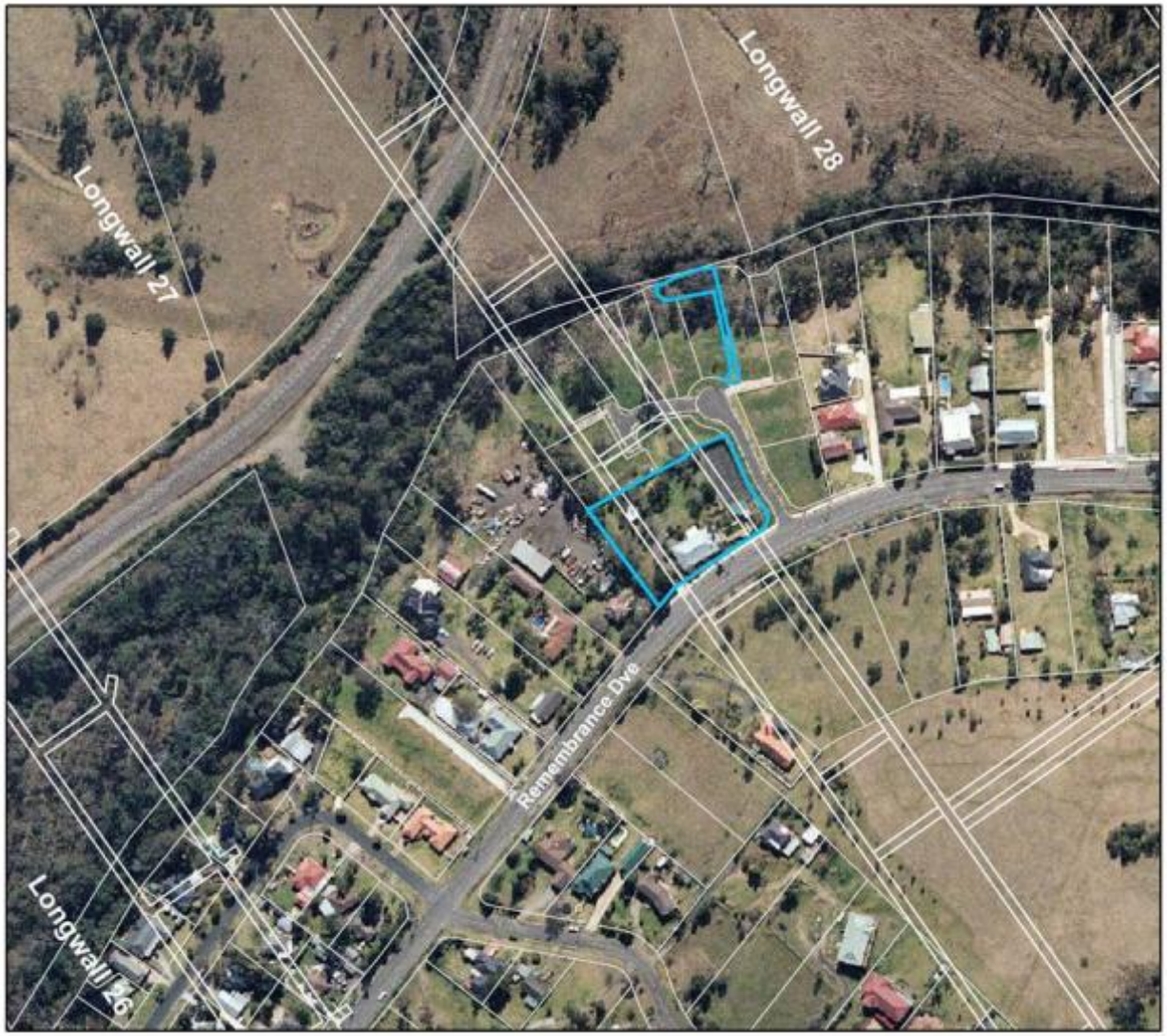
Figure 3: Longwalls 27 and 28 at Tahmoor Colliery and their proximity to Tahmoor House (Source: Tahmoor Colliery, 2012)



6 Regulatory and Assessment Framework

6.1 The NSW Heritage Act 1977

The NSW *Heritage Act 1977* is a statutory tool designed to conserve environmental heritage in NSW. It is used to regulate development impacts on the state's historical heritage assets. The Act defines a heritage item as 'a place, building, work, relic, moveable object or precinct'.

To assist management of the state's heritage assets, the Act distinguishes between items of Local and State heritage significance.

'Local heritage significance', in relation to a place, building, work, relic, moveable object or precinct means significance to an area in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item;

'State heritage significance', in relation to a place, building, work, relic, moveable object or precinct means significance to the State in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item;

Archaeological features and deposits are afforded statutory protection by the relics provisions of the Act (as amended in 1999). Section 139[1] states that:

A person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit.

To assist with the assessment of the environmental heritage of NSW under the Act, the NSW Heritage Manual (1996) provides Heritage Council endorsed guidelines which explain the three steps to manage heritage items in the NSW context. These steps are:

1. Investigate significance
2. Assess significance
3. Manage significance

The steps apply to all types of heritage, including built, archaeological and landscape places. They apply to any level of significance assessment.

This assessment of Tahmoor House and its environs has been undertaken using the three steps as outlined in the NSW Heritage Manual (1996).

6.2 The NSW Environmental Planning & Assessment Act, 1979

The NSW *Environmental Planning and Assessment Act* 1979 (EP & A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process and requires that environmental impacts are considered prior to land development; this includes impacts on heritage items and places. The Act also requires that local governments prepare planning instruments [such as Local Environmental Plans] in accordance with the principles of the legislation to provide guidance on the level of environmental assessment required.

In 1999 Tahmoor Colliery was issued a consent for the mining of Longwalls 27-30 (DA 67-98) under Part 5 of the EP & A Act. The approval was amended in 2006 and the following consent conditions relate to the management of historical heritage items:

27 The Applicant shall not cause damage to any building or structure which is a Heritage Item without the prior approval of Council. The application for such approval shall include a detailed report assessing:

i. likely subsidence and the potential damage to the item arising from subsidence;
ii. impacts of expected damage on the historical significance of the Item (prepared by a qualified heritage expert endorsed by Council); and
iii. appropriate mitigation, management or restoration measures.

Note: In this condition, "Heritage Item" means an item either listed in Schedule 1 of the Wollondilly Local Environmental Plan 1991 or identified in the Wollondilly Heritage Study 1993. The power for Council to issue an "approval" is established under this condition, and should not be read as establishing any requirement for the application for and grant of development consent under the Act.

30. If the Applicant becomes aware of any heritage or archaeological material that may be affected by mining or subsidence, all work likely to affect the material shall cease immediately and the relevant authorities consulted about an appropriate course of action prior to recommencement of work. The relevant authorities may include NPWS, the Heritage Office, and the Local Aboriginal Land Council. Any necessary permits or consents shall be obtained and complied with prior to recommencement of work.

This report aims to partially fulfil Condition 27. It will form part of a broader Subsidence Management Plan (SMP) prepared by John Matheson and Mine Subsidence Engineers on behalf of Tahmoor Colliery.

7 Heritage Searches

7.1 National and Commonwealth Heritage Registers

Under the EPBC Act Amendments (No. 88, 2003), two mechanisms have been created for the protection of heritage places of National or Commonwealth significance (http://www.environment.gov.au/heritage/places/national/index.html) – the National Heritage List (NHL) and the Commonwealth Heritage List (CHL). The NHL provides protection to places of cultural

significance to the nation of Australia, while the CHL comprises natural, Aboriginal and historic heritage places owned and controlled by the Commonwealth.

The Register of the National Estate (RNE) is a non-statutory list of important places maintained by the Commonwealth and publicly available archive and educational resource. The existence of an entry for a place in the RNE does not in itself create a requirement to protect the place under Commonwealth law. Nevertheless, information in the RNE may continue to be current and may be relevant to decisions about protection and management.

The Australian Heritage Database (AHD) is maintained by the Department of Sustainability, Environment, Water and Population and Communities (DOSEWPC). The AHD contains includes records of CHL, NHL and RNE places.

- A search of the AHD was undertaken on 14 November 2012. Tahmoor House is not listed on CHL or the NHL. It is listed as Place ID 3313 on the RNE as an important early inn along the Great South Road.
- The house is also listed with the National Trust of Australia (NSW).

7.2 NSW State Heritage Register and State Heritage Inventory

The *State Heritage Register* (SHR) holds items that have been assessed as being of State Significance to New South Wales. The *State Heritage Inventory* (SHI) contains items that are listed on Local Environmental Plans and/or on a State Government Agency's Section 170 registers (NSW Office of Environment and Heritage Website – www.heritage.nsw.gov.au/index.html). Items appearing on either the SHR or SHI have been granted a defined level of statutory protection under NSW legislation.

- Searches of the SHR and SHI were completed on 14 November 2012. Tahmoor House is not entered in the SHR or SHI.

7.3 Wollondilly Local Environmental Plan (LEP) 2011

Each Local Government Area (LGA) is required to create and maintain an LEP that identifies and conserves Aboriginal and historical heritage items. These items are protected under the EP&A Act 1979. As outlined in Clause 5.10(2) of Wollondilly LEP 2011, development consent is required for any of the following:

(a) demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance):

(i) a heritage item,

(ii) an Aboriginal object,

(iii) a building, work, relic or tree within a heritage conservation area,

- A search of the Wollondilly LEP (2011) was undertaken on 25 October 2012. Tahmoor House is listed as a locally significant heritage item in Schedule 5 of the LEP (Item ID 232).

8 Site History

8.1 Local History

Tahmoor was the official name given to the study area in 1916 (Fairfax 1991:3). Prior to being named Tahmoor the area was referred to as Myrtle Creek or Bargo and was part of 'Cowpastures' and the 'Picton District'.

The 'Cowpastures' region was named after Governor Hunter who visited the area in 1795 and found a herd of about 60 wild cattle. Four cows and two bulls had escaped from the Government Farm at Sydney Cove. The cattle had crossed the Nepean and bred into the wild herd sighted by Hunter. The government, hopeful of future cattle breeding in the colony, prohibited anyone from crossing the Nepean River without a permit in order not to disturb the cattle (Jervis 1941:277; Vincent 1996: 3). The prohibition of the 'Cow Pastures' was not lifted until the 1820s, when Governor Macquarie wanted to open up the colony into a larger area of settlement.

The land situated between Stonequarry Creek and Myrtle Creek was surveyed into small land grants under the Surveyor Harper in 1821 (Jervis 1941:289). These land grants ranged from 30 to 80 acres and were mostly taken up by ex-convicts (Fairfax n.d. Tahmoor NSW). Conditions of these grants often included the cultivation of fifteen acres of the grant within five years, so the early settlers grew wheat, barley, oats, maize, potatoes (Steele 1904:165).

Opening up settlement in 'Cowpastures' and beyond was of no consequence without a road allowing access in and out of the settlements. John Warby, a settler at Prospect, established a track to the Nepean at Camden, which was the line of road surveyed by James Meehan in 1805, and became the first section on the Great Southern Highway. That same year Meehan was instructed to survey grants at 'Cowpastures' and was instructed "*…to preserve a road as much as possible on the flat ground, so that the public may hereafter have a passage to Stonequarry Creek"* (Jervis 1939:412). In 1818 Meehan referred to "*the present Stonequarry Road*" (Jervis 1939:413).

The country was explored beyond Bargo, by Hume and Hovell, Meehan and Charles Throsby. Macquarie, in a letter to the Commissary General Drennam in 1819, advised of "*…a working party to the newly discovered country under the direction of Mr Throsby for the purpose of constructing a cart road as far as settlement about to be established there"* (Villy 2011:40). In October 1819 the new line for the Great Road South began at Stonequarry. The road was 75 miles long and ended at the Cookbundoon

Range near Goulburn. The road was 30 feet wide and had 6 bridges (Villy 2011:40). This portion of the road passed through Myrtle Creek (Tahmoor). As the colony grew and convicts became settlers many people were looking for land to settle and the new road to the south made that country accessible. Facility's for travellers along the new road sprang up including Edward Doyle's Accommodation House, which was later to become Travellers Inn, and then Tahmoor House (Villy 2011:40).

In 1829 the bridge at Stonequarry had been washed away. A bridge party Overseer Parkes was stationed at the creek to replace the bridge (Villy 2011:41). Parkes was reprimanded several times for leaving his gang and drinking. Whilst stationed at Stonequarry Creek he was in easy reach of The Travellers Inn at Myrtle Creek. He was dismissed in October 1833 and a letter informing Mitchell of his dismissal explains why "*Overseer Parkes has again fallen into the habit of drinking, remaining in the public house at Myrtle Creek for days and leaving the government stores quite unprotected and totally neglecting the work he is entrusted with."* (Villy 2011:60-61).

Work on various sections of the Great South Road continued for years. Work began on the road from Bargo in 1829. Instructions were given to finish the road crossing the Razorback Range in 1830. This work was carried out intermittently over the next decade. New lines were established for the road through Mittagong and Berrima across the Paddy's River bearing south to Goulburn. In the 1850s efforts were made to have the road cross Broughton Pass (Jervis 1939:424-429). This continual construction and improvement of the Great Road South meant there was an increased flow of travellers and settlers passing through Myrtle Creek, increasing the demand for accommodation and Inns along the way. The demand was further increased by the Ironed gangs stationed at intervals to perform the construction work. There was a gang housed at the stockade at Razorback, the bridge gang already mentioned at Stonequarry Creek and another stationed "*at Myrtle Creek, near* Klensendorlffe*'s Inn"* (Jervis 1939:429).

In 1863 the construction of a railway was commenced with a terminus at Picton. The railway terminus was at Picton. The railway was a boom for the economy of Picton but had quite the opposite effect on places like Myrtle Creek (Tahmoor) just south of Picton, where there were no townships just Inns (such as the Travellers Inn) which relied heavily on the though fare along the Great South Road. The railway was extended to Mittagong in 1867 but did not go through Tahmoor. It was not until 1914 that the Picton to Mittagong deviation began. The deviation line followed that of the Great South Road and went through Tahmoor and Bargo. The line opened in 1917 (Vincent 1996:22). The railway through Tahmoor marked a boom period with many more sub-divisions and settlers moving to the area, a township began to grow centring around the station.

In 1921, 240 acres of land was subdivided between Myrtle Creek and Bargo Creek. The subdivision was called Tahmoor Park Estate. Surveys for water pipelines were made through Tahmoor on the 13th

November 1899 (LTO 1899 1544-3000) and the advertisements for Tahmoor Park Estate mention running water as a feature (ML TP T1/15). It was not until the 1930s that surveys for the Port Kembla Electricity Supply, Yerrinbool to Picton, were made (LTO 1937; 9543.3000; Gallop 1933: 8529.3000; Gallop 1933: 8530-3000).

In the 1970s the town was bypassed by the new Hume Freeway, but its prosperity was saved by the development of the coal mining industry around the same time. The industry is still strong in Tahmoor and the town is well populated (Biosis 2009:12).

8.2 History of Tahmoor House

Edward Doyle received a Crown Grant of 50 acres of land on the 1st November 1822 (Ref Appendix 1 – Chain of Title for Tahmoor House; also see Figure 4). The land granted in the County of Camden and the district of Picton was described as follows:

> "*Bounded on the north east by Goodwins Farm bearing south 27 degrees east on the south east by a line bearing west 27 degrees south ten chains. On the southwest by a line bearing north 27 degrees west to the Myrtle Rivulet and on the northwest by that Rivulet*" (LTO Vol. 14 page 114).

The land grant description above was used to identify this particular portion of land in the Conveyance Indentures as the original land grant later became consolidated into 240 acres of land.

Conditions of the land grant included 15 acres to be cultivated. The government reserved the right of a highway through the land and had the rights to unlimited timber on the land (LTO Vol. 14 page 114).

Doyle was an ex-convict who upon receiving the land grant lived at the property with his wife Mary and their four children (Fairfax n.d 'Historic Buildings'). A dwelling was built on the property for Doyle and his family to live in, and he ran an Accommodation House from his premises ('Tahmoor House' NSW Environment and Heritage). The idea of running an Inn on the land also occurred to him as he applied for a liquor licence in 1823 but was unable to afford it (Fairfax n.d 'Historic Buildings'). Early 1824 he sold the property. Around this same time his marriage broke down and Doyle put a notice in the paper warning the public against paying debts owed to him to his wife as it had "*been proved before a bench of magistrates at Minto that my wife….for a long time past has acted most improperly ……Edward Doyle, Myrtle Creek*" (The Sydney Gazette and New South Wales Advertiser Thursday 1st April 1824: 3).

Figure 4: 1886 Parish of Couridjar County of Camden showing Edward Doyle's land grant in Portion 203. Held at the Mitchell library

The property was sold to William Klensendorlffe of Liverpool, a settler. Klensendorlffe paid one hundred and fifty pounds for the property on the 27th March 1824 (LTO Book K No. 694). Klensendorlffe, was a German who served in the British Army, came to the colony as a free settler in 1819 (Fairfax n.d 'Historic Buildings) where he married Elizabeth "*the daughter of a wealthy and respectable non-commissioned officer of the Old New South Wales corps*" (The Monitor Friday 6th April 1827: 8).

Klensendorlffe continued to run an 'Accommodation House' from the premises and in October 1824 the distinguished guest William Hovell stayed there overnight and breakfasted there the following morning, whilst on his expedition to Port Phillip (Jervis 1937: 283; 'Tahmoor House' NSW Environment and Heritage). Klensendorlffe had established the premises as an Inn by the 15th of September 1825 when he was reported in the *Sydney Gazette and New South Wales Advertiser* as being fined 12 pounds 10 for selling liquor to '*Government Servants'* on the Sabbath (SG & NSW Advertiser 8th February 1826: 3).

These 'Government Servants' would have been associated with the Ironed gangs associated with the construction of the Great Southern Road, most likely one of the gangs stationed near the Inn.

Whether Klensendorlffe added to the original building built by Doyle or if he started afresh is uncertain. In 1827 a letter to the Editor of the monitor described the Inn as "*The Traveller Inn, with nine good rooms and large out-buildings, kept by Mr. Klensendorlffe*" (The Monitor Friday 6th April 1827: 8). In 1829 Klensendorlffe stated he had built a weatherboard cottage in a letter to the Colonial Secretary (Fairfax n.d 'Historic Buildings).

The article above is one of the earliest references to the name of the Inn being 'Traveller Inn'. Prior to that references are to 'Klensendorlffe's Inn' or 'Myrtle Creek Inn'.

While Klensendorlffe remained the owner of the Inn, in 1830 Ralph Hush took over the licence (Fairfax n.d 'Historic Buildings). Ralph Hush was actually a convict sent to the new colony for life in 1820. His wife and children came as free settlers in 1824 and Mrs Hush requested that he be appointed to her. Fortunately this came about and together they ran the Inn for Klensendorlffe (Villy 2011:83). The Sydney Gazette mentioned the inn when Hush was the publican in April 1832:

> "*…Myrtle Creek, a picturesque spot embellished by a good inn, the sign of "The Traveller"; built by Mr. W. Klensendorlffe, and now kept by Ralph Hush, where you will greatly rejoice in a hospitable reception, excellent fare and moderate charges*" (SG 26th April 1832: 3).

In 1835 James Crispe took over the licence of the Inn. A notice in the newspaper from Ralph Hush junior of Myrtle Creek offered a reward for a lost or stolen mare and foal and both he and James Crispe of Brickfield were named from whom the reward could be obtained (SMH Thursday 17th July 1834:2). The letter dated 22nd May 1834 indicates that Crispe was already lined up to take over the licence of the Inn.

All this while, Klensendorlffe had unsuccessfully been trying to sell the Inn and property. Advertisements for its sale appear in the papers from 18th January 1831. The advertisements give a very good description of the Inn and associated structures as well as other land uses within estate. The description is as follows:

> *"The House comprises ten good rooms, with an entrance hall. The out buildings comprise a servant's room, a kitchen and store-room, a five-stalled stable, a substantial barn, built of stone 60 feet long and 20 wide. There is also another servant's room detached, stock-yard and other farm- yard conveniences, suitable for a farming establishment. The lands attached to the Inn and Premises comprise 240 acres of fine sound wheat land, the earth a chocolate and deep red, betoking the*

presence of whin-stone, so suitable, by its sound healthy nature, for the production of wheat, and more particularly the vine; on the Eastern side of the hills. One hundred acres out of the 240 are substantially fenced in, and of the hundred so fenced eighty are cleared and (save a few acres)/ in cultivation; the fields furnish plenty of water. The Inn and Farm are at present let to a good tenant, on a lease of three years, at the rate of £114 per annum, one year of which is unexpired ; but-many arrangements will be made, if required, to give the purchaser immediate possession. There is on the farm fronting the Inn a good orchard of two acres, well stocked with tree's, which have been planted five or six years." (SG & NSW Advertiser 18th January 1831: 3; Tuesday 15th February 1831:1).

James Crispe brought the property on 31st May 1836 and is noted in the Indenture of Lease and Release as being from Myrtle Creek. This is because he had already been working at the Inn two years prior to purchasing it (LTO Book K No. 682). Crispe purchased the consolidated land of 240 acres which included a 60 acre portion, an 80 acre portion, two 50 acre portions (one of which was the 50 acre grant to Edward Doyle), and the building "*known by the name or sign of the Traveller's Inn together with all houses buildings & way"*. In total Crispe paid one thousand pounds (LTO Book K No. 682).

The Sydney Gazette informed its readers that "*Mr. James Crispe of Brickfield-hill has become the purchaser of the "Traveller's Inn" at Myrtle Creek, with 240 acres of land, late the property of Mr. William Klensendorlffe, for the sum of £1,000*" (SG Tuesday 21st April 1835: 2). James Crispe also advertised the sale in a notice to the public that:

"…he has taken that old established House known as the Travellers' Inn, Myrtle Creek, where he has provided the best of accommodation-namely, good Wines, Porter, Spirits, etc., and where he will be happy to entertain any of his old or new friends. Good Stabling" (SMH Thursday 27th August 1835 p1).

Mrs Mann the daughter of James Crispe reminisced of her life spent at Tahmoor to F. Walker in 1922. She incorrectly claimed "Travellers Inn" was never owned by Klensendorlffe and that it was built and established by her father. Despite this misinformation she recalled detailed accounts of the main house and structures on the property:

"The house is a substantial building of ironbark timber, on stone foundations. It is roofed with the old style of "ridged" squares of iron, which has been placed over the original shingles. The building contains about twelve rooms, some of them being of generous proportions, but when originally built, the present large rooms were subdivided into smaller apartments….Originally, the building contained one or more attic-room, but these have been removed. The stairs leading to these communicated with the hall. The front verandah, a cool and shady retreat on the hottest day, is

stone flagged, a portion being laid in a diagonal pattern, and the remainder in squares. A fine iron balustrade, recessed into top and bottom railings, and fitted with two gates, borders the verandah. The latter portion marks the public entrance and square holes in the flagging show where the partition dividing the public from the private entrance was placed.

In the backyard is a huge well, fourteen feet square, with a raised stone parapet all round, about three feet high, and capped with flat stones, with projecting edges. This was constructed by convict labour, but the building itself, apart from the stone work was erected by free men…. The old stables, formerly in use when the building was a celebrated coaching establishment, are now represented by one or two solitary up- right timbers, standing upon a stone pavement, now overgrown by grass and weeds. The ground slopes considerably from the road elevation, so that the back portion, which is constructed of stone, allows for roomy cellars beneath the house. A flight of much- worn stone steps leads down into the yard. Close alongside the well is a huge stone trough, about six feet long by two feet wide, and four deep, which, originally a solid block of stone, must have cost some considerable labour to make.

In the early days the hill opposite, now cleared and cut up into building allotments, forming the Tahmoor Park Estate, was a flourishing orchard, and provided abundance of fruit for the establishment and surrounding district" (Walker 1922: 387-388).

The Sydney Morning Herald described Crispe as having reigned supreme at Myrtle Creek having a "*courtly bow and polite but somewhat grandiose style of welcome"* (SMH 2 June 1865:5).

The article described a garden on the opposite side of the road to the Inn which Crispe took great care of. On that same side of the road Crispe had a Summer House. By the time of the article in 1865, the garden had disappeared with the exception of "*…a few spectral fruit-trees; a giant aloe whose tall flower-stem hung toppling over as if no longer able to bear the sight of the desolation around; and the ruins of a summer house*" (SMH 2 June 1865:5).

Figure 5: Photograph of Tahmoor Park House taken Prior to 1920 Tahmoor Subdivision Plans 1920: Held at the Mitchell Library (TP T1/20).

Figure 6: Close up Photograph of Tahmoor Park House taken Prior to 1920 ML Tahmoor Subdivision Plans 1920: Held at the Mitchell Library (TP T1/20)

Figure 7: ca1914-ca1941. A view of Tahmoor Park House built in 1824 as Myrtle Creek Hotel on the main Southern Road near Bargo, N.S.W http://trove.nla.gov.au/picture?q= ID:H23655

Figure 8: ca1914-ca1941. The back steps in Tahmoor Park House, built in 1824, as the Myrtle Creek Hotel ... near Bargo, N.S.W. http://trove.nla.gov.au/picture?q= ID:H23658

Figure 9:ca1914-ca1941. An old stone bath cut from solid block by convict labour and now used as a Trough at the old Tahmoor Park House http://trove.nla.gov.au/picture?q= ID: a09715

Figure 10: ca1914-ca1941. A huge stone well, 15 feet square, & built by convict labour, it is at the back of Tahmoor Park House from http://trove.nla.gov.au/picture?q= ID: a09716

Despite all the effort and care Crispe put into the Inn and property he struggled to make his mortgage repayments. July 17th 1844 the Mortgagee Peter William Plomer took possession of Crispes' land including the "Traveller's Inn" (LTO Book 7. No. 115). Crispe moved on to be a host at the George Inn at Picton (SMH Saturday 22nd January 1848: 2).

James Blake became the licensee of the Inn until John Gray took over in 1847, at which point the name of the Inn changed to the "Pastoral Inn" (Fairfax n.d 'Historic Buildings) or "Pastoral Hotel" (SMH Wednesday 3 March 1852: 4). A notice in the Sydney Morning Herald listed the certificates for publicans' licenses granted on May 14th 1851 with in County of Camden. Among them Mr Gray was listed at Myrtle Creek (SMH Friday 16th May 1851:2).

Gray purchased the property on 1st April 1853 (LTO Book 25 No. 991). After five years of owning the property, the "Pastoral Hotel" and acreage were put up for sale due to "*poor health*". The property was described then as follows:

> *"The house (which has recently undergone a thorough repair) consists of bar, taproom, five parlours, nine' bed- rooms, and spacious verandahs back and front, together with large stone cellar, store-room, pastry, scullery, and detached kitchen, &c. The outbuildings consist of servants' houses, laundry, stabling for twenty horses large stone barn, coach-house, fowl-houses, piggeries, stock and milking yards, and a slaughter-house, &c. The proprietor has just had completed, at a considerable expense, a large stone tank, supplied from the roof of the house (which is of galvanized iron), capable of containing, four months' supply of water. Adjoining the house is the garden, containing two acres, fully stocked with fruit trees of the best description, many of which are in full bearing."(*SMH Saturday 11th December 1858:3).

Another advertisement 8 months later for the sale of "Gray's Pastoral Hotel" described the hotel as follows:

> "*HARDWOOD WEATHER BOARD BUILDING, on stone foundation, having a frontage of 79 feet, and containing back verandahs to the front and back, and sixteen large rooms, viz.-bar, tap-room, two parlours, and three bed- rooms at the public end, and three parlours and six good bedrooms at the other end. The whole is faithfully built, painted, and in good condition, the principal rooms being wall papered. The-out-buildings include .kitchen and servants' room and .huts, oven, large stone barn, and stone water tank, 13feet x 12 feet, fitted with pump; stabling for fourteen horses, and enclosed coach-house; strong stock- yards,..*" (SMH Saturday 20th August 1859: 7).

Grey was having financial difficulties and unable to sell the property. The mortgagee, John Fletcher, took control of it on the 2nd November 1859 (LTO Book. 64 No. 115). It seems Grey remained as the publican.

The mortgage was transferred to John Morrice and McDonald Smith and Co. (LTO Book 85 No. 915). Grey continued to struggle with financing the property (LTO Book 109 No.405). With the railway line bypassing the Inn and the decreased number of travellers using the Great South Road, his financial woes became worse. Grey was soon listed as insolvent. A detailed survey of the property was drawn up in 1862 (See Figure 11). The causes of insolvency were reported as loss of cattle and failure in business as well as pressure from creditors (Empire Friday 22 October 1869: 2; The Maitland Mercury & Hunter River General Advertiser Saturday 23 October 1869: 3). Grey went bankrupt and the property was sold to James Watson, a butcher from Sydney on the 31st January 1870 (LTO Book 117 No. 842).

By this time, the location of the building meant that as an Inn the business was no longer profitable. Watson leased the premises out as a private residence and the house was referred to as "Myrtle House" (Fairfax n.d 'Historic Buildings). The property was then sold to George Bradbury Esquire on the 3rd of November 1879 (LTO Book 196 No 348). Bradbury occupied the premises for 41 years during which time he named it '*Leigham Holme'* (Fairfax n.d 'Historic Buildings; Figure 12).

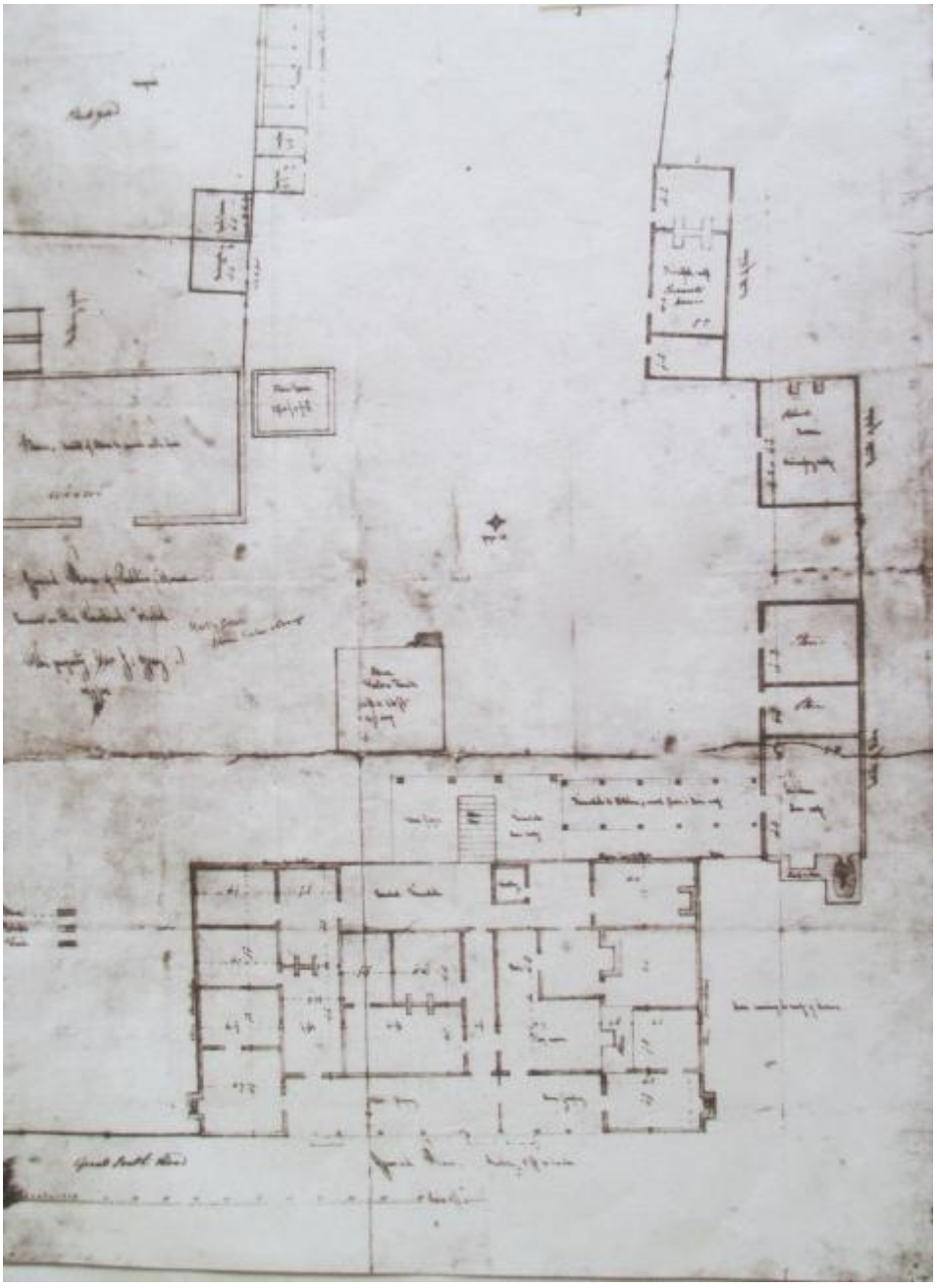


Figure 11: Ground Plan of the Pastoral Hotel, 1862, when Mr Gryy was the owner and publican of the property. Held at the Mitchell Library (Plan XV*/Arch/7)

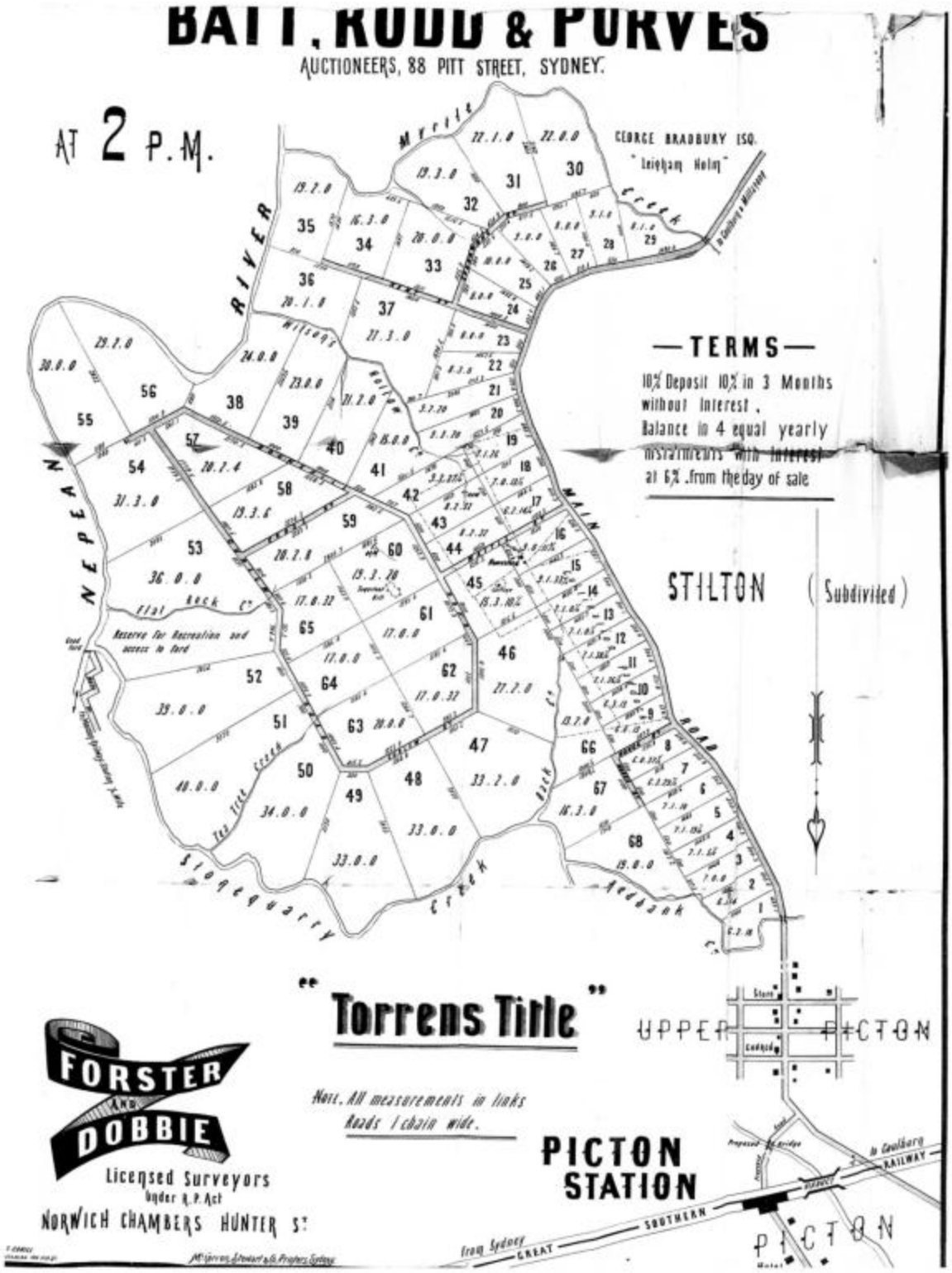


Figure 12: Picton Subdivision Plan showing Bradbury's "Leigham Holme". Held at the Mitchell Library. (TP P1/10)

Bradbury involved himself with local affairs and was appointed a magistrate of the colony in 1882 (SMH Friday 6th October 1882:5). He was a secretary of the Camden and Picton A & H Society that ran an Annual Show (Australian Town and Country Journal Saturday 4 April 1885: 3). He was involved with the local school and donated two acres of land for a new school to be built (Dobbie 1905. 2547-3000).

On the 25th February 1921 Bradbury sold to the property developers Robert William Hardie, David Storey, Edwin Samuel Phippard (LTO Book 1178 No. 787; Vol.3178 Fol. 56; Vol.3228 Fol. 145). The acreage was subdivided into blocks and the development was called Tahmoor Park Estate. The house was located in Lot 12 and was known as 'Tahmoor Park House' (see Figure 13) and soon after was just called 'Tahmoor House' (see Figure 14). The property was sold to John Sanderson on the 23rd January 1922. Sanderson ran a boarding house from the property. It is likely that he ran the boarding house prior to the actual purchase date. The advertisement for the subdivision of the estate has "Tahmoor Park Estate Boarding House" clearly marked on the allotments. The auction was scheduled for 4th October 1920 (see Figure 14). Another advertisement for auctions scheduled for 4th October 1920 reads:

> *"In the midst of the estate and facing the Main Southern Road is the well- known Tahmoor Park House (the original Homestead of Mr Bradbury,) a Boarding House kept by Mrs Sanderson. This is a thoroughly comfortable House, and people wishing to inspect the land and district should stay there, either for lunch or for the week-end, or longer. Stabling and garage. Address: Mrs Sanderson 'Tahmoor Park House, Post Office Tahmoor.*
>
> *Only 5 minutes walk from the Station, buggy will meet you at the Station. Terms very moderate. N.B Motorists can contain Lunch Afternoon Tea and Refreshments."* (ML 1920 TP T1/16).

The date of this advertisement is about one and a half years before Sanderson purchased the lot and is actually prior to the official sale of the property from Bradbury to the developers. So it seems the Sanderson's moved it and set up the Boarding House before the developers had legally bought the property from Bradbury.

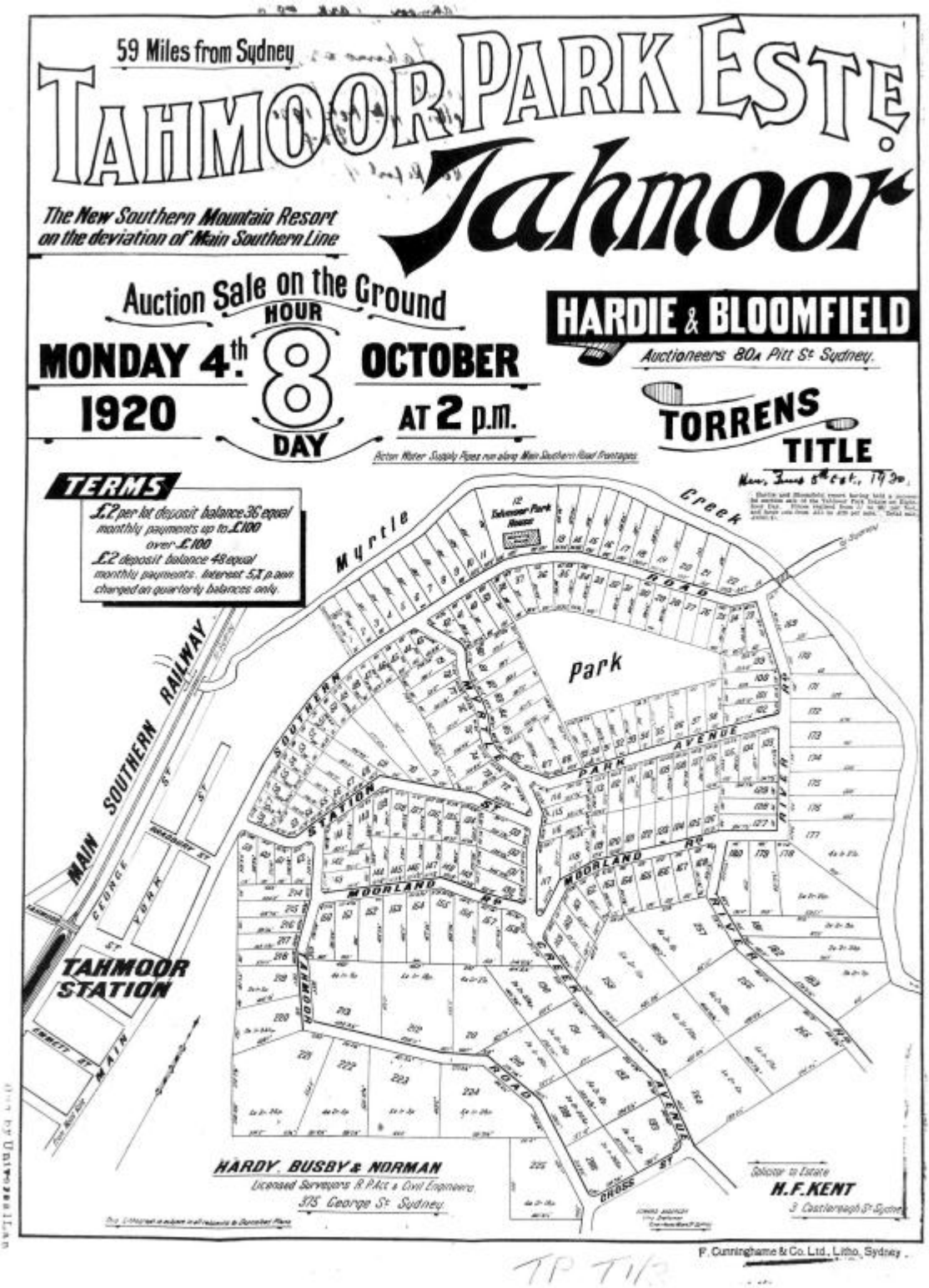


Figure 13: 1920. Subdivision Plans of Tahmoor Park Estate showing 'Tahmoor Park House' as a Boarding House. Held at the Mitchell Library (TP T1/3)

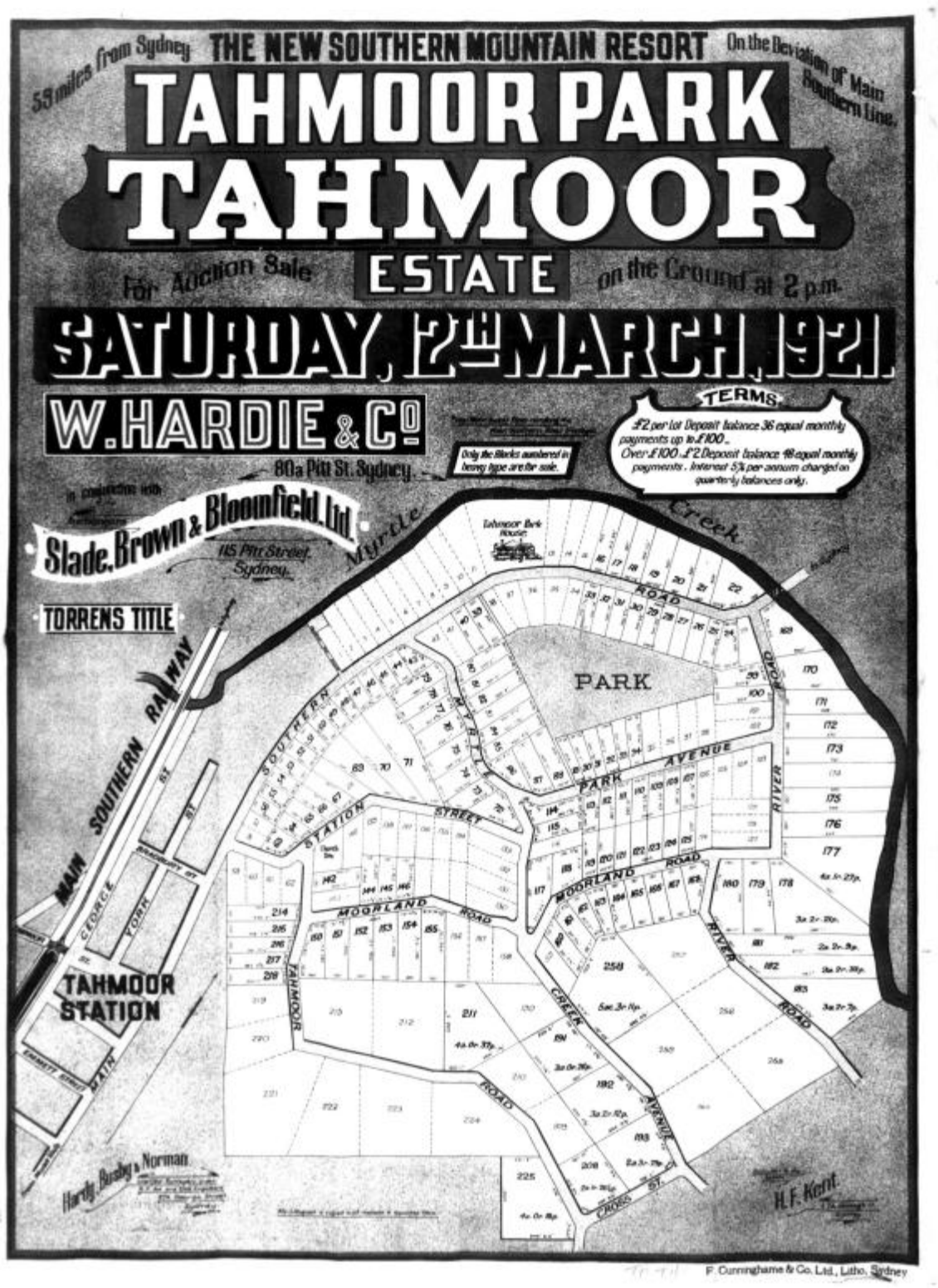


Figure 14: 1921. Subdivision Plans of Tahmoor Park Estate showing 'Tahmoor House'. Held at the Mitchell Library (TP T1/8)

If Sanderson had any financial difficulties in business, as did the houses predecessors Crispe and Grey, finances were to improve as he came fourth place in the lottery in 1937 (Barrier Miner Wednesday 17 February 1937:4). Sanderson's widow Alice sold the property to Harry Royson on the 2nd May 1946 (LTO Vol. 3274 Fol.109), who then sold it to Leslie Howard Quinion on the 22nd July 1953 (LTO Vol. 3274 Fol.109). His widow Mildred Clare Quinion became the proprietor of the property on the 20th September 1968 (LTO Vol. 3274 Fol.109) and then the property was transferred to June Callan on the 15th May 1970 (LTO Vol. 3274 Fol.109).

George and Maree Rhodes purchased the property on the 17th June 1972 (LTO Vol.3274 Fol.109) by which stage the house was in a poor state requiring refurbishment (Fairfax n.d 'Historic Buildings). The house was infested with rats and possums and the sunroom and kitchen were badly damaged through white ant activity. The gardens were overgrown and intruded into the living areas of the house (Figure 15).

Figure 15: The northwest corner with the sunroom and kitchen, showing the condition of Tahmoor House at the beginning of restoration work in 1972 (Anon. n.d)

The sunroom floorboards, ceiling and windows were removed. The ceiling and windows in the kitchen were also replaced, though the floorboards were retained. Some ceiling joists needed to be replaced. A small extension was added either side of the fireplace to accommodate cupboards in the kitchen. The Rhodes spent six years repairing and refurbishing the house (Anon n.d).

John and William Colless purchased the property on the 19th May 1986 (LTO Vol. 3274 Fol.109; Vol 15455 Fol. 2) and they undertook further restorations and maintenance (Fairfax n.d 'Historic Buildings). The property was again sold at auction in 2002 and the property subdivided into residential blocks. Tahmoor House now occupies just over an acre of land with a further 500m2 on the creek together with an access way (Anon. n.d).

In August 2009 the house was purchased by Terry and Sheila Ings. Additional restoration work was conducted in 2010, including deconstruction and reconstruction of a sandstone brick feature wall, which exposed the original foundations, conversion of the pool into a pond and garden area, and repairs to the tennis court wall and pavilion (Anon. n.d).

Other undated, though post-1976 National Trust of Australia (NSW) listing, alterations to the house have included the replacement of the original Moorwood & Rogers galvanised iron roof tiles and stop chamfered verandah posts. Infilling has also occurred at the south end of verandah (NSW Environment and Heritage 'Tahmoor House' 2012).

9 Physical Evidence and Archaeological Potential

9.1 Site Description and Condition

Tahmoor House is a single storey weatherboard residence constructed on sandstone foundations in c1821 (Plates 1 & 2). It features a corrugated steel clad hipped roof that continues over the front verandah, which is flagged with sandstone and has been in-filled at its southern end (Plate 3).

As per its original floor plan (see Figure 11), the house features two front entrances, one of which appears to be original (Plate 4). The original pitch of the roof has been slightly modified and the original verandah posts replaced and original railings removed. Of note, the flagstones on the verandah are original and feature two patterns – the diagonal design for the private section of the former Inn and the square patter for the public section (see Plate 3).

On the eastern side of the house a formal pond is present (Plate 5). This water feature was created in July 2010 by modifying a former swimming pool added to the property in the 1970s. Behind and adjacent to the formal pond, a grassed area, bbq area and tiered garden beds were also added c2010 (Plate 6). The bbq area features recycled bricks that vary in age and condition (Plate 7).

Along the eastern boundary of the property a tennis court, pavilion and associated retaining wall were added in the 1980s (Plates 8 & 9). The tennis court is below ground level and its construction would have involved considerable excavation and levelling works. Timber decking has been added more recently. Large worked sandstone blocks have been used to edge the garden beds in this area (Plate 10). Given their size and workmanship they appear to have been recycled from the large stone water tank shown in early photographs. A chicken coop is located directly adjacent to the tennis courts.

The rear of the house features very impressive original sandstone stairs leading from the rear verandah to the rear yard (Plate 11) and a covered car port (Plate 12). The stairs are considerably worn resulting from their extended use since construction of the house in c1821. The rear courtyard features sandstone and concrete paving (Plate 13). A noticeable depression in this paving indicates the original location of the former stone tank. A gravel driveway on the western side of the property leads to the car port and a large timber barn, which occupies the north-west corner of the property (Plate 14).

Two mature pepper trees and a hoop pine were noted in the rear yard. At least two large trees are shown in the 1955 aerial photograph suggesting that the pepper trees may have been planted during the early nineteenth century.

Internally, there has been considerable modification to the original floor plan. Various walls, floor boards, windows and ceiling joists have been replaced due to white ant damage. Further comparative analysis of the 1862 plan and a detailed survey of the property would be necessary to document the extent and condition of original internal fabric. This is beyond the scope of this study.

Plate 1: Front view of Tahmoor House (Source: Niche 2012)

Plate 2: Rear view of Tahmoor House (Source: Niche 2012)

Plate 3: Sandstone flagging on front verandah (Source: Niche 2012)

Plate 4: Original (west) entrance (Source: Niche 2012)

Plate 5: Formal pond (converted swimming pool) (Source: Niche 2012)

Plate 6: Rear garden beds (Source: Niche 2012)

Plate 7: Brick paving in bbq area, using recycled bricks (Source: Niche 2012)

Plate 8: Sunken tennis court (Source: Niche 2012)

Plate 9: Tennis Court Pavilion and timber decking (Source: Niche 2012)

Plate 10: Sandstone blocks re-used for garden beds (Source: Niche 2012)

Plate 11: Sandstone staircase at rear of house (Niche: 2012)

Plate 12: Car port at rear of house (Source: Niche 2012)

Plate 13: Concrete and sandstone paving and location of former stone well (Source: Niche 2012)

Plate 14: Rear timber shed and pepper tree (Source: Niche 2012)

9.2 Archaeological Potential

An overlay of the 1862 plan and a current aerial photograph indicates that the rear yard of property has high archaeological potential for historical relics (See Figure 15). As shown in this plan, the rear yard may contain remnants of the following former buildings / structures below current surfaces:

- The detached kitchen, scullery and store-rooms;
- The servant's houses and laundry;

- A large stone tank; and
- A large stone barn, coach-house, fowl-houses, stock and milking yards and stables;

Apart from excavation for the tennis court and formal pond, there has been minimal disturbance to the rear yard of the property. It is therefore likely that structural features, such as the footings of the large stone tank and the large stone barn have survived below the current ground, although some of the sandstone has been re-used for garden beds. Significant archaeological deposits, particularly deep deposits associated with wells and privies, are also likely to have survived with some localised disturbance.

Figure 16: Overlay of the 1862 Survey and a current aerial photograph (Source: Niche 2012)

10 Statement of Significance

The NSW *Heritage Manual*, prepared by the former NSW Heritage Office and Department of Urban Affairs and Planning, provides the framework for the following assessment and statement of significance. These guidelines incorporate the five aspects of cultural heritage value identified in the *Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 1999* (Burra Charter) into a framework currently accepted by the NSW Heritage Council.

(a) An item is important in the course, or pattern, or NSW's cultural or natural history (or the cultural or natural history of the local area);

(b) An item has strong or special associations with the life or works of a person, or group of persons, of importance in the cultural or natural history of NSW (or the cultural and natural history of the local area);

(c) An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievements in NSW (or the local area);

(d) An item has a strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;

(e) An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);

(f) An item possess uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);

(g) An item is important in demonstrating the principal characteristics of a class of NSW's:

— Cultural or natural places; or

— Cultural or natural environments;

(or a class of the local area's)

— Cultural or natural places; or

— Cultural or natural environments;

No assessment of Aboriginal cultural heritage values has been undertaken as part of this study.

10.1 Significance Assessment

(a) An item is important in the course, or pattern, or NSW's cultural or natural history (or the cultural or natural history of the local area);

Tahmoor House is one of the earliest surviving houses in the Tahmoor area. Built c1822 by Edward Doyle, Tahmoor House was designed as an accommodation house, and later Inn, for travellers on the Great Southern Road. During the early to mid nineteenth century the Inn was one of a few that serviced the main roads of the colony. Such establishments were crucial to its expansion and the growth of settlements along early routes. Tahmoor House continued to operate as an Inn until the 1870's, when

the number of travellers using the Great South Road declined. Following use as a private house and then a boarding house, the property fell in to disrepair in the 1970s.

5. Tahmoor house is considered to be state significant in terms of this criterion.

(b) An item has strong or special associations with the life or works of a person, or group of persons, of importance in the cultural or natural history of NSW (or the cultural and natural history of the local area);

Tahmoor House is associated with a number of figures important to the cultural history of the Tahmoor area including: Edward Boyle, William Klensendorlffe, James Crispe and George Bradbury. The property also has a fleeting associated with a person important to the cultural history of NSW: the explorer William Hovell, who stayed as a guest during his expedition to Port Phillip in 1824.

6. Tahmoor house is considered to be locally significant in terms of this criterion.

(c) An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievements in NSW (or the local area);

The property is likely to have been an important landmark for travellers on the Great Southern Road during the colonial period. Today, however, the house is unlikely to display aesthetic characteristics or a high degree of technical achievement as much of its original fabric has been modified since its original construction. The staircase at the rear of the property, however, is an exceptional element and has considerable aesthetic value. Its worn appearance demonstrates the considerable age of the property and its frequent use by travellers during the colonial period.

7. The rear staircase of Tahmoor House is considered to be state significant in terms of this criterion.

(d) An item has a strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;

Tahmoor House does not have a strong or special association with a particular community or cultural group.

8. Tahmoor House is not considered to be significant in terms of this criterion.

(e) An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);

An 1862 survey of Tahmoor House indicates that numerous outbuildings were located to the rear of the house during the nineteenth century. These buildings included: a detached kitchen, scullery and store-rooms; servant's houses and laundry; a large stone tank; and a large stone barn, coach-house, fowl-houses, stock and milking yards and stables. Apart from the construction of a tennis court and formal pond, the rear yard of the property is relatively intact. It is therefore likely that structural remains and

subsurface archaeological deposits associated with wells and privies have survived below current surfaces. The analysis of such relics is likely to yield information that would contribute to our understanding of the property's history, occupation and use during the early to mid nineteenth century.

9. The property is considered to be state significant in terms of this criterion.

(f) An item possess uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);

Despite the loss and modification of original fabric at Tahmoor House it is one of only a few early colonial Inns still standing in NSW. It is therefore considered a rare and endangered place type.

10. Tahmoor House considered to be state significant in terms of this criterion.

(g) An item is important in demonstrating the principal characteristics of a class of NSW's *(or a class of the local area's)*:

— Cultural or natural places; or

— Cultural or natural environments.

Whilst Tahmoor House is an early and representative example of a Colonial Georgian Inn built along the main roads of the colony in the 1820s, much of its original fabric has been modified during various renovations. As such, its representative value has been compromised. Various built elements, including one of its front entrances, sandstone flagging on the front verandah and the rear staircase, have survived and are significant in terms of this criterion.

11. Tahmoor House features various built elements with original fabric which are considered to be state significant in terms of this criterion.

10.2 Statement of Significance

Tahmoor House is one of the earliest surviving houses in the Tahmoor area and is an important example of an early Colonial Georgian Inn. Built c1822 by Edward Doyle, Tahmoor House was designed as an accommodation house, and later Inn, for travellers on the Great Southern Road. The Inn was one of a few that serviced the main roads of the colony. Such establishments were crucial to its expansion and the growth of settlements along early routes. The house is associated with a number of figures important to the cultural history of Tahmoor including: Edward Boyle, William Klensendorlffe, James Crispe and George Bradbury. Despite significant modification to its fabric, the house features notable elements that possess representative and aesthetic value, including: the rear staircase, the front (west) door and the sandstone flagging on the front verandah. The rear of the property also has considerable research potential, with remnants of former outbuildings, wells and cesspits likely to be present in less disturbed areas. Tahmoor House is currently listed as a locally significant heritage item; however further assessment indicates that it has values that would meet the threshold for state heritage significance.

11 Recommendations

The following recommendations are provided to assist Tahmoor Colliery to minimise impact on the heritage significance of Tahmoor House during proposed Longwall mining:

1. It is recommended that this report be incorporated into Tahmoor Collieries Subsidence Management Plan (SMP) for Tahmoor House to inform future management and mitigation strategies during proposed mining of Longwalls 27 and 28. Such strategies should include:
   - The preparation of a pre-mining structural inspection of the house by a qualified structural engineer to document the current condition of the house;
   - Assessment of the likely impacts of subsidence on the house using MSEC subsidence data; and
   - Regular monitoring, with a particular focus on significant heritage elements including: the sandstone house footings, sandstone flagging on the front verandah and the rear staircase.

2. If monitoring of Tahmoor House demonstrates that impacts to the site have occurred, or are likely to occur, during Longwall mining, appropriate site management strategies, including mitigation works, should be developed in consultation with subsidence experts (MSEC), structural engineering experts (John Matheson and Associates) and a suitably qualified heritage consultant (Niche). Wollondilly Shire Council should be notified of the management strategy and any actions arising from it. Depending on the nature of the impact, the heritage consultant (Niche) will advise Tahmoor Colliery of any statutory requirements to notify government agencies, such as the Heritage Branch, Office of Environment and Heritage..

12 References

Primary Sources

Archival Plans & Maps

Mitchell Library

Parish of Couridjar, County of Camden 1886 From the Mitchell Library

Subdivision Plan Tahmoor . F Cunningham and Co. "*Tahmoor Park Estate, Tahmoor. Auction Sale on the Ground Monday 4th October 1920".* TP T1/3

Subdivision Plan Tahmoor. F Cunningham and Co. "*Tahmoor Park, Tahmoor Estate. For Auction Sale Saturday 12th March 1921".* TP T1/8

Subdivision Plan Tahmoor TP T1/15 – Part of pamphlet F Cunningham and Co. "*Tahmoor Park Estate, Tahmoor", Auction Sale 4th October 1920.* TP T1/13 and TP T1/14.

Subdivision Plan Tahmoor TP T1/20. Part of pamphlet F Cunningham and Co. "*Tahmoor Park Estate, Tahmoor", Auction Sale 4th October 1920.* TP T1/13 and TP T1/14.

Architectural Plan: Pastoral Hotel, near Picton NSW, 1862. XV* / Arch / 7

Department of Lands

Anon. 1899. Picton Water Supply Plan Shewing Easements from Pipe Line. Crown Plan 1544-3000

Anon. 1937. Port Kembla Electricity Supply Yerrinbool to Picton Plan Shewing site of easement proposed to be resumed for Transmission Line- Parish of Couridjah & County of Camden. Crown Plan 9543-3000

Gallop, E. 1933. Port Kembla Electricity Supply Yerrinbool to Picton Plan Shewing proposed resumption of easement for Transmission Line- Parish of Couridjah & County of Camden. Crown Plan 8530-3000.

Gallop, E. 1933. Port Kembla Electricity Supply Yerrinbool to Picton Plan Shewing proposed resumption of easement for Transmission Line- Parish of Couridjah & County of Camden. Crown Plan 8529-3000.

Certificate of Titles from Land and Property Information

'Grants of Land' Vol. 14 No. 114.

Book K. No. 694

Book K. No. 682

Book 7. No. 115

Book 25. No. 991

Book 64. No. 115

Book 85. No.915

Book 109. No. 405

Book 117. No. 842

Book 196. No. 348

Book 1178. No. 787

Vol. 3178 Fol. 56

Vol. 3228 Fol. 145

Vol. 3274 Fol. 109

Vol. 15455 Fol.2

Trove Digitised Newspapers- http://trove.nla.gov.au/newspaper

Newspapers

Australian Town and Country Journal. Saturday 4th April 1885 p 3.

Barrier Miner. Wednesday 17th February 1937 p4.

Empire. Friday 22nd October 1869 p2.

The Sydney Gazette and New South Wales Advertiser Thursday 1st April 1824 p3.

The Sydney Gazette and New South Wales Advertiser 8th February 1826 p3.

The Sydney Gazette and New South Wales Advertiser 18th January 1831 p3

The Sydney Gazette and New South Wales Advertiser 15th February 1831 p1

Sydney Gazette 26th April 1832 p3.

Sydney Gazette 21st April 1835 p2.

The Mainland Mercury & Hunter River General Advertiser. Saturday 23rd October 1869 p3.

The Monitor. Friday 6th April 1827 p8.

Sydney Morning Herald. Thursday 17th July 1834 p2.

Sydney Morning Herald. Thursday 27th August 1835 p1.

Sydney Morning Herald. 2nd June 1865 p5.

Sydney Morning Herald. 22nd January 1848 p2.

Sydney Morning Herald. Wednesday 3rd March 1852 p4.

Sydney Morning Herald. Friday 16th May 1851 p2.

Sydney Morning Herald. Saturday 11th December 1858 p3.

Sydney Morning Herald. Saturday 20th August 1859 p7.

Sydney Morning Herald. Tuesday 15th November 1870 p1.

Sydney Morning Herald. Thursday 25th September 1873 p1.

Sydney Morning Herald. Friday 6th October 1882 p5.

Trove Pictures, Photos, objects http://trove.nla.gov.au/picture?q

Photographs

ca1914-ca1941. A view of Tahmoor Park House built in 1824 as Myrtle Creek Hotel on the main Southern Road near Bargo, N.S.W ID:H23655

ca1914-ca1941. The back steps in Tahmoor Park House, built in 1824, as the Myrtle Creek Hotel ... near Bargo, N.S.W. ID:H23658

ca1914-ca1941. An old stone bath cut from solid block by convict labour and now used as a Trough at the old Tahmoor Park House ID:a09715

ca1914-ca1941. A huge stone well, 15 feet square, & built by convict labour, it is at the back of Tahmoor Park House ID:a09716

Secondary Sources

Anon. n.d. *'Tahmoor House Restoration' in Tahmoor House, available from* http://www.tahmoor-house.com/restoration.php

Australia ICOMOS (2004) *The Illustrated Burra Charter: Good Practice for Heritage Places*, Deakin University, Burwood Victoria.

Biosis Research. 2009. Tahmoor Colliery Longwalls 27-30 Impacts of Subsidence on Cultural Heritage. Report for Tahmoor Colliery Tahmoor.

Department of Urban Affairs and Planning (1996) *NSW Heritage Manual.*

Fairfax 1991. *It has no definite name – Postal history of Tahmoor.* Picton and District Historical and Family History Society.

Fairfax, M. n.d. '*Historic Buildings*' in *Homepage of Marlene Fairfax, A Local and family history site, NSW, Australia.* http://www.acenet.com.au/~marlane/tahmoorhousesa_nsw.htm

Jervis, J. 1937. *The Wingecarribee and Southern Highlands District. Its Discovery and Settlement.* In *Journal of the Royal Australian Historical Society, Vol* 23. 1937. Pp247-291.

Jervis, J. 1939. *The Great South Road.* In *Journal of the Royal Australian Historical Society, Vol* 25. 1939. Pp412-432.

Jervis, J. 1941. *Settlement in the Picton and The Oakes District.* In *Journal of the Royal Australian Historical Society, Vol* 27. 1941. Pp276-298.

NSW Environment and Heritage 'Tahmoor House' http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2690128

Steele, J. 1904. *Early Days of Picton.* In *The Australian Historical Society. Journal and Proceedings. Vol* 1. 1901-1905. Pp165-172.

Villy, E. 2011. *The Old Razorback Road: Life on the Great South Road between Camden and Picton 1830-1930.* Everbest Printing Co. Ltd. China.

Vincent, L. 1996. *A Brief History of Picton.* Alted Printing Picton.

Walker, F. 1922. *"Tahmoor Park House", Near Picton. Reminiscences of Mrs James Mann of Thirlmere, New South Wales. .* In *Journal of the Royal Australian Historical Society, Vol* 8. 1922-1923. Pp385-388.

Appendices

Appendix 1 - Tahmoor House Chain of Title

Area of Title	Name of Purchaser	Date of Conveyance	Reference	Notes
Portion 203 in Parish of Couridjah	Edward Doyle	1st November 1822	LTO *Grants of Land* Vol. 14 page 114.	Crown Grant of 50 acres.
	William Klensendorlffe	26th & 27th March 1824	LTO Book K No. 694	
	James Crispe	30th & 31st May 1836	LTO Book K No. 682	"Traveller's Inn" noted as included in the conveyance.
	Peter William Plomer	17th July 1844	LTO Book 7. No. 115	Plomer was the mortgagee to Crispe. Hutchinson Bell as the Official Assignee on behalf of Crispe sold the property to Plomer as Crispe was unable to repay his debt to Plomer.
	John Gray	1st April 1853	LTO Book 25 No. 991	
	James Watson	31st January 1870	LTO Book 117 No. 842	
	George Bradbury	3rd November 1879	LTO Book 196 No 348	
	Robert William Hardie, David Storey, Edwin Samuel Phippard	25th February 1920	LTO Book 1178 No. 787; Vol.3178 Fol. 56; Vol.3228 Fol. 145	
Lot 12 DP 10669	John Sanderson	23rd January 1922	LTO Vol. 3274 Fol.109	
	Harry Royston	2nd May 1946	LTO Vol. 3274 Fol.109	Transferred from Alice Sanderson
	Leslie Howard	22nd July 1953	LTO Vol. 3274	

	Quinion		Fol.109	
	Mildred Clare Quinion	20th September 1968	LTO Vol. 3274 Fol.109	Noted as widow so must have inherited the estate
	June Callan	15th May 1970	LTO Vol. 3274 Fol.109	Likely to have inherited the estate
	George Noskvitch Rhodes and Maree Rhodes	17th July 1972	LTO Vol. 3274 Fol.109	
	John William Colless and Kathleen Ann Colless	19 May 1986	LTO Vol. 3274 Fol.109; Vol 15455 Fol. 2	

John Matheson & Associates Pty Ltd

Review of Longwall LW27 Subsidence Management.

Structural Report: R0198-Rev A

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20 November 2012

Xstrata Coal, Tahmoor Colliery
Remembrance Drive
Tahmoor NSW 2573

Attention; Mr. Ian Sheppard

Re: Subsidence Management Plan for Longwall LW27, Tahmoor

Dear Ian,

Please find enclosed our report concerning MSEC567-12 Structures Management Plan Rev C for Longwall LW27 at Tahmoor.

In summary, a review has been conducted of the structures management plan in the context of possible structure impacts due to LW27, previous experience of subsidence impacts Tahmoor resulting from LW22-LW26 and comparative data concerning damage to residential structures cause by reactive soil foundations. Some minor changes have already been discussed with and impemented by MSEC, who have adjusted the Structures Management Plan, and these have been included in MSEC567-12 Structures Management Plan Rev D.

The intent, approach and processes included in MSEC567-12 Structures Management Plan Rev D for Longwall 27, are adequate to manage the safety and serviceability of any public, commercial, residential or farm building and associated structures that may be affected by mine subsidence from the extraction of Longwall 27.

Yours faithfully
John Matheson & Associates Pty Ltd

John Matheson
Director

DOCUMENT HISTORY			
Revision	Date	Amendments	Author
Draft	16.11.2012	Draft Issued	JM
Rev A	20.11.2012	Issued to Tahmoor Colliery	JM

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1 INTRODUCTION

This report has been prepared by Mr John Matheson from this office at the request of Mr Ian Sheppard on behalf of Tahmoor Colliery. The purpose of this investigation is to examine the MSEC567-12 Structures Management Plan Rev C for Longwall LW27 prepared by MSEC and report concerning the suitability of the management process adopted, including proposed controls in terms of structure serviceability and safety.

At the completion of coal extraction from Longwall Panel LW26, subsidence movements during mining of Longwall panels LW22-LW26 have been imposed on a total of 1522 dwellings, public amenities and commercial buildings, 1100 of which sit directly above the goaf. The MSB has received a toal of 415 claims from individual properties (not including refused claims) of which 373 claims relate to main structures or 25% of the 1522 dwelling affected by subsidence.

The majority of impacts are considered very slight to slight (Cat 0, 1 and low level Cat 2 damage to Table C1 in Appendix C of AS2870) and consist of sticky doors and minor impacts to walls, ceiling or floor finishes. However, 2.6% of impacts are considered to be moderate or greater and in ten cases (0.7% of all building structures), the impacts were substantial and the cost to repair the structure exceeded the cost to replace.

2 REDUNDANCY IN RESIDENTIAL BUILDING STRUCTURES

The design of residential building structures is typically carried out in accordance with AS4055: Wind Loads for Housing, AS1684 Residential Timber Framed Construction, AS3700 Masonry Structures and AS2870 Residential Slabs & Footings and AS1170.1 & 4. These Australian Standards were first produced as follows:

i. AS4055: First published in 1992. Prior to this, wind loads were calculated in accordance with AS1170.2-1975
ii. AS1684: First published in 1992. Prior to this, AS O56—1948.
iii. AS3700: First published in 1998. Prior to this, AS CA32—1963.
iv. AS2870: First Published in 1986.
v. AS1170.1: First Published in 1971. Prior to this, ASCA34.1
vi. AS1170.4: First Published in 1993. Prior to this, AS 2121—1979.

The above list demonstrates that a comprehensive list of material engineering design standards have been available for the use in the design of residential building structures since 1948, with reference ot clad and brick veneer timber framed construction.

Timber framed construction is generally regarded as being a ductile form of construction that is able to tolerate significant deformation whilst maintaining structural integrity. Prior to the late 1960's, the majority of timber framed residential construction consisted of a pitched timber framed roof supported by underpurlins and roof struts, ceiling joists and hanging beams to transmit the roof load down to the perimeter and internal timber framed stud walls, suspended timber ground floor framing and supporting brick piers and perimeter brick pedestal walls. The timber stud walls usually incorporated timber bracing cut into and nailed to the timber studs, which were lined internally with plasterboard and externally by weatherboard or clad with a brick veneer. The timber member sizes and frame layout was frequently chosen by the builder based on the "light timber framing code" and what was considered then to be normal practice.

These structures are generally smaller in size than dwellings constructed more recently and the roof and floor framing form relatively stiff bracing diaphragms ensuring that horizontal wind loads, for example, are distributed to the timber framed stud walls with minimal frame distortion. These

structures have seen upwards of fifty years of service and have been subject to significant environmental wind loads and earthquake; Robertson and Bowral (Magnitude 5.6) on 21 May 1961 (some damage Moss Bale, Bowral, Robertson) and Picton (Magnitude 5.6) 9 March 1973 (Minor damage in Picton) neither of which caused loss of life or substantial damage. Whilst these structures may have not been engineer designed at the time of construction, they have generally proved to be resilient and serviceable if properly maintained.

Systematic curvature and ground strain of the magnitude typically predicted in Tahmoor (±1.5mm/m) tends to be distributed along the structure length (typically not more than 15metre in length pre-1975) building with damage generally occurring at frequent intervals rather than accumulating at one location. However, in the unlikely event that a differential displacement develops between the roof and wall framing, where the walls lengthen by 22mm (1.5mm/m strain) and the roof remains unchanged in length, it is difficult to contemplate how a common rafter or ceiling joist could lose support from a wall top plate with a relative displacement of 11mm at each end of the building.

More recent construction has seen considerably more engineering oversight in terms of engineered timber frames and roof trusses that have been used to construct considerably larger residential dwellings. Structures post 1975, have seen increasing use of metal strap and plywood sheet bracing and tie down elements (post Cyclone Tracy) to ensure that the timber frames used in the construction of residential dwellings are safe and serviceable for the expected wind loads.

In summary, provided the buildings have been appropriately maintained, the majority of timber framed dwellings (clad and brick veneer) are expected to have numerous redundant load paths to resist additional lateral loads induced between the roof and ground floor framing by tilt caused by subsidence. Furthermore, roof and wall framing consists of multiple parallel members that can effectively share load with adjacent members should some members become overstressed for any reason. Provided that overall tilt-induced loads (5mm/m to 7mm/m tilt) do not exceed 10% of the calculated 20Year ARI wind load (serviceability design wind load) at eaves level, previous analysis carried out on over 100 residential dwellings in Tahmoor indicates that the braced timber frames can generally be expected to remain serviceable during subsidence.

3 PREVIOUS EXPERIENCE IN TAHMOOR

Mine subsidence related to coal extraction from Longwall Panels LW22 to LW26 has been imposed on a total of 1522 dwellings, public amenities and commercial buildings and to date, there has been no record of an immediate or sudden safety hazard emerging, refer to section 4.1 of MSEC567-12 Structures Management Plan Rev C.

Structural responses to ground movements caused by mine subsidence develop in proportion to the rate of change in subsidence (strain, curvature & tilt). Consequently, structural damage of this nature, is the result of structure deformation in response to imposed strain and not specifically applied load. Whilst the strains generated in masonry and plasterboard wall linings in response to subsidence may exceed the tensile strength of the brickwork and plasterboard respectively, the structure effectively becomes articulated (less stiff) and more able to dissipate additional strain.

There have been some instances where geology or topographic features (such as valley incisions, in some cases hidden but identified by MSEC) have caused non-systematic subsidence to develop and surface ground movements have exceeded the non-systematic predictions, particularly in Progress Street, Abelia Street, Tahmoor Road and Moorland Road. In each case, the monitoring that was carried out as required by the Management Plan for Potential Impacts to Public, Commercial and Residential Structures for Longwall 26, picked up the development of non-systematic movement in the form of ground surface bumps and spikes in the road survey data along Progress Street, Abelia Street and Tahmoor Road before the impacts were detected in the main dwelling structures at the

adjoining properties. In response, the frequency of inspections and contact with the property owners/occupants was increased in the affected areas, structure impacts were logged and categorised in terms of Tables C1 & C2 of Appendix C of AS2870.

3.1 SUPPLEMENTARY STRENGTHENING PRIOR TO SUBSIDENCE

Prior to approval to mine Longwall 24, a detailed investigation of the Inghams Large Bird Plant and the Tahmoor Commercial Centre was undertaken to determine the potential for subsidence impacts on the main structures. Some other minor supplementary measures have been carried out in the Tahmoor/Thirlmere area during LW22 to LW26 such as guy-wire restraint of isolated brick chimney structures and some alterations to long roof structures bridging two adjacent structures to limit the possible extent of damage due to ground strain and tilt.

In respect of the structures identified in this section, where some perceived deficiencies were identified, each structure possessed some degree of structural capacity to resist tilt-induced horizontal loads such that in the event that the supplementary strengthening had not been carried out, the structures would have responded elastically up to the point where cracking developed and displacement of the structure became more apparent. If an alternate approach had been adopted, where no mitigation measures were undertaken prior to mining, the structures management plan would have been designed differently to include increased monitoring frequencies with displacement/strain/crack width triggers set to manage risk. It was decided that whilst subsidence impacts would be noticeable and were expected to develop gradually before a structural failure under the alternate approach, the conservative approach of supplementary strengthening prior to subsidence was preferred to avoid the need, whilst unlikely, for short lead time activity if subsidence caused significant structure damage to develop during subsidence.

3.1.1 BICYCLE SHOP IN REMEMBRANCE DRIVE

This single storey shop was formed by removing most of the central common wall between two adjoining commercial units and some internal walls to the rear of the building. There were insufficient records of the built structure and the structure alterations and a decision was taken to provide additional temporary support along the line of the original common wall and to provide some cross bracing to increase the transverse rigidity of the building in response to the predicted transient transverse tilt. There was little discernable impact on the structure due to Longwalls 24 or 25 and the supplementary strengthening was removed.

3.1.2 AQUARIUM

This two storey full masonry structure had been modified over time and internal ground floor walls had been removed and there appeared to be a limited amount of transverse structure rigidity for the mass of the structure. Whilst the predicted tilt and ground strain were not particularly large, a decision was taken to introduce a plywood bracing wall in the transverse direction between the ground and first floor slab to increase the transverse resistance to earthquake and wind load during the active and subsidence period and limit possible damage due to subsidence.

3.1.3 TAHMOOR TOWN CENTRE

Some workmanship issues were detected at the base of approximately 20 basement columns and a decision was taken to strengthen the base of the columns by wrapping the bottom 800mm of the reinforced concrete columns in carbon fibre to improve concrete confinement prior to active subsidence.

During the active subsidence period, frequent inspection and monitoring of the structure was carried out and any new damage or change in existing damage was recorded. There was a concentration of subsidence movement in the retaining walls along the eastern elevation basement retaining walls of

the main shopping centre and the MSB replaced some of these walls after Longwall 25. Displacements occurred gradually between precast concrete wall panels and the overlying suspended concrete ground floor slab around the basement perimeter, which were accommodated by the ductile wall panel connections and flexible joint sealants.

A light pole toward the north-east corner of the main shopping centre building, and the columns supporting the canopy roof above the petrol bowsers at the petrol station developed substantial tilt. Remedial actions were taken in both cases after the developing tilts had reached a trigger level after having been monitored continuously over a period of several weeks. Some remedial works were also carried out on the inground pipework below the driveway slab at the petrol station.

3.2 Supplementary Strengthening During Active Subsidence

During the active subsidence period for Longwall 26, non-systematic ground movements were detected in Progress Street and Moorland Road, which resulted in significant structure damage to two main dwellings, which triggered a response to install supplemtary strengthening during the active subsidence period. Ground surface bumps and survey spikes were first detected in Progress Street and Tahmoor Road (near Moorland Road) shortly before the adjacent structures were affected and monitoring frequency was increased in response.

The structure impacts increased gradually over time and they were monitored by a building inspector on a daily basis and a structural engineer twice weekly up to the point that where a decision was taken to provide limited supplementary support to one wall in each case as the structure damage transitioned through Category 4 towards Category 5 in response to compressive ground strain in both cases, pushing a strip footing back into the building underneath an overlying perimeter brick wall.

4 Proposed Risk Management Plan

A key element of the risk management plan is regular consultation with the community before, during and after mining to enable effective lines of communication to operate if and when subsidence impacts occur. This has been successfully undertaken at Tahmoor (refer to section 5.3 of MSEC567).

The development of subsidence impacts on residential building structures in Tahmoor has a direct corellation with the development of subsidence irrespective of whether the impacts are caused by systematic or non-systematic effects. The greatest structural damage reported in Tahmoor has generally occurred where brick veneer structures have been constructed on strip footings above hidden creeks or where near surface geological features have caused localised anomalous ground movements to impact these structures. In such cases, whilst Cat 4 & Cat 5 damage may have ultimately been occasioned on the structure, the impact of the anomaly was detected early in the form of compression impacts in the adjacent street and the early development of subsidence impacts on the residential structure were notified to either Tahmoor colliery, the MSB or both. The structures were then monitored frequently with structural intervention taking place where circumstances required.

A front of house inspection has been conducted for all of the residential properties above the first 600metres of LW27. The main dwelling structures have generally been identified as clad or brick veneer timber framed structures with a timber framed roof supported by a concrete raft slab or strip footings. The front of house inspections provide an indication of the general condition and level of maintenance of each structure. An internal inspection will be recommended if a potential structural deficiency is perceived. While the inspections are a responsible method of managing risk, it should be recognised that it may not always be possible to discern structural deficiencies in every structure as many structural elements are concealed.

The three most important factors in managing risk are the structural redundancy normally present in building structures; the gradual development of subsidence movements at Tahmoor and the implementation of an effective community consultation program. Due to these three factors, it is likely that the owner will have notified Tahmoor Colliery or the MSB of significant displacement or deflection well before structural failure will occur. The undertaking of pre-mining inspections and monitoring undertaken during mining provide a valuable additional level of risk management but are secondary in importance.

The site specific investigations, monitoring, trigger and response plan outlined in MSEC567-12 Structures Management Plan appear to be sufficient to identify the structures that are most at risk of significant subsidence impacts to enable adequate response time should circumstances arise during the mining of Longwall 27.

5 APPENDIX A: STRUCTURAL RESPONSE TO GROUND MOVEMENT

The paper "Damage to residential building structures due to ground movement" by Gad, Sivanerupan and Wilson (Swinburn University of Technology, Hawthorn, Victoria) presents the findings of a preliminary research project seeking to identify and quantify the causes of damage to residential building structures constructed in Victoria post-1986, after AS2870-1986 came into use. This report was based on damage data collected by Foundation and Footings Society Victoria (FFSV) specifically for the study. The damage reports were sourced from consultants and only properties constructed since the implementation of the first edition of AS 2870 (1986) were chosen for the study.

The paper reports the percentage of damage categories grouped in terms of site classification (foundation reactivity) based on an assessment of 367 houses (71% single story, remainder two storey) of which 95% were of brick veneer construction and the remainder light cladding or full masonry construction, refer to Table 1 in Appendix A. In each case, inspection of the damage was carried out on average within 5years of construction, which seems consistent with the owners desire to resolve issues prior to the end of the 7year warranty period.

Approximately 10% of all houses surveyed had Cat 1 damage indicating that the owners had requested an inspection even though Cat 1 damage is considered to be minor damage in accordance with AS2870. This suggests that a significant number of owners have a relatively low tolerence to structure damage and possibly little understanding of the significance of crack width. This pattern of behaviour of a low tolerance to damage reported by Gad et al, has positive implications in terms of monitoring building structures during the active subsidence period for Longwall 27 as the survey and monitoring team and can expect contact from owners at relatively low levels of damage beyond which stage regular inspections can be carried out by a qualified building inspector.

A comparison of the data reported for reactive soils in Victoria and the subsidence impacts recorded for main dwelling structures in Tahmoor for Longwalls 22-26 by MSEC and the MSB (refer table 2 in and MSEC567-12 Structures Management Plan Rev C.) indicate that where the structures have been damaged by ground movement, the distribution of damage to structures caused by reactive soil foundation movement (constructed on raft slabs post 1986) is more negatively skewed toward higher damage categories than the MSEC/MSB data for structures that have been damaged in Tahmoor by subsidence (including structures constructed pre-1986 including strip footings and suspended timber floors), which is positively skewed toward lower damage categories. It is noted that the structures impacted by subsidence in Tahmoor have been generally constructed on soils of moderate reactivity and thus the effects of subsidence have been superimposed on any pre-existing effects of a reactive soil foundation.

Some inferences that may be drawn from the two data sets are:

i. Whilst a greater proportion of structures have been affected by subsidence in Tahmoor (LW22-LW26) than those constructed upon raft slabs on reactive soil foundations across Victoria (since 1986), the impact of subsidence on the affected residential structures in Tahmoor, appears to be less severe than for residential building structures affected by reactive soil foundations in Victoria.

ii. The profile of structure damage on reactive soil foundations in table 1 suggests that there has been a tendency to underpredict the reactivity of soil foundations in Victoria.

iii. The experience of subsidence in Tahmoor and reactive soil foundations in Victoria show that owners react to minor structural damage (Cat 1).

Table 1(Category of recorded damage (% of houses in the sample) versus site classification, extract data from paper by Gad, Sivanerupan, Wilson)

Site Classification	Cat 0 (%)	Cat 1 (%)	Cat 2 (%)	Cat 3 (%)	Cat 4 (%)	No Cat (%)
S	0	0	0.8	0.8	0	0.6
M	0	2.7	9	6.8	4.4	6.2
H	0	4.9	21.6	7.4	4.1	7.4
E	0	0	1.4	2.5	2.2	2.2
P	0	2.5	3.8	3.6	0.5	0.5
None Classified	0	0	2.2	0.5	0	1.4
Sum	0	10.1	38.8	21.6	11.2	18.3

Table 2 Distribution of damage to main dwelling structures damaged in Tahmoor inferred from MSEC MSEC567-12 Structures Management Plan.

Damage Category	Cat 0, 1 & 2 (%)	Cat 3 (%)	Cat 4, 5 (%)
	97.4	0	2.6

Table 3 Classification of Tilt Impacts generally based on Digest 475: British Research Establishment and work conducted by Waddington Kay & Associates Pty Ltd

Description	Measured Building Tilt	Category
• Building tilt can be noticeable at this level of tilt but remedial work unlikely. Tilt induced load at eave level approximately 5% of 20-year ARI wind load.	5mm/m	A
• Adjustment to roof drainage and wet area floors might be required. Tilt induced load at eave level approximately 10% of 20-year ARI wind load.	5mm/m<Tilt<7mm/m	B
• Minor structural work may be required to rectify for tilt. Adjustments to roof drainage and wet area floors will probably be required and remedial work to surface water drainage and sewerage systems might be necessary. Tilt induced load at eave level approximately 15% of 20-year ARI wind load.	7mm/m<Tilt<10mm/m	C
• Considerable structural work may be required to rectify tilt. Jacking to level or rebuilding could be necessary in the worst cases. Remedial work to surface water drainage and sewerage systems might be necessary. Tilt beyond 20mm/m, structure distress may be apparent.	>10mm/m	D

Table 4 AS2870: Classification of Damage With Reference to Walls

Description of typical damage and required repair	Approximate crack width (w) limit (see note 1)	Damage Category
Hairline cracks	w<0.1mm	0
Fine cracks, which do not need repair	0.1mm<w<1mm	1
Cracking that is noticeable but easily filled. Doors and windows stick slightly	1mm<w<5mm	2
Cracking that can be repaired and possibly a small amount of wall may need to be replaced. Doors and windows stick. Service pipes can fracture. Weather tightness often impaired.	5mm<w<15mm (or a number of cracks 3mm or more in one group)	3
Extensive repair work involving the breaking-out and replacement of wall sections, especially over doors and windows. Window and doorframes distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted.	15mm<w<25mm but also depends on the number of cracks	4